Perceptions of Responsibility: Urenco and the Troika's Commercial and Nonproliferation Policies in Theoretical and Historical Perspective; *A narrative of policy and practice in the evolving nuclear nonproliferation regime and nuclear exports landscape.*

–

Percepties van verantwoordelijkheid: Urenco en de trojka's commerciële en nonproliferatiebeleid in theoretisch en historisch perspectief; *Een verhaal van beleid en praktijk in het zich ontwikkelende nucleaire non-proliferatie regime en nucleaire export landschap.*

Thesis

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llustration 1:

Vertical section of the U7 IIIB Gas Centrifuge

Rotierendes System:
01 Obere Rohrwelle
02 Rotor
03 Untere Rohrwelle
04 Absaugdüse
05 Motorwelle
06 Motorläufer
07 Zentralklemmung und Drehzahlgeber

Obere Gasdichtung:
A Gaskammer
C Sperrkammer
10 Gehäuse der oberen Gasdichtung
12 Gaszuführung
16 Evakuierungsleitung
18 Ölableitung

Motor:
M Motorraum
20 Motorgrundplatte
21 Oberes Halslager
22 Ständerblechpaket
23 Kühlmantel des Ständers
24 Druckkammer des Ölkolben-Spurlagers
25 Dichtungshülse am Ölkolben- Spurlager
26 Unteres Halslager
27 Ölvorlage
28 Oberes Dämpflager
29 Fühldrossel des Schwingungsmessgerätes

Sicherheitsmantel:
D Mantelraum
30 Ölfänger
31 Sicherheitsmantel
32 Kühlschlange
33 Schraubenring
34 Fangringe
35 Schutzauskleidung
36 Schutzring
37 Gleitfläche für die Halteklammern 38
38 Halteklammern zur Verbindung der unteren Gasdichtung mit dem Sicherheitsmantel
39 Ölvorlage

Untere Gasdichtung:
E Sperrkammer
F Gaskammer
40 Unterer Deckel des Sicherheitsmantels
41 Anschluss für die Gasfalle
43 Evakuierungsleitung
45 Ölableitung
47 Ölableitung

Fundament:
51 Gerätträger
52 Verdrehungssicherung der unteren Gasdichtung
53 Betonfundament

Abb. 2. Vertikalschnitt einer Gaszentrifuge U7 III B.

Abstract

In the 1960s, the smaller Western alliance partners took the lead in uranium enrichment technology development by bringing the gas centrifuge technology to commercial maturity. This created a challenge to the American nuclear fuel production hegemony in the West that had both security and commercial implications. How this challenge was addressed by the US and how its British, West-German and Dutch allies and competitors organized the responsible exploitation of the centrifuge method in a fast-changing and sometimes volatile international environment, as told mainly from the perspective of the Netherlands, is the subject of this thesis.

To develop this narrative of a minor alliance partner seeking to play a role of significance economically and politically amid the tensions and controversies that marked inter-alliance life and superpower rivalry during the 1960s to 1980s, the Netherlands' particular history of nuclear technology development and non-proliferation policy is presented. This narrative leads from the early international collaborations that the Netherlands developed in the nuclear field and its search for a suitable specialized industry to its choice for gas centrifuge technology and exploration of a European collaboration that would support its strategic energy independence aims. It then describes the wider history of development and classification of that particular technology, the latter in which the United States played a leading and controversial role. The three Troika partners persevered in their drive for a partnership and eventually negotiated the Treaty of Almelo to form Urenco: the Uranium Enrichment Company. With its establishment and its commercial expansion outside of the Troika territory from the mid 1970s on, the responsibility to balance non-proliferation norms and national economic interests in the emerging and evolving nuclear non-proliferation regime became a domestic and inter-Troika issue that could only be stabilized and eventually resolved after considerable controversy and conflict that at times seemed to threaten the collaboration itself. These political questions largely played out in the multinational decision-making organ established for this purpose, the Troika's Joint Committee. Using never before published primary sources from the Dutch Ministry of Foreign Affairs' classified archives, as well as other primary and secondary sources, this thesis offers the first comprehensive reconstruction of the Dutch perspective of those Joint Committee debates in the 1970s and 1980s.

To theoretically ground this narrative, this study uses a combination of insights from international relations theory, political science and philosophy and sociological theory to offer a perspective on international practices and norms and how they relate to international regimes. Traditional international relations theory fails to convincingly explain actors' interaction in international regimes as situated in the international practice, because its epistemological foundations and ontological tools do not allow it to engage with regimes' inter-subjective nature. Recognition of international actors' constitutive nature as social agents must be included in any analysis of policy choices because their actions are so clearly normative; they adhere to and contest norms, act as norm entrepreneurs and appraise the standing of self and others in international society on the basis their ethical choices. This referential interaction is particularly visible in international regimes as situated in

international practice and so insights from critical theory, post-positivist regime theory, international practice theory, structuration theory and social philosophy are used to construct a model that can engage with the norm-dynamics we see in those. The resulting theoretical framework predicts that participants in international practices and institutionalized areas of practice, such as the nuclear non-proliferation regime, appraise each others' actions and act upon the ethical reputations of other states and international organizations. The thesis and its case study confirm this and the existence of practices as constituting international society and underlying the behavior of states through rules and norms, as well as the existence of the nuclear non-proliferation regime as an institutionalized area of unsettled practice, in accordance with the adapted definition of international regimes that I propose.

The case study shows that Troika's commercial policy was impacted by domestic and international political and economic considerations and the normative commitments the Dutch and other partners made in the context of the evolving nuclear non-proliferation regime. Set against the wider historical context of a global market into which second generation nuclear exporters had to fiercely compete to gain a foothold, the Troika, albeit sometimes after intense internal debate but eventually institutionalized in its interim export policy, was willing to forgo economic gains in order to uphold a normative standard that not all its state-owned competitors held themselves to. In doing so it incurred material costs in return for a strengthened non-proliferation regime, the establishment of Urenco's reputation as a responsible supplier as well as the elevation of the partners' standing in international society over the medium and long term.

The role of the Netherlands in the Troika was clearly that of a norm entrepreneur, its officials consistently pushing the status quo towards a more responsible balance between economic and non-proliferation interests. Pressured by an (sometimes overly) involved Parliament that prioritized non-proliferation ideals over economics and constrained by the non-proliferation policies of previous governments, Dutch officials took substantial risks in attempts to shape Troika non-proliferation policy to their design and political requirements. Towards the late 1970s these efforts, coinciding with and supported by strong non-proliferation norm entrepreneurship by the US Carter Administration, were rewarded when the other Troika partners recognized the changes to the normative landscape and as a result Joint Committee discussions on potential exports became less contentious. When that norm weakened again at the start of the 1980s, partly because the US Reagan Administration reneged on keeping to a strict nuclear export policy, the Troika's export policy had taken shape and the partners resisted economic pressures to compromise on it in the face of competition that once again had sensitive technologies on offer to incentivize potential clients.

Gaining strength as it evolved, the norm of non-proliferation was particularly visible in the contestation that occurred and the resolution that followed as new standards of proper conduct in export and safeguards became institutionalized in the nuclear non-proliferation regime. The historical narrative of this study offers a view, reflective of that institutionalization, of how in the consecutive appraisals of potential Urenco customers for enrichment services in Brazil, South Africa, Australia, Japan, Israel, Libya, Iraq, Spain, Iran, Yugoslavia, Egypt, Indonesia, India, Taiwan, Mexico and China, the awareness and perceptions of these norms with Dutch

and other Troika officials evolved and was reflected in their decision-making and institutionalization of policy. The benefit and risks of upholding normative standards in nuclear exports are exposed in these country cases. After taking great commercial risks by pushing nuclear safeguards diplomacy to its limit with Brazil, the Dutch partner extracted far-going concessions from a non-NPT member that then was co-opted into advocating responsible nuclear safeguards policy internationally. The benefit of international reputation management became apparent in the Australia episode, when high-level démarches could draw attention to the Troika's non-proliferation credibility as a responsible supplier. The avoidance of proliferating centrifuge technology to a nuclear weapons program in the case of Yugoslavia also illustrates the foresight of this approach. Similarly, the caution that was eventually shared between the Troika partners avoided export adventures in Iraq, Libya, Israel and Taiwan, at a time when there was still a lack of clarity about those states' nuclear ambitions. Some contracts were lost, such as in India and Japan, but it remains unclear whether Urenco's commercial interests became the victim of the Troika's strict policy and/or strategic competition in these cases.

Disagreements on a common Troika position on nuclear safeguards at GCEPs played out during the same period. Here also, Dutch officials were willing to incur material costs and risk exposure of commercially sensitive information to strengthen non-proliferation norms. The highly technical and specialized nature of discussions as they progressed in the Standing Advisory Group on Safeguards Implementation (SAGSI), International Fuel Cycle Evaluation (INFCE) and Hexapartite Safeguards Project (HSP), in which the Troika participated and which sometimes triggered heated internal debates, helped eventually establish a more intrusive international norm that allowed limited safeguards inspections of the cascade halls of GCEPs. Competing appraisals in the Joint Committee on these and export matters were normative in that they argued in reference to existing or emerging norms, particularly between the norm of sovereignty (and national prerogatives such as energy security and more generally the national economic interest) and the norm of nuclear non-proliferation and its collective security benefits.

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Although as a 'external' Ph.D.-student I was not always very involved with academic life at the Erasmus University Rotterdam, I taught there for a couple of years and want to thank the people that helped me in the process of figuring everything out. Dr. Frans van Nispen stands

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Frederik Voûte,

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Table of Contents

List of Figures, Tables and Illustrations **18**

List of Abbreviations **19**

Chapter 1: Introduction – The Troika, Urenco and Non-proliferation during the Cold War **23**

Chapter 2: Genealogy of Political Realism in International Relations **32**

Foucault's Critique on Knowledge Creation (and Why It's Relevant to Us) *33*

The Tenets and History of Political Realism *39*

Machiavelli and Hobbes as Political Science ***40***

Niccolo Machiavelli *41*

Thomas Hobbes *43*

Positivism and Logical Positivism *49*

Positivism into Political Realism *51*

The Efficacy of Nuclear Weapons: Deterrence Theory *56*

The Cold War Arms Race *62*

Disarmament and Arms Control *64*

Chapter 3: Contemporary Debates in Social and IR Theory; Towards Post-Positivist Theory **68**

Critical Theory *70*

Structure and Agency *76*

Duality of Structure in IR *82*

Rules and Rule-following *85*

Causality and Constitutive Rules *89*

Frost's Practice-based Theory of International Action *92*

Chapter 4: International Relations Ontology: Regime Theory Revisited **102**

Part 1: From Hegemonic Stability Theory to Regime Theory ***103***

A Consensus Regime Definition *108*

Part 2: Taking Traditional Regime Theory into the Constructivist Turn ***111***

Pickings from Young's Institutional Bargaining Model *112*

Epistemic Communities *114*

Part 3: From the Constructivist Turn into the Post-Positivist Era of Regime Theory *121*

Chapter 5: Practices and Regimes **126**

The Relationship between Norms and Rules *127*

Redefining Regimes *133*

Methodology and Sources ***135***

The Historical Narrative Method *136*

Application of the Theory to the Case: Hypotheses ***138***

Focus of Analysis *138*

The Application of Practice-based Theory to the NPR *138*

Hypothesis I *141*

Hypothesis II *144*

Hypothesis III *145*

Use of Sources *147*

Syntax of References *150*

Syntax of Quotations *151*

Chapter 6: Dawning of the Nuclear Age & The Nuclear Nonproliferation Treaty and Regime **152**

Front End of the Fuel Cycle *153*

Back End of the Nuclear Fuel Cycle *156*

The Inherent Proliferation Risks of the Nuclear Fuel Cycle: Nuclear Weapons ***157***

Nuclear Weapon Designs 159

Entering Into the Nuclear Age **160**

International Political Practice and the First Generation Nuclear Weapon States 162

First Nuclear Weapon Development and Nuclear Technology Classification 166

Proliferation Potential and Resource Denial 169

The Acheson-Lilienthal Report 171

The Baruch Plan 173

Atoms for Peace 1953-1955 174

Atoms for Peace in Strategic Context 176

Creation of the IAEA 180

The Creation of EURATOM 181

Toward the Treaty on the Non-Proliferation of Nuclear Weapons 185

Chapter 7: Nuclear Infrastructure Development and Research in the Netherlands **187**

The Smyth Report 188

Industrial Scale Isotope Production at Clinton 194

Building Dutch Nuclear Physics and Engineering Expertise After the War **195**

Dutch-Norwegian Reactor Cooperation 195

Success and Methodical Diversification in Isotope Separation 198

Start of the Dutch and Troika Partners' Gas Centrifuge Tracks **200**

The Amsterdam Symposium, 23-27 April 1957 202

Gernot Zippe 203

Hans Kronberger 205

The Dutch 'Nuclear Energy Brief', 1957 206

The Western European Union 210

Early Multinational Enrichment Initiatives 212

Chapter 8: Classification of Centrifuge Technology **215**

Centrifuge Development in the United States *215*

The Push for Classification *217*

After Classification: International Patents and Evolution of Classification ***230***

West German Patents *233*

East German Patents *234*

Japan *235*

Australia *236*

European Pushback *237*

American 'Maximum Delay' (BOX) *239*

Chapter 9: Toward the Treaty of Almelo **244**

Centrifuge Development in the Netherlands *244*

Centrifuge Development in the FRG *249*

Centrifuge Development in the UK *250*

The Dished End-cap Challenge *253*

Negotiation of the Treaty of Almelo ***256***

International Developments *257*

Enter the British *259*

Negotiating Non-proliferation Goals *261*

Tripartite Agreement *263*

The Parliamentary Debate on the Treaty of Almelo in the Netherlands *266*

International Reactions *274*

French and American Diffusion Initiatives *278*

Chapter 10: The Uranium Enrichment Company (Urenco) **281**

The Machine and Plant Negotiations and a Short History of R&D and Capacity Build-up *281*

Commercial Development and Signing Clients *284*

Association for Centrifuge Enrichment 285

The Joint Committee 289

Case Studies of Potential Customers **292**

Case: Brazil ***293***

Exchange of Notes 299

West German-US Tensions over the Brazil Deal (BOX) 299

German Pressure and Parallel Issues 302

A Pending Decision 305

Mixed Signals from the IAEA 313

Changing Perceptions 314

Further Delay, More Band-aids 318

Agreement with Brazil and a Decision by the New Government 322

The Motion(s) Van Houwelingen 324

An Interpretative Statement 327

Toward a Common Export Policy for Urenco ***333***

The London Club/The Nuclear Suppliers Group 333

The 1975 Disarmament Note 340

The 1978 Nuclear Non-Proliferation Act 341

The UCN Common Export Policy Proposal 343

A Package Deal 346

An Interim Export Policy 351

The International Nuclear Fuel Cycle Evaluation (INFCE)(BOX) ***353***

An Offer to CAS 356

The A.Q. Khan Affair (BOX) 358

Anti-nuclear Energy Protests and a National Debate (BOX) 360

Case: South Africa ***361***

South African Uranium Enrichment Program 362

Nuclear Trade with South Africa 363

Case: Australia **369**

Uranium Enrichment Research in Australia 371

The Jervis Bay Tender 371

The Uranium Embargo 373

Urenco and Australia 376

The Mission to Canberra 382

Pre-feasibility Report UEGA 385

The Full Feasibility Study 387

A Technology Choice is Made 393

The Dutch MFA and the Australian Deal in the Media 396

Incoming Australian Labor Government Reverses Policy 399

Case: Japan **402**

Enrichment in Japan 404

Urenco and Japan 406

SWUs for Technology 409

Cases: Iraq, Libya and Israel **414**

Cases: Spain, Iran **416**

Case: Indonesia **417**

Case: Egypt **419**

Urenco and Egypt 420

Case: Yugoslavia **421**

Urenco and Yugoslavia 424

Case: Taiwan **427**

Urenco and Taiwan 429

'The Submarine Affair': The Dutch Export-drive clashes with China (BOX) 430

Case: Mexico ***436***

Case: India ***438***

Urenco and India *440*

Case: Turkey ***441***

Case: China ***443***

Chinese Uranium Enrichment Research *446*

Urenco and China *449*

Chapter 11: International Safeguards Developments and Urenco **452**

EURATOM, the IAEA and NPT Safeguards *456*

Safeguards at Urenco *463*

Establishment of the Black Box Principle *466*

EURATOM-IAEA Facility Attachment Negotiation *470*

INFCE Working Group 2 on GCEP Safeguards *471*

The Hexapartite Safeguards Project (HSP) *477*

The LFUA model of the HSP *487*

The Facility Attachment for Almelo *490*

After HSP: A GCEP Safeguards Epilogue *492*

GCEP Safeguards in China *495*

New Urenco Plants in France and the United States *498*

GCEP Safeguards in Iran *503*

Chapter 12: Summary, Analysis and Conclusions **506**

Theory of International Society and Regimes *506*

The Nuclear Non-proliferation Regime, US leadership and Western Europe *509*

Classification *511*

The Nuclear Non-proliferation Regime and its Contradictions *512*

The Troika *515*

Urenco and the Clash of Economics and Non-proliferation *517*

Brazil *518*

The Interim Export Policy *520*

Australia *521*

Japan *522*

Other Potential Customers *522*

Yugoslavia *523*

Taiwan *524*

Additional Insights from the Country Cases *525*

GCEP Safeguards *526*

Overall Conclusion *529*

Bibliography **532**

Annex I: The 'Toirkens-Voûte'-Protocol **594**

Annex II: Sources from the National Archives of the Netherlands **597**

Annex III: Classified Sources from the Archives of the Netherlands Ministry of Foreign Affairs **609**

List of Figures, Tables and Illustrations

Figure 1: Estimated Global Nuclear Warhead Inventories 1945-2017. Source: Kristensen, Hans, M., Norris, Robert, S., 'Status of World Nuclear Forces', Federation of American Scientists. 63

Table 1: Urenco estimation of its contractual obligations as of November 1977. Source: Letter, Chairman Urenco UK P. Jelinek-Fink to Atomic Energy Division, Department of Energy C. Herzig, 30th of December 1977, including paper 'Urenco contractual commitments and the need for decisions', (n.d., est. end of November 1977), 2.03.01/10859, p. 7. 288

Illustration 1: Vertical section of the U7 IIIB Gas Centrifuge, Beyerle, K., et al, 'Anreicherung der Uranisotope', in Kistemaker, J., Bigeleisen, J., Nier, A.,O.,C. (eds.), 'Proceedings of the International Symposium on Isotope Separation', 23-27 April, 1957, Amsterdam (North-Holland Pub. Co.: Amsterdam 1958) p. 671. 3

Illustration 2: A caricature of the NSG in the North-South debate, Mandelbaum, Michael, 'A Nuclear Exporters Cartel', in *Bulletin of Atomic Scientists*, Vol. 33, No. 1, p. 42. 340

Illustration 3: Prime Minister Lubbers (front left) and Prime Minister Nakasone (front center) during the walk through the Akasaka Garden (at the Imperial Palace, Tokyo). In the background, among others (left to right), FRG Chancellor Helmut Kohl, UK Prime Minister Margaret Thatcher, US President Ronald Reagan - Tokyo Economic Summit Conference of 4-6 May 1986, Photograph, 'Margaret Thatcher on the International Stage', *The Asahi Shimbun*, 5th of May 1986, http://www.gettyimages.com/license/166103032, website checked 2-8-2018. 411

List of Abbreviations

AAEC	–	Australian Atomic Energy Commission
ACDA	–	Arms Control and Disarmament Agency (US)
ACE	–	Association for Centrifuge Enrichment
AEC	–	Atomic Energy Commission (US)
AGR	–	Advanced Gas-cooled Reactor
ALP	–	Australian Labor Party
BMFT	–	Bundesministerium für Forschung und Technologie (FRG)
BNFL	–	British Nuclear Fuels Ltd.
BoG	–	Board of Governors (IAEA)
BWR	–	Boiling-Water Reactor
C/S	–	Containment and Surveillance
CAS	–	Committee on Assurance of Supply
CD	–	Conference on Disarmament
CENTEC	–	Centrifuge Technology Company
CIA	–	Central Intelligence Agency
CNEN	–	Commissao Nacional de Energia Nuclear (Brazil)
CNOR	–	Cultivated Nuclear Orbital Rotor
CT	–	Critical Theory
DGES	–	Directorate for European Cooperation
DIO	–	Directorate International Organizations
DIO/PI	–	Directorate International Organizations, Political and International Security Affairs Department
DOE	–	Department of Energy (US)
DPRK	–	Democratic People Republic of Korea
DPV	–	Directorate Political United Nations-Affairs
DPV/NW	–	Directorate Political United Nations-Affair Nuclear Weapons Desk
DRW	–	Council of Europe and Scientific Cooperation Directorate
DRW/AT	–	Council of Europe and Scientific Cooperation Directorate Atomic Affairs Desk
DI/DIV	–	Design Information/Design Information Verification
EC	–	European Community
ECN	–	Energie Centrum Nederland
EDC	–	European Defense Community
EEC	–	European Economic Community
ENDC	–	Eighteen-Nation Committee on Disarmament
EPS	–	European Political Cooperation
ERDA	–	Energy Research and Development Administration (US)
ESCOM	–	Electricity Supply Commission (South Africa)
ESD	–	Euratom Safeguards Directorate
EURATOM	–	European Atomic Energy Community
FA	–	Facility Attachment
FCO	–	Foreign and Commonwealth Office (UK)

FOM	–	Stichting voor Fundamenteel Onderzoek der Materie
FRG	–	Federal Republic of Germany
FSS	–	Full-Scope Safeguards
GCS	–	Global Civil Society
GDR	–	German Democratic Republic
GCEP	–	Gas Centrifuge Enrichment Plant
GkT	–	Gesellschaft für Kernverfahrenstechnik mbH
GnV	–	Gesellschaft fur nukleare Verfahrenstechnik mbH
HEU	–	High Enriched Uranium
HFR	–	High Flux Reactor
HSP	–	Hexapartite Safeguards Project
HST	–	Hegemonic Stability Theory
HWR	–	Heavy-Water Reactor
IAEA	–	International Atomic Energy Agency
INFCE	–	International Nuclear Fuel Cycle Evaluation
INFCIRC	–	Information Circular (IAEA)
IPS	–	International Plutonium Storage
JC	–	Joint Committee
JENER	–	The Joint Establishment for Nuclear Energy Research
JNFI	–	Japan Nuclear Fuel Industries
KMP	–	Key Measurement Point
KWU	–	Kraftwerk Union AG
LEU	–	Low Enriched Uranium
LFUA	–	Limited Frequency Unannounced Access
LWR	–	Light-water Reactor
MAD	–	Mutually Assured Destruction
MBA	–	Material Balance Area
MEA	–	Ministry of Economic Affairs
MFA	–	Ministry of Foreign Affairs
MOX	–	Mixed-Oxide Fuel
MUF	–	Material Unaccounted For
NAM	–	Non Alignment Movement
NATO	–	North Atlantic Treaty Organization
NCM	–	Nederlandse Credietverzekering Maatschappij
NDA	–	Non Destructive Assay
NMA	–	Nuclear Material Accountancy
NNPA	–	Nuclear Nonproliferation Act
NNWS	–	Non-Nuclear Weapon State
NPP	–	Nuclear Power Plant
NPR	–	Non-proliferation Regime
NPT	–	Treaty on the Non-proliferation of Nuclear Weapons
NSG	–	Nuclear Supplier Group
NWS	–	Nuclear Weapon State
OEEC	–	Organization for European Economic Co-operation

PHWR	–	Pressurized Heavy Water Reactor
PNC	–	Power Reactor and Nuclear Fuel Development Corporation (Japan)
PWR	–	Pressurized Water Reactor
RCN	–	Reactor Centrum Nederland
RSV	–	Rijn-Schelde-Verolme
SAGSI	–	Standing Advisory Group on Safeguards Implementation
SSAC	–	State System for Accounting and Control
SILEX	–	Separation of Isotopes by Laser Excitation
SNOR	–	Scientific Nuclear Orbital Rotor
SOS	–	Subcommittee on Safeguards
SOSS	–	Society of Sovereign States
SQ	–	Significant Quantity
START	–	Strategic Arms Reduction Treaty
SWU	–	Separative Work Unit
TENEX	–	Techsnabexport
TNO	–	Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek/Dutch Organization for Applied Physics Research
TSWG	–	Technical Safeguards Working Group
UC	–	Ultra-centrifuge
UCN	–	Ultra-Centrifuge Nederland N.V.
UEGA	–	United Enrichment Group of Australia
UF6	–	Uranium Hexaflouride
UK	–	United Kingdom
UKAEA	–	United Kingdom Atomic Energy Authority
UNGA	–	United Nations General Assembly
UNSC	–	United Nations Security Council
URENCO	–	Uranium Enrichment Company
US	–	United States
USSR	–	United Soviet Socialist Republics
VMF	–	Verenigde Machine Fabrieken
WEU	–	Western European Union
WOB	–	Wet Openbaar Bestuur

Dutch Political Parties

ARP	–	Anti-Revolutionaire Partij (Anti-Revolutionary Party)
CDA	–	Christen-Democratisch Appèl (Christian Democratic Appeal)
CHU	–	Christelijke Historische Unie (Christian Historic Union)
CPN	–	Communistische Partij Nederland (Communist Partij Netherlands)
CSP	–	Christelijk-Sociale Partij (Christian Social Party)
D66	–	Democraten-66 (Democrats-66)
KVP	–	Katholieke Volkspartij (Catholic People's Party)
PPR	–	Politieke Partij Radikalen (Political Radical Party)
PSP	–	Pacifistich Socialistische Partij (Pacifistic Socialist Party)
PvdA	–	Partij van de Arbeid (Labour Party)

SGP	–	Staatkundig Gereformeerde Partij (Reformed Political Party)
VVD	–	Volkspartij voor Vrijheid en Democratie (Liberal Party)

Chapter 1: Introduction

The Troika, Urenco and Non-proliferation during the Cold War

The thesis before you aims to theoretically and historiographically contribute to the understanding of the nuclear non-proliferation regime. It does so from the conviction that there is something to contribute; that the current theoretical understanding of this regime and international regimes in general causes misunderstanding and misinterpretation of events connected to them. Similarly, this thesis adds to the historiographic treatment of the non-proliferation regime, because certain episodes of it have not been properly or fully narrated yet, because of lack of interest or (access to) sources. The latter was certainly the case in the story of Urenco, the Dutch-British-German enrichment company, about which many archival sources necessarily were and to a large degree remain classified. Urenco, and how that Troika of states managed its establishment and operation in the nuclear non-proliferation regime is the subject of this thesis.

Urenco, the nuclear non-proliferation regime and the Cold War represent stories of different scale that are part of one another. The controversies are many. Most people hearing the name Urenco in a non-proliferation context will associate it with the Pakistani nuclear scientist Khan, who stole a trove of machine blueprints and helped his country make a leap towards a nuclear weapon. In the context of the 1970s and 1980s (the first twenty years of Urenco's operations) the name Khan is but a footnote however. The knowledge and possible implications of the theft were for a long time not known to many, and so even when news about the theft emerged in the media in the late 1970s, it would take until the late 1990s for the actual implications to become known and fully appreciated. The story that emerges from the Dutch Ministry of Foreign Affairs archives shows that when it came to the Dutch membership of the Troika, the Khan Affairs did not meaningfully impact its commercial and non-proliferation policies other than those that dealt with improving the security policies at the laboratories and plants. The Khan Affair does therefore not feature heavily in this thesis.

The larger controversy is that junior Western alliance (NATO) members took the lead in sensitive nuclear technology development, banded together and managed to pool their resources, policies and interests to break into the US monopoly on enriched uranium in the non-communist world market and did so responsibly. Today, Urenco enrichment technology dominates that market and the company covers about one third of global enrichment needs.

But why is this controversial? What is it about enrichment technology that has the potential to have such a great impact on international security?

Both highly enriched uranium and plutonium can be used in nuclear weapons. Plutonium is a product from nuclear reactors. Enriched uranium is a product of the enrichment process, which separates the heavier uranium isotope from the lighter one. Once you separate enough of the lighter isotope from the heavier one, you can make nuclear explosives with it. Whether you produce enough plutonium in a reactor and separate it from the reactor's spent fuel, or

you enrich enough uranium to get your material that way – it is fair to say that producing this 'fissile material' is the most challenging part of the task to make a nuclear weapon.

And what about centrifuge technology? What makes it different from how enrichment was done before?

The answer is that the gas centrifuge 'does it' cheaper, faster and less detectable. Even though there are several technologies to enrich uranium, the others do it slowly, inefficiently and/or by brute force. As mentioned above, producing plutonium for a bomb requires a reactor and a separation plant. These are large structures that are both expensive and visible. The other route, uranium enrichment, can use gaseous diffusion, the most-used technology before gas centrifuge became technologically mature. Diffusion requires large factories that use a lot of energy and are therefore easy to see and hard to hide. Compared to centrifuge plants, these plants are extremely inefficient as the applied method uses pressure to forcibly push uranium gas through metal membranes. Moreover, the method's efficiency reduces as the enrichment grade becomes higher, and so the process has a ceiling that requires a complementary technology to enrich to 90% or higher (the level of nuclear weapon-usable material). From a proliferation standpoint the 'plutonium route' and enrichment by gaseous diffusion are therefore unattractive to a country interested in a *covert* nuclear weapons program. In contrast, centrifuge technology is much less power-intensive and is able to operate efficiently in much smaller installations. You can therefore hide a centrifuge enrichment plant much easier from prying eyes.

Centrifuge technology is very difficult to develop. An efficient centrifuge spins at very high speeds over very long periods of time, meaning it must be very strong and durable, yet flexible, and extremely well-balanced. To construct plants of these requires a program that employs specialized physicists, chemists, engineers, metallurgists and others over long uninterrupted periods of time in order to foster expertise. These experts need access to specialized materials, measurement technology and machinery to construct centrifuges and the installations they operate in. It took centrifuge programs at universities and specialized laboratories in the Netherlands, the United Kingdom and West-Germany roughly twenty years of continuous investment in human infrastructure and technical means to develop centrifuge technology that was dependable and efficient enough to be commercially viable. Most countries in the world at that time could not have duplicated that effort if they had wanted to; they simply did not have a high-end scientific and engineering human and technological infrastructure in place to set to this task. Even countries that did have those means, such as the United States, failed to come up with a competitive design.

Taken together, this is why centrifuge technology was and still is proliferation sensitive. Most states do not have the knowledge or industrial infrastructure that would support such an effort, nor do their economies support the prolonged investment needed to develop those. However, if a dedicated state receives information explaining exactly how to construct efficient centrifuges and build a centrifuge plant with them, that becomes a different story; a development program using such information would still need highly-skilled individuals and a sizable investment, but could 'leap frog' the otherwise required long-term investment in

fundamental research. For that reason the US and Troika countries chose to classify this sensitive technology in the early 1960s.

Then why use centrifuge technology at all?

The answer is that besides for nuclear weapons, enriched uranium was and is the fuel for most of the world's nuclear power and research reactors. Producing that (mostly low-enriched) fuel is good business and to do so more efficiently makes good commercial sense. Furthermore, the business of enrichment services is very competitive and historically saw state-actors entirely or partly subsidizing their enrichment research and national enrichment plants. Besides a proliferation risk for nuclear weapons programs, centrifuge technology is also proliferation sensitive for commercial reasons.

This is where the Troika comes in. The three countries that would eventually establish Urenco and pool their centrifuge research programs, the United Kingdom, West-Germany and the Netherlands, had sought ways to develop nuclear technology of their own following the Second World War as nuclear power generation was expected to become a large part of their national and the global energy mix. Scientists in these countries recognized early on that the centrifuge had the potential to produce enriched uranium for nuclear fuel efficiently and without the massive up-front investments that diffusion plants demanded. With government support, the research investments eventually paid off, and produced technology that was very likely to be much more competitive than diffusion technology and therefore would allow these countries to produce the means to safeguard their own energy security and break the US monopoly on this market.

Responsibility is a key concept in this thesis. It connects to both the central theory featured in this thesis as well as an important part of the historical narrative. That is no happy accident: to tell the story of and explain the development of Dutch government policy towards Urenco requires a theory that can incorporate the ethical dimension in that decision-making process, as early on in my archive research it became evident that there was much more going on for Dutch policymakers than stimulating the economy and facilitating the creating of job in a high-technology sector.

States do not operate in a vacuum. They are part of an international society of states, in which they attempt to safeguard their own interest in the short, medium and long term, with varying degrees of success. The story of Dutch Troika membership and Dutch policies towards Urenco are an excellent example of how this works. Seeking the cooperation with its Troika partners made commercial sense because it would allow all the major non-American players in centrifuge technology development to band together and benefit from each others knowledge and experience, share investment costs and reduce their dependence on and avoid going up against the monopolist in enriched uranium-services in the non-communist world by themselves. At the same time, concern over the proliferation of nuclear weapons provided an long-term strategic incentive for the UK (already a nuclear weapon state) and the Netherlands to make sure West-Germany was included in the multinational collaboration. In turn, West-German officials wanted to alleviate proliferation concerns about its ambitious civil nuclear

program through its participation in the Troika and establishment of its (initial) enrichment plant on foreign soil.

The thesis shows that for the Dutch, these considerations were informed by both the larger international context as well as through the smaller national one. The Dutch perspective and Dutch policies take center stage in the case study. In the same year of the Troika's official conclusion of the Treaty of Almelo (1970) and thus its intention to move forward together, the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) came into force, its negotiation concluded and opened for signature two years earlier. It and associated agreements on international exports and control of nuclear technology and materials created a benchmark, a norm, of responsible behavior in what would become known as the Non-proliferation Regime (NPR). The historical data, some of which made public for the first time in this thesis, shows that the regime was foundational to the Dutch role in the Troika as norm entrepreneur for responsible stewardship of sensitive nuclear technology and the sensitive materials it produced with it. It also shows that that role was partly forced upon the Dutch Government by that country's scrutinizing parliament and societal perspectives on nuclear weapons and energy.

Today, making up the tally of 75 years of nuclear non-proliferation policies by states and an even longer period of military secrecy surrounding nuclear technology usable for weapons, the long term record of nuclear non-proliferation can be judged to have been positive. Efforts to reign in nuclear proliferation have been anything but flawless; a considerable amount of nuclear technology and materials spread around the world since the advent of the nuclear age, available to both state and non-state actors. The fact that in 2018 we are concerned about less than handful of nations acquiring nuclear weapons, and the nuclear weapons disarmament agenda now only involves nine (de facto) nuclear weapon states (the United States, the Russian Federation, China, France, the United Kingdom, Israel, Pakistan, India and North Korea) is in large part thanks to the NPR and the states that supported its rules and norms that successfully deterred and discouraged countries not to pursue nuclear weapons capability, or convinced them to give those capabilities up once acquired. The NPR is one of the most preeminent examples of what collaborative projects international society is capable of. Events and developments prior to the establishment of the NPR are just as relevant to explain its success and challenges as those that happened after; the regime must be seen as a political reaction to technical and political opportunities and challenges that the growth and spread of nuclear technology across the world produced.

Since the end of the Cold War, we have seen a period of disarmament that resulted in substantial reductions in nuclear warheads and missiles. These are largely the result of the willingness by US and Russian Federation in the 1990s to further reduce their arsenals and normalize their security relations. The 2010 New START (Strategic Arms Reduction Treaty) renewal could be one of the most substantive signs of this trend of post-Cold War detente with regard to strategic nuclear weapon posture and yet threats to a sustained agenda of disarmament are proving to be larger than they appear. Particularly the US-Russian fallout over the Intermediate-Range Nuclear Forces (INF) Treaty, after Russian President Putin repeatedly signaled its constraints and bilateral nature were detrimental to Russian security

and the Russian Federation's consequently violated the treaty, marks a turning point. The US withdrawal procedure from the INF triggered in 2019, citing the Russian continued violation, was quickly mirrored by the Russian Federation, after which the diplomatic blame-game began. 'Trust but verify' is the Russian proverb, but there is little trust and no agreement to verify anything at the moment, and this does not bode well for the New Start renewal that needs to be negotiated before February 2021. This has arms control experts worrying about the effects of new weapon system development by the US, the Russian Federation and other potential arms control partners.[1] Less than a decade after the call by four of the most distinguished US national security experts (Schultz, Perry, Kissinger and Nunn) for the US and the world to make haste of the work of nuclear disarmament in light of contemporary challenges, there is renewed need to heed it.[2]

Meanwhile, Iran has challenged the regime by first attempting to covertly develop its sensitive nuclear infrastructure and when discovered using it as a hedge vis-à-vis the demands of the international community. North Korea is steadily sophisticating its ballistic missile program, with which it seeks to strengthen the deterrent effects of its nuclear weapons program and its ability to strike all of its (regional) adversaries.

Regardless, the fact remains that even with nine states possessing rudimentary to sophisticated capabilities to deliver a nuclear explosive device, none have used these in conflict since World War II. This tally of nine should give us hope, because however anarchic and zero-sum the world must have seemed to state leaders, policymakers and academics in recent history, there has been enough belief in our common rational humanity to invest and keep investing in the public good that is the NPR. Common sense dictates we should keep assessing our non-proliferation efforts in light of evolving challenges and ask critical questions about what underlies the nature of the challenge before us. The context of international security is the arena of international politics. Foundational to our understanding of that context is our theoretical understanding of the practices of international politics, as it is the one locality available to humanity to continuously reignite and rediscover our common humanity in a single community. Local communities inform the policies of nations, and those in turn determine for a large part what can be achieved internationally. That constitutive relationship is important to recognize for not just social theorists but to any policymaker engaged with international challenges.

Political theorists have been studying nuclear weapons and the non-proliferation regime for many years and most of these have adhered to the explicit or implicit reasoning of Realism, which is a school of political theory that is both popular in the wider study of international affairs but that is particularly dominant in the area of strategic and security studies. A break

1 Pifer, Steven, Oliver Meier, 'Are We Nearing the End of the INF Treaty?', in *Arms Control Today*, Vol 48 (January/February 2018) https://www.armscontrol.org/act/2018-01/features/we-nearing-end-inf-treaty, website checked 24-8-2018.

2 Shultz, George, P., Perry, William, J., Kissinger, Henry, A., Nunn, Sam, 'Towards a World without Nuclear Weapons', Nuclear Security Project, https://www.nti.org/media/pdfs/NSP_op-eds_final_.pdf?_=1360883065, website checked 24-8-2018. This series of op-eds was originally printed in *The Wall Street Journal*, from January 2007 to March 2011.

with this tradition is needed because new theories and the philosophical constructs on which they are based have drawn attention to severe shortcomings of realist theory in comprehensively explaining international political dynamics. New insights and better explanations on historical episodes have come to show that when international politics is conducted, there is much more to explaining and predicting events than the narrow state-centric focus of material interests and power.

This thesis starts out with addressing that theoretical challenge. **In chapters 2 to 5**, I attempt to give this study on non-proliferation a strong theoretical structure using epistemology and ontology originating in political, sociological and international relations (IR) theory, that includes a discussion on the philosophy of science. Chapter 2 contains a discussion of the history of Political Realism and how it is relevant to our present study and the contemporary field of IR. Chapter 3 reviews contemporary debates in social and political theory, with a focus on international relations theory epistemology and ontology, resulting in a recommendation for practice-based theory based on social rules.[3] Chapter 4 introduces regime theory, it's historical evolution and how in relation to it the post-positivist turn in IR theory is relevant to matters of ontology. In Chapter 5, the practice-based approach is brought together with the concept of regimes and an adapted model of regimes is proposed to accommodate new insights in theory. It is followed by a short explanation of the chosen methodology for this study and a set of questions and hypotheses of how the theory applies to the case study and how the case study validates the choice for a practice-based regime theory.

The theoretical framework that this thesis presents functions to shore up the background against which the historical narrative of the main body plays out. It allows for the structuring of analysis of that narrative, and particularly the Urenco case study, by asking and attempting to answer the questions that come up about the motivations of the main actors and how their perception of their own interests and their wider responsibilities in international society evolved over time.

In the early 1970s, the future role of nuclear energy and weapons wasn't as clear as it sometimes seems in hindsight. The information position of countries was much poorer than today and the attraction of acquiring a nuclear weapons capability for reasons of national security, prestige or power projection much greater. With the coming into force of the NPT the normative international landscape evolved in the 1970s and 1980s, but much uncertainty about the effectiveness and likelihood of survival of the NPR remained.

Part of that uncertainty was located in how new technologies would challenge the boundaries that the NPR set between the 'haves and have-nots' possessing nuclear technology and infrastructure and between Nuclear Weapon States (NWS) and Non-Nuclear Weapons States (NNWS) as sanctioned by the NPT. As the gas centrifuge method became technologically and commercially mature, the smaller partners in the Western alliance challenged the American nuclear fuel production hegemony in the West and its ability to dictate the conditions of technology proliferation. How these challenges were addressed by the US and how its British, West-German and Dutch allies (and competitors) organized the responsible exploitation of the

3 Specifically, the application of the constitutive theory of Mervyn Frost.

centrifuge method in a fast-changing and sometimes volatile international environment, as told mainly from the perspective of the Netherlands, constitutes the case study of this thesis. To take a step back from the focus on the superpower-dynamic in this period and detail smaller histories that expose some of the tensions and controversies that marked inter-alliance life during the Cold War helps to come to a greater understanding of this period of international history as a whole.

Therefore, in the second part of the thesis (**chapters 6 to 9**) general and particular histories of nuclear proliferation, non-proliferation and technology development are presented. Chapter 6 introduces the reader to the basics of nuclear technology and nuclear weapons, and provides a general overview of thinking about nuclear weapons, the Cold War arms race, and the first disarmament initiatives. Chapter 6 relates a short history of the first generation NWS and the history of non-proliferation efforts up to the NPT. Chapter 7 details the particular history of the development of nuclear infrastructure in the Netherlands and early work there on developing centrifuge technology for isotope separation as well as early initiatives for collaboration in the field of isotope separation. Chapter 8 describes the wider history of development and classification of that centrifuge technology, in which the United States played a pivotal and often controversial role. Chapter 9 describes how the Troika of three countries, the Netherlands, the Federal Republic of Germany and the United Kingdom each continued development of centrifuge technology, started exploring collaboration and eventually negotiated the Treaty of Almelo to form Urenco: the Uranium Enrichment Company.

Chapters 10's and 11's focus is on the multinational enrichment company Urenco. Chapter 10 narrates the commercial history of the company, as the Troika sought to exploit their combined technologies for commercial gain, while attempting to find a balance between their economic interests and wider non-proliferation responsibilities. The case study consists of a number of country studies, and for the first time provides a detailed history of the behind-the-scenes commercial history of Urenco, based on classified correspondence and memorandums of the Dutch MFA. It sheds ample light on the controversies involved with selecting customers and negotiating the conditions for supply of enriched uranium with each individual potential customer. Some of these negotiations with potential customers lasted for years, involved high levels of political involvement and produced intense domestic, Troika, and international debate, negotiations and elaborate commercial agreements with nuclear safeguards components.

Nuclear non-proliferation safeguards are the subject of chapter 11, as it tells the history of international development and negotiations of safeguards at Urenco's commercial centrifuge facilities; the first enrichment facilities to be subject to international safeguards. I trace how policymakers in the Netherlands understood and acted upon their evolving responsibility in furthering the norm of non-proliferation and how they negotiated political and economic pressures from the domestic and international sphere. The chapter also sheds light on what role the Urenco company itself played in the agreement on and further development of the safeguards arrangements it became subject to.

In **chapter 12**, I provide an analysis of what the historical narrative and particularly the case study tell us. Using the insights from the theoretical framework on the workings of international society and regimes helps to illustrate how, during a crucial period in nuclear energy technology development and the evolving non-proliferation regime, the Netherlands and its Troika partners sought to understand and negotiate their own and their partners' interest in the commercial exploitation of a highly competitive and proliferation-sensitive industry.

This thesis aims at providing a historical narrative of a part of the nuclear non-proliferation history which has been under-represented in the English-language literature. That is partly because it is a small-country history of the Netherlands, and small countries are easily overlooked. Some of the literature on this history has been relatively inaccessible to the wider academic community because it existed only in Dutch and was never translated. Furthermore, much of the detailed information contained in official documents was classified (and probably an even larger part still remains so). Hopefully policymakers, academics and all others interested in this subject will appreciate this alternative, small country perspective. To improve the accessibility of this study, I have translated all quotes from Dutch-language sources into English.[4]

The broader story that will emerge from this historical narrative of nuclear technology exploitation, set against a background of the evolving non-proliferation regime, is one of resistance. Superpower hegemony during the Cold War inevitably created dissent, such as expressed in the resistance to the non-proliferation norms the US tried to establish. Such resistance originated in two major considerations. First, some states (not just those allied to the US) historically resisted the further implementation of legal boundaries to the universal access to all elements of the fuel cycle, as well as the normative push towards such implementation, in light of fears of permanently reduced sovereignty and their right to self-determination. Some of these states interpreted these sovereign rights to include the right to develop nuclear weapons. In that respect, the players that employ a nuclear hedging strategy may since have changed, but the game hasn't. Second, during a period in which national spearhead industries were economically and therefore politically tied in with the national interest, junior alliance partners resisted the wishes of and pressure from the senior partner toward overly restrictive classification and technology export limitations, because it was perceived that the latter was using its political rhetoric advocating stronger non-proliferation norms to disguise a policy of economic protectionism. Classification of centrifuge technology made good sense, but the US motives behind non-proliferation norm advocacy were viewed with suspicion nonetheless.

Resistance to the push towards an export cut-off to sensitive fuel cycle technologies such as uranium-enrichment and spent-fuel reprocessing technologies also carried symbolic weight wider than the mere economic consequences of such a cut-off; it impinged on the agreed right of all states party to the NPT to develop the peaceful applications of nuclear technology. The contemporaneous objections to a more restrictive interpretation of the regime are rooted in

4 Whenever a Dutch-language source provided the quoted text in English, I've noted so in the accompanying footnote.

how the regime took shape and how its voluntary and permissive nature evolved, during the period under investigation in this thesis and after, to something markedly less so. These objections have been and are particularly pronounced in two aspects of the nuclear non-proliferation system as it currently functions; the national economic interests embedded in commercial nuclear industries and the voluntary nature of the mechanisms of export control for non-proliferation purposes agreed upon in the Nuclear Suppliers Group (NSG), and so a history on this subject is included as well.

With the establishment of Urenco and its commercial expansion outside of the Troika territory the responsibility to balance non-proliferation norms and national economic interests became a domestic and inter-Troika issue that could only be stabilized and eventually resolved after considerable controversy and conflict that at times seemed to threaten the collaboration itself. At the same time, Troika was confronted with assertive customers that were willing to play competing nuclear fuel services providers against one another to obtain more favorable supply conditions and extract offers of technology transfer, as well as with competitors that would enlist their national governments to strengthen their own position with potential or existing customers and to undercut the competition. Likewise, the Troika governments were enlisted to represent Urenco's interests abroad, were instrumental in shaping the non-proliferation conditions under which the company could attract and supply customers with its enrichment services, as well as represented the Troika interests in negotiating an acceptable safeguards regime for its facilities. In the process of doing so and by the standard of responsibility that the Troika set for itself, particularly inspired by the non-proliferation activism of the Dutch partner (in turn pressured to adopt its stance by the activism of the Dutch Parliament) that constrained a tendency to let economics run the enterprise, the tripartite centrifuge collaboration between the United Kingdom, the Federal Republic of Germany and the Netherlands became a symbol of responsible non-proliferation stewardship that showcased the benefits of multilateral ownership of sensitive fuel-cycle infrastructure.

Chapter 2: Genealogy of Political Realism in International Relations

In order to know and fully understand what is being said about an object of study, it is insightful to learn how that knowledge was arrived at. When it comes to political theory, study of the historical context can be key to understand a theory or framework of thought. The important term here is context; ideas are made intelligible by the context in which they are (first) presented. Powerful ideas survive their context; they can be taken out of their historical setting and applied to new situations. However, the same is often done with ideas that are not able to survive the extrapolation from their context intact. This is one argument I will forward in this chapter about the pervasiveness of Political Realism in International Relations (IR) theory and texts. By, in a limited demonstration, placing the core ideas of Realism in the historical context in which authors credited with its invention lived, I will show the relevance of that context to the base-line assumptions inherent to those ideas.

What this chapter offers is an overview that helps us understand how the development of the study of IR lead to the dominance in this academic field of Political Realism, from its historic beginnings up to contemporary times, in which distrust was emphasized over confidence, conflict over cooperation, anarchy over order, unitary concepts over integrated interconnected ones, official histories over the complexity of conflicting narratives, and in which there existed a dominant current that preferred positivist divorces of cause and effect and agency and structure. Such an overview also functions as a narrative about the processes that aided one school of IR-theory to attain preeminence and maintain its dominance since, necessarily marginalizing others.

Such an endeavor attempts to tell a big story about a big subject, that necessarily suffers from fragmentation and lack of detail due to the limited amount of attention I can give it here, but that in its general aim puts forth just one argument; as historians and international political analysts, let us free ourselves from our trained dogmas, become more aware of the theoretical complexity available to us and create a space for alternative interpretations in IR theory. Let's accept that human history is messy, complicated and progress not the product of a string of rational actions, and recognize that tracking the major actors through history is useful, but that contrasting theirs with the histories of small actors produces a much fuller and interesting picture.

It is not my intention to offer a fully fledged historical and theoretical critique of Political Realism here or attempt to establish a fully fledged theoretical framework in its place. The theoretical approach I propose in the next couple of chapters is based on existing theories, and provides the lens through which the subject matter of this study can be perceived and be better understood. It is in some ways an unfinished product of what have become my personal convictions on epistemology, ontology and theory; a composition of the more compelling post-positivist theoretical ideas that for the most part fall under a number of existing labels, such as post-structuralist, post-modernist, and constitutive theory, and most recently, the practice turn in IR-studies. However, to bring the reader around to my perspective, it's important to at least offer arguments why the 'traditional' perspective no longer suffices.

Foucault's Critique on Knowledge Creation (and Why It's Relevant to Us)

I include the following paragraphs because of a certain personal skepticism I've developed about the nature of thesis-writing and the academic process and profession more generally. When awareness of a certain futility dawns upon the researcher, it can be resolved by the suppression of that awareness (which is an abdication of responsibility) or one can take action; one can walk away from the whole endeavor or one can try to incorporate the spirit of the realization into ones work, in however limited way this is possible given the nature of the original critique of the process itself. I've attempted to mediate this position; by making no great claims of scientific progress, nor by claiming to have access to truth, I merely present the reader of this thesis with a perspective that I hope is sufficiently convincing that it will be taken along in future references on this particular subject. At the very least, this thesis' case study, in the greater scheme of non-proliferation studies, uncovers some new historical data from the archives. At most, I hope its alternative structure and presentation will inspire other students of international security to take innovations in theory seriously, to broaden the disciplinary constraints by involving other disciplines in their work and, most importantly, to tell big stories about 'small' historical subjects.

The discussion below is a summary of a couple of points Michel Foucault made on the nature of academia and knowledge creation. I take these as warnings and feel I should make other academics aware of these, so they can make a choice whether to take heed as well. I conclude this discussion with what I think is the most responsible answer to engage these warnings.

To academically understand a domestic or international political problem, one needs to understand how the dominant knowledge about that situation and its environment has come about, and has continued to be dominant. The historical rise to dominance and re-establishment of that dominance through disciplinary processes of Political Realism serves to introduce this point and expose this process. The general tenets of this idea originate with Michel Foucault and those he was inspired by, and are commonly referred to in the IR field and elsewhere as post-modernist, and placed in the wider current of post-Structuralism. Usually, and as is the case here, such theoretical labels are intended to help categorize ideas and knowledge, but also help hide the vast complexity of and sometimes contradictory ideas grouped together under them. If however one had to offer one common denominator, it would be that most ideas labeled as post-modernist, and some as post-structuralist, criticize the uncritical acceptance of the historical constitution of knowledge, and therefore this criticism can help us understand how we can come to new understandings of seemingly familiar objects of study. Such a criticism is presented in the limited genealogy on Political Realism produced below, under *The Tenets and History of Political Realism*, on page 39.

We must ask how our contemporary knowledge has come about, how it relates to the historical context in which it was conceived, and how the way in which this knowledge was created and established as dominant, has come about. Questions like these demand taking a critical look at the history and philosophy of science, at the constitution of academic knowledge, the history, philosophies and theories of the academic discipline of International Relations and all related subjects particular to our subject of study, such as non-proliferation,

strategic and security studies. We must trace the development of the science of knowledge pursuant to our object of study and ask ourselves if and how this process has resulted in ‘silences’; aspects of our object of study and ways to study it that historically have been, and still now are judged unscientific, irrelevant, politically incorrect/unpopular, involving actors that in traditional knowledge-building are deemed to have little responsibility in a specific context, or too insignificant an influence 'in the big picture' to take note of. Such is sometimes the fate of a small country in world politics, such as the Netherlands, and for example its role in promoting non-proliferation norms in the commercial nuclear fuel and infrastructure market.

Whether if, where and how the above mentioned silences in discourse exist in our understanding of IR and specifically the non-proliferation field, with which to a large extent our case study is associated, remains to be seen. Developmental pathways of both the philosophy of science in general, and political theory in the context of international relations and non-proliferation in particular, have been subjected to what Foucault calls ‘disciplinary power’.[5] With it, Foucault refers to historically vast processes that in their essence have to do with how collective human cognitive processes work and express themselves in institutions, and how in practice these are manipulated by the dominant political programs, and how those programs reproduce the power and knowledge imbued in them.[6] 'Surveillance' then serves as a disciplinary technique to keep practitioners in view of the shore, within the acceptable bounds of practice in the dominant program.[7]

Discourse itself is multi-layered. When writing a history of science, international politics and commerce, non-proliferation efforts, all of the above or of any other subject for that matter, commentary on primary sources has an interdependent relationship with its subject. The form obeys certain rules;

> 'On the one hand, it permits us to create new discourses ad infinitum: the top-heaviness of the original text, its permanence, its status as discourse ever capable of being brought up to date, the multiple or hidden meanings with which it is credited, the reticence and wealth it is believed to contain, all this creates an open possibility for discussion.'[8]

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5 Foucault, Michel, *The Archaelogy of Knowledge and the Discourse on Language* (Pantheon Books: New York 1972) pp. 6-8, Foucault, Michel, *Discipline and Punish: The Birth of the Prison,* Second Edition (Vintage Books: 1977) pp. 170-194.

6 Foucault, Michel, *The Archaelogy of Knowledge and the Discourse on Language* (Pantheon Books: New York 1972) pp. 178-186.

7 Foucault based his notion of surveillance, which imposes self-discipline on the subject, on Bentham's model prison, the Panopticon, Foucault, Michel, *Discipline and Punish: The Birth of the Prison,* Second Edition (Vintage Books: 1977) pp. 195-228, Der Derian, James, 'The (S)pace of International Relations: Simulation, Surveillance, and Speed', in *International Studies Quarterly*, Vol. 34, No. 3 (September 1990) pp. 303-304. There are strong similarities between 'surveillance' in the Foucauldian sense, and the 'reflexive monitoring' that takes place in practices (discussed in Giddens' Structuration Theory, Chapter 3, page 78).

8 Foucault, Michel, 'The Discourse on Language', Appendix to Foucault, Michel, *The Archaelogy of Knowledge and the Discourse on Language* (Pantheon Books: New York 1972) p. 221.

On the other hand, commentary is a form of repetition, 'perhaps, nothing other than what was there at the point of departure: simple recitation.'[9] 'Commentary averts the chance element of discourse by giving it its due: it gives us the opportunity to say something other than the text itself, but on condition that it is the text itself which is uttered and, in some ways, finalised'; not straying too far from its original meaning. 'The novelty lies no longer in what is said, but in its reappearance.'[10] Authors are constrained as well; '[w]e ask authors to answer for the unity of the works published in their names; we ask that they reveal, or at least display the hidden sense pervading their work', to display a continuity of thought.[11]

In academic disciplines, authors and their texts are subject to even greater constraints, Foucault argues; '… in order to belong to a discipline, a proposition must fit into a certain type of theoretical field.'[12] Furthermore, an academic discipline requires that what proposed is within a certain rational space; '… a proposition must fulfill some onerous and complex conditions before it can be admitted within a discipline; before it can be pronounced true or false it must be … 'within the true'.'[13] An author-commentor 'would only be in the true, ..., if one obeyed the rules of some discursive 'policy' which would have to be reactivated every time one spoke. (Academic) disciplines constitute a system of control in the production of discourse, fixing its limits through the action of an identity taking the form of a permanent reactivation of the rules.'[14]

Academic disciplines also are exclusive; membership comes with understanding and implicit appreciation of the *power* that a discipline wields; 'it is more a question of determining the conditions under which it may be employed, of imposing a certain number of rules upon those individuals who employ it, thus denying access to everyone else.'[15] This creates 'rarefaction' or exclusiveness; '... none may enter into discourse on a specific subject unless he has satisfied certain conditions or if he is not, from the outset, qualified to do so.'[16] From discourse in academic disciplines to everyday talk, 'not all areas of discourse are equally open and penetrable; some are forbidden territory (differentiated and differentiating) while others are virtually open to the winds and stand, without any prior restrictions, open to all.'[17]

> 'Education may well be ... the instrument whereby every individual, ... can gain access to any kind of discourse. .... Every educational system is a political means of maintaining or of modifying the appropriation of discourse, with the knowledge and the powers it carries with it.'[18]

9 Ibid.
10 Ibid.
11 Ibid., p. 222.
12 Ibid., p. 223.
13 Ibid., p. 224.
14 Ibid.
15 Ibid.
16 Ibid., pp. 224-225.
17 Ibid., p. 225.
18 Ibid., p. 227.

Foucault sets out two measures to expose the formations of power in discourse, 'for the analysis of instances of discursive control': criticism and genealogy.[19] Genealogy as method 'concerns the effective formation of discourse, whether within the limits of control, or outside of them,' or both.[20] Genealogies are 'about the insurrection of knowledges'; 'insurrection against the centralizing power-effects that are bound up with the institutionalization and workings of any scientific discourse organized in a society such as ours.'[21] Criticism analyses the processes of rarefaction, consolidation and unification in discourse', or particular to academics, the processes that claim a discourse as unique and exclusive to a particular discipline. These measures, or 'tasks', 'are not always exactly complementary'; submission to 'selection and control' is not instantaneous as discourse is produced and its effects are limited.[22]

> 'The regular formation of discourse may, in certain conditions and up to a certain point, integrate control procedures (this is what happens, for example, when a discipline takes on the form and status of scientific discourse). Conversely, modes of control may take on life within a discursive formation ….'[23]

Criticism must 'analyse the discursive regularities through which these instances [of discursive control] are formed.'[24] Genealogy, through thick historical description, can expose the limits of discursive control and reconstitute a narrative in its messy form; without any pretensions of historical determinism, without any notion that there was a rational efficient idea behind its process all along. As such, '[t]he difference between the critical and the genealogical enterprise is not one of object or field,' for they can both be applied simultaneously, 'but of point of attack, perspective and delimitation.'[25]

> 'The project of these disorderly and tattered genealogies is to reactivate local knowledges – Deleuze would no doubt call them "minor" – against the scientific hierarchicalization of knowledge and its intrinsic power-effects. To put it in a nutshell: Archeology is the method specific to the analysis of local discursivities, and genealogy is the tactic which, once it has described these local discursivities, brings into play the desubjugated knowledges that have been released from them.'[26]

This is partly what I will attempt in this thesis; to provide a thick historical account of the case study that can serve as a point of attack to the dominant discourse that has mainly been told

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19 Ibid., p. 233.

20 Ibid., p. 233.

21 Foucault, Michel, *"Society Must Be Defended": Lectures at the Collège de France, 1975-76* (Picador: New York 2003) p. 9.

22 Foucault, Michel, 'The Discourse on Language', Appendix to Foucault, Michel, *The Archaelogy of Knowledge and the Discourse on Language* (Pantheon Books: New York 1972) p. 233.

23 Ibid.

24 Ibid.

25 Foucault, Michel, *The Archaelogy of Knowledge and the Discourse on Language* (Pantheon Books: New York 1972) pp. 10-12, Foucault, Michel, 'The Discourse on Language', Appendix to Foucault, Michel, *The Archaelogy of Knowledge and the Discourse on Language* (Pantheon Books: New York 1972) p. 233.

26 Foucault, Michel, *"Society Must Be Defended": Lectures at the Collège de France, 1975-76* (Picador: New York 2003) pp. 10-11.

from an uncritical American perspective, offering an alternative perspective that attempts to delimit that discourse into one of multiple conflicting perspectives.[27] I do not make the dramatic claim that Dutch academia on this subject has somehow suffered from active exclusion or somehow has been disqualified or resisted because it does not fit the scientific rationale that persists in non-proliferation scholarship. Its under-representation, I think, is largely self-inflicted by under-investment and this in part is what the *Proliferation Studies Project*, of which this research project is part, attempted to address.

Whether these disciplinary techniques and their resulting modes of control are a result of systemic forces or individual choice, which also relates to the effects and contradictions that accompanies categorization of knowledge into separate and divorced 'streams' (for example academic disciplines), is a matter of some controversy. In this thesis, this process is conceptualized as circular; to speak of systemic qualities is merely to categorize and label effects that the collective idea-holding and resulting decision-making of individuals in institutions have on all participants in the system. Yet, one does not have to be a post-modernist to agree that such dynamics exist. It is here that we can see how meta-level ideas about how knowledge and ideas are relevant and structured can overlap between disciplines, or how the same concepts can be reinvented in other disciplines (for example the structure-agency debate, see Chapter 3, *Structure and Agency*).

Foucault's understanding of the constitution of knowledge and how it (re-)constitutes power has very interesting overlaps with thinking about structure in the IR discipline. In the IR discipline, the knowledge-power continuum/dynamic can be understood in several different ways, and the perspective I offer is now not so controversial. The dominant modes of thought resisted new streams of theory so successfully that the discipline itself became disjointed, and triggered a phase of introspection, of genealogy, that exposed how Political Realism and its associated epistemology Positivism had, to put it dramatically, taken the discipline hostage.[28] The dominance of the Structural Realism of Kenneth Waltz (structure represents the dynamic created by only the materialistic configuration of assets) was augmented, not replaced, by the Social Constructivism of Alexander Wendt (material configurations constitute collective ideas about the world, which in turn reinforce the material configuration of power) that preserved Waltz as the master, the almost singular point of reference, to which all future theoretical avenues should pay tribute.[29] And so we do; the alternative ideas; from thick Constructivism to post-structuralist accounts of IR; they all take the form of rebellion, in which every narrative first has to tear down the old before it can legitimize itself as the new, and in doing

27 Though the discussion here grounds the methodology of this thesis, additional discussion on it can be found in Chapter 5, under *Methodology and Sources*, page 135.

28 A valuable account of how the discipline became disjointed, and how the different schools of thought were rooted in different philosophical positions on epistemology, and arguably a good example of geneology's usefulness, is given by Steve Smith in Smith, Steve, 'Beyond Positivism', in Smith, Steve, Booth, Ken, Zalewski, Marysia (eds.), *International Theory: Positivism and Beyond* (Cambridge University Press: Cambridge 1996) pp. 11-44.

29 A relatively recent example can be found in, Dunne, Tim, Hansen, Lene, Wight, Colin, 'The end of International Relations theory?', in *European Journal of International Relations*, Vol 19, No. 3 (September 2013) pp. 408-410, 413.

so partially reconstitutes the old as the legitimate starting point, the point of reference. And so, Realism endures.

Academically, we cannot escape categorizations and abstractions; we need concepts and theories to describe the complexity of the world, and by employing these we (re-)produce power in discourse. Uncritical reproduction of these will result in reification, in normalization. When such categorizations become institutionalized processes and *frameworks of knowledge* emerge, such as happens in the modern state bureaucracies or in academic disciplines (and as such represent a factor that constitutes *institutional memory*), a parallel process emerges that disciplines all new knowledge. Particularly scholars show a strong tendency to fit all that is new into the institutional practices or structures of knowledge that are familiar, as they must legitimize their work by making it part of the existing dominant paradigm. A paradigm in this sense is the collection of '"the fundamental assumptions scholars make about the world they are studying"' as well as the scientific philosophy that defines and demarcates the possibilities of studying it.[30]

When inter-categorical ideas (whether they for example relate to institutional reform in a governmental ministry or a new theory in academic discourse) do not fit into, or fit multiple of our already categorized, labeled and thus normalized understandings, a tendency exists to reject those, due their inconsistency with established validity. An example of the latter process we can easily find in the separation of academic disciplines, a situation that has certainly lead to increased specialization and deeper expertise in those disciplines, but that frustrates the comprehensive study of ideas or problems with an inherently inter-disciplinary nature, such as the study of non-proliferation. To Foucault, these biases, inherent in basic human cognitive processes and institutional tendencies, represent but the lower level-processes that frustrate our attempts for greater understanding of human affairs, and the possibilities for human emancipation that ride on that understanding.

We can try to navigate this conundrum by making explicit what these concepts and theories are and to what we owe allegiance when we use them, to ensure that our understanding of the concept's content and history isn't lost on us. Moreover, we must try guard against the effects of the above mentioned 'compartmentalization' of academic science into divorced disciplines that don't speak critically to one another, by educating ourselves across disciplines and by being open to inter-disciplinary research projects that bridge those separations. This thesis is a modest attempt at this, mainly in that it tries to introduce IR theory back into the realm of non-proliferation studies, a niche subject grouped under security studies, where the focus on the military expression of power reserved it mainly for realist theoretical analysis, if any.

This thesis attempts to combine elements from such diverse and divergent academic disciplines as history, strategic and security studies, sociology, social psychology and IR to draw out a comprehensive, holistic picture to complement the growing literature on issues of nuclear non-proliferation, in line with the requirements of Critical Theory (see chapter 3, *Critical Theory*). This thesis advocates the collapse of the divorce of disciplines, and suggests

30 Vasquez, John, A., 'The Realist Paradigm and Degenerative versus Progressive Research Programs: An Appraisal of Neotraditional Research on Waltz's Balancing Proposition', in *The American Political Science Review*, Vol. 91, No. 4 (December 1997) p. 900.

that specialization in academia must mean attaining both in-depth disciplinary knowledge and broad inter-disciplinary knowledge, and seeking the application of one on the other and vice versa.

The Tenets and History of Political Realism

Political Realism harnesses assumptions about and attitudes toward reality that, for long periods of Western history, seemed to form an accurate base from which to extrapolate political theory. Whether this was objectively the case, or whether soon after its inception, through education, political culture started observing Realism's theoretical rules and suggestions of proper conduct (thus creating a world in which its assumptions and predictions became increasingly true), and whether technological and intellectual progress has since overtaken the theory as it described the workings of (international) society; and even whether Realism accurately captures 'human nature' as it underlies all political behavior, I will leave aside for now.

Realism, as a school of thought in IR, made a strong comeback in the second half of the 20th century, when its theorists chose close epistemological association with the contemporaneously popular Logical Positivism, a new golden standard of theoretical rigor in the philosophy of science field during this period. Realism's dominance in IR-theory can not only be explained by the attractiveness of its reputation, historical relevance, ideas or epistemological associations, but also by recognizing the role played by historical discursive processes of modernity that helped to ensure its academic dominance.

Visiting the history and philosophy of science as it relates to IR serves to put somewhat into perspective currently popular academic views on these subjects. It's important to delve deeper into Realism's historical foundations because, as Charles Taylor has argued,

> '... the dominant interpretations and practices may be so linked with a given model that this is, as it were, constantly projected for the members as the way things obviously are … Freeing oneself from the model cannot be done just by showing an alternative. What we need to do is to get over the presumption of the unique conceivability of the embedded picture. But to do this, we have to take a new stance towards our practices. Instead of just living in them and taking their implicit construal of things as the way things are, we have to understand how they have come to be, how they came to embed a certain view of things.'[31]

31 Taylor, Charles, 'Philosophy and History', in Rorty, Richard, et al. (eds.), *Philosophy and History* (Cambridge University Press: Cambridge 1984) p. 21, as quoted in Kratochwil, Friedrich, *Rules, Norms, and Decisions: On the Conditions of Practical and Legal Reasoning in International Relations and Domestic Affairs* (Cambridge University Press: Cambridge 1989) pp. 2-3.

Machiavelli and Hobbes as Political Science

What follows below is part of a complex historical account that could be told in several different ways, but for our purpose will be brief, simplified and as much as possible chronologically narrated. It will take note of important ideas and thinkers that can inform our understanding of the historical and contemporary popularity of positivist theorizing and Political Realism in IR in general and security related subjects such as non-proliferation in particular.

When scholars write about the history of the study of international relations, they often start with a history of the study of war, for example by means of Thucydides' account of the Peloponnesian War (which lasted 431–404 BC). The writings of the ancient Greeks and Romans on war and other interstate relations were for a long time the only accounts in the West that remotely resembled a scholarly account of statecraft. In Western history, many of the surviving Greek and Roman accounts were increasingly rediscovered and re-appreciated around the time of the Italian Renaissance. This brings us to possibly the most famous author of that time that wrote about war and statecraft; Nicolo Machiavelli (1469-1527). Machiavelli has been credited with the idea that a ruler must be ready to do everything and anything, even if morally deplorable, in order to keep a secure grip on power, as power itself brought with it moral responsibility for the well-being of one's subjects.[32] Machiavelli's writings could have served as the inspiration for Thomas Hobbes (1588-1679) to formulate one of his most important thesis in *Leviathan* (1951), which work placed him next to Machiavelli as one of the main classical thinkers of Political Realism.[33] Hobbes thesis in *Leviathan* states that while men have tamed the 'state of nature' (or 'state of war') domestically by means of government and the state apparatus, in the great game of international affairs this is not the case, and due to the continued incommensurability of different states' interest (the accumulation of power), can never be the case. Hobbes describes the state of nature, or state of war, as a continuous fight of all against all, in which security is a sought-after good that is impossible to ever be possessed fully.[34] The link to Machiavelli becomes clear in that *Leviathan* inspired the idea that in inter-state relations no room for universal morality exists; it is a continuous fight for survival between states, and choosing the moral high-ground in one's policies will result in assured extinction. Survival in this account is given the meaning of having power; those with power have security, those without have not. It is in this conception of power and security that forces states and their leaders to be forever occupied with maximizing power, either absolutely or relatively to other states' power, that Political Realism finds its origins.

However, both the above accounts are simplifications of the content of the actual writings of Machiavelli and Hobbes, lacking important contextual (historical) dimensions to their works, allowing abstract theories to be subsumed from them. The existence of these dimensions are lost to some commentators as they have difficulty in drawing in the social historicity of the writings through secondary sources; the original accounts were written in (and thus reflect on)

32 Machiavelli, Nicollo, *Il Principe* (Written in 1513, first published in 1532).
33 Hobbes, Thomas, *Leviathan or The Matter, Forme and Power of a Common Wealth Ecclesiasticall and Civil* (1651).
34 Ibid., pp. 77-79, 90-91, 111.

a specific time, and intended for a specific audience, in order to accomplish certain goals of the author (which can be understood as goals of personal advancement as well as serving a public good). Both *Il Principe* and *Leviathan* are partly political tracts describing a state of affairs and offering advice to contemporary rulers in how to manage this state of affairs, and did not offer a timeless theory on states' internal and external affairs.

Machiavelli's political patrons were the Borgia family in Florence and Hobbes associated himself with the royalist cause in England in the period of the English civil war (1642-1651). Both lived in times of great domestic upheaval; during his lifetime, Machiavelli's patrons lost their dominion of Renaissance Florence to the powerful Medici family, and Hobbes had to flee England to France to join his exiled political allies. To what extend exactly these authors allowed the political color of their patrons and allies influence their writings is subject to discussion, but what is clear is that both of them were dependent on the favor of their audiences for their future livelihoods.[35] Both authors, and with them most political philosophers throughout the centuries, lived in times very different from the present. When taking appealing ideas out of their texts and thus historical contexts risks separating them from the awareness of the relevance of that context.

Niccolo Machiavelli

Machiavelli's Florence was a city-state that competed for power with several other city-states and the families that headed them, in the northern Italian peninsula. Political power was absolute and fickle; the great families and councils that ruled these cities and their lands allowed little to no political dissent, knowing that civil unrest could very quickly lead to domination and conquest by another city (or another local family). For long periods at a time, alliances between city-states and in time the rising Papal State shifted rapidly and with hardly any prior warning, representing the first recognizable and documented *balance of power-system* in Europe since ancient times. The constant communications needed to negotiate alliances as well as the continuous need for information about the affairs of undependable allies saw a new formative phase of an intensified practice of diplomacy, for example introducing resident-ambassadors and systems of daily dispatches to keep rulers and officials up to date on events abroad.[36]

35 Skinner, Quentin, 'Machiavelli', Tuck, Richard, 'Hobbes', in *Great Political Thinkers* (Oxford University Press: 1992), MacGillivray, Royce, 'Thomas Hobbes's History of the English Civil War A Study of Behemoth', in *Journal of the History of Ideas*, Vol. 31, No. 2 (1970) pp. 180-181, McCormick, John, P., 'Prophetic Statebuilding: Machiavelli and the Passion of the Duke', in *Representations*, Vol. 115, No. 1 (Summer 2011) pp. 1-19.

36 Mattingly, Garrett, *Renaissance Diplomacy* (Butler and Tanner Ltd: London 1955) pp. 83-89, 102, Fubini, Riccardo, 'Diplomacy and government in the Italian city-states of the fifteenth century (Florence and Venice)', in Frigo, Daniela (ed.), *Politics and Diplomacy in Early Modern Italy*, (Cambridge University Press: Cambridge 2000) pp. 26, 45-46, Ilardi, Vincent, 'The First Permanent Embassy outside Italy: The Milanese Embassy at the French Court, 1464-1494', in Thorp, Malcolm, R., Slavin, Arthur, J., (eds.), *Politics, Religion, and Diplomacy in early modern Europe: Essays in Honor of De Lamar Jensen* (Sixteenth Century Journal Publishers: Kirksville 1994) pp. 2, 14, 16.

The evolution of diplomatic and foreign policy practices with which the age of Machiavelli is known in IR was situated in the wider context of the transformation of Western society during the late Middle Ages into the Early Modern age.[37] This wider context sees, due to a range of geographical, political and historical factors that looked favorably first on Italy, and gradually on the rest of Europe, the rise of a system of states. The process of institutionalization of the modern practice of diplomacy and statecraft should be seen as a part of this wider phenomenon. The process had its origins in the Middle Ages and, while distinctively and progressively evolving during the Renaissance, continued with other societal changes deep into the Early Modern age. Technological improvements during this time changed social life and business practices. Many of these developments and their societal consequences increased the assertiveness of cities vis-à-vis their local feudal patrons, and political developments further sabotaged feudal security; the Holy Roman Empire, for the longest time having more or less kept a lid on conflict, was declining, and its princely vassals were eliciting a newfound assertiveness. The late Medieval and Early Modern advances in firearms technology produced cannon light and strong enough to take campaigning, giving kings and queens the tools to pacify their rebel aristocracies, expulse foreign occupiers, and start centralizing authority away from the feudal hierarchical structure.[38] The papacy's authority over Western Christendom took a heavy blow during the Great Western Schism of 1378 to 1417, during which multiple popes claimed religious supreme authority. 'The belief in the unity of Western Christendom had at various times in the course of the crusades been seriously shaken ....', and with the (relative) decline of *res publica Christiana*, Europe saw the first truly secular states evolve; the Italian cities.[39]

The Italian peninsula had always been geography shielded off from the rest of Europe by the Alps.[40] Politically it was isolated as well, although we must not draw this assertion too far; monarchs and other aristocrats in Europe were dynastic stakeholders in the states of Renaissance Italy, but had not been much involved until France's Charles VIII's invasion of Italy in 1494.[41] This relatively closed system allowed the Italians to keep their focus mostly on each other. The Italian states were due to their small size well organized; they were much smaller than the forerunners of their European counterparts and thus, where geographical distances made assertive sovereignty and proper tax collection a mere concept to their neighbors, they could assert a high measure of control over the territories they claimed. The availability of, relative to other European states, a high percentage of educated men allowed

37 Mallett, Michael, 'Italian Renaissance Diplomacy', in *Diplomacy & Statecraft*, Vol. 12, No. 1 (2001) p. 63

38 Parker, Geoffrey, *The Military Revolution: Military innovation and the rise of the West, 1500-1800*, Second Edition (Cambridge University Press: Cambridge 1996) pp. 8-9.

39 Burckhardt, Jacob, *The Civilization of the Renaissance in Italy: an Essay* (Phaidon Press: 1960) pp. 37-39, 77-78, Mallett, Michael, 'Italian Renaissance Diplomacy', in *Diplomacy & Statecraft*, Vol. 12, No. 1 (2001) p. 62, Mattingly, Garrett, *Renaissance Diplomacy* (Butler and Tanner Ltd: London 1955) pp. 20, 55.

40 Mattingly, Garrett, *Renaissance Diplomacy* (Butler and Tanner Ltd: London 1955) p. 60.

41 King Ferdinand of Aragon had a right of succession to the kingdom of Naples but was occupied with the Reconquista until 1492. The French king could make several hereditary claims, most important those pertaining to his hereditary rights as the duke of Orleans (the rightful lord of Milan), but his kingdom took decades to recover from devastating Hundred Year War that lasted until 1453, Mattingly, Garrett, *Renaissance Diplomacy* (Butler and Tanner Ltd: London 1955) pp. 61, 139

them to run an efficient state apparatus.[42] This resulted in a practice in foreign policy that was 'more continuous and better organised than any hitherto seen.'[43] At the same time, a major problem of the states (due their usually small size and population) was the inability to manage the upkeep of large standing armies, forcing them to use undependable mercenaries, partly explaining the unpredictable and inconclusive nature of war in Renaissance Italy.[44] It's easy to overstate the likeness of these states to their contemporary counterparts, as their measure of bureaucratic and political integration can easily be overemphasized. During the process of state centralization and integration, 'bonds of fealty, constrains of protection, interweaving interests and client networks took no account of still uncertain and insecure borders', and continued to exist.[45] Moreover, in the wider European context diplomacy and foreign policy was not conducted by any single group of actors, but by '… factions, court parties, aristocratic groups, large mercantile companies, and so on', once more illustrating the non-centralized medieval customs and practices that were foundational to it. [46]

This image of war and insecurity in Renaissance Italy can be readily associated with Machiavelli's writings and ideas. According to the dominant interpretation of Machiavelli, a ruler was allowed to use every means at disposal to maintain the status quo of power by creating the best circumstances to maintain order, stability, and independence from domination. Machiavelli's policy prescriptions therefore can be interpreted as also having a strong communitarian character, arguing that in order to serve the moral rights of the community (its right to security and survival), *moral duty* dictated that immoral acts can and must be committed by the ruler to protect both his or her position in political power, in order to secure that of the community in the volatile context of the Italian mercenary wars. Thus, immoral acts like deceit, treachery and murder became morally defensible, because the security of the community trumped all other considerations.

This idea of moral rationality would be married to Political Realism for centuries to come, and to this date can be observed to be an element of the dominant mode in which states formulate policies to serve their interests internationally, reflective of educative background of generation after generation of policymakers.

Thomas Hobbes

As Martin Luther nailed his ninety-five thesis to the castle church door in Wittenberg (1517) and John Calvin's published *Institutes of the Christian Religion* (first published in 1536) and preached, a movement of thinkers critical of the Catholic church in the early and mid 16th century set in motion events known as the Reformation. The resulting religious heterodoxy led to a host of civil-religious conflicts, many of which in the centuries that followed were

42 Mallett, Michael, 'Italian Renaissance Diplomacy', in *Diplomacy & Statecraft*, Vol. 12, No. 1 (2001) p. 63.
43 Anderson, M., S., *The Rise of Modern Diplomacy 1450-1919* (Longman Group: Essex 1993) p. 3.
44 Hamilton, Keith, Langhorne, Richard, *The Practice of Diplomacy: Its Evolution, Theory and Administration* (Routledge: London 1995) pp. 30-31.
45 Frigo, Daniela, 'Introduction', in Frigo, Daniela (ed.), *Politics and Diplomacy in Early Modern Italy*, (Cambridge University Press: Cambridge 2000), p. 8
46 Ibid.

fought out on the battlefields and streets of Europe. During the 16th century, a rift opened between Catholic states and those states whose elites converted to forms of Protestantism. A period of religious inter-state and civil war ensued, during which England under Elizabeth I, the Dutch Provinces (and later the Dutch Republic), and many small principalities in what today is Germany saw themselves under siege by a grand Catholic coalition, united under the Habsburg banner. With the English and the Dutch united against Spanish armadas and armies and successfully resisting subjugation, eventually the theater of war shifted to the German principalities. The Thirty Year War (1618-1648) tore up the German countryside (a large part of a by now weak political entity known as the Holy Roman Empire), already divided between Catholic and Reformist/Protestant principalities, and saw many of the European armies involved in a struggle that was as much about religious freedom and religious affiliations of the European rulers and their elites, as it was about early national identities, glory-seeking leaders, self determination and sovereignty. The English Civil Wars, 1642 to 1651 followed by the Restoration of 1660, the second *Fronde* in France from 1650-1653, the winding down of the 80-year war between the Dutch Republic and the Spanish-Habsburg Empire, and the end of the Thirty Year War, the later two which were settled in the peace treaties of Osnabruck and Münster, collectively known as the Peace of Westphalia, marks the period in which religious wars in Western Europe ended. The Westphalian peace treaties and the events that preceded them were formative for the period of international politics that came after, having changed the 'official' rules of international affairs forever; a 'mythological beginning of the modern state system.'[47] The treaties, inspired by contemporaneous thinking on international law exemplified in the writing of Hugo Grotius, stipulated an early form of religious freedom and tolerance, barred from undue outside interference or prosecution.[48] As Oran Young explained,

> '.. the constitutional contracts articulated at Westphalia in 1648, Vienna in 1815, and San Francisco in 1945 all belong to this class of comprehensive or framework agreements. In all these cases, as it happens, the contract identifies the sovereign state

47 Krasner, Stephen, D., 'Compromising Westphalia', in *International Security*, Vol. 20, No. 3 (Winter, 1995-1996) p. 141.

48 Principles set down in the Peace of Augsburg (1555) almost a century earlier, 'that the [ruler] could set the religion of his subjects, the actual provisions of the [Westphalian] Peace constrained sovereign prerogatives in Germany in favor of some forms of religious toleration. Those Catholics who lived in Lutheran states or Lutherans who lived in Catholic states were given the right to practice in the privacy of their homes, and to educate their children at home or to send them to foreign schools. Five cities with mixed Lutheran and Catholic populations were to have freedom of religious practice for both groups. In four of these cities, offices were to be divided equally between Catholics and Lutherans. The Treaty of Osnabruck provided that Catholics and Lutherans should be equally represented in the assemblies of the Empire. .... The Treaties of Munster and Osnabruck, one or the other of which was signed by almost all the great powers, did not sanction the right of German princes to do whatever they pleased with regard to the practice of religion within their own territories. The Peace dictated a set of internal practices for much of the Holy Roman Empire.', Krasner, Stephen, D., 'Compromising Westphalia', in *International Security*, Vol. 20, No. 3 (Winter, 1995-1996) p. 141, Krasner, Stephen, D., 'Sovereignty, Regimes, and Human Rights', in Rittberger, Volker, Mayer, Peter (eds.), *Regime Theory and International Relations* (Clarendon Press: Oxford 1993) pp. 147-151, Wendt, Alexander, 'Anarchy is What States Make of It: The Social Construction of Power Politics', in *International Organization*, Vol. 46, No. 2 (Spring 1992) p. 414.

as the fundamental unit of international society and sets forth a set of basic rights and rules intended to guide interactions among states.'[49]

Sovereign states, in this model, are territorial and autonomous and are the only actors with competence to conclude international treaties. Over the centuries, the concept of the Westphalian model of state sovereignty has grown to include notions of what it means to be a nation state, such as the ability to control domestic affairs and the flow of persons into and out of the territoriality of the state.[50] The Westphalian model has become the 'basic concept for some of the major theoretical approaches to international relations, including Neorealism and neoliberal institutionalism, for both of which it is an analytic assumption, as well as international society perspectives, for which it is an empirical regularity.'[51] Seen in the English School and constructivist theoretical traditions of IR, the Westphalian model is cast as a 'behavioral regularity' based on actors' (whether 'public officials, diplomats, statesmen, political leaders') inter-subjective understanding of the roles of sovereign states in international society and the rules they are bound by.[52]

Civil strife in Hobbes' England halfway the 17th century between supporters of the Catholic monarchy and the largely protestant/reformist Parliament created a state of affairs in which the state as a sovereign entity and the monarch as a religiously-partisan sovereign increasingly became divorced and subject of contestation. At a time when surrounding states' rulers

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49 Young, Oran, R., 'Political Leadership and Regime Formation: On the Development of Institutions in International Society', in *International Organization*, Vol. 45, No. 3 (Summer, 1991) p. 282. 'Vienna in 1815' refers to the Congress of Vienna that took place after the defeat of Napoleonic France and 'San Francisco in 1945' refers to the conference that established the United Nations; both conferences involved most of the major (victorious) powers and re-affirmed the competence of the nation-state in international politics.

50 Krasner, Stephen, D., 'Compromising Westphalia', in *International Security*, Vol. 20, No. 3 (Winter, 1995-1996) pp. 115, 119.

51 Ibid., p. 121. 'For neo-realism, the ontological givens in the international system are Westphalian states, understood as unitary rational actors operating in an anarchic setting and striving to enhance their well-being and security. These states are constrained only by the external environment, that is, by the power of other states. Realism does not suppose that all states can guarantee their autonomy. If, however, a state loses its autonomy – if, for instance, its political structures and personnel are chosen by others – then neo-realism has nothing to say about how such penetrated non-Westphalian states might act.' For neoliberalists, 'the actors are assumed to be Westphalian states, unified rational autonomous entities striving to maximize their utility in the face of constraints that emanate from an anarchic although interdependent international environment. What distinguishes neo-liberalism from neo-realism is its different understanding of the characteristic problem for these Westphalian states: for neo-liberal institutionalism, the problem is the resolution of market failures, whereas for neo-realism it is security and distributional conflicts.', Krasner, Stephen, D., 'Compromising Westphalia', in *International Security*, Vol. 20, No. 3 (Winter, 1995-1996) pp. 121-122.

52 Ibid., p. 122. The Peace of Westphalia 'did not, as is sometimes said, mark the beginning of the modern international system or states system, which must be dated from the appearance of sovereign states whose behaviour impinged on one another, and began at least as early as the late fifteenth century. Still less does the Peace of Westphalia mark the emergence of a system of nation-states, which is a development only of the late eighteenth and nineteenth centuries in Europe, and outside Europe is coming to fruition only in our own times. What the Peace of Westphalia did mark, however, was the emergence of an international society as distinct from a mere international system, the acceptance by states of rules and institutions binding on them in their relations with one another, and of a common interest in maintaining them', Bull, Hedley, 'The Importance of Grotius in the Study of International Relations', in Bull, Hedley, Kingsbury, Benedict, Roberts, Adam (eds.), *Hugo Grotius and International Relations* (Clarendon Press: Oxford 1990) pp. 75-76.

became increasingly absolutist in character, the English monarchs, in a evolving political process that had started centuries ago with *Magna Carta*, saw their mandate to conduct affairs of state and wage war, and levy the taxes to finance them, let alone impose their religious views on the state, increasingly curtailed by a suspicious and assertive Parliament. Nevertheless, the Royal Prerogative to wage war remains to this day a powerful tool of foreign policy in the hands of the Government of the United Kingdom.

Hobbes, one of the first English-language philosopher of note, offered in his writings a view of reality and of the state's organization that was highly conservative and pessimistic. Hobbes posited the state of war as a constant force of chaos buried beneath the civic order, and one that was always present in its (near-) naked form on the international stage. A government therefore was tasked to maintain strict order at home and be ruthless abroad. This position was hardly surprising, considering Hobbes' political associations, and the war-like nature of European politics in the centuries before and during Hobbes' time, of which he must have been aware. The sovereign monarch as protector of the realm (as supreme commander of the army and navy) was a tested formula that both saw to (a sense of) effective security as well as a state of continuous warfare between the European kingdoms, principalities, republics, etc. The curtailing of the sovereign's privileges domestically could be seen as directly affecting the sovereign's ability to conduct affairs abroad and thus undermining the whole of the state enterprise by limiting the maneuverability of the state.[53]

Important for our purposes are two observations or ideas that emerge from the above overview; first, from Machiavelli to Hobbes (and Francis Bacon), a clear distinction evolves between domestic and foreign policy prerogatives; the sovereign's role in the former is subjected to some checks, while in the latter, both in the absolutist states as the parliamentarian monarchies in pre-modern Europe, the prerogative largely remains unchecked and with the executive power.[54] Second, regarding policy prerogatives pertaining to international affairs and war, the perception of total insecurity that the late-Medieval and early Modern political entities in Europe (both from internal and external sources) was subjected to caused Machiavelli's and Hobbes' writings to be interpreted as to condone a divorce between universal (cosmopolitan) Christian morality and the particular interests of communities (states). These two distinctions were increasingly consistently employed during this historical period, against a background in which some older political institutions like the Holy Roman Empire and the Papal State sought a return to unification under their religious banners. It is no coincidence that another current in thought emerged, in which the philosopher and political thinker Hugo Grotius followed the intellectual tradition of Gentili and Spanish School writers Vitoria and Suarez and rejected the assumed permanent nature of the status quo, and proposed a collective solution to the problem of perpetual insecurity; that an agreement on

53 In contemporary times, the effect of such curtailing seems observable in the distinction between the effectiveness and efficiency of behavior by parliamentary democracies and monolithic one-party states or dictatorships in international affairs; the latter can be much more effective than the former in bringing domestic policy in line with its perceived interests and commitments internationally, because several bureaucratic and political layers of consultation are absent, of a symbolic nature or can be easily bypassed.

54 Domestic checks would be effective as traditions and societal norms in the form of privileges held by particular domestic groups (such as aristocracy, regions or cities), not as legal constrains in the modern sense.

cosmopolitan law between all peoples and nations should be concluded. However, in the centuries that followed, the idea and application of international law and increasing the relevance of it only succeeded in limited ways and Europe, and much of the Europe-dominated world, remained for the most part governed by naked state power and competition in the centuries that followed.[55]

Having drawn out some of the historical context of these thinkers and their writings, in order to show the relevance of the historical reality to which they spoke, I now turn to the contemporary study of them. While realists will argue that what Machiavelli and Hobbes 'discovered' were timeless instructions for a sovereign state to successfully operate within a anarchic system of states, such reasoning represents a position that leads to what Richard Ashley has aptly named 'Genesis Amnesia'.[56] As Onuf wrote:

> 'Political thought from Niccolò Machiavelli to the end of the eighteenth century developed liberal tenets without presuming international anarchy. Only gradually has the image of international relations as state of nature come to dominate thinking, and we now read Machiavelli, Hobbes, and their successors accordingly. If international relations have changed less than the image we hold, what has changed far more is the contrast between international relations and domestic political societies. While this may be a reason to enrich liberal thought with additional assumptions and qualifications, as indeed has been the case, it hardly justifies the judgment that international relations no longer, or never did, constitute a political society.'[57]

Divorcing dynamics in international society as somehow different and separate from those in a Western-centrist conception of domestic society; a community without communal drivers and constrains such as 'moral norms, economic regimes, or legal principles' as seen in the domestic spheres, results in 'a deferment of domestic community's essential project for a universal and timeless rational unity.'[58] That the commitment to such and connected assertions constitute a political project led Ashley to characterize the realist project as *a ritual of power*, that uplifts those actors that act or acted, historically or contemporaneously, in accordance with its policy prescriptions, and vilifies those that attempt to step outside its political program.[59] As such, this ritual of power '[administers] a silence regarding the historicity of the boundaries it produces, the space it historically clears, and the subjects it historically constitutes'; a artificial, timeless distinction between inside and outside, between a domestic

55 Bull, Hedley, 'The Importance of Grotius in the Study of International Relations', in Bull, Hedley, Kingsbury, Benedict, Roberts, Adam (eds.), *Hugo Grotius and International Relations* (Clarendon Press: Oxford 1990) pp. 71-73.

56 Ashley, Richard, K., 'The Geopolitics of Geopolitical Space: Toward a Critical Social Theory of International Politics', in *Alternatives: Global, Local, Political*, Vol. 12 (1987) p. 419, Kratochwil, Friedrich, *Rules, Norms, and Decisions: On the Conditions of Practical and Legal Reasoning in International Relations and Domestic Affairs* (Cambridge University Press: Cambridge 1989) p. 4.

57 Onuf, Nicholas, Greenwood, *World of Our Making: Rules and Rule in Social Theory and International Relations* (University of South Carolina Press: Columbia 1989) p. 167.

58 Ashley, Richard, K., 'The Geopolitics of Geopolitical Space: Toward a Critical Social Theory of International Politics', in *Alternatives: Global, Local, Political*, Vol. 12 (1987) pp. 413-415, 418.

59 Ibid., pp. 417-419.

'*community-as-presence*' versus 'a primordial *absense-of-community*' in the international realm.[60]

The counterclaim, that a divorce between the historicity of the idea (and thus also what Hobbes or Machiavelli meant by it), and the contemporary popularity of its theoretical content is possible, is certainly valid as long as consequently no claim of authority is made on the basis of Hobbes' or Machiavelli's dominant presence in the wider discourse.[61] However, as Friedrich Kratochwil has argued, this is exactly what often happens in the contemporary use of these famous political philosophies; ideas and theories are taken out of their historical context while laying claim to authority deriving from their historical prominence. Students of diplomacy the world over, taking part in political and/or bureaucratic practices, still largely operate under a foundational realist understanding of international affairs, as most were and are taught a respect for its authority in the field. As such, whether or not the historicity of these ideas is involved in claims towards the legitimization of such *modus operandi*, if the majority of actors involved in shaping the society of states *perceive* the rules of Realism to be valid, the dynamic created by their actions and the claims they make to legitimize those actions effectively reconstitute a world that operates on realist rules, even though even Hobbes himself never claimed such a bleak picture as an unalterable state of nature as the international arena has since been cast as.[62] There are two sides to this coin however.

These historical illustrations serve to open up a space to contend that the system of states is not, as realists insist, a static phenomenon with set mechanisms on which timeless instructions apply and in which states act as rational actors that operate solely as power maximizers. Instead, it is a collection of international and domestic rules and practices that evolve with the wider societal developments. When 'life as a state' becomes safer due to the rise of widely observed norms that respect sovereignty and international law, does that not result in the state bureaucracy and policy elites reviewing their understanding of the society of states and the optimum manner of operating in that society?[63] In fact, will a failure to do so; to keep operating on the premises of imminent possibility of war and destruction, instead of recognizing the increasing influence of international institutions that have moved the society of states, increasingly so in the post WWII history, away from a 'state of war', not adversely affect a state once the *rules of the game* have changed? Perceptions that hold unto the idea of perpetual Hobbesian insecurity lag behind actual developments and are unable to cope with alternative avenues of power, created by the possibilities of our changing social, economic, technological international landscape.

The argument of changing rules is countered by realists, warning that underneath loose associations between states, everlasting distrust remains and can never be eradicated, as states are forced to act like egoists by the very anarchic nature of the international system. Any build-up of norms of good behavior can be eradicated by continued unopposed bad behavior.

60 Ibid., p. 419. Italics in original.

61 Kratochwil, Friedrich, *Rules, Norms, and Decisions: On the Conditions of Practical and Legal Reasoning in International Relations and Domestic Affairs* (Cambridge University Press: Cambridge 1989) pp. 3-5.

62 Ibid., pp. 3-4.

63 Wendt, Alexander, 'Anarchy is What States Make of It: The Social Construction of Power Politics', in *International Organization*, Vol. 46, No. 2 (Spring 1992) pp. 405-407

International institutions are reflections of international power relations; once they stop serving their political purpose, they are abandoned, and states are not that interested in the transparency and the other benefits they provide. Material circumstances underlie the structures that compel state behavior, regardless of what narratives politicians wield rationalizing their actions to their audiences.[64] I will return to this, in the eyes of most realists, inescapable determination of *structure and agency* in the international system, in the next chapter (see *Structure and Agency*, on page 76).

Positivism and Logical Positivism

An additional phenomenon can be called upon to explain the persistent dominance of Political Realism in political science. The historical dominance of Positivism as a epistemological foundation for all Enlightenment-based sciences, including to a great extend the social sciences, allowed the Political Realism school to manifest a structural power in its field of study, particularly by drawing on Positivism's legitimacy among social scientists.

The long century of Enlightenment thinking (starting in the 17th century) brought forth numerous authors that produced philosophies, theories and methodologies that would turn out to be foundational to modern science. Slowly, innovative standards of observationalism, experimentalism, inductive and deductive logic and scientific rigor replaced remaining pre-Enlightenment dogmas and techniques as the standard of scientific philosophy and methodology. Rene Descartes' arguments provided an important step towards rational man needed for such endeavors, that went beyond Aristotelian philosophy. His 'I think, therefore I am' refers to the independent mind, divorced from the body and the senses, able to produce rational ideas on its own (Cartesian dualism).

One of the more prominent theories of the later Enlightenment was the Positivism of Auguste Comte (1798-1857).

> 'Positivism is the view that the only way to obtain knowledge of the world is by means of sense perception and introspection and the methods of the empirical sciences. Positivists believe that it is futile to attempt to deduce or demonstrate truths about the world from alleged self-evident premises that are not based primarily on sense perception. They consider, on the contrary, that knowledge of things can only be advanced by framing hypotheses, testing them by observation and experiment, and reshaping them in the light of what these reveal. Thus they regard metaphysics, in so far as it is the effort to find out about the world by methods other than those employed in the empirical sciences, as a hopelessly misdirected activity. The method of hypothesis, they hold, is applicable to any field of factual enquiry, although they admit that differences of subject-matter may call for very considerable variations of emphasis. Such variations, however, important though they be, are, on their view, matters of detail, and do not detract from the essential sameness of the effective

64 Mearsheimer, John, J., 'The False Promise of International Institutions', in *International Security*, Vol. 19, No. 3 (Winter, 1994-1995) pp. 14, 20-21, 30, 40, 44-46.

method. This method was first consciously analysed by reference to the sciences of nature, where its use has led to impressive results both in the theoretical and practical sphere.'[65]

As the above definition isn't a comprehensive one, it captures the core but not the full scope of Comte's philosophy of science. Nevertheless, it's a fair overview of what he and his followers (which have been many, including at one time Comte's contemporary John Stuart Mill) produced as a body of thought in the tradition of David Hume's empiricism.[66]

Positivism is problematic when studying human behavior and organization. The scientific method, when applied to this subject matter, must assume rational behavior and seeks to determine 'dependent variables' that can create predictability and natural laws. However, humans don't follow natural laws; they have free will and can thus act 'irrational' when placed in a framework that analytically limits the amount of actions deemed rational. Human action is dependent on perception, and perceptions are uncountable in their variety and nuance. Subsequently, positivist observations through experimentation that see human subjects acting outside the boundaries of accepted rational behavior and knowledge are rejected as anomalies. In an experiment in the natural sciences, the object of study will always return the same rational response, for example by a particular object falling with a consistent speed and acceleration. An experiment in the social sciences will show your object of study (whether a person or a community) sometimes acting rationally according to the framework of expectations of the experiment, but often instead behaving in unexpected and unanticipated ways. If we accept that our social world is continuously changing in a process of societal evolution, it becomes very difficult to, in a 'natural scientific way', produce 'social laws of nature'.[67]

Historically, most noticeably in the 19th and early 20th century, this has not stopped social scientists, philosophers and economist to formulate laws of social behavior often accompanied by prescriptions for behavior and social organization. Debates ensued between the positivist scientists in the tradition of Comte, and those that focused on the social construction of humanity, as standing apart from the natural scientific reality. This culminated in the rise of social and economic societal theories that, drawing on the specific historical experiences of nations and social classes in human societies, sought to elevate human endeavors to a higher plane, creating the foundations of wildly ambitious political projects. Academics and politicians alike thus constructed and bought into the ideologies of the 19th and 20th century, such as Nationalism, Marxism, Fascism and National Socialism.

Positivism made a comeback in the 20th century thanks to the work of philosophers of science such as Rudolf Carnap (1891-1970) and Karl Popper (1902-1994). Many of its proponents then were active in Austria (the Vienna Circle) and Germany (the Berlin School) in the 1920s;

65 Acton, H., B., 'Comte's Positivism and the Science of Society', in *Philosophy*, Vol. 26, No. 99 (1951) p. 1 (Abstract).

66 Neufeld, Mark, A., *The Restructuring of International Relations Theory* (Cambridge University Press: Cambridge 1995) pp. 24-25.

67 See for a comprehensive critique of Positivism, Neufeld, Mark, A., *The Restructuring of International Relations Theory* (Cambridge University Press: Cambridge 1995).

adding the 'adjectival modifier 'logical' in logical positivism to indicate how this variant of positivism attempted to overcome the limitations of Comte's approach' and '[b]y means of symbolic logic this group of philosophers attempted to purge the last vestiges of metaphysics from the positivist legacy (for which they blamed, in large part, Comte himself) by providing a precise, formal rendering of the structure of science', in which a fact-value distinction was clearly articulated.[68]

Karl Popper's vicious attack on what he called *Historicism* was his reaction to the aforementioned ideological political programs that rooted political ideology in historical and social analysis that were passed off as abstract scientific law to an uninformed public. The current in social science that had been abused this way had advocated the interpretive method and holism as better ways to the complex ways in which individuals relate to society.[69] The alternative philosophy of science Popper and some of his contemporary colleagues offered to an academia still smarting from the aftermath of Nazism and Fascism, during which particular nations had projected a sense of exceptionalism and uniqueness upon themselves (backed by pseudo-scientific theories), and confronted with the rise of Communism which seemed to fall into the same trap of promoting a brand of Manifest Destiny that set particular nations apart from others as superior (backed by an ideological-political interpretation of economic theory), a philosophy of science that was strictly structured and seemingly immune to politicization. He and others argued for a return to Enlightenment principles of science by means of the adoption of *Logical Positivism,* as the quality standard for both the natural and social sciences through such methodological standards as falsification; any good scientific theory had to be able to accommodate hypothesis that allows it to be proven incorrect. Popper also leveled criticism at Carnap and other logical positivists, rejecting particular methods, such as deduction, as unscientific.

Positivism into Political Realism

During the inter-war period, a period that marks the inception of International Relations as an academic field, Idealism was dominant in its English-speaking academia.

> 'When International Relations first emerged as a distinct field of study, it was in reaction to the carnage of the First World War, to the apparent casualness with which that war had been allowed to occur, and to the loss of control over the development of civilisation that it seemed to represent. The field was driven by the search for causes of war, and for prescriptions to prevent its recurrence. This first round ended with the

68 Neufeld, Mark, A., *The Restructuring of International Relations Theory* (Cambridge University Press: Cambridge 1995) p. 25. For an overview of (Logical) Positivism's tenets as they relate to IR theory, see Neufeld, Mark, A., *The Restructuring of International Relations Theory* (Cambridge University Press: Cambridge 1995) pp. 24-38, Nicholson, Michael, 'The Continued Significance of Positivism?'. in Smith, Steve, Booth, Ken, Zalewski, Marysia (eds.), *International Theory: Positivism & Beyond* (Cambridge University Press: Cambrigde 1996) pp. 128-148, Frost, Mervyn, *Ethics in International Relations: a Constitutive Theory* (Cambridge University Press: Cambridge 1996) pp. 18-19.

69 Popper, Karl, *The Poverty of Historicism* (Routledge: London 1957)

> catastrophes of the 1930s and 1940s, and the failure of the collective security mechanisms embodied in the League of Nations.'[70]

John Mearsheimer, in his delivery of the 2004 E.H. Carr Memorial Lecture, explains why the realist E.H. Carr took issue with this dominance, and how he responded;

> '"The Twenty Years' Crisis was written with the deliberate aim of counteracting ... the almost total neglect of power'. The problem with British thinkers, according to Carr, was not just that they ignored power, but that they were utopians as well. He thought they held a hopelessly idealistic view of international politics. In particular, they had a normative agenda which led them to pay little attention to the world around them and to focus instead on changing how states relate to each other. Indeed, they were determined to radically transform world politics and create a peaceful international order where statesmen no longer cared about the balance of power. The idealists, Carr believed, saw themselves as the key agents for accomplishing this revolution. 'The utopian', he wrote, 'believes in the possibility of more or less radically rejecting reality, and substituting his utopia for it by an act of will.' …. Carr did not think it was possible to escape the existing world, a world where 'power is an essential element of politics.' The fact is that Carr was a determinist at heart who did not think that individuals could purposely reorder the international system in fundamental ways. Consequently, he took out his cudgel and hammered away at the idealists' worldview. When he was done, little of that enterprise was still standing.'[71]

With the discrediting of idealistic political theories in the Western world and specifically the United States, where supposedly the 'First Great Debate' between idealists and realists had taken place in the 1920s and 1930s, or the 1930s and 1940s, Political Realism came out as the vindicated victors in the field after WWII.[72] The previous 'generation of scholars [had] failed to predict fascism, the breakdown of the League of Nations and the outbreak of the Second World War'; '[p]olitical realists in following generations thus came to blame the earlier thinkers for failing to take note of the irrational aspects of human nature (nationalism, fascism) and the realities of power.'[73] Robert Jackson concurs with Mearsheimer's assessment of the success of Carr's attack on idealism in IR, but Ken Booth contends that Carr's particular victory over the idealist David Davies was,

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70 Buzan, Barry, 'The Timeless Wisdom of Realism?', in Smith, Steve, Booth, Ken, Zalewski, Marysia (eds.), *International Theory: Positivism and Beyond* (Cambridge University Press: Cambridge 1996) p. 48.

71 Mearsheimer, John, J., 'E.H. Carr vs. Idealism: The Battle Rages On', in International Relations, Vol. 19, No. 2 (2005) pp. 140-141.

72 Lapid, Yosef, 'The Third Debate: On the Prospects of International Theory in a Post-Positivist Era', in *International Studies Quarterly*, Vol. 33, No. 3 (September 1989) p. 236, Smith, Steve, 'Positivism and Beyond´, in Smith, Steve, Booth, Ken, Zalewski, Marysia (eds.), *International Theory: Positivism and Beyond* (Cambridge University Press: Cambridge 1996) pp. 11-12, Waever, Ole, 'The Rise and Fall of the Inter-Paradigm Debate´, in Smith, Steve, Booth, Ken, Zalewski, Marysia (eds.), *International Theory: Positivism and Beyond* (Cambridge University Press: Cambridge 1996) p. 150.

73 Frost, Mervyn, *Ethics in International Relations: a Constitutive Theory* (Cambridge University Press: Cambridge 1996) p. 62.

> '... simplified and twisted, and became a myth. It helped create and sustain the view that the academic subject of International Politics was about 'power politics' between states and could only be respectably studied from a 'realist' perspective. This belief, at times elevated to science, had disciplinary power and intellectual glamour.' [74]

I used the word 'supposedly' to describe the first of the Great Debates because this is what has been taught in the IR canon, but Lucian Ashworth (following Peter Wilson) has convincingly argued that this idea of a 'Great Debate' is greatly overstating the factual importance of idealist-realist discussions at the time, instead projecting the relevance of later theoretical debates back in time. Other contemporaneous debates in IR at that time, such as over the above-mentioned question on the causes of war, were more prominent.[75] Moreover, it is questionable whether idealists and realists during this period could even be considered coherent schools.[76]

On the epistemological plane, already started,

> '... after the First World War … [the] tendency [of positivists] to reduce political problems to scientific propositions won general acceptance. …. Thus began what can properly be called the age of the scientific approach to international affair, and the end is not yet in sight.'[77]

Western political science academia itself was perceived as being partly responsible for not eradicating the subjective forms of scientific knowledge and its methodologies sooner, and now, during what is commonly known as the Second Great Debate in IR between traditionalists (aiming to preserve the historiographic/narrative method) and behaviorists (supporting scientism) that can be argued to have initiated by the ideas of the Chicago School in the 1920s and 1930s, many adopted Logical Positivism as a new golden standard of epistemology in IR by the late 1960s, the only scientific philosophy deemed acceptable. The marriage between Logical Positivism and Political Realism (particularly its post-WWII school of Neorealism) was and is the most successful one to date in 20th century IR theory. The basic tenets of modern Political Realism were well suited to be modeled to the likeness and rigor of the positivist scientific models originally conceived for the advancement of the natural sciences.[78]

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74 Booth, Ken, ´75 Years on: Rewriting the Subject's Past – Reinventing its Future', in Smith, Steve, Booth, Ken, Zalewski, Marysia (eds.), *International Theory: Positivism and Beyond* (Cambridge University Press: Cambridge 1996) p. 329.

75 Ashworth, Lucian, M., 'Did the Realist-Idealist Great Debate Really Happen? a Revisionist History of International Relations', in *International Relations*, Vol. 16 (2002) pp. 35, 47-48.

76 Lake, David, A., 'Theory is Dead, Long Live Theory: The End of the Great Debates and the Rise of Eclecticism in International Relations', in *European Journal of International Relations*, Vol. 19, No. 3 (September 2013) p. 569

77 Morgenthau, Hans, J., *Politics Among Nations: The Struggle for Power and Peace*, Seventh Edition (McGraw-Hill: New York 2006) p. 44.

78 Lake, David, A., 'Theory is dead, long live theory: The end of the Great Debates and the rise of eclecticism in International Relations', in *European Journal of International Relations*, Vol. 19, No. 3 (September 2013) pp. 569-570. By no means was the victory of Scientific Realism complete: 'Like the first Great Debate, this one also remains a running battle with traditionalists still vibrant throughout the field, especially within the English

Some of the main concepts and principles of Neorealism came from traditionalist realist thinking. The efficacy of power, as expressed by one of the leading figure of the first generation of proponents of Political Realism in IR after WWII, Hans Morgenthau, was commensurate with earlier realist principles. Morgenthau formulated six 'principles of Political Realism' in his *Politics Among Nations* (1948). The first was a declaration of allegiance to positivism; 'like society in general', Political Realism 'is governed by objective laws that have their roots in human nature.'[79] The second principle is 'the concept of interest defined in terms of power', underlying all motivations of statesmen and imposing 'intellectual discipline upon the observer' and 'infuses rational order into the subject matter of politics'.[80] As such, the 'structure of international relations' as it emerged through the centuries and 'as reflected in political institutions, diplomatic procedures, and legal arrangements', expressed for instance in the assumption of 'sovereign equality' is directly at odds with, and thus irrelevant to, 'the reality of international politics.'[81] Nevertheless, in the third principle, Morgenthau posits that while this concept of interest defined as power is an objective category, it's not permanently fixed in its meaning; while interest as a driver is timeless, the concepts of interest and power are particular to a period in history and 'the political and cultural context within which foreign policy is formulated', giving his Classical Realism an ideational dimension that allows for change in basic preferences of states.[82]

The latter three principles Morgenthau defines are concerning the ethical character of politics. In the fourth principle, he states that Political Realism rejects the application of 'universal moral principles' in unfiltered form, because of the tension that exists between them and 'the requirements of successful political action' (in line with Machiavelli and Hobbes); 'political ethics judges action by its political consequences.'[83] As such, the state has to be prudent and cannot risk its own security for the sake of a moral good other than in its own, narrowly defined, interest; to do so would be immoral. Consequently, the fifth principle states that, for a state to engage in moral absolutism is to engage in 'moral excess and political folly'; a state must be able to perceive other nations' interests and it is able to perceive its own, and formulate moderate policies that take all those interests into account.[84] On the efficacy of other relevant dimensions, Morgenthau advocates a intellectual divorce of disciplines in the sixth principle;

School (Linklater and Suganami, 2006), and possibly even dominant in Europe where constructivism and various forms of reflexivity have taken deep hold on the discipline. Despite the behaviorists' assertions of supremacy, this second Great Debate remains alive and is still a major cleavage in the field.', Lake, David, A., 'Theory is dead, long live theory: The end of the Great Debates and the rise of eclecticism in International Relations', in *European Journal of International Relations*, Vol. 19, No. 3 (September 2013) p. 570.

79 Lake, David, A., 'Theory is dead, long live theory: The end of the Great Debates and the rise of eclecticism in International Relations', in *European Journal of International Relations*, Vol. 19, No. 3 (September 2013) p. 569, Morgenthau, Hans, J., *Politics Among Nations: The Struggle for Power and Peace*, Sixth Edition (Beijing University Press: Beijing 2004) p. 4.

80 Morgenthau, Hans, J., *Politics Among Nations: The Struggle for Power and Peace*, Sixth Edition (Beijing University Press: Beijing 2004) p. 5.

81 Ibid., p. 8.

82 Ibid., pp. 10-11.

83 Ibid., p. 12.

84 Ibid., p. 13.

> 'the political realist maintains the autonomy of the political sphere, as the economist, the lawyer, the moralist maintain theirs. He thinks in terms of interest defined as power, … the moralist, of the conformity of action with moral principles.'[85]

As such,

> '[t]he political realist is not unaware of the existence and relevance of standards of though other than political ones. As political realist, he cannot but subordinate these other standards to those of politics.'[86]

Additionally, Morgenthau formulated three main assumptions, that Vasques summarized as follows:

> '(1) Nation-states are the most important actors in international relations;
>
> (2) there is a sharp distinction between domestic and international politics;
>
> - and (3) international relations is a struggle for power and peace.'[87]

These basic principles and assumptions of Political Realism were passed on to a next generation of political realists, which found its most important contribution in the writings of Kenneth Waltz. Neorealism, or Structural Realism, as this new current was called, applied and argued to universally enforce strict epistemological and ontological discipline on the academic field of International Relations with positivist and rationalist principles providing the epistemological base and concepts such as the *balance of power* making up the ontological landscape. Structural Realism assumed that 'the international system is anarchic'; that all states possess some form of offensive capability and thus pose a danger to other states; that states can never be certain of others' intentions; that a basic drive for survival and retention of sovereignty motivates all states; and that while states are 'instrumentally rational' in thinking strategically about their survival, they 'miscalculate from time to time because they operate in a world of imperfect information'.[88] Taken together, these assumptions show that states live in 'a “self-help” system', in which their perpetual suspicion of other states makes them into security-seekers that 'aim to maximize their relative power positions over other states.'[89] This in turn creates a balance of power-system in which the participants seek to avoid domination by, and exploit the weakness of other states, although cooperation is difficult because of concerns over cheating.[90] Structural realists downplay the equalizing force of international institutes, claiming they 'largely mirror the distribution of power in the

85 Ibid.

86 Ibid., p. 14.

87 Vasquez, John, A., 'The Realist Paradigm and Degenerative versus Progressive Research Programs: An Appraisal of Neotraditional Research on Waltz's Balancing Proposition', in *The American Political Science Review*, Vol. 91, No. 4 (December 1997) p. 899.

88 Mearsheimer, John, J., 'The False Promise of International Institutions', in *International Security*, Vol. 19, No. 3 (Winter, 1994-1995) p. 10, Waltz, Kenneth, N., *Theory of International Politics* (Waveland Press: Long Grove Il. 1979) pp. 102-103, 111-123, 129, 195.

89 Mearsheimer, John, J., 'The False Promise of International Institutions', in *International Security*, Vol. 19, No. 3 (Winter, 1994-1995) p. 11, Waltz, Kenneth, N., *Theory of International Politics* (Waveland Press: Long Grove Il. 1979) pp. 104-105, 113, 118, 195.

system', the balance of power is the independent variable that explains war; institutions are merely an intervening variable in the process.'[91]

Ideational factors that had served in earlier Political Realism (now dubbed Classical Realism) were largely removed. When an IR theory is said to be based on rationalist principles it generally implies that actors 'have consistent, ordered preferences, and that they calculate costs and benefits of alternative courses of action in order to maximize their utility in view of those preferences'; actors act rationally and thus predictably.[92] In political theory, models with such underlying premises are called *rational-choice* models; Rational Choice Theory (RCT) is one such model.

Thus were created the systemic theories of IR, in which 'the actors' characteristics are given by assumption, rather than treated as complex variables; changes in outcomes are explained not on the basis of variations in these actor characteristics, but on the basis of changes in the attributes of the system itself.', and '[t]he variables of a systemic theory are situational; they refer to the location of each actor relative to others'.[93] Both neorealist and neoliberal schools of IR theory operate on the above principles, but not all associated theories assume actors' characteristics completely; deficient outcomes in early game-theoretical models used by theorists to 'game' behavior showed that more comprehensive models, including more complex starting assumptions about actors, were needed.[94]

The Efficacy of Nuclear Weapons: Deterrence Theory

How is the above discussion relevant to our case study? Neorealism's popularity in the International Relations academic literature coincided with its insertion into related fields that were receptive of the relative straight-forward system that it proposed. For example, Strategic

90 Mearsheimer, John, J., 'The False Promise of International Institutions', in *International Security*, Vol. 19, No. 3 (Winter, 1994-1995) pp. 12-13

91 Ibid., p. 13.

92 Keohane, Robert, O., *After Hegemony: Cooperation and Discord in the World Political Economy* (Princeton University Press: 1984) p. 27, Waltz, Kenneth, N., *Theory of International Politics* (Waveland Press: Long Grove Il. 1979), Waltz, Kenneth, N., 'The Emerging Structure of International Politics', in *International Security*, Vol. 18, No. 2 (Autumn, 1993).

93 Keohane, Robert, O., 'The Demand for International Regimes', in *International Organization*, Vol. 36, No. 2 (Spring 1982) p. 327, Waltz, Kenneth, N., *Theory of International Politics* (Waveland Press: Long Grove Il. 1979) pp. 67-73, Keohane, Robert, O., 'Theory of World Politics: Structural Realism and beyond', in Finifter, Ada (ed.), *Political Science: The State of the Discipline* (American Political Science Association: Washington, DC 1983) p. 508, Keohane, Robert, O., *After Hegemony: Cooperation and Discord in the World Political Economy* (Princeton University Press: 1984) p.. 25.

94 Moravcsik, Andrew, 'Taking Preferences Seriously: A Liberal Theory of International Politics', in *International Organization*, Vol. 51, No. 4 (Autumn, 1997) pp. 519, 521-522, 542-545, Snidal, Duncan, 'The Limits of Hegemonic Stability Theory', in *International Organization*, Vol. 39, No. 4 (Autumn, 1985), Grieco, Joseph, M., 'Anarchy and the Limits of Cooperation: A Realist Critique of the Newest Liberal Institutionalism', in *International Organization*, Vol. 42, No. 3 (Summer 1988), Koremenos, Barbara, Lipson, Charles, Snidal, Duncan, 'The Rational Design of International Institutions', in *International Organization*, Vol. 55, No. 4 (Autumn 2001), Koremenos, Barbara, 'Contracting around International Uncertainty', in *The American Political Science Review*, Vol. 99, No. 4 (Nov., 2005).

Studies, an academic niche born out of the need to understand nuclear weapons' strategic roles and functions, embraced realist premises and theory and conceived Deterrence Theory. Deterrence Theory is a good example of the real-world effects that political theory can have.[95]

> 'In the course of the past half-century, deterrence has developed as a strategy and a theory. Judging from the degree of resistance and hostility that critiques of it encountered, deterrence also assumed the status of a religious relic, which, if frequently paraded in public and blessed in the right language by the high priests of national security, might protect the community against the ultimate evil of nuclear war.'[96]

Nuclear weapons are nuclear explosive devices, but in general terms are often understood to be missiles carrying a nuclear explosive device; the 'bomb' and the ability to deliver it. The ability to deliver a nuclear weapon across large distances is part of its attraction and deterrent utility to states that are concerned for their security, seek to expand their regional or global influence through military intimidation, or pursue the capability because of its perceived aggrandizing effect of becoming part of a small select club of mainly great powers, boasting industrial and technological prowess and in the process bolstering domestic support for a government.[97]

Discussions have evolved over the years why states pursue nuclear weapons and why they refrain from them, whether it increases a state's security or instead subverts it.[98] Political theorists have made the argument that the spread of nuclear weapons was beneficial to international security as it creates the ultimate deterrent to war.[99] The last point has been contentious, with decision-makers during the Cuban Missile Crisis and several other near-misses narrowly avoiding nuclear exchange, representing the inherent danger of sizable nuclear weapons postures. These contrast the arguments made on nuclear weapon non-use since World War II, positing the success of nuclear weapons in the argument that conflict in Europa since 1945 'has not been frozen, but its course [in history] has been steadied by

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95 Dunne, Tim, Hansen, Lene, Wight, Colin, 'The End of International Relations Theory?', in *European Journal of International Relations*, Vol 19, No. 3 (September 2013) p. 413.

96 Lebow, Richard Ned, 'Deterrence: Then and Now', in *The Journal of Strategic Studies*, Vol. 28, No. 5 (October 2005) p. 765. Thus, what in this interpretation Deterrence Theory enjoys is a particular expression of what Richard Ashley dubbed Realism's *ritual of power*, see page 47.

97 Greenwood, Ted, Feiverson, Harold, A., Taylor, Theodore, B., *Nuclear Proliferation: Motivations, Capabilities, and Strategies for Control* (McGraw-Hill: New York 1977) pp. 50-52.

98 A well known and often cited source on this subject is Etel Solingen's *Nuclear Logics: Contrasting Paths in East Asia and the Middle East* (Princeton University Press: 2007).

99 Mandelbaum, Michael, *The Nuclear Future* (Cornell University Press: 1983) p. 37, Waltz, Kenneth N., 'Nuclear Myths and Political Realities', in *The American Political Science Review*, Vol. 84, No. 3 (1990) pp. 731-745, Sagan, Scott, Waltz, Kenneth, *The Spread of Nuclear Weapons: a Debate* (W.W. Norton & Company: 1995) with sequels published in 2003 (Sagan, Scott, Douglas, Waltz, Kenneth, Neal, *The Spread of Nuclear Weapons: a Debate Renewed; with New Sections on India and Pakistan, Terrorism, and Missile Defense* (W.W. Norton & Company: 2003)) and 2013 (Sagan, Scott, Douglas, Waltz, Kenneth, Neal, *The Spread of Nuclear Weapons: An Enduring Debate* (W.W. Norton & Company: 2013)), Doyle, James, E., 'Why Eliminate Nuclear Weapons?', in *Survival*, Vol 55, No. 1 (February-March 2013) pp. 7-34.

nuclear weapons, and it has thus been peaceful'.[100] Furthermore, in a somewhat self-contradictory argument, the absence of nuclear war is credited to the existence of nuclear weapon arsenals.[101]

> 'Not only have the world's leaders behaved cautiously when the use of nuclear weapons seemed possible, they have actually said that their caution was induced by the dangers these weapons present. All nations that have them say that their nuclear weapons are for defensive purposes only – that they have them, in fact, not to use them against others but to prevent others from making nuclear attacks against them.'[102]

> 'The existence of these weapons may have had the profoundest possible effect on international politics. They may have prevented a third world war.'[103]

The specter of nuclear war is not comparable to the last few revolutions in war, first the mass draft and 'mobilization of an entire society for war' during the Napoleonic wars, and second 'the systemic union of industrialism and warfare, which brought the machine gun and ultimately the tank and the airplane into common use in war', an evolution which sped up during World War I and culminated in World War II.[104] The difference lies in the fact that, as Thomas C. Schelling wrote,

> '…"nuclear weapons can do it quickly. " ... "To compress a catastrophic war within the span of time that a man can stay awake, drastically changes the politics of war, the process of decision, the possibility of central control and restraint, the motivation of the people in charge, and the capacity to think and reflect while war is in progress. It *is* imaginable that we might destroy 200.000.000 Russians in a war of the present, though not 80.000.000 Japanese in a war in the past. It is not only imaginable, it is imagined. It is imaginable because it could be done "in a moment, in the twinkling of an eye, at the last trumpet. …. This is the difference between nuclear weapons and bayonets. It is not in the number of people they can eventually kill but in the speed with which it can be done, in the centralization of decision, in the divorce of the war from political processes, and in computerized programs that threaten to take the war out of human hands once it begins. That nuclear weapons make it *possible* to compress the fury of global war into a few hours does not mean that they make it *inevitable*. We have still to ask whether that is the way a major nuclear war would be fought, or ought to be fought. Nevertheless, that the whole war might go off like one big string of firecrackers makes a critical difference between our conception of nuclear war and the world wars we have experienced.'[105]

Mandelbaum expands on this markedly new and different situation;

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100 Gompert, David, C., et al, *Nuclear Weapons and World Politics: Alternatives for the Future* (McGraw-Hill: New York 1977) p. 18.
101 Ibid., p. 17.
102 Mandelbaum, Michael, *The Nuclear Future* (Cornell University Press: 1983) p. 22.
103 Ibid., p.34.
104 Ibid., pp. 22-23.
105 Schelling, Thomas, C., *Arms and Influence* (Yale University Press: New Haven 1973) pp. 20-21, italics in original.

> 'Nations went to war in the past because they believed that they could win. A large-scale nuclear war would so damage the two sides engaged in it as to call into question the very idea of victory. This is a revolutionary feature of nuclear weapons for which there is no precedent. It is in this sense that these weapons are different from any that have every existed before. The destruction from a nuclear exchange would be so great that it is questionable whether the conflict would deserve to be described as a war. War implies the use of force for some political purpose. It is difficult to imagine a political purpose that would be served by the slaughter and devastation that even a handful of nuclear weapons would bring to the societies at which they were aimed.'[106].

What Mandelbaum is eluding to is a profound change in calculation of politicians and military decision makers. Deterrence, a concept preceding the nuclear age, suddenly was bestowed a new and absolute meaning.

> 'The basis of the nuclear-weapons policy of the United States and – although this can be said with less confidence – of the Soviet Union is deterrence. Deterrence is the central concept of the nuclear age. …. Deterrence means prevention by threat. One party tries to keep another from doing something by threatening some sort of punishment in retaliation. …. Nuclear weapons lend themselves particularly well to deterrence.. No other purpose besides defense – indeed, almost no other purpose besides the prevention of their own use – has thus far seemed plausible for them.'[107]

Part of the new calculations of the superpowers (itself a concept of the nuclear age, because of the overwhelming nuclear but also unprecedented conventional destructive force at their disposal) in the age of nuclear deterrence was the tied-in concept of assured destruction.

> 'It comes from the realization that nuclear weapons are so powerful that they might be used by one country to strike a disarming blow against the nuclear arsenal of the other. …. To avoid this outcome, to deter such an attack, a nuclear arsenal would have to be designed so that it could not be completely smashed by a preemptive attack. For one nuclear power facing another, deterrence depends on the assurance of being able to weather an attack with enough firepower to deliver a devastating retaliatory blow against the attacker. The capacity for an assured *second* strike will deter a *first* strike.'[108]

Deterrence is both a theory and a strategy, with the former informing the latter. Thomas Schelling first applied game theory and a rational actor model to the problem of nuclear deterrence.[109] It lies at the heart of modern defense alliances such as NATO and security

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106 Mandelbaum, Michael, *The Nuclear Future* (Cornell University Press: 1983) pp. 24-25.
107 Ibid., pp. 28-29.
108 Ibid., pp. 29-30. Italics in original.
109 Schelling, Thomas C., *The Strategy of Conflict* (Harvard University Press: Cambridge 1960), Schelling, Thomas C., *Controlled Response and Strategic Warfare* (International Institute for Strategic Studies: London 1965), Schelling, Thomas C., *Arms and Influence* (Yale University Press: New Haven 1966).

assurances such as those extended by the nuclear weapon states to states they are friendly with.[110]

The concept of deterrence fits well in the larger theory and assumptions of Neorealism; it posits state actors as unitary and rational, assumes the international arena to be a self-help system where states are solely responsible (to make arrangements) for their own security and where institutions play a negligible role. It uses relatively simple game theoretical models (games such as 'chicken') that feature a limited amount of possible actions in which payouts are formalized (meaning, the result of an action is symbolized by a particular payout that is better or worse than the other possible results). Resulting strategies such as 'nuclear brinkmanship' (partially based on 'chicken') subsequently ignore questions of morality and cosmopolitan responsibility that they evoke.[111] This is not to say that in its evolution, thinking on deterrence hasn't evolved to compromise on the 'hard' demands of game theory, adding complexity to its models. Yet it was and is clearly a model that reflects the strategic nature of the geopolitical confrontation it was conceived in, in which detailed knowledge of the other's perceptions was lacking and efforts to understand them under-resourced as part of uncompromising adversarial ideological stances. This is reflective of the positivist epistemology that assumes the world 'as is', discounts cultural factors, ideology and the ability of communication and learning to change perceptions and thus makes far-going assumptions about the information position and rationality of actors (making them 'predictably deterrable').[112]

Aside from its questionable theoretical strength, as a whole Deterrence Theory strongly underwrites nuclear deterrence as an effective strategy of state security and thus promotes the acquisition of nuclear weapons. At least, it provides an argument to not abandon them, once acquired. As such, its acceptance as a valid theory has been detrimental to efforts to curb nuclear proliferation and further disarmament.

The comprehensive image of the efficacy of nuclear weapons that persisted during the Cold War has been addressed by James E. Doyle in his seminal article, 'Why Eliminate Nuclear Weapons?'.[113] Written in the context of US President Obama's 2009 speech in Prague which

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110 Such assurances are commonly referred to as 'positive nuclear guarantees', whereas assurances to states that they will not be targeted or threatened with nuclear weapons are called 'negative nuclear guarantees', and these are thought to have a positive effect on nuclear non-proliferation, as they increase the sense of security of non-nuclear weapon states, Shaker, Mohammed, *The Nuclear Non-Proliferation Treaty: Origins and Implementation, 1959-1979* (Oceana Publications: 1980), http://www.nonproliferation.org/the-nuclear-non-proliferation-treaty-origins-and-implementation-1959-1979/, website checked 13-7-2017, pp. 472-473.

111 Nuclear brinkmanship was first conceived by Schelling, who describes two antagonists standing on a slippery slope next to a ravine, tied together by a rope. If one goes over the brink, so does the other, spelling disaster for both. The guiding principle behind the game is that its a challenge of resolve; whichever of the antagonists can convince the other that it has more resolve (by moving closer to the brink) can induce the other to concede, and give in to the demands of the other, Schelling, Thomas C., *Arms and Influence* (Yale University Press: New Haven 1966) pp. 99-105.

112 Payne, Keith, B., *The Fallacies of Cold War Deterrence and a New Direction* (University Press of Kentucky: Lexington 2001) pp. 17-20.

113 The article by Doyle in *Survival*, a publication by the International Institute for Strategic Studies, was after publication classified by Los Alamos National Laboratories despite having been vetted and cleared for

advocated the abolition of nuclear weapons, the article takes issue with a number of the above long-held beliefs and theory about nuclear weapons, and presents strong arguments in opposition. Some of these arguments benefits from hindsight, such as when Doyle points to new sources that unveil how much closer than we were previously aware of actual nuclear weapon use was considered by the Soviets during the Cuban Missile Crisis, as well as during NATO's Able Archer 83 exercise.[114] They should inform our thinking of the value of deterrence theory now, but not be projected in full upon the historical case studies in this text, though we may assume a reasonable amount of then available public information to be part of the awareness of the policy makers. Many of the other 'accidents, malfunctions, mishaps, false alarms and close calls, often initiated by mechanical and human error', should be placed in the proper context of when they became publicly known, although many classified events were of course known to top decision makers and should have informed earlier internal debates. To illustrate this point, careful scholarship on the Japanese surrender in August of 1945, revealing that the USSR's decision to enter the war against Japan is the more likely reason for the Japanese decision to surrender, and not the devastation caused by the US use of nuclear weapons, was only conducted in the 21st century, failing to benefit decision-makers in the 20th century.[115]

Doyle questioned the claim that leaders practice 'war-avoidance' in the nuclear age, and while acknowledging the plausibility of 'security alliances, ongoing East-West security dialogues

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publication by the classification experts at Los Alamos, Doyle's place of employment. Doyle's security clearance was subsequently revoked and he was later fired. Editors of *Survival* Mark Fitzpatrick and Dana Allin have written in support of Doyle. Deploring his treatment, they've argued that Doyle's article contained no information that wasn't already widely available in the public domain. Fitzpatrick has suggested and Allin has stated that the more likely reason for Doyle's treatment was his argument against nuclear deterrence and for nuclear disarmament, rather than any sort of issue related to classified material. The episode revealed some worrying signs that at least inside one of the US nuclear weapons laboratories nuclear deterrence is still treated as 'a religious relic' and a much needed discussion on the efficacy of nuclear weapons is still not possible. A more cynical view could link the theory's usefulness for rationalizing a multi-billion dollar interest of the military-industrial complex, Doyle, James, E., 'Why Eliminate Nuclear Weapons?', in *Survival*, Vol. 55, No. 1 (February-March 2013) http://www.iiss.org/-/media//silos/survival/2013/survival—global-politics-and-strategy-february-march-2013/55-1-02-doyle/55-1-02-doyle.pdf, website checked 14-7-2017, pp. 7-34, Fitzpatrick, Mark, 'Survival Article on Eliminating Nuclear Weapons Eliminates Author's Job', Politics and Strategy: The Survival Editors' Blog, 1st of August 2014, http://www.iiss.org/en/politics%20and%20strategy/blogsections/2014-d2de/august-bce1/doyle-397e, website checked 14-7-2017, Allin, Dana, 'Dana Allin: In the Matter of James E. Doyle', Politics and Strategy: The Survival Editors' Blog, 2nd of September 2014, http://www.iiss.org/en/politics%20and%20strategy/blogsections/2014-d2de/september-b6af/in-the-matter-of-james-e-doyle-4d9c, website checked 14-7-2017. The events following the article's publication were first reported on by the Center for Public Integrity, Birch, Douglas, 'Nuclear Weapons Lab Employee Fired After Publishing Scathing Critique of the Arms Race: Los Alamos lets a 17-year employee go after retroactively classifying his published article', 31st of July 2014, The Center for Public Integrity website, https://www.publicintegrity.org/2014/07/31/15161/nuclear-weapons-lab-employee-fired-after-publishing-scathing-critique-arms-race?utm_campaign=syndication&utm_source=yahoo-news&utm_medium=continue-reading-link, website checked 14-7-2017.

114 Doyle, James, E., 'Why Eliminate Nuclear Weapons?', in *Survival*, Vol. 55, No. 1 (February-March 2013) http://www.iiss.org/-/media//silos/survival/2013/survival—global-politics-and-strategy-february-march-2013/55-1-02-doyle/55-1-02-doyle.pdf, website checked 14-7-2017, pp. 10-11, 17-19.

115 Ibid., p. 13, Wilson, Ward, 'The Myth of Nuclear Deterrence', in *The Nonproliferation Review*, Vol. 15, No. 3 (2008) pp. 422-423, 426-427.

and the evolution of European integration [playing] a role in avoiding a third world war', he rejects the causal link to deterrence as 'belief, unsupported by anything approaching a strong, clear body of historically documented evidence.'[116] Furthermore, awareness of the 'security-dilemma' certainly didn't lead to the development of awareness that was inclusive enough to avoid dangerous miscalculations or the deliberate ignoring of the adversarial perspective in the nuclear age.[117] It leads Doyle to conclude that,

> 'Eliminating nuclear weapons is profoundly in the national-security interest of the United States and its allies and its friends. …. The international community must reject the myths and expose the risks of the ideology of nuclear deterrence if it is to successfully meet the mutual global challenges of the twenty-first century.'[118]

One could add that deterrence theory arguments also clearly show the simplistic binary and selective nature of the neorealist perspective in scholarship; in reference to Mandelbaum's quote above (on page 58), any argument that causally ties the absence of something to the existence of something else is, in the complexity of international relations and security, dangerously simplistic. As to the argument that nuclear weapons' deterrent qualities promote peace, it is unfair to take Europe as a measure for the world and project global success unto it as doing so ignores large parts of the world that during the Cold War were enveloped in some of the most destructive wars recorded in history, both in humanitarian and economic cost, often as proxy to the overall superpower struggle. These included interstate conflicts, among which armed conflicts between nuclear-armed states.

The Cold War Arms Race

The concept and the requirements of deterrence and later of Mutually Assured Destruction (well known by its acronym MAD) at a time of extreme distrust between the superpowers explains the nuclear arms race that ensued after the initial period of American nuclear weapon monopoly. Philip Noel-Baker, writing in 1958, placed the nuclear arms race in its proper historical context by showing a more general arms race had been going on for many decades (if not centuries) before nuclear weapons became a factor in it. An arms race is,

> '… the struggle for the " lead " in weapons, first one side, then another, gets ahead. With every " advance, " the tension mounts. With every year of arms-race thinking, the moral basis of society is further eroded.'[119]

The arms race turned from the '[a]lmost overnight' adoption of the conscript army after Bismarck's victories in 1866 and 1870 against the professional armies of first the Austrian alliance and then the French into a constant succession of technological, logistical and infrastructural advancements being directly applied to the betterment of the national army,

116 Ibid., p. 14.
117 Ibid., pp. 18-19, 25-26.
118 Doyle, James, E., 'Why Eliminate Nuclear Weapons?', in *Survival*, Vol. 55, No. 1 (February-March 2013) p. 9.
119 Noel-Baker, Philip, *The Arms Race* (Atlantic Books,: 1958) p. 11.

navy and later, air force.[120] Noel-Baker turned from the race in naval power before WW1 (the 'Dreadnought competition' between the UK and Germany), to the race for the fission bomb in WW2, to the decision by US President Truman in 1950 to pursue the hydrogen bomb after the USSR exploded its first nuclear weapon in the previous year, with the Russians in the close pursuit of it, showing its nature; decisions are made in reference to 'the other',[121]

> '… the choice which, in one shape or another, confronts governments at every new development of the arms race. They dare not leave their nation at the mercy of some better-armed and, as they think, ruthless foe. So, in the quest for national safety, they increase their armaments to the limit of their power. And while the general level of armaments goes on increasing, no government dares to stand aside.'[122]

During the Cold War it was overwhelmingly the USSR and the US that engaged in a nuclear arms race. Nuclear weapons postures by other states were not inconsequential altogether, but none of those states had the capability to follow the superpowers in their respective build ups. Figure 1 below illustrates an estimation of that buildup, with the US taking the lead early in the Cold War period and the USSR gaining supremacy in numbers from the start of the 1980s.

Figure 1:

Source: Kristensen, Hans, M., Norris, Robert, S., 'Status of World Nuclear Forces', Federation of American Scientists.[123]

120 Ibid., pp. 31-32.
121 Ibid., pp. 32-37.
122 Ibid., p. 37.
123 Kristensen, Hans, M., Norris, Robert, S., 'Status of World Nuclear Forces', Federation of American Scientists, https://fas.org/issues/nuclear-weapons/status-world-nuclear-forces/, website checked 12-7-2017.

Disarmament and Arms Control

The disarmament agenda, in all its semi-autonomous negotiation complexity, is part of a bigger whole, which I refer to in this thesis as the Non-proliferation Regime (NPR). While often accounts of the NPR start with a negotiation history of the NPT including such initiatives as the Baruch plan and the Acheson-Lilienthal report (See chapter 6, pages 171 and 173), it is important to place an account of the NPR against the background of the superpower arms race as well as the pursuit and successful acquisition of nuclear weapons by all the other permanent members of the UNSC (the UK, France and China) by the year 1964. The spread of nuclear technology and weapon capability, both through domestic development, bilateral aid and nuclear trade created an acute awareness with the superpowers that this would not remain and indeed was not the privileged domain of the US and USSR and that analysts had 'concentrated too much on such subjects as weapons systems and strategic parity considerations; they tended to neglect examining dangers that could arise from the unfettered transfer of peaceful nuclear technology and materials.'[124]

Particularly the entrance of China into the nuclear club, by most standards still a developing country in the early 1960s, confirmed what US President Kennedy had publicly said in March 1963 based on an assessment provided to him by his Secretary of Defense McNamara; that if nothing was done, there could be eight new nuclear weapon states (including China) in the next ten years, and many more into the 1970s with average costs of nuclear weapons going down by a factor 2 to 5.[125] Moreover, China had a much more sophisticated advanced weapons program than previously anticipated by the CIA, following information obtained from satellite imagery, and this caused some alarm in Washington.[126] It was McNamara's assessment in 1963 that,

> 'The continued diffusion of nuclear weapons is clearly not in the interest of the US. Even if these weapons are not used, diffusion will make existing disputes more acute and will generate new ones. And although their use by a weak power will be irrational, such action cannot by ruled out. Moreover, the existence of additional nuclear countries would make the course of a major crisis involving the US less predictable and more dangerous.'

Speaking in the context of the efficacy of the impending Limited Test Ban Treaty (to be signed later that same year in Moscow) McNamara noted that the number of new countries with a nuclear weapon capability would probably not be large in the next decade, but that

124 Ebinger, Charles, K., *The Washington Papers Vol. VI: International Politics of Nuclear Energy* (Sage Publications, Beverly Hills & London 1978) p. 31.

125 Lavoy, Peter, R., 'Predicting Nuclear Proliferation: A Declassified Documentary Record', in *Strategic Insights*, Vol. 3, No. 1 (January 2004) http://fas.org/man/eprint/lavoy.pdf, website checked 12-7-2017, p.1, Memorandum, Secretary of Defense to the President, 'The Diffusion of Nuclear Weapons With and Without a Test Ban Agreement', 12th of February 1963, http://fas.org/man/eprint/dod1963.pdf, website checked 12-7-2017.

126 Lavoy, Peter, R., 'Predicting Nuclear Proliferation: A Declassified Documentary Record', in *Strategic Insights*, Vol. 3, No. 1 (January 2004) http://fas.org/man/eprint/lavoy.pdf, website checked 12-7-2017 p.2, Report, 'China Today: Nuclear Industry', JPRS Report, Science & Technology China, JPRS-CST-88-002, Foreign Broadcast Information Service, 15th of January 1988, http://fissilematerials.org/library/jprs88.pdf, website checked 3-1-2017, p. 51.

after this period, 'there are likely to be many more nuclear countries unless some effective actions is taken'.[127] He recognized the role the US and USSR together, as the sole superpowers, had in refraining others from testing could have a greater benefit down the line;

> 'The cooperation that may develop between the US and USSR, as a result, has a potential importance. In some cases, we, and others, would probably have to employ stronger incentives and sanctions than has seriously been considered so far.'[128]

McNamara's recognition mirrored that of both US and USSR administrations during a period that saw a push for nuclear non-proliferation safeguards. Perhaps illustrative of the new importance assigned to the issue by the USSR side was its decision to abandon its resistance to the IAEA safeguards system when in 1963 it informed 'an astonished IAEA Board of Governors that the IAEA's most important task was the application of safeguards.'[129] The US-USSR rapprochement resulted in the some of the important early elements of the institutionalization of non-proliferation objectives, such as the first safeguards agreements in 1966 and the negotiation and signing of the NPT, which I will briefly discuss in chapter 6.

The advent of this latest chapter of a great power arms race and the expansive nuclear postures developed, carrying with them the inherent dangers of accidental and escalating use, explain the constant domestic and international calls for a cessation of the nuclear arms race and a reversal through bilateral and multilateral disarmament initiatives. The first rounds of the struggle to set limits were already underway in the late 1950s, but in the decades since became extensive and relatively successful. Agreements to limit and later altogether ban nuclear weapon testing were partially pursued for environmental reasons and partly in the interest of arms control and non-proliferation considerations. After eights years of negotiations, in 1963 the US and USSR agreed on the (Partial or) Limited Test Ban Treaty, which prohibited 'nuclear weapons tests "or any other nuclear explosion" in the atmosphere, in outer space, and under water.'[130] The Strategic Arms Limitation Talks (SALT I and II) initially started in 1969 and ran into the mid 1980s, when they stalled and eventually

127 Memorandum, Secretary of Defense to the President, 'The Diffusion of Nuclear Weapons With and Without a Test Ban Agreement', 12th of February 1963, http://fas.org/man/eprint/dod1963.pdf, website checked 12-7-2017, p. 5.

128 Memorandum, Secretary of Defense to the President, 'The Diffusion of Nuclear Weapons With and Without a Test Ban Agreement', 12th of February 1963, http://fas.org/man/eprint/dod1963.pdf, website checked 12-7-2017, p. 5.

129 Fischer in 1992 posited that the switch in USSR policy came due to either detente with the US and the soon to be signed PTBT, and/or its bad experience with China, that had used the USSR-provided enrichment technology for the production of fissile material in its first nuclear weapon. In the Verification Yearbook 2000, he assessed that Soviet opposition to the safeguards system was merely part its propaganda war with the West, while at the same time it 'genuinely doubted the wisdom of a global diffusion of nuclear technology', Fischer, David, *Stopping the Spread of Nuclear Weapons: The Past and the Prospects* (Routledge: London & New York 1992) pp. 42-43, Findlay, Trevor, Meier, Oliver (eds.), *Verification Yearbook 2000* (VERTIC: 2000) pp. 46-47. On the USSR leadership's change of heart on safeguards, also see Chapter 6, *Toward the Treaty on the Non-Proliferation of Nuclear Weapons*, page 185, and *China*, page 164.

130 'Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water' Bureau of Arms Control, Verification and Compliance, U.S. Department of State website, https://www.state.gov/t/isn/4797.htm, website checked 1-8-2018, 'Limited Test Ban Treaty', Federation of American Scientists, http://fas.org/nuke/control/ltbt/index.html, website checked 12-7-2017, Ferguson, Charles,

foundered over the USSR's invasion of Afghanistan and subsequent accusations of political bad faith. However, the SALT talks were successful in that (among other achievements) they produced the ABM (Anti-Ballistic Missile treaty (1972) as well as an initial freeze and then reduction of strategic nuclear delivery vehicles. From 1982 the Strategic Arms Reduction Treaty (START I) talks began and, following a large number of subsequent partial agreements, were signed in 1991 and successfully concluded in 2001.[131] START II was first signed in 1993 but was only ratified by the US and Russian Federation in 2000, its provisions required to be implemented by the last day of 2007. START III was discussed from 1997 and agreed on 1999, designed to take the reductions in nuclear armaments even further but failed because of geopolitical initiatives under the President G.W. Bush administration (such as an initiative for a missile shield in Poland and the Czech Republic), producing the 'toothless' ('without verification provisions') SORT (Strategic Offensive Reductions Treaty) instead.[132] In order for the START process not to stall completely and the countries to be completely released from their commitments, presidents Medvedev and Obama (Russian Federation and United States respectively) restarted negotiations in 2009 and successfully concluded New START in 2010, agreeing to historic cuts in armaments.[133]

Over the past few years, accusations of violations of the 1987 Intermediate-Range Forces (INF) Treaty has caused a rift on arms control between the US and the Russian Federation. Negotiations on this treaty started in 1981 amid NATO concerns about intermediate-range ground-launched missiles in Europe. In reaction to the USSR deploying the SS-20 system, NATO eventually responded by deploying GLCMs (Ground Launched Cruise Missiles) and Pershing-II systems to Europe. In the INF Treaty, the US and USSR (whose obligations were later taken over by the Russian Federation and other post-Soviet states) agreed to ban the testing and deployment of such intermediate-range weapons. In 2007, Russian Federation President Putin 'expressed concern that, although the United States and Russia were banned from having intermediate-range missiles, third countries were developing and fielding such systems, and those countries tended to be in close proximity to Russia.'[134] In 2014, the US accused the Russian Federation of testing a intermediate-range GLCM, and in return Russia accused the US of violating the treaty in its development of a missile defense system in Eastern Europe as well as its development of armed drones. Since, the Russian Federation President Putin has unveiled new tactical nuclear weapon systems and the US has announced a build-up as well.[135]

'Ratify Test Ban Treaty to Help Protect Nuclear Secrets', in *Federation of American Scientists Defense News*, 24th of May 1999, http://fas.org/nuke/control/ctbt/news/990524-ctb-fas.htm, website checked 12-7-2017.

131 For a detailed overview, see 'Strategic Arms Reduction Treaty (START I) Chronology', Federation of American Scientists, http://fas.org/nuke/control/start1/chron.htm, website checked 12-7-2017.

132 The qualifications are Joseph Cirincione's, a US non-proliferation pundit, Cirincione, Joseph, 'Strategic Collapse: The Failure of the Bush Nuclear Doctrine', in *Arms Control Today*, Vol. 38 (November 2008) https://www.armscontrol.org/act/2008_11/cirincione#ftnt29, website checked 12-7-2017.

133 Pifer, Steven, 'New START: Good News for U.S. Security', in *Arms Control Today*, Vol. 40 (May 2010) http://www.armscontrol.org/act/2010_05/Pifer, website checked 12-7-2017.

134 Pifer, Steven, Oliver Meier, 'Are We Nearing the End of the INF Treaty?', in *Arms Control Today*, Vol 48 (January/February 2018) https://www.armscontrol.org/act/2018-01/features/we-nearing-end-inf-treaty, website checked 24-8-2018.

The success of Russian-United States negotiated reductions and verification mechanisms during and after the Cold War had until recently put pressure on other nuclear weapon powers to start committing to disarmament as well. So far, rhetoric towards this end has been rebuffed by the other P5 members. Furthermore, the nuclear weapon states in South Asia (Pakistan and India) perceive their security as severely compromised by the nuclear capabilities of the other and have engaged in the past two decades in an arms race of their own.[136] Israel, widely considered to be nuclear armed, has so far denied the existence of its nuclear weapons program and and refused to acknowledge any nuclear weapons tests it may have conducted, although information has emerged over the years that shows that Israel crossed the nuclear weapons threshold as early as 1967.[137] In 1994, the United Nations Conference on Disarmament (CD) started negotiations on a formal Comprehensive Test Ban Treaty (CTBT) which it completed in 1996. The Treaty has a provision that 44 states listed in Annex II of the treaty have to ratify it for it to come into force, which hasn't happened yet, with notable hold-outs the United States, Pakistan, India and the DPRK.[138]

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135 Ibid., Ali, Indrees, 'With an Eye on Russia, U.S. to Increase Nuclear Capabilities', Reuters website, 2nd of February 2018, https://www.reuters.com/article/us-usa-nuclear-russia-military/with-an-eye-on-russia-u-s-to-increase-nuclear-capabilities-idUSKBN1FM2J0, Roth, Andrew, 'Putin threatens US arms race with new missiles declaration', The Guardian website, https://www.theguardian.com/world/2018/mar/01/vladimir-putin-threatens-arms-race-with-new-missiles-announcement, website checked 24-8-2018.

136 Fitzpatrick, Mark, 'Cold War Lessons for South Asia Nuclear Arms Race', IISS Voices, 12th of September 2012, http://www.iiss.org/en/iiss%20voices/blogsections/iiss-voices-2013-1e35/september-2013-38d4/cold-war-lessons-5d6e, website checked 12-7-2017.

137 Cohen, Avner, 'The 1967 Six-Day War: New Israeli Perspective, 50 Years Later', Nuclear Proliferation International History Project, Wilson Center, https://www.wilsoncenter.org/publication/the-1967-six-day-war, website checked 12th of November 2017.

138 'Status of Signature and Ratification', Prepatory Commission for the Comprehensive Test Ban Treaty Organization website, https://www.ctbto.org/the-treaty/status-of-signature-and-ratification/, website checked 24-8-2018.

Chapter 3:

Contemporary Debates in Social and IR Theory; Towards Post-Positivist Theory

In the last few decades, theorists of international relations have started to turn away from adhering to a strict standard of, or at least using as the main point of reference, Logical Positivism as the epistemological and ontological basis for theories and methodologies. They have done so because the limits of its explanatory power in the social sciences have become more and more apparent.[139] Logical Positivism's stifling domination ('this self-imposed positivist trap') began to fade around the last decade of the Cold War, during which scholars in IR explored alternative epistemological and ontological foundations for international political theory. Schools of theory such as Constructivism and post-Structuralism took up the themes and concepts of traditional theory and opened them up for re-evaluation.[140] This provides the bridge to the last point I wish to make about Realism's success and the creation of knowledge, which we can apply to our own epistemological and ontological choices.

The larger debate between Positivism and post-Positivism, also known as 'the Third Debate', caused large rifts to open up in the IR theoretical landscape, from the second half of the 1980s onward.[141] The full body of controversies regarding epistemology, ontology and methodology are too diverse and complex to discuss here, but some elements of it are relevant to revisit, and chapter 4's focus on the concept of regimes will serve as an illustration of some its effects.

Some influential constructivists have claimed to be able to occupy 'a middle ground' between positivist and post-positivist IR theory (the latter represented by postmodernists, post-structuralists, critical theorists and feminists that 'build on a relativist philosophy of science and interpretivist sociology of knowledge'). Recently some have even (perhaps wishfully) heralded the end of the inter-paradigm debate, in favor of a sort of armistice of pluralism, in which theoretical differences are not resolved but merely accepted. These claims are unconvincing.[142] As Mark Neufeld wrote in 1995,

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139 Lapid, Yosef, 'The Third Debate: On the Prospects of International Theory in a Post-Positivist Era', in *International Studies Quarterly*, Vol. 33, No. 3 (Sep., 1989), Wendt, Alexander, 'Anarchy is What States Make of It', in *International Organization*, Vol. 46, No. 2 (Spring 1992) pp. 393-394, 401-402, 422-425, Hansen, Lene, *Security as Practice: Discourse Analysis and the Bosnian War* (Routledge: Oxon 2006) pp. 8-9.

140 Hansen, Lene, *Security as Practice: Discourse Analysis and the Bosnian War* (Routledge: Oxon 2006) pp. 3-4, Lapid, Yosef, 'The Third Debate: On the Prospects of International Theory in a Post-Positivist Era', in *International Studies Quarterly*, Vol. 33, No. 3 (Sep., 1989) p. 246.

141 The 'Third Debate' is named in reference to the First Debate (see page 52) and Second Debate (see page 77) in IR. Lapid casts the First Debate as that between idealists and realists (the uncritical interpretation), Lapid, Yosef, 'The Third Debate: On the Prospects of International Theory in a Post-Positivist Era', in *International Studies Quarterly*, Vol. 33, No. 3 (Sep., 1989) pp. 236-237.

142 Hollis, Martin, Smith, Steve, *Explaining and Understanding International Relations* (Oxford University Press: Oxford 1990), George, Jim, 'International Relations and the Search for Thinking Space: Another View of the Third Debate', in *International Studies Quarterly*, Vol. 33, No. 3 (September 1989) pp. 269-279, Lapid, Yosef, 'The Third Debate: On the Prospects of International Theory in a Post-Positivist Era', in *International Studies Quarterly*, Vol. 33, No. 3 (September 1989) pp. 235-254, Adler, Emanuel, 'Seizing the Middle Ground: Constructivism in World Politics', in *European Journal of International Relations*, Vol. 3, No. 3 (1997) pp. 321-322, Dunne, Tim,. Hansen, Lene, Wight, Colin, 'The End of International Relations Theory?', in *European Journal of International Relations*, Vol. 19, No. 3 (2013) pp. 406-407, Waever, Ole, 'The rise and fall of ther

> 'In terms of International Relations theory, ... an immanent critique of positivist epistemology leads well beyond conventional conclusions about the need to refine techniques of information gathering and processing. In raising questions about issues such as the status of norms, of the human subject, and of reason/truth, it directs our attention to the imperative for a fundamental rethinking of all of the assumptions upon which the discipline rests: ontological as well as epistemological.'[143]

Nevertheless, the perseverance of explaining international relations by what Ruggie calls a 'Hempelian ideal' (after logical positivst Carl Hempel) of seeking covering-law models that 'demands that the deductive-nomological construction is the only acceptable logical protocol for scientific explanations', has persisted in the field, despite convincing criticisms pointing out the aggregative nature of events in international politics.[144]

This is not necessarily surprising, if we take note of Lakatos' interpretation of theoretical progress and paradigm shifts. Following insights developed by Kuhn, Lakatos explained that families of theories that surrounded a core of hard assumptions like a protective belt, collected in a paradigm, need to be evaluated on a broader scale than the conditions Popper set. Lakatos lamented Kuhn's lack of rational basis on why paradigms replace one another through revolution (total replacement of one by the other), adhered to the Popperian 'revolution in permanence' interpretation, and worked to improve Popper's criteria. He developed a set of criteria that could classify paradigms as either being progressive or degenerative by identifying whether within them progressive or denegerative *problem-shifts* occurred. For example, a progressive problem-shift occurs if a theory in the paradigm can predict a novel fact (not before known), and a degenerative problem-shift occurs when theorists use semantic devices to 'save' a falsified theory and allow it to survive in the paradigm.[145]

Popper, Kuhn and Lakatos used the natural sciences as their main reference point to think about paradigmatic theory development, but nevertheless their work became a standard reference in theoretical IR discussions.[146] Onuf argued that social sciences instead work with proto-theories, and that consequently, a larger 'paradigm-theory' is probably not even possible

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inter-paradigm debate', in Smith, Steve, Booth, Ken, Zalewski, Marysia (eds.), *International Theory: Positivism & Beyond* (Cambridge University Press: Cambrigde 1996) pp. 149-185.

143 Neufeld, Mark, A., *The Restructuring of International Relations Theory* (Cambridge University Press: Cambridge 1995) p. 6.

144 Ruggie, Gerard, John, Constructing the World Polity: Essays on international institutionalization (Routledge: Oxon 1998) pp. 93-94. Sociologist and social theorist Anthony Giddens is one of them; even though he acknowledges the challenges that any such covering-law model would face in many fields of social science, and considers it preferable not to speak of laws in the social sciences, he also clearly wants to maintain the option of introducing them later on, if possible, Giddens, Anthony, The Constitution of Society: Outline of the Theory of Structuration (University of California Press: Berkeley 1984) pp. 344-347.

145 Vasquez, John, A., 'The Realist Paradigm and Degenerative versus Progressive Research Programs: An Appraisal of Neotraditional Research on Waltz's Balancing Proposition', in *The American Political Science Review*, Vol. 91, No. 4 (December 1997) pp. 900-901, Lakatos, Imre 'Science and Pseudoscience', edited transcript, BBC Radio Talk, 13th of June 1973, http://www.lse.ac.uk/philosophy/science-and-pseudoscience-overview-and-transcript/, website checked 2-8-2018, p. 3, Lakatos, Imre, 'Criticism and the Methodology of Scientific Research Programmes', in *Proceedings of the Aristotelian Society, New Series*, Vol. 69 (1968 – 1969) pp. 150-151, Onuf, Nicholas, Greenwood, *World of Our Making: Rules and Rule in Social Theory and International Relations* (University of South Carolina Press: Columbia 1989) pp. 165-166.

in IR. This is because IR's constitutive paradigmatic claims are tied in with the assumption that the practices of IR form a coherent whole, an 'operative paradigm'.[147] Onuf doubted this. He takes issue with the 'core of hard assumptions' (see above) of IR such as anarchy as its 'distinctive condition' and the 'Western state system' as a reflection of it.[148] This leads him to assert that as an academic discipline, IR should be abandoned.[149]

I agree that some of the assumptions of some of the theories in IR, such as that of anarchy, are problematic and cannot form the core of a paradigm of IR. Yet, as a student of both traditional IR theory and contemporary approaches, I see the current 'paralysis' not as insurmountable but as a symptom of the maturation of the discipline. Anarchy as a core assumption may not be tenable as a timeless construct reflecting the nature of IR, but perhaps this means we can come up with better core assumptions. Another issue is IR's interdisciplinary nature. The constructivist turn has helped to introduce theories and ideas from many other disciplines, begging the question what is still unique about IR that validates its separate status. But perhaps that is exactly how it is unique: it has the ability to incorporate many interdisciplinary influences in one subject, one framework. Even though some of the new theories in IR using such outside insights seem to address only very particular aspects of international society, together they constitute fruitful progress. Moreover, work on theories that try to account for the whole of the international sphere continues, show promise and are not produced elsewhere. Whether then these are indicative or constitutive of a Lakatosian progressive problem-shift, part of a Popperian ongoing evolution or we find ourselves at the cusp of a Kuhnian revolution, is a matter of debate that lays outside the scope of this thesis.

Critical Theory

This leads me to draw attention to three principles of early Critical Theory (CT) that point to additional forms of bias that we must be aware of when practicing social science. While CT finds its historical philosophical origins in the writings of Immanuel Kant, Georg Wilhelm Friedrich Hegel and Karl Marx, these principles were formulated in the early 20th century by the founders of the Frankfurt School Max Horkheimer, Theodor Adorno and Herbert Marcuse. CT would go on to inspire a wide collection of academic work, political projects and art. Some work such as that of Jurgen Habermas stayed close to the original research project and so he can be considered a second generation Frankfurt School academic.

Horkheimer's seminal essay "Traditional and Critical Theory" marks the theoretical starting position of CT. The three principles in his essay are that instead of gradual reform, a radical change in society is needed, that any theory should be informed by current social consciousness and that the theorists in social sciences cannot claim external objectivity to

146 Onuf, Nicholas, Greenwood, *World of Our Making: Rules and Rule in Social Theory and International Relations* (University of South Carolina Press: Columbia 1989) p. 13.
147 Ibid., pp. 14-16.
148 Ibid., pp. 6, 166.
149 Ibid., p. 27.

their subject matter.[150] Breaking down the barrier between knowledge and interests, Horkheimer argued that,

> '... social changes are the most powerful forces for change in theory. Knowledge is therefore not independent of our existence, but integral to social relations and has a social function'.[151]

The distinction between traditional science and CT is necessary, according to Horkheimer and others and as already reflected on in the discussion on Realism in Chapter 2, because traditional theory is a-historic, it does not consider the 'historical character of the perceiving organ', and thus any academic not actively taking this into account will create or employ theory that reproduces the current ideological order and the social injustices encapsulated therein.[152] This is part of Hegel's critique of Kant; rejecting social distinctions as naturally sanctioned and locating in them the source of humanity's 'alienated existence', Hegel argued that critique could draw out the fact that constraints upon human emancipation were themselves humanly constructed.[153]

> '[Hegel] underscored the fact of the 'intersubjective' and historically contingent nature of human identity and human consciousness. The synthesizing categories of the mind to which Kant had drawn attention - but for which he was unable to account theoretically - were now understood as historically emergent intersubjective categories shared by mutually interdependent members of a community. Moreover, because these categories were now understood as products of an historical process, they were also seen to be subject to change and further evolution as human communities continued their struggle to comprehend and master a changing social environment of which they are, at one and the same time, the product and the creator. In short, argued Hegel, the criteria of reliable knowledge are themselves historically emergent social products.'[154]

This is a total rejection of the logical positivist position that science *should* be a-historic and the recognition that it simply cannot be. CT rejects the assumption that the building blocks that make up the social world are immutable, that contemporary modes of inclusion and exclusion and the relationships of power that produce them in the form of structural constrains, are unchangeable. CT is therefore inherently emancipatory.[155] CT is normative; for the theorist to realize their own position in society, their normative assumptions about the

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150 Horkheimer, Max, 'Traditional and Critical Theory', in *Critical Theory: Selected Essays* (The Continuum Publishing Company: New York 2002) pp. 188-243, Hoffman, Mark, 'Critical Theory and the Inter-Paradigm Debate', *Millennium: Journal of International Studies*, Vol. 16 (1987) p. 232.

151 Ibid., pp. 232-233.

152 Jahn, Beate, 'One Step Forward, Two Steps Back: Critical Theory as the Latest Edition of Liberal Idealism', *Millennium: Journal of International Studies*, Vol. 27 (1998) p. 615, and Linklater, Andrew, 'The Achievements of Critical Theory', in Smith, Steve, Booth, Ken, Zalewski, Marysia (eds.), *International Theory: Positivism and Beyond* (Cambridge University Press: Cambridge 1996) pp. 279-280.

153 Neufeld, Mark, A., *The Restructuring of International Relations Theory* (Cambridge University Press: Cambridge 1995) p. 17.

154 Ibid., p. 16.

155 Linklater, Andrew, 'The Achievements of Critical Theory', in Smith, Steve, Booth, Ken, Zalewski, Marysia (eds.), *International Theory: Positivism and Beyond* (Cambridge University Press: Cambridge 1999) p. 282.

world and *how the world should be,* have to be made explicit. The centrality of the question, 'what ought to be done' in CT, carries with it another fundamental rejection of the fact-value distinction of Positivism, setting it decisively apart from traditional theory.[156] In CT, theory is political and has an emancipatory mission to address questions regarding power and conflicting interests, in which neutrality cannot be claimed.[157]

The definition that Habermas assigns to the project of emancipation is closely linked to this rejection of positivism. Where earlier critical theorists became pessimistic with the mission because they viewed the totality of science as reproducing repressive structures in society, Habermas, in the words of Jim George, asserted that,

> '... scientific rationality per se is not an ideological force, nor the instrumental action it produces. What is repressing emancipatory thinking and action is the power of social theories such as positivism, which transfer the logic of instrumental rationality from its appropriate sphere to the sphere of everyday communicatory activity, where it distorts the categories of practical social life and reduces questions that ought to be open to political and ethical discussion into closed issues of technical formula.'[158]

A fundamental rethinking should target such epistemological assumptions about causality and ontological assumptions regarding the constitution of (international) society. Causality perceived in a mode of instrumental rationality (empiricism) when applied to the social world is inherently problematic in positivist epistemology, because it can not satisfy its own rigorous requirements. Causality in the social world is unobservable in that cause and effect are separate in time, and is closed to experimentation (as the social world doesn't allow the controlling of variables). Techniques to overcome these problems, such as 'statistical operations', requiring 'reasonably large and robust sets of observational data', and 'randomized experiments' requiring the manipulation of causal variables, neither of which conditions can be met for society nor 'for the international system *as a whole*', cannot provide a solution.[159]

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156 Frost, Mervyn, *Ethics in International Relations: a Constitutive Theory* (Cambridge University Press: Cambridge 1996). p. 12, Neufeld, Mark, A., *The Restructuring of International Relations Theory* (Cambridge University Press: Cambridge 1995) p. 99, McCarthy, Thomas, 'Kantian Constructivism and Reconstructivism: Rawls and Habermas in Dialogue', in *Ethics*, Vol. 105, No. 1 (1994) p. 46, Finnemore, Martha, Sikkink, Kathryn, 'International Norm Dynamics and Political Change', in *International Organization*, Vol. 52, No. 4 (Autumn 1998) p. 916.

157 McCarthy, Thomas, 'Kantian Constructivism and Reconstructivism: Rawls and Habermas in Dialogue', in *Ethics*, Vol. 105, No. 1 (1994) p. 46, Linklater, Andrew, 'The Achievements of Critical Theory', in Smith, Steve, Booth, Ken, Zalewski, Marysia (eds.), *International Theory: Positivism and Beyond* (Cambridge: Cambridge University Press 1999) , p. 279.

158 George, Jim, *Discourses of Global Politics: a Critical (Re)Introduction to International Relations* (Lynne Rienner Publishers: Boulder 1994) p. 153.

159 Ruggie, Gerard, John, Constructing the World Polity: Essays on international institutionalization (Routledge: Oxon 1998) pp. 92-93. Italics in original, Winch, Peter, The Idea of a Social Science and its Relation to Philosophy, Second Edition (Routledge: London 1990) pp. 113, 115, Wendt, Alexander, 'Agent-Structure Problem in International Relations Theory', in International Organization, Vol. 41, No. 3 (Summer 1987) p. 353, Wendt, Alexander, Social Theory of International Politics (Cambridge University Press: Cambridge 1999) pp. 78-80. Even aware of this, theorists dedicated to an empirical causality will employ quasi-experiments and counter-factual reasoning to stay within the bounds of what they find scientifically acceptable, for example, Levy, Marc, A., Young, Oran, R., Zürn, Michael, 'The Study of International Regimes', WP-94-113, International

Furthermore, a choice to retain a positivist dedication to causal epistemology can be questioned from a postmodern perspective by pointing out that '[c]ausal epistemology is … a particular discourse of knowledge, which cannot sustain its privilege outside of its own historical and political location.'[160]

A way for Critical Theory to open up a space of methodology away from Positivism and a mode of explaining based on causal theorizing, was to embrace the *verstehen* (understanding) tradition of Herder, Schleiermacher, Dilthey, and Weber. *Verstehen* relies on *hermeutics* or interpretative method, and the rejection that the social world could be known through natural scientific methods.[161] The interpretative method in it's modern version, represented in Peter Winch's *The Idea of a Social Science*, combined Weber's and Dilthey's work with Wittgenstein's late period philosophy and advocates 'a rejection of the positivst assumptions about the nature of social reality.'[162] Winch makes the argument that 'social science is primarily concerned with the analysis of the *actions* and *interactions* of people and that actions are not givens which are immediately observable in the way that the date of the physical sciences are'; the different nature of the data the social scientist works with, in comparison to the hard facts of natural science, require the data to be interpreted, and this requires understanding from an internal point of view of the practice in which the actions and interactions are situated.[163] That is to say, with action providing the basic data of the social world, looking at a single action (individuation) and engaging in concept formation requires the investigating social scientist to have a participant's understanding, him/her to 'adopt a participant perspective' and his/her findings to be 'tested against the self-understandings of the investigatees.'[164] Additionally, the social scientist must come to understand the constitutive language of a practice in order to understand the symbolic interaction that takes place within it, and he/she must endeavor to become aware of the value systems of the participants as it provides the normative background to all action, and in these ways the task of the social scientist is anthropological. This in turn implies a requirement of holism; before part of the practice can be understood, the whole of it needs to be understood. In the process, the social scientist must engage with the participants in order to correct mistakes in his/her analysis. In

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Institute for Applied Systems Analysis, Luxemburg, Austria (November 1994) pp. xxx-xxxi. An alternative solution is employed by constructivists that associate themselves closely with the scientific realism of Anthony Giddens; they '[subscribe] to a notion of social causality that takes reasons as causes', which I will discuss further below on page 80. Adler, Emanuel, 'Seizing the Middle Ground: Constructivism in World Politics', in European Journal of International Relations, Vol. 3, No. 3 (1997) p. 329. Italics in original, Giddens, Anthony, The Constitution of Society: Outline of the Theory of Structuration (University of California Press: Berkeley 1984) pp. 345-346.

160 Michel Foucault (1970) and (1974) as referenced in Hansen, Lene, *Security as Practice: Discourse Analysis and the Bosnian War* (Routledge: Oxon 2006) pp. 8-9.

161 Van der Pijl, Kees, *A Survey of Global Political Economy*, version 2.1 (University of Sussex, 2009) https://www.sussex.ac.uk/webteam/gateway/file.php?name=4constructivism09&site=12, website checked 16-8-2017, pp. 88-113.

162 Winch, Peter, *The Idea of a Social Science* (Routledge and Kegan Paul: London 1958), Frost, Mervyn, *Ethics in International Relations: a Constitutive Theory* (Cambridge University Press: Cambridge 1996) pp. 23-24.

163 Frost, Mervyn, *Ethics in International Relations: a Constitutive Theory* (Cambridge University Press: Cambridge 1996) p. 24. Italics in original.

164 Ibid., pp. 24-26.

summary, for proper understanding of any practice, holding on to the ideal of an objective external observer is untenable.[165]

Some constructivist authors, such as Alexander Wendt, have argued for a side-by-side epistemology, one wherein a positivist approach could answer causal ("why' … and 'how") questions, whereas a post-positivst approach could answer constitutive ones ("how-possible?' or 'what?"), in order to keep our focus on the 'real business of IR' instead of on 'the epistemology business', about which social scientists should not be so 'worried'.[166] Wendt himself claims that epistemologically he is a positivist, while ontologically he believes "… social life is "ideas all the way down" (or almost anyway …)" in an attempt to straddle rationalism and reflectivism at the same time.[167] His collapse of causal and constitutive questions, as having elements of the other in them, wherein for example, '[s]ocialization is in part a causal process of learning identities'; '[n]orms are causal insofar as they regulate behavior'; and '[r]easons are causes to the extent that they provide motivation and energy for action.'[168] On the face of it, these assertions make sense, but without an epistemologically valid avenue to access this causality, the argument rests too heavily on semantics.[169]

To this author, to collapse choices of theory and their underlying scientific philosophy to an all-inclusive category that allows one to pick and choose whatever one needs, to give credit to a particular explanation regarding a case study, is irresponsible and is at risk of making a

165 Frost, Mervyn, Lechner, Sylvia, 'Understanding International Practices from the Internal Point of View', in *Journal of International Political Theory*, Vol. 12, No. 3 (July 2016) p. 307, Frost, Mervyn, *Ethics in International Relations: a Constitutive Theory* (Cambridge University Press: Cambridge 1996) pp. 26-28.

166 Wendt, Alexander, 'On Constitution and Causation in International Relations', in *Review of International Studies*, Vol. 24 (December 1998) p. 115, Wendt, Alexander, *Social Theory of International Politics* (Cambridge University Press: Cambridge 1999) p. 373.

167 Wendt, Alexander, 'On Constitution and Causation in International Relations', in *Review of International Studies*, Vol. 24 (December 1998) pp. 104-108, Wendt, Alexander, *Social Theory of International Politics* (Cambridge University Press: Cambridge 1999) p. 90, Smith, Steve, 'The Discipline of International Relations: Still an American Social Science?', in *British Journal of Politics and International Relations*, Vol. 2, No. 3 (October 2000) pp. 389-390. Similar moves are attempted by Kratochwil (1989) and Finnemore and Sikkink (1998), attempting to preserve RCT in the constructivist turn, ignoring the epistemological dimension of the 'fault-line' they attempt to bridge, Kratochwil, Friedrich, *Rules, Norms, and Decisions: On the Conditions of Practical and Legal Reasoning in International Relations and Domestic Affairs* (Cambridge University Press: Cambridge 1989), pp. 74-81, Finnemore, Martha, Sikkink, Kathryn, 'International Norm Dynamics and Political Change', in *International Organization*, Vol. 52, No. 4 (Autumn 1998) pp. 909-914.

168 Wendt, Alexander, *Social Theory of International Politics* (Cambridge University Press: Cambridge 1999) pp. 81-82.

169 Wendt presents in argument a 'how' (causal) question, 'how does this engine work?', which according to him results in an answer that both includes the constitution of the engine (how its constitutive elements work together to create motion by using the energy released by combustion) as well as what causes it to 'work' (combustion driving motion). This example merely shows that the use of semantic distinctions (with 'why' and 'how' questions somehow causal in nature, and different from constitutive ones like 'what' and 'how-possible') are arbitrary and not useful to describe the difference between causal and constitutive matters. As with the example above, neither will the question 'why does the engine make the car move' generates a strictly causal explanation; a full answer will always be constitutive in nature and deal with the different parts of the engine that interact in order to create motion. The example does however support the claim that answers to constitutive questions offer explanations, see below, Wendt, Alexander, *Social Theory of International Politics* (Cambridge University Press: Cambridge 1999) p. 373.

mockery of the epistemological debate itself. Was Wendt attempting to straddle, in the terminology of Imre Lakatos (and in my interpretation), the degenerative and progressive research programs in the field simultaneously?[170]

Wendt's perception that ontologically the 'natural and social worlds are at least in part made of different kind of stuff', and his attempt to give ontology primacy over epistemology, explains in part why he thought such a divorce is possible, yet he readily adds they be cannot reduced to those differences; begging the question of how then would one apply a two-option epistemology/ontology and not do violence to the subject studied under either.[171]

Nevertheless, Wendt recognized that constitutive theories also have explanatory power. Such explanation may not be strictly causal in the positivist sense (he therefore refers to it as 'non-causal') but constitutive explanation nevertheless can be useful in the production of knowledge.[172] I agree with Wendt that,

> 'constitutive theories must be judged against empirical evidence just like causal ones. Not all interpretations are equally valid, and so constitutive inquiry ultimately faces the same epistemological problem as causal inquiry: how to justify a claim about unobservables (whether constitutive rules or causal mechanisms) from what we can see?'[173]

Yet I disagree that this requirement then opens the door to positivist epistemology, as if somehow we cannot conduct social *science* without it. Answering 'what-questions' involves descriptive inference, and classifies social kinds as one thing or another (the answer to 'what is the Cold War?' for example), including implicitly capturing the intersubjective understandings about it, and as such becomes explanatory. This is so because in this example, describing the Cold War as a conflict without mention of the ideas that both agents of both parties and commentators (including social scientists) had of it, would fail to explain its very existence and longevity; only by including a holistic description of its constitution, including how ideas about self and the other constituted and reconstituted the Cold War (its 'naturalization'), only to be broken by shifts in perceptions triggered by new insights into the ideas that the opponent held of each other (for example, the realization by the Soviet

170 For a short overview and discussion of Lakatos work on paradigm shifts and the role of degenerative and progressive research programs, see page 69.

171 Wendt, Alexander, *Social Theory of International Politics* (Cambridge University Press: Cambridge 1999) pp. 85-87, Wendt, Alexander, 'On Constitution and Causation in International Relations', in *Review of International Studies*, Vol. 24 (December 1998) pp. 104-108, 115-117. Wendt's use of scientific realism has been criticized in an edited volume dedicated to his work, particularly his *Social Theory of International Politics* (Cambridge University Press: Cambridge 1999), Suganami, Hidemi, 'Wendt, IR, and philosophy: a critique', in Guzzini, Stefano, Leander, Anna (eds.), *Constructivism and International Relations: Alexander Wendt and His Critics* (Routledge: Oxon 2006) pp. 60-61, Guzzini, Stefano, Leander, Anna, 'Wendt's constructivism: a relentless quest for synthesis', in Guzzini, Stefano, Leander, Anna (eds.), *Constructivism and International Relations: Alexander Wendt and His Critics* (Routledge: Oxon 2006) pp. 73, 77-78.

172 Wendt, Alexander, 'On Constitution and Causation in International Relations', in *Review of International Studies*, Vol. 24 (December 1998) pp. 108-109.

173 Wendt, Alexander, *Social Theory of International Politics* (Cambridge University Press: Cambridge 1999) p. 85.

leadership under Gorbachev that it was partly responsible for the continuation of the conflict), can a satisfying account of this particular social kind be given (and the social kind itself be 'explained').[174]

Lets be clear: causal inference offers explanatory power. But it cannot support a claim to a direct line to 'truth' or 'fact' as it can in the natural sciences. Causal inference nevertheless can offer credible explanations. Organization of such explanations to what-questions under a concept ('as opposed to a law, as in the logical empiricist model of causal explanation') is a process of unification that can lend coherence to the whole of explanations.[175] 'Explanation-what' or 'explanation by concept' are 'the dominant mode of explanation in history' and 'pervade the social sciences'.[176] The aggregative nature of international politics invites us to turn to constitutive theory and a historiographic narrative-based methodology to make sense of particular concepts in this sphere of the social world, which I will elaborate on in the next chapter (see pages 92 and 136).

Structure and Agency

The conceptualization of the world of international politics as a social environment, in which all processes are ultimately constituted by the actions of individuals, was marginalized in traditional International Relations theory and in the Neorealism/Neoliberalism debate. Our stories of what goes on in (international) human relations can never start and finish with concepts like systemic, structure, etc. What is often referred to as ‘international society’ or the ‘society of sovereign states’ is contemporaneously made up of nation-states, their governments, their citizens (socially) organized in local and international practices, and ultimately, individuals. The term 'international society' its contemporary use lies in Grotius' popularity, though the idea originates a century before Grotius with Vitoria and his rejection of Christendom's denial of heathen rights (although Christian exceptionalism still dominated Vitoria's and Grotius' thinking).[177] How individuals have organized themselves in civil society and consequently perceive themselves as being represented by political parties, NGOs, nations and nation-states (or guilds, tribes and kingdoms for that matter) sheds a light on the forces in (international) society that often are described as systemic or structural processes.

Understood this way, ‘systemic’ or ‘structural’ says something about the distance certain processes have to the individual or citizen and how these in turn, by the regulations these

174 Wendt, Alexander, 'On Constitution and Causation in International Relations', in *Review of International Studies*, Vol. 24 (December 1998) pp. 109-110.
175 Ibid., p. 110.
176 Ibid.,On Constitution and Causation in International Relations p. 111, Wendt, Alexander, *Social Theory of International Politics* (Cambridge University Press: Cambridge 1999) p. 86.
177 Bull, Hedley, 'The Importance of Grotius in the Study of International Relations', in Bull, Hedley, Kingsbury, Benedict, Roberts, Adam (eds.), *Hugo Grotius and International Relations* (Clarendon Press: Oxford 1990) pp. 80-82, Bull, Hedley, The Anarchical Society: A Study of Order in World Politics, Third edition (Palgrave: Basingstoke 2002) pp. 13-19, Buzan, Barry, 'From International System to International Society: Structural Realism and Regime Theory: Meet the English School', in *International Organization*, Vol. 47, No. 3 (Summer, 1993).

individuals individually or collectively agree to adhere by, and the norms they find themselves compelled to uphold, collectively constitute and explain these systemic qualities. Systemic qualities however do not equate to structure in the positivist sense. While it seems hard to directly relate these 'macro-processes' to the practices in which individuals are the main actors, individuals are always, through the civil organizations they participate in and the language they use to give meaning to the world, connected to and constitutive of these processes.[178]

The role of structure and how it is constituted has been thoroughly debated in the IR field, in the 'structure versus agency' debate. The structure-agency problem opened traditional IR theory up to criticism regarding epistemology and ontology, yet the debate itself was focused on issues of method and to an extend ontology, and should therefore (and confusingly) be seen as an extension of the Second Great Debate in IR, as its participants were largely concerned with saving the positivist project in IR by, for example, applying Scientific Realism while attempting to resolve the shortcomings of Waltz's structuralism.[179]

When a theory treats structure as a constraining agency, for example by conceiving an actor acting upon rational-choice-type set-preferences that brought an anarchic structure into being, that in turn constrains the actions of actors (as posited by neorealists), it is forced to treat the properties of actors as *a priori* given and 'ontologically primitive'; as 'system structures cannot generate agents if they are defined exclusively in terms of those agents in the first place.'[180] Any falsifiable theory regarding the state then becomes impossible to construct. Similarly, a structure-dominant theory like Wallerstein's world-systems theory treats agency (the states) as 'structural 'idiots", as 'effects of the structure of the world system'.[181] Both theories 'ultimately reduce one unit of analysis to the other.'[182]

Constructivists took the lead in moving the discipline on from traditional structural theories by offering theory that observed a dialectical relationship between structure and agency; theory in which structure and agency are *mutually constitutive* and that give 'agents and structures equal ontological status', permitting 'us to develop theoretical accounts of both state agents and system structures without engaging in either ontological reductionism or

178 Frost, Mervyn, 'The Role of Normative Theory in IR', in Millennium – Journal of International Studies, Vol. 23 (1994) pp. 113. I will discuss this assertion more thoroughly in my treatment of Frost's practice-based constitutive theory below, under *Frost's Practice-based Theory of International Action*, page 92.

179 The Second Great Debate in IR took place between behaviorists that sought to introduce positivist methodology, and traditionalist that sought to preserve the historical-narrative method in the discipline. At its core of this particular debate between Wendt on the one hand and Hollis and Smith on the other, are contested Wendt's use of Structuration Theory, Waltz's structuralism and the inter-connectedness of ontology and epistemology, among other themes, Gould, Harry, D., 'What *Is* at Stake in the Agent-Structure Debate?', in Kubálková, Vendulka, Onuf, Nicholas, Kowert, Paul (eds.), *International Relations in a Constructed World* (Routledge, Oxon 1998) p. 83-85, 87-91.

180 Wendt, Alexander, 'Agent-Structure Problem in International Relations Theory', in *International Organization*, Vol. 41, No. 3 (Summer 1987) pp. 341-344.

181 Ibid., pp. 344 -346. The term 'structural idiots' I take from Adler, Emanuel, 'Seizing the Middle Ground: Constructivism in World Politics', in *European Journal of International Relations*, Vol. 3, No. 3 (1997) p. 325.

182 Wendt, Alexander, 'Agent-Structure Problem in International Relations Theory', in *International Organization*, Vol. 41, No. 3 (Summer 1987) p. 339.

reification.'[183] This evolution was made possible by the introduction of concepts of social theory developed by what are generally known as scientific realists, in S*tructuration Theory.* These 'structuration theorists' according to Thrift include Philip Abrams, Roy Bhaskar, Pierre Bourdieu, Anthony Giddens, and Derek Layder', have four basic positions in common:

> '1) In opposition to individualists, they accept the reality and explanatory importance of irreducible and potentially unobservable social structures that generate agents.
>
> 2) In opposition to structuralists, they oppose functionalism and stress "the need for a theory of practical reason and consciousness that can account for human intentionality and motivation."
>
> 3) These oppositions are reconciled by joining agents and structures in a "dialectical synthesis" that overcomes the subordination of one to the other, which is characteristic of both individualism and structuralism.
>
> 4) Finally, they argue that social structures are inseparable from spatial and temporal structures, and that time and space must therefore be incorporated directly and explicitly into theoretical and concrete social research.'[184]

Furthermore, Scientific realists attempted to 'reverse the subordination of ontology to epistemology, which is characteristic of empiricism' (but not just empiricism), 'and instead to make the form of scientific explanations dependent on the nature and causal properties of entities.'[185] Structuration is more a tool of analysis, of conceiving of ontology in a particular way, than a theory. Yet at the same time, it's basic premises have offered insights into the centrality of human practices in recursively constituting social structures that have, in the past two decades, helped a new school of IR theory known as 'the practice-based approach' come into being.[186]

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183 Wendt, Alexander, 'Agent-Structure Problem in International Relations Theory', in *International Organization*, Vol. 41, No. 3 (Summer 1987) pp. 339, 349, 360-361, Onuf, Nicholas, Greenwood, *World of Our Making: Rules and Rule in Social Theory and International Relations* (University of South Carolina Press: Columbia 1989) p. 41. The move to situate the agent-structure problem as a 'debate in philosophy of science between positivists and scientific realists over the ontological status of phenomena that cannot be directly observed' can be credited to Wendt, Gould, Harry, D., 'What *Is* at Stake in the Agent-Structure Debate?', in Kubálková, Vendulka, Onuf, Nicholas, Kowert, Paul (eds.), *International Relations in a Constructed World* (Routledge, Oxon 1998) p. 81.

184 Wendt, Alexander, 'Agent-Structure Problem in International Relations Theory', in *International Organization*, Vol. 41, No. 3 (Summer 1987) pp. 356. Besides Wendt, an David Dessler has argued for a scientific realist approach to the agent-structure problem, see Dessler, David, 'What's at Stake in the Agent-Structure Debate?', in *International Organization*, Vol. 43, No. 3 (Summer 1989).

185 Wendt, Alexander, 'Agent-Structure Problem in International Relations Theory', in *International Organization*, Vol. 41, No. 3 (Summer 1987) pp. 361.

186 Wendt, Alexander, 'Agent-Structure Problem in International Relations Theory', in *International Organization*, Vol. 41, No. 3 (Summer 1987) p. 355. This practice-based social constructivist school appears to follow two separate approaches; a number of scholars follow Bourdieau, such as Adler and Pouilot, and others follow a Wittgensteinian interpretation of practices, such as Frost and Lechner. Frost and Lechner qualify this dichotomy as being largely based on taking an external (Aristotelian) or internal (Wittgensteinian) view in understanding practice, that they argue are not incommensurable. In their view of this distinction, 'Aristotle usefully pointed out that agents always act with some end in view, and Wittgenstein, that certain (even though

In structuration, agents and structures are seen as mutually constitutive, by the centrality of practices that are 'ordered across space and time', and are 'recursive'; 'they are not brought into being by social actors but continually recreated by them via the very means whereby they express themselves as actors' and through social activities human agents 'reproduce the conditions that make these activities' meaningful and possible.[187] The self-understanding of actors, at both conscious and unconscious levels, makes possible 'the specifically reflexive form of the knowledgeability of human agents', in turn making possible 'the recursive ordering of social practices.'[188]

> 'To be a human being is to be a purposeful agent, who both has reasons for his or her activities and is able, if asked, to elaborate discursively upon those reasons (including lying about them). …. Human action occurs as … a continuous flow of conduct, as does cognition. Purposive action is not composed of an aggregate or series of separate intentions, reasons and motives. Thus it is useful to speak of reflexivity as grounded in the continuous monitoring of action which human beings display and expect others to display. The reflexive monitoring of action depends upon rationalization, understood here as a process rather than a state and as inherently involved in the competence of agents. An ontology of time-space as constitutive of social practices is basic to the conception of structuration, which begins from temporarility and thus … 'history'.'[189]

For the agent, 'reflexive monitoring of activity is a chronic feature of everyday action and involves the conduct not just of the individual but also others', including social and physical aspects of 'of the contexts in which they move.'[190] Agents in social life 'maintain a continuing 'theoretical understanding' of the grounds of their activity' and this rationalization of action serves as the 'principle basis upon which the generalized 'competence' of actors is evaluated by others.'[191] Giddens warned that such rationalizations should not be equated 'with 'normative

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not all) ends of action are intelligible as 'parts' embedded within social 'wholes' or language-games (practices), where each practice is constituted as a more or less autonomous system of rules.' Frost, Mervyn, Lechner, Silviya, 'Two conceptions of international practice: Aristotelian praxis or Wittgensteinian language-games?', in *Review of International Studies*, Vol. 42 (2016) pp. 349. Bueger and Gadinger follow the same line, though labeling the opposition as between pragmatists and critical theorists, Bueger, Christian, Gadinger, Frank, 'The Play of International Practice', in *International Studies Quarterly*, Vol. 59, No. 3 (2015) pp. 454-457,

187 Giddens, Anthony, *The Constitution of Society: Outline of the Theory of Structuration* (University of California Press: Berkeley 1984) p. 2. The concept of Wittgensteinian practice was called 'the Background' ('the set of nonintentional or preintentional capacities that enable intentional states of function') by John Searle, and 'habitus' in the work of Pierre Bourdieu. Searle locates its earlier understanding in the work of Hume, followed by Nietzsche's recognition that this background understanding is mutable, Searle, John, *The Construction of Social Reality* (The Free Press: New York 1995) pp. 129, 132-137.

188 Giddens, Anthony, *The Constitution of Society: Outline of the Theory of Structuration* (University of California Press: Berkeley 1984) p. 3.

189 Ibid., Giddens, Anthony, *New Rules of Sociological Method: A Positive Critique of Interpretative Sociologies* (Polity Press: Cambridge 1993) p. 89. 'I shall define as 'intentional' or 'purposive' any act which the agent knows (believes) can be expected to manifest a particular quality or outcome, and in which this knowledge is made use of by the actor in order to produce this quality or outcome.', Giddens, Anthony, *New Rules of Sociological Method: A Positive Critique of Interpretative Sociologies* (Polity Press: Cambridge 1993) p. 83.

190 Giddens, Anthony, *The Constitution of Society: Outline of the Theory of Structuration* (University of California Press: Berkeley 1984) p. 5.

191 Ibid., pp. 4-5.

commitments" as in his perspective 'norms are 'factual' boundaries of social life, to which a variety of manipulative attitudes are possible.'[192] Rationalizations (having self-understanding) should therefore be separated from the discursive reasons that agents give to explain their actions. The ability to provide the latter is associated with one's competency as an agent, even though usually, during ordinary interaction, the agent will not be faced with a challenge to provide them.[193]

> '... purposiveness is necessarily intentional, in the phenomenological sense – that is, 'logically' tied to descriptions of 'purposive acts' – but the rationalization of action is not, since this refers to the principled grounding of such acts. The rationalization of conduct expresses the causal anchoring of agency in tying purposes to the conditions of their realization within the ongoing *Praxis* of day-to-day life. Rather than simply saying reasons are, or may be, causes, it is more accurate to say that rationalization is the causal expression of the grounding of the purposiveness of the agent in *self-knowledge* and in *knowledge of the social and material worlds* which are the environment of the acting self.'[194]

Besides locating causal dimensions in the rationalization of action, Giddens also conceived of them in two other types: 'unconscious influences and influences which affect the circumstances of action within which individuals carry on their conduct.'[195] Circumstances of action in this sense are the 'many elements which that actor neither helped to bring into being nor has any signification control over' that make up the context in which the actor is situated, and '[s]uch enabling and constraining features of contexts of action include both material and social phenomena.'[196]

When Giddens conceptualized the power of the agent; their ability to act in a meaningful way, he moved toward introducing its relationship to structure. To have power as an agent is 'to be able to deploy (chronically, in the flow of daily life) a range of causal powers, including that of influencing those deployed by others'; "to make a difference' to a pre-existing state of affairs or course of events.'[197] Giddens argued that,

> '… we can express the duality of structure in power relations in the following way. Resources (focused via signification and legitimization) are structured properties of social systems, drawn upon and reproduced by knowledgeable agents in the course of

192 Ibid., p. 4. That is not to say that norms cannot be part of a rationalization; but they are not always. Giddens' discussion of norms in (1984) is very cursory, and their designation by Giddens as 'factual' is confusing because norms should be seen as intersubjective and mutable in their very nature. I will return to the discussion of norms later on, in Chapter 5, page 126.

193 Ibid., pp. 5-6.

194 Giddens, Anthony, *New Rules of Sociological Method: A Positive Critique of Interpretative Sociologies* (Polity Press: Cambridge 1993) p. 92. Italics in original. Praxis refers to social activity here, Onuf, Nicholas, Greenwood, *World of Our Making: Rules and Rule in Social Theory and International Relations* (University of South Carolina Press: Columbia 1989) pp. 48, 63.

195 Giddens, Anthony, *The Constitution of Society: Outline of the Theory of Structuration* (University of California Press: Berkeley 1984) p. 346.

196 Ibid.

197 Ibid., p. 14. Italics in original.

> interaction. …. In this conception the use of power characterizes not specific types of conduct but all action, and power is not itself a resource. Resources are media through which power is exercised, as a routine element of the instantiation of conduct in social reproduction. We should not conceive of the structures of domination built into social institutions as in some way grinding out 'docile bodies' who behave like the automata suggested by objectivist social science. Power within social systems which enjoy some continuity over time and space presumes regularized relations of autonomy and dependence between actors or collectivities in context of social interaction. But all forms of dependence offer some resources whereby those who are subordinate can influence the activities of their superiors.'[198]

This is what Giddens called 'the *dialectic of control* in social systems.'[199] Power is a primary concept in social science, and 'is the means of getting things done and, as such, directly implied in human action.'[200] However, Giddens rejected the Nietzschian interpretation that power has primacy (and is prior) to all other concepts, such as seen in the work of Foucault; '[i]t is a mistake to treat power as inherently divisive, but there is no doubt that some of the most bitter conflicts in social life are accurately seen as 'power struggles', 'regarded as to do with efforts to subdivide resources which yield modalities of control in social systems.'[201]

In structuration, structure's relation to agency is 'always both constraining and enabling' and should be conceived as 'the structuring properties which make it possible for discernibly similar social practices to exist across varying spans of time and space and which lend them 'systemic' form.'[202] Structurationists differ from structuralists because the former don't see social structures as independent from the activities they govern, nor do these structures '"... exist independently of the agents' conceptions of what they are doing in their activity"', giving 'social structures an inherently discursive dimension', 'inseparable from the reasons and self-understandings that agents bring to their actions.'[203]

Collectivities of reproduced social practices 'exhibit 'structural properties'', that represents a 'virtual order' of transformative relations that can be interpreted as hierarchically ordering those practices; such structures consist of rules and power-exercising resources.[204] Rules, in a Wittgensteinian interpretation, 'implicated in the reproduction of social systems' are non-formalized, exist in ('loosely') associated constellations, 'cannot be conceptualized apart from resources' (Giddens conceived of several categories of material and ideational resources) as together they infuse the transformative, structural processes that produce and reproduce social practices with relations of domination and power; the duality of structure.[205] '[C]rucial to the

198 Ibid., pp. 15-16. The term 'docile bodies' is Foucault's,
199 Ibid., p. 16. Italics in original.
200 Ibid., p. 283.
201 Ibid.
202 Ibid., pp. 17, 25.
203 Wendt, Alexander, 'Agent-Structure Problem in International Relations Theory', in *International Organization*, Vol. 41, No. 3 (Summer 1987) pp. 358-359.
204 Giddens, Anthony, *The Constitution of Society: Outline of the Theory of Structuration* (University of California Press: Berkeley 1984) p. 17.
205 Ibid., pp. 17-19, 258-261.

constitution of the agent' are the 'forms of knowledgeability and symbolism built into practical consciousness', in Wittgenstein's *praxis*.[206] As such, the 'skilled knowledgeable subject, whose activities are geared into the continuities of day-to-day social life' expresses its knowledge in practice and as such constitutes itself as a competent agent.[207]

Duality of Structure in IR

The introduction of constitutive theory to IR, inspired by the structuration school, was first given strong impetus by the work of Alexander Wendt. Wendt based his work on Bhaskar's who, compared to Giddens, observed a more demanding scientific realism than the latter and provided Wendt with 'legitimacy cover' when offering his 'thin' constructivism in challenge of Neorealism and its dominant position and claims to scientific legitimacy in the field of IR.[208] It also provides him 'with the framework for causal theorizing in a way that alternative meta-theories do not', as he 'considers causal explanations as essential to his account of change.'[209] But, as Petr Drulák pointed out, 'Wendt's scientific realism cannot provide a framework for understanding reflexivity', as Wendt himself admits.[210] Wendt tried to make Scientific Realism work in ways it's not capable of; 'complex learning in which subjects are shaped by objects does fit in the framework; the reflexivity which refers to subjects bringing about new social realities, such as Kantian norms, does not.'[211] Reflexivity stands opposed to the reification of social kinds that takes place in scientific realism, and so his paradoxial choice for a positivist epistemology and post-positivist ontology is exposed.[212]

> 'When addressing reflexivity, Wendt refers to Giddens's notion of 'double hermeneutics' ..., which can be seen as a defining feature of the constructivism in IR .... Giddens (together with Habermas and others) belongs to the group of social theorists who have developed the concept of reflexive modernity by drawing on the philosophical hermeneutics of Gadamer .... Gadamer's elaboration of the Heideggerian concept of the hermeneutic circle makes the notion of reflexivity more tangible. It is a

206 Giddens, Anthony, 'Subjectivity, and the Constitution of Meaning', in *Social Research*, Vol. 53, No. 3 (Autumn 1986) p. 539.
207 Ibid.
208 Wendt, Alexander, *Social Theory of International Politics* (Cambridge University Press: Cambridge 1999) pp. 1-2. Wendt's work is rife with references to Neorealism and Waltz's major publications, The Theory of International Politics (Addison-Wesley: Boston 1979) and Man, the State, and War (Columbia University Press: New York 1959), for example in, Wendt, Alexander, *Social Theory of International Politics* (Cambridge University Press: Cambridge 1999) pp. 2-3, 5-6, 8, 11-12, 15-22, 30-32, 97-109, 145-147, 151, 188-189, 228, 239, 244, 249, 252, 318-319, 370.
209 Drulák, Petr, 'Reflexivity and structural change', in Guzzini, Stefano, Leander, Anna (eds.), *Constructivism and International Relations: Alexander Wendt and His Critics* (Routledge: Oxon 2006) p. 146.
210 Ibid., p. 147
211 Ibid. p. 147. Drulák argues that using different epistemological frameworks for his different (micro and macro) levels of analysis can help Wendt solve this paradox, but as stated above, such a solution fails to take epistemology seriously, Drulák, Petr, 'Reflexivity and structural change', in Guzzini, Stefano, Leander, Anna (eds.), *Constructivism and International Relations: Alexander Wendt and His Critics* (Routledge: Oxon 2006) pp. 154-157.
212 Ibid., pp. 145-147.

> circle in which we move when trying to gain knowledge, 'seeking to understand the whole in terms of its parts, and its parts in terms of the contribution they make to the meaning of the whole' .... Gadamer ... argues that understanding is dependent on pre-existing structures *(Vorstrukturen)* which are themselves historical and subject to change. He thus rehabilitates tradition, authority and prejudice as preconditions of our knowledge *(Vorurteile als Bedingungen des Verstehens),* as its *horizon*. Reflexivity can thus be understood as perpetual movement in the hermeneutic circle in which we try to understand things at the same time in which the very conditions of this understanding change (the horizon of things).'[213]

Such an understanding of reflexivity therefore places an additional responsibility on the social scientists engaged in the double hermeneutic. Structures have normative dimensions to them, with which the social scientists has to engage before engaging in deep analysis. To not do this would leave unproblematic the normative dimension that the social scientist brings into the analysis, by being for example a realist, a constructivist, or a Marxist. Such theoretical choices determine 'what counts as salient facts, which might verify or falsify their theories', and may in themselves be in some way reflective of the value system of the social scientist.[214] Furthermore, '[A]ctions do not present themselves in a straightforward, objective way'; they are bound up in the 'self understandings of the actors being investigated; this includes taking account of their value systems' in order to be able to evaluate the discursive reasons (often including ethical dimensions) offered by them.[215] These self understandings include interpretations of structure, and as a consequence the social scientist him/herself will have to evaluate these interpretations 'in terms of [his/her] own normative commitments.'[216] As such, argued Frost, normative arguments should take place prior to structural analysis.[217]

Wendt, as early as 1987, wrote that,

> '… in contrast to the neorealist definition of international system structures as consisting of externally related, preexisting, state agents, a structurationist approach to the state system would see states in relational terms as generated or constituted by internal relations of individuation (sovereignty) and, perhaps, penetration (spheres of influence). In other words, states are not even conceivable as states apart from their position in a global structure of individuated and penetrated political authorities. The nature and configuration of the internal relations that comprise a social structure, in turn, define a set of possible transformations or combinations of its elements.'[218]

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213 Ibid., p. 150.

214 Frost, Mervyn, 'The Role of Normative Theory in IR', in *Millennium – Journal of International Studies*, Vol. 23 (1994) pp. 115-116.

215 Ibid., pp. 116-117.

216 Frost, Mervyn, 'The Role of Normative Theory in IR', in *Millennium – Journal of International Studies*, Vol. 23 (1994) p. 117, Giddens, Anthony, *New Rules of Sociological Method: A Positive Critique of Interpretative Sociologies* (Polity Press: Cambridge 1993) p. 50.

217 Frost, Mervyn, 'The Role of Normative Theory in IR', in *Millennium – Journal of International Studies*, Vol. 23 (1994) p. 118.

218 Wendt, Alexander, 'Agent-Structure Problem in International Relations Theory', in *International Organization*, Vol. 41, No. 3 (Summer 1987) p. 357.

The above seems a dialectical conception of structure and agency, yet Wendt stays, from his 1987 article to his 1999 theoretical treatise, within the rationalist and structuralist traditions by keeping his theory essentially state-centric and individualistic (the state as the lowest unit of analysis), and by conceptualizing structure as always based in material configurations, given 'meaning for human action through the structure of shared knowledge in which they are embedded.'[219] Wendt gives center stage to social structures, which 'exist, not in actors' heads nor in material capabilities, but in practices', and only 'in process.'[220] This process is 'stable enough to constitute' structures and agents 'as relatively enduring objects'; '[a]gents and structures are themselves processes, in other words, on-going "accomplishments of practice."'[221] Therefore, institutions of anarchy, such as self-help and power politics, are 'not essential features of anarchy' and are subject to change, and anarchy itself has no logic 'apart from the practices that create and instantiate one structure of identities and interests rather than another'; '*Anarchy is what states make of it*.'[222]

Material circumstances become dependent on the social structure of Wendt's system (in contrast to Waltz's structuralism), in which '[t]he distribution of actors' material capabilities affects the possibility and likelihood of certain outcomes', '[t]he "composition" of material capabilities, and in particular the character of the technology they embody, has similar constraining and enabling effects' and geography and the access to natural resources matter.[223]

Wendt defines culture as the locus for ongoing structural change and 'cultural forms articulate … and give meaning to material forces, and ... the latter in turn constrain the former.'[224] He locates norms, rules, institutions inside culture and these induce contradictory practices, which can cause change. Imperfect socialization of actors (in that they have private beliefs upon which they act), 'unintended consequences of shared beliefs' that can 'cause a change of that belief', exogenous shocks such as revolutions and (cultural) imperialism, and creativity that introduces new ideas within a culture, are also all factors of such change, Wendt argues.[225]

By 2002 Nicholas Onuf, a 'thick' constructivist, in no uncertain terms judged the structure-agent debate to be over, yet inconclusive, and partly responsible for the fragmentation of the constructivist project;

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219 Wendt, Alexander, 'On Constitution and Causation in International Relations', in *Review of International Studies*, Vol. 24 (December 1998) p. 113, Wendt, Alexander, 'Constructing International Politics', in *Intenrational Security*, Vol. 20, No. 1 (Summer 1995) p. 73, Wendt, Alexander, *Social Theory of International Politics* (Cambridge University Press: Cambridge 1999) pp. 315, 317-318, 326-342.

220 Wendt, Alexander, 'Constructing International Politics', in *Intenrational Security*, Vol. 20, No. 1 (Summer 1995) pp. 73-74.

221 Wendt, Alexander, *Social Theory of International Politics* (Cambridge University Press: Cambridge 1999) p. 313.

222 Wendt, Alexander, 'Anarchy is what States Make of it: The Social Construction of Power Politics', in *International Organization*, Vol. 46, No. 2 (Spring 1992) pp. 394-395. Italics in original.

223 Wendt, Alexander, *Social Theory of International Politics* (Cambridge University Press: Cambridge 1999) pp. 109-111, 139.

224 Ibid., p. 190.

225 Ibid., p. 188.

> 'Wendt's turn away from philosophical issues turned out to be a mixed blessing. As the field gained from an expanded agenda, constructivism lost what should have been its most distinctive features. Any concern with language was left to the dissidents; as a derivative of performative speech, rules ceased to matter; without rules as media of social construction, the co-constitution of agents and structures became an airy abstraction, needlessly subject to just the sort of debate that Wendt seems to have had enough of. Ironically, Wendt holds some of the responsibility for making "the agent-structure debate" so confused and pointless that most scholars (I among them) will have nothing to do with the subject'.[226]

For Roxanne Doty, the problematic nature of the debate lays in the scientific realist underpinning most of the solutions offered; scientific realism's essentialism (its drive to explain structure through description of its attributes) lead to explanations of structure as constituted by rules. But in doing so, it divorced the connection the rules have with '"the intersubjective understandings of agents in their immediate and local practices"'.[227] The centrality of practice and its 'ruled context' that Onuf advocated would appeal to Doty, Gould argued, whereas structuration could not explain how 'agents and structures constitute one another.'[228] Onuf (quoted in Gould) offered rules as a constituting and re-constituting mechanism, because:

> 'The co-constitution of people as social beings and of society is a continuous process. Rules are central to this process because they make people active participants (or agents) in society, and they give any society its distinctivecharacter (or structure). Rules define agents in terms of structures, and structures in terms of agents. ... As rules change in number, kind, relation and content, they constantly redefine agents and structures, always in terms of each other. (1996, 6)

Using rules in this way 'simultaneously leads in two directions--toward agents and their choices, and toward social arrangements that eventuate from agents choices"'.[229]

Rules and Rule-following

According to Giddens', '[r]ules relate on the one hand to the constitution of *meaning*, and on the other to the *sanctioning* of modes of social conduct'; determining at once what is meaningful behavior and what is not, and why, and most are usually 'only tacitly grasped by actors'.[230] Separately, formalized rules such as 'canons of law, bureaucratic rules, rules of games and so on' are codified versions of rules; they can be conceived as having existed as

226 Onuf, Nicholas, 'Worlds of Our Making' (2002), in Onuf, Nicholas, Greenwood, *Making Sense, Making Worlds: Constructivism in Social Theory and International Relations* (Routledge, Oxon 2013) p. 31.
227 Gould, Harry, D., 'What *Is* at Stake in the Agent-Structure Debate?', in Kubálková, Vendulka, Onuf, Nicholas, Kowert, Paul (eds.), *International Relations in a Constructed World* (Routledge, Oxon 1998) p. 94.
228 Ibid., p. 80.
229 Ibid., p. 80.
230 Giddens, Anthony, *The Constitution of Society: Outline of the Theory of Structuration* (University of California Press: Berkeley 1984) pp. 18, 22. Italics in original.

'techniques or generalizable procedures applied to the enactment/reproduction of social practices' before they were made (relatively) immutable through 'verbal expression'/codification.[231] Even though codified rules are more explicit and non-compliance with them (in civil society) often carries sanctions, 'the prescriptions involved in the structuring of daily interactions are much more fixed and constraining than might appear from the ease with which they are ordinary followed.'[232]

Philosopher John Searle qualifies this first distinction, between the constitution of meaning and the (non-codified) sanctioning of modes of social conduct, as between *regulative rules* and *constitutive rules*, a distinction which semantically originates in Kant's work, although Kant's use of the terms and its distinction was not between the 'permissible' and the 'possible' but between the 'existential relations' and 'logical relations'.[233] Searle's definition originates in Rawls (1955), who explained practice-based constitutive and regulative rules using the example of a game of baseball.[234] The use of the terms and distinction between them, as used by Searle, is that the first 'regulate antecedently existing activities', whereas the second 'do not merely regulate, they also create the very possibility of certain activities'; in chess, for example, '[t]he rules are constitutive of chess in the sense that playing chess is constituted in part by acting in accord with the rules' and if one doesn't follow 'a large subset of [these] rules', one is not playing chess.[235]

This distinction between constitutive and regulative rules is located in a larger discussion that centers around the interpretation of Wittgenstein by John Rawls and Peter Winch, in which the latter claimed that all meaningful human behavior is '*ipso facto* rule-governed', a sweeping statement that sparked some debate.[236] The suggested interpretation of Winch by Onuf in which he suggested that this could mean that rules don't just govern meaningful behavior, but in fact affect behavior in a causal way, as in, 'rules as causes' (Giddens' 'reasons as causes', page 80) should be rejected.[237]

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231 Ibid., p. 21.

232 Ibid., p. 23. This is more obvious in the international context, where oftentimes sanctions (following a violation of codified rules) are absent or difficult to organize and enforce. This point contributes to the discussion of norms in international society, in Chapter 5, on page 126.

233 Onuf, Nicholas, Greenwood, *World of Our Making: Rules and Rule in Social Theory and International Relations* (University of South Carolina Press: Columbia 1989) p. 51.

234 Rawls, John, 'Two Concepts of Rules', in The Philosophical Review, Vol. 64, No. 1 (January 1955) pp. 24-29, Ruggie, Gerard, John, *Constructing the World Polity: Essays on International Institutionalization* (Routledge: Oxon 1998) p. 91.

235 Searle, John, *The Construction of Social Reality* (The Free Press: New York 1995) pp. 27-28, Onuf, Nicholas, Greenwood, *World of Our Making: Rules and Rule in Social Theory and International Relations* (University of South Carolina Press: Columbia 1989) p. 38.

236 Winch, Peter, *The Idea of a Social Science and its Relation to Philosophy*, Second Edition (Routledge: London 1990) pp. 51-52. Italics in original, Giddens, Anthony, *New Rules of Sociological Method: A Positive Critique of Interpretative Sociologies* (Polity Press: Cambridge 1993) pp. 50-51, Onuf, Nicholas, Greenwood, *World of Our Making: Rules and Rule in Social Theory and International Relations* (University of South Carolina Press: Columbia 1989) p. 49.

237 If only because it clearly does not follow from Winch's subsequent example that he suggests such a narrow interpretation: 'The anarchist has reasons for acting as he does; he makes a point of not being governed by explicit, rigid norms. Although he retains his freedom of choice, yet they are still significant choices that he makes: they are guided by considerations, and he may have good reasons for choosing one course rather than

As should Bhaskar's idea that Winch's proposition ('the rule-following paradigm') '*presupposes* the category of causality'; Bhaskar claimed Winch doesn't provide an adequate answer to the question how we can distinguish whether someone follows a rule or not, but Winch does.[238] Bhaskar, as part of his critique of the hermeneutical tradition, disagreed with the fact that Winch provided it in inter-subjectivity, and not in an objective category. Winch argued that it's not just the action of the person that is important, 'but also the *reactions of other people* to what' that person does, and then it is only in a situation in which another person 'could in principle discover the rule which I am following that I can be intelligibly be said to follow a rule at all.[239] 'Action, so construed, is based on rules that constitute criteria for its correct performance.'[240] Bhaskar tried to prove his claim of causality by attempting to insert the distinction between objective ('real') and 'professed' ('possible') reasons given by the actor, but this misunderstands the fundamental social character of rule-following that Winch implied.[241] As Frost and Lechner (2016) explained,

> 'Within a practice, the activity of rule-following, as Wittgenstein and Winch pointed out previously, cannot be a solipsist business: it presupposes criteria of correct action that are publicly accessible to other participants in a practice and to those seeking to investigate it. 'It is of course possible', Winch writes, '… for an individual to adhere to a *private* rule of conduct. What Wittgenstein insists on, however, is … that it must be in principle possible for other people to grasp that rule and judge when it is being correctly followed' (Winch, 1958: 32–33, original emphasis; see also 1958: 39). The agent who understands a practice from the internal point of view is not a Cartesian subject whose private domain of consciousness is sealed off from scrutiny by other observers. Internalism is an *intersubjective* point of view that is open to those who do not yet understand the practice but who are willing to learn how to understand or act within it.'[242]

another.' Winch, Peter, *The Idea of a Social Science and its Relation to Philosophy*, Second Edition (Routledge: London 1990) p. 52-53.

238 Onuf, Nicholas, Greenwood, *World of Our Making: Rules and Rule in Social Theory and International Relations* (University of South Carolina Press: Columbia 1989) p. 49, Giddens, Anthony, *The Constitution of Society: Outline of the Theory of Structuration* (University of California Press: Berkeley 1984) p. 345, Bhaskar, Roy, *The Possibility of Naturalism: A Philosophical Critique of the Contemporary Human Sciences*, Third Edition (Routledge: London 1998) p. 160.

239 Winch, Peter, *The Idea of a Social Science and its Relation to Philosophy*, Second Edition (Routledge: London 1990) p.30 Italics in original.

240 Frost, Mervyn, Lechner, Sylvia, 'Understanding International Practices from the Internal Point of View', in *Journal of International Political Theory*, Vol. 12, No. 3 (July 2016) p. 304.

241 Bhaskar, Roy, *The Possibility of Naturalism: A Philosophical Critique of the Contemporary Human Sciences*, Third Edition (Routledge: London 1998) pp. 160-161.

242 Frost, Mervyn, Lechner, Sylvia, 'Understanding International Practices from the Internal Point of View', in *Journal of International Political Theory*, Vol. 12, No. 3 (July 2016) p. 308, Italics in original. Compare to Rawls (1955); 'It is the mark of a practice that being taught how to engage in it involves being instructed in the rules which define it, and that appeal is made to those rules to correct the behavior of those engaged in it. Those engaged in a practice recognize the rules as defining it. The rules cannot be taken as simply describing how those engaged in the practice in fact behave: it is not simply that they act as if they were obeying the rules.' However, Rawls comments were made in the context of a defense of utilitarianism; 'Thus it is essential to the notion of a practice that the rules are publicly known and understood as definitive; and it is essential also that the rules of a practice can be taught and can be acted upon to yield a coherent practice. On this conception', then, rules are not

Practice internalism, to which Frost and Lechner referred here, 'must be distinguished from well-known intersubjective positions associated with Weber's (1978) doctrine of social action or Searle's (1969, 1995) theory of institutional facts', which are external in nature.[243] Whereas Weber exhibited this externalism in that he holds on to an individualist atomism which takes the individual as the "upper limit" and "sole carrier" of meaningful conduct, Searle (1995) remained vague about where his 'biologically innate', irreducible, collective intentionality leads, but gives examples of how it can imbue functionality in objects (paper as money, sticks as levers, walls as boundaries, etc) in that '[i]nstitutional facts exist, …, on top of brute physical facts'.[244] His example to explain what a brute fact is shows Searle's allegiance to externalism; 'the fact that the sun is ninety-three million miles from the earth' 'exist independently of any human institutions', as Searle claimed in a positivist vein, does not hold in the internal view; science is a human practice, and the collective understanding of what a mile is was established in that practice, originating in a somewhat arbitrary choice made some time ago in England.[245]

Bhaskar (in line with Searle) also advocated the divorce of constitutive and regulative rules, whereas Giddens and Onuf, following Winch, didn't. Bhaskar, criticizing Winch, argued that the rule-following paradigm doesn't 'tell us how to 'carry on', how it provides causal explanation for all behavior.[246] Onuf declared that Bhaskar is wrong, and that indeed rules do tell us how to carry on, but that 'rules cannot provide closure for the purposes of carrying on

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generalizations from the decisions of individuals applying the utilitarian principle directly and independently to recurrent particular cases. On the contrary, rules define a practice and are themselves the subject of the utilitarian principle.' Rawls, John, 'Two Concepts of Rules', in *The Philosophical Review*, Vol. 64, No. 1 (January 1955) pp. 3-4, 24.

243 Frost, Mervyn, Lechner, Sylvia, 'Understanding International Practices from the Internal Point of View', in *Journal of International Political Theory*, Vol. 12, No. 3 (July 2016) p. 309. Bueger and Gadinger also provide an overview of a different set of practice approaches that is focused more on Bourdieau and Latour, but also discussed aspects of the critical approach, Bueger, Christian, Gadinger, Frank, 'The Play of International Practice', in *International Studies Quarterly*, Vol. 59, No. 3 (2015) pp. 449-460.

244 Frost, Mervyn, Lechner, Sylvia, 'Understanding International Practices from the Internal Point of View', in *Journal of International Political Theory*, Vol. 12, No. 3 (July 2016) pp. 308-309, Searle, John, *The Construction of Social Reality* (The Free Press: New York 1995) pp. 24-25, 35, 37-40.

245 Searle, John, *The Construction of Social Reality* (The Free Press: New York 1995) p. 27. Frost and Lechner locate a declaration of his physicalism in Searle's 1983 *Intentionality: An Essay in the Philosophy of Mind* and in *Mind: A Brief Introduction* (2004), in which he commits to a neuro-biological individualism in his treatment of consciousness, Frost, Mervyn, Lechner, Sylvia, 'Understanding International Practices from the Internal Point of View', in *Journal of International Political Theory*, Vol. 12, No. 3 (July 2016) pp. 309-310. Searle's speech act theory has been widely used, but employs a strong (positivist) distinction between 'word and world', which makes it incommensurate with ('thick') constructivist principles, a reflection of Searle's allegiance to the Englishtenment tradition that he himself readily declares, Searle, John, R., *Mind, Language, and Society: Philsophy in the Real World* (Basic Books: New York 1998) pp. 4-6, 14, 24, Onuf, Nicholas, Greenwood, *World of Our Making: Rules and Rule in Social Theory and International Relations* (University of South Carolina Press: Columbia 1989) pp. 82, 94, Searle, John, R., *Intentionality: An Essay in the Philosophy of Mind* (Cambridge University Press: Cambridge 1983), Searle, John, R., *Mind: A Brief Introduction* (Oxford University Press: Oxford 2004).

246 Bhaskar, Roy, *The Possibility of Naturalism: A Philosophical Critique of the Contemporary Human Sciences*, Third Edition (Routledge: London 1998) pp. 157-158.

because rules are not the sufficient agency whereby intentions become equivalent to causes.'[247] Onuf wondered if we can construe rules as a 'constitutively decisive agency for the realization of human intentions'.[248] The clarification on the distinct but commensurable Aristotelian and Wittgensteinian views offered by Frost and Lechner is useful here; The former can shed light on individual intentionality as to the ends of action, the latter on how its these ends of action are made intelligible when situated in larger social wholes.[249]

On a different note, Giddens pointed out that regulative rules can have constitutive effects as well, and instead perhaps are aspects of the same thing, as constitutive rules have regulative effects; chess has the regulative rule that the rook can never move diagonally, yet how pieces in chess are allowed to move also forms part of what is chess, of its constitution as a game, which in turn creates its regulative structure.[250] David Dessler supported Giddens in this integration and his choice to put resources and rules central as 'instruments of action', in which rules are '"the media through which action become possible and which action itself reproduces and transforms"', 'which agents appropriate and through which action reproduces and transforms.'[251] Structure is transformative as a function of activity, and rules are transformative as they are applied in activity. Nevertheless, structure and agency are '"radically different kinds of things"', said Dessler quoting Bhaskar, a distinction he accused Wendt of obscuring in his interpretation of Bhaskar.[252]

Causality and Constitutive Rules

Searle drew attention to Wittgenstein's answer to the question of how the constitutive rules of practice, or 'Background rule' (Searle), relate to intentionality. If these rules have no causal quality, then 'this is just what a person does', behavior devoid of intentionality; 'an ungrounded way of acting'?[253] It's important to keep in mind here that Searle's theory required him to

247 Onuf, Nicholas, Greenwood, *World of Our Making: Rules and Rule in Social Theory and International Relations* (University of South Carolina Press: Columbia 1989) p. 51.
248 Ibid.. Structures of intentionality is a theme I turn to below in *Causality and Constitutive Rules* below.
249 Frost, Mervyn, Lechner, Silviya, 'Two conceptions of international practice: Aristotelian praxis or Wittgensteinian language-games?', in *Review of International Studies*, Vol. 42 (2016) pp. 349. Also see page 78.
250 Giddens, Anthony, *The Constitution of Society: Outline of the Theory of Structuration* (University of California Press: Berkeley 1984) pp. 19-20, Searle, John, *The Construction of Social Reality* (The Free Press: New York 1995) pp. 29, 230, note 10, Gould, Harry, D., 'What *Is* at Stake in the Agent-Structure Debate?', in Kubálková, Vendulka, Onuf, Nicholas, Kowert, Paul (eds.), *International Relations in a Constructed World* (Routledge, Oxon 1998) pp. 81-82,Onuf, Nicholas, Greenwood, *World of Our Making: Rules and Rule in Social Theory and International Relations* (University of South Carolina Press: Columbia 1989) pp. 47-52.
251 Gould, Harry, D., 'What *Is* at Stake in the Agent-Structure Debate?', in Kubálková, Vendulka, Onuf, Nicholas, Kowert, Paul (eds.), *International Relations in a Constructed World* (Routledge, Oxon 1998) p. 87, quoting Dessler, David, 'What's at Stake in the Agent-Structure Debate?', in *International Organization*, Vol. 43, No. 3 (Summer 1989) p. 467.
252 Gould, Harry, D., 'What *Is* at Stake in the Agent-Structure Debate?', in Kubálková, Vendulka, Onuf, Nicholas, Kowert, Paul (eds.), *International Relations in a Constructed World* (Routledge, Oxon 1998) p. 88.
253 Searle, John, *The Construction of Social Reality* (The Free Press: New York 1995) pp. 138-140.

ground his Background as 'a certain category of neurophysiological causation' (and thus, physicalism).[254] Nevertheless, his solution is interesting. Searle explained that, '[t]he key to understanding the causal relations between the structure of the Background and the structure of social institutions is to see that the Background can be causally sensitive to the specific forms of the constitutive rules of the institutions without actually containing any belief or desires or representations of those rules.'[255] 'The basic idea, …, is that one can develop, one can evolve, a set of abilities that are sensitive to specific structures of intentionality without actually being constituted by that intentionality. One develops skills and abilities that are, so to speak, functionally equivalent to the system of rules, without actually containing any representations or internalizations of those rules.'[256]

Searle clarified the role of constitutive rules by providing the example of money. Users of money do not know the constitutive rules of money-using, argued Searle; users neither consciously or unconsciously apply the constitutive rules of money when dealing with currency. They have learned to use money as a means of exchange of good, that it has value regardless of the value of the material it's made out of (paper or metal) and following the example of Searle, they 'have to be responsive to the distinction between counterfeit money and real money', even though only an expert could say with certainty what is and what is not counterfeit currency.[257] '[T]hose sorts of abilities, this type of know-how, that become ingrained are in fact a reflection of the sets of constitutive rules whereby we impose functions on entities that do not have those functions in virtue of their physical structure, but acquire those functions through collective agreement or acceptance.'[258] When agents are 'able to deal with money; to cope with society; and speak a language', they do not stop and think of this collective agreement or acceptance in any conscious or unconscious way, in that function is imposed 'according to a rule of the form 'X counts as Y in C' and requires collective agreement'; '[r]ather we develop skills' that make and allow us to be competent actors in a particular practice (what Searle called a (social) institution; in this example as a participant in a society that employs a monetized economy); 'skills that are responsive to that particular institutional structure.'[259]

Action by agents in Searle's interpretation is seemingly even more habitual and causally pathway-dependent than in Giddens', because the latter allows for active engagement of agents with their knowledgeability (in rationalizations and the discursively giving of reasons) that is 'bounded on the one hand by the unconscious and on the other by the unacknowledged conditions/unintended consequences of action.'[260] Nevertheless, Giddens delineated routine

254 Ibid., p. 129.

255 Ibid., p. 141.

256 Ibid., p. 142.

257 Ibid.. Searle used 'the expression 'social fact' to refer to any fact involving collective intentionality. …. A special subclass of social facts are institutional facts, facts involving human institutions. So for example, the fact that this piece of paper is a twenty dollar bill is an institutional fact.', Searle, John, *The Construction of Social Reality* (The Free Press: New York 1995) p. 26.

258 Ibid., p. 142.

259 Ibid., pp. 47, 142-143, 146

260 Giddens, Anthony, *The Constitution of Society: Outline of the Theory of Structuration* (University of California Press: Berkeley 1984) pp. 281-282.

('our day-to-day conduct') from 'relatively unusual circumstances, situations which in some way break with routine', which are directly motivated, whereas the former is not.[261]

At the causal level, agents (whether users of money, baseball players or diplomats) behave in such and such way because of a rule-governed structure disposes their behavior in a certain way. At a functional level, this disposition follows from a sensitivity towards the 'rule structure of the institution.'[262] This disposition comes about through the processes in which agents learn to 'cope with social reality', in which they 'acquire a set of cognitive abilities that are everywhere sensitive to an intentional structure, and in particular to the rule structures of complex institutions', without adopting internal 'mechanisms' that strictly reflect those rules.[263] Agents don't act "as if" they were following the rules of the institution; Searle proposed adding 'a diachronic level'; an internalized mechanism in agents that is 'sensitive to the rules', that 'explains the behavior', and 'is explained by the system of rules, but the mechanism need not itself be a system of rules.'[264] Such an interpretation of agency in its relation to social institutions allows us to conceive of the latter of having a 'socially created normative component', located in its constitutive rules, which can therefore act causally. Without its constitutive rules, using counterfeit money could not count as wrong (as an abuse of the institution). The ('diachronic') mechanism Searle refers to then allows agents to act competently in a bounded space of social institutions (observe a certain pathway-dependency in their behavior) while at the same time they are able to reconstitute those institutions over time, including through discursive interaction with the normative dimension over what defines competency.[265]

Theories on the intricate working of society and the relationship of the individual to society such as those of Giddens and Searle offer a way of understanding the socialization of individuals and groups into larger social wholes (practices), but these do not translate easily to the international (political) level. Merely 'moving up' their models, so that society becomes international society and the rationalizations and motivations of individual actors become those of states is problematic if one wants to maintain the constitutive view of states as made up of political leadership, bureaucratic structures, domestic audiences, media industry, etc. It's the trap that state-centric models are bound to fall into. Taking practices seriously and allowing their centrality in human social organization, as Searle (physicalism), Giddens (structuration), and Onuf (thick constructivism) seem to advocate, requires us to conceive of the socialization of states in practice as constituted by, and not separate from, the domestic level of social organization. We can analyze the international environment using ontological tools such as practices, but doing so requires models that fit and are part of the same theoretical framework we use to analyze other (social) levels. That means we can conceive of

261 Ibid., pp. 6, 282. Motives are not always accessible for discursive reporting; [u]nconscious motivation is a significant feature of human conduct', Giddens writes, leading him into a discussion of *practical consciousness* ('The Unconscious') as inspired by Freudian insights. Giddens, Anthony, *The Constitution of Society: Outline of the Theory of Structuration* (University of California Press: Berkeley 1984) pp. 6-7, 41-45, 91, 327.

262 Searle, John, *The Construction of Social Reality* (The Free Press: New York 1995) p. 144.

263 Ibid., pp. 145-146.

264 Ibid., p. 146.

265 Ibid., pp. 48, 146-147. Searle couched this boundedness in his 'deontic power relations' that make up society, Searle, John, R., 'Social ontology: Some Basic Principles', in *Anthropological Theory*, Vol. 6, No. 1 (2006) p. 18.

states as actors that exhibit social behavior in international practices, while we are required to always involve their constitutive nature when asking and answering questions about that behavior. Without taking this requirement seriously it becomes impossible to engage with the ethical dimensions of state decision-making in international society.

Frost's Practice-based Theory of International Action

Constitutive theory extends some of the tenets of Critical Theory (see above, *Critical Theory*, page 70) into a perspective upon international relations that takes these ethical dimensions seriously. Constitutive theory has two distinct dimensions, one of which asks,

> ''How is this thing constituted?' State theory, for example, does not always ask how the modern state came to be, but can focus solely on questions, such as, 'What is a state?', 'How is a state constituted?', 'Which functions does the state play in society?''[266]

The other dimension,

> '… examine[s] the ways in which rules, norms and ideas constitute social objects (Onuf, 1989). For these theorists, the social world (and perhaps the natural world) is constituted through the ideas, or theories, that we hold. For this type of constitutive theory, it becomes important to theorize the act of theorizing, since theories are not simply neutral observations of a given world, but are complicit in the construction of that world (Smith and Owens, 2008: 176–177). This type of theory can take many forms. For example, some theorists examine how meanings and interpretations construct discourses surrounding particular phenomena, and consider how these discourses are not simply descriptive of the objects they study but actually constitute them.'[267]

Mervyn Frost is one of constitutive theory's important advocates in the IR discipline.[268] His theoretical project involves both dimensions and evolved from a normative constitutive theory couched in the work of Hegel (1986) and a focus on 'settled norms' in international society (1986, 1996, 2009a, 2009b) to that of international practices (2002, 2009a, 2009b) and Wittgensteinian rule-based international practice theory (together with Sylvia Lechner, 2016a, 2016b).[269]

266 Dunne, Tim, Hansen, Lene, Wight, Colin, 'The End of International Relations Theory?', in *European Journal of International Relations*, Vol 19, No. 3 (September 2013) p. 411.
267 Ibid.
268 Brown, Chris, Ainley, Kirsten, *Understanding International Relations*, Third Edition (Palgrave MacMillan: Basingstoke 2005) pp. 93, 102. 222, Erskine, Toni, 'Normative International Relations Theory', in Dunne, Tim, Kurki, Milja, Smith, Steve (eds.), *International Relations Theories: Discipline and Diversity*, Third Edition (Oxford University Press: Oxford 2013) pp. 43, 46, Frost, Mervyn, *Global Ethics: Anarchy, Freedom and International Relations* (Routledge: Oxon 2009) p. 27.
269 Frost, Mervyn, *Towards a Normative Theory of International Relations: A Critical Analysis of the Philosophical and Methodological Assumptions in the Discipline with Proposals Towards a Substantive Normative Theory* (Cambridge University Press: Cambridge 1986), Frost, Mervyn, *Ethics in International*

Frost's work has been considered communitarian (as opposed to cosmopolitan) 'in relation to ethical questions in international relations'.[270] In this opposition,

> '[c]ommunitarians criticize cosmopolitan positions for suggesting that one can disregard the particularity of one's life in order to make decisions from an impartial point of view. They counter that membership in particular communities, and participation in their practices, are morally defining. As moral agent (or bearer of duties), one is first and foremost British or American, Muslim or Christian, someone's son or daughter. In the words of the philosopher Alasdair MacIntyre ..., these sorts of identities and roles necessarily define one's moral starting point. To abstract from them would be to render oneself incapable of ethical reasoning.'[271]

In general, Erskine could be correct that 'the communitarian stance within normative IR theory is characterized in a way that treats the morally defining community and the state synonymously' which makes it 'uniquely *state-centric*.'[272] Nevertheless, this does violence to the clearly visible individualist universalist aspects of Frost's theorizing; while his concept of the Society of Sovereign States (SOSS) as an international practice of socialized states can be characterized as state-centric, it's twinned with the Global Civil Society (GCS) international practice as a double anarchy that simultaneously throws up ethical dilemmas and the means (or mechanisms) to resolve them (I will return to this point below). He furthermore clearly subscribes to a constitutive model of the social world that relies on (often conflicting) social practices on every level, as valued members in 'families, churches, political parties, liberation movements, and so on.'[273] Yet, other than contract theory that presents the individual 'as having value prior to any community', constitutive theory asserts 'that a person only has value *qua* individual in a relationship of mutual valuation with another person or other people, i.e. within a community', making 'explicit the complex system of mutual recognition within which individuality comes to be a value', and as such can be considered communitarian.[274]

Relations: a Constitutive Theory (Cambridge University Press: Cambridge 1996), Frost, Mervyn, 'Global Civil Society: An Ethical Profile', in Hovden, Eivind, Keene, Edward (eds.), *The Globalization of Liberalism* (Palgrave MacMillan: Basingstoke 2002) pp. 152-172, Frost, Mervyn, *Global Ethics: Anarchy, Freedom and International Relations* (Routledge: Oxon 2009), Frost, Mervyn, 'Ethical Competence in International Relations', in *Ethics & International Relations*, Vol. 23, No. 2 (June 2009) pp. 91-100, Frost, Mervyn, Lechner, Sylvia, 'Two Conceptions of International Practice: Aristotelian *Praxis* or Wittgensteinian *Language-Games*?', in *Review of International Studies*, Vol. 42, No. 2 (April 2016) pp. 334-350, Frost, Mervyn, Lechner, Sylvia, 'Understanding International Practices from the Internal Point of View', in *Journal of International Political Theory*, Vol. 12, No. 3 (July 2016) pp. 299-319.

270 Erskine, Toni, 'Normative International Relations Theory', in Dunne, Tim, Kurki, Milja, Smith, Steve (eds.), *International Relations Theories: Discipline and Diversity*, Third Edition (Oxford University Press: Oxford 2013) p. 43.

271 Ibid., pp. 43-44.

272 Ibid., p. 43.

273 Frost, Mervyn, *Global Ethics: Anarchy, Freedom and International Relations* (Routledge: Oxon 2009) pp. 25, 31, 54-73, 96-113, Frost, Mervyn, 'Global Civil Society: An Ethical Profile', in Hovden, Eivind, Keene, Edward (eds.), *The Globalization of Liberalism* (Palgrave MacMillan: Basingstoke 2002) pp. 154.

274 Frost, Mervyn, *Ethics in International Relations: a Constitutive Theory* (Cambridge University Press: Cambridge 1996) p. 141.

Frost contends that individuals are intersubjectively constituted as 'first-generation rights holders' in GCS, and these rights 'are not granted to us by the state within which we live, or by the system of sovereign states, or by some international organization', yet all of these 'play an important part in protecting our rights.'[275] While I concede that in recent times there are clear signs of the functioning of a GCS, I have some reservations as to whether we can accept this notion as an a-historical, non-positional (non-Western) social institution; do we just intuitively recognize we are potential right-holders, did we always intuitively recognize slavery as not in line with basic human values, irrespective of the history of thought on ethical questions? While Frost advocates a greater attention to the importance of the GCS, he also presents it as a (yet imperfect) project; as the object of a goal we should work towards (making the above reservation a relative one. Outsiders join this project, this institution, 'by being treated as rights holders and learning to behave as such.'[276] As opposed to Justin Rosenbergs account, Frost denies that the GCS can have imperial policies because as a non-hierarchical anarchy it does not have policies at all, yet he concedes it can be imperial in (for example) how participation as a rights-holder in GCS might lead a member of a traditional society to come into conflict with 'the norms of traditional practices and in this way it may threaten the long-term viability of such practices.'[277] Since no central authority is involved in such conquest by the GCS, it's imperialism is not seen as negative by the conquered, Frost argues; subjects of conquest 'understand themselves to have shifted status; from being subjects, they have become right holders.'[278] Whether this argument is convincing depends on ones perspective; in societies in which the majority values collective rights over individual rights, for example, the majority might see such reform of their society merely as the imposition of a Western 'human-rights regime', tearing down traditional institutions and erasing otherness, co-opted by a local liberal elite.

Frost would possibly respond that subjects are resolving their inherent alienation within the current social structures they are subject to, which in this case are the oppressive aspects of traditional practices and their norms. This is a normative function of constitutive theory; '[a] successful argument in constitutive theory seeks to overcome the *alienation* a person might feel with regard to certain aspects of a practice within which she is living', which that person experiences in a negative way (e.g. burdensome), by making explicit and understandable that the person's position as a rights-holder is connected to their participation in a particular institutional arrangement, and both the rights and the institution 'are conceived as being components of a wider practice.'[279] This notion of alienation in practices originates in how

275 Frost, Mervyn, 'Global Civil Society: An Ethical Profile', in Hovden, Eivind, Keene, Edward (eds.), *The Globalization of Liberalism* (Palgrave MacMillan: Basingstoke 2002) pp. 156-157.
276 Ibid., pp. 154, 166, 169-170.
277 Ibid., pp. 155-156.
278 Ibid., pp. 165-166.
279 Frost, Mervyn, *Ethics in International Relations: a Constitutive Theory* (Cambridge University Press: Cambridge 1996) p. 139-141. Thus, argues Frost, 'in order to understand how individuality is constituted within the context of a given practice, we need to examine the whole hierarchy of institutions'; a drive to comprehensive understanding by means of constitutive theory that I wholly subscribe to in our efforts to understand IR, Frost, Mervyn, *Ethics in International Relations: a Constitutive Theory* (Cambridge University Press: Cambridge 1996) p. 147. 'A further key feature of constitutive theory is its focus on individual actors who are simultaneously constituted in multiple social arrangements that relate to one another in interesting and complex

Hegel conceived of the shortcomings of lower-order practices such as families and civil society being overcome by participation in higher order ones, so that 'individuality is constituted within a hierarchy of institutions', culminating in the state (which is central to Hegel).[280]

In my opinion, Frost (1986, 1996), following Charvet, preserves too much of Hegel's typology of practices (family, civil society, state), which is deeply reflective of the age of early modernity in which Hegel lived and wrote. Nevertheless, recognizing the holism that the model provides, and that it allowed for the SOSS to be added to its hierarchy of practices is highly intuitive and creative. Reviving Hegel's argument, that the constitution of individuals as free citizens is conditioned on the actualization of their state through its recognition by other sovereign states as autonomous, is particularly useful in conceptualizing the intersubjective nature of state sovereignty, both horizontally (states recognizing states in the international practice) and vertically (individuals in civil society practices recognize themselves as collectively constituting 'their' state and how they have an investment in its well-being). Such horizontal recognition in the anarchy of SOSS is conditional on the arrangements that make it a state; the institutions and citizens that create the circumstances that we often associate with Westphalian sovereignty (a system of laws, the means to define and protect its territorial claims, etc.). However, this conditionality is not met in a process of rigid classification ('is this a fully fledged autonomous nation state?') but in a process in which another state is judged for its potential to *become* a competent rule-observing participant in the practice of the SOSS.

Frost largely let go of Hegel's/Charvet's typology of practices in his later work (2009a) while preserving a notion of alienation in the idea that higher-order practices (the state, GCS and SOSS) 'can do things to alleviate the endemic competition, the alienation and the inequalities brought about through the operation of civil society over time.'[281]

> '… a practice, an entire domain of interconnected rules must be presupposed as a background. …. On this view, the rules and their applications are internally connected within a social practice. The practice is a social – or common – domain of activity because a community of participants jointly accepts its rules .... The rules to be followed, then, are not 'public' in the sense of standards of reasoning external to the individual's mind but 'public' in the sense of common standards of action internal to an entire practice. We say entire because a practice attains intelligibility at the level of

ways. Taken together these practices form the social architecture within which we are constituted as who we are. As these social practices evolve and change tensions emerge within this architecture. Of particular interest are the ethical tensions that arise from time to time.', Frost, Mervyn, *Global Ethics: Anarchy, Freedom and International Relations* (Routledge: Oxon 2009) p. 28.

280 Frost, Mervyn, *Ethics in International Relations: a Constitutive Theory* (Cambridge University Press: Cambridge 1996) p. 142.

281 Frost, Mervyn, *Towards a Normative Theory of International Relations: A Critical Analysis of the Philosophical and Methodological Assumptions in the Discipline with Proposals Towards a Substantive Normative Theory* (Cambridge University Press: Cambridge 1986) pp. 167-169, 172-173, Frost, Mervyn, *Ethics in International Relations: a Constitutive Theory* (Cambridge University Press: Cambridge 1996) pp. 139, 142-155, Frost, Mervyn, *Global Ethics: Anarchy, Freedom and International Relations* (Routledge: Oxon 2009) pp. 20, 24, 27 footnote 29, 105-106.

> the whole, as a 'form of life' (Wittgenstein, 1953: I, §241). Our conception of practices, 'language-games' in Wittgenstein's phrase, refers to complex social wholes constituted by rules, a view known as practice holism ....'[282]

Practices are social institutions in which its participants 'acknowledge a complex set of rules which specify, among other things: who is qualified to be a participant; what would count as disqualifying behavior by a participant that would result in his/her exclusion from the practice; what range of actions are available to qualified participants; what actions are specifically disallowed to participants within the practice; what procedures are appropriate for changing the rules of the practice; what is to be done to those who flout the rules; how to make an ethical evaluation of the history of interaction between the participants.'[283] This list also includes what means of recourse participants have when they find themselves forced to flout the rules of the practice. Together, these constitute 'a body of settled rules, norms and maxims'.[284] Participants thus know 'the ethical underpinnings of the practice' that 'specify what the point and purpose of the practice are and what values are made possible within it'; these 'ethical underpinnings specify what values are so fundamental to the participants in the practice that the flouting of these rules would result in the exclusion (excommunication, expulsion, ostracization) of actors who [repeatedly] flout them.'[285]

> 'This ethical de-constitution or decommissioning of an actor is achieved not by some feat of physical force but by making the case that the actor has fallen foul of one or more constitutive norms – by showing that the immanent ethic of the practice has been severely breached through the action in question.'[286]

Constitutive practices such as the GCS and SOSS are 'underpinned by rather thick sets of ethical values which constrain in severe and complex ways the actions of the actors thus constituted.'[287] To be an actor is to be a participant in a practice, and as such maintain a 'ethically constituted status', which requires an actor to make 'evaluations about what, from an ethical point of view, … would be appropriate to do next', in light of these 'specific sets of

282 Frost, Mervyn, Lechner, Sylvia, 'Understanding International Practices from the Internal Point of View', in *Journal of International Political Theory*, Vol. 12, No. 3 (July 2016) p. 305.

283 Frost, Mervyn, *Global Ethics: Anarchy, Freedom and International Relations* (Routledge: Oxon 2009) pp. 20-21, 25.

284 Ibid., p. 25.

285 Ibid., pp. 21, 26-27, 33. 'Consider a state that never honoured its treaty commitments and often breached the requirements of international diplomatic protocol. Such a state would no longer be deemed a sovereign state in good standing within the international community of states. It might be termed a *pariah* or a *rogue state*.', Frost, Mervyn, *Global Ethics: Anarchy, Freedom and International Relations* (Routledge: Oxon 2009) p. 27. The image of the Democratic Peoples Republic of Korea (DPRK) comes to mind; for decades it has broken diplomatic protocol (for example by conducting a program of international kidnapping and assassination conducted by its agents), has abused international trust by subverting technical aid provided through the IAEA's technical assistance program to build nuclear weapons, has engaged in international arms smuggling to circumvent UN sanctions, and has threatened violence to its neighbor (the Republic of Korea) in order to extort international aid. As a consequence, its viewed with intense distrust by most international actors, its regime is subject to international sanctions and its leaders can only travel to friendly states, which in turn incur costs to their international standing by their association with the DPRK.

286 Ibid., p. 33.

287 Ibid., p. 19.

ethical commitments.'[288] Such ethical considerations are not necessarily defined as some lofty ideal such as universal justice in some form or other, but are 'internal to their constituting international practices'; in the case of the SOSS, these are 'the ethical values embedded in the inter-state practice' that define what makes and delimits 'ethically justifiable conduct.'[289] It does not 'only authorize a single action as ethically appropriate in a given context', but 'rules, maxims, principles and the background ethic which supports them' allow for 'a range of different actions by a specific action in a given situation.'[290]

We therefore find the indication of the existence of a practice when we see members of a group of people or states 'acknowledge the pertinence of a common set of criteria for appraising one another's actions.'[291] Actors participate in a practice when they offer 'to one another explanations and justifications for what they do by referring to a commonly accepted set of 'rules of the game"; 'a pattern of claims and counterclaims between a group of people.'[292] In their actions and appraisals, participants are vulnerable to the critical appraisals of other participants, irrespective of their power, as they operate within the boundedness of the above-mentioned 'mutually recognized maxims, rules and norms in terms of which they make their justifications and criticisms.'[293] Participants 'criticize those who seek to undermine these.'[294]

> 'These need not be rules or norms that are overtly articulated. They may simply be tacitly understood. Participants show their understanding of such rules by knowing what counts as getting a particular action right and what would count as having made a mistake in the execution of the action.[295]

Frost words the above in very general terms, but we can clearly see how such a 'background understanding' is alike to Searle's 'Background rule' and Giddens' 'rationalization of action', and likewise Frost's 'rules, maxims, principles and the background ethic' located in practice share commonalities with the functioning of structure in the Giddens dialectic of control. Actors that employ 'reflexive monitoring' in social life in Giddens' theory (1984) show great similarity to Frost's practice participants, who 'scan the conduct of others and their own past and future conduct in order to determine whether or not their actions are appropriate to the underlying ethic embedded in these practices.'[296] This results in a day-to-day routine that is usually uneventful and unchallenged, and doesn't require conscious thought, and breaks from

288 Ibid., pp. 19-20.
289 Ibid., pp. 19, 25.
290 Ibid., p. 27.
291 Ibid., p. 22.
292 Frost, Mervyn, *Global Ethics: Anarchy, Freedom and International Relations* (Routledge: Oxon 2009) pp. 22-23, Frost, Mervyn, *Ethics in International Relations: a Constitutive Theory* (Cambridge University Press: Cambridge 1996) p. 66.
293 Frost, Mervyn, *Global Ethics: Anarchy, Freedom and International Relations* (Routledge: Oxon 2009) pp. 23, 25. Indicative of the border of a practice, 'by those criticisms to which we pay no attention – to the criticisms that we take as not being relevant to us.', Frost, Mervyn, *Global Ethics: Anarchy, Freedom and International Relations* (Routledge: Oxon 2009) p. 22.
294 Ibid., p. 25.
295 Ibid., p. 23.
296 Ibid., p. 25.

that routine that involve motivation (Giddens) or 'ethical disputes' that often emerge 'where there is a dispute about a fundamental rule(s) in the practice in question' (Frost).[297]

> 'In order to become a participant in a practice a person has to learn what the constitutive rules, norms and maxims of the practice are, for these determine who is to count as a legitimate participant and what is to count as appropriate conduct within the practice. Appropriate conduct in turn determines one's standing as an actor in the practice in question.'[298]

This standing is the measure of 'inter-subjective ethical approval' a participant enjoys, which is determined by 'inter-subjectively valuing one another as actors of a certain kind through adherence to rule-governed patterns of reciprocal recognition', and which serves as a precondition for whatever else the actor may wish to achieve within that practice.'[299] This requires actors to 'correctly appraise the ethical constraints applicable to their status and that they do not fall foul of these'; to do so negatively affects ones standing in the practice.[300] As a result, [a]ssessors do not set out to make their assessments from an ethically neutral platform'; they have 'ethical baggage – they come to the task carrying ethical burdens imposed on them by the previous assessment of others.'[301] They are aware of this and consider the tactical and strategic efficacy of the accounts they give, set against this historical record, in an effort to 'make his/her/its appraisal into the one that carries the day, the one that wins the ethical argument in the teeth of previous hostile assessments made by others.'[302]

Manipulative attitudes are possible and sometimes successful in this process. Participants in a practice can in several ways offer an account of action that is deficient, leaving their appraisal vulnerable to criticism that exposes these. Such deficiencies can include 'omission of ethically relevant features of the history that lead up to the existing state of international affairs (e.g. leaving out relevant parts of the history of blame and responsibility among the participants, including one's own history); deceit of one kind or another (e.g. lying, bluffing, pretending about who was responsible for what); and demonstrated hypocrisy (e.g. upholding one criterion in one appraisal only to ignore its relevance in the next comparable case)'.[303] Power makes a difference as far as actors can invest resources in getting their message across to

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297 Giddens, Anthony, *The Constitution of Society: Outline of the Theory of Structuration* (University of California Press: Berkeley 1984) p. 3, Frost, Mervyn, *Global Ethics: Anarchy, Freedom and International Relations* (Routledge: Oxon 2009) pp. 33-34.

298 Frost, Mervyn, *Global Ethics: Anarchy, Freedom and International Relations* (Routledge: Oxon 2009) p. 23. I will further discuss Frost's use of rules and norms in Chapter 5, where I attempt to harmonize it with their use in defining what an international regime is (see page 133).

299 Ibid., pp. 32-33.

300 Ibid., p. 32.

301 Ibid., p. 69.

302 Ibid.,pp. 69-70.

303 Frost, Mervyn, *Global Ethics: Anarchy, Freedom and International Relations* (Routledge: Oxon 2009) p. 70. Such a description of manipulative attitudes seems commensurate with Giddens (1984): 'One aspect of such attitudes, although a relatively superficial one, is to be found in the commonplace observation that the reasons actors offer discursively for what they do may diverge from the rationalization of action as actually involved in the stream of conduct of those actors.', Giddens, Anthony, *The Constitution of Society: Outline of the Theory of Structuration* (University of California Press: Berkeley 1984) p. 4.

either international and/or domestic audiences. Such resources can be used to manipulate other participants 'into accepting their appraisals and that they can prevent criticisms reaching the ears of the audience they are addressing.'[304] Nevertheless, having ones account exposed as a weak assessment (such as when the US and UK were exposed to have given false accounts of the threat Iraq posed in the run-up to the 2003 invasion of that country) qualifies as an 'ethical wrong' and significantly erodes the responsible participant(s) standing, negatively effecting their 'power, authority, and prestige.'[305]

It's important to note, as Frost does, that the layer of ethical constrains that he presents as ubiquitous to all practices is not antithetical to a conception of international relations in which the pursuit of power is central. However, it sets 'ethical limits' to how power can be legitimately pursuit, beyond which additional costs are incurred.[306] Participants, in for example the SOSS, 'are free (ethically authorized) to make arrangements with one another in order to advance what they consider their interest to be.'[307]

The double anarchy should be seen as two global practices intertwined into 'complementary social institutions', a 'practice of practices', contends Frost.[308]

> 'The system of sovereign states within which we enjoy citizenship rights builds on the ethical identities made possible within global civil society within which actors are established as civilians – as individual rights holders.'[309]

As individual rights holders, participants in the GCS enjoy freedom to pursue whatever they conceive as 'the good life', as long as this conception does not impinge on the other participants. As citizens of sovereign states in the SOSS, they collectively enjoy the freedom

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304 Frost, Mervyn, *Global Ethics: Anarchy, Freedom and International Relations* (Routledge: Oxon 2009) p. 71. Giddens defined resources are 'media through which power is exercised', which chimes well with Frost's usage, Giddens, Anthony, *The Constitution of Society: Outline of the Theory of Structuration* (University of California Press: Berkeley 1984) p. 4.

305 Frost, Mervyn, *Global Ethics: Anarchy, Freedom and International Relations* (Routledge: Oxon 2009) pp. 70-71, Frost, Mervyn, 'Ethical Competence in International Relations', in *Ethics & International Relations*, Vol. 23, No. 2 (June 2009) pp. 91-92. Jurgen Habermas in his Discourse Theory of Morality (Discourse Ethics), which takes up elements from Lawrence Kohlberg's Theory of Moral Development, could provide a more in-depth account of how well participants discursively perform in the practice and why. Habermas developed his Discourse Ethics in Habermas, Jürgen, *Theory of Communicative Action, Volume 1: Reason and the Rationalization of Society* (Beacon Press: Boston 1985), Habermas, Jürgen, *Theory of Communicative Action, Volume 2: Lifeworld and System: a Critique of Functionalist Reason* (Beacon Press: Boston 1985), Habermas, Jürgen, *Moral Consciousness and Communicative Action* (Polity Press: Cambridge 1990), Habermas, Jürgen, *Justification and Application: Remarks on Discourse Ethics* (Wiley: Hoboken 1991). See for a good discussion how his Discourse Ethics is relevant to IR, Linklater, Andrew, *The Transformation of Political Community: Ethical Foundations of the Post-Westphalian Era* (Polity Press: Cambridge 1998) pp. 90-100. Nicholas Onuf (1989) explored the efficacy of both Piaget's and Kohlberg's stages of moral development as it applies to practices, Onuf, Nicholas, Greenwood, *World of Our Making: Rules and Rule in Social Theory and International Relations* (University of South Carolina Press: Columbia 1989) pp. 112-119.

306 Frost, Mervyn, *Global Ethics: Anarchy, Freedom and International Relations* (Routledge: Oxon 2009) pp. 29, 31.

307 Ibid., p. 29.

308 Ibid., p. 110.

309 Ibid.

to move their national project forward, to conceive of their state in whichever way they see fit, again, if this does not impinge upon the freedom of other states. States have a double responsibility here; because there is no central world government (although, an argument can be made that the United Nations and other IOs provide a measure of governance), they have a task not to just guarantee the freedom of its citizens, by safeguarding their own sovereignty, but also 'that portion of GCS' that their citizenship represents, as individual rights holders.[310] The individual (as collectivities represented in a state, or as individual right holders) freedom to pursue the good life allows for great diversity and requires actors to pursue what they conceive as their self-interest. In this way, Frost preserves but transforms the concept of self-help as central to the traditional theories in IR.[311]

Because there is no central, rule-making government in an anarchy, tensions in the double anarchy or within the SOSS or GCS respectively can only be resolved through a 'process of ethical adjustment', which is 'a complex *political* process'.[312] This process takes the form of discussion between participants, in which the tensions are identified and solutions to their resolution are proposed. The constitutive rules of the GCS and SOSS in principle entitle participants 'an equal voice in this political process', and thus 'give ethical power and influence to actors that, from a material and military perspective, are weak.'[313] The political process is necessarily piecemeal, as it depends on consensus between and adoption by participants, who are apprehensive about how new rules will affect them and the overall practice. Asymmetrical adoption of changes in/to rules (in either the GCS or SOSS and by a limited selection of participants) will proceed ahead of more universal adoption, allowing participants 'to see how different modifications turn out before committing themselves to follow suit.'[314] Norm dynamics play a crucial role in this process, which I will discuss more extensively in chapter 5. Also, I posit that regimes, on which discussion will continue in the next two chapters, are the locus of such change in institutional form.

The example of (the doctrine of) humanitarian intervention is particularly illustrative here, because it shows not just how a tension can come to exist between the GCS (human rights are universal and should always be protected) and SOSS (intervention in the internal affairs of a sovereign state are unacceptable), but how states have to grapple with their identities as both participants in the GCS as in the SOSS. The doctrine of humanitarian intervention is relatively new to international politics. The genocides of the 20th century, more efficient and more visible than those of times past, created an awareness that gave rise to the doctrine and how it could be executed under the aegis of the United Nations or otherwise. One could call the doctrine a regime, though currently still a weak one. Some states have started to internalize an individual rights-based norm that allows for humanitarian intervention in particular

310 By safeguarding their sovereignty, they simultaneously safeguard the anarchy, Frost argues, Frost, Mervyn, *Global Ethics: Anarchy, Freedom and International Relations* (Routledge: Oxon 2009) pp. 63-64, 84-85, 87, 111. The pursuit of the good life is a central theme in classical ethics, Habermas, Jürgen, *Justification and Application: Remarks on Discourse Ethics* (The MIT Press: Cambridge 1994) pp. 116-117.

311 Frost, Mervyn, *Global Ethics: Anarchy, Freedom and International Relations* (Routledge: Oxon 2009) pp. 85-86, 89.

312 Ibid., pp. 112-113. Italics in original.

313 Ibid.

314 Ibid., p. 113.

circumstances (for example, those countries that take the consequence of their membership of the Genocide Convention very seriously) and some have given priority to the non-interventionist norm, protecting state rights. The successes and failures of humanitarian interventions since the 1990s are appraised in a ongoing discussion on its possibilities and limits in the international practice.[315]

This thesis studies the effects of a tension within the SOSS. For the sake of collective international security the NPR was established to control the spread and application of nuclear technology. Through its grand bargain, the NPR itself institutionalized a compromise of national sovereignty, in which states signed away their right to build nuclear weapons in exchange for the benefits of being a participant in the regime and the regime purpose itself. In the evolution of the NPR, this created a number of contradictions that in turn sparked a rich history of appraisals and counter-appraisals on what exactly the rights and obligations of the participants were and should be. To fully and properly understand the part of that history retold in this thesis, an exploration how regimes relate to international practice(s) and of the concept of regimes itself is necessary.

315 Ibid., p. 98.

Chapter 4:

International Relations Ontology: Regime Theory Revisited

> '… [H]ow one thinks about regimes is a function of how one thinks about learning, about the growth of human consciousness, about social evolution. The ontogeny of theories about regimes recapitulates the history of science.'[316]

Having discussed some of the fundamental problems that handicap knowledge generation in general and theorizing in IR specifically in the previous chapters, and staking out a theoretical position that addresses some of the shortcomings of other theories, this chapter will take a more narrow approach and discuss the existing literature on what is called 'regime theory' and in doing so produce a genealogy of the concept of regime as used in IR theory. Regime theory is a niche in the IR theoretical field that looks at problems and successes of complex and enduring international cooperation between states, which are referred to as *international regimes*.[317] A regime is the common ontological concept to describe an enduring form of institutionalized cooperation and coordination between states, and regime theory tries to define this concept and answer questions about it. However, the previously discussed problems plaguing IR theorizing as a whole can also be located in the literature of this particular concept.

Regime theory as a concept is important to discuss because as a starting point, it is one of the few locations where IR theory offers insight into current understandings of existing regimes, including the nuclear non-proliferation regime. For the purpose of this thesis and its case study, the international non-proliferation agreements reached between small or large groups of states (such as the NPT) and agreements between individual or groups of states and the international organizations IAEA and EURATOM (such as safeguards agreements), as well as for bilateral and multilateral agreements over nuclear trade and technical cooperation (such as the Almelo Treaty that created Urenco), and the domestic political perceptions and processes that underlay those, need to be given a satisfying ontology in order to be made understandable and applicable to the case study. I will therefore examine the growth of the existing literature, to find if there are adequate concepts to be used to connect to Frost's practice-based constitutive theory, to add ontological depth to the application of that theory to the case study. This will provide a theoretical context that will serve as background to the historical narrative-centric methodology that I will apply to the case study, allowing me to both

316 Haas, Ernst, B., 'Words Can Hurt You; or, Who said What to Whom about Regimes', in *International Organization, Vol.* 36, No. 2 (Spring 1982) p. 207, which was also published in Krasner, Stephen, D. (ed.), *International Regimes* (Cornell University Press, Ithica 1983).

317 John Gerard Ruggie first used the term/concept in his doctoral dissertation (1974) and in a 1975 article defined 'international regimes' as 'sets of mutual expectations, generally agreed-to rules, regulations and plans, in accordance with which organizational energies and financial commitments are allocated', Ruggie, Gerard, John, 'International Responses to Technology: Concepts and Trends', in *International Organization*, Vol. 29, No. 3 (Summer 1975) pp. 569, Ruggie, John, Gerard, *The State of the Future: Technology, Collective Governance and World Order*, Ph.D. Dissertation, Department of Poltiical Science, University of California (Berkeley: 1974), Ruggie, John, Gerard, *Constructing the World Polity: Essays on International Institutionalization* (Routledge: London 1998) p. 56 (footnote).

theoretically inform questions to ask of the case study, drawing out historical patterns in it, as well as match those patterns against the theory and its ontological assumptions.

Broadly, from an epistemological standpoint we can discern three periods of regime theorizing, which are not temporally distinct. The cooperation literature from which initial regime theory came forth was situated in a field of discussion between positivist neorealists and neoliberals on the viability of international cooperation and the conditions under which it is possible; a proving ground because of its real-world complexity. In this initial period, regimes as an ontological concept gained legitimacy as a separate entity worth studying in the international cooperation literature; roughly starting at the end of the 1970s and lasting to the start of the 1990s.

In the second period, a new avenue for theory grew out of neoliberal successes during the initial period, but explored new ground in that it embraced constructivist principles as the basis for theory on and thinking about regimes. It therefore still adhered to many of the basic epistemological premises of positivist theory, while including more ideational factors; it was recognized that how people think about regimes matters to how successful a regime is and can be into the future. Such success can be defined as the measure in which the rules and norms of the regime are observed and taken into account by states, referring to international agreements on the implementation of a regime. Lastly, I perceive a third contemporary current of regime theory, initiated during the mid-1980s, that made the switch to a post-positivist epistemological foundation, while attempting to maintain many of the ontological concepts that were conceived in the other currents. In the next chapter, I will investigate what elements of this third current of regime theory are commensurate with Frost's *Practice-based Theory of International Action*.

It is useful to turn to each of these periods separately in order to produce a regime-theory genealogy. An inescapable trap we face in doing so is that critiques that have successfully challenged the dominance of one school of thought in this field, or particular concepts over others, are part of the same genealogy and in turn have been, or will be, critiqued themselves. Every ‘generation’ of regime theory builds upon, temporarily exists next to and finds fault with the previous one. Nevertheless, for purposes of brevity, only some of the major points of discussion in that debate will be highlighted, in order for the theoretical evolution of the main concept to become evident.

Part 1: From Hegemonic Stability Theory to Regime Theory

In the 1960s and early 1970s, the earlier institutionalist key assumption, 'that international governance is whatever international organizations do', was replaced by more comprehensive models of integration and institutionalization in international governance.[318] The new literature sprang up not merely because of the dearth of work on global governance before, but also because of some of the economic and political shocks in international politics in the

318 Ruggie, John, Gerard, *Constructing the World Polity: Essays on International Institutionalization* (Routledge: London 1998) pp. 87-88.

first half of the 1970s that were partially associated with the decline of US hegemony and for which scholarship did not have 'ready-made explanations' available .[319]

Charles Kindleberger's *The World in Depression, 1929-39,* published in 1973, was theoretically innovative in that it connected the presence of a global hegemon with the amount of stability and legitimacy of the current world order.[320] In short, he argued that with its refusal to provide the world with financial-economic leadership during the *interbellum* (1919-1939) the United States, the only actor capable of providing such leadership at that time, caused systemic financial instability and a collapse of the free trade and capital regime. States turned protectionist after a period of relative open markets, and political national exceptionalism gained popularity in lockstep, increasing instability, and eventual financial and economic ruin, in the Great Depression of the 1930s.

Kindleberger's thesis is located in the study of global economic order, and conceptualized 'stability' of that order as a public good, in 'the broader context of Mancur Olsen's (1965) theory of collective action.', and did not set out to engage with regimes other than those in the global financial-economic realm.[321] The main argument of Kindleberger's thesis was picked up by Robert Keohane, who in 1980 formulated the *Theory of Hegemonic Stability* (HST) and gave it 'its intellectual prominence through his criticisms and revisions' and by locating it in the rational-choice tradition.[322] Keohane set out its basic premises and claims, which are reducible to its two main assertions:

> '(1) [R]egimes are established and maintained by actors who hold a preponderance of power resources (relevant to the issue-area in question)'
>
> '(2) [R]egimes decline (i.e. decrease in strength or effectiveness) when power becomes more equally distributed among their members (Keohane 1980).'[323]

A third proposition was located by Keohane and Nye in the relationship of hegemony and leadership. Besides being in a position to provide hegemonic leadership, they pointed to the fact that a state also has to be willing to take on a leadership role.[324] When provided, such leadership will have a positive system-wide effect, and in the example of Kindleberger's thesis on economic hegemony, make the entire system of interstate relations more stable, by actively managing its rules and ensuring compliance.[325] A case in point that shows the

319 Ibid., pp. 88-89.
320 Kindleberger, Charles, P., *The World in Depression 1929-39* (University of California Press: 1973).
321 Hasenclever, Andreas, Mayer, Peter, Rittberger, Volker, *Theories of International Regimes* (Cambridge Univresity Press: Cambridge 1997) p. 88.
322 Robert O. Keohane, 'The Theory of Hegemonic Stability and Changes in International Economic Regimes, 1967-1977', in Holsti, Ole, R., Siverson, Randolph, George, Alexander (eds.), *Changes in the International System* (Westview: Boulder 1980), Smith, Roger, K., 'Explaining the Non-Proliferation Regime: Anomalies for Contemporary International Relations Theory', in *International Organization*, Vol. 41, No. 2 (Spring, 1987) p. 254, n. 4.
323 Hasenclever, Andreas, Mayer, Peter, Rittberger, Volker, *Theories of International Regimes* (Cambridge Univresity Press: Cambridge 1997) p. 90.
324 Nye, Joseph, S., Keohane, Robert, O., *Power and Interdependence: World Politics in Transition* (Little, Brown and Company: Boston 1977) p. 44.
325 Ibid., pp. 44-45.

alternative is the unwillingness of the United States to provide hegemonic leadership in the *interbellum*, and its willingness to provide it during and after WWII.

The idea that only through hegemonic leadership an international public good, such as a regime, could be established and maintained was quickly shown not to hold by empirical evidence. In the 1970s, several regimes were seen to exist, while there was a consensus that American hegemony was in decline. 'More cooperation has persisted than the theory of hegemonic stability would have predicted.'[326] Pertaining to the topic of this thesis, the nuclear non-proliferation regime shows the opposite of what HST posits; 'as the position of American hegemony eroded, cooperation on nuclear non-proliferation has grown.'[327]

After having delivered a thorough critique of Realism and its inability to explain structural international economic cooperative processes in *Transnational Relations and World Politics* (1970), Joseph Nye and Robert Keohane in *Power and Interdependence: World Politics in Transition* (1977) had a few years before provided a new view on cooperation in world politics that became almost synonymous with the neoliberal school in IR. It is also one of the first major IR texts that presents regimes as an important object of study and as the pivotal concept to understand.[328] They defined a regime as,

> '[R]elationships of interdependence [that] often occur within, and may be affected by, networks of rules, norms and procedures that regularize behavior and control its effects. We refer to the sets of governing arrangements that affect relationships of interdependence as *international regimes.*'[329]

Writing in 1977, Nye and Keohane, other than their realist contemporaries to which they made reference, deemed regimes not insignificant, and likened their nature to that of the nature of world politics itself:

> 'In world politics rules and procedures are neither so complete nor so well enforced as in well-ordered domestic political systems, and the institutions are neither so powerful nor so autonomous. …. The weakness of international organizations and the problems of enforcing international law sometimes mislead observers into thinking that international regimes are insignificant, or into ignoring them entirely. Yet although overall global integration is weak, specific international regimes often have important

326 Keohane, Robert, O., *After Hegemony: Cooperation and Discord in the World Political Economy* (Princeton University Press: 1984) p. 215, see also Hasenclever, Andreas, Mayer, Peter, Rittberger, Volker, *Theories of International Regimes* (Cambridge Univresity Press: Cambridge 1997) p. 103.

327 Smith, Roger, K., 'Explaining the Non-Proliferation Regime: Anomalies for Contemporary International Relations Theory', in *International Organization*, Vol. 41, No. 2 (Spring 1987) p. 271. Nevertheless, there is an argument to be made that this decline was relative.

328 Keohane, Robert, O., Nye, Joseph, S., *Transnational Relations and World Politics* (Harvard University Press: Harvard 1971), Keohane, Robert, O., Nye, Joseph, S., *Power and Interdependence: World Politics in Transition* (Little, Brown and Company: Boston 1977).

329 Keohane, Robert, O., Nye, Joseph, S., *Power and Interdependence: World Politics in Transition* (Little, Brown and Company: Boston 1977) p. 19.

> effects on interdependent relationships that involve a few countries, or involve many countries on a specific issue.'[330]

Keohane, in *After Hegemony* (1984), writing in the rationalist tradition to maintain an epistemological link with Realism, further developed his 1980 theory by positing that regimes could be 'adaptable to a post-hegemonic era rather than be doomed to complete collapse.'[331] Keohane also recognized that some strict rational-choice assumptions, such as actors' access to perfect information, were untenable and as such chose to move away into *bounded rationality*, in which actors have to base their decisions on imperfect information.[332] This opened the door to the next argument along this line, that with an inability of actors to know a complex reality, actor's perceptions and 'how people think about their interests' cannot be denied to matter.[333] This position can be argued to symbolize the transition from traditional theories based on rationalism (Neorealism and Neoliberalism) into the theoretical realm where ideational factors (in this case, Ernst Haas' emphasis on *learning*) started taking a much more prominent position, into the constructivist turn.[334] Keohane himself recognizes how he strays from the accepted rationalist pathway and declares,

> '[O]nly the crude version of the theory of hegemonic stability offers nontautological explanations of changes in international regimes on the basis of changes in the distribution of world power. The refined version of the theory does not make such predictions and should be considered not a theory but merely a framework of ideas that is useful for description and interpretation but not for explanation.'[335]

Predictably, this straying from the path of rationalism was recognized and 'jumped upon' by purist Duncan Snidal, who argued that,

> 'Keohane's solution is to demote the theory to a nonfalsifiable "interpretive framework," useful for description but not for explanation. He uses this framework as part of an often compelling account of postwar international cooperation, but the theory itself is left in limbo: neither right nor wrong, just available.'[336]

We see here the cracks in the epistemological bastion of traditional IR-theory; what Keohane does, by choosing to relax the scientific demands made by traditional IR-theory's epistemology, can be seen to be inspired by a recognition that the rationalists' toolbox is ill-

330 Ibid., pp. 19-20.

331 Keohane, Robert, O., *After Hegemony: Cooperation and Discord in the World Political Economy* (Princeton University Press: 1984) pp. 29, 183.

332 Ibid., p. 111.

333 Ibid., pp. 131-132.

334 Keohane, Robert, O., *After Hegemony: Cooperation and Discord in the World Political Economy* (Princeton University Press: 1984) p. 132, Haas, Ernst, B., *When Knowledge is Power: Three Models of Change in International Organizations* (University of California Press: Berkeley 1990). I will discuss 'learning' more in depth in Part 3 of this chapter: *From the Constructivist Turn into the Post-Positivist Era of Regime Theory*, on page 121.

335 Keohane, Robert, O., *After Hegemony: Cooperation and Discord in the World Political Economy* (Princeton University Press: 1984) p. 195.

336 Snidal, Duncan, 'The Limits of Hegemonic Stability Theory', in *International Organization*, Vol. 39, No. 4 (Autumn 1985) p. 581.

equipped to adequately abstract a viable model of what a regime is and how it works. Having delved into regime dynamics, he feels the need to declare a retreat from the claim of actually positing a theory, into positing 'a framework of ideas'.

We see Keohane's rejection of Realism's pessimism on the possibility of cooperation in world politics and the success of multilateral international institutions return and further explained in *After Hegemony*. He proposes, in his *Functional Theory of Regimes*, that the efficacy of regimes can be explained by the occurrence (or danger of occurrence) of *political market failure*. 'Like imperfect markets, world politics is characterized by institutional deficiencies that inhibit mutually advantageous cooperation.'[337] Regimes are institutional devices, as in that they are a specific 'type' of international institution, designed to overcome the causes of political market failure. The perception that states can overcome information-deficits as obstacles to cooperation through regimes and that all participants can be a part of a solution based on a drive towards Pareto optimality, places Keohane squarely in the neoliberal camp of regime theorizing. As mentioned before, taking out the role of information deficits altogether, by whatever logical argument or construction, leads to a system that posits actors as all-knowing entities, a signature stance of neoliberal theorists.[338]

Krasner, another neoliberal (though self-declared realist) regime theorist[339], wrote; '[t]he success or failure of regime-building can be explained by the extent to which regimes provide information, monitoring capabilities, or focal points that allow states to move to the Pareto frontier; everyone becomes better off at the same time; absolute rather than relative gains matter.'[340] Increased information provides transparency that reduces uncertainty and thus the risk of making agreements. Focal points are important because linking issues that are closely related reduces transaction costs of potential cooperation. Simultaneously, they increases the cost of staying outside a cooperative framework, as well as the potential cost of temporarily 'straying' outside it.

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337 Keohane, Robert, O., *After Hegemony: Cooperation and Discord in the World Political Economy* (Princeton University Press: 1984) p. 85.

338 Krasner, Stephen, D., 'Sovereignty, Regimes, and Human Rights', in Rittberger, Volker, Mayer, Peter (eds.), *Regime Theory and International Relations* (Clarendon Press: Oxford 1993) pp. 139-140. On Pareto optimality, see below.

339 Keohane, Robert, O., 'Stephen Krasner: Subversive Realist', Paper prepared for delivery at the 2010 Annual Meeting of the American Political Science Association, September 2-5, 2010, https://www.princeton.edu/~pcglobal/conferences/basics/papers/keohane_paper.docx, website checked 27 June 2018.

340 Rittberger, Volker (ed.), *Regime Theory and International Relations* (Clarendon Press, Oxford 1993) p. 139, Krasner, Stephen, D., 'Compromising Westphalia', in *International Security*, Vol. 20, No. 3 (Winter, 1995-1996) p. 123) Pareto frontiers and Pareto optimality/Pareto efficiency are rational choice theory concepts. Pareto optimality signifies the allocation of resources in such a way, that no further adjustments can be made to improve one actor's situation without worsening that of another. The Pareto frontier is the distribution of allocated resources. 'Game theorists have become interested in common knowledge because it helps solve games in which the structure of preferences and capabilities alone ("material" structure) generate multiple equilibria, which are probably most games in real life. Common knowledge solves these games by defining "salient outcomes" or "*focal points*" around which actors' expectations can converge, reducing transaction costs and uncertainty and thereby enabling actors to coordinate their strategies around a single equilibrium', Wendt, Alexander, *Social Theory of International Politics* (Cambridge University Press: Cambridge 1999) p. 167. Italics mine.

On the last point, the increase in cost of non-cooperation in the presence of a regime in a certain issue area, Roger Smith says, '[t]he significance of regimes lies not in their formal legal status, since any pattern of legal liability can be overturned by the action of sovereign states, but in the establishment of stable mutual expectations about others' patterns of behavior that permit the development of working relationships.[341] Regimes provide a semblance of legal liability so that the '"costs of reneging on commitments are increased, and the cost of operating within these frameworks are reduced."'[342] Smith adds that '[R]egimes can help governments assess others' reputations by not only providing standards of behavior against which performance can be measured, but also basic information on performance.'[343]

What Smith touches on here is that states can have expectations of reciprocity based on the *social standing* of their partners in practices of cooperation, and that this standing is determined by how other actors in the practice collectively *perceive* the reliability of the participant in question. However, as is typical of scholars writing in the traditional tradition, he does not expand on how these normative expectations are *constituted*; I will pick up this point in Chapter 5, when integrating a practice-based constitutive approach and regime theorizing.

Within the 'neo-neo' debate in the regime theory niche, intellectual battles were not only fought on epistemological grounds, but also on the ontological content of a rationalist approach to theorizing regimes, as the above discussion reveals. However, for purposes of brevity, I defer the reader on the intricacies of that ontological debate to elsewhere.[344]

A Consensus Regime Definition

Theoretical agreement was also found to be possible. Early in the regime debate Stephen D. Krasner helped convene a set of workshops in 1980-1981 that culminated in a special issue of

341 Smith, Roger, K., 'Explaining the Non-Proliferation Regime: Anomalies for Contemporary International Relations Theory', in *International Organization*, Vol. 41, No. 2 (Spring 1987) pp.273-274.

342 The quote is from Keohane, Robert, O., *After Hegemony: Cooperation and Discord in the World Political Economy* (Princeton University Press: 1984) p. 89, in Smith, Roger, K., 'Explaining the Non-Proliferation Regime: Anomalies for Contemporary International Relations Theory', in *International Organization*, Vol. 41, No. 2 (Spring 1987) p. 273.

343 Smith, Roger, K., 'Explaining the Non-Proliferation Regime: Anomalies for Contemporary International Relations Theory', in *International Organization*, Vol. 41, No. 2 (Spring 1987) p. 274.

344 An excellent discussion of the most important contributions to this debate are captured by second generation regime theorists Hasenclever, Mayer and Rittberger in their 1997 book *Theories of International Regimes, c*hapters 3 and 4, and earlier contributions to their research project, Hasenclever, Andreas, Mayer, Peter, Rittberger, Volker, *Theories of International Regimes* (Cambridge University Press: Cambridge 1997) pp. 23-135, O'Meara, Richard, L., 'Regimes and Their Implications for International Theory', in *Millenium – Journal of International Studies*, Vol. 13, No. 3 (December 1984), Rittberger, Volker (ed.), *Regime Theory and International Relations* (Clarendon Press, Oxford 1993), Levy, Marc, A., Young, Oran, R., Zürn, Michael, 'The Study of International Regimes', WP-94-113, International Institute for Applied Systems Analysis, Luxemburg, Austria (November 1994), Hasenclever, Andreas, Mayer, Peter, Rittberger, Volker, 'Interests, Power, Knowledge: The Study of International Regimes', in *Mershon International Studies Review*, Vol. 40, No. 2 (October 1996), Hasenclever, Andreas, Mayer, Peter, Rittberger, Volker, 'Integrating Theories of International Regimes', in *Review of International Studies*, Vol. 26 (2000).

International Organization on regimes, and the collection of articles by theorists that had already been active in the regime debate (and would continue to be so) was also published in an edited book by Krasner.[345] These contributors, from realists and neoliberalists such as Robert Jervis and Stephen Krasner, to early constructivists such as John Gerard Ruggie and Oran R. Young, managed to reach a limited consensus on the following definition;

> 'Regimes are defined as sets if implicit or explicit principles, norms, rules and decision-making procedures around which actor expectations converge in a given issue-area of international relations.'
>
> 'Principles are beliefs of fact, causation and obligations.'
>
> 'Norms are standards of behavior defined in terms of rights and obligations.'
>
> 'Rules are specific prescriptions or proscriptions for action.'
>
> 'Decision-making procedures are prevailing practices for making and implementing collective choice.'[346]

Krasner explained:

> 'A fundamental distinction must be made between principles and norms on the one hand, and rules and procedures on the other. Principles and norms provide the basic defining characteristics of a regime. There may be many rules and decision-making procedures that are consistent with the same principles and norms. *Changes in rules and decision–making procedures are changes within regimes,* provided that principles and norms are unaltered. …. *Changes in principles and norms are changes of the regime itself.* When norms and principles are abandoned, there is either a change to a new regime or a disappearance of regimes from a given issue-area.'[347]

And he adds,

> '*If the principles, norms, rules, and decision-making procedures of a regime become less coherent, or if actual practice is increasingly inconsistent with principles, norms, rules, and procedures, then a regime has weakened.*'[348]

It is important to question if we can accept how Krasner *et al* define these regime mechanisms. In itself, it is important to pick apart any definition we may visit or adopt, as a 'theoretical safeguard' against speech confusions and any sort of 'wooliness' (referring to Susan Strange's critique on the state of regime theory in the early 1980s, in Krasner's edited volume) that may slip into our discussion.[349]

345 *International Organization*, Vol. 36, No. 2 (Spring 1982) pp. 185-510, Krasner, Stephen, D. (ed.), *International Regimes* (Cornell University Press: Ithica 1983).

346 Krasner, Stephen, D., 'Structural Causes and Regime Consequences: Regimes as Intervening Variables', in Krasner, Stephen, D.(ed.), *International Regimes* (Cornell University Press: Ithica 1983) p. 2.

347 Ibid., pp. 3-4. Italics in original.

348 Ibid., p. 5. Italics in original.

349 Strange, Susan, 'Cave! Hic Dragones: A Critique of Regime Analysis', in *International Organization*, Vol. 36, No. 2 (Spring 1982) p. 479.

Even though academic discussion lead to the above discussed consensus, it is of limited use because when we turn to the involved scholars for answers on how the above described definition and resulting posited dynamic by Krasner can be inferred from the constitutive nature of regimes and international society, the answers vary widely. Krasner himself distinguishes between three schools that take an interest in the early 1980s; conventional structuralism, represented by Susan Strange's skeptical view on the entire concept of regimes; modified structural approaches, represented by Robert Keohane and Arthur Stein; and thirdly, 'Grotian' perspectives, represented by scholars such as John Gerard Ruggie, Oran Young, Raymond Hopkins and Donald Puchala, whom in today's IR terminology would be labeled constructivists.[350] All of these, in this early phase in the regime literature, came up with different answers to how we can ontologically conceive of regimes, regardless of this common definition.

Every article or paper of note on regime theory since has referred (and the majority deferred) to the consensus-definition.[351] However, the definition is problematic for traditional theorists. While there was consensus among theorists that this definition adequately reflected reality, that it appeared to accurately describe the contemporary regimes, and in that it was based on distinctive principles and the discourse surrounding regimes exhibits a clear normative dimension (in that principles and norms are said to have a bearing on the underlying practices of regimes), traditional schools of theory have a hard time adding ontological depth to these concepts. Because these two concepts are distinctively ideational (and cannot be reduced to underlying material factors) traditional theorists based on rationalist principles were left between choosing to 'game' the normative dimension or to leave principles and norms as empty concepts that have no substantive bearing on the rules and decision-making procedures of a regime (the 'operational' part). For traditional theorists, the definition was contradictory, one that creates cognitive dissonance; why must principles and norms be included in a definition if the theorist then decides they have no bearing on the dynamic of the regime? The simple answer is that theorists thinking about regimes are knowledgeable participants in the practice of the regimes they study and as such, and irregardless of their allegiances, recognize that principles and norms somehow have bearing on what a regime is and how it works. I continue this discussion in *Part 3: From the Constructivist Turn into the Post-Positivist Era of Regime Theory* below, on page 121.

350 Krasner, Stephen, D., 'Structural Causes and Regime Consequences: Regimes as Intervening Variables', in Krasner, Stephen, D.(ed.), *International Regimes* (Cornell University Press: Ithica 1983) pp. 6-8.

351 See for example, O'Meara, Richard, L., 'Regimes and Their Implications for International Theory', in *Millenium – Journal of International Studies*, Vol. 13, No. 3 (December 1984) p. 245, Keeley, James, F., 'Toward a Foucauldian Analysis of International Regimes', in *International Organization*, Vol. 44, No. 1 (Winter 1990) p. 83, Levy, Marc, A., Young, Oran, R., Zürn, Michael, 'The Study of International Regimes', WP-94-113, International Institute for Applied Systems Analysis, Luxemburg, Austria (November 1994) p. x, Hasenclever, Andreas, Mayer, Peter, Rittberger, Volker, 'Interests, Power, Knowledge: The Study of International Regimes', in *Mershon International Studies Review*, Vol. 40, No. 2 (October 1996) p. 179, Hasenclever, Andreas, Mayer, Peter, Rittberger, Volker, *Theories of International Regimes* (Cambridge University Press: Cambridge 1997) p. 9, Yoshimatsu, Hidetaka, 'International Regimes, International Society, and Theoretical Relations', Working Paper Series Vol. 98, No. 10, The International Centre for the Study of East Asian Development, Kitakyushu, Japan (May 1998) p. 5, Hasenclever, Andreas, Mayer, Peter, Rittberger, Volker, 'Integrating Theories of International Regimes', in *Review of International Studies*, Vol. 26 (2000) p. 3.

The former solution, to use game theory to explain the normative dimension is, if one goes along with the generally accepted view that social practices are mutable, impossible to get right. A stable actor preference formation for a game based on Rational Choice Theory is impossible if the social understanding of the practice that the game represents is in flux; how can one extract a stable formation of preferences when actors themselves can be aware of the evolving nature of the practices that make up the regime that they are involved in, and thus will be forced to reassess their policies continuously, in the hermeneutical sense? All the rationalist theorists can do then, is capture 'snapshots' based on an informed calculated order of preferences of actors based on the configuration of material resources and expected accompanying attitudes and perceptions of actors at a specific point in time, which precludes the possibility of any predictive ability whatsoever. Furthermore, if Keohane's 'framework' posits that stable preferences can lead to the establishment of regimes, the counterfactual illuminates the paradox; a change in preference must first have occurred before the rise of a regime, 'otherwise, why would the regime not already exist?'[352]

Part of Strange's critique targeted these problems. Besides the formulations on interdependence (Keohane and Nye) and regimes (Krasner) being imprecise ('woolly'), Strange accused the (then contemporaneous) approach to regimes to be 'value-loaded', by which she meant that discussions on it implied 'an exaggerated measure of predictability and order in the system', and that it contained an inherent normative element that suggest that this is what people want more of, and that 'greater order and managed interdependence should be the collective goal.'[353] Strange recognized that regime theory could not adequately deal with the constant change in international politics, whether in finance, trade, or the results of technological progress (which connects to the 'snapshot' argument above).[354]

Part 2: Taking Traditional Regime Theory into the Constructivist Turn

Constructivists take the mutable social nature of regimes more seriously than traditionalists, and it is this approach to IR that will provide the next step in this theoretical discussion. Several contributions from this camp are worth noting. In the early discussions, three scholars, Oran Young, Peter Haas and John Gerard Ruggie (discussed in this and the next part) stand out by their contributions to the regime theory debate. An important contribution to thinking about regimes came when theorists (with Haas as its main proponent) started to develop the idea of epistemic communities, discussed further below.

352 Smith, Roger, K., 'Explaining the Non-Proliferation Regime: Anomalies for Contemporary International Relations Theory', in *International Organization*, Vol. 41, No. 2 (Spring 1987) p. 276.
353 Strange, Susan, 'Cave! Hic Dragones: A Critique of Regime Analysis', in *International Organization*, Vol. 36, No. 2 (Spring 1982) pp. 484-487.
354 Ibid., pp. 488-490.

Pickings from Young's Institutional Bargaining Model

Young's model of regime formation is worth discussing in the context of the above treatment on traditional theory. His main proposition was that we should conceive of the process of regime formation as one that is driven by institutional bargaining. Institutional bargaining is a model to explain agreements between self-interested parties while departing from 'mainstream utilitarian accounts of the bargaining process.'[355] Young added complexity to the ontology of the bargaining process in international politics, by pointing to the need for unanimity (instead of majority rule) as a prerequisite for success in these processes.[356] He furthermore touched upon the relevance of actors' perceptions by discussing the relevance of the availability of agreements that can be perceived as fair by participants. But, and understandably, considering the theoretical landscape on this subject of the late 1980s and early 1990s, his account remained a conversation with traditional theorists.

Young rejected utilitarian rationalism as a proper ontological basis for studying regimes, partly because the 'identity of the relevant participants in these [regime] negotiations is seldom cast in concrete.'[357] He opened up the domestic level of analysis in IR, by pointing to the relevance of intra-party bargaining and transnational linkages among interest groups; the processes involving sub-state actors that impact upon the bargaining process. This prompted him to move away from the traditional state-centric approach in IR theory and move toward constitutive theory.[358] He expanded upon this by linking the importance of looking at leadership to that of looking at the actions of individuals, non-state actors (such as NGOs) and non-hegemonic states in world politics; he argued that leadership is more often provided by such actors that adapt an entrepreneurial role, than by hegemonic states.[359] Young recognized the efficacy of Haas' concept of *epistemic communities* (see below) to help understand the role of knowledge and learning with regard to international politics and negotiation in relation to the formation of regimes.[360]

The above is not to say that Young conceived individuals as having a large impact beyond those in entrepreneurial leadership roles; 'individual actors are typically unable to exercise

355 Young, Oran, R., 'The Politics of International Regime Formation: Managing Natural Resources and the Environment', in *International Organization*, Vol. 43, No. 3 (Summer 1989) p. 359.
356 Ibid., pp. 360, 368.
357 Ibid., pp. 356-360.
358 Ibid., pp. 363-364, 373-374.
359 Young, Oran, R., 'Political Leadership and Regime Formation: on the Development of Institutions in International Society', in *International Organization*, Vol. 45, No. 3 (Summer 1991) pp. 285-287, Young, Oran, R., 'The Politics of International Regime Formation: Managing Natural Resources and the Environment', in *International Organization*, Vol. 43, No. 3 (Summer 1989) pp. 355, 373. In his earlier publication on the subject, he still reserved the regime-category of 'imposed orders' for hegemonic states, with great likeness to the type of order described in Kindleberger's Hegemonic Stability Theory, Young, Oran, R., 'Regime Dynamics: The Rise and Fall of International Regimes', in *International Organization*, Vol. 36, No. 2 (Spring, 1982) p. 285.
360 Young, Oran, R., 'The Politics of International Regime Formation: Managing Natural Resources and the Environment', in *International Organization*, Vol. 43, No. 3 (Summer 1989) p. 364, Young, Oran, R., Osherenko, Gail, 'Testing Theories of Regime Formation: Findings from a Large Collaborative Research Project', in Rittberger, Volker (ed.), *Regime Theory and International Relations* (Clarendon Press, Oxford 1993) pp. 235-237, 250.

much influence on their own over the character of the regime.' Young saw the collective behavior of individuals as constitutive of the 'human artifacts', and he conceptualizes regimes as such, '… having no existence or meaning apart from the behavior of individuals or groups of human beings'.[361] 'Social practices and convergent expectations frequently prove resistant to change, even when they produce outcomes that are widely understood to be undesirable or suboptimal', Young argued, because change requires agents to 'assimilate alternative procedures or patterns of behavior', 'to accept (initially) unknown outcomes' as well as the 'coordination of expectations around new focal points.'[362]

Patterned behavior, combined with the convergent expectations that either give rise to that behavior, or are caused by it, constitute a mutually reinforcing relationship that in turn gives rise to a regime. Such a conjunction 'ordinarily produces *conventionalized* behavior or behavior based on recognizable social conventions.'[363] Conventions in this context are, according to Young, 'guides to action or behavioral standards, which actors treat as operative without making detailed calculations on a case-by-case basis.'[364] As such, successful socially institutionalized regimes 'can be expected to acquire a life of their own in the form of operative social conventions.'[365] Actors foregoing case-by-case calculations of interests signify an acceptance of the legitimacy, or at the very least, a recognition and acceptance of efficacy, of such social conventions. It does not automatically follow that actors will always observe convention(s) but, this is to be expected with regard to social institutions, and does not automatically signify a detrimental effect to the regime; there can be legitimate reasons for disregarding regime rules (both its law-like injunctions and its social conventions) in specific cases.[366] To Young, 'social conventions typically acquire an aura of legitimacy or propriety, which is normative in characters', but he rejects 'sets of recognized norms' as defining characteristics of international regimes', not conforming with the consensus definition.[367] Thus he locates the 'rights and obligations' (the definition of norms in the consensus regime definition) in conventions.

Regimes may be resistant to change, but they also 'undergo continuous transformation in response to their own inner dynamics as well as to changes in their political, economic and social environments.'[368] With these, changes in 'a regime's structures of rights and rules, the characters of its social choice mechanisms, and the nature of its compliance mechanisms' can be significant.[369] '*[I]nternal contradictions*, changes in 'the *underlying structure of power* in the international system', as well as '*exogenous forces'* such as changes in 'the nature and distribution of technology' can fuel processes of transformation.[370] In analyzing

361 Young, Oran, R., 'Regime Dynamics: The Rise and Fall of International Regimes', in *International Organization*, Vol. 36, No. 2 (Spring, 1982) p. 279.
362 Ibid., pp. 278, 280.
363 Ibid., p. 278. Italics added.
364 Ibid.
365 Ibid.
366 Ibid., pp. 278-279.
367 Ibid., p. 279.
368 Ibid., pp. 290-291.
369 Ibid., p. 291.

transformation, Young warns that because processes of transformation will usually be interwoven, it is easy to let 'philosophical or ideological perspectives' lead our focus;

> '[n]ot only does each point of view approach the problem of regime transformation from a fundamentally different direction, they also rest on incompatible first principles that are ultimately ontological in nature. Nonetheless, it is useful to bear these differences in mind in exploring the problem of regime transformation. Doing so is likely to increase the sophistication of efforts to understand specific cases of regime transformation as well as to improve communication among those interested in the problem of regime transformation.'[371]

Epistemic Communities

With Young opening up the playing field to a variety of actors within regimes, the next question that comes up is, 'which actors?' Who takes the lead and who participates in constituting the social understanding of a regime? Where Young assigns this role up to anyone that has an 'entrepreneurial' contribution to make, Puchala and Hopkins conceptualize 'regime elites'; as 'bureaucratic units or individuals who operate as parts of the "government" of an international subsystem by creating, enforcing or otherwise acting in compliance with norms'.[372]

But what of academic experts, not part of the government or taking on a diplomatic entrepreneurial role, who become part of the discourse of a particular regime, either through publication or other forms of commentary? The same can be asked about powerful lobbyists from the NGO or corporate sector. We could strictly hold (and abstract from reality) that government agents are the main actors who influence the rules, decision-making procedures, norms and principles of a regime through their collective behavior (meanwhile maintaining, as offered above, that individual behavior in itself is inconsequential), but this leaves open the question what roles those other non-governmental actors play.

If all these actors contribute to the dominant discourse about a regime, then they all add to how we understand a regime and thus how we conceive of possibilities to strengthen or weaken it. In fact, it's easy to agree that potential for change, in the guise of unexplored political avenues or technical improvements to implementation, can and will often be

370 Ibid., pp. 291-294. Young suggests (in my view correctly, and as discussed in the previous chapter) that, '… it may be helpful to examine these internal contradictions in terms of the holistic perspective associated with dialectical reasoning. Note that this approach need not take the form of dialectical materialism or of any particular variety of Marxism; rather, its hallmarks are the analysis of social orders as dynamic wholes coupled with the search for dialectical laws pertaining to patterns of change in these entities.', Young, Oran, R., 'Regime Dynamics: The Rise and Fall of International Regimes', in *International Organization*, Vol. 36, No. 2 (Spring, 1982) p. 292.

371 Ibid., pp. 295-296.

372 Puchala, Donald, J., Hopkins, Raymond, F., 'International Regimes: Lessons from Inductive Analysis', in *International Organization*, Vol. 36, No. 2 (Spring, 1982) p. 247, also cited in O'Meara, Richard, L., 'Regimes and Their Implications for International Theory', in *Millenium – Journal of International Studies*, Vol. 13, No. 3 (December 1984) p. 257.

conceived or be championed by non-governmental actors, such as has been the case with NGOs, thinktanks and private actors in the non-proliferation regime.[373]

These questions have in a limited way been addressed in the concept of epistemic communities. I locate the concept as first used by Burkart Holzner in Reality Construction in Society (1968) and first applied in IR in 1975 by John Gerard Ruggie, who used the concept,

> '...to refer to a dominant way of looking at social reality, a set of shared symbols and references, mutual expectations and a mutual predictability of intention. Epistemic communities may be said to consist of interrelated roles which grow up around an *episteme;* they delimit, for their members, *the* proper construction of social reality.'[374]

Ruggie '[differentiates] three levels of institutionalization' of collective behavior that states turn to; epistemic communities, international regimes, and international organizations. The strong conceptual link between the first two is also reflected in the wider literature on epistemic communities.[375]

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373 Examples in the NPR can be found in the political momentum that NGOs such as the International Campaign to Abolish Nuclear Weapons (ICAN) and PAX (formerly IKV Pax Christi) created in organizing a United Nations General Assembly vote on a ban for nuclear weapons in July 2017 (which resulted in a treaty that opened for signature on September 20th, 2017), and the innovations in open source research methods to which the Institute for Science and International Security (ISIS) contributed to regime verification efforts, such as the successful use of commercial satellite imagery to monitor for and discover signs of undeclared activities in countries suspected of nuclear proliferation. The example of the LEU Fuel Bank initiative is particularly interesing because it was conceived by an NGO (the Nuclear Threat Initiative (NTI)), received its initial conditional financing from a private investor (Warren Buffett), was approved by the IO responsible for the issue area and the initiative's future management (the International Atomic Energy Agency) and found a host/sponsor in a nation-state (Kazachstan), 'Nuclear weapons ban treaty adopted!', PAX-No Nukes, https://nonukes.nl/nuclear-weapons-ban-treaty-adopted/, website checked 24-8-2017, Bendix, Aria, '122 Nations Approve 'Historic' Treaty Banning Nuclear Weapons', *the Atlantic,* 8th of July 2017, https://www.theatlantic.com/news/archive/2017/07/122-nations-approve-historic-treaty-to-ban-nuclear-weapons/533046/, website checked 24-8-2017, Albright, David, Hinderstein, Corey, 'The Iranian Gas Centrifuge Uranium Enrichment Plant at Natanz: Drawing from Commercial Satellite Images', Report, 14th of March 2003, Institute for Science and International Security, http://isis-online.org/isis-reports/detail/the-iranian-gas-centrifuge-uranium-enrichment-plant-at-natanz-drawing-from-/8#images, website checked 24-8-2017, Pabian, Frank, 'Commercial Satellite Imagery as an Evolving Open-Source Verification Technology: Emerging Trends and Their Impact for Nuclear Nonproliferation Analysis', Joint Research Center Technical Report, JRC97258 (European Atomic Energy Community: 2015) http://publications.jrc.ec.europa.eu/repository/bitstream/JRC97258/reqno_jrc97258_online%20version%20pdf.pdf, website checked 24-8-2017, 'The IAEA LEU Bank: An Investment in a More Secure Future', Nuclear Threat Iniatitive, 21st of August 2017, http://www.nti.org/analysis/articles/iaea-leu-bank-investment-more-secure-future/, website checked 25-8-2017.

374 Holzner, Burkart, *Reality Construction in Society* (Schenkman: 1968) pp. 69-71, Ruggie, Gerard, John, 'International Responses to Technology: Concepts and Trends', in *International Organization*, Vol. 29, No. 3 (Summer 1975) pp. 569-570). With a slight alteration the definition again appears in his 1998 book, Ruggie, Gerard, John, *Constructing the World Polity: Essays on International Institutionalization* (Routledge: Oxon 1998) p. 55. The term episteme was taken from Foucault, Foucault, Michel, *The Order of Things: An Archaeology of the Human Sciences* (Routledge: London 1989) pp. xxiii-xxiv.

375 Ruggie, Gerard, John, Constructing the World Polity: Essays on International Institutionalization (Routledge: Oxon 1998) p. 55, Haas, Peter, M., 'Do Regimes Matter? Epistemic Communities and Mediterranean Pollution Control', in *International Organization*, Vol. 43, No. 3 (Summer 1989), Cowhey, Peter, F., 'The

Peter Haas continued work on the concept, reviving it in 1989 in an article on international regimes and later taking elements from Holzner and Marx (1979), Fleck (1979) and Kuhn (1970) to come up with a more elaborate definition:[376]

> 'An epistemic community is a network of professionals with recognized expertise and competence in a particular domain and an authoritative claim to policy-relevant knowledge within that domain or issue-area. Although an epistemic community may consist of professionals from a variety of disciplines and backgrounds, they have (1) a shared set of normative and principled beliefs, which provide a value-based rationale for the social action of community members; (2) shared causal beliefs, which are derived from their analysis of practices leading or contributing to a central set of problems in their domain and which then serve as the basis for elucidating the multiple linkages between possible policy actions and desired outcomes; (3) shared notions of validity – that is, intersubjective, internally defined criteria for weighing and validating knowledge in the domain of their expertise; and (4) a common policy enterprise – that is, a set of common practices associated with a set of problems to which their professional competence is directed, presumably out of the conviction that human welfare will be enhanced as a consequence.'[377]

Haas gave new impetus to work on epistemic communities by organizing a special issue of *International Organization* (Winter 1992), in which the above definition was published. The definition clearly shares elements with the consensus definition of international regimes, not surprisingly because the relevance of professional experts is particularly clear in policy areas that have a high level of (technical) complexity that require far-going policy coordination to address. Arguably, at the heart of any regime, there is a type of epistemic community that 'does' the international regime; that is instrumental in creating the conditions for its establishment and once established facilitates its management in different ways.

The above offered definition allows us, though with slight alterations, to conceive of epistemic community members as participants in a practice. Members of an epistemic community are influential because they can offer superior appraisals of complex matters of international policy, which policy makers solicit and apply in periods of uncertainty (such as when 'failed policies, crisis, and unanticipated events ... call into question their understanding of an issue area'), which in turn can put experts in a position to '[consolidate] bureaucratic

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International Telecommunications Regime: The Political Roots of Regimes for High Technology', in *International Organization*, Vol. 44, No. 2 (Spring 1990), Haas, Peter, M., 'Introduction: Epistemic Communities and International Policy Coordination', in *International Organization*, Vol. 46, No. 1 (Winter 1992), Adler, Emanuel, 'The Emergence of Cooperation: National Epistemic Communities and the International Evolution of the Idea of Nuclear Arms Control', in *International Organization*, Vol. 46, No. 1 (Winter 1992).

376 Haas, Peter, M., 'Do Regimes Matter? Epistemic Communities and Mediterranean Pollution Control', in *International Organization*, Vol. 43, No. 3 (Summer 1989), Holzner, Burkart, Marx, John, H., *Knowledge Application: The Knowledge System in Society* (Allyn & Bacon: Boston 1979), Fleck, Ludwig, *Genesis and Development of a Scientific Fact* (University of Chicago Press: Chicago 1979), Kuhn, Thomas S., *The Structure of Scientific Revolutions*, Second Edition (University of Chicago Press: Chicago 1970).

377 Haas, Peter, M., 'Introduction: Epistemic Communities and International Policy Coordination', in *International Organization*, Vol. 46, No. 1 (Winter 1992) p. 3, Haas, Ernst B. *When Knowledge is Power: Three Models of Change in International Organizations* (University of California Press: Berkeley 1990) p. 41.

power within national administrations and international secretariats', allowing an epistemic community to 'institutionalize its influence and insinuate its view into broader international politics.'[378] Ernst Haas argues 'that epistemic communities seek to monopolize access to strategic decision-making positions, though few of them succeed in holding such a position for a long period.'[379]

Policy makers ignore expert advice at the risk of 'making choices that not only ignore the interlinkages with other issues, but also highly discount the uncertain future, with the result that a policy choice made now might jeopardize future choices and threaten future generations.'[380] In other words, a uninformed pursuit of the national interest now may negatively affect a state's ability to pursue a greater national interest later on. To avoid an inferior course of action, epistemic communities can help policymakers understand the 'cause-effect relationships and provide advice about the likely result of various courses of action', 'shed light on the nature of the complex interlinkages between issues and on the chain of events that might proceed either from failure to take an action or from instituting a particular policy' (and if decision-makers are receptive, allows for redefining 'the nature of the problem' 'in broader and more interlinked terms'), 'help define the self-interests of a state or factions within in it', as well as 'help formulate policies' by for example, introducing policy alternatives that policy makers were not aware of.[381]

So far, this very much sounds like an academic add-on of how national bureaucracies and associated policy experts influence decision makers in their policy formulation process. However, these epistemic community experts are neither exclusively academics nor nationally organized; they navigate transnational networks (such as in international organizations) in which 'diffusion of community ideas through conferences, journals, research collaboration, and a variety of informal communications and contacts' takes place continuously.[382]

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378 Haas, Peter, M., 'Introduction: Epistemic Communities and International Policy Coordination', in *International Organization*, Vol. 46, No. 1 (Winter 1992) p. 3-4, 13, 21, 29. In support of the constructivist project, the concept therefore supported a nonsystemic generation of national interests as constituted by ideas. The notion that ideas inform policy draws out a number of questions such as 'Are ideas themselves socially conditioned, or do social conditions merely affect which ideas gain acceptance? How are ideas disseminated? Why do some prevail over others? What is the life cycle of ideas? How do they evolve?´, Haas, Peter, M., 'Introduction: Epistemic Communities and International Policy Coordination', in *International Organization*, Vol. 46, No. 1 (Winter 1992) p. 27.

379 Haas, Ernst B. *When Knowledge is Power: Three Models of Change in International Organizations* (University of California Press: Berkeley 1990) p. 42. I have a notion that the successful ones play an important role in establishing and maintaining the regimes associated with their specialization, their issue-area.

380 Haas, Peter, M., 'Introduction: Epistemic Communities and International Policy Coordination', in *International Organization*, Vol. 46, No. 1 (Winter 1992) pp. 13-14.

381 Ibid., pp. 13-16, 29-30.

382 Ibid., pp. 14, 16-17. Interestingly, different takes on epistemic communities and on whether their membership is internally or externally validated, connects to practice internalism and externalism (see page 87). In this sense, Peter Haas is an internalist, and Ernst Haas an externalist, Haas, Peter, M., 'Introduction: Epistemic Communities and International Policy Coordination', in *International Organization*, Vol. 46, No. 1 (Winter 1992) pp. 17-18, Haas, Ernst B. *When Knowledge is Power: Three Models of Change in International Organizations* (University of California Press: Berkeley 1990) p. 41.

In Peter Haas' view, epistemic communities set themselves apart by holding 'shared normative commitments' and pursuing ethical causes that 'closely reflect the community's principled beliefs', '[reflecting] a particular political vision', and this sets them apart from the larger communities (professional communities or members of their academic disciplines) in which they move.[383] This creates a conundrum for traditional theorists interested in the concept, because if we allow for epistemic community members to inform alternative advice on this basis, 'it will differ from the behavior typically analyzed and predicted by rational choice theorists and principal-agent theorists.'[384]

The next line in Haas' 1992 article is particularly salient in light of the commonalities between the epistemic community concept and a practice in practice theory:

> 'Sociologist Joseph Ben-David, writing about scientific communities with tightly shared beliefs, notes that they provide "an example of an extreme case of effective social control by a minimum of informal sanctions" and demonstrate "one of the interesting instances where a group of people is held together by a common purpose and shared norms without the need of reinforcement by familial, ecological, or political ties."'[385]

This lead Peter Haas to investigate the source of such disciplining force, and the power inherent in a group that, in the absence of objective reality, is 'responsible for articulating the dimensions of reality has great social and political influence', as '[i]t can identify and represent what is of public concern, particularly in cases in which the physical manifestations of a problem are themselves unclear'.[386] As a separate theme, the power to discursively frame particular issues in a specific context, as well as its effects, was first picked up by Ole Wæver who by applying Austin's speech act theory grouped the framing around the theme of security under the concept *securitization;* '[a] successful securitization attempt requires that the actor has the position of authority to make the securitizing claim, that the alleged threats facilitate

383 Haas, Peter, M., 'Introduction: Epistemic Communities and International Policy Coordination', in *International Organization*, Vol. 46, No. 1 (Winter 1992) pp. 19, 27.

384 Ibid., p. 20. 'The solidarity of epistemic community members derives not only from their shared interests, which are *based on cosmopolitan beliefs of promoting collective betterment*, but also from their shared aversions, which are based on their reluctance to deal with policy agendas outside their common policy enterprise or invoke policies based on explanations that they do not accept.', Haas, Peter, M., 'Introduction: Epistemic Communities and International Policy Coordination', in *International Organization*, Vol. 46, No. 1 (Winter 1992) p. 20. Italics mine.

385 Ibid., p. 20.

386 Ibid., p. 23.

securitization and that the securitizing speech act follows the grammar of security.'[387] In this process, epistemic communities can play a central role.[388]

Ernst Haas argued that, 'epistemic communities are the most significant agents of institutional innovation.'[389] Nevertheless, 'the impact of epistemic communities is sharply limited by *habitual social practices*, which are routines of collective behavior that have acquired the legitimacy of long usage.'[390] The other actors in the policy-making process and their collective ideas and opinions are 'far more powerful than the specialized knowledge of experts' as,

> '[p]olitical actors are prone to adhere to the institutional forces that predispose choice toward the familiar rather than to take their chances with innovations urged upon them by experts who draw on their specialized skills. James Rosenau labels this syndrome the "habit-driven actor approach."'[391]

This 'syndrome' will cause epistemic communities centered in social science to be less effective than their natural science counterparts, because their ideas have to 'compete' with the dominant *praxis* in social reality (which acts like a 'blocking power'), according to Lindblom and Cohen, who invoke Giddens (1979).[392] Epistemic community's effectiveness, their ability to 'more directly contribute to informal convergence of policy preferences', is higher when it

387 Smith, Steve, 'The Increasing Insecurity of Security Studies: Conceptualizing Security in the Last Twenty Years', *Contemporary Security Policy*, Vol. 20, No. 3 (1999) p. 85, Dunne, Tim, Hansen, Lene, Wight, Colin, 'The End of International Relations Theory?', in *European Journal of International Relations*, Vol 19, No. 3 (September 2013) p. 413. Wæver first presented the concept in, Ole Wæver, Ole, 'Securitization and Desecuritization', in Lipschutz, Ronnie (ed.), *On Security* (Columbia University Press: New York 1995) pp.46-86. The avenue opened by the concepts of securitization and 'security communities', and earlier Barry Buzan's re-conceptualization of the national interest and focus on regions, spawned a constructivist security studies literature that also connected with critical theory scholars, Buzan, Barry, *People, States & Fear: an Agenda for International Security Studies in the Post-Cold War Era* (Harvester Wheatsheaf: 1991), Buzan, Barry, Wæver, Ole, De Wilde, Jaap, *Security: a New Framework for Analysis* (Lynne Rienner Publishers: Boulder 1998), Adler, Emanuel, Barnett, Michael, *Security Communities* (Cambridge University Press: Cambridge 1998), Buzan, Barry, Wæver, Ole, *Regions and Powers: The Structure of International Security* (Cambridge University Press: Cambridge 2004), Buzan, Barry, Wæver, Ole, 'Macrosecuritisation and Security Constellations: Reconsidering Scale in Securitisation Theory', in *Review of International Studies*, Vol. 35 (2009), Albert, Mathias, Buzan, Barry, 'Securitization, Sectors and Functional Differentiation', in *Security Dialogue*, Vol 42, No. 4-5 (October 2011), Hansen, Lene, *Security as Practice: Discourse Analysis and the Bosnian War* (Routledge: Oxon 2006), Behnke, Andreas, 'The Message or the Messenger? Reflections on the Role of Security Experts and the Securitization of Political Issues', in *Cooperation and Conflict*, Vol. 35 (2000), Balzacq, Thierry, 'The Three Faces of Securitization: Political Agency, Audience and Context', in *European Journal of International Relations*, Vol. 11 (2005), Krause, Keith, Williams, Michael, C. (eds.), *Critical Security Studies: Concepts and Cases* (Routledge: Oxon 1997), Williams, Michael, C., 'Words, Images, Enemies: Securitization and International Politics', in *International Studies Quarterly*, Vol. 47 (2003), Jabri, Vivienne, 'War, Security and the Liberal State', in *Security Dialogue*, Vol. 37 (2006).

388 Buzan, Barry, Wæver, Ole, de Wilde, Jaap, *Security: a New Framework for Analysis* (Lynne Rienner Publishers: Boulder 1998) pp. 77, 91, Adler, Emanuel, Haas, Peter, M., 'Conclusion: Epistemic Communities, World Order, and the Creation of a Reflective Research Program', in *International Organization*, Vol. 46, No. 1 (Winter 1992) p. 381.

389 Haas, Ernst B. *When Knowledge is Power: Three Models of Change in International Organizations* (University of California Press: Berkeley 1990) p. 40.

390 Ibid., p. 43. Italics mine.

391 Ibid.

has a transnational dimension, when their ideas are 'strongly embedded in the regulatory agencies of an individual country' (though more so when internationally embedded), and when its members enjoy a high degree of respect in their area of specialization and when they 'can have a direct impact on agenda setting and negotiations'.[393] As before mentioned, timing is important because policymakers are more open to policy alternatives following crisis, which prompt them to actively seek out advice from epistemic communities, entrenched or newly involved. All these factors have mutually-reinforcing effects.

I would add that national (non-transnational) epistemic communities are more likely to be effective in influencing international policy if their arguments, informed by their 'shared set of normative and principled beliefs' are able to occupy a moral high-ground in the policy debate and reorient their state's policy, and that this effect allows smaller states (adopting this discourse) to not be overly penalized for their lack of leverage. Haas and Adler (1992) seem to conceive a more limited ability of small states to influence international policy formulation, yet argue that 'to the extent that the advice of an epistemic community justifies a particular policy pursued by the state, it also legitimates the power that the state exercises in moving toward that policy.'[394] The latter statement could be taken as in line with Frost's take on what role weaker states can play in international political discussions; leverage is not just the state's ability to economically, militarily or otherwise 'lean' on those that are weaker, although that certainly matters and makes a difference, but also depends on the power of the better argument.[395]

Though Haas and Adler point out that many epistemic communities are quite small, a broader interpretation of the concept is certainly possible and helpful to understand how advocacy around issue areas can affect change in international politics. The link made by Finnemore and Sikkink (1998) to norm entrepreneurship, which sees individual NGOs, states or groups of states, possibly in coalition with 'larger advocacy networks' (which can consist of NGOs, but usually also have strong collaborative links with IGOs) push for the introduction of a new norm in international society, is particularly helpful in creating understanding on how small actors can induce big changes by 'framing' in ethical terms.[396] I will discuss norm entrepreneurship more in depth in the broader discussion of norms in Chapter 5 on page 126).

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392 Ibid., p. 44. Peter Haas and Emanuel Adler suggest a structurationist approach to epistemic communities in order to engage with their coordinating role of re-constituting both agency and structure, a move Ernst Haas is too unsure of to commit to, Adler, Emanuel, Haas, Peter, M., 'Conclusion: Epistemic Communities, World Order, and the Creation of a Reflective Research Program', in *International Organization*, Vol. 46, No. 1 (Winter 1992) p. 371, Haas, Ernst B. *When Knowledge is Power: Three Models of Change in International Organizations* (University of California Press: Berkeley 1990) pp. 44, 46.

393 Adler, Emanuel, Haas, Peter, M., 'Conclusion: Epistemic Communities, World Order, and the Creation of a Reflective Research Program', in *International Organization*, Vol. 46, No. 1 (Winter 1992) pp. 379-380, Finnemore, Martha, Sikkink, Kathryn, 'International Norm Dynamics and Political Change', in *International Organization*, Vol. 52, No. 4 (Autumn 1998) p. 899.

394 Adler, Emanuel, Haas, Peter, M., 'Conclusion: Epistemic Communities, World Order, and the Creation of a Reflective Research Program', in *International Organization*, Vol. 46, No. 1 (Winter 1992) p. 380, 389.

395 Frost, Mervyn, *Global Ethics: Anarchy, Freedom and International Relations* (Routledge: Oxon 2009) pp. 112-113.

396 Finnemore, Martha, Sikkink, Kathryn, 'International Norm Dynamics and Political Change', in *International Organization*, Vol. 52, No. 4 (Autumn 1998) pp. 897, 899-900.

Part 3: From the Constructivist Turn into the Post-Positivist Era of Regime Theory

John Gerard Ruggie and Friedrich Kratochwil decisively broke with the traditional theories, when they declared a need to pursue a new epistemological and ontological approach to understanding regimes. Epistemologically, they rejected logical positivism as a proper foundation to approach regime ontology, and cited three reasons for doing so.[397] First, the 'positivist precepts and prescriptions that prevail in the field of study' do not allow to say anything substantive about regimes because of the small-n problem; there are too few regimes, and even less have been thoroughly studied. When they have been, empirical data is largely qualitative in nature.[398] Second, the ontology has a distinctive intersubjective character. Intersubjectivity refers to 'the state of affairs existing among the actors that comprise any given regime'.[399] Referencing Krasner's 1983 consensus definition of regimes, Ruggie reminds us that,

> '[t]he emphasis on convergent expectations as the constitutive basis of regimes gives regimes an inescapable intersubjective quality. It follows that we know regimes by their shared understandings of desirable and acceptable forms of social behavior.'[400]

This is a markedly different approach to interpreting collective cognitive processes as 'learning', in which actors gain knowledge that gives them a better understanding of the public good that should or shouldn't be subscribed to and supported. In a 'learning'-interpretation, policy change is brought about through changes in knowledge about and perception of the particular public good instead of through the evolving self-understanding of the actors in relation to the public good.[401] An interpretation of collective cognitive processes as learning fails to recognize that actor's preferences based on perceived interests originate in a continuous reassessment of one's role and status in a social practice, and how evolving insight into the importance of that role and normative status will in turn lead the actor to reassess interests, and therefore preferences. Instead, the process of acquiring knowledge through learning is understood as 'filling in gaps' in lapses of knowledge related to material interests and therefore falls to explain the dynamic of change in a meaningful way.

To understand social institutions, Ruggie and Kratochwil based themselves on Searle's distinction between brute and institutional facts, as elaborated upon by Kratochwil.[402] Kratochwil distinguishes three worlds of 'social facticity'; the world of brute physical

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397 Ruggie, Gerard, John, *Constructing the World Polity: Essays on International Institutionalization* (Routledge: Oxon 1998) pp. 89-96, which is a partial reprint from, Kratochwil, Friedrich, Ruggie, John, Gerard, 'International Organization: A State of the Art on an Art of the State', in *International Organization*, Vol. 40, No. 4 (Autumn 1986) pp. 753-775.

398 Ruggie, Gerard, John, *Constructing the World Polity: Essays on International Institutionalization* (Routledge: Oxon 1998) p. 89.

399 Ibid., p. 85.

400 Ibid., p.89.

401 Aggarwal, Vinod, K., *Institutional Designs for a Complex World: Bargaining, Linkages, and Nesting* (Cornell University Press: Ithaca 1998) p. 24.

402 Kratochwil, Friedrich, *Rules, Norms, and Decisions: On the Conditions of Practical and Legal Reasoning in International Relations and Domestic Affairs* (Cambridge University Press: Cambridge 1989), Ruggie, Gerard, John, *Constructing the World Polity: Essays on International Institutionalization* (Routledge: Oxon 1998) p. 90.

(observational) facts, the world of intentionality and meaning (simplified: in which individual ideas and attitudes towards the physical world are encompassed) and the world of institutional facts.[403] The world of institutional facts can be conceived to consist of two sets of 'rules'; a set of constitutive (or 'enabling') rules, and a set of regulative and enforcement rules (see for a more thorough discussion, *Rules and Rule-following*, page 85). Much of the regime literature has focused on the second set of rules, and less attention has been paid to the implications of the existence of the first set, argues Ruggie. Regulative rules were and are often equated with the regime itself, with regimes operating as injunctions ('external constraints on state behavior that function either as independent or intervening variables') between states and the regime organization(s).[404] Nevertheless,

> '… regimes, like principles and norms more generally, function not only in the causal sense of injunctions but also in *a broader communicative and even constitutive sense*. …. Part of the efficacy of regimes in practice has to do with the mutual intelligibility and acceptability of actions within the intersubjective framework of understanding that is embodied in the regime's principles and norms. This dimension gets lost by focusing on the regulative role of regimes only. Yet it may tell us more about how robust a regime is than its more "objective" aspects, such as formal compliance with its specific injunctions. Thus, interpretive epistemologies remain central to appreciating how regimes function.'[405]

Post-positivist epistemology allows engagement with regimes as contestable 'conceptual creations'.[406] Kratochwil and Ruggie didn't stake out a new position for themselves, but instead declared an allegiance to an intersubjective conception of normative structures alike to Giddens' structuration and urged consideration of a number of contemporary alternatives to resolve the contradictions between epistemology and ontology in the regime concept, such as Kratochwil's work using Habermas' 'universal pragmatics' (under which the latter's Theory of Communicative Action falls) and Ernst Haas' application of 'consensual knowledge'.[407]

403 Ruggie, Gerard, John, *Constructing the World Polity: Essays on International Institutionalization* (Routledge: Oxon 1998) p. 90, Kratochwil, Friedrich, *Rules, Norms, and Decisions: On the Conditions of Practical and Legal Reasoning in International Relations and Domestic Affairs* (Cambridge University Press: Cambridge 1989) pp. 21-28.

404 Ruggie, Gerard, John, *Constructing the World Polity: Essays on International Institutionalization* (Routledge: Oxon 1998) p. 85, Smith, Roger, K., 'Explaining the Non-Proliferation Regime: Anomalies for Contemporary International Relations Theory', in *International Organization*, Vol. 41, No. 2 (Spring, 1987) p. 257, Rosenau, James, J., 'Before Cooperation: Hegemons, Regimes, and Habit-Driven Actors in World Politics', in *International Organization*, Vol. 40, No. 4 (Autumn, 1986) p. 883, Levy, Marc, A., Young, Oran, R., Zürn, Michael, 'The Study of International Regimes', WP-94-113, International Institute for Applied Systems Analysis, Luxemburg, Austria (November 1994) p. 5, Hasenclever, Andreas, Mayer, Peter, Rittberger, Volker, 'Interests, Power, Knowledge: The Study of International Regimes', in *Mershon International Studies Review*, Vol. 40, No. 2 (October 1996) p. 180, Smith, Roger K., 'Opaque Proliferation and the Fate of the Non-proliferation Regime', in *Journal of Strategic Studies*, Vol. 13, No. 3 (1990) p. 96.

405 Ruggie, Gerard, John, *Constructing the World Polity: Essays on International Institutionalization* (Routledge: Oxon 1998) pp. 85-86. Italics mine.

406 Ibid., p. 87, Haas, Ernst B. *When Knowledge is Power: Three Models of Change in International Organizations* (University of California Press: Berkeley 1990) p. 46.

407 Ruggie, Gerard, John, *Constructing the World Polity: Essays on International Institutionalization* (Routledge: Oxon 1998) pp. 96, 99.

Success of such an alternative hinges on its ability to 'open up regime analysis to the communicative rather than merely the referential functions of norms in social interactions.'[408] It has to allow for an epistemological understanding that 'a breach of an obligation undertaken within a regime is not simply an "objective description" of a fact but an intersubjective appraisal', and that 'what constitutes reciprocity or reasonableness of behavior within regime contexts is not an issue that can be resolved simply by a monological treatment of "objective information," as is characteristic of a propositional language'; '[f]or regimes are inherently dialogical in character.'[409] This brings this alternative conception of regimes' normative dynamics very close to the dynamics found in the practice-based approach advocated by Frost (see Chapter 3: *Frost's Practice-based Theory of International Action*, on page 92). This similarity is discussed further in Chapter 5: *Redefining Regimes*, on page 133).

Nicholas Onuf adopted a position alike to Giddens' view of rules that are both constitutive and regulative, though with differentiation in what measure they perform both functions. These 'more or less coherent rule sets' create 'particularly dense, complex patches of international relations.'[410] Onuf argued that, in reference to the consensus definition of regimes, that Kratochwil is right when he noted 'that principles, norms and rules all possess 'prescriptive force', as indeed do decision-making procedures'; they are all prescriptive statements.[411] Prescriptive statements, containing 'some considerable degree of formality and institutional support are *legal*' and 'take the linguistic form of a rule'.[412] Furthermore, '[p]rinciples and procedures are capable of being legal no less than rules – they *are* rules respectively of great generality and specificity', and widely supported norms that have 'any durability and importance' are like 'customary law.'[413] Onuf used these arguments to reduce regimes to a purely (differentiated) rule-governed institution, though acknowledged that '[i]nformal rules and related practices spring up in the margins of any rule set'.[414] As such, he allowed himself to collapse everything into the one concept: '[s]tates are regimes', '[s]ocieties are congeries of regimes and regimes themselves', and '[i]nternational society is nothing more than an inclusive regime, within which are nested all international regimes, themselves constituted from the relations of states and other well-bounded regimes.'[415] Regimes are the same as

408 Ibid., p. 100.

409 Ibid.

410 Onuf, Nicholas, Greenwood, *World of Our Making: Rules and Rule in Social Theory and International Relations* (University of South Carolina Press: Columbia 1989) p. 143, Onuf, Nicholas, 'Constructivism: A User's Manual', in Kubálková, Vendulka, Onuf, Nicholas, Kowert, Paul (eds.), *International Relations in a Constructed World* (Routledge, Oxon 1998) p. 68.

411 Onuf, Nicholas, 'The Constitution of International Society', in *European Journal of International Law*, Vol. 5, No. 1 (1994) p. 9, Onuf, Nicholas, 'Constructivism: A User's Manual', in Kubálková, Vendulka, Onuf, Nicholas, Kowert, Paul (eds.), *International Relations in a Constructed World* (Routledge, Oxon 1998) pp. 68-69.

412 Onuf, Nicholas, 'Constructivism: A User's Manual', in Kubálková, Vendulka, Onuf, Nicholas, Kowert, Paul (eds.), *International Relations in a Constructed World* (Routledge, Oxon 1998) p. 69.

413 Onuf, Nicholas, 'The Constitution of International Society', in *European Journal of International Law*, Vol. 5, No. 1 (1994) p. 10.

414 Ibid., pp. 10-15, Onuf, Nicholas, 'Constructivism: A User's Manual', in Kubálková, Vendulka, Onuf, Nicholas, Kowert, Paul (eds.), *International Relations in a Constructed World* (Routledge, Oxon 1998) p. 70.

415 Onuf, Nicholas, 'The Constitution of International Society', in *European Journal of International Law*, Vol. 5, No. 1 (1994) pp. 7, 9.

institutions, Onuf claimed, causing him indirectly to conflate markedly different institutions such as 'the balance of power, spheres of influence, and treaties' with regimes.[416] 'Agents act as observers when they recognize any institution as such, no matter how complex it is', he correctly pointed out, but somehow failed to recognize that these competent agents actively distinguish between types of institutions as profoundly different things, because they understand the concepts as participants in a practice in which these institutions play active but different roles, and it is that internal understanding that scholars need to pursue in describing the (international) social world.[417] This lead Onuf into the following, in my view, fallacy:

> 'International society is marked by the presence of many rules conventionally described as legal. These rules constitute a broad, historic regime well known to us as international law. This regime does not coincide exactly with international society, to which must be added other regimes identifiable to the observer despite their informality - regimes constituted by 'rules of the game' instead of legal rules. Nevertheless, the international legal regime dominates the congeries of regimes constituting international society because its rules provide the chief agents in that society with their standing as such, and the scope and formality of these rules provide agents and observers alike with an unavoidable frame of reference.'[418]

The primacy of international law over aspects of international society defined by 'rules of the game', that Onuf argued, is mistaken. Following Frost, it's exactly the other way around; international society is an international practice, in which the rules of the game are the major constitutive element, the main points of reference to its participants, and the international legal framework is secondary to it, perhaps even as little as an inaccurate, often outdated reflection of the former. International society is not 'a legal environment' where behavior is necessarily constrained by legal limits, nor a 'heteronomy' (Onuf's suggestive replacement of anarchy); it is first and foremost an international practice, situated in a double anarchy.[419] From the participants' internal view, regime rules are experienced as more pronounced, codified, etc. But that prominence does not equate to primacy; the 'real' background (following Giddens, Searle and Frost) is not consciously observed by the participants. Primacy of practice furthermore becomes clear from its essential priority to international legal agreements, as part of regimes or otherwise; a state needs to be member of international society, as participant in the SOSS and GCS, to even be able to qualify for membership of international legal agreements in any form. The ability to qualify as a member of international society is both based on a state's internal constitution that determines if it can perform the basic functions of a state, as well as the reciprocal recognition as a state by other practice participants.

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416 Onuf, Nicholas, 'Constructivism: A User's Manual', in Kubálková, Vendulka, Onuf, Nicholas, Kowert, Paul (eds.), *International Relations in a Constructed World* (Routledge, Oxon 1998) pp. 70-71.

417 Ibid., p. 71. In Onuf's classification, these are 'administrative regimes', Onuf, Nicholas, Greenwood, *World of Our Making: Rules and Rule in Social Theory and International Relations* (University of South Carolina Press: Columbia 1989) pp. 153-154.

418 Onuf, Nicholas, 'The Constitution of International Society', in *European Journal of International Law*, Vol. 5, No. 1 (1994) p. 15.

419 Onuf, Nicholas, 'Constructivism: A User's Manual', in Kubálková, Vendulka, Onuf, Nicholas, Kowert, Paul (eds.), *International Relations in a Constructed World* (Routledge, Oxon 1998) pp. 69, 77.

Nevertheless, heteronomy can occur in the anarchy, as Onuf convincingly argued it did during the Cold War, fostering relationships of unequal exchange that create 'a disjunction between the formal appearance of autonomy and the social reality of super- and subordination'.[420] Such effects also bear on the case study of this thesis, as it is situated in the Cold War, and in the sense that nuclear trade relations often carry within them deliberate relations of control, called by Hirschman an "'influence effect"', in which 'consequent asymmetries in opportunity costs of foregoing these trade relations allow the officials constructing the situation to control their counterparts by threatening to withdraw from the relationship'; because of one partners lower gain, it's easier for them to use the relationship to gain leverage.[421]

420 Onuf, Nicholas, Greenwood, *World of Our Making: Rules and Rule in Social Theory and International Relations* (University of South Carolina Press: Columbia 1989) pp. 221-227.
421 Ibid., pp. 221-222.

Chapter 5:

Practices and Regimes

In Frost's theoretical work, from 1986 to 1996 to 2009, he often grouped rules and norms together ('settled rules, norms') or conflates the two terms, stating that rules are 'settled norms', participants in practices 'recognize themselves as bound by the rules of the game, as bound by certain norms', and also used the term rule to describe norms.[422] Additionally, he considered '[t]he *institution of diplomacy*' and 'the idea of international law' as a public good a settled norm, as are the '[subsets] of the rules of international law usually referred to as the *ius in bello' and 'ius ad bellum'*.[423]

Martha Finnemore and Kathryn Sikkink in their important 1998 article on norm dynamics use norms as rules in the sociological tradition, locating regulative and constitutive norms (comparative to regulative and constitutive rules of Giddens and Searle) but also prescriptive norms. The latter's 'puzzling' absence (Finnemore/Sikkink) from most analysis can be explained by (following Kratochwil) all rules'/norms' inherent prescriptive dimension.[424]

The interchangeable use of rules and norms is a tendency also seen in the (international) legal field and with some sociologists such as Weber. Durkheim, and following him, Parsons, who used rule to indicate a constraining rule, whereas a norm indicates when one or more actors find something to be an end in itself.[425] Onuf considers that '[r]ules and norms are distinguishable by how formal they are, norms being sufficiently informal that observers are not always sure that they are rules until they see how other agents respond to them.'[426] Ruggie does not semantically distinguish between norms as international laws, international regulations and the norms found in regimes and says,

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422 Frost, Mervyn, *Towards a Normative Theory of International Relations: A Critical Analysis of the Philosophical and Methodological Assumptions in the Discipline with Proposals Towards a Substantive Normative Theory* (Cambridge University Press: Cambridge 1986) pp. 57, 65, Frost, Mervyn, *Ethics in International Relations: a Constitutive Theory* (Cambridge University Press: Cambridge 1996) p. 108, Frost, Mervyn, *Global Ethics: Anarchy, Freedom and International Relations* (Routledge: Oxon 2009) pp. 23, 25, 63.

423 Frost, Mervyn, Ethics in International Relations: a Constitutive Theory (Cambridge University Press: Cambridge 1996) pp. 109-110, Italics in original. Ius ad bellum refers to the rules governing the initiation of war, ius in bello refers to the rules of conduct in war. Perhaps the seeming conflation of rules and norms is reflective of Frost's intellectual debt to international law scholar Ronald Dworkin, as in the discipline of International Law, the term 'international norms' is often used interchangeably with 'international laws' and 'international rules', Frost, Mervyn, *Towards a Normative Theory of International Relations: A Critical Analysis of the Philosophical and Methodological Assumptions in the Discipline with Proposals Towards a Substantive Normative Theory* (Cambridge University Press: Cambridge 1986) pp. Ix, 3, 102-103, 116, 227, Kratochwil, Friedrich, Rules, Norms, and Decisions: *On the Conditions of Practical and Legal Reasoning in International Relations and Domestic Affairs* (Cambridge University Press: Cambridge 1989) pp. 1-2, 33, Ruggie, Gerard, John, *Constructing the World Polity: Essays on International Institutionalization* (Routledge: Oxon 1998) p. 97.

424 Finnemore, Martha, Sikkink, Kathryn, 'International Norm Dynamics and Political Change', in *International Organization*, Vol. 52, No. 4 (Autumn 1998) pp. 891-892.

425 Onuf, Nicholas, 'The Constitution of International Society', in *European Journal of International Law*, Vol. 5, No. 1 (1994) p. 10, Onuf, Nicholas, Greenwood, *World of Our Making: Rules and Rule in Social Theory and International Relations* (University of South Carolina Press: Columbia 1989) pp. 129-130.

426 Onuf, Nicholas, 'Constructivism: A User's Manual', in Kubálková, Vendulka, Onuf, Nicholas, Kowert, Paul (eds.), *International Relations in a Constructed World* (Routledge, Oxon 1998) p. 70.

> 'The impact of norms within international regimes is not a passive process, which can be ascertained analogously to that of Newtonian laws governing the collision of two bodies. Precisely because state behavior within regimes is interpreted by other states, the rationales and justifications for behavior that are proffered, together with pleas for understanding or admissions of guilt, as well as the responsiveness to such reasoning on the part of other states, all are absolutely critical component parts of any explanation involving the efficacy of norms. Indeed, such communicative dynamics may tell us far more about how robust a regime is than overt behavior alone.'[427]

On norm dynamics, Frost stated that 'norms are consolidated by being reiterated.'[428] Discourse is the locus in which we can observe whether a norm is settled, and this connects to the above discussion on appraisals. A norm is settled when 'it is generally recognized that any argument denying the norm (or which appears to override the norm) requires special justification'; '[w]hat people say in support of their actions thus gives us an indication of whether a given item is settled within a specified domain of discourse.'[429] Another indication is 'provided by the way in which acts which infringe the norm are undertaken'; 'acts which infringe a given norm are often (normally) undertaken clandestinely, [and] this is *prima facie* proof that the norm in question is a settled one.'[430]

Similarly, Finnemore and Sikkink pointed out that, 'because norms by definition embody a quality of "oughtness" and shared moral assessment, norms prompt justifications for action and leave an extensive trail of communication among actors that we can study.'[431] Finnemore and Sikkink made a lot of good points on what norms are and how they operate, but don't seem to recognize that they are situated in particular practices, and that makes their analysis not so much suspect, but incomplete, yet very useful.

The Relationship between Norms and Rules

Rules and norms are central to understanding the social constitution of society, because meaningful (collective) human action takes place in practices. Practice internalism allows us to conceive of rule-following as an intersubjective process that allows actors to perceive who is a participant and to evaluate their actions and their standing in the practice. But what different roles do rules and norms play in that process? If we see rules as defining the

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427 Ruggie, Gerard, John, *Constructing the World Polity: Essays on International Institutionalization* (Routledge: Oxon 1998) p. 100.

428 Frost, Mervyn, *Global Ethics: Anarchy, Freedom and International Relations* (Routledge: Oxon 2009) p. 161.

429 Frost, Mervyn, *Ethics in International Relations: a Constitutive Theory* (Cambridge University Press: Cambridge 1996) p.105, Frost, Mervyn, *Towards a Normative Theory of International Relations: A Critical Analysis of the Philosophical and Methodological Assumptions in the Discipline with Proposals Towards a Substantive Normative Theory* (Cambridge University Press: Cambridge 1986) p. 121.

430 Frost, Mervyn, *Ethics in International Relations: a Constitutive Theory* (Cambridge University Press: Cambridge 1996) p.105-106. Italics in original.

431 Finnemore, Martha, Sikkink, Kathryn, 'International Norm Dynamics and Political Change', in *International Organization*, Vol. 52, No. 4 (Autumn 1998) p. 892.

'background understanding' of practices, this opens up a theoretical space for norms as aspects of social institutions that function to enable and constrain meaningful action, reflected in how agents discursively interact with each other, and by which interaction the institutions themselves are reconstituted. This allows for a model that explains through what processes agency and practice are mutually constitutive.[432]

Therefore, I propose to specifically maintain a distinction between norms and rules, while arguing that they are part of the same dynamic. In this, I'm taking the internal view of participants in practices seriously, as they mention and refer to norms and rules together but generally don't collapse their meaning, because they recognize they are somehow different things. I'm not suggesting anything not already proposed, but merely offer a clarification. Whereas Frost maintained a difference between norms and rules and settled norms and rules respectively, and Finnemore and Sikkink talked of emerging norms that, after a norm cascade, result in norm internalization (see below), I suggest that when speaking of international practices norms are actively political and contested, articulated and consciously accessible to participants, whereas rules are accepted, depoliticized, and internalized as part of the relatively inarticulate, inaccessible background. Settled norms (Frost's term) represent the in-between; dominant norms that have not yet been internalized. Norms, after becoming settled and after internalization, become rules of a practice. The regulative and constitutive rules are universal in and specific to their particular practice, whereas norms can be seen to exist as soon as two participants in a practice agree to uphold its normative content. This allows norms to be local, domestic, regional and global. Norms are communicative; they are continuous and in constant flux, subject to all the appraisals that directly or indirectly reference them in support or contestation. In summary, rules *are* the practice, and norms *(re-)make* the practice. Therefore, 'the norm life cycle' is particularly interesting and important to study.[433]

Finnemore and Sikkink conceptualize the norm life cycle as follows. They discuss norm dynamics as relevant to states, but they suggest wider usage, and it's easy to see how their concepts can work in any practice setting.

> 'Norm influence may be understood as a three-stage process. … the first stage is "norm emergence"; the second stage involves broad norm acceptance, which we term, following Cass Sunstein, a “norm cascade”; and the third stage involves internalization. The first two stages are divided by a threshold or "tipping" point, at which a critical mass of relevant state actors adopt the norm. This pattern of norm influence has been found independently in work on social norms in U.S. legal theory, quantitative research by sociology's institutionalists or "world polity" theorists, and various scholars of norms in IR.'[434]

432 Frost, Mervyn, Lechner, Sylvia, 'Understanding International Practices from the Internal Point of View', in *Journal of International Political Theory*, Vol. 12, No. 3 (July 2016) p. 308. For a discussion of 'background understanding', see Chapter 3, pages 79 and 97 and also features in chapter 5, under *Redefining Regimes*, on page 135.

433 Finnemore, Martha, Sikkink, Kathryn, 'International Norm Dynamics and Political Change', in *International Organization*, Vol. 52, No. 4 (Autumn 1998) pp. 892-893, 895-905

434 Ibid., p. 895.

Because 'new norms never enter a normative vacuum but instead emerge in a highly contested normative space where they must compete with other norms and perceptions of interest', the tipping point is not always reached.[435] New norms are championed by 'norm entrepreneurs' which are 'agents having strong notions about appropriate or desirable behavior in their community.'[436] With this 'appropriateness' Finnemore and Sikkink refer to the 'logic of appropriateness' as conceptualized by March and developed by March and Olsen, but in trying to explain why norms matter to agents, feel forced ('it is very difficult to explain the motivation of norm entrepreneurs without reference to … ') to refer to 'empathy, altruisim, and ideational commitment'.[437] I imagine such a move invites much complication when one wants to conceive of states as norm entrepreneurs, because norm dynamics could lead us the opposite direction as well, for example when states motivate their international policies with values that emphasize the unconstrained pursuit of self-interest, tit-for-tat transactionalism and nationalism (in line with realist theories' premises). The logic of appropriateness is not necessarily cosmopolitan in nature; communitarian values could inform normative projects in international society.

Instead, using a practice-based constitutive approach allows for the domestic level to help explain the way in which states become norm entrepreneurs. Discourse ethics at the domestic level can explain how bureaucratic and political elites can become captured and moved into redefining their perception of the state's interest, for example by epistemic communities, NGOs, regional and national interest groups, and others. The similitude to the role of epistemic communities in regimes (discussed on page 114) is apparent, as is how difficult it can be to change the attitudes, and dominant ideas (Finnemore and Sikkink speak of

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435 Ibid., p. 897.

436 Ibid., pp. 896-898. See for example, March, James, G., 'Footnotes to Organizational Change', in *Administrative Science Quarterly,* Vol. 26, No. 4 (December 1981) pp. 563-577, March, James, G., Olsen, Johan, P., 'The Logic of Appropriateness', in Goodin, Robert, E. (ed.), *The Oxford Handbook of Political Science* (Oxford University Press: Oxford 2011) pp. 479-497.

437 Finnemore, Martha, Sikkink, Kathryn, 'International Norm Dynamics and Political Change', in International Organization, Vol. 52, No. 4 (Autumn 1998) p. 898. March and Olsen's logic of appropriateness is distinct from the logic of consequentialism (or the behavioral logic), Risse, Thomas, "'Let's Argue!": Conmunicative Action in World Politics', in International Organization, Vol. 54, No. 1 (Winter 2000) p. 3. 'The behavioral logic underlying the economistic and rational choice approaches to norm analysis is utility maximization. Actors construct and conform to norms because norms help them get what they want. An alternative approach to understanding norm conformance is what March and Olsen call the "logic of appropriateness," in which actors internalize roles and rules as scripts to which they conform, not for instrumental reasons – to get what they want – but because they understand the behavior to be good, desirable, and appropriate. Habit, duty, sense of obligation and responsibility as well as principled belief may all be powerful motivators for people and underpin significant episodes of world politics.', Finnemore, Martha, Sikkink, Kathryn, 'International Norm Dynamics and Political Change', in International Organization, Vol. 52, No. 4 (Autumn 1998) p. 912. The problem with a choice between these logics is, according to Finnemore and Sikkink following Ruggie and March and Olsen, that they lead to one respective side of the agent-structure divide, as an intersubjective ontology (though available, if we look at the state of the 1998 literature), was not applied at the time of writing, Finnemore, Martha, Sikkink, Kathryn, 'International Norm Dynamics and Political Change', in International Organization, Vol. 52, No. 4 (Autumn 1998) pp. 912-913, March, James, G., Olsen, Johan, P., 'The Institutional Dynamics of International Political Orders', in *International Organization*, Vol. 52, No. 4 (Autumn, 1998) pp. 943-969,
Ruggie, John, Gerard, 'What Makes the World Hang Together? Neo-Utilitarianism and the Social Constructivist Challenge', in *International Organization*, Vol. 52, No. 4 (Autumn, 1998) pp. 855-885.

'normative biases' rooted in trained professionalism, Foucault could call it an effect of professional discipline) of decision-makers.[438] A norm entrepreneur draws attention to issues by discursively shaping them, and 'names, interprets, and dramatizes them' through framing (see Chapter 4, *Epistemic Communities,* page 114).[439] By situating their arguments in 'belief systems or life worlds that transcend a specific cultural or political context', making their claims widely accessible, norm entrepreneurs also increase their chance of success.[440] Anchoring these issues and arguments in organizational platforms such as IOs or treaty organizations can assist norm entrepreneurship, but also considerably affect it because of the wider agenda of the IO.[441]

When norm entrepreneurs gain support and a norm gains traction, institutionalization can help the process of gaining even wider acceptance. In a domestic setting this could entail a public campaign funded by the state (for example, to create awareness about a health issue), the foundation of an agency with issue-specific authorities, or the formulation of official government policy. In the international setting, networks of bilateral agreements, treaties, gentlemen's agreements and the foundation of international agencies provide the parallel examples.

> 'Such institutionalization contributes strongly to the possibility for a norm cascade both by clarifying what, exactly, the norm is and what constitutes violation (often a matter of some disagreement among actors) and by spelling out specific procedures by which norm leaders coordinate disapproval and sanctions for norm breaking.'[442]

Past the 'tipping point', when norm entrepreneurs have persuaded 'a critical mass' of actors to also become 'norm leaders' in adopting the new norm over the old one, 'a norm cascade' is triggered; 'a different dynamic' in which agents are more rapidly socialized to the new norm.[443] This process of socialization is related to agents' identities, Finnemore and Sikkink correctly think. They incorrectly attempt to categorize the redefinition of appropriateness, at the tipping point, to some arch-type of state-identity such as 'a ”liberal” state or a European state.'[444] Involving possible motivations such as 'legitimization, conformity, and esteem' leads them to descriptive analysis that gets very close to describing an agent's ethical standing in a practice (with agents for example seeking to raise the national esteem, and trying to avoid cognitive dissonance or the disapproval of their peers), but in their 1998 article they fail to recognize the unifying factor; that norms are the focal points of ethical discourse in social practice.[445]

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438 Finnemore, Martha, Sikkink, Kathryn, 'International Norm Dynamics and Political Change', in *International Organization*, Vol. 52, No. 4 (Autumn 1998) pp. 898-900, 905.
439 Ibid., pp. 897.
440 Ibid., pp. 907. The term 'life worlds' is Habermas', Habermas, Jürgen, *Theory of Communicative Action, Volume 2: Lifeworld and System: a Critique of Functionalist Reason* (Beacon Press: Boston 1985) pp. 118-152.
441 Finnemore, Martha, Sikkink, Kathryn, 'International Norm Dynamics and Political Change', in *International Organization*, Vol. 52, No. 4 (Autumn 1998) pp. 899-900.
442 Ibid., p. 900.
443 Ibid., pp. 901-902
444 Ibid., p. 902.
445 Ibid., pp. 903-904.

> 'At the extreme of a norm cascade, norms may become so widely accepted that they are internalized by actors and achieve a "taken-for-granted" quality that makes conformance with the norm almost automatic.'[446]

I argue that they become completely automatic; they become *rules*. Internalization of norms leads them to become an integrated part of the practice itself, as the presupposed background (Frost and Lechner), operating as the un-purposive 'rationalization of action' (Giddens).[447] When actively contested by emerging norms, rules have to brought back to the foreground of practice, re-assume the status of norms, and be defended in the face of contestation.[448]

So, what makes a norm succeed? What helps it reach the tipping point and successfully cascade into universalization to the point it can become established long enough to become internalized as a rule? Again, Finnemore and Sikkink offer a number of explanations that can translate to a practice-based explanation. They posit that norms held by states that are 'widely viewed as successful and desirable models' are more likely to be successful, which explains the success of many Western norms.[449] On the face of it, this explanation seems convincing, yet it fails to include the inequality of resources (in Giddens' meaning) that agents can invest to push a norm, and that should in part be taken to be responsible for the success of Western norms. Nevertheless, the amount of resources a state has available to push its appraisals internationally (or a political party in domestic civil society, for that matter) certainly affects how that agent can maintain and improve its standing in the respective practice. Additionally, and perhaps more importantly, Finnemore and Sikkink point to the 'intrinsic qualities of the norm itself', in order to explain its success:

> 'We can divide these claims between those stressing the formulation of the norm (its clarity and specificity) and those stressing the substance of the norm and the issues it addresses (its content). Those stressing the form of the norm argue that norms that are clear and specific, rather than ambiguous and complex, and those that have been around for awhile, surviving numerous challenges, are more likely to be effective. Institutionalists in sociology have also argued that norms making universalistic claims

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446 Ibid., p. 904, Risse, Thomas, '"Let's Argue!": Conmunicative Action in World Politics', in *International Organization*, Vol. 54, No. 1 (Winter 2000) p. 6. 'When norms become internalized in actors, actors are no longer choosing to conform to them in any meaningful way.', Finnemore, Martha, Sikkink, Kathryn, 'International Norm Dynamics and Political Change', in *International Organization*, Vol. 52, No. 4 (Autumn 1998) p. 913.

447 Frost, Mervyn, Lechner, Sylvia, 'Understanding International Practices from the Internal Point of View', in *Journal of International Political Theory*, Vol. 12, No. 3 (July 2016) p. 305, Giddens, Anthony, *The Constitution of Society: Outline of the Theory of Structuration* (University of California Press: Berkeley 1984) pp. 4-5, Giddens, Anthony, *New Rules of Sociological Method: A Positive Critique of Interpretative Sociologies* (Polity Press: Cambridge 1993) p. 92.

448 I have a notion that this process relates to what Foucault exposed in his treatment of instiutions, in the concept of 'subjugated knowledges', showing that through history institutions acquired new reasons to back up their institutional power and legitimacy, yet always obscuring the conflict that preceded it, Foucault, Michel, *"Society Must Be Defended": Lectures at the Collège de France, 1975-76* (Picador: New York 2003) pp. 6-8.

449 Finnemore, Martha, Sikkink, Kathryn, 'International Norm Dynamics and Political Change', in *International Organization*, Vol. 52, No. 4 (Autumn 1998) p. 906.

> about what is good for all people in all places (such as many Western norms) have more expansive potential than localized and particularistic normative frameworks.'[450]

There are multiple interesting things here. Clarity and specificity as factors correspond to which appraisals in practice are successful. So does universality; arguments that are only true in specific situations are more easily contested. But of particular interest is that norms that survive many challenges become more robust, in that they become more effective. Why is that? Agents let themselves be convinced by the better argument, in line with what Thomas Risse calls the 'logic of arguing' (an application in the international sphere of Habermas' 'communicative action' and his concept of the '"ideal speech situation"'), which stands apart from instrumental and strategic action and March and Olsen's logics of consequentialism and appropriateness.[451] This helps them choose which norms to follow, at the expense of other norms. But it's conceivable that not all agents approach norms in this way; they could also act strategically and start observing or resisting a new norm in order to mimic or please others because of their moral status or power, as part of a bargaining strategy, to avoid becoming socially isolated, or because they are being coerced or even threatened.[452]

> 'Alongside communicative action, [Habermas] introduces other, exclusively 'teleological' types: instrumental and strategic action. In both of them the actor pursues a goal, choosing appropriate means, and acts according to maxims, choosing and deciding between alternatives. Whereas instrumental action refers to the interchange of individuals with nature, strategic action belongs in a social dimension, together with communicative action (which possesses a teleological aspect). However, the latter implies an inclination towards 'understanding' and 'agreement', in contrast to strategically-oriented conduct, which handles other agents as manipulable objects in correspondence to one's purposes, rather than as subjects.'[453]

The similarity to March and Olsen's logics of consequentialism and appropriateness is apparent. How agents interact with norms is dependent on their moral development, and if we translate this to their role as participants in a practice, we can see how their development will affect their ethical standing. Instrumental and strategic action will only get one so far; communicative action is the mode in which one shows awareness of rights and obligations in practice and can prove itself a competent participant of high standing.[454]

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450 Ibid., pp. 906-907.

451 Risse, Thomas, '"Let's Argue!": Conmunicative Action in World Politics', in *International Organization*, Vol. 54, No. 1 (Winter 2000) pp. 6-11, Habermas, Jürgen, *Theory of Communicative Action, Volume 1: Reason and the Rationalization of Society* (Beacon Press: Boston 1985), Habermas, Jürgen, *Theory of Communicative Action, Volume 2: Lifeworld and System: a Critique of Functionalist Reason* (Beacon Press: Boston 1985).

452 Finnemore, Martha, Sikkink, Kathryn, 'International Norm Dynamics and Political Change', in *International Organization*, Vol. 52, No. 4 (Autumn 1998) pp. 900-901.

453 Domingues, José, Maurício, *Sociological Theory and Collective Subjectivity* (MacMillan Press: Basingstoke 1995) p. 43

454 Moral development of agency and resulting competency in discursive practices were mentioned in Chapter 3, under Frost's Practice-based Theory of International Action, page 99. Though I will be attentive to the stages of moral development of agency as developed by Habermas, I will not develop these ideas further here.

Redefining Regimes

Depending on its institutionalization, a regime can allow for a measure of hierarchy that otherwise doesn't exist in the anarchy. By collectively endowing an international organization such as the IAEA in the NPR with authority to assess compliance with the regime, to apply intrusive verification tools that compromise sovereignty of members and the ability to attach consequences to non-compliance (even in a weak form such as having the power of referral to the UNSC), the international organization gains the responsibility and authority to act as an appraiser, and its appraisals are valued by and valuable to participants in the practice, both in themselves and as a point of reference for states to base their own appraisals on and imbue them with some of the (international) authority accorded the international organization. Because the IO speaks with the voice of its members (in the IAEA for example, through decisions by the Board of Governors), its appraisals are *ipso facto* intersubjective.

As to norm dynamics in regimes, and similar to what Frost said about norm dynamics in practice above, flouting the rules is not just harder 'to get away with'; an actor's standing in the practice or a regime is more severely affected if/when they flout the rules and do not provide a proper 'excuse' for doing so; if/when they fail to pass 'the ethical test'. A good example of a successful excuse in the context of an economic regime is provided by Ruggie, who showed that,

> '… the very essence of international regimes is expressed in cases such as that of France in 1968, asking for "sympathy and understanding" from its trading partners, as France invoked emergency measures against imports after the May disturbances of that year – and getting both from GATT (General Agreement on Tariffs and Trade) even though no objective basis existed in fact or in GATT law for doing so.'[455]

France offered a convincing appraisal of why it should be allowed to temporarily flout the rules, promising to cease the emergency measures as soon as the situation permitted (and doing so), and as a result was not penalized for taking the measures by the other regime members, nor was its standing in practice adversely affected.[456]

Failing to offer an appraisal of their action(s) that convinces the international organization with responsibility over the issue area (and other regime members) that the flouting was somehow warranted, a freak occurrence, a necessity because of external circumstances, violates the norm of regime rule-adherence and will negatively affect the IO's and other participants' appraisals of the rule-flouting, resulting in ethical penalties that lower the participant's standing in the regime as well as in wider international society. Possible motives for strategic action such as deceiving and manipulating other regime members and the international organization, and even to campaign to reduce the IO's credibility and by

455 Kratochwil, Friedrich, Ruggie, John, Gerard, 'International Organization: A State of the Art on an Art of the State', in *International Organization*, Vol. 40, No. 4 (Autumn 1986) p. 765, Ruggie, John, Gerard, 'International Regimes, Transactions, and Change: Embedded Liberalism in the Postwar Economic Order', in *International Organization*, Vol. 36, No. 2 (Spring, 1982) p. 411, fn. 97.

456 Ruggie, John, Gerard, 'International Regimes, Transactions, and Change: Embedded Liberalism in the Postwar Economic Order', in *International Organization*, Vol. 36, No. 2 (Spring, 1982) p. 411, fn. 97.

extension its authority (for example through a media campaign that tries to cast doubt on the IO's impartiality), are thus born. Equally, strategic action towards other participants is possible, for example by bribing or threatening them to withhold or alter their appraisals. In turn those participants risk incurring ethical penalties for offering disingenuous appraisals of the violation, which in itself counts as an ethical wrong.[457]

However, not all rule-flouting results in penalties. When a rule becomes obsolete or unwanted for whatever reason, appraisals can also take the form of norm entrepreneurship and actively contest a rule in support of an alternative norm. If such a norm is sufficiently supported by the regime members, following a norm cascade and norm universalization, this can lead to its institutionalization. This leads me to conclude my argument by positing that, in line with much of what Ruggie, Kratochwil, Onuf and others have said on the subject before, *regimes are the institutionalized vehicle of norm entrepreneurship in a particular issue area*; they are part of the ethical project to integrate and internalize norms into becoming rules of the practice. Regimes are the institutionalized results of negotiations of strategic and communicative action, in which agents apply logics of consequentialism, appropriateness and discourse ethics (the logic of arguing) to perceive of their interests and make decisions.

The consensus definition of regimes can not be harmonized with the before-going theoretical treatment, but we can salvage elements. Let us revisit Krasner's definition once more:

> 'Regimes are defined as sets if implicit or explicit principles, norms, rules and decision-making procedures around which actor expectations converge in a given issue-area of international relations.'[458]

Instead I propose that *regimes are institutionalized areas of practice, organized around an issue area*. In the consensus definition, principles are 'beliefs of fact, causation and obligations'; principles tell agents what the purpose of the regime is.[459] As such, they are reflective of the principles norm entrepreneurs invoke when promoting a new norm but they also underlie all the existing norms in a regime. For the NPR, and most relevant to the subject matter of this thesis, the principle that unchecked proliferation of nuclear technology will create a crisis in international security that should be avoided, while at the same time countries should enjoy the benefits of nuclear technology, informed, informs and likely will inform all past, current and future norms of the regime to do with the rights and obligations of NWS and NNWS.[460] Evolving perceptions on how this should be done and what these rights

457 Frost, Mervyn, *Global Ethics: Anarchy, Freedom and International Relations* (Routledge: Oxon 2009) pp. 32, 69-71.

458 Krasner, Stephen, D., 'Structural Causes and Regime Consequences: Regimes as Intervening Variables', in Krasner, Stephen, D.(ed.), *International Regimes* (Cornell University Press: Ithica 1983) p. 2.

459 Onuf, Nicholas, 'Constructivism: A User's Manual', in Kubálková, Vendulka, Onuf, Nicholas, Kowert, Paul (eds.), *International Relations in a Constructed World* (Routledge, Oxon 1998) p. 73.

460 I say 'likely' because I believe that over time, the principles of a regime can change. Foucault showed us that the rationality projected upon institutions can change over time and that in the absence of critical engagement (through for example constructing genealogies) the reproduction of power in discourse can lead to the construction of frameworks of knowledge about an institution that obscure its original intent, its founding principles. A study of how this can happen in international institutions is beyond the scope of this thesis. See Chapter 2, *Foucault's Critique on Knowledge Creation (and How It's Relevant to Us)*, page 33.

and obligations are explain the existence of competing norms in the regime during its existence and is further discussed below.

> ‘Norms are standards of behavior defined in terms of rights and obligations.’[461]

With rules defined as, 'specific prescriptions or proscriptions for action', we can clearly see here that the consensus definition defines norms as constitutive rules, and rules as regulative rules.[462] A change is in order; we must define norms as explicit, discursively articulated, contestable and the locus of politics, both in practice as well as regime. Norm internalization in a practice is functionally parallel to a norm to cause rule institutionalization in a regime.

Rules in a regime are both constitutive and regulative, embodying both the rights and obligations as well as the specific prescriptions and proscriptions of action, and are universal to a particular regime. Because a regime is a normative project, of *unsettled practice*, these rules are not part of a background understanding as we see in the wider international practice, but do represent the settled part of the regime; they are *constitutive* to it. The institutionalization of a regime provides for these rules to be codified in treaties, bilateral agreements and reflected in the statutes and ‘[d]ecision-making procedures' of IOs that underlie the prevailing regime-specific practices 'for making and implementing collective choice.’[463] Rules therefore represent the most recent institutionalization of the interpretation of the regime's principles.

Regime coherence, which ultimately can lead to its successful transfer into the background of practice, is dependent on coherence of its constitutive elements: principles, rules and decision-making procedures. Unresolved contradictions in these, such as can be seen in the NPR, result in the persistence of competing norms that are visible when regime members among themselves as well as participants of the wider practice of international society offer appraisals in a political debate of which norm should be adhered to, invoking rules of the regime, but also to a varying extend and level of explicitness the norms of the wider practice. The case study of this thesis will showcase several such debates.

Methodology and Sources

As I eluded to before in Chapter 1, 2 and 4, I will apply a thick historical narrative to the case study, as inspired by Michel Foucault's method ('activity') of genealogy.[464] Both process tracing and genealogy have been successfully used in the study of norm origins, yet as of 1998, 'little theoretical work [had] focused exclusively on the process of "norm building,".'[465]

461 Krasner, Stephen, D., 'Structural Causes and Regime Consequences: Regimes as Intervening Variables', in Krasner, Stephen, D.(ed.), *International Regimes* (Cornell University Press: Ithica 1983) p. 2.
462 Ibid.
463 Ibid.. I expect the settled part of a regime to be able, when it becomes universally accepted by participants of international society, to become part of the background of that practice.
464 Foucault, Michel, *“Society Must Be Defended”: Lectures at the Collège de France, 1975-76* (Picador: New York 2003) p. 8. See Chapter 1 for an introduction on genealogy.
465 Finnemore, Martha, Sikkink, Kathryn, 'International Norm Dynamics and Political Change', in *International Organization*, Vol. 52, No. 4 (Autumn 1998) p. 898.

In a strict interpretation, I cannot replicate this kind of endeavor, because part of what the case study has to offer is brand new to the public domain. I follow the idea of genealogy though, by drawing attention to a history of conflicting perceptions that are revealed in detailed historical description of policy negotiation and creation, as I offer in the case study.

The theoretical practice-based turn 'implies a move to more empirical and descriptive work', in which practice-theory is a 'heuristic device' that '"... opens up a certain way of seeing and analyzing social phenomena"' and in which 'practice theory and methodology should be considered as a coherent package', though the implementation of methodology depends on whether one has pragmatist or critical leanings.[466] So far, according to Gadinger and Bueger, much of the methodological prescriptions in the turn have produced negative guidelines; advice on what not to do. Participants observation, which requires the scholar to acquire the internal view of practice and which requires the interpretive method to make sense of the data, is possibly by creating genealogies based on the smallest possible forms of discourse; preferably in primary sources that capture participant action in 'descriptions of detailed situations' (in discourse and behavior), but also in secondary sources that help construct a comprehensive context of practice in which the action takes place.[467] As such, a compromise between pragmatist and critical approaches to practice-based methodology is possible.

The Historical Narrative Method

Ruggie, summarizing Polkinghorne's discussion on the subject of explanation by narrative, adequately sets out how the narrative mode works.

> 'In the narrative mode, causality is not defined in terms of a "constant antecedent" (gravity, for instance), but conforms to its ordinary language meaning of whatever antecedent conditions, events, or actions are "significant" in producing or influencing an effect, result, or consequence. Significance, in turn, is attributed to antecedent factors by virtue of their role in some "human project" as a whole – such as a revolution, in Nagel's example. The narrative explanatory protocol comprises two "orders" of information: the descriptive and the configurative. The first simply links "events" along a temporal dimension and seeks to identify the effect one has on another. These events may be more or less "thickly" (i.e., analytically) described (Geertz 1973). The second organizes these descriptive statements into an interpretive "gestalt" or "coherence structure" (Polkinghorne 1988).'[468]

This is roughly the method this thesis will follow. The first 'order', the descriptive narrative, is provided in the case study, which is a chronologically ordered narrative of the Dutch gas centrifuge program, as it became technologically mature, part of a multinational construction in Urenco, and part of a commercial operation that required the Dutch state shareholder to

466 Bueger, Christian, Gadinger, Frank, 'The Play of International Practice', in *International Studies Quarterly*, Vol. 59, No. 3 (2015) p. 457.
467 Ibid.
468 Ruggie, Gerard, John, *Constructing the World Polity: Essays on International Institutionalization* (Routledge: Oxon 1998) p. 94.

contribute to formulating a Troika nuclear export policy that satisfied its national policy commitments. This case study employs a gradually improving thickness of description, culminating in the client case studies, in which the Troika simultaneously evaluated potential clients of enrichment business, internally negotiated the conditions of its continuation and expansion and defined a non-proliferation policy for its nuclear enrichment services and technology exports.

The foregoing theoretical model of this thesis serves to support the second configurative 'order' of information; it provides the coherence structure through the practice-based constitutive theory of Frost and the practice-based regime theory I've proposed. Ruggie, quoting Polkinghorne, adds;

> '"[it] is not the imposition of a ready-made plot structure on an independent set of events; instead, it is a dialectic process that takes place between the events themselves and a theme which discloses their significance and allows them to be grasped together as parts of one story" (1988:19-20). The aim is to produce results that are verisimilar and believable to others looking over the same events.'[469]

In other words and more simply put, the story needs to make sense. Ruggie proceeds to point out that explanatory modes should match 'the epistemological situation at hand', which in my interpretation means that it makes no sense to hold on to positivist methodologies inspired by the natural sciences, once one commits to a post-positivist approach. He continues to explain that,

> '… the narrative explanatory mode is not limited to "events" as traditionally understood, but can encompass human projects on a Braudelean scale. In international relations, as Richard Ashley has noted (1984), classical realism, in contrast to neorealism, was more likely to have utilized a narrative as opposed to a deductive-nomological explanatory scheme, though on the whole it was relatively unselfconscious about epistemological issues.'[470]

Social constructivism into the post-positivist turn is more self-conscious, but also more able to epistemologically defend a choice to let go of the empirical tradition based on the natural sciences in international relations research.

Causality can be *inferred* from understanding that emerges from constitutive theory applied to historical case study material. As such, it can not have an equal status in epistemology nor be legitimized by ontological constructs that would somehow be able to 'explain' causal relations. Causality is part of the generation of conclusions that takes place after applying constitutive theory and the historical-narrative method to the case study. A historical narrative uses chronology to create structure while allowing a high level of detail based on participants self-understanding to open up space for 'complex, often nonlinear and incoherent narratives that include multiple voices of practitioners'[471]. This incoherence should be allowed and embraced, as it reduces our penchant to do structural violence to the narrative by sweeping all events into

469 Ibid.
470 Ibid., p. 95.

a chronology that can claim total causal internal consistence. At the same time, some constitutive elements (structure) will allow us to make sense of the whole, to increase clarity of why things happened the way they did, to provide plausibility to the narrative.

The case study in this research project will also function as providing items of confirmation of the existence of the ontological concepts I've chosen to examine; whether or not state actors, through their officials and bureaucracies, and other actors influencing international policy, (discursively) act as if they are constituted in practices, and whether or not they (discursively) act as if they they are acting within a regime.

Application of the Theory to the Case: Hypotheses

Focus of Analysis

To uncover the normative conflicts between states and within states, we need to localize these conflicts in the practices in which they take place. For non-proliferation norms and the norms with which they conflict (such as the norm of sovereignty and, tied in with it, the norm of the pursuit of national interest through economic independence), it is helpful to create an overview of the relevant practices that connect(ed) to the the issue area of nuclear non-proliferation. Key focal point will be indicators of non-proliferation norm entrepreneurship (international 'lobbying' for the tightening or loosening of rules, the reform of decision-making procedures, in service of the observance or change of norms and principles of the regime). Does the norm entrepreneurship of actor X as reflected in discourse and action show a consistency with the principles and contemporaneous norms of the non-proliferation regime? Is the norm entrepreneurship or conservatism of actor X more conform with strategic or communicative action?

The chosen case study lends itself to such questions because the particular normative questions on non-proliferation as related to commercial policy (and related economic interests) and how the relevant actors evolved their perception of their interests, as around them circumstances changed and norms developed, are relatively isolated to and focused around the conflicts within the Troika, and its collective (but also individual-country) discursive interaction with customers, allies, competitors and international organizations. Exploring and finding a convincing narrative that reflects this is in itself a worthwhile endeavor. Connecting such a narrative to IR theory adds additional value.

The Application of Practice-based Theory to the NPR

Frost's constitutive theory of international practices sheds light on why regimes are so useful in addressing dilemmas of policy coordination in the SOSS and GCS; they 'set aside' a particular policy area that features particularly complicated contradictions of interests of

471 Bueger, Christian, Gadinger, Frank, 'The Play of International Practice', in *International Studies Quarterly*, Vol. 59, No. 3 (2015) p. 458.

actors over the short, medium and long term into an institutionalized area of practice. These contradictions can be between the expressions in the regime of the competing norms of the SOSS and GCS and within them, or a combination of these. This institutionalized area of practice allows participants the benefits of relatively depoliticized, technocratic interaction and negotiation in the issue area, facilitated by a high measure of articulation and codification of principles and rules and decision-making procedures to be followed. In turn, membership requirements, rights and obligations in a regime are more clearly defined than in the wider practice, which facilitates actor's appraisals of their own and others' actions in reference to the norms and rules of a regime.

For the nuclear non-proliferation regime, such contradictions are seen in the main treaty of the regime (NPT) itself, as it institutionalized a discriminatory prohibition (regime rule) of nuclear weapons, as well as the unequally placed burdens upon its members, in the strict sense that the safeguards sub-regime only applies to non-nuclear weapon states (regime rule). Furthermore, the safeguards sub-regime in itself is an example of a locus of competing norms; it promotes the norm of responsible nuclear technology use (regime norm), while it compromises the norm of sovereignty of the SOSS. Similarly, a regime norm advocating the limiting transfers of sensitive parts of the nuclear fuel cycle in the interest of non-proliferation had to contend with the SOSS norm of free trade, both as part of the NPT (set down in Article IV: a regime rule) as well as subscribed to as a norm by sizable portion of participants in the SOSS (during the Cold War, at the time the issue came up).

This left regime members to figure out among themselves, in the process of further constructing the regime in the 1970s and 1980s, which norms to give precedence and which to compromise on, including those of the wider international practice. Put differently, NPR members and non-members alike were figuring out the balance between their rights and responsibilities regarding the risks of proliferation and the benefits of nuclear trade. Consequently, individual and coalitions of states would champion one norm over another, united by a common perceived interest in preventing further proliferation, the further compromising of equal access to nuclear technology or as an aspect of the norm of state sovereignty. In the Urenco/Troika case study, we see the international norm of restrictive trade practices for non-proliferation purposes gain strength in a gradual way over the case study period.

Some of these contested issues in the non-proliferation regime were reflective of the greater contests of the international practice going on at the time; the Article IV issue of equal access to technology for example was perceived by participants in the wider international practice as reflective of the struggle for more equal (trade) relations between the global North and South. We see elements of this appear in the Yugoslavia and India cases, with Yugoslavia requiring centrifuge technology alongside fuel contracts to support its energy independence (and/or its nuclear weapons program) and India refusing to bend to Western nuclear safeguards requirements on nuclear imports.

One clear example of such norm contestation is the gradual strengthening of international nuclear safeguards. The inadequacies of the safeguards sub-regime, exposed over time,

resulted in the norm of transparency to verify responsible nuclear technology use becoming more demanding, which in turn resulted in repeated clashes with the wider sovereignty norm, to which regime members appealed in order to resist more intrusive and burdensome safeguards inspections. Some of that evolution is captured in the historical narrative of this thesis; GCEP cascade hall access for the IAEA was a contentious issue that from the late 1970s into the 1980s exposed some of the difficulty of bridging the contradictions in the NPR as they became entrenched in the political positions of the different stakeholders. With NWS GCEPs not subject to safeguards under the NPT, the Troika sought and extracted considerable political compromise before it allowed international inspectors access to the most sensitive part of its facilities, exposing itself to an additional safeguards burden and the risk of (commercial) espionage for the sake of supporting and strengthening the regime.

Likewise, strengthening of a non-proliferation norm was for a time resisted, when second generation nuclear suppliers initially refused to have their nuclear trade efforts subjected to restrictive nuclear transfer guidelines that hadn't affected the first generation nuclear suppliers (particularly the US). Therefore, they made the ethical claim that they were as entitled to compete under the conditions and restrictions their entrenched competitors had enjoyed for a share of the nuclear energy market. This particular part of the regime's evolution features heavily in the case study of this thesis, because of (Troika member) the FRG's prominent political and economic role as a second generation exporter. The FRG’s Kraftwerk Union (KWU) faced an uphill battle trying to break into the nuclear reactor export market, faced with the already entrenched US competitors that were not skittish to play dirty. In the context of the Troika members coming to understand their partners' perceptions on their individual and collective rights and obligations, the case study shows the norm of free access to markets and competition to have regularly clashed with the norm of non-proliferation and responsible stewardship of sensitive nuclear technology. Inter-Troika bargaining between these responsibilities and economic interests during its first decade strongly determined how the collaboration would eventually take shape through institutionalization and convergence of perceptions of interest.

Simultaneously, international forums served to address the contradictions in the NPR and the Troika members actively participated in these. Three forums stand out as particularly impact-full in the case study period and in relations to the issues discussed above: the Nuclear Suppliers Group (NSG), the International Nuclear Fuel Cycle Evaluation (INFCE) and the Hexapartite Safeguards Project (HSP). These forums (temporarily) added an additional layer of institutionalization to the regime, in which issues were isolated and depoliticized by a heavy involvement of the relevant epistemic community and through the structure and agenda-setting of the forums as well as the technical nature of discussions, facilitating communicative action. These forums, as means of communication and coordination, allowed for the logics of appropriateness and arguing (discourse ethics) to recognize and articulate common responsibilities and prevail over the main regime contradictions between NWS and NNWS as well as over individual state pursuit of narrow (short and medium-term) economic interests. In doing so these settings allowed the participants (including our main protagonists in the Troika) to explore and (re-)define their roles as participants in the NPR practice and in wider international society. Were they going to be detractors from that common responsibility

or instead actively engage with it and even champion it as norm entrepreneurs? The case study will show that it was (mostly) the latter and that these forums resulted in the effective formation of widely carried norms (among participants) that provided strong references for future action.

How do these findings relate to the theoretical arguments with which I started this thesis out with? Could I have explained these findings using traditional IR theory and have come up with an equally convincing argument? Below follow three hypotheses that can serve as a starting point to address these questions and relate them to the case study.

A theory of International Relations provides a way in which we can view the world – a perspective, a lens to interpret action with. The theoretical work in this dissertation provides a nuance, a small addendum, to a particular school of theory, of which there are many. And although the comprehensiveness of the approach with which I have sought to introduce this addendum, these hypotheses, as well as the classic theory-followed-by-case-study structure of this work as a whole, may create the impression that the case study's purpose is to 'prove' the theory to be right, I do not believe any single case study can accomplish this. The case study can merely illustrate that the consideration of this perspective, this way of interpreting international relations, is worthwhile and that it helps us better understand this particular case, the story of Dutch non-proliferation and export policy with regards to ultracentrifuge technology and its exploitation by Urenco. That is what I have sought to do, and these hypotheses and the case study that follow should be seen in light of this limited ambition.

Hypothesis I

Realism's (and other traditional theory's) state centrism, drawing strong boundaries between inside and outside and casting the state as a unitary actor is untenable. Therefore, an ontological choice that takes the constitutive nature of the state seriously, recognizing that both national and international social processes affect its policy-choices is imperative.

State-centric theory ignores sub-state level practices and the normative pressures that these put on national policy-makers. When national policy-makers respond to these pressures by altering policies and defending changes on ethical grounds, and exhibit a long-term commitment to such policies, non-constitutive theory that ignores the role of norms in international society cannot offer a satisfying explanation of such policy outcomes.

Question I:

How does the case study show that an inside/outside distinction (theoretical state-centrism) is inadequate to explain foreign policy outcomes? Why is a constitutive theoretical model needed?

Hypothesis:

State actors are not unitary actors; their 'perceptions' are made-up of the participants in the practices in which the state interests are given meaning and policy is formulated and coordinated. Therefore the case study shows attention to what we can collectively call the non-proliferation practices, with a focus of those in the Netherlands. But which practices have relevance to non-proliferation issues as they emerge from the commercial industrial operation of the Troika collaboration? Three dimensions seem relevant: the technical, commercial and political.

1. Technical practices: besides nuclear technology itself, relevant technical practices concern those in which the nuclear safeguards experts work on non-proliferation issues. Practitioners in this practice can be found in national and international laboratories that develop technical safeguards solutions, such as the European Union Joint Research Center, the national laboratories such as in the United States (Los Alamos, Lawrence Livermore, Brookhaven, Sandia, etc), the EURATOM and IAEA directorates of safeguards and of technical assistance, national nuclear commissions and independent contractors.

2. Commercial practices concern those actors pursuing commercial interests that touch on non-proliferation considerations: national and international nuclear industrial corporations that sell uranium enrichment services (Urenco, USAEC, Eurodif, TENEX), independently or in package deals in collaboration with nuclear reactor vendors (KWU, Westinghouse, etc), national export licensing authorities (usually ministries of economic and/or financial affairs), state officials tasked with acquisition of nuclear infrastructure, and illicit networks of suppliers and traffickers, whether run on behalf of a state or not.

3. Political practices contain those national and international non-proliferation practices that formulate and coordinate policy (in the relevant departments in national ministries of foreign affairs and economic affairs, parliamentary oversight committees and individual actors, international bureaucrats and national representatives in international organizations such as the IAEA and EURATOM in for example the IAEA Board of Governors, IAEA secretariat and its relevant directorates, and such as the Nuclear Suppliers Group (NSG), the Zangger Committee, as well as commentators on and critics and advocates of national and international policies in NGOs, think tanks, and less so from academia.

Many of these participants must necessarily be relegated to supportive cast roles, as part of the context, as I chose to focus on formulation and evolution of the Dutch and Troika non-proliferation policies as above described. Some parts of this support cast will receive more introduction than others, as they play a greater role in and are themselves constitutive of the non-proliferation practice; an example of these are EURATOM and the IAEA organizations and their officials. As part of the Dutch representation in the Troika, the Council of Europe and Scientific Cooperation Directorate (DRW) of the Dutch Ministry of Foreign Affairs was

the driving force behind promoting non-proliferation concerns and interests in the political practice for the period under study; it thus features prominently in the case study.

The case study also shows that political and social parties and movements influenced the formulation of foreign policy in the Netherlands during the case study period. This exhibited itself not just in the regulative sense that the Dutch Parliament took an active role in dictating the boundaries of Government policy in nuclear exports and accompanying non-proliferation responsibilities. Some of those non-proliferation practitioners in Parliament were strongly influenced by the anti-nuclear groups in Dutch society. Over time, the Troika partners therefore also became attentive to how the issue of international exports was situated the broader public debate in the Netherlands.

So how should we understand the role of Realism in the real world when we acknowledge on the one hand practices as making up the constitutive structure of international relations and on the other the pervasiveness and significance of norms in those practices? Clearly, Realism isn't just theory that describes the structure of international relations from a particular perspective, assigning the actors in that system certain characteristics that drive their behavior. Regardless of whether we think this theory and its assumptions are convincing and why, even when policymakers, diplomats, academics and commentators do not let it completely determine their perception and behavior, it certainly alters and informs those; acting upon Realism's prescriptions makes the theory relevant in the 'real world'.

I have shown there are historical reasons for this, but there are also pragmatic ones. Being able to reduce the complexity of international politics by thinking of states as unitary actors that act according to an uncomplicated set of preferences that reflect narrowly defined core interests is attractive. Particularly when those interests are so broadly defined ('security', 'power') that *post hoc* corrections can always be made as to what they mean in practice.

Similarly, we often see diplomats speak the unitary actor-language casting their state’s policy as something uncritically a-historic; a blanket truth that the state as a whole subscribes to. Those trained professionals knowing better (participants in the diplomacy practice, whether officials or civil society experts) are aware that many of such statements are the product of internal contestation and may even as they are spoken still be controversial within the state.

Though overcoming the institutional preoccupation with Realism is a challenge in itself, the real benchmark that any new theory must live up to is whether it can be inclusive of the world that has been described, explained and in turn shaped by traditional theory. That is a much higher bar than Realist theorists hold themselves to and are held to by others; a clear sign that Realism still occupies a position of privilege. New theories must take Realism into account and prove the world is not a realist one; the burden of proof is mostly one-sided. Only when serious challengers that speak the same positivist language come along, such as when Liberal Institutionalism exposed the weakness of realist account on the endurance of institutions and the importance them to provide participating actors with information, realist theorists are forced to engage.

There are good reasons why Realism can no longer be the IR field's reference point and why on several grounds it must be rejected. These reasons have been set out in the previous chapters, but the most important ones are summarized below. Doing so can help clarify the important questions that theory as applied to the case study must conform with.

Hypothesis II

Realism (and other traditional theories) operate on rational choice or rational design principles in a positivist epistemology. Positivism and its preoccupation with observables, empirical methods (such as a requirement of falsification) and 'objective laws that have their roots in human nature' (such as stable state preferences and interests) is not suitable to study complex human behavior and the institutional artifacts that behavior creates. Important aspects of human behavior are not determinable through a value-free method and human societies do not follow natural laws. Post-positivism offers the superior epistemology in IR because it takes into account the position of the social scientists in the practices they study, the mutable nature of social life and the roles of history and discourse in that evolution. Epistemologically and ontologically it allows structure and agency to be theoretically understood as mutually constitutive, opening up a space for how socialization processes evolve perceptions of self and others.

Question II:

How does the case study show a justification for post-Positivism's use over a positivist epistemology? What justifies a subsequent choice for international practice theory?

Hypothesis:

The case study shows that the constitutive practice-based regime theory and its accompanying ontology that serve as background to the case study allow for a greater understanding of its historical narrative. Particularly on the subject of norms will the theory and case show the relevance of going beyond positivism and its requirements.

The argument starts with an assumption and the evidence that convincingly show that assumption to hold. That assumption is that products of intersubjective understanding such as social rules and social norms exist, matter but are not directly observable in the positivist sense. In fact, we can only indirectly observe them through the discourse of practice participants, either when they reference them explicitly, implicitly or otherwise show their awareness of them (for example, through rationalizations of behavior). This awareness is particularly visible in the case study when we see the Troika adhere to and adopt its long term policies in accordance with international norms. By adopting a positivist epistemology, traditional theory cannot address the status of norms in international society. This is so

because an ontology based on a positivist epistemology cannot adopt intersubjective elements; it's concepts are bound by strict prescriptions that disallow non-observable phenomena and exclude the role of the social background in perception, even though some phenomena require an insider-perspective to be understood in their historical and social contingency (the practice). Put simply: to a positivist IR theory, norms do not exist.

This thesis argues that even though actors in international politics often follow Realist policy prescriptions and may seem to act predictable according to rational choice-type set preferences, they in fact operate in an environment that has a much deeper, more complex and dynamic structure enabling and constraining their choices. A priori-given actor preferences are ontologically primitive and cannot account for the roles that learning and socialization play in evolving the identities and perceptions of actors, as both Young and Frost have shown. In the case study's context of the evolving NPR, the FRG's preferences regarding nuclear exports clearly change over time, with much more emphasis on non-proliferation considerations later on, reflective of the evolving international norm.

A structure that can account for those is an international society made up of practices, in which state actors have a social identity as participants that continuously develops subject to their geography, history, cultural perceptions and a myriad of other factors and that sees them recognize other states as fellow participants and in which all participants make ethical appraisals at almost every turn. In the case study, we see Dutch officials and the Troika appraising every client state as part of the determination whether to explore or take up enrichment contracts with them. The evolution of social structures (social rules and norms) alongside the evolution of the identity of participants in such a society (state actors as practice participants) is a mutually constitutive relationship that requires the kind of ontological complexity and dynamism that only a post-positivist approach allows. Practice theory echoes many of these conditions: it rejects individualism and incorporates the irreducibility of structure and agency in its ontological concept of practices. It rejects functionalism and recognizes human intention and motivation as important to include in theoretical constructs. Practice theory recognizes that agency and social structures form a dialectical relationship that is space and time-contingent.

Hypothesis III

The third important reason why a sophisticated practice-based regime theory allows for superior analysis of the evolving NPR during the case study period is the nature of the regime's persistence and continued evolution.

The NPR as a whole, and nuclear export norms in particular (the subject of this thesis) became more restrictive during the case study period, even though influential actors (namely the US) ceased to invest in its norm entrepreneurship in this area at the start of the 1980s. Nuclear proliferation presented international society with a collective-action problem that required more than a temporary commitment to cooperation.

Question III:

How is the NPR's persistence and evolution better understood through application of a practice-based regime theory and how does the Troika case study contribute to that understanding?

Hypothesis:

A post-positivist constitutive theory of regimes that casts regimes as institutionalized areas of practice is necessary to explain and understand the social dynamics that are the locus of change in this institution, which are intersubjective in nature. To understand change in a regime, we must look at how the effects of regime rules and norms, and particularly the means by which those can evolve, constrain and empower regime members. A departure from positivist epistemology is therefore required because theories based on it are not equipped to engage with the intersubjective agent-structure relationship in which not material but ideational factors explain change.

I contend that the NPR's persistence and evolution can only be explained by the mutual recognition between regime participants that a measure of trust is required for states to practice self-denial (of for example, short and medium-term economic and energy security gains). The growth of this awareness by states during the case study period from the 1960s into the 1980s flies directly in the face of the realist assumption that mistrust is endemic in IR and no international institution will survive a lack of hegemonic actor-backing and investment. A separate, institutionalized area of practice (a regime) was necessary to isolate political discussion on nuclear non-proliferation and disarmament issues from the wider international practice. Steadily, as the norm of non-proliferation became more compelling and regime membership grew, members were willing to accept more constraints on action and intrusive elements of control in the knowledge that to lesser or greater degree their fellow participants, valuing their standing in the regime and the regime itself, would as well. The case shows that despite strong commercial competition, the Troika chose to commit to a policy of export restraint as well as to accept an instrusive and expansive safeguards inspection regime at its facilities. By doing so, they took a norm entrepreneurial role in the regime.

The case study also shows the development of Dutch and Troika non-proliferation policy in the wider context of the evolving NPR. It furthermore shows that norms and intersubjective appraisals played a central role in how policy decisions were made. Every instance an actor in the case study made reference to a norm or an institution connected to a norm (for example, a reference to the Nuclear Supplier Group and its norm of export restraint) and particularly when that norm was emergent, shows how they identified with its normative content and recognized ways in which it would serve or subvert their state's long term interest. Moreover, actors recognized and actively supported or opposed such norms through their national

policies because they perceived them to reflective or contrary of their state's identify and its ethical standing in international society. The broad resistance to US non-proliferation policies in the 1970s can be explained not just by how it affected the economic interests of other states, but by the US its strategic use of ethical claims. Subsequent forums in which it sought to further particular norms (NSG, INFCE, HSP) therefore required significant US political concessions to compensate for its lowered ethical standing and the case study shows this.

The case study does, to my knowledge, not evidence the transfer of an international norm into the background of the international practice. However it does provide strong evidence of the institutionalization of a norm as a rule in the regime as well as of other norm dynamics. It shows how a norm emerges through norm-entrepreneurial activities by states and their officials, how it becomes a reference point and subsequently a standard of behavior in the regime. The case study thus presents a historical narrative that is more consistent with the above offered alternative definition of regimes than with the traditional consensus definition. It also showcases norm entrepreneurship by states, particularly the Netherlands and the US, through the policy-making decisions of their officials, as well as other normative behavior by regime members consistent with what a practice-based normative interpretation of regimes would expect to see.

The case study will certainly not serve to prove all epistemological, ontological and theoretical arguments that have been laid out above and in the previous chapters. No single case study could do so convincingly for the whole of international society or even for a single regime with the scope of the NPR, and so my ambitions are more modest.

I believe that in what follows I convincingly show that intersubjective appraisals are at the heart of social relations in international society, in line with the sociology of Giddens and the theories of Ruggie, Kratochwil and (most importantly) Frost as I have presented and interpreted these. These appraisals are carried out by government officials and others in national, bilateral and multilateral settings. A regime such as the NPR, as an institutionalized area of practice, provides a set of ethical benchmarks for these appraisals that makes the behavior of other states' policies more accessible to evaluation. The case study will showcase a range of these appraisals in different issue areas of the regime, as they are carried out.

Use of Sources

Arguably the most unique contribution this thesis makes to the academic domain, is that its narrative is partly based on a collection of primary sources that are new to the public domain. These archival sources have been made available to this research by the Ministry of Foreign Affairs of the Netherlands, subject to a specifically designed protocol to safeguard their responsible use. This protocol is based on older protocol that ministries in the Netherlands had used to give research journalist José Toirkens extensive access to their respective archives. Therefore, I have dubbed the revised protocol the Toirkens-Voûte Protocol. The full Protocol

can be found in Annex I. The used archival (codified) sources from the archives of the MFA are added to a separate section of the bibliography.

The generous access that the Ministry of Foreign Affairs provided to the members of the Proliferation Studies Project, of which this thesis is part, allowed me the freedom to choose the subject of my research without much restrictions. Nevertheless, some access was still denied; archival records with the designation Urenco or Joint Committee, which are subject to a mode of classification that requires treaty-partners to also provide permission for access, remained off-limits.

The access provided directed me towards a wide narrative approach, because the archival documents told many stories, but those stories were often fragmented across a myriad of documents and also incomplete; if the resulting case study gives the impression of being a complete narrative, this is because I varied the 'thickness' of it based on the source material available. Yet arguably, it's about as a complete a story one will be able to draw from the MFA archive, for this period and with this level of access, on these subjects featured in the case study. Additional research to make the narrative more complete would do well to on the one hand, secure access to Ministry of Economic Affairs (MEA) archives, as well as secure permission from the Troika countries to access to documents classified with the label Urenco and Joint Committee from both the MFA and MEA archives. Particularly, access to JC documents would allow more insights into why the Troika rejected certain customers; this often does not become clear from that sources available to this project. Naturally, similar projects making use of United Kingdom and German classified sources would complete the picture. Perhaps a coordinated research effort involving scholars from the Troika countries could negotiate such access and complete the story in the future.

The case study period was similarly inspired by the nature of the access I enjoyed. The Toirkens-Voûte Protocol was designed to mediate an administratively burdensome procedure regulated under the Wet Openbaar Bestuur (WOB – the Public Information Act), a law that allows the public to petition the Government to declassify any documents in its archives that were created more than 30 years ago. Therefore, I chose to search the archives up to the years 1986-1987; the latest date I imagined handing my dissertation to be 2016-2017. The (focus) period in the case study that makes use of classified sources therefore is set from 1976 to 1989, though the larger case study runs from before WWII to beyond 1990.

Besides the still classified archives of the Dutch Ministry of Foreign Affairs, I've used declassified primary sources from them, as well as from the National Archives of the United Kingdom and of the National Archives of Australia.

I've used (newspaper) articles, (working and conference) papers, books, chapters in edited books, dissertations, and all sorts of official documentation material I thought of relevance to the narrative. I've attempted to represent the content of these sources as truthfully as possible, yet always interpreting the meaning of the texts, the biases inherent in them and the affiliations of the author(s) or publication. As much as was practical and possible, I've used sources contemporaneous with the events they describe, to best capture periodically relevant perceptions of those.

While researching and writing, other authors have caught up with me and published relevant material, and I've attempted to use as much as reasonably possible in my own text. During the period of writing (for obvious reasons) I was not able to share a large portion of my case study with commentators, and the text may have suffered some because of that. I have had the benefit of commentary on some other parts of my thesis however, and its important to note that any faults remaining in those pieces of the text that benefited from such commentary, are entirely my own.

A couple of sources need to explicitly mentioned because of my elaborate use of them. Most importantly, this concerns the work of R.B. Kehoe, who wrote an extremely comprehensive history of Urenco from its early history, to its foundation, up to the year 2000.[472] I could not have constructed the narrative of Urenco and placed the sources I uncovered in the Dutch Foreign Affairs archives so neatly in an overall history, had this history not been available to me. I've attempted to give full credit to all the research Kehoe did by extensively referencing his *The Enriching Troika: A History of Urenco to the Year 2000*, but sometimes needed to find additional sources for his claims because his book is not academically footnoted. Nevertheless, in cross-referencing its information with other sources, I found it to be a highly accurate and dependable resource.

Another important source is Frederik Den Haan's, *De Urenco-kwestie: De leverantie van verrijkt uranium aan Brazilië*.[473] It allowed me to corroborate much of the case study work on Brazil, and also served to show me in the context of my initial archival exploration that there was more interesting history to uncover when it came to Urenco's customers and the Government's and Parliament's involvement in shaping Dutch non-proliferation policy, particularly as it related to Urenco.

Elmar Hellendoorn's thesis, *Between the Devil and the Deep Sea - The Netherlands and the Struggle for European Nuclear Order*, as well as Tom Coppen's *The Law of Arms Control and the International Non-Proliferation Regime: Preventing the Spread of Nuclear Weapons* as well as this thesis are all part of the *Proliferation Studies Project*, an academic project by the universities of Utrecht and Rotterdam, funded by the Dutch Ministry of Foreign Affairs, which sought to rebuild nuclear non-proliferation expertise in the Netherlands, by sponsoring these Ph.D. students.[474] Hellendoorn's thesis' subject has some overlap with mine, but I found his selection of historical period to neatly dovetail with my own, and so hardly any substantive overlap exists. Nevertheless, his narrative provided me with a valuable source to describe some of the historical background of my case study, as well as corroborate some other sources, for which I am grateful. As Tom Coppen took a contemporary subject on the subject of international law, I've not used his text in my own.

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472 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002).

473 Den Haan, Frederik, M., *De Urenco-kwestie: De leverantie van verrijkt uranium aan Brazilië* (Instituut voor Internationale Studiën – Rijksuniversiteit Leiden: Leiden 1985).

474 Hellendoorn, Elmar, *Between the Devil and the Deep Sea - The Netherlands and the Struggle for European Nuclear Order,* Ph.D. Dissertation, Faculty of Humanities, Utrecht University (April 2016), Coppen Tom, *The Law of Arms Control and the International Non-Proliferation Regime: Preventing the Spread of Nuclear Weapons* (Brill Nijhoff: Leiden 2016).

William Burr's work for the National Security Archives is of great importance to non-proliferation scholarship. I've used many of the sources he has uncovered and evaluated on its website, as well as his stand-alone publications in academic journals. His work was instrumental for me to get a good inside perspective on the thinking of US officials in the period covered in my thesis. His spring 2017 article in the *Journal of Cold War Studies* made my summary of American classification policy based on his work for the National Security Archives website partly redundant; the most prominent example of how new scholarship caught up with my lenghty thesis-writing process.[475] I'm very appreciatively of his work and hope he will judge kindly on any overlap our work shows, and read the rest of my thesis with interest.

Another instance in which this happened is when Abel Streefland published his book *Jaap Kistemaker en uraniumverrijking in Nederland 1945-1962* in September 2017, on which thesis he defended his Ph.D. the same month. After handing in my own Ph.D. thesis in December 2017, I was made aware of it by my professor. Again, as with Burr's publication, there was overlap. In this case, it mirrored some of the research I did in the Dutch National Archives. Working through Streefland's book in order to properly reference it in my thesis, I came across several interesting facts of which I had not been aware and which I have as much as possible incorporated in my narrative. I also found that his research focus for the relevant period was different from mine, mostly centering on the person Kistemaker, his contribution to the Dutch gas centrifuge project and the domestic policy politics surrounding the project up to the moment he took his leave in 1962.

I also need to mention the valuable work that the Nuclear Threat Initiative (NTI) does in providing historical information on nuclear weapons and energy related subjects. Besides important advocacy work on matters of nuclear non-proliferation, NTI has a legitimate online collection on a myriad of subjects that are based on academic sources, for which public availability I am grateful.

Syntax of References

I've used references whenever I take an idea or direct quotes from other texts. In the case of direct quotes, I immediately place the reference at the end of the sentence. In the case of one or more ideas, I place the reference at the end of paragraph, or before the next sentence with a direct quote, in order to maintain clarity of what is referenced at a particular point in the text.

As to the references themselves, I've attempted to maintain a syntax that is efficient, clear and not overly convoluted in the information it attempts to provide. This system of syntax has been adopted from the Chicago style of referencing, but contains slight alterations. I include titles of articles and their publication, titles of books, names of authors and/or editors, and in the case of a stand-alone publication (a book), a publisher, when possible its place of publication, and a year. Articles from journals include volume and issue numbers, indicated

475 The article is Burr, William, 'To “Keep the Genie Bottled Up”: U.S. Diplomacy, Nuclear Proliferation, and Gas Centrifuge Technology, 1962, 1972', in *Journal of Cold War Studies*, Vol. 19, No. 2 (Spring 2017).

by 'Vol.' and 'No.'. Chapters from edited books will be separately mentioned with their author and title in between single parenthesis, as are article and (working-)paper titles. The main publication (whether the (edited) book-title or name of the journal, etc.) will be *italicized*.

I've used the Latin term *Ibidem* (short: Ibid.) when a source is repeated in two references directly following one another. When the second and following references of the same source refer to the same page-number or page-numbers as the first one, I will use 'Ibid.'. When they concern different page-numbers, I added these after; 'Ibid. p. x', or 'Ibid. pp. x-y'. As shown, I will indicate sources from which a single page is used with 'p.', and when more than one page is used, 'pp.'

In the text, I've retained the economic-financial data in guilders, the historical currency of the Netherlands during the period of study. I've added amounts in dollars in historical terms. These dollar amounts are calculated using historical exchange rates, and these should be interpreted as approximations. The tools to calculate these are for the earlier period up to 1971 the MeasuringWorth website, which only features yearly exchange rates, and for the period from 1971 the United States Federal Reserve Bank statistical release service, which provides daily ones.[476]

Syntax of Quotations

Partial sentences and terms taken from other texts are singly parenthesized ('example'). When parts of a text longer than a sentence are quoted, a separate, indented, paragraph is created, between single parenthesis. If a quoted paragraph starts in part of a sentence, I indicate this by leading in this sentence with three periods followed by a space (…) In such a paragraph, if I leave out a full sentence from the quoted text, this is indicated by four periods followed by a space (….). When for reasons of clarity or grammar the content of a quotation is altered, the altered content is placed between brackets; [content]. If another quote is quoted, and text from the original quote is left out, this is indicated by three periods (…).

476 Officer, Lawrence, H., 'Exchange Rates Between the United States Dollar and Forty-one Currencies', MeasuringWorth website, http://www.measuringworth.com/exchangeglobal/, 'Netherlands – Spot Exchange Rate, Guilders/US$', Historical Data, H.10 Foreign Exchange Rates, Federal Reserve Statistical Release (United States Federal Reserve Bank) https://www.federalreserve.gov/releases/H10/hist/dat89_ne.txt, websites checked 30-7-2018.

Chapter 6:

Dawning of the Nuclear Age & The Nuclear Non-proliferation Treaty and Regime

The Nuclear Fuel Cycle & Nuclear Weapons

The industrial process that translates the energy potential of nuclear fissionable material into an electric current that comes out of your wall socket, or that produces medical isotopes using a reactor's irradiating qualities, is called the nuclear fuel cycle. We speak of a cycle because it involves a sequence of processes that involve different technologies in facilities that often are at different locations and requires transport of nuclear material from one location to the next, but that serve one purpose; the production of nuclear fuel and its use in reactors. In most cases it is merely a sequence and not a cycle, but we can speak of a 'true' cycle (a closed cycle) when a state's nuclear energy program involves reprocessing facilities that extract remaining and newly produced (through the process of the irradiation of nuclear fuel in a nuclear reactor) fissionable material from the spent fuel from nuclear reactors and makes new fuel from it.

There are several ways to schematically capture the nuclear fuel cycle. The first one distinguishes between a front end and a back end of the cycle; 'steps in the fuel cycle that precede the introduction of the fuel into the reaction are referred to as the front end of the fuel cycle. Those that follow the removal of the fuel from the reactor comprise the back of the fuel cycle.'[477] The second categorical subdivision is between types of cycles; the *Once-through cycle*, the *Reprocessing fuel cycle*, and the *Breeding cycle*.[478] The latter two are closed cycles, as the used (irradiated) fuel coming out of reactors is reprocessed and the extracted fissile material can again be used for power production. Most countries operate a Once-through cycle, because of the relative abundance of uranium deposits across the world and the resulting low price of the natural uranium, as well as the economic efficacy of Light Water Reactors (LWRs). Other reasons it is favored are the technological and operational challenges inherent in industrial-scale reprocessing and the breeding cycle, as well as the political pressure particularly from the US to move countries to forgo the closed cycle.[479]

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477 Bodansky, David, *Nuclear Energy: Principles, Practices, and Prospects*, Second Edition (Springer-Verlag: New York 2004) p.195.

478 Ibid., p.194.

479 Fissile Material: Definition '4.5. Special fissionable material — "plutonium-239; uranium-233; uranium enriched in the isotopes 235 or 233; any material containing one or more of the foregoing; and such other fissionable material as the Board of Governors shall from time to time determine; but the term 'special fissionable material' does not include source material" … 4.6. Fissionable material — in general, an isotope or a mixture of isotopes capable of nuclear fission. Some fissionable materials are capable of fission only by sufficiently fast neutrons (e.g. neutrons of a kinetic energy above 1 MeV). Isotopes that undergo fission by neutrons of all energies, including slow (thermal) neutrons, are usually referred to as fissile materials or fissile isotopes. For example, isotopes 233U, 235U, 239Pu and 241Pu are referred to as both fissionable and fissile, while 238U and 240Pu are fissionable but not fissile.', *IAEA Safeguards Glossary 2001 Edition*, International Verification Series No. 3 (International Atomic Energy Agency: Vienna 2002) http://www-pub.iaea.org/MTCD/publications/PDF/nvs-3-cd/PDF/NVS3_prn.pdf, website checked 12-7-2017., pp. 30-31.

Front End of the Fuel Cycle

The front end of the fuel cycle is understood to include uranium (or thorium) *mining* and *milling*, *conversion*, uranium *enrichment*, and *fuel fabrication*. In general, we can speak of a front end nuclear process when it takes place before the insertion and irradiation of nuclear fuel in a reactor core.

Prospecting, Mining and Milling: Not usually considered part of the nuclear fuel cycle, prospecting is essential for finding the uranium or thorium suitable for extraction. Prospecting has led to the discovery of many size-able deposits (large ones can be found in countries such as Australia, Kazachstan, Uzbekistan, Canada, the US and the Russian Federation) which in turn has affected choices between different nuclear technologies in the past. The aforementioned dominance of the Once-through cycle has resulted in a relative steady continuously growing demand for uranium ore. Thorium is not a fissile material, but can be used to 'breed' fissile material (U-233) for use as nuclear fuel.[480] Uranium is found in rocks in the form of uranium oxide and in seawater as uranyl tricarbonate ion. While seawater extraction has been explored, uranium mining is currently the only process in industrial operation.[481] Prospecting determines the quality of the ore before extraction; some ores contain a higher percentage of uranium oxide, others less. Uranium extraction is done through two processes, either through open pit or underground mining, or through 'in situ leaching'. In the mining method, uranium rocks are extracted from the mine, transported to a milling facility where it is crushed into a fine powder, and an acid 'leach' is added that binds to the uranium in the rock. The product is then dried which produces a solid uranium ore concentrate commonly known as *yellowcake* (for its color and texture).[482] In-situ leaching makes use of the same process, but instead leaves the rock in the ground and pumps into and extracts the acidic leaching agent from the ground with the uranium bound to it. Currently, most uranium extraction is done through the 'conventional' mining method, but by 2001 the most commonly used method in the US was in-situ leaching.[483]

Uranium Conversion and Enrichment: The majority of nuclear power and research reactors in the world are, and have been in the nuclear power era, Light Water Reactors which require enriched uranium fuel to operate. Heavy Water Reactors use natural uranium or slightly

480 While Thorium-cyle R&D is ongoing in India and Norway, and it was used in power generation in the USA and Germany in the past, currently only India operates a small Thorium-based reactor and it carries little relevance to the subjects discussed in this thesis, 'Thorium', World Nuclear Association, http://www.world-nuclear.org/info/current-and-future-generation/thorium/, update February 2017, website checked 16-5-2017.

481 Seko, Noriaki, et al, 'Aquaculture of Uranium in Seawater by a Fabric-Absorbent Submerged System, in *Nuclear Technology*, Vol. 144 (November 2003) http://info.ornl.gov/sites/nfrw/Shared%20Documents/Uranium%20Extraction%20Seawater/nuclear20technol_v144_n2_pp274-278%5B1%5D.pdf, website checked 12-7-2017, pp. 1-5, Tabushi, Iwao, Kobuke, Yoshiaki, Nishiya, Takako, 'Extraction of Uranium from Seawater by Polymer-bound Marcocyclic Hexaketone', in *Nature*, No. 280 (23 August 1979) http://www.nature.com/nature/journal/v280/n5724/abs/280665a0.html, website checked 12-7-2017, pp. 665-666.

482 Fitzpatrick, Mark (ed.), *Preventing Nuclear Dangers in Southeast Asia and Australasia*, IISS Strategic Dossier series (The International Institute for Strategic Studies: London 2009) p. 22.

483 Bodansky, David, *Nuclear Energy: Principles, Practices, and Prospects*, Second Edition (Springer-Verlag: New York 2004) p.197.

enriched uranium as fuel and are mostly irrelevant in the context of uranium enrichment.[484] LWRs can be largely separated into two groups: Boiling Water Reactors (BWRs) and Pressurized Water Reactors (PWRs). While enrichment degrees for different power reactor types have varried over the years from 2% to nearly 5%, Bodansky reports typical use in the US at 3% for BWR fuel and 3,75% for LWR fuel[485]. The IAEA reports global data up to 2006 for BWRs and PWRs as 'up to 4.95%'. Other reactor types, such as the British-developed Advanced Gas-cooled Reactor (AGR) using enriched fuel of between 2%-4%, and the *Reaktor Bolshoy Moshchnosti Kanalnyy* or High-Power Channel-type Reactor (RMBK) used up to 2.8%.[486]

The percentages discussed above concern the degree of enrichment of nuclear fuel, which is the amount of the fissionable isotope U-235 in the uranium. The remainder of the uranium consists of the non-fissionable U-238, and a very small amount of U-234. Natural uranium contains on average 0.7% of the U-235 isotope.

Before the uranium in yellowcake can be enriched to be used in enriched uranium fuel, for most processes it needs to be converted into to a gaseous form. The gas found most suitable for this purpose is uranium hexaflouride, or UF6 (in the nuclear industry jargon referred to as 'hex'). It is suitable because it takes a gaseous form at much lower temperatures than other uranium gaseous compounds.[487]

Uranium enrichment is commonly achieved through an industrial-scale process, contemporarily only through the use of the efficient (low power-using) gas centrifuge method. For the first decades of enriched uranium fuel production however enriched uranium was mainly produced using the gaseous diffusion process in the US, France, the USSR and China, and using gas centrifuge technology in the then USSR and the Urenco countries (UK, West-Germany, the Netherlands).[488] Currently, Laser enrichment using the Separation of Isotopes by Laser Excitation (SILEX) method has been licenced in the US, but commercial production is not yet underway.[489] Industrial application of enrichment using a chemical exchange process

484 For an overview of reactor-types, see Bodansky, David, *Nuclear Energy: Principles, Practices, and Prospects*, Second Edition (Springer-Verlag: New York 2004) pp. 171-179.

485 Bodansky, David, *Nuclear Energy: Principles, Practices, and Prospects*, Second Edition (Springer-Verlag: New York 2004) p.199.

486 Rahman, Rehab, O., Abdel, 'Introduction to Current Trends in Nuclear Material Research and Technology', in Rahman, Rehab, O., Abdel, Saleh, Hosam, El-Din, Mostafa (eds.), *Nuclear Material Performance* (Intech: 2016) https://www.iaea.org/About/Policy/GC/GC51/GC51InfDocuments/English/gc51inf-3-att5_en.pdf, website checked 12-7-2017, pp. 1-2, 'RBMK Reactors', World Nuclear Association, http://www.world-nuclear.org/information-library/nuclear-fuel-cycle/nuclear-power-reactors/appendices/rbmk-reactors.aspx, updated June 2016, website checked 12-7-2017.

487 Bodansky, David, *Nuclear Energy: Principles, Practices, and Prospects*, Second Edition (Springer-Verlag: New York 2004) pp. 198-199.

488 For a complete overview of global enrichment capacity developments up to 1980, see 'Chapter 8: The world enrichment picture', in Krass, Allen, *et al*, *Uranium Enrichment and Nuclear Weapons Proliferation* (Stockholm International Peace Research Institute, Taylor & Francis Ltd: London and New York 1983) https://www.sipri.org/sites/default/files/files/books/SIPRI83Krass/SIPRI83Krass.pdf, website checked 3-9-2017, pp. 211-260.

489 Hylko, James, H., 'SILEX Process Promises Third-Generation Uranium Enrichment Technology for U.S.', in *Power*, 9th of January 2013, http://www.powermag.com/silex-process-promises-third-generation-uranium-

has been considered in the past, such as the CHEMEX and ASAHI methods, but did not find their way into commercial production.

Many research reactors and isotope production reactors used to require High Enriched Uranium (HEU, as opposed to Low Enriched Uranium, LEU) which means uranium that has been enriched to a percentage of 20% or more in U-235. Some of these research reactors used above 90% enriched uranium, which is a weapon-grade/usable level of enrichment and therefore posed a potential proliferation risk. Efforts have been underway, such as under the US Argonne National Laboratory Reduced Enrichment for Research and Test Reactors (RERTR) program (started in 1978), to design new fuels for these reactors and convert the reactors to stop dependence on HEU. Under the Global Threat Reduction Initiative (GTRI) by the National Nuclear Security Administration (NNSA) program of the US Department of Energy (DOE), 129 reactors were scheduled for either conversion or shutdown by 2018. As of 2007, 55 were already converted or shut down, with 74 remaining and 78 falling outside of the scope of the program.[490]

Fuel Fabrication: Whether using natural or enriched uranium as a fuel, it needs to be processed into the right form to be used in a reactor. A chemical process changes the enriched UF6 into uranium oxide powder which is pressed into small balls (pellets) that are heated at high temperature to form a ceramic. The pellets are then inserted and sealed into an alloy tube, usually made of zirconium. These 'fuel rods' are than fabricated into structures called fuel assemblies, which are suitable for insertion into a reactor core.[491]

Nuclear fuel can also consist in other forms be made from other materials. For example, Mixed-oxide fuel (MOX) uses a mix of uranium oxide and plutonium and has been used to exploit the energy resources in plutonium (extracted from spent fuel by reprocessing it) as well as to help reduce the plutonium stockpile that was left over from decomissioned nuclear weapons after the Cold War.[492]

Reactor Operation: Inside a nuclear reactor, a nuclear chain reaction is carefully managed so that it creates large amounts of heat but does not run out of control and cause an explosion.

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enrichment-technology-for-u-s/?printmode=1, website checked 12-7-2017.

490 Roglans-Ribas, J., 'Conversion of research and test reactors to low enriched uranium fuel: technical overview and program status', ANL/NE/CP—60316, Paper presented at International Conference on Research Reactors: Safe Management and Effective Utilization; Sydney, Australia; 5-9 Nov 2007, http://www-pub.iaea.org/MTCD/publications/PDF/P1360_ICRR_2007_CD/Papers/J.%20Roglans-Ribas.pdf, website checked 12-7-2017. 'As of 26 September 2016, 24 countries had at least 1 kg of highly-enriched uranium in their civilian stocks.', 'Materials: Highly enriched uranium', International Panel on Fissile Materials, http://fissilematerials.org/materials/heu.html, website checked 12-7-2017.

491 Bodansky, David, *Nuclear Energy: Principles, Practices, and Prospects*, Second Edition (Springer-Verlag: New York 2004) p. 205, 'Nuclear Fuel and its Fabrication', World Nuclear Association, http://www.world-nuclear.org/information-library/nuclear-fuel-cycle/conversion-enrichment-and-fabrication/fuel-fabrication.aspx, website checked 12-7-2017.

492 Bodansky, David, *Nuclear Energy: Principles, Practices, and Prospects*, Second Edition (Springer-Verlag: New York 2004) p. 205.

The chain reaction is started and maintained by irradiating (exposing to ionizing radiation; 'bombarding of atoms with nuclear particles') the fuel.[493] Inside the reaction,

> '… there is a continual destruction of U-235, through fission and neutron capture, and the buildup of plutonium isotopes through neutron capture and beta decay. The plutonium sequence starts with Pu-239, following neutron capture in U-238, and continues to include plutonium isotopes up to Pu-242, as well other heavy radionnuclides …'[494]

The heat from the chain reaction turns water into steam in a large steam engine, which produces electricity. The efficiency of nuclear fuel, or 'the energy obtained per unit mass of fuel' is commonly referred to as the *fuel burnup*, expressed in gigawatt-days of thermal output per metric tonne of uranium fuel.[495] The efficiency of the reactor in turning heat into electricity is called called the *thermal efficiency.*[496]

Back End of the Nuclear Fuel Cycle

The back end of the fuel cycle include the activities that take place after the fuel has been used in the reactor; it includes the short-term storage of the irradiated fuel after it has been extracted, possible reprocessing for fissile material extraction, and preparation for and the placement of spent fuel materials in long term storage.

Fuel Extraction and Short Term Storage: The type of reactor has bearing on its proliferation potential. The LWR is found to be superior from a non-proliferation perspective; LWRs typically are shutdown for fuel replacement every two years, if no technical difficulties presented themselves requiring a shutdown for maintenance during the period.[497] These scheduled shutdowns for refueling are communicated to the relevant safeguards authorities (such as EURATOM or the IAEA) so inspectors can be present to monitor the process if this is found to be desirable for inspection purposes. Some reactors, such as the Canadian designed CANDU HWR, have on-line refueling capacity, meaning a fuel assembly containing fuel rods can be taken out and put in the reactor while it is operational. This makes the covert irradiation of fuel rods harder to detect, as safeguards measures do not automatically trigger because of an unscheduled reactor shutdown.

When irradiated fuel assemblies are removed from the reactor core, they are extremely hot and highly radioactive and therefore difficult to handle. The assemblies are typically placed in

493 Fitzpatrick, Mark (ed.), *Preventing Nuclear Dangers in Southeast Asia and Australasia*, IISS Strategic Dossier series (The International Institute for Strategic Studies: London 2009) p. 22.
494 Bodansky, David, *Nuclear Energy: Principles, Practices, and Prospects*, Second Edition (Springer-Verlag: New York 2004) p. 208.
495 Ibid., p. 206.
496 Ibid., p. 205.
497 Rahman, Rehab, O., Abdel, 'Introduction to Current Trends in Nuclear Material Research and Technology', in Rahman, Rehab, O., Abdel, Saleh, Hosam, El-Din, Mostafa (eds.), Nuclear Material Performance (Intech: 2016) https://www.iaea.org/About/Policy/GC/GC51/GC51InfDocuments/English/gc51inf-3-att5_en.pdf, website checked 12-7-2017, p. 2.

cooling ponds located on the premises of the plant, where can they remain for several years to cool down. Because many countries do not have a suitable location for long term storage, spent fuel can remain in the cooling ponds for a long time, 'in many cases for more than 20 years'.[498]

Reprocessing Spent Fuel: As mentioned above, after spent fuel is extracted from the reactor core it is highly radioactive because the uranium oxide that the fresh fuel contained has, due to irradiation, turned into a wide array of actinides; heavy, usually highly radioactive elements such as relatively large amounts of Plutonium (isotopes 238 through 242), and smaller amounts of Neptunium 237 and 239, Curium 244 and Americium 241 and 243, besides a number of less heavy but also radioactive elements such as isotopes of iodine and cesium.[499] After a period of cooling in the pools of water near the reactor, the reprocessing process takes place in a particularly for this purpose constructed special facility with thick (lead) shielding and remote handling equipment, often referred to as a *hot cell*. Hot cells are also used in research settings. Fuel rods are first cut up in smaller parts before being dissolved by means of a chemical procedure (one of which for example is the most widely used PUREX process, for Plutonium Uranium Extraction) the desired Pu and U are separated for re-use in nuclear fuel.

Long Term Storage and Disposal of Spent Fuel: Besides the above mentioned option of storing spent fuel in the cooling pools at the reactor site, after an initial cooling period of several years, spent fuel has sufficiently cooled down and can be put in dry-storage or in permanent storage in geological depositories. For long term storage in depositories, spent fuel can be processed in several ways to make it more resistant to environmental factors that it will be exposed to during storage.

The US had a long term depository planned at Yucca Mountain, but those plans have been shelved, possibly indefinitely.[500] Finland has started construction at the Onkalo site, which is expected be in use by 2020.[501] The Netherlands stores its nuclear waste in the COVRA facility in Vlissingen in a building designed for this purpose, where low and medium radioactive waste is put in concrete, and high radioactive waste in glass.[502]

The Inherent Proliferation Risks of the Nuclear Fuel Cycle: Nuclear Weapons

The inherent proliferation risk of all industrial nuclear activity is the ability of fissile material and nuclear technology to be diverted from peaceful civil use to military use. The 1980 International Nuclear Fuel Cycle Evaluation (INFCE) final report of Working Group 2 qualified such misuse of materials and/or technology as follows:

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498 Bodansky, David, *Nuclear Energy: Principles, Practices, and Prospects*, Second Edition (Springer-Verlag: New York 2004) p. 213.
499 Ibid., p. 209.
500 Wald, Matthew, L., 'Future Dim for Nuclear Waste Repository', in *The New York Times*, 5th of March 2009, http://www.nytimes.com/2009/03/06/science/earth/06yucca.html, website checked 12-7-2017.
501 'Multiple barriers helps to ensure that no nuclear waste will be released to living nature', Posiva website, http://www.posiva.fi/en/final_disposal/onkalo, website checked 11th of November 2017.
502 'Radioactive waste', COVRA N.V., https://covra.nl/en/radioactive-waste, website checked 12-7-2017.

> 'The relevance of nuclear power programmes to proliferation risks arise mainly from the access such programmes may provide to materials technology and from the availability of facilities which can contribute to the potential acquisition of nuclear weapons. The activities identified in this respect include: (1) The possible removal of materials from nuclear power cycle facilities. (2) The misuse of a facility designed for commercial operation modified as necessary to produce weapons-usable material. (3) The construction and operation of a non-declared facility for conversion of material to weapon-usable form.'[503]

The inherent proliferation risk of fissile material exists in its very nature; in the right amount, combination and purity, U-233, U235 and Pu-239 can sustain a chain reaction that releases great amounts of energy in the form of heat and radiation; a nuclear explosion.[504]

The proliferation risk of nuclear technology lays in the access it is able to give to these immense explosive powers. The right uranium enrichment technologies can be used to create 80% or higher HEU (U-235) and reprocessing technology can be used to separate U-233 and Pu-239 with a high level of purity from spent fuel (although Neptunium and Americanium bombs are theoretically also possible).[505] U-233 can be isolated through irradiation of thorium in a reactor and subsequently separating protactinium (Pa-233) from the fuel, which fairly quickly (with a half-life of 27 days) decays into U-233. Only one country (the United States in 1955) has ever exploded a thorium-based bomb however.[506] Mastery of the technology of

503 The International Nuclear Fuel Cycle Evaluation (INFCE) 1980 final report of Working Group 2: Enrichment Availability is of special significance to the conclusions drawn from the archival case research presented in chapters 10 and 11. It reflects the shared perceptions of experts from a wide range of countries (including the Netherlands) participating in Working Group 2 drawn up in a relevant time frame (the end of the 1970s, 1980) proximate to the research time frame of the 1970s and 1980s, when Urenco ensued commercial operations that brought up relevant proliferation-relevant questions for national policymakers. 'Communal' perceptions of experts of course evolve constantly, but the approximation of the relevant time frame at the very least approaches the wisdom of the day; what were commonly understood to be the proliferation risks as relevant to enrichment operations. To project contemporary insights of proliferation risks unto an earlier situation would constitute an anachronism. A certain level of anachronism however is impossible to avoid, because of uncertainties of when particular evolutions in perceptions became widely shared and considered in policy decisions, 'Enrichment Availability: Report of INFCE Working Group 2', International Nuclear Fuel Cycle Evaluation, STI/Pub/534 (International Atomic Energy Agency: Vienna 1980) pp. 22-23. Also see chapter 11, *INFCE Working Group 2 on GCEP Safeguards*, page 473.

504 I will not discuss in detail the physical process of nuclear fission, but instead refer to the very easy to follow description of the process given by Michael Rosenthal in Appendix A.1 of the excellent textbook, Rosenthal, Michael (ed.) *Deterring Nuclear Proliferation: The Importance of IAEA Safeguards* (Brookhaven National Laboratory: April 2013), which is publicly available here: https://www.bnl.gov/NNS/IAEAtextbook.php, Website checked 25-3-2017.

505 Bodansky, David, *Nuclear Energy: Principles, Practices, and Prospects*, Second Edition (Springer-Verlag: New York 2004) 487, Rosenthal, Michael (ed.) *Deterring Nuclear Proliferation: The Importance of IAEA Safeguards* (Brookhaven National Laboratory: April 2013) https://www.bnl.gov/NNS/IAEAtextbook.php, Website checked 25-3-2017, p. 212.

506 'Operation Teapot: 1955 – Nevada Proving Ground', Nuclear Weapons Archive, http://nuclearweaponarchive.org/Usa/Tests/Teapot.html, last updated October 1997, website checked 12-7-2017, Alvarez, Robert, 'Thorium: The Wonder Fuel That Wasn't, Bulletin of Atomic Scientists website, 11th of May 2014, http://thebulletin.org/thorium-wonder-fuel-wasnt7156, website checked 12-7-2017.

explosive devices can employ these special fissionable materials in several types of explosive devices, and when made sufficiently compact missile technology can be used to propel these devices across long distances and even to the other side of the world.

The two main routes to a nuclear weapon are thus the uranium-enrichment and plutonium-separation routes. The uranium-enrichment route has great relevance to the subject of this thesis and will be more thoroughly discussed in Chapter 7. The plutonium-separation route has several elements worth mentioning here.

For plutonium to be used in a nuclear explosive device, its needs to be created in a reactor. There are generally two ways to (mis-)use reactor fuel for this purpose; first, by diverting spent fuel from either spent fuel ponds or another storage facility and second, by 'online reloading' (possible in some reactors such as the CANDU heavy water reactor mentioned above) which means taking irradiated fuel out of the reactor core and replacing it with fresh fuel while the reactor is in operation (without a shutdown). The irradiated fuel can then be reprocessed in a facility for that purpose.

During the course of the nuclear age, the plutonium-separation route has become less and the uranium-enrichment route more attractive for those states covertly pursuing acquisition of a nuclear weapon. This has to do with several factors such as risk of detection through advancement in surveillance technology (for example, Krypton-85 detection, improved satellite imagery), increased deterrent effects of safeguards, improved availability of enrichment technology and overall economics.[507]

Nuclear Weapon Designs

There are two types of nuclear weapons that are relevant to be distinguished from a non-proliferation standpoint, the gun-type weapon and the implosion-type weapon. In order to cause a nuclear explosion, two things need to happen. First, a 'critical mass' has to be established. Second, the chain reaction has to be triggered with a large release of neutrons, in a condition called supercriticality. Critical mass is the minimum amount of fissile material needed to sustain a chain reaction. Depending on design features, for example by use of a

507 'Monitoring atmospheric 85Kr, a radioactive noble gas produced as a fission product in nuclear reactors and released as effluent when spent nuclear fuel is reprocessed to recover plutonium, may help verify [a ban on plutonium production]. The importance of detecting reprocessing activity was recognized in a secret United States program, “Operation Bluenose,” started in the late 1940s as an effort to monitor plutonium production around the world through tracing released fission product gases, especially 85 Kr, by both airborne sampling and a global land-based network including U.S. embassies equipped with 85 Kr samplers. The data was used apparently to produce detailed weekly maps of global 85 Kr.', Mian, Z., Noyyar, A., H., 'An Initial Analysis of 85Kr Production and Dispersion from Reprocessing in India and Pakistan', in *Science and Global Security*, Vol. 10 (2002) https://www.princeton.edu/sgs/publications/sgs/pdf/10_3%20151%20179%20Mian.pdf, website checked 12-7-2017, p. 152, Kalinowski, M.,B.,; Feichter, J.; Nikkinen, M.; Schlosser, C., 'Environmental Sample Analysis', in Avenhaus, R., Kyriakopoulos, N., Richard, M., Stein, G., (eds.), *Verifying Treaty Compliance* (Springer Berlin, Heidelberg 2006) pp. 367-387, Kalinowski, Martin, B., 'Remote environmental sampling for the detection of clandestine nuclear weapons production and testing', in Janssens-Maenhout, G., *Nuclear Safeguards and Non-Proliferation, Syllabus of the ESARDA Course* (December 2008) pp. 269-278.

reflector (tamper) that bounces scattering neutrons back into the volume mass, this can be as low as 15 kg for a uranium bomb, and 5 kg for a plutonium bomb (with estimates by scientists as low as 1 kg Pu).[508] Supercriticality is reached by bringing two subcritical masses together rapidly, causing a neutron burst and starting a chain reaction. In the gun-type, as the name implies, this is done by 'shooting' one mass into another. In the implosion-type, this is done by detonating chemical explosives around several separated parts of a sphere-shaped assembly. Critical mass is very dependent on density however, and an effective (technically sophisticated) implosion device can create circumstances in which much less fissile material is needed than in the bombs described in the open literature, explaining the much lower estimates of required mass.[509] Plutonium is not suitable for use in a gun-type weapon because its assembly is too slow, as 'some isotopes of plutonium undergo *spontaneous fission* (i.e., they can fission even without absorbing a neutron)'.[510] Both uranium and plutonium can be used in an implosion-type weapon, but this type of weapon is more difficult to develop.[511]

Another type of weapon is the fusion bomb. These are much more technologically sophisticated and are based on a combination of nuclear fission and fusion. Also known as a thermonuclear or hydrogen bomb (for the hydrogen used in the secondary, fusion reaction), it uses the energy pressure and heat) of a fission explosion to trigger a more powerful fusion reaction. The fusion bomb design has a much greater potential in explosive power (or 'yield') than the fission bomb. The essential fission-based primary stage of the explosion as well as the sophisticated design features are its main non-proliferation relevant aspects.

Entering Into the Nuclear Age

With the evolution of the whole of interrelated non-proliferation activities also came the evolution of expert perceptions of these activities; 'our' perceptions on non-proliferation considerations now are therefore markedly different from those 45 years ago when the NPT was created and came into force, and those in turn were different from the ideas about nuclear energy, nuclear weapons and what could be done to prevent their proliferation at the end of World War II. A pattern of change in perceptions and policy constitutes the evolution that led us to where we are now. The practices that this study puts central did not exist at the time of the first public demonstration of the nuclear weapon's tactical and strategic potential at the end of World War II, except in limited form inside the Manhattan Project. Nuclear energy technology did not exist in the perceptions and understandings of the wider public and by extension neither did its potential for commercial exploitation. The US possessed nuclear weapons and while there was a sense of the importance of non-proliferation of that weapon

508 Bodansky, David, *Nuclear Energy: Principles, Practices, and Prospects*, Second Edition (Springer-Verlag: New York 2004) pp. 488-489.
509 Ibid.. For more information on what determines critical mass see, Bodansky, David, *Nuclear Energy: Principles, Practices, and Prospects*, Second Edition (Springer-Verlag: New York 2004) pp. 486-490.
510 Rosenthal, Michael (ed.) *Deterring Nuclear Proliferation: The Importance of IAEA Safeguards* (Brookhaven National Laboratory: April 2013) https://www.bnl.gov/NNS/IAEAtextbook.php, Website checked 25-3-2017, p. 210, italics in original.
511 Ibid., pp. 210-211.

exemplified by immediate public and diplomatic discussions ensuing after its first use (reflected in the US-initiated Acheson-Lilienthal report and Baruch plan and Soviet counter-proposals), there was no community, no practice of experts and diplomats specialized in dealing with this novel problem. However, political practices dealing with conventional arms control and international industrial competition did. To understand the initial period of (international) non-proliferation efforts we must not only acknowledge these facts but take them seriously and use them as a point of departure in understanding the perceptions that dominated non-proliferation efforts and discussions during this and subsequent periods thereafter. 'We did not know what we do now' seems a good phrase to keep in mind in helping us understand and evaluate efforts and choices made in the emerging practices that underlay the non-proliferation regime and international nuclear industry.

To demarcate the historical period of non-proliferation efforts as starting from a strategic *tabula rasa* (a fresh, blank page) and leading up to today leaves out an important contextual background that informs us of the main strategic actor's considerations at that moment in time in 1945 when suddenly the secret was out. It is vital that we understand the 1945 situation, and the full history up to now as superimposed upon a strategic reality that existed before, evolved with it (but was not solely influenced by the new strategic military factor that had to be considered with the introduction of nuclear weapons) and will exist even after a hypothetical reality of a future world without nuclear weapons comes into existence. This baseline strategic reality is represented in the historical narrative of the long shift in the West from political, scientific, economic and cultural modernity into post-modernity. It starts halfway Hobsbawm's 'Long Nineteenth Century', around the onset of his 'Age of Capital: 1848-1875' and ends with the close of his 'Age of Empire: 1975-1914'.[512] This period encompasses the rise of the centralized nation-state in Western Europe, North America and East Asia, in different forms and shapes, of colonialism and the quest for military and economic hegemony under a nationalist agendas leading up to what historians have come to call 'the Long War'; the awakening of national and ethnic ideologies and identities in the colonies and the initial push for de-colonialisation; the inconclusive First World War interrupted by a period of great power disengagement and shifting power relations, climaxing in the geographically all-encompassing Second World War. Hobsbawm shows that periods in history should not solely be defined by its major conflicts, but also by the strategic economic, military, political and cultural shifts that happen in between them and as such we can understand the big shifts in power and global dominance more fully, with military conflict merely being an expression of those shifts.

For our story, one needs to introduce two particular stories that go before. The first prequel will provide a summary of the state of international political practice during the discovery and first phase of the proliferation and attempts at non-proliferation of nuclear (weapon) technology. The second prequel shows the first movements towards classification as a result of increased insights into the possible military uses of this new frontier in science against the backdrop of this turbulent period of shifting power relations right before, during and after the Second World War.

512 Hobsbawm, E.,J., *The Age of Capital: 1848–1875* (Weidenfeld & Nicolsen: London 1975), Hobsbawm, E., J., *The Age of Empire, 1875-1914* (Pantheon Books: New York 1987)

International Political Practice and the First Generation Nuclear Weapon States

This first prequel starts with British, French and Japanese economic and military projection and geographical dominance and ends with United States and USSR dominance and Western European perceptions playing catch-up to that a strategic reality. The historical evolution of these perceptions of dominance and power are deserving of emphasis because they explain for a large part the decision-making of former and current great powers in the immediate post-Second World War nuclear age and after.

United States: The role of the United States immediately after World War II is more fully understood when seen in light of its pre-World War II political culture of isolationism and prioritization of Western hemisphere hegemony. While one of the founders of the League of Nations (although not a member), in the period up to its entering into the Second World War in 1942 its global leadership role was contested and questionable, exemplified in its disinterest in and disapproval of European power competition in Europe and in the colonies, while it maintained its own *de facto* colony in the Philippines. During the war its ability to assist its allies by means of its unequaled industrial base and willingness to enter the fray played a decisive role militarily and made it a global leader by default. The period right after the war must therefore be seen as one of a fledgling superpower adjusting to its new role. It's nuclear weapon monopoly did not begin to cover but yet symbolically represented that role.

USSR: The role of the USSR at the dawn of the nuclear age is better understood when cast in light of its historically ambivalent and adversarial role vis-à-vis the Western European powers. its antagonistic relationship with France and Great Britain in the Crimean War (1853-1856) which was further fomented during the Russian Civil War of 1917-1922, as well as its disastrous military confrontation with Japan in 1905. The Russian Civil War saw Britain and France and others side with Russian conservatives and liberals against the revolutionary Bolshevik government, resulting in eventually a victory for the latter but costing the USSR the territories of Finland, Poland, Latvia, Estonia and Lithuania (which became sovereign states). With the evolution of its powerful state ideology after the revolutions in 1917, it evolved into an ideological threat towards the other powers, celebrating socialism, calling for worldwide social revolution as well as actively supporting revolutionary socialist and communist movements abroad. This was novel in that the USSR not only was revisionist back home but it sought to change the entire international system as well. Socially conservative governments in Europe and the US diametrically opposed these policies, creating mutual distrust and disengagement. When Stalin came to power he found the USSR internationally isolated. His policy of officially refocusing the Communist revolution from an international to a national one did little to alleviate the position in which the USSR found itself in the inter-war years.

Stalin's mistrust and non-committing attitude towards his wartime allies can be better understood through this history, other than pointing to his apparent paranoid personality. The USSR had begun its own nuclear weapons program very early on, partially by stealing secrets from the Manhattan project. While publicly opposing proliferation on the international stage in the first years after WWII, its leadership was implementing a crash program to get back to

technological military parity with the United States. It first successfully tested a weapon in 1949. During the nuclear arms race the USSR tried to keep at par with the US, but only managed to surpass it in amount of weapons in 1978, at a time when the revolution in electronics ensured the US for the foreseeable future could maintain its technological advantage.[513]

France and Great Britain: The roles of France and Britain were very dissimilar in the inter-War years (1919-1939) and later when responding to the forces of de-colonialism through their respective political elites, held onto similar beliefs about the dominant and independent role its respective nation should pursue in the world vis-à-vis the rising superpowers. Perceptions on how to achieve continued relevance in the post WWII world diverged however; where the United Kingdom sought an active partnership (as the smaller partner) with the United States, France chose a much more 'go it alone' route. Much of the post-1945 nuclear decision-making, both in relation to military and commercial uses can be seen as commensurate with those perceptions. Both countries started nuclear reactor development early on.

Whereas the UK in certain fields depended heavily on the US, such as in its dependence on the US for the maintenance of its nuclear arsenal, France sought and successfully acquired an independent nuclear weapons program. Both in the military and commercial sense these two (former – but not in their own perception) Great Powers represented the antagonistic relationship of Europe with the United States, between those that sought strong bonds and a measure of dependence with and upon the United States as a matter of perceived necessity to ward off USSR domination of Europe (using American nuclear delivery vehicles) versus one that sought a renewed independence and leadership role in Europe upon which the United States was perceived to be encroaching. Yet, as much as possible, the UK and France kept their own course and council while slowly adapting to the new reality.

In the case of France, adaptation quickened when harsh facts presented themselves. After the disastrous battle of Dien Bien Phu and the subsequent withdrawal from and loss of French Indochina (both in 1954), the French cabinet was quick to act and authorized the development of a nuclear bomb. Another shock came when the 1956 Suez crisis proved that the colonial period was quickly coming to an end, and that in the process European powers could not rely on the United States to bargain for influence or mediate the pain. the Americans had pressured the British to abandon the Suez expedition who in turn had resigned and abandoned the French and Israelis. The bomb program was stepped up with a commitment to tests, right after the crisis. The loss of French influence had to be compensated and its ability to act like a power of consequence bolstered. France had been producing plutonium in its first nuclear reactors using natural uranium found in large quantities in France and early successes with plutonium separation (the know-how originating from the French contribution to the Manhattan Project) warranted a pilot plutonium reprocessing plant that became operational in 1954. The first of a series of plutonium bomb tests started in February 1960 in the French

513 Norris, Robert, S., Kristensen, Hans, M., 'Global Nuclear Weapons Inventories, 1945-2010', in *Bulletin of Atomic Scientists*, Vol. 66, No. 4 (July-August 2010) http://journals.sagepub.com/doi/pdf/10.2968/066004008, website checked 16-5-2017.

colony of Algeria. In 1965, France's first gaseous diffusion plant came online and in 1967 the first weapons-grade HEU became available to the program.

China: The Japanese invasion and occupation of China started in 1937, quite some time before the outbreak of WWII in Western definitions; encroachment of China's traditional sphere of influence and territories in eastern Asia started decades before. From 1895 to 1937, Japanese armies occupied first Formosa (Taiwan), Korea and then Manchuria. Before the Japanese became a force in the region, China had to endure humiliation by Western colonial powers exemplified by the infamous Opium Wars halfway the 19th century; a series of military disasters and extortionist settlements at the hands of chiefly Great Britain. From 1937 to 1945, its people suffered the brutal Japanese colonial regime and after Japan's defeat, it suffered continued conflict during its civil war, wherein Chang Kai-shek's nationalists were eventually routed by Mao Zedong's communists. During the same post-WWII period, mainland China was snubbed by the other great powers as they invited nationalist China (Chang Kai-shek's Repbulic of China on Formosa, later known as Taiwan) to join the United Nations Security Council (a snub that was only corrected in 1971).

China was not considered a relevant power internationally. And then suddenly it was, when it achieved major successes in the third phase of the Korean War, surprising and defeating a Western dominated coalition army (under the UN flag) in direct confrontation. The decision to intervene was a product of the American failure to appreciate the Chinese position and actively alienating them; part of Truman's intervention in Korea was to bring the 5th fleet in the Taiwanese straights, protecting the nationalists in Taiwan from mainland invasion, while General MacArthur from his Tokyo headquarters persisted in his demand for unconditional surrender, 'coupled with barely veiled direct threats against the PRC and the USSR', while diplomatically, the US failed to convince China that the UN offensive would stop at the Chinese border, marked by the Yalu river.[514] Soviet hedging, only committing to Korea after China clearly signaled its commitment and Chinese unwillingness to have troops of its ideological adversary stationed on its border further helped Mao and the Chinese leadership make up their minds.[515]

514 Mansourov, Alexandre, Y., 'Stalin, Mao, Kim, and China's Decision to Enter the Korean War, September 16–October 15, 1950: New Evidence from the Russian Archives', in *Cold War International History Project Bulletin*, No. 6–7 (Winter 1995) https://www.wilsoncenter.org/sites/default/files/CWIHP_Bulletin_6-7.pdf, website checked 13-7-2017, p. 105, Dingman, Roger, 'Atomic Diplomacy during the Korean War', in *International Security*, Vol. 13, No. 3 (Winter, 1988-1989) http://www.jstor.org/stable/pdf/2538736.pdf, website checked 13-7-2017, p. 68.

515 Mansourov, Alexandre, Y., 'Stalin, Mao, Kim, and China's Decision to Enter the Korean War, September 16–October 15, 1950: New Evidence from the Russian Archives', in *Cold War International History Project Bulletin*, No. 6–7 (Winter 1995) https://www.wilsoncenter.org/sites/default/files/CWIHP_Bulletin_6-7.pdf, website checked 13-7-2017, p. 105, Bajanov, Evgueni, Assessing the Politics of the Korean War, 1959-51', in *Cold War International History Project Bulletin*, No. 6–7 (Winter 1995) https://www.wilsoncenter.org/sites/default/files/CWIHP_Bulletin_6-7.pdf, website checked 13-7-2017, p. 89, Yufan, Hao, Zhihai, Zhai, 'China's Decision to Enter the Korean War: History Revisited', in *The China Quarterly*, No. 121 (March 1990) p. 102, Whiting, Allen, S., *China Crosses the Yalu: The Decision to Enter the Korean War* (Macmillan: New York 1960).

The combination of the Japanese invasion and occupation during WWII, the Taiwan Straight crisis with the US, the UN snub, the Korean War and American nuclear threats during that war [516] and willingness of Soviets to provide nuclear assistance to its 'comrades' pushed China under Mao (who had earlier referred to nuclear weapons as 'paper tigers') to commit to a nuclear weapons program.[517] Despite the small size of its economy, with Soviet assistance in the form of nuclear technology, China managed a crash program that produced a working nuclear weapon by 1964.[518]

(West-) Germany: The German experience is particularly important to this thesis and during this period is the odd one out with its total defeat in the Second World War and almost complete eradication of nationalist ideology and exceptionalism from its political culture. Once West-Germany (Federal Republic of Germany, or FRG in this thesis) was allowed more leniency by its former victors and current allies to pursue a similar course as France and Britain of security-seeking through economic strength and independence, it did so through a new brand of political assertiveness that was loyal to its allies yet protective of its (particularly economic) national interest, by for example rolling out an ambitious program that established a sizable nuclear infrastructure geared towards domestic production as well as export. This strategy was no doubt inspired by its precarious position as a 'buffer-zone' between the rising superpowers US and USSR dividing up Europe in their respective spheres of influence. The FRG saw nuclear technology as an opportunity for it to excel and beat its industrial competitors in a rapidly growing high value export market while at the same time promoting its own energy security. After in late 1963 ordering several American nuclear reactors and enriched uranium fuel supply, the Germans set out to, based on the Westinghouse reactor technology and licenses, come up with their own improved reactor model.[519] West-Germany's strategic policy was sensitive to the wishes of its allies, some of which were up to 1955 also its occupiers. Attaining international leadership in nuclear technology and the associated commercial exports also had high priority. The FRG considered but did not pursue its own nuclear weapons capability and instead opted in on NATO nuclear sharing while at the same time creating an industrial base that would ensure a *breakout capability* in the event it found it could not depend on its allies for its security some time in the future.[520]

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516 Dingman, Roger, 'Atomic Diplomacy during the Korean War', in *International Security*, Vol. 13, No. 3 (Winter, 1988-1989) http://www.jstor.org/stable/pdf/2538736.pdf, website checked 13-7-2017, pp. 50, 54, 61-62, 68, 70, 75-76, 89.

517 Powell, Ralph, L., 'Great Powers and Atomic Bombs are "Paper Trigers"', in *The China Quarterly*, No. 23 (July-September 1965) http://www.jstor.org/stable/pdf/651723.pdf?refreqid=excelsior%3A037c9b9b3b7d58f6586ee625f383b9ea website checked 13-7-2017, pp. 55, 59, Mizokami, Kyle, 'The Dragon's Fire: Welcome to Chinese Nuclear Weapons 101', The National Interest website, 5th of January 2015, http://nationalinterest.org/blog/the-buzz/the-dragon%E2%80%99s-fire-welcome-chinese-nuclear-weapons-101-11968, website checked 13-7-2017.

518 Shen, Zhihua, Xia, Yafeng, 'Between Aid and Restriction: Changing Soviet Policies toward China's Nuclear Weapons Program: 1954-1960', Working Paper #2, Nuclear Proliferation International History Project (May 2012) https://www.wilsoncenter.org/sites/default/files/soviet_policies_twrds_chinas_nuclear_weapons_prgm_1.pdf, website checked 13-7-2017, pp. 1-39.

519 Ebinger, Charles, K., *The Washington Papers Vol. VI: International Politics of Nuclear Energy* (The Center for Strategic and International Studies: Sage Publications, Beverly Hills & London 1978) p. 28.

Japan: After World War II Japan was (like Germany) psychologically defeated and its infrastructure was largely destroyed, dealing with similar conditions and considerations, augmented by its experience with nuclear warfare in Hiroshima and Nagasaki. Unlike the FRG, which in the first decades after WWII did consider the acquisition of nuclear weapons in order to keep up with strategic realities, the issue of acquisition did not gain prominence in Japan until only in the late 1990s when long-time adversary North Korea intensified its pursuit of a nuclear weapons capability.

Occupied by American forces after its defeat in WWII, it's Cold War allies saw the strategic importance of helping the country quickly get back on its feet economically. This process was aided greatly by the outbreak of the Korean War as the main supply bases were in occupied Japan. It had however (as opposed to West-Germany) not much to fear from the Soviet regional presence after the Korean War; it was clear the USSR had disengaged from eastern Asia after China had stepped forward fighting on the North Korean side. China, despite its relative success in Korea, was not and would not be able to project power across the region for decades to come (the economic dwarf that it was) and posed no threat to or rival for the Japanese. Territorially, Japan could make due with the self-protection force of a maximum of 100.000 soldiers as laid out in its post-War constitution. Consequently, for many decades following, nuclear weapon ambitions were almost completely absent.

First Nuclear Weapon Development and Nuclear Technology Classification

The discovery of fissionable material, first in theory and then in practice, initially took place at the universities in the United Kingdom and via the international academic community of physicists and chemists resulted in the military programs of some of the main actors of World War II. Reading Richard Rhodes' seminal narrative of the start and first phases of the atomic age *The Making of the Atomic Bomb* (1986) we see the dynamic of the scientific revolution that is relatively open and collaborative but which turn secretive once the feasibility and potential of an atomic weapon becomes established. As late as 1935 scientists were sharing their work in publications and scientific conferences on the atomic structure and radioactivity with colleagues from nations that would be their future wartime enemies.[521]

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520 Geier, Stephan, *Schwellenmacht: Kernenergie und Außenpolitik der Bundesrepublik Deutschland von 1949 bis 1980*, Ph.D. Dissertation, Faculty of Philosophy and Faculty of Theology, Friedrich-Alexander University of Erlangen-Nürnberg (December 2012) p. 838. A breakout capability is the term used to signify a potential of technological development, industrial capacity and fissionable material acquisition that, if a decision was taken to do so, a crash-program of nuclear weapon acquisition can in the time-span of weeks or months be successfully completed, defined by a CIA report on Iraq's WMD as, '[k]nowledge, infrastructure, and materiel, which usually lie beneath the threshold of suspicion, but which can be rapidly adapted or reorganized to allow for weaponization processes to be undertaken. Such capabilities require pre-disposed resources and often employ dual-use technology, equipment, or knowledge.', Report, 'Director of Central Intelligence's Special Advisor Report on Iraq's WMD, Volume 3', (Central Intelligence Agency: 2004) https://www.cia.gov/library/reports/general-reports-1/iraq_wmd_2004/, website checked 16-5-2017.

521 Rhodes, Richard, *The Making of the Atomic Bomb* (Simon & Schuster: New York 1986) pp. 128, 162, 209, 211, 213.

It was Leonard Szilard, who himself played an instrumental part in making the nuclear age a reality, who first started taking the idea of 'information denial' seriously. Szilard in 1934 amended his patent on the neutron chain reaction and described the possibility of '"the liberation of nuclear energy for power production and *other purposes* ...".[522] He unsuccessfully filed the patent with the War Office in order to get it classified even though his description showed how by using a neutron reflector shield (a *tamper*) critical mass could be achieved in the chain reaction that could create an explosion.[523] Szilard in 1936 successfully filed his patent with the Admiralty after his colleague Frederick Lindemann pressed his case by describing the potential of Szilard's discovery in the hands of 'certain Powers which might attack this country'.[524] Other scientists kept in the public race of publishing important results even when war was looming. Rhodes wrote that Szilard tried to convince Enrico Fermi (at the time working in the United States) as late as 1939 of the dangers of not keeping some essential parts of their field of research secret.[525] Fermi and Szilard asked the editors of the Physical Review to hold publication of two of their papers until they've resolved the secrecy issue (Szilard proposed the founding of a closed academic society) only to be confronted by a rival publication in *Nature* by Joliot, Von Halban and Kowarski.[526] This French article and its follow-up articles triggered the German Reich to take notice, convey a secret conference on the subject in Berlin and intensify their own work on the chain reaction.[527]

Interestingly it was Niels Bohr, when was asked to support the call for secrecy by Szilard, Wigner, Wheeler and Rosenfeld, that resisted the idea of secrecy but partially on the basis of the technology itself; he deemed uranium enrichment too challenging to be possible in the amounts needed. 'Bohr insisted that "it can never be done unless you turn the United States in to one huge factory"', words that proved of near prophetic quality. Bohr was very resistant to the idea of secrecy in science because,

> '[h]e had worked for decades to shape physics into an international community, a model within its limited franchise of what a peaceful, politically united world might be. Openness was its fragile, essential charter, an operational necessity, as freedom of speech is an operational necessity to a democracy. Complete openness enforced absolute honesty: the scientist reported all his results, favorable and unfavorable, where all could read them, making possible the ongoing correction of error. Secrecy would revoke that charter and subordinate science as a political system ... to the anarchic competition of the nation-states.'[528]

It is often Albert Einstein's letter to Roosevelt in August 1939, which Szilard helped draft, that is taken as the first 'wake-up call' to nuclear dangers, but the above shows that realization was dawning on the scientific community years before that, with Szilard initiating the debate for

522 Ibid., p. 214. Italics added.
523 Ibid.
524 Ibid., pp. 224-225.
525 Ibid., p. 280.
526 Von Halban, H., Joliot, F., Kowarski, L., ' Liberation of Neutrons in the Nuclear Explosion of Uranium', in *Nature*, Vol. 143 (18 March 1939) pp. 470-471.
527 Rhodes, Richard, *The Making of the Atomic Bomb* (Simon & Schuster: New York 1986) pp 293, 295-296.
528 Ibid., p. 294.

what can be argued as the first nuclear non-proliferation measures in the form of classification. In 1941, a British committee under the leadership of G.P. Thomson that studied the issue concluded the same need for secrecy because of the spectacular potency of the new technology in what became known as the MAUD report. The same report argued for cooperation with wartime allies to maximize the allied efforts in light of fears of German scientific advancements. The potential for Germany to finish first in the race to the bomb was considered great enough to in the fall of 1943 warrant the creation of a special branch in the fledgling American intelligence service Office of Strategic Services (OSS) that was tasked with finding out how far the German efforts had brought them.[529] After D-Day, in operation *Alsos* the OSS collected and interrogated most of the German (and Italian, who turned out not to be connected to the German program) scientists suspected of involvement with the Nazi drive for the bomb. Statements by them and documents found revealed the German side were, contrary to what some experts among the Allies had believed, not that far along; they had no operational reactor, uranium enrichment operation or successful plutonium separation process.

What is interesting about the covert study of the German program by OSS is its use of intelligence methods that would be mirrored in later non-proliferation intelligence gathering; the monitoring of academic publications on any subject related to peaceful or military application of nuclear fission, the capture and interviewing of scientists suspected of having knowledge of or connections to that program, 'on the ground' intelligence on buildings that potentially were nuclear facilities and surveillance of the acquisition of relevant materials such as the mining of uranium ore. Before and during the war, the mining and production of uranium was largely in allied hands. With the invasion of Belgium in 1940 however, the Germans captured a substantial amount of uranium (an estimated 1200 tonnes) mined in the Belgian Congo, adding to the German program's potency. When operation Alsos ensued high priority was given to securing this cache of uranium, with operatives entering into what would become the Russian zone of occupation in eastern Germany as late as April 1945 to secure and extract the main cache of Belgian uranium (-ore and oxide) from Stassfurt.[530]

The manner in which the Alsos operation pursued the uranium using locally captured documents to establish its volume and locations is arguably the first instance of Nuclear Material Accountancy (NMA) with the purpose of safeguarding material and precluding the possibility of any of the Belgian uranium being diverted without Allied knowledge of its whereabouts. This was done much more for strategic reasons than as part of the duties involved with responsible nuclear stewardship; the purpose was to deny the Russians and anyone else materials and technological expertise in the form of German scientists. That Alsos was only partially successful in this mission is shown by the work on centrifuge development the captured German prisoners of war did for the Soviet enrichment program (see Chapter 7, *Start of the Dutch and Troika Partners' Gas Centrifuge Tracks,* page 200).

Denial of information on technology as well as nuclear materials to Germany and its allies became wartime standard practice but also included the denial of information to the Russians.

529 Richelson, Jeffrey, *Spying on the Bomb: American Nuclear Intelligence from Nazi Germany to Iran and North Korea* (W. W. Norton & Company: New York 2007) p 37.
530 Rhodes, Richard, *The Making of the Atomic Bomb* (Simon & Schuster: New York 1986) pp. 608-610.

Just as the Germans had, the Russians noted the absence of publications by the most notable American scientists on fission-related research.[531] When the discovery of spontaneous fission in uranium by a Russian scientist named Igor Kurchatov, and published in the Physical Review journal in June 1940, resulted in '"[t]he complete lack of any American response to the publications of the discovery"' this convinced the Russians the Americans were working on a secret project.[532]

The allied camp eventually consolidated its resources in the United States by having the leading scientists from the United Kingdom, France, Canada and the United States, not to mention several German scientists that had fled the Nazi's, combine their work in what became known as the Manhattan Project. After Fermi's spectacular success in 1942 running a chain reaction with his 'Chicago Pile-1' reactor it had become clear that the enrichment of uranium's fissile isotope U235 and/or the separation of plutonium from irradiated uranium was possible and constituted two possible routes towards creating a nuclear explosive device. The construction of a massive industrial plant in Oak Ridge, Tennessee, based on the enrichment technology of gaseous diffusion and electromagnetic separation ensued, as well as plutonium production in Hadfield, Washington State.[533]

After the war, even though there was still strict secrecy in effect with regards to the Manhattan Project, the Smyth report was published. It was intended for the US Congress, to explain wartime expenditures on this part of the war effort. It detailed the creation and workings of the project and while not disseminating important technical details and partly obscuring for example the more sensitive work at particular sites[534], it read like a generalized history of a nuclear weapons development program, implicitly showing that with the proper planning, industrial base and commitment, a modern industrialized state could develop a nuclear weapons capability of its own.[535]

Proliferation Potential and Resource Denial

The earliest agreement to pursue international nuclear stewardship was signed by President Truman of the United States, Prime Minister Atlee of the United Kingdom and Prime Minister King of Canada on November 15, 1945, in which they stated the development of atomic energy had generated a means of destruction unknown before to mankind, that there was no adequate defense to atomic weapons and that a nuclear weapons monopoly for any state

531 Ibid., p. 345.
532 Ibid., p. 327.
533 Enrichment technologies are discussed in Chapter 7.
534 Wellerstein, Alex, 'Los Alamos and the Smyth Report', Restricted Data: The Nuclear Secrecy Blog, 15th of August 2012, http://blog.nuclearsecrecy.com/2012/08/15/los-alamos-and-the-smyth-report/, website checked 13-7-2017.
535 Smyth, H., D., *Atomic Energy for Military Purposes: The Official Report on the Development of the Atomic Bomb under Auspices of the United States Government 1940-1945* (Princeton University Press: Princeton 1945), Rhodes, Richard, *The Making of the Atomic Bomb* (Simon & Schuster: New York 1986) p. 750. See for more on the Smyth Report, chapter 7, *The Smyth Report*, page 188.

would prove impossible to maintain.[536] Moreover and important for this study, the above and other points in the statement reflect an early attempt to capture non-proliferation principles, 'that the responsibility for devising means to insure that the new discoveries shall be used for the benefit of mankind, instead of as a means of destruction, rest not on our nations alone but upon *the whole civilized world*.'[537] Here we see the recognition of the nature of the problem of proliferation as one that requires all nations to work together to prevent it, not just that of the 'haves', which at the time were the nations that had signed. The paragraph continues: 'Nevertheless, the progress that we have made in the development and use of atomic energy demands that we take an initiative in the matter, and we have accordingly met together to consider the possibility of international action.'[538] In this example of norm entrepreneurship, the three nations signal their early support for a norm of responsible nuclear technology use and norm of nuclear non-proliferation.

Should the foregoing quote be interpreted as stating a right of initiative or as a responsibility of initiative? Arguably both, as it is a *modus operandi* we see return later in nuclear history, for example with the convening of the Nuclear Suppliers Group, an international initiative between those nations that possessed the most advanced nuclear technologies and infrastructure in the early 1970s that intended to create clarity on nuclear technology export in light of proliferation risks. See Chapter 10, *The London Club/The Nuclear Suppliers Group*.

Article 3 of the declaration recognized the limits to what the international community can achieve with safeguards and that any system resulting from its efforts would never become full-proof. Rather, future prevention of conflict is the only guarantee that will contain future threats from nuclear weapons or otherwise.[539] The statement continues with formulating a principle regarding knowledge sharing;

> '(4) Representing as we do, the three countries which possess the knowledge essential to the use of atomic energy, we declare at the outset our willingness, as a first contribution, to proceed with the *exchange of fundamental scientific information and the interchange of scientists and scientific literature for peaceful ends with any nation that will fully reciprocate.*
>
> (5) We believe that the *fruits of scientific research should be made available to all nations* .... In pursuance of this policy, the basic scientific information essential to the development of atomic energy for peaceful purposes has already been made

536 'Declaration on Atomic Bomb by President Truman and Prime Ministers Attlee and King, Washington, 15th of November 1945, http://www.nuclearfiles.org/menu/key-issues/nuclear-energy/history/dec-truman-atlee-king_1945-11-15_print.htm, website checked 13-7-2017, Rosenthal, Michael (ed.) *Deterring Nuclear Proliferation: The Importance of IAEA Safeguards* (Brookhaven National Laboratory: April 2013) https://www.bnl.gov/NNS/IAEAtextbook.php, Website checked 25-3-2017, Rosenthal, Michael (ed.) *Deterring Nuclear Proliferation: The Importance of IAEA Safeguards* (Brookhaven National Laboratory: April 2013) https://www.bnl.gov/NNS/IAEAtextbook.php, Website checked 25-3-2017 p. 27.

537 'Declaration on Atomic Bomb by President Truman and Prime Ministers Attlee and King, Washington, 15th of November 1945, http://www.nuclearfiles.org/menu/key-issues/nuclear-energy/history/dec-truman-atlee-king_1945-11-15_print.htm, website checked 13-7-2017, italics mine.

538 Ibid.

539 Ibid.

> available to the world. .... We trust *that other nations will adopt the same policy, thereby creating an atmosphere of reciprocal confidence in which political agreement and cooperation will flourish.*'[540]

The principle of scientific (and implicitly technological) liberalism is clearly promoted here, a principle we can later see return in the NPT's article IV. The last sentence of point 5 is particularly interesting because it speaks of the importance of reciprocity to build confidence; as a whole, the enterprise will not prove viable when international trust is absent. This principle is reflected in a practical way in part of the statement that follows:

> 'We are not convinced that the spreading of the specialized information regarding the practical application of atomic energy, *before it is possible to devise effective, reciprocal, and enforceable safeguards acceptable to all nations,* would contribute to a constructive solution of the problem of the atomic bomb.'[541]

Fundamental knowledge should be shared, but specialized information on its practical application should for the time being be restricted. And,

> 'In particular the commission should make specific proposals: .... (d) For effective safeguards by way of inspection and other means to protect complying states against the hazards of violations and evasions.'[542]

Most non-proliferation initiatives keep to this principle of trust through verification (through inspections of safeguards). Even at a time when hope for the United Nations to reach its potential for peace was at an all-time high right after the war, we see the caution of statesmen; trust between nations can only exist when this trust can be verified, as set against the natural (Realism-inspired) tendency of mistrust in considerations of national security.

The USSR responded to the Truman-Atlee-King declaration with the Moscow Declaration, which called for a UN commission on atomic energy to start addressing the challenges of effective control. In January of 1946, the United Nations Atomic Energy Commission (UNAEC) was established as a result of a diplomat initiative by the USSR, US and UK with their proposal co-sponsored by China and France.[543]

The Acheson-Lilienthal Report

In anticipation of the work in the UNAEC, the first US diplomatic non-proliferation effort started with the convening of a committee headed by then assistant-secretary of state Dean Acheson and including among others General Leslie Groves (who had overseen the Manhattan Project), to come up with a policy proposal to deal with the atomic conundrum in the years to come. Acheson asked David E. Lilienthal to chair a sub-committee towards this

540 Ibid, italics mine.
541 Ibid., italics mine.
542 Ibid.
543 Scheinman, Lawrence, *The International Atomic Energy Agency and World Nuclear Order* (Resources for the Future and Johns Hopkins University Press: Washington D.C. 1987) p. 50.

end, consisting of a number of consultants among which nuclear scientist J. Robert Oppenheimer.

The resulting Acheson-Lilienthal report was a representation of majority of the nuclear scientist's beliefs and shared by a majority of the public as derived from opinion polls, that it would prove impossible to maintain a monopoly on all matters nuclear and that therefore the US should see international cooperation on the control of knowledge and materials in the form of an international monopolist as in its long term interest. It also reiterated the principles in the Attlee/King/Truman declaration including the call for a system of international safeguards.[544] The disagreements within the main committee and in the US administration on this subject at this moment in time can be seen as originating in disagreements on estimations how long the nuclear monopoly could be maintained. Manhattan Project scientists put this estimate at around five years, whereas the 'hawk camp' led by Leslie Groves continued to trust in their policy of material resource denial centered around the Western alliance effort to control the output of all uranium and thorium ore production sites in the world and the estimation that the industrial prowess in resources and *know-how* of the USSR was insufficient to duplicate what the Americans had done.[545]

In Gregg Herken's 1980 article on the subject, part of the reason for those underestimation of USSR capabilities seems to stem from Groves' sense of American exceptionalism, reflected in his public statement, '"We have a spirit in the United States that is not duplicated elsewhere"', although this can of course be a reflection of personal pride in the achievements of the Manhattan Project crew under his leadership.[546] The trust in this assumption partly derived from the seemingly successful attempt to 'corner the market' of the relevant ores, while grossly underestimating the ore reserves in Eastern Europe and the Soviet Republics. It also derived from the estimation that other than the Americans, the Russians would not be able to manage a parallel approach in a crash-project, unable to combine the scientific with the technological work. Groves later (in 1954) admitted that he had overlooked the Russians ability to mine uranium in East Germany, falsifying his assertion that the policy of raw materials denial had been effective.[547]

544 Herkin, Gregg, '"A Most Deadly Illusion": The Atomic Secret and American Nuclear Weapons Policy, 1945-1950' in *Pacific Historical Review*, Vol. 49, No. 1 (University of California Press: February, 1980) p 54, Barnard, C., I., Oppenheimer, J., R., Thomas, C., A., Winne, H., A., Lilienthal D., E., *A Report on the International Control of Atomic Energy; Prepared for the Secretary of State's Committee on Atomic Energy*, Washington D.C., 1946., Rosenthal, Michael (ed.) *Deterring Nuclear Proliferation: The Importance of IAEA Safeguards* (Brookhaven National Laboratory: April 2013) https://www.bnl.gov/NNS/IAEAtextbook.php, Website checked 25-3-2017, p. 28, Scheinman, Lawrence, *The International Atomic Energy Agency and World Nuclear Order* (Resources for the Future and Johns Hopkins University Press: Washington D.C. 1987) p. 51.
545 Herkin, Gregg, '"A Most Deadly Illusion": The Atomic Secret and American Nuclear Weapons Policy, 1945-1950' in *Pacific Historical Review* Vol. 49, No. 1 (University of California Press: February, 1980) pp. 55, 57.
546 Ibid.
547 Ibid., p. 75.

The Baruch Plan

With such differing views existing between scientists, policy makers and the military, and with an actual monopoly on nuclear weapons in place, early diplomatic non-proliferation efforts had to compete with the US Government's perception that it could run the table and make whatever demands it saw as in its interest, with little consideration for the 'scepter of the future'; the possibility that it would not remain the sole nuclear weapon state for very long. The Baruch Plan, named after the U.S.'s first representative to the UNAEC, was a diplomatic initiative with strong cosmopolitan tenets that sought to maintain this status quo through 'managerial control or ownership of of all atomic energy activities potentially dangerous to world security …; authority to control, inspect, and license all other atomic energy activities; and … responsibility to engage in atomic energy research and developments' by a single international agency established for those purposes.[548] In a diplomatic counter-stroke, the USSR proposed the destruction of all nuclear weapons before considering such international control over its domestic affairs, which it as well as the proposed agency's ability to impose sanctions without UNSC recourse, opposed.[549] Progress in the UNAEC appeared impossible, with the American and most of the rest of the commission members perceptions reflected in the third and final report of the UNAEC, blaming the USSR while recognizing that, in the words of Lawrence Scheinman, 'the international control of atomic energy posed a formidable challenge to traditional precepts and prerogatives of national security and sovereignty, and to existing international political and economic practices.'[550]

These and other factors (such as the public outrage following the revelations over Russian atomic spies) led to President Truman's decision to choose the road of denial. The Atomic Energy Act of 1946 banned the sharing and publishing of scientific information on atomic energy with other countries altogether, pending a congressional declaration that an effective international safeguards system against military use had been established. It was a complete turn-around of earlier publicly stated principles, such as those in the Attlee/King/Truman declaration of '45. It put severe pressure on the relationship with close allies Canada, the UK and France, who felt put out in the cold after having been contributors in the wartime nuclear effort. Particularly the United Kingdom and France would during the next decade continue to push the United States to relent and let them share in its nuclear secrets, the former eventually successful in that endeavor (the Bermuda deal, see page 213), the latter left disappointed and aggrieved. The US Atomic Energy Commission (AEC), established by the act, was given full control of both nuclear weapon and energy development on the 1st of January 1947 and was essentially tasked with maintaining the atomic secret. A Joint Committee on Atomic Energy of the US Congress was to provide oversight of the act's civilian and military aspects.[551]

548 Scheinman, Lawrence, *The International Atomic Energy Agency and World Nuclear Order* (Resources for the Future and Johns Hopkins University Press: Washington D.C. 1987) p. 17.
549 Ibid., pp. 17, 52-53.
550 Ibid., p. 55.
551 Rosenthal, Michael (ed.) *Deterring Nuclear Proliferation: The Importance of IAEA Safeguards* (Brookhaven National Laboratory: April 2013) https://www.bnl.gov/NNS/IAEAtextbook.php, Website checked 25-3-2017, pp. 31-32, Howlett, Darryl, A., *EURATOM and Nuclear Safeguards* (The Macmillan Press Ltd.: Basingstoke 1990) pp. 37, 40-41, Ebinger, Charles, K., *The Washington Papers Vol. VI: International Politics of Nuclear Energy* (The Center for Strategic and International Studies: Sage Publications, Beverly Hills & London 1978) p. 29.

Atoms for Peace 1953-1955

Following the Berlin crisis of 1948-1949, the USSR detonated its first nuclear weapon in August of 1949 and the UK followed in 1952, showing that denial by the US was not working as far as industrially capable countries were concerned. The Korean War had broken out in 1950 (with an armistice agreed in July of 1953) and aided in worsening tensions between the communist countries (the Soviet block and China) and the West. Progress in the Disarmament Commission, the newly established (1952) conventional and nuclear arms reduction negotiation-forum of the UN, had stalled.[552] After thermonuclear testing had begun by the US in 1951 with the first mature thermonuclear weapon successfully detonating in November 1952 at a yield of 10 Megatons TNT (roughly 1000 times that of the Hiroshima bomb), the USSR followed suit with what they claimed was their own successful thermonuclear weapon test in 1953.[553] Earlier in 1953, Joseph Stalin, General Secretary of the USSR's Communist Party had died and President Eisenhower, a former US general, had been elected the previous year, creating a political opportunity to reinvent American policy and its engagement with its allies, the USSR and the rest of the world.[554] Eisenhower did so in December of 1953 at the UN, proposing the Atoms for Peace program. He began by explaining to his audience, the General Assembly of the UN, the terrible strategic dilemma that was emerging with the ending of the American nuclear weapon monopoly and some of the realities of nuclear deterrence and war and then proposed his initiative that would commit,

> '[t]he Governments principally involved, to the extent permitted by elementary prudence, to begin now and continue to make joint contributions from their stockpiles of normal uranium and fissionable materials to an International Atomic Energy Agency. We would expect that such an agency would be set up under the aegis of the United Nations.'[555]

In a reversal of US policy up to that point, he announced the divorce of the requirement of an international safeguards system as a condition to be met ahead of US nuclear technology sharing, 'the stringent safeguards requirements of the Baruch Plan were essentially abandoned'

552 Cavers, David, F., 'Arms Control in the United Nations: A Decade of Disagreement', in *Bulletin of the Atomic Scientists* (April 1956) p. 108.

553 'Hydrogen Bomb – 1950', Atomic Heritage Foundation, 19th of June 2014, http://www.atomicheritage.org/history/hydrogen-bomb-1950, website checked 13-7-2017, 'Soviet Hydrogen Bomb Program', Atomic Heritage Foundation, http://www.atomicheritage.org/history/soviet-hydrogen-bomb-program, website checked 25-3-2017. The Soviet claim was disputed by an American panel, stating that because a large part of the 400 ton TNT yield was from its fission reaction, what the Soviet's claimed was a thermonuclear device was in fact a 'boosted' fission bomb, Wellerstein, Alex, 'A Hydrogen Bomb by any Other Name', in *The New Yorker*, 8th of January 2016, http://www.newyorker.com/tech/elements/a-hydrogen-bomb-by-any-other-name, website checked 25-3-2017.

554 Rosenthal, Michael (ed.) *Deterring Nuclear Proliferation: The Importance of IAEA Safeguards* (Brookhaven National Laboratory: April 2013) https://www.bnl.gov/NNS/IAEAtextbook.php, Website checked 25-3-2017, p. 33.

555 Eisenhower, Dwight, 'Atoms for Peace', Speech to the General Assembly of the United Nations, 8th of December1953, http://voicesofdemocracy.umd.edu/eisenhower-atoms-for-peace-speech-text/, website checked 25-3-2017, 'Dwight D. Eisenhower Atoms for Peace', Youtube, https://www.youtube.com/watch?v=P8HIiam9m9c, website checked 25-3-2017.

in an acknowledgment of the contemporary inability 'to develop a comprehensive international control regime':[556]

> 'Undoubtedly initial and early contributions to this plan would be small in quantity. However, the proposal has the great virtue that it can be undertaken without the irritations and mutual suspicions incident to any attempt to set up a completely acceptable system of world-wide inspection and control.'[557]

As to the tasks of the to-be-established new agency, he proposed:

> 'The Atomic Energy Agency could be made responsible for the impounding, storage, and protection of the contributed fissionable and other materials. The ingenuity of our scientists will provide special safe conditions under which such a bank of fissionable material can be made essentially immune to surprise seizure. The more important responsibility of this Atomic Energy Agency would be to devise methods whereby this fissionable material would be allocated to serve the peaceful pursuits of mankind. Experts would be mobilized to apply atomic energy to the needs of agriculture, medicine, and other peaceful activities. A special purpose would be to provide abundant electrical energy in the power-starved areas of the world. Thus the contributing powers would be dedicating some of their strength to serve the needs rather than the fears of mankind.'[558]

After thus promising the 'power-starved' developing world access to nuclear technology, he made the USSR jointly responsible for making such a program a reality:

> 'The United States would be more than willing – it would be proud to take up with others "principally involved" the development of plans whereby such peaceful use of atomic energy would be expedited. Of those "principally involved" the Soviet Union must, of course, be one.'[559]

After a thunderous applause from the assembly and followed in the period immediately after the speech by more push-back from the Soviet delegates, eventually the latter relented in its criticism that the ambitious proposal failed to address the increasing stockpiles of nuclear arms in the ongoing arms race.[560] Perhaps this was because after the initial Soviet resistance to

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556 Scheinman, Lawrence, *The International Atomic Energy Agency and World Nuclear Order* (Resources for the Future and Johns Hopkins University Press: Washington D.C. 1987) pp. 58, 61.

557 Eisenhower, Dwight, 'Atoms for Peace', Speech to the General Assembly of the United Nations, 8th of December1953, http://voicesofdemocracy.umd.edu/eisenhower-atoms-for-peace-speech-text/, website checked 25-3-2017, 'Dwight D. Eisenhower Atoms for Peace', Youtube, https://www.youtube.com/watch?v=P8HIiam9m9c, website checked 25-3-2017.

558 Ibid.

559 Ibid.

560 Scheinman, Lawrence, *The International Atomic Energy Agency and World Nuclear Order* (Resources for the Future and Johns Hopkins University Press: Washington D.C. 1987) pp. 59-60, 66, Eisenhower, Dwight, 'Atoms for Peace', Speech to the General Assembly of the United Nations, 8th of December1953, http://voicesofdemocracy.umd.edu/eisenhower-atoms-for-peace-speech-text/, website checked 25-3-2017, 'Dwight D. Eisenhower Atoms for Peace', Youtube, https://www.youtube.com/watch?v=P8HIiam9m9c, website checked 25-3-2017.

move forward with constructive negotiations on US proposals and the Soviet's implicit rejection of safeguards and their attempts to shift the international political focus back to disarmament, the US had 'declared that with or without Soviet participation it might examine the establishment of the agency with other interested nations', carrying within it the threat and danger of Soviet political isolation.[561] The US administration launched the Atomic Energy Act of 1954 to create the legal window for nuclear technology sharing while keeping major elements of classification and secrecy of the 1946 act in place. The 1954 act, signed into law by the President in August of the same year, allowed for a private nuclear industry and a freer flow of information, helped by the full and partial declassification of technical information for the use of private industry.[562]

Atoms for Peace in Strategic Context

The US Government's rationale for the Atoms for Peace initiative should be seen in the context of the larger strategy of 'Operation Candor', which contained a public relations offensive that offered, in a measured approach, information on public measures of civil defense; 'reassuring words' to balance the 'frightening words' of the ongoing arms race, which Eisenhower didn't intend to curb.[563] As a strategy, Candor was meant to protect the US,

> '… and its efforts to consolidate a liberal capitalist "free world," by keeping the cold war perpetually cold. That meant mounting an effective deterrent against any possible Soviet attack. It also meant consolidating the cold war consensus – both in the United States and withing the "free world" alliance – so fully and permanently that negotiations with the Soviet Union would pose no danger to it. The administration was confident that, once the domestic and international consensus was solid, the Soviet threat could be contained over the long haul.'[564]

Following the Soviet thermonuclear detonation the US administration and its now very worried President launched a policy initiative based on National Security Council document 68, dubbed 'the New Look'; an aggressive pursuit of 'security alliances, covert operations, overseas propaganda, and nuclear weapons' in large quantities; eventually the US nuclear weapon stockpile under Eisenhower would grow from 841 to more than 18.638 weapons.[565] '[N]egotiation and massive retaliation' became 'the twin tools of apocalypse management'

561 Scheinman, Lawrence, *The International Atomic Energy Agency and World Nuclear Order* (Resources for the Future and Johns Hopkins University Press: Washington D.C. 1987) pp. 66-68.
562 Krige, John, 'Atoms for Peace, Scientific Internationalism, and Scientific Intelligence', in *Osiris*, Vol 21, No. 1 (University of Chicago Press: 2006) pp. 164-165.
563 Chernus, Ira, *Eisenhower's Atoms for Peace* (Texas A&M University Press: College Station 2002) pp. 48, 61-62.
564 Ibid., p. 51.
565 Lavoy, Peter, R., 'The Enduring Effects of Atoms for Peace', in *Arms Control Today*, Vol 33, No. 10 (December 2003) https://www.armscontrol.org/act/2003_12/Lavoy, website checked 26-3-2017, Chernus, Ira, *Eisenhower's Atoms for Peace* (Texas A&M University Press: College Station 2002) pp. 54, 56, Krige, John, 'Atoms for Peace, Scientific Internationalism, and Scientific Intelligence', in *Osiris*, Vol 21, No. 1 (University of Chicago Press: 2006) p. 162.

under the New Look, wrote Ira Chernus.[566] Meanwhile, the US was looking for ways to reduce its conventional troops overseas, facing domestic political pressures that called for 'less international involvement and drastically reduced foreign aid and military budgets', without upsetting its allies in Europe (and thus, for example, avoid sabotaging the European Defense Community initiative).[567] Secretary of State John Foster Dulles came up with a plan that would forward the goals of the New Look while also, if successful, alleviate world tensions and allow such a withdrawal. His idea was to propose to the Soviets a spectacular withdrawal of troops in Europe by both sides but that also would require the disbandment of the Soviet-controlled satellite state system in Eastern Europe, along with stringent controls of nuclear weapons. Thus, whether the Soviets accepted or not (unlikely, as they had rejected an earlier proposal on which the idea was based), the US would seize the diplomatic initiative and favor of world opinion. Dulles disarmament proposal was not acted upon but did inspire the Atoms for Peace initiative.[568]

The Atoms for Peace initiative therefore can be seen as a part of the New Look policy. John Krige listed several additional dimensions that help explain why Atoms for Peace came at the right time for the US administration. It helped the US in dealing with a 'bellicose' image in light of its nuclear arms build-up and testing, exemplified by the public relations-disaster of the first Castle test series (dubbed Bravo) on the 1st of March 1954, which was unexpectedly potent in yield and 'vaporized three islands in the Bikini atoll in the Marshall Islands' and radioactively contaminated a large area due to unfavorable winds, including an unlucky Japanese fishing boat named *Lucky Dragon Five*, eighty nautical miles away.[569] Additionally, the AEC had failed for years, hampered by secrecy, to interest the US private industry in nuclear power projects. With the UK launching the first nuclear power plant and Russia following suit soon after, the US was falling behind; the Atomic Energy Act of 1954 created an distinction between the American military and civilian nuclear industry and allowed private industry to access some of the technical data accumulated in the US and the Atoms for Peace initiative in time created the domestic and foreign markets with which American companies could do business.[570]

566 Chernus, Ira, *Eisenhower's Atoms for Peace* (Texas A&M University Press: College Station 2002) p. 58.
567 Ibid., pp. 59-62.
568 Ibid., pp. 59-60.
569 Krige, John, 'Atoms for Peace, Scientific Internationalism, and Scientific Intelligence', in *Osiris*, Vol 21, No. 1 (University of Chicago Press: 2006) p. 163.
570 The civil-military distinction built into the 1954 act also allowed for continued denial of military nuclear technology to the UK and France, which frustrated both but particularly the latter, because the former was well on its way forging a special nuclear relationship with the United States, evidenced by the Bermuda Conference result only a few years later (see page 213) France perceived the continued denial as a strategy by the US to maintain nuclear hegemony within the NATO alliance while keeping France isolated, Howlett, Darryl, A., *EURATOM and Nuclear Safeguards* (The Macmillan Press Ltd.: Basingstoke 1990) pp. 40-41. The Atomic Energy Act of 1954 was amended in 1964 ('the "privatization" policy') to remove 'a key legal barrier' and allow US companies to own special nuclear materials and commercially exploit enrichment technologies and offer toll enrichment services, Wonder, Edward, F., *Nuclear Fuel and American Foreign Policy* (Westview Press: Boulder 1977) pp. 7-8, Charpie, Richard, Alan, *Essays on Uranium Enrichment*, Ph.D. Dissertation, Department of Management, The Massachusetts Institute of Technology (February 1979) p. 101.

Combined with lenient financial packages underwritten by the state, the resulting supply of nuclear infrastructure, materials and know-how to many countries across the world was intended to present the US as a benevolent and generous leader of the non-Communist world while securing profitable foreign nuclear markets for years to come. Furthermore, nuclear trade was used, both by the US and the USSR, to foster existing and emerging patron-client relationships (an exhibition of the Cold War 'heteronomy' that Onuf theorized, see Chapter 4, *Part 3: From the Constructivist Turn into the Post-Positivist Era of Regime Theory*, on page 124) Nuclear reactors, fuel and training could be used to win the allegiance of newly-independent states following decolonization, be used to mollify allies worried about the US growing nuclear arsenal as well as gain a measure of influence over the many emerging national nuclear programs across the world; nuclear technology could be used as political currency and nuclear trade as a means of control of that technology.[571] An added perceived benefit was that if the USSR or any other state would attempt to match the US program, this would divert resources from their military programs.[572] An active promotional role for the US administration helped with that; in a joint effort with the UK and Canada and under auspices of the UN, the aforementioned countries' scientists would 'present "papers of real substance on the technical aspects" of reactor construction, and many features of the technology, from the social and economic aspects of nuclear energy, to medical, biological and industrial uses of radioisotopes would be discussed' at a conference in Geneva in 1955.[573] The resulting Atoms for Peace Conference was a public relations success and fostered a new professional appreciation between scientists of many nations, including between those from the East and West.[574]

In March 1955 Eisenhower directed the AEC to provide non-Communist block nations with technical and material assistance in the nuclear field. Bilateral agreements under Atoms for Peace were signed from June 1955 and by August 'the AEC had negotiated two dozen research bilaterals; by 1961, the number had reached thirty-nine.'[575] In late 1956, the AEC lowered the price of U-235 from $ 25 to $ 16 per gram, making LEU fuel purchases much cheaper.[576] In June 1958, former AEC Chairman Lewis Strauss wrote on the early success of the program:

571 Krige, John, 'Atoms for Peace, Scientific Internationalism, and Scientific Intelligence' in *Osiris*, Vol 21, No. 1 (University of Chicago Press: 2006) p. 173-174, Van Ginkel, J, Neuman, H.J., Visser C.J., *Kernenergie en Kernwapens: Nederland en het Non-proliferatiebeleid* (Nederlands Instituut voor Vredesvraagstukken, Staatsuitgeverij: The Hague 1977) p. 15, Lavoy, Peter, R., 'The Enduring Effects of Atoms for Peace', in *Arms Control Today*, Vol 33, No. 10 (December 2003) https://www.armscontrol.org/act/2003_12/Lavoy, website checked 26-3-2017.

572 Krige, John, 'Atoms for Peace, Scientific Internationalism, and Scientific Intelligence', in *Osiris*, Vol 21, No. 1 (University of Chicago Press: 2006) p. 164. The idea that nuclear aid would divert resources from military programs was inspired by the still-persisting belief that uranium and thorium ores were in limited supply.

573 Ibid., p. 165.

574 Ibid., pp. 165-166, 174-180.

575 Krige, John, 'Atoms for Peace, Scientific Internationalism, and Scientific Intelligence', in *Osiris*, Vol 21, No. 1 (University of Chicago Press: 2006) pp. 173-174, Lavoy, Peter, R., 'The Enduring Effects of Atoms for Peace', in *Arms Control Today*, Vol 33, No 10 (December 2003) https://www.armscontrol.org/act/2003_12/Lavoy, website checked 26-3-2017, p. 26.

576 Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) p. 125.

> 'Twenty-seven countries have agreements covering atomic research, and 12 countries have agreements covering both research and atomic power. Pursuant to these agreements, an American manufacturer is building a small power reactor for installation in Belgium and has contracted to build a full-scale power reactor for installation at Milan, Italy. Other concerns are negotiating with various countries. Research reactor projects are, of course, more numerous. Seven research reactors exported from the United States are in operation in six countries. Upon completion of the 13 under construction and five others planned, American industry will have built 25 research reactors for 15 countries. Five other reactors in three countries are using reactor fuel obtained from the United States. …. Nearly 600 foreign nationals have received training at our Oak Ridge Institute of Nuclear Studies in radio-isotope techniques or at Argonne National Laboratory in reactor science and engineering.'[577]

The Atoms for Peace program of nuclear technology dissemination reversed the diplomatic priorities that the US had set before; instead of an emphasis on proliferation controls and safeguards, now nuclear development came first.[578] This was reflected in the pre-IAEA US required bilateral safeguards;

> '[T]he new export policy "ordinarily" required recipients of U.S. fissile materials or reactors to send used fuel elements to U.S. facilities for chemical processing; to establish adequate production accounting, inspection, and other control technologies; and eventually accept IAEA safeguards. In practice, however, U.S. enforcement of these measures was not very strict ….'[579]

Other first generation nuclear exporters such as the UK, Canada and France followed the American 'pattern' of providing information and training and the (financial) means to acquire 'necessary equipment, including research reactors'. By 1978, these nuclear exports resulted in 'about 400 research and experimental reactors under 20 megawatts (MW) in approximately fifty countries, with more projected for 1980.'[580] Of these, many 'had no military significance, although two, the CIRUS reactor supplied to India by Canada (along with US heavy water), and the Dimona reactor, provided to Israel by France, were larger facilities – capable of producing militarily significant quantities of plutonium.'[581] In the wake of this wave of exports that helped countries become familiar with nuclear technology, the Atoms for Peace program

577 Strauss, Lewis, L., 'The U.S. Atomic Energy Program 1953-1958' in *Bulletin of Atomic Scientists*, Vol 16, No. 7 (September 1958) p. 258.

578 Van Ginkel, J, Neuman, H.J., Visser C.J., *Kernenergie en Kernwapens: Nederland en het Non-proliferatiebeleid* (Nederlands Instituut voor Vredesvraagstukken, Staatsuitgeverij: The Hague 1977) p. 17.

579 Lavoy, Peter, R., 'The Enduring Effects of Atoms for Peace' in *Arms Control Today*, Vol 33, No. 10 (December 2003) https://www.armscontrol.org/act/2003_12/Lavoy, website checked 26-3-2017.

580 Ebinger, Charles, K., *The Washington Papers Vol. VI: International Politics of Nuclear Energy* (The Center for Strategic and International Studies: Sage Publications, Beverly Hills & London 1978) p. 17.

581 Müller, Harald, Fischer, David, Kötter, Wolfgang, *Nuclear Non-Proliferation and Global Order* (Oxford University Press: 1994) p. 16, Scheinman, Lawrence, *The International Atomic Energy Agency and World Nuclear Order* (Resources for the Future and Johns Hopkins University Press: Washington D.C. 1987) pp. 18-19. Plutnoium separated from CIRUS fuel was used for India's 1974 nuclear detonation, and Dimona's plutonium was likely used in Israel's nuclear weapon program, although the existence of that program is still denied by Israel to this day, see chapter 10, *Case: India,* page 439 and *Cases: Iraq, Libya and Israel*, page 414

facilitated the export of nuclear power reactors, such as when the US provided India, deemed strategically important to the US, with loans and grants that 'subsidized the construction and operation of India's first power reactor at Tarapur.'[582]

Creation of the IAEA

Arguably the most important strategic objective of Atoms for Peace was to '[move] beyond the impasse that characterized the Soviet-American nuclear dialogue' and present a peaceful alternative to the arms race that was under way. It appeared to have that effect, when in September 1954 the USSR made a new argument on 'technical means that could prevent materials located at peaceful facilities and intended for peaceful purposes from being used for military ends' and signaled a willingness for further negotiations in this subject at a multilateral conference in August 1955. Parallel to this, the US and seven of its allies moved forward by drafting a statute to create the international atomic agency as envisioned in Eisenhower's speech. While the UN General Assembly objected to the unrepresentative make-up of this group, it applauded the initiative. Following the success of the 1955 scientific conference, the UN General Assembly's First Committee debated the draft-statute of a to-be-established agency and planned a conference in September 1956 in order to come to agreement. In preparation of this conference the US and a group of allies were joined by the USSR, Czechoslovakia, India and Brazil and produced a new draft of the statute that envisioned agency safeguards to be conditioned on the reception of agency assistance, excluding those countries that did not require assistance (the nuclear weapon states, US, UK and USSR) from those obligations. The so-called Group of Twelve, which would also act as sponsors of the Conference of the IAEA Statute, submitted the produced draft to the UN member states.[583]

Eighty-two nation states attended the Conference on the IAEA Statute, which opened on the 20th of September 1956 and the resulting statute was signed by seventy nations by the end of October. Negotiations on safeguards had proven contentious, particularly the issues of whether natural uranium should be safeguarded (it wasn't). Several countries with major ore deposits (Australia, Canada, Belgium) were for this idea, while India, France and others were against it. The questions of how intrusive safeguards should be allowed to be also exposed disagreement, with particularly the Soviets and Indians casting it as interference in economic development by the IAEA, and the US, Canada and the UK arguing that the draft statute provided for at least a minimum requirement of assurance.[584]

The IAEA's first General Conference was held in October 1957 during which among other things, member budgetary contribution scales, the appointment of a Director General, the

582 Lavoy, Peter, R., 'The Enduring Effects of Atoms for Peace', in *Arms Control Today*, Vol 33, No. 10 (December 2003) https://www.armscontrol.org/act/2003_12/Lavoy, website checked 26-3-2017.

583 Scheinman, Lawrence, *The International Atomic Energy Agency and World Nuclear Order* (Resources for the Future and Johns Hopkins University Press: Washington D.C. 1987) pp. 67-70.

584 Ibid., pp. 70-73. For more on (early) safeguards, see chapter 11, *EURATOM, the IAEA and NPT Safeguards*, on page 456.

initial working program and budget and the expansion of the preliminary Board of Governors with additional members were decided upon. The Board of Governor's (BoG) constitution used a formula (that over time evolved) that ensured a regional representation with a heavy emphasis on a high level of nuclear development and/or production capabilities of source materials in its members.

Besides establishing the IAEA's Secretariat, the BoG established a training fellowship program aimed at lesser developed countries and initiated 'exploratory negotiations' on the Agency's technical assistance program and appropriate safeguards for it.[585] Augmenting the fellowship program was a technical information dissemination campaign that included the setting up of a specialized library based on the American Atoms for Peace library and donated collections from other member states. In combination with providing training in radiological application, the Agency started work on standardization of safety guidelines for work in member states on radioactive isotopes use and the wider field of radiation protection, in collaboration with the UN and its already existing specialized agencies (such as the International Commission on Radiological Protection). It also started to work out modalities by which it could receive the 5140 kg of fissionable material already offered to it as well as share that material with members applying to the IAEA for assistance, in order for the Agency to developed its intended function as a 'bank or broker for special fissionable and source materials'.[586]

A General Conference decision in 1958, approved by the BoG in 1959, established an Agency laboratory for analysis of 'samples of radioactive fallout' from nuclear tests, 'preparation of international radioactivity standards', '[c]alibration of equipment for measuring radioactivity', special materials quality control and '[m]easurements and analysis in support of the IAEA's health and safety and safeguards work', which became operational in Seibersdorf, Austria in 1961.[587] The IAEA laboratory at Seibersdorf (and others) became instrumental in the analysis of environmental samples taken in the field in the context of the Safeguards Division's inspectorate discharging its duties.

The Creation of EURATOM

The integration of Europe started in earnest in the second half of the 1950s. After the disappointment of the EDC's failure, the political integration of Europe gathered considerable momentum with the 'Relaunch of Europe' in May 1955 following '*the Benelux Memorandum*',

585 'The First Year of IAEA' in *World Atomics: Bulletin of the International Atomic Energy Agency*, Vol. 0-1 (September 1958) https://www.iaea.org/publications/magazines/bulletin/0-1, website checked 1-4-2017, pp. 6-8.
586 Ibid., pp. 9-11. A detailed description of how the IAEA differs from its original concept in the Baruch plan, its rules and procedures and comprehensive contents of its assistance programs can be found in Schiff, Benjamin, N., *International Nuclear Technology Transfers: Dilemmas of Dissemination and Control* (Rowman & Allanheld: Totowa 1984) pp. 55-76.
587 Fischer, David, *History of the International Atomic Energy Agency: The First Forty Years* (The Agency: Vienna 1997) http://www-pub.iaea.org/MTCD/publications/PDF/Pub1032_web.pdf, website checked 4-1-2017, p. 92, Schiff, Benjamin, N., *International Nuclear Technology Transfers: Dilemmas of Dissemination and Control* (Rowman & Allanheld: Totowa 1984) p. 64.

the positive reception of its call for 'functional integration' and the memorandum's thorough discussion during the ECSC's Messina Conference later that same year.[588] The Messina Conference was followed by the Brussels Conference, during which the challenges surrounding the supra-nationalism of a transnational body for Europe were debated, as well as how and to what degree this would affect the 'fledgling nuclear programmes' of the European states involved in the talks.[589] Out of the Brussels Conference came the Spaak Committee, which looked at a number of integration issues, including issues of nuclear energy. The United Kingdom its involvement's end in the integration process was marked by its premature exit from the Spaak Committee deliberations and the remaining countries (calling themselves 'the Six') continued the process after the committee presented its final report.[590] The report stopped short of a plan for full integration of national nuclear programs into a transnational one but did provide the 'blueprint' for the draft of the EURATOM Treaty. Neither was military use of nuclear infrastructure entirely excluded, 'largely as a result of the objections of France'.[591] Eventually more discussions during 1956 led to to the establishment of a group of experts dubbed 'the Three Wise Men' (the French Armand, German Etzel and Italian Giordeni, all renowned experts on European integration).[592] This group recognized the need for support from the United States for the EURATOM project and secured it early on, issuing a February 1957 joint statement with the State Department and USAEC on the parties' intention to collaborate. The Three Wise Men then formulated a role for nuclear energy in Western Europe's electricity production in their Target for *EURATOM*, its optimist tone reflecting the mood of the time. The ensuing debate, as summarized by Darryl Howlett, centered on three major issues with an overarching theme:

> 'These were: whether EURATOM should give top priority to the construction of an isotope separation plant; whether EURATOM was to prohibit military applications of nuclear energy by its Member States; and finally, whether EURATOM should have the monopoly of nuclear supplies and be the official public voice of all the Member States on any nuclear issue. According to [J. Polach in *Euratom: It's Background, Issues, and Economic Implications* of 1964], although these three issues are quite distinct from each other, all had the same common ancestry: the notion that Europe should unite to become a 'third force' in international affairs. The principal question at issue was thus the extent to which EURATOM was to be 'an instrument not only of atomic and economic, but also political and military independence from both “super-powers”, the United States and the Soviet Union'.'[593]

588 The European Coal and Steel Community (ECSC) was the first 'tool' of economic integration that would eventually lead to the European Community, Howlett, Darryl, A., *EURATOM and Nuclear Safeguards* (The Macmillan Press Ltd.: Basingstoke 1990) p. 20. Italics in original.

589 These were the Benelux countries (The Netherlands, Belgium, Luxemburg), France, the FRG, Italy and the United Kingdom, Howlett, Darryl, A., *EURATOM and Nuclear Safeguards* (The Macmillan Press Ltd.: Basingstoke 1990) p. 21.

590 Ibid., pp. 21-24.

591 Ibid., p. 24.

592 Ibid., pp. 25-26.

593 Ibid., p. 27.

These aspects of the push toward European integration were met with suspicion and alarm by the USSR, and at least apprehension with regards to how it would affects its Cold War US Atomic Energy Act objectives (among which, promoting non-proliferation through European integration) within the Western alliance by the United States. When therefore the EURATOM and EEC Treaty negotiations were nearly concluded in March 1957, it was met by a forceful statement by the USSR casting EURATOM and the EEC as having 'aggressive aims and intentions' and which included a counter-proposal towards a Europe-wide (including the Soviet sphere of influence) nuclear development program.[594] Shortly after its conclusion, belief among the Six that EURATOM was the appropriate vehicle to explore far-going integration waned and by the time the treaty came into force at the start of 1958, ambitions for the organization were much tempered, reflected in the member states unwillingness to give it far-reaching supranational powers over their national nuclear industries; political traditions of national sovereignty prevailed.[595] Nevertheless, the established EURATOM Supply Agency did receive 'very far-reaching' authority with regards to nuclear materials in the treaty-area; 'total control of and responsibility of supply' was to be its mandate, which was reminiscent of the Baruch Plan and Acheson-Lilienthal Report and likened to the 1954 US Atomic Energy Act provisions, although over the years member states (notably France) undermined this authority by working around it (see page 277). Another far-reaching mandate was endowed on the EURATOM Safeguards Inspectorate, envisioning 'safeguards coverage across the full range of the nuclear fuel cycle.'[596] This extensive safeguards authority, granted under Articles 2, 77, 78 and offset by Article 84 left enough ambiguity that one could wonder, as Darryl Howlett does, whether EURATOM was even mandated to obtain detailed information on military nuclear facilities.[597] The safeguards agreed under the EURATOM treaty did not expressly forbid military use of nuclear material as had been pushed by the US and Canada, as a result of domestic political developments in France.[598]

Part of the rationale for establishing an independent European safeguards system was to provide assurances towards the outside world, particularly the nuclear suppliers Canada and the United States, that material and technology supplied to the EURATOM countries would not be diverted for military use and in doing so this would eliminate the need for bilateral safeguards from suppliers.[599] This would,

> '… avoid a situation where United States safeguards personnel would have long-term and far-reaching access to their nuclear facilities. At the heart of this concern was more the issue of industrial espionage than military secrecy.'[600]

To further acceptance by the United States and others of EURATOM safeguards, the safeguards provisions of the treaty were specifically drafted to resemble those of the US bilateral agreements and appear sufficiently credible in their stringency to be acceptable to

594 Ibid., p. 27, 45-46, 54-56.
595 Ibid., p. 29-30.
596 Ibid., pp. 90-91, 93.
597 Ibid., pp. 70, 97-99.
598 Ibid., p. 70.
599 Ibid., pp. 9, 67, 87-88.
600 Ibid., p. 68.

any other future suppliers.[601] Additionally, the EURATOM inspection regime also needed to be acceptable to the countries subject to its work, the EURATOM members, as they accepted in their national territories an infringement of sovereignty that could be construed as 'legalized espionage'.[602] More so than in the plans for an international safeguards system under the IAEA, the EURATOM safeguards system signified a crucial step in European integration because,

> '… of the political and legal ramifications of the EURATOM Treaty. Put simply, because of the wider aspirations of the European Community it was intended that the EURATOM and EEC Treaties would eventually have legal character in the domestic environments of Member States. The EURATOM Treaty was thus in theory designed to provide the legal basis for the regulation of the nuclear industries throughout the European Community, irrespective of territorial boundaries. The EURATOM Safeguards Inspectorate would thus in future deliberations have recourse to the legal context of the EURATOM Treaty to enforce their rights of access. This in itself created a very novel situation.'[603]

In this aspect the EURATOM safeguards system was and remained distinctly different from the IAEA safeguards system both pre- and post-NPT, as the latter never attained legal recourse, just a political one (referral of a non-compliant country to the UNSC).

In 1958, The United States decided to accept EURATOM safeguards instead of attempting to force the EURATOM countries to accept the existing US bilateral safeguards system. Countries but also officials in the US critical of the EURATOM system, because to them it constituted a form of self-inspection, saw the decision as a capitulation of US non-proliferation policy to its commercial interests that in the process seriously undermined the viability of the IAEA safeguards system, even though political progress on the latter was being hampered at the time by resistance from mainly India and the USSR, whom considered it discriminatory towards the developing world. The US had no intention of backing one safeguards system at the expense of another and hoped its decision to support the EURATOM system would allow it to serve as a stepping stone that could promote a global system while also furthering European integration. The 1958 decision and subsequent approval by Congress was perceived that way, but planted the seeds for the adversarial relationship that developed between EURATOM and the IAEA later on.[604] How the EURATOM safeguards system developed further and how its relationship with the IAEA evolved will be discussed in chapter 11.

601 Ibid., p. 69.
602 Ibid., p. 88.
603 Ibid., pp. 88-89.
604 The criticism that EURATOM's safeguards were essentially self-inspection was brought up again by the USSR during the NPT negotiations, Howlett, Darryl, A., *EURATOM and Nuclear Safeguards* (The Macmillan Press Ltd.: Basingstoke 1990) pp. 69-75, 79, 81, 125, 139 (note 5).

Toward the Treaty on the Non-Proliferation of Nuclear Weapons

The 1960s saw a number of seminal events that through discussion and confrontation shaped a consensus that eventually led to an unique agreement – the Nuclear Non-proliferation Treaty of 1968. Though a short summary of events leading up the treaty coming into force will be provided here, the intricate international political history of its creation can be found elsewhere.[605] An overview and discussion of the pre- and post-NPT safeguards system can be found in Chapter 11: International Safeguards Developments and Urenco, from page 452.

The Irish resolution in the United Nations General Assembly, unanimously adopted by the member states in 1961 followed an earlier 1958 Irish initiative. The 1961 resolution dovetailed contemporaneous USSR and US proposals that sought to ban the transfer of nuclear weapons from one state to the next. The Cuban Missile Crisis in 1962 marked a Cold War high-point of confrontation but the thawing of tensions that followed it created the political space for the US and USSR to push for arms control and non-proliferation initiatives with teeth, marked by UNGA (United Nations General Assembly) resolution 2028 that tasked the Eighteen-Nation Committee on Disarmament (ENDC) with negotiating a treaty based on five core principles that found their origin in the Irish initiatives.[606] Part of the changing USSR perception on and increasing willingness to discuss intrusive non-proliferation measures (safeguards) came in the wake of its 1963 realization that China was using Soviet nuclear aid to develop its own nuclear weapon, its concerns over the FRG's emerging nuclear infrastructure and the proposal and discussion in NATO on the Multilateral Force (MLF), a nuclear-weapon sharing initiative that could give the FRG (indirect) access to nuclear weapons, as well as 'reflected a de-escalating of political tensions already marked by the 1963 Test Ban Treaty'.[607]

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605 'Timeline of the NPT', Arms Control Association, https://www.armscontrol.org/system/files/NPT_Timeline.pdf, website checked 13-7-2017, 'Treaty of the Non-Proliferation of Nuclear Weapons and the IAEA - A Chronology', International Atomic Energy Agency, https://www.iaea.org/newscenter/focus/npt/chronology-of-key-events, website checked 13-7-2017, Barnaby, Frank, Goldblat, Jozef, Levinson, Macha, *The NPT: The Main Political Barrier to Nuclear Weapon Proliferation* (Taylor & Francis, 1980) https://www.sipri.org/publications/1980/npt-main-political-barrier-nuclear-weapon-proliferation, website checked 13-7-2017, Bunn, George, Rhinelander, John, B., 'LOOKING BACK: The Nuclear Nonproliferation Treaty Then and Now', in *Arms Control Today*, Vol. 38 (Arms Control Association: July-August 2008) https://www.armscontrol.org/act/2008_07-08/lookingback, website checked 13-7-2017, Burns, Richard, D., Coyle III, Philip, E., *The Challenges of Nuclear Non-Proliferation* (Rowman & Littlefield: London 2015) pp. 45-68, Ebinger, Charles, K., *The Washington Papers Vol. VI: International Politics of Nuclear Energy* (The Center for Strategic and International Studies: Sage Publications, Beverly Hills & London 1978) pp. 31-36, 'Nuclear Non-Proliferation Treaty [NPT] – Background', Federation of American Scientists, https://fas.org/nuke/control/npt/back.htm, website checked 13-7-2017. Mohammed Shaker's book, now out of print, can be found here: Shaker, Mohammed, *The Nuclear Non-Proliferation Treaty: Origins and Implementation, 1959-1979* (Oceana Publications: 1980), http://www.nonproliferation.org/the-nuclear-non-proliferation-treaty-origins-and-implementation-1959-1979/, website checked 13-7-2017.

606 Joyner, Daniel, *International Law and the Prolfieration of Weapons of Mass Destruction* (Oxford University Press: Oxford 2009) pp. 3-7, Van Ginkel, J, Neuman, H.J., Visser C.J., *Kernenergie en Kernwapens: Nederland en het Non-proliferatiebeleid* (Nederlands Instituut voor Vredesvraagstukken, Staatsuitgeverij: The Hague 1977) p. 18.

607 Ebinger, Charles, K., *The Washington Papers Vol. VI: International Politics of Nuclear Energy* (The Center for Strategic and International Studies: Sage Publications, Beverly Hills & London 1978) pp. 28, 32, Howlett,

After several years of negotiations and consultations with a wide selection of non-ENDC countries and protracted discussions on 'the safeguards and inspection regime to be included in Article III of the NPT', the USSR and US submitted a joint draft treaty that after two months of further negotiation was submitted to the UNGA for approval.[608] What became draft Resolution 2373 was adopted by a sizable majority of the GA on the 12th of June 1968, the same day the US, USSR and UK submitted a draft resolution (that was first discussed in the ENDC) to the UNSC in which they proposed (as NWS) a number of security assurances toward the NNWS, as part of the negotiation toward the NPT draft treaty. This resolution (nr. 255) was adopted by the UNSC and must be seen as part of the 'grand bargain' that the NPT represents. The Treaty on the Non-Proliferation of Nuclear Weapons came into force on the 3rd of March 1970 when the three depository state and forty other states ratified it.[609]

The NPT divided the world up in Nuclear Weapons States and Non-Nuclear Weapon States. NWS under the treaty obligated themselves to negotiate in good faith towards the global elimination of nuclear weapons and not to transfer their nuclear weapons or related weapons technology to other countries while the NNWS promised not to obtain nuclear weapons. In exchange for NNWS foregoing the acquisition of nuclear weapons, the treaty parties promise to help all states develop their peaceful nuclear infrastructure by providing assistance in the form of nuclear knowledge, equipment and special nuclear materials. As such the 'Grand Bargain' not only constitutes a deal between the NWS and NNWS but also between the global North and South, and between the nuclear supplier and recipient countries.[610]

Darryl, A., *EURATOM and Nuclear Safeguards* (The Macmillan Press Ltd.: Basingstoke 1990) p. 120, Shaker, Mohammed, *The Nuclear Non-Proliferation Treaty: Origins and Implementation, 1959-1979* (Oceana Publications: 1980), http://www.nonproliferation.org/the-nuclear-non-proliferation-treaty-origins-and-implementation-1959-1979/, website checked 13-7-2017, pp. 655-656. In Scheinmann's 1985 *The Nonproliferation Role of the International Atomic Energy Agency: A Critical Assessment* it is argued that the Soviet tone and attitude in diplomatic fora softened noticeably as early as 1962, the year of the Cuban missile crisis, quoted in Howlett, Darryl, A., *EURATOM and Nuclear Safeguards* (The Macmillan Press Ltd.: Basingstoke 1990) p. 140 (note 6). See also in chapter 2 under *Disarmament and Arms Control*, page *65* and chapter 11, page 452.

608 Joyner, Daniel, *International Law and the Prolfieration of Weapons of Mass Destruction* (Oxford University Press: Oxford 2009) p. 7.

609 Ibid., pp. 7-8, Shaker, Mohammed, *The Nuclear Non-Proliferation Treaty: Origins and Implementation, 1959-1979* (Oceana Publications: 1980), http://www.nonproliferation.org/the-nuclear-non-proliferation-treaty-origins-and-implementation-1959-1979/, website checked 13-7-2017, pp. 475-477, United Nations Security Council, Security Council resolution 255 (1968), 'Question relating to measures to safeguard non-nuclear-weapon States', 19th of June 1968, S/RES/255 (1968) http://unscr.com/en/resolutions/255, website checked 8-9-2018.

610 'The Treaty on the Non-Proliferation of Nuclear Weapons (NPT)', 2005 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), 2-27 May 2005, New York, http://www.un.org/en/conf/npt/2005/npttreaty.html, website checked 2-5-2017.

Chapter 7:

Nuclear Infrastructure Development and Research in the Netherlands

Before the Second World War nuclear science had been in development in several European countries. In 1939 several discoveries followed one another in rapid succession, of which Dutch scientists took notice. Hahn and Straszmann showed that uranium cores could be split and Nier showed that of these, the 235 isotope was 'the culprit'. French research under Joliot has reported that uranium fission produced more neutrons than it needed and Perrin theorized that a ball of 40 tons of natural uranium could be critical. Late in 1939 the *Review of Modern Physics* summarized the quickly growing literature on the subject and concludes:

> '1. – That nuclear fission releases a very large amount of energy;
>
> 2. – That in nuclear fission, fast neutrons are released;
>
> 3. – That it is scarce U235 that splits, and that U238 'absorbs' neutrons;
>
> 4. – Because more than two neutrons appear to be released, a potential exists for a chainreaction that can release very large amounts of energy in a very short amount of time;
>
> 5.– That chainreaction can be controlled in a 'uranium-machine' that exists of uranium and a moderator.'[611]

Taken together, these points not only describe the potential of the chain-reaction for energy production but also for military purposes. Soon after these insights spread, 'secret teams in Germany, Japan, the United Kingdom, Russia, France and the United States began research into the military dimension'.[612] 'Tests in the Sahara had been mentioned', Kistemaker reports.[613] Allied attacks on the Heavy Water production plant in Norway, captured by the Germans, had also given an indication as to the strategic importance of the development of new technological elements that were intended to contribute to the exploitation of nuclear fission.[614]

Before the Second World War uranium-oxide had already been imported to the Netherlands. After the Hahn-Straszmann publication, Dutch scientists sent the Prime Minister a collective

611 'Ontdekking van kernsplijting', De Geschiedenis van Kernenergie in Nederland, http://www.kernenergieinnederland.nl/faceted_search/results/taxonomy%3A52, website checked 13-7-2017, The Smyth Report, discussed below, also provides a summary of common academic knowledge on the subject as of June 1940, repeating above points and others, Smyth, H., D., *Atomic Energy for Military Purposes: The Official Report on the Development of the Atomic Bomb under Auspices of the United States Government 1940-1945* (Princeton University Press: Princeton 1945) pp. 26-28.

612 'Ontdekking van kernsplijting', De Geschiedenis van Kernenergie in Nederland, http://www.kernenergieinnederland.nl/faceted_search/results/taxonomy%3A52, website checked 13-7-2017.

613 Kistemaker, J., *De Geschiedenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991) http://laka.org/docu/boeken/pdf/1-01-8-30-19.pdf, websites checked 2-1-2017, p. 1. The context in which Kistemaker mentioned the rumor of the Sahara tests indicate they took place prior to or during the war, but he does not specify their timing.

614 Ibid.

letter that pointed to the potential of Germany to pursue nuclear technology for military purposes. They suggested the Dutch government seize this opportunity and proceed to purchase 'several tonnes' of uraniumoxide.[615] While an estimated 10.000 kg of uraniumoxide was procured from a mine operated by Union Minière in the Belgian Congo by Delftse Glasfabrieken (Delft Glassworks), it was the Dutch Ministry of War that footed the bill. The glassworks involvement served as a cover as the uranium could also be used to color glass. The purchased uraniumoxide was stored in the cellars of the Kamerlingh Onnes Laboratorium in Leiden and later moved to a location in Delft, where it remained during the war. The 'yellow-cake' (uraniumoxide) hidden in Delft was never discovered by the Germans, and neither were the American, Canadian or British liberators informed of its existence. After the occupation ended, the Ministry of War handed over the uranium to the Ministry of Education, Arts and Sciences. G.J. Sizoo was asked to be its caretaker, to which he agreed on the 6th of February, 1946. A small part of the yellow-cake (2 barrels) was shipped to the physics laboratory at the Free University (Amsterdam) for Sizoo to start purification experiments on it and in 1950 6 tons was exchanged with the British for metallic uranium. Kistemaker is later able to make use of some of the 'Delft' material in his experiments.[616]

Before the war Philips (the light-bulb company) also procured a large amount of uraniumoxide from the same mine in Belgian Congo. Four other Dutch companies purchased small amounts. The tons of uraniumoxide at Philips were gone after the war, but it is unclear where the material disappeared to; researchers found no mention of it in the company archives and the most likely scenario seems to be that the German occupiers found and took it or that it was taken away when the OSS Alsos mission made a stop at Eindhoven.[617]

The Smyth Report

During and up to the end of the German occupation, the Netherlands was stripped clean of any resources valuable by the German forces to aid the German war effort. Its infrastructure was severely reduced. Some universities had closed during the war. The scientific community had had some opportunity to continue physics research during the war but by 1945 it was far behind the UK and US in fundamental research and engineering. The Smyth report and its description of scientific progress, both theoretically and in engineering, exemplified that

615 'Advies aankoop uranium', De Geschiedenis van Kernenergie in Nederland, https://www.kernenergieinnederland.nl/node/552, 'Aankoop uranium', De Geschiedenis van Kernenergie in Nederland, https://www.kernenergieinnederland.nl/node/553, websites checked 23-7-2018.

616 Van Delft, Dirk, 'Tegen de Roof: Het Kamerlingh Onnes Laboratorium in Oorlogstijd', in *Gewina*, Vol. 30 (2007) p. 251, note 26., ´Uranium verborgen in Delft´, ´Uranium naar OK&W', De Geschiedenis van Kernenergie in Nederland, https://www.kernenergieinnederland.nl/node/558, website checked 23-7-2018, Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 10, Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) p. 39.

617 'Aankoop uranium', De Geschiedenis van Kernenergie in Nederland, https://www.kernenergieinnederland.nl/node/553, website checked 23-7-2018.

progress and Dutch scientists were shocked and impressed when they read it. It also impressed upon them how far they had fallen behind in recent years.[618]

The Smyth Report not only shocked the Dutch scientists but motivated them as well; '[o]ur motivation was to work on making peaceful nuclear energy available in Western Europe', despite 'the universally imposed secrecy on anything related to atomic nuclei', Kistemaker writes.[619] As much as possible nuclear scientific and technological knowledge should be in the possession of Dutch scientists themselves, as should mastery of one of the essential technologies that makes up the nuclear energy cycle, Kistemaker thought. On the motivation to pursue a program towards this end he said: only through such possession of technology 'do you matter and do you have a say in the world'.[620]

The Smyth report gave Dutch scientists a comprehensive overview of what technologies were available and which were possibly worth pursuing. The report is an administrative history of the Manhattan project, the collective undertaking of the US government, private companies and the science community that developed the first atomic bombs. It is a report to the US Congress, to explain the considerable resources spent on the project during the war. While not much technical detail is in the report, the history gave clear descriptions of the type of paths available for uranium enrichment and atomic bomb construction that had been explored, indicating which had been abandoned and which had been more thoroughly pursued. Several theoretical ways to separate isotopes were described in the report and it evaluated how successful attempts at engineering those 'options' were, based on the experiences of the scientists and engineers involved in them. The separation processes discussed in 1945 are generally the same processes we know today, with the exception of newer processes that use laser technology, such as AVLIS (Atomic Vapor Laser Isotope Separation) and SILEX.

In its general discussion on isotope separation, separation factors were discussed. The difference in mass of isotopes is the quality that is generally used to create isotope separation. Mass differences can be exploited in several ways. Average speed of an isotope is a quality that can be exploited and is determined by its mass. Ionization of isotopes and subsequent manipulation of qualities caused by the ionization, such as by magnetic and electric fields, is another one.[621] Isotope separation is also possible by using 'interatomic and intermolecular forces' as they 'slightly alter the behavior of two isotopes in certain chemical reactions'.[622]

The report discussed the separation processes that US explored during the war, divided in six relatively successful statistical methods, which depend on 'average behavior', and the non-statistical electromagnetic method.[623] The statistical methods are:

618 Kistemaker, J., *De Geschiedenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991) http://laka.org/docu/boeken/pdf/1-01-8-30-19.pdf, websites checked 2-1-2017, p. 92.
619 Ibid.
620 Ibid.
621 Smyth, H., D., *Atomic Energy for Military Purposes: The Official Report on the Development of the Atomic Bomb under Auspices of the United States Government 1940-1945* (Princeton University Press: Princeton 1945) pp. 154-155.
622 Ibid., pp. 155-156.
623 Ibid., p. 163.

Gaseous Diffusion: A process shown to work in the late 19th century by Lord Rayleigh, is based on the principle that lighter (in mass) molecules move faster than their heavier isotopic counterparts, and when material is in gaseous form this means that the lighter gas passes through 'a porous barrier into an evacuated space' faster, achieving a higher content of the lighter isotope on the other side.[624] The only usable gaseous form of uranium considered suitable was and is uranium hexafluoride, as fluoride has only one isotope and its use therefore did not created more mass differences between the heavy (U-238) and lighter (U-235) isotopes.[625]

Thermal Diffusion: Already before 1920 the idea was floated that if there was a temperature difference in a space with a gas of several isotopes,

> '... there would be a tendency for one type of molecule to concentrate in the cold region and the other in the hot region. This tendency depends not only on the molecule weights but also on the forces between the molecules'.[626]

H. Clusius and G. Dickel successfully used this method to separate isotopes in 1938 in Germany. They found that a countercurrent flow was created due to the transferring of heat, and due to thermal diffusion the movement of heavier molecules towards the outside of the vertical tube that they used for their experiment occurred.[627]

Fractional Distillation: This process uses different boiling points and corresponding vapor pressures of isotopes to achieve separation. In a fractionating tower, the aim is to,

> '... produce an upward-directed stream of vapor and a downward-directed stream of liquid, the two streams being in intimate contact and constantly exchanging molecules. The molecules of the fraction having the lower boiling point have a relatively greater tendency to get into the vapor stream and vice versa.'[628]

Fractional distillation was used during the Manhattan project to produce heavy water for plutonium production.

Gas Centrifuge: A centrifuge uses gravitational forces to separate isotopes in a gas. In a centrifuge, gravitational forces push molecules downward proportional to their weight and thus separation can be achieved. A successfully constructed centrifuge uses a countercurrent flow, which is 'a downward flow of vapor in the outer part of the rotating cylinder and an upward flow of vapor in the central or axial region.'[629] Separation is achieved in this way because

> '[a]cross the interface region between the two currents there is a constant diffusion of both types of molecules from one current to the other, but the radial force field of the centrifuge acts more strongly on the heavy molecules than on the light ones so that the

624 Ibid., p. 158.
625 Ibid., p. 159.
626 Ibid., p. 161.
627 Ibid., pp. 161-162.
628 Ibid., p. 160.
629 Ibid., p. 161.

concentration of heavy ones increases in the peripheral region and decreases in the axial region, and vice versa for the lighter molecules.'[630]

Centrifuges had been recognized early on as an effective process for separation, but attempts to build and operate them productively in the early 1920s had failed. Jesse Beams was the first to successfully use a centrifuge to separate isotopes in 1934 through the 'evaporation' technique (using liquids as feed material, which turned into vapor in the machine), but by 1938 it was clear the gas-fed centrifuges had greater potential. At around the same time, Hans Martin and W. Kuhn were developing a gas centrifuge in Germany.[631] The Smyth report explains the appeal of the gas centrifuge by pointing to the superior separation factor compared to the diffusion method.[632]

Chemical Exchange: While the Smyth Report downplayed the likeliness of chemical exchange being a viable isotope separation process for uranium, it did report success with isotope separation of deuterium from water, creating heavy water (needed for plutonium production). It reports however that 'separation effects are known to decrease in general with increasing molecular weight, so that there is but a small chance of applying this method successfully to heavy isotopes like uranium'.[633] In the decades following the report, the French and Japanese would challenge this assertion, as the French developed their CHEMEX process and the Japanese Asahi company also came up with a functioning process based on chemical exchange principles (also see in chapter 10, *Enrichment in Japan*, page 404)

Electrolysis: The use of electrolytic cells in commercial production of hydrogen and oxygen led to the awareness that the process also led to an increased production of heavy water. At the time of writing (of the Smyth Report) its authors reported that 'a full explanation of the effect has not yet been worked out'.[634] The electrolysis method was used for the production of heavy water in the production plant in Norway that was captured by the Nazis.

Evaluating the potency of these 'statistical' methods, the Smyth report draws the following conclusions. The methods discussed above only separate isotopes at a small factor, meaning 'successive stages of separation are required'.[635] Also, the amount of time needed to practically set up a process as well as the 'hold up' values (meaning, the amount of feed material that has to make its way through the separation stages before separated product can be subtracted, for each type of process) are high. The report therefore warned that it is 'inadvisable to make final choice of method without first studying in detail the particular

630 Ibid., p. 161.
631 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 5.
632 Smyth, H., D., *Atomic Energy for Military Purposes: The Official Report on the Development of the Atomic Bomb under Auspices of the United States Government 1940-1945* (Princeton University Press: Princeton 1945) p. 161.
633 Ibid., pp. 162-163.
634 Ibid., p. 163.
635 Ibid., p. 163.

isotope, production rate, etc., wanted'.[636] It concluded that considering the experiences in the Manhattan project, the chemical exchange, electrolysis and distillation methods are 'probably unsuitable' for uranium-235 separation.[637]

Of the statistical methods, diffusion, thermal diffusion and the gas centrifuge were reported to be the most suitable for separation heavy isotopes like uranium.[638] 'In all the statistical methods of separating isotopes many successive stages of separation are necessary to get material that is 90 per cent or more U235 or deuterium' and a series of such 'successive separating stages is called a *cascade* if the flow [of material] is continuous from one stage to the next'.[639] The report makes two points about cascades. First, there must be 'recycling'. Higher stages in the cascade require feed material that is enriched to a higher percentage in the U-235 isotope. 'Impoverished' material (also called 'tails'), the 'waste' stream coming out of the process, can be re-introduced as feed material in lower stages of the cascade in a process called 'recycling'.[640] The second point the report makes about cascades is that in the higher stages of a cascade, the dynamic of the process changes, requiring a much smaller flow of uranium(-gas, uranium hexafluoride) This means that it isn't necessarily true that the same method effective in separating uranium isotopes at a low enrichment is the best choice when working in the high percentage range.[641] It therefore makes sense to build a number of serially connected separation processes/banks that are connected in a parallel 'hierarchy' of lower and higher separation factor-stages.

Electromagnetic: The mass spectrographic (or 'electromagnetic', or the nowadays much more commonly used 'mass spectrometric') method for separating isotopes was used early on in non-radioactive isotope research. During the Manhattan project, it was the method used to measure the factor of separation when testing the different processes. As a measuring tool, the method is very effective because of it can 'effect almost complete separation of the isotopes very rapidly and with small hold-up and short start-up time'.[642] The reason it was initially not considered as a separation method for uranium itself was that it could initially only separate isotopes in very small quantities, with problems expected to arise when used in a scaled up setting.

In an electromagnetic isotope separation (EMIS) process, the material to be separated is turned into a gas which is then ionized. The gas is then allowed to escape into an electric field, which accelerates the ionized molecules to high speeds, giving all ionized isotopes the same kinetic energy and the heavier ions more momenta than the lighter ones.[643] The ions then enter a magnetic field which causes their paths to become semi-circular, and the difference in momenta causes those semi-circular paths to have different radii, causing the heavy and light

636 Ibid., p. 163.
637 Ibid.
638 Ibid.
639 Ibid., p. 166.
640 Ibid., pp. 165-166.
641 Ibid., p. 167.
642 Ibid., p. 164.
643 Ekinetic=1/2*mass*velocity2 explains that when ions have the same energy added to them while their mass is different, their velocity will be different as well. Momentum is calculated by: P(momentum)=mass*velocity.

ions to ‘land’ at different places. Manipulating a collection device to only collect ions at a particular ‘landing spot’ results in very effective separation.

The Smyth report sets out anticipated problems expected when scaling up the electromagnetic method to suit an industrial scale separation process. The absence of, before the summer of 1941, solutions to these anticipated problems led the Uranium Committee to not select this method to be applied in large-scale separation. It turned out later however that the anticipated problems were surmountable by the Manhattan project scientists and the first ‘appreciable-size samples of pure U-235’ were produced using the EMIS method, by use of the calutron (a type of cyclotron developed at the University of California).[644] Other electromagnetic methods that appeared potent but which took a back seat to the calutron were the isotron and the ionic centrifuge. Work on the isotron was largely abandoned after Februari 1943. Work on the ionic centrifuge continued into 1945, but the report states that its action was 'erratic'.[645]

> 'A great deal of information this technology, electromagnetic isotope separation, was declassified after World War II. The United States concluded that calutrons were a dead end, and there was little reason to keep the technology under wraps.'[646]

By 1991 was still considered 'an old, expensive, energy-intensive technology', which is why '[t]he U.S. government never controlled exports of specific calutron components, as it did for other enrichment technologies.'[647] This is why, even though 'a “fair amount of art” about building and operating calutrons had not been made public', Iraqi scientists were able to use calutrons for uranium enrichment in its secret nuclear weapons program that was discovered in 1991 during one of the more spectacular episodes of the United Nations Special Commission (UNSCOM) inspections in Iraq.[648] Following the revelations around Iraq's secret

644 Smyth, H., D., *Atomic Energy for Military Purposes: The Official Report on the Development of the Atomic Bomb under Auspices of the United States Government 1940-1945* (Princeton University Press: Princeton 1945) pp. 165, 188.

645 Ibid., pp. 166,188, 190, 200.

646 Albright, David, Hibbs, Mark, 'Iraq's Nuclear Hide-and-seek', in *Bulletin of Atomic Scientists*, Vol. 47, No. 7 (September 1991) p. 18.

647 Ibid., pp. 15, 18.

648 Thorne, Leslie, 'IAEA Nuclear Inspections in Iraq', in *IAEA Bulletin*, Vol. 34, No. 1 (1992) p. 20,
Albright, David, Hibbs, Mark, 'Iraq's Nuclear Hide-and-seek', in *Bulletin of Atomic Scientists*, Vol. 47, No. 7 (September 1991) p. 20. The episode is recounted in detail by Leslie Thorne: 'Reconnaissance photographs showed that immediately after the first inspection team departed, the Iraqis had uncovered and removed buried disc-shaped objects from a location outside the Tuwaitha site. …. The second inspection took on the character of a chase to locate the discs, which turned out to be magnets for the EMIS process. The team visited a military camp where the equipment was known to have been taken but inspectors were denied access. Three days later, after protests at the highest level, access was allowed. But by then no trace of the equipment could be found. The equipment was relocated three days later. This time, no warning of where the inspection was to take place was given to the Iraqi authorities and the team appeared without notice at the gates of a large military camp. The usual altercation took place at the gates as admission was refused. While this was going on, two members of the team climbed to the top of a nearby water tower and spotted a convoy moving off in the distance through a rear exit. Two other team members drove off at high speed to intercept. This was not so simple since the convoy was several miles away and the only way to bypass the camp was by a tortuous route through local village markets and cutting onto a motorway. The chase was rewarded with the sight of nearly a hundred heavy vehicles loaded with the equipment. Surprise had been so great that in many cases equipment was exposed, not fully covered, vehicle loading ramps were not secured, and several vehicles had stalled in the rush to clear the camp. Set after

nuclear weapons program, the Nuclear Suppliers Group (see Chapter 10: *The London Club/The Nuclear Suppliers Group*) 'met for the first time in thirteen years' and 'updated the trigger list and compiled a new control list for dual-use items'.[649] These 'Guidelines for transfers of nuclear-related dual-use equipment, material, and technology (items that have both nuclear and non-nuclear applications), which could make a significant contribution to an unsafeguarded nuclear fuel cycle or nuclear explosive activity' were published as 'Part 2 of INFCIRC/254'.[650]

Other: The Smyth report makes brief mention of some alternative methods. A.K. Brewer reported some promising results using the 'ionic mobility method' as well as with an 'evaporation method'.[651]

Industrial Scale Isotope Production at Clinton

While the gas centrifuge and diffusion method both seemed the most promising early on, the gas centrifuge did not make it to the latter stages of the Manhattan project. A pilot plant was constructed and operated at the predicted efficiency, but 'the magnitude of engineering problems' involved meant that the step towards industrial scale implementation was not made and work on the centrifuge was discontinued.[652] Industrial scale diffusion, thermal diffusion and electromagnetic plants were constructed, and together produced the material for the first atomic bombs. At the Manhattan project-site of Clinton, Tennessee, the thermal diffusion plant enriched feed material for the electromagnetic (calutron) plant.[653] The 'Clinton Laboratories' were later renamed, becoming the Oak Ridge National Laboratory.

A wealth of information is present in the Smyth report's discussion on the construction of pilot and industrial scale plants for these methods. For example, the engineering principles, challenges and requirements associated with diffusion barriers and cascades are elaborately discussed.[654] Another interesting fact revealed in the report was that exclusively uranium hexafluoride was used in the gas-based separation methods, though the suitability of other gasses had been researched. Some of the described engineering challenges and solutions contained useful information for other methods.[655]

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set of detailed photographs were taken.', Thorne, Leslie, 'IAEA Nuclear Inspections in Iraq', in *IAEA Bulletin*, Vol. 34, No. 1 (1992) p. 20.

649 Hibbs, Mark, *The Future of the Nuclear Suppliers Group* (Carnegie Endowment for International Peace: Washington D.C. 2011) p. 6.

650 'Nuclear Suppliers Group', Nuclear Threat Initiative, http://www.nti.org/learn/treaties-and-regimes/nuclear-suppliers-group-nsg/, website checked 3-7-2018.

651 Smyth, H., D., *Atomic Energy for Military Purposes: The Official Report on the Development of the Atomic Bomb under Auspices of the United States Government 1940-1945* (Princeton University Press: Princeton 1945) p. 166.

652 Ibid., p. 169.

653 Ibid., pp. 202-203.

654 Ibid., pp. 173-179, 182.

655 Ibid., pp. 67, 159, 176, 182.

Building Dutch Nuclear Physics and Engineering Expertise After the War

The Dutch scientific community took note of the Smyth report through two copies of it that had arrived by special messenger from the US in October 1945. Kistemaker described receiving it and being told it would only be available to him for the next 24 hours, as it made its way among the relevant Dutch scientists.[656] The Dutch scientists acted on the eyeopening information quickly. On the 3rd of November of 1945, with support from the science-minded Prime Minister Schermerhorn, H.A. Kramers convened a meeting on the subject and the committee that Committee for Nuclear Physics (also knows as the Committee Kramers) was formed. It produced a written advice to cabinet minister G. Van der Leeuw, urging him to act on the lag in development the Dutch scientific community had developed compared to the American one. Though from reading the Smyth Report it had become clear that the Dutch would not be able replicate the enormous resource-intensive efforts of the Manhattan project, the possibility of creating a Dutch 'pile' (after the first make-shift nuclear reactor, the 'Chicago pile' by Fermi) using the uranium in Dutch possession was discussed. Plans were made to develop an indigenous mass-spectrograph. The committee was also informed that the Philips company was in an advanced stage of producing a working cyclotron. This machine would eventually be moved to the to-be-established Zeeman laboratory in Amsterdam (see below).[657]

On the 16th of Februari 1946, the Committee for Nuclear Physics dispatched Kistemaker to Niels Bohr's laboratory in Copenhagen, to learn about electromagnetic separation using a large mass spectrometer. This meant, Kistemaker wrote in 1991, that as far as isotope separation efforts of the Dutch were concerned, 'more or less a choice for the calutron in the Smyth Report' was made.[658] The pursuit of this method over the successful alternatives presented in the Smyth Report made sense; the crippled Dutch economy could not make the kind of investments needed for the energy and resource-intensive methods of gaseous diffusion, even when engineering challenges could be overcome. Thermal diffusion would also be pursued. These options allowed the Dutch scientists to gain the type of experience needed without committing to investments the Netherlands could not afford right after the end of the occupation.

On the 15th of April 1946, the 'Foundation for the Fundalmental Research of Matter' (Stichting voor Fundamenteel Onderzoek der Materie, or FOM) was established. It was intended to be inclusive for both physicists and chemists and stimulate their professional interaction. FOM was made possible through a grant by the Dutch government, in order to make the Dutch

656 Kistemaker, J., *De Geschiedenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991) p. 1, http://laka.org/docu/boeken/pdf/1-01-8-30-19.pdf, websites checked 2-1-2017.

657 'Advies voor kernfysisch onderzoek', De Geschiedenis van Kernenergie in Nederland, https://www.kernenergieinnederland.nl/node/559, website checked 23-7-2018, Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) pp. 38-40.

658 Kistemaker, J., *De Geschiedenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991) http://laka.org/docu/boeken/pdf/1-01-8-30-19.pdf, websites checked 2-1-2017, p. 2. Kistemaker's trip is also mentioned in Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) pp. 42, 44-46.

sciences competitive again deploying 'not unsubstantial means'. The following March, 50.000 guilders (about $ 19.000) was made available, allowing FOM to attract its first employees.[659]

On the 29th of June of the same year, the Institute for Nuclear Physics (Instituut voor Kernfysica – IKO) Research Foundation came about, its founding participants the city of Amsterdam, the NV Philips Lightbulp factories and FOM. Located in an old gasworks building in Amsterdam, the Zeeman Laboratory Amsterdam was set up, where from the start of 1947 preparations were made for isotope-separation using the electromagnetic method, with C.J. Bakker as its first director.[660] When Philips' cyclotron had proved itself a viable machine, at the request of Prince Bernhard (husband to Queen Juliana), Bakker traveled to Argentina to meet with President Perón and the enigmatic nuclear scientists Ronald Richter (whose turned out to be an imposter). After the US said they had no objection, Philips sold the Argentinians a cyclotron in 1951 and FOM sold them the blueprints for the machine two years later.[661]

Kistemaker returned from Copenhagen and started work there, assisted by a master instrument-maker.[662] In October 1948 the city of Amsterdam provided FOM with a temporary location for their isotope-separation group in an old power station at Hoogte Kadijk. In September 1949, the FOM Laboratory for Mass Spectrography moved into the new location. Kistemaker led the operation while Bakker remained group leader. Its activities included mass spectrometrics, chemistry (on uraniumtetrachloride), electromagnetic separation and electro-engineering.[663] Kistemaker, due to 'his enthusiasm for the subject and his personable nature' was able to get in contact with a number of European returnees from the Manhattan project. On a trip to England in 1948 he met with among others Rudolf Peierls and Marcus Oliphant, the latter who had worked with Ernest Lawrence on the calutron in the Manhattan project.[664]

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659 'FOM opgericht', De Geschiedenis van Kernenergie in Nederland, http://www.kernenergieinnederland.nl/faceted_search/results/taxonomy%3A55, website checked 13-7-2017, Officer, Lawrence, H., 'Exchange Rates Between the United States Dollar and Forty-one Currencies', MeasuringWorth website, http://www.measuringworth.com/exchangeglobal/, website checked 30-7-2018.

660 A.H. Lindhout, 'Geschiedenis van de ultracentrifuge-ontwikkeling', in Kelling, F. E. T., Lindhout, A. H., Van de Wijngaert, B. H., Van der Stoel, M., *Uraniumverrijking in Nederland* (Reactor Centrum Nederland, The Hague 1973) p. 23, Kistemaker, J., *De Geschiedenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991) http://laka.org/docu/boeken/pdf/1-01-8-30-19.pdf, websites checked 2-1-2017, p. 4.

661 Streefland also mentions interests from a Japanese professor for the machine's blueprints, Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) pp. 80-84.

662 Kistemaker, J., *De Geschiedenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond (FOM-Instituut voor Atoom- en Molecuulfysica: 1991)* http://laka.org/docu/boeken/pdf/1-01-8-30-19.pdf, websites checked 2-1-2017, p. 4.

663 Ibid.

664 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 10.

Dutch-Norwegian Reactor Cooperation

Leading up to 1950, nuclear reactor development came back in to view for the Dutch. Directly after the war, reactor development had been considered but was deemed too ambitious a project for a small country like the Netherlands to take up by itself. In the years that followed, collaboration with other small nations started to be seen as a viable alternative.[665] In January 1950 H.A. Kramers visited Norway, which already had a reactor under construction at Kjeller. A collaboration between Norway and the Netherlands seemed feasible as the Norwegians did not have access to uranium but did have heavy water. Together with the head of the Norwegian Institute for Nuclear Energy (IFA) Gunnar Randers, Kramers defined the main conditions for collaboration on reactor development between IFA and FOM.[666] By March 1950, a concept agreement was ready in which the Netherlands committed itself to provide 6 tons of uranium oxide to the project as well as share in its costs. Attempts at a French-Norwegian cooperation agreement along the same line did not materialize.[667]

In November 1950, FOM made an official proposal to the Ministry of Education, Arts and Sciences with a three phased plan to develop nuclear energy in the Netherlands. Phase one was the construction of the reactor in Norway and studying options to do the same in the Netherlands. Phase two was the construction of a 5 MW reactor and phase three the construction of a 100 MW reactor. Late December, the Government adopted to a large extent the FOM proposal and reserved 300.000 guilders (about $ 80.000) for its implementation for 1951.[668]

The Dutch-Norwegian cooperation was named The Joint Establishment for Nuclear Energy Research (JENER) and official started on the 15th of March, 1951. The Dutch contributed 350.000 guilders (about $ 90.000) for 1951-1952. With the cooperation agreement, Norway and the Netherlands suddenly were in the lead of nuclear development in Europe, surpassing countries of comparable size and means such as Belgium and Sweden but also France, which before the war had been a leading nation in nuclear research.[669]

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665 A.H. Lindhout, 'Geschiedenis van de ultracentrifuge-ontwikkeling' in Kelling, F. E. T., Lindhout, A. H., Van de Wijngaert, B. H., Van der Stoel, M., *Uraniumverrijking in Nederland* (Reactor Centrum Nederland, The Hague 1973) pp. 23-24.

666 'Samenwerking met Noorwegen', De Geschiedenis van Kernenergie in Nederland http://www.kernenergieinnederland.nl/node/571, website checked 13-7-2017, Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) p. 63.

667 'Concept-overeenkomst samenwerking', De Geschiedenis van Kernenergie in Nederland http://www.kernenergieinnederland.nl/node/572, website checked 13-7-2017.

668 'Plan ontwikkeling kernenergie in Nederland', De Geschiedenis van Kernenergie in Nederland, http://www.kernenergieinnederland.nl/node/574, website checked 13-7-2017, Officer, Lawrence, H., 'Exchange Rates Between the United States Dollar and Forty-one Currencies', MeasuringWorth website, http://www.measuringworth.com/exchangeglobal/, website checked 30-7-2018.

669 'Noors-Nederlandse samenwerking feit', De Geschiedenis van Kernenergie in Nederland, http://www.kernenergieinnederland.nl/node/575, website checked 13-7-2017, Tweede Kamer der Staten Generaal, Zitting 1961-1962 – 4727, 5300, 5851, 'Nota inzake de kernenergie (Opwekking van elektriciteit door middel van kernenergie), Nota inzake de opleiding op het gebied van atoomenergie (Rijksbegrioting voor 1958, 5300, hoofdstuk VI, nr. 16), Regelen met betrekking tot vrijmaking van kernenergie en de aanwending van radioactive stoffen en ioniserende stralen uitzendende toestellen (Kernenergiewet)', Nr. 7, Memorie van Antwoord, p. 3, Officer, Lawrence, H., 'Exchange Rates Between the United States Dollar and Forty-one

The Netherlands exchanged 6 tons of its uraniumoxide with the British (paying England 50.000 guilders (about $ 13.000) per ton), to obtain an equal amount of metallic uranium to be used as fissile material in the reactor. Norway supplied the heavy water and graphite was procured from France. On the 30th of July 1951, the 250kW Dutch-Norwegian Joint Establishment Expirimental Pile (or JEEP) reactor in Kjeller became critical for the first time. It's probably the first operational reactor outside of the Manhattan-project countries (England, US, Canada) or countries with a military nuclear program, like the USSR. According to 'nuclear lore', those present at the startup warily kept their eye on the only person present that had ever seen a nuclear reactor in operation, the Englishman Dunworth, so when he would take off running, they could do the same. The reactor started operations on November 28th of the same year.[670]

Success and Methodical Diversification in Isotope Separation

The early Dutch success in starting a reactor-path led to the insight that in order to in the future operate reactors that used enriched uranium, the separation of uranium isotopes would have to be possible at a much larger scale. For that reason the group 'Mass-Separation I' at FOM started researching and developing other methods more intensively.[671] The group had already been working on thermal diffusion and by 1950 Kistemaker had some thermal diffusion columns in operation.[672]

During 1953 and early 1954, the calutron at FOM worked 'to satisfaction', steadily producing 1-2 mg uranium-235 per day.[673] In early 1953, Kistemaker became group leader of the 'Mass Separation I' group at the FOM laboratory and Bakker moved on to become head of CERN in Geneva. In the same year, on the 6th of November 1953, the first sample of enriched uranium was officially handed over to the board of FOM.[674] The 10 milligram quantity, produced using the electromagnetic method was enriched by a factor of 10 and it represents the first time the

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Currencies', MeasuringWorth website, http://www.measuringworth.com/exchangeglobal/, website checked 30-7-2018.

670 'Noors-Nederlandse reactor kritisch', De Geschiedenis van Kernenergie in Nederland, http://www.kernenergieinnederland.nl/node/577, website checked 13-7-2017, Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) p. 63, Officer, Lawrence, H., 'Exchange Rates Between the United States Dollar and Forty-one Currencies', MeasuringWorth website, http://www.measuringworth.com/exchangeglobal/, website checked 30-7-2018.

671 A.H. Lindhout, 'Geschiedenis van de ultracentrifuge-ontwikkeling' in Kelling, F. E. T., Lindhout, A. H., Van de Wijngaert, B. H., Van der Stoel, M., *Uraniumverrijking in Nederland* (Reactor Centrum Nederland, The Hague 1973) p. 24.

672 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 11.

673 A.H. Lindhout, 'Geschiedenis van de ultracentrifuge-ontwikkeling' in Kelling, F. E. T., Lindhout, A. H., Van de Wijngaert, B. H., Van der Stoel, M., *Uraniumverrijking in Nederland* (Reactor Centrum Nederland, The Hague 1973) p. 24.

674 Kistemaker, J., *De Geschiedenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991) http://laka.org/docu/boeken/pdf/1-01-8-30-19.pdf, websites checked 2-1-2017, p. 5.

American embargo on enriched materials was broken.[675] The enriched uranium was needed for the Dutch-Norwegian reactor project, to find out what an effective measurement of a cross-section of the uranium was in order for it to successfully fission in the reactor. Scientists at Kjeller worked with the uranium and found the needed results. D. Popovic, a guest-employee from Belgrade, presented their findings at the first non-classified symposium in Ann Arbor, Michigan in June of 1954. Popovic's colleague there present, the Dutch T.J. Barendrecht remembers 'great upheaval amongst the Americans; after all this was 'classified' science.[676] Following Popovic's presentation, the FOM received many distinguished guests at de Hoogte Kadijk laboratory, such as 'Ernest Lawrence, Niels Bohr, Irene Curie, P.H. Abelson, Sam Goudsmit [and] Jean Perrin'.[677]

Contacts with other European scientists started to develop after this initial success. Kistemaker was granted special permission to visit West-Germany in April and May of 1954, visiting a number of scientists in four different cities. In August, FOM was approached by the French, who were interested in enriched uranium. On the 10th of September the FOM gave permission to go ahead with the supply of 10 mg of 8% enriched uranium at 350 guilders ($ 92) per mg to the French CEA (Commissariat à l'Energie Atomique, the French Atomic Energy Commission) for their reactor research.[678]

Kistemaker's separation work was becoming well known among the relevant scientists, resulting in an invitation for him to visit the Oak Ridge Laboratory. Early in the trip Kistemaker visited with Jesse Beams and A.R. Kuhltau in Virginia, where the American centrifuge project was located. Kistemaker recalls that '[*nobody*] *is allowed to share anything*. Everything was 'classified".[679] At the Oak Ridge the culture and system of compartmentalization of work for the purpose of maintaining a high degree of secrecy, including between specialist groups, had been maintained since the Manhattan project days. Speaking at a joint colloquium led by A.M.Weinberg and attended by scientists from several specialist groups, Kistemaker gave a lecture titled 'How to build a calutron', 'candidly

675 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 10, Kistemaker, J., *De Geschiedenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991) http://laka.org/docu/boeken/pdf/1-01-8-30-19.pdf, websites checked 2-1-2017, p. 5.

676 Kistemaker, J., *De Geschiedenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991) http://laka.org/docu/boeken/pdf/1-01-8-30-19.pdf, websites checked 2-1-2017, p. 5.

677 Ibid. While a larger scale separation operation using the electromagnetic method was considered, the notion was quickly abandoned again. A.H. Lindhout, 'Geschiedenis van de ultracentrifuge-ontwikkeling' in Kelling, F. E. T., Lindhout, A. H., Van de Wijngaert, B. H., Van der Stoel, M., *Uraniumverrijking in Nederland* (Reactor Centrum Nederland, The Hague 1973) p. 24.

678 Kistemaker, J., *De Geschiedenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991) http://laka.org/docu/boeken/pdf/1-01-8-30-19.pdf, websites checked 2-1-2017, p. 5, Officer, Lawrence, H., 'Exchange Rates Between the United States Dollar and Forty-one Currencies', MeasuringWorth website, http://www.measuringworth.com/exchangeglobal/, website checked 30-7-2018.

679 Kistemaker, J., *De Geschiedenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991) http://laka.org/docu/boeken/pdf/1-01-8-30-19.pdf, websites checked 2-1-2017, p. 6, italics in original.

describing his entire calutron system', astonishing those attending.[680] 'This is the end of the classification', Weinberg told Kistemaker after his lecture.[681] Weinberg was right; several months after Kistemaker's performance at Oak Ridge, the American Congress declassified isotope-separation using calutrons.[682] According to Kistemaker, the declassification was one of the goals the Committee Kramers had set for the field in 1945.[683]

Start of the Dutch and Troika Partners' Gas Centrifuge Tracks

In the previous period, it was not possible for the laboratory to acquire mass spectrometers due to classification, nor was it allowed to develop its own. In 1952 however, American mass spectrometers became available on the open market and companies in Europe started developing them. This prompted Kistemaker and his colleague Veenstra in November 1954 to attend the Convention of German Physicists (Deutsche Physiker Tagung) and Kistemaker to make a trip to Atlas-Werke to inquire about the purchase of a mass-spectrometer but after arriving found their machine not working. He decided to take a train to Hamburg to visit the department of physical chemistry at the university of Hamburg. Arriving there, he found the place deserted;

> 'He found his way to the institute's lecture theatre and entered, unseen, by a door in the rear. The missing researchers filled the theatre and were listening to a lecture by G. Herz, a German who was professor at Lund University in Sweden. His topic was the separation of argon isotopes in a gas centrifuge. Sitting quietly at the back, Kistemaker's eyes were opened to the possible use of the gas centrifuge technique which, he felt, might be applicable to the separation of uranium isotopes. He knew that some attempts had been made with this technology in the Manhattan Project but that it had been abandoned as too difficult to engineer. Herz had actually been one of a team including Groth and others working on centrifuges in Hamburg during the war. The lecture ignited Kistemaker's enthusiasm to try this new process. He left the lecture as quietly and unseen as he had entered it, and returned to Bremen on the last train.'[684]

680 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 11.

681 Kistemaker, J., *De Geschiedenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991) http://laka.org/docu/boeken/pdf/1-01-8-30-19.pdf, websites checked 2-1-2017, p. 6.

682 Ibid., Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 11.

683 Kistemaker, J., *De Geschiedenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991)http://laka.org/docu/boeken/pdf/1-01-8-30-19.pdf, websites checked 2-1-2017, p. 6.

684 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) pp. 11-12. This account of events is disputed by Abel Streefland. Basing himself on Kistemaker's travel account, he argued that Kistemaker's visit to Hamburg preceded his visit to Bremen, and that therefore the anecdote about the broken mass-spectrometer at Atlas-Werke couldn't have happened. However, in Kehoe's account, Kistemaker travels to Bremen, then to Hamburg, then back to Bremen. The travel account referred to by Streefland is titled 'travel account to Hamburg and Bremen' though, supporting Streefland's interpretation. On a different note, Streefland figured out that the G. Herz that Kistemaker mentioned was actually Hermann Gerhard Hertz,

The eye-opening experience that Kistemaker had in Hamburg led him to immediately report back to FOM on how far the Germans had come with the centrifuge method. They had also done significant research on thermo-diffusion and isotope sluices.[685] The next day, he approached the Dutch engineering company Werkspoor and found director Baars ready to right away grant 50.000 guilders (around $ 13.000) for the purpose of developing centrifuges, under proviso Werkspoor would receive the majority of orders. Starting in December 1954, the FOM team looked to the method developed by Groth, of whose work Kistemaker had become aware visiting Hamburg, considering both horizontal and vertical centrifuge installations.[686] A horizontal centrifuge was built, spinning at high speeds but 'a frightening degree of of vibration' could not be avoided.[687]

When the centrifuge research went into its experimental phase and Werkspoor started building a pilot installation to test the technology, FOM considered it no longer in line with her competences (as a place where only fundamental research takes place). The Reactor Center Netherlands (Reactor Centrum Nederland, or RCN, see *The Dutch 'Nuclear Energy Brief', 1957*, page 206), established in 1955 to 'coordinate nuclear developments in the Netherlands', assumed responsibility over the project in 1956. The locations remained the same but RCN, formally independent of the state but dependent on its funding, directed and funded the 'Ultracentrifuge Project'.[688]

Kistemaker, together with his colleague Veldhuyzen, visited Groth in Bonn in early 1956. Groth reported all kinds of problems related to the use of UF6 in his centrifuges. Groth was very open and shared some interesting information with his visitors. He told them about the German scientists that were returning from Russia, about Steenbeck's as well as Lange and Brasch's centrifuge programs there, and about the construction of enrichment plant using the gas centrifuge in Moscow, confirming to Kistemaker the potency of the technology. Groth offered to initiate an exchange of technical information, which Kistemaker thought was premature.[689]

Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) pp. 98-99, 305-306 fn. 9.

685 Kistemaker, J., *De Geschiedenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991) http://laka.org/docu/boeken/pdf/1-01-8-30-19.pdf, websites checked 2-1-2017, p. 6.

686 Ibid., p. 10, Officer, Lawrence, H., 'Exchange Rates Between the United States Dollar and Forty-one Currencies', MeasuringWorth website, http://www.measuringworth.com/exchangeglobal/, website checked 30-7-2018.

687 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 12, Kistemaker, J., *De Geschiedenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991) http://laka.org/docu/boeken/pdf/1-01-8-30-19.pdf, websites checked 2-1-2017, p. 6.

688 Note, Chef der Directie Raad van Europa en Wetenschappelijke Samenwerking, Ministerie van Buitenlandse Zaken Mr. A. Kruyt aan Ministerie van Economische Zaken Mr. H.K. Mani, 'Ultracentrifuge-project', DRW/AT-10043/365 GS, Geheim, 17th of January 1968, 2.06.101/E24099/842, pp. 2-3.

689 Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) pp. 105-107. Subsequent publications on Russian nuclear history show that no sizable plant was constructed in Moscow. After in 1952 scientists in Russia completed a viable centrifuge prototype, construction of a 2435 centrifuge pilot plant was commissioned in 1955 and completed in 1957. This plant was located in Verkh Neyvinsk, near Novouralsk, in Sverdlovsk Oblast in the Urals. It was followed up by a more expansive

The Amsterdam Symposium, 23-27 April 1957

Kistemaker's team reputation grew and his laboratories received many requests for visits from those working on similar subjects. To cope with the demand it was decided that the Dutch scientists working on isotope-separation would host a symposium on isotope-separation in April 1957 in Amsterdam and invite all those interested at the same time.[690] In 1955 there had already been a conference on nuclear energy organized by the United Nations, which brought scientists from east and west together (the Cold War was fully underway). It was a moment when particularly the Americans were impressed by how far the USSR had managed to catch up in the development of nuclear technology.[691] By the end of the year, the American Congress lifted the American embargo on enriched isotope products.[692]

The conference in Amsterdam in 1957 did not include participants from the USSR and its allies, but among others participants from Germany, France, the United Kingdom, the United States, Italy, Israel and Switzerland contributed to the proceedings.[693] It did however include some of the prominent German scientists that had worked on the USSR's enrichment program as captives of war. One of the technologies developed there was a superior centrifuge method, developed by professor Steenbeck and his associates. One of those associates, Gernot Zippe, was present at the Amsterdam symposium, even though Kistemaker, not knowing who he was, had rejected his application.[694]

At the 1958 Second United Nations International Conference on the Peaceful Uses of Atomic Energy Kistemaker presented some of his research on isotope-separation by centrifuge and announced the Dutch program's intention to collaborate with that of Groth in the FRG. As part of the same delegation, Prof. Dr. J.H. De Boer announced the Dutch intention to build a

plant that employed tens of thousands of machines in 1959, also in Novouralsk. Consequently, an industrial-sized plant that employed hundreds of thousands of centrifuges was commissioned in 1960 and constructed inside a decommissioned diffusion plant; in sections it became operational between 1962 and 1964, Bukharin, Oleg, 'Understanding Russia's Uranium Enrichment Complex', in *Science & Global Security*, Vol 12 (2004) p. 196, Podvig, Pavel, 'History of Highly Enriched Uranium Production in Russia', in *Science & Global Security*, Vol. 19 (2011) p. 58, Albright, David, Berkhout, Frans, Walker, William, *Plutonium and Highly Enriched Uranium 1996 – World Inventories, Capabilities and Policies*, Stockholm International Peace Research Institute (Oxford University Press: Oxford 1997) p. 102.

690 Kistemaker, J., *De Geschiedenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991) http://laka.org/docu/boeken/pdf/1-01-8-30-19.pdf, websites checked 2-1-2017, p. 10, Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 12, A.H. Lindhout, 'Geschiedenis van de ultracentrifuge-ontwikkeling' in Kelling, F. E. T., Lindhout, A. H., Van de Wijngaert, B. H., Van der Stoel, M., *Uraniumverrijking in Nederland* (Reactor Centrum Nederland, The Hague 1973) p. 26.

691 'Kernenergie conferentie Geneve', De Geschiedenis van Kernenergie in Nederland, https://www.kernenergieinnederland.nl/node/592, website checked 18-12-2017.

692 Kistemaker, J., *De Geschiedenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991) http://laka.org/docu/boeken/pdf/1-01-8-30-19.pdf, websites checked 2-1-2017, p. 8.

693 Ibid., p. 10.

694 A.H. Lindhout, 'Geschiedenis van de ultracentrifuge-ontwikkeling' in Kelling, F. E. T., Lindhout, A. H., Van de Wijngaert, B. H., Van der Stoel, M., *Uraniumverrijking in Nederland* (Reactor Centrum Nederland, The Hague 1973) p. 26, Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) pp. 141-142.

demonstration plant with the West-Germans, with Kistemaker and FOM taking the lead in the project, contracted by RCN. The West-German delegation denied that a final decision on such a project had been made.[695] Kistemaker met Steenbeck at the conference, which led to the two scientists corresponding over the next year. A request by Kistemaker to invite Steenbeck to visit the Dutch project was denied by RCN, on the grounds of the unacceptable risk of proliferation of knowledge to the East-German centrifuge program and beyond, amid rising geopolitical tensions.[696]

Gernot Zippe

After being captured by Russian troops at the end of the war, Zippe had worked at 'Institute A', in Suchumi (Sukhumi), USSR, 'becoming the head of all centrifuge experimental work' for Steenbeck's group there.[697] It was only three weeks after his release by the Russians when he attended the Amsterdam symposium.[698] Zippe did not contribute but was reportedly 'delighted' to find peace-loving Western scientists working on isotope-separation by centrifuge.[699] Zippe requested a private meeting with Kistemaker and visited him at his home on Saturday the 28th of April, following the conclusion of the proceedings. 'Zippe poured out to Kistemaker all that he had developed while in Russia', and succeeded in convincing his counterpart that the horizontal centrifuge would never produce the desired operational levels and reliability.[700]

The next Monday, on April 29, saw Kistemaker trying and succeeding to convince the research director of Werkspoor that a 'pin-bearing at the bottom and a magnetic bearing at the top' of a vertical centrifuge was the line of development to follow. The Groth line was abandoned and the Steenbeck line adopted.[701] Kistemaker recalled it being a credit to the

695 'Proceedings of Second United Nations International Conference on the Peaceful Uses of Atomic Energy', 1-13 September 1958, Geneva, Vol. 33, Index of Proceedings (United Nations, Geneva 1958) http://www-naweb.iaea.org/napc/physics/2ndgenconf/data/Proceedings%201958/NG900090.pdf, website checked 23-2-2017, p. 119, 'Proeffabriek voor Goedkope Atoombrandstof in Ons Land?', in *Leeuwarder Courant*, 10th of September 1958, p. 3, 'Isotopenscheiding: Nederland Samen met Duitsland', in *De Tijd*, 11th of September 1958, p. 1.

696 Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) pp. 165, 170.

697 Oleynikov, Pavel, V., 'German Scientists in the Soviet Atomic Project', in *The Nonproliferation Review*, Vol. 7, No. 2 (Summer 2000) http://cns.miis.edu/npr/pdfs/72pavel.pdf, website checked 13-7-2017, p. 11.

698 Kistemaker, J., *De Geschiedenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991) http://laka.org/docu/boeken/pdf/1-01-8-30-19.pdf, websites checked 2-1-2017, p. 10.

699 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 12.

700 Ibid.

701 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 12, Kistemaker, J., *De Geschiedenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991) http://laka.org/docu/boeken/pdf/1-01-8-30-19.pdf, websites checked 2-1-2017, p. 10, A.H. Lindhout, 'Geschiedenis van de ultracentrifuge-ontwikkeling' in Kelling, F. E. T., Lindhout, A. H., Van de Wijngaert, B. H., Van der Stoel, M., *Uraniumverrijking in Nederland* (Reactor Centrum Nederland, The Hague 1973) p. 26, Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) p. 143.

culture in the Werkspoor construction group, that in the frame of 24 hours, a 'salto mortale' was completed and the idea of a centrifuge as a device that needed to be 'large, heavy and strong' and using plain bearings was abandoned for one that conceived it as having to be 'light, flexible and self-aligning, using magnetic and pivot bearings'.[702]

Soon after the Amsterdam symposium Zippe found interest for the Suchumi centrifuge designs at the Degussa company. He had previously approached the West German government, 'but found no interest because of their caution towards American views on the sensitivity of enrichment technology' there.[703] He had also approached the newly established International Atomic Energy Agency but technology development fell outside its compentencies. Working at Degussa, Zippe was forbidden to further discuss the subject with outsiders, something Kistemaker experienced only three weeks after the symposium when visiting Vienna seeking to receive further clarifications from Zippe; '[He] refused … to say anything'.[704] Degussa had also encouraged Zippe to apply for patents, which he did. After RCN applied for the Dutch UC7 vertical centrifuge design patent on the 27th of December 1957, it became known that Degussa had done so for a similar design six weeks prior, on November 11th 1957, in Germany.[705] A.F. Arnold, in charge of patents for RCN, revealed the RCN logs to the judge, showing that they had already started work on a vertical centrifuge using the new bearings a year prior. The judge ruled the German and Dutch patent applications of equal merit. Degussa later nevertheless tried to claim patent infringement, but of no legal consequence. The Dutch patent for the new centrifuge was publicized in April 1959, and officially established on the 16th of August 1959.[706]

The West-German government officials had mentioned Zippe and his work to their American counterparts, who showed great interest. With approval from Degussa and after earlier contacts between Zippe and American officials in the spring of 1957, USAEC (US Atomic Energy Commision) officials approached Zippe and put him in touch with Jesse Beams in Virginia. In August 1958 Zippe traveled to Virginia and worked with Beams on the centrifuge project there, 'reproducing the centrifuge design he had worked on in Russia'.[707] In his last six months there before returning to Germany in July 1960, Zippe wrote up two important reports. The first was on his centrifuge design, describing what he had built and tested in Virginia.[708] The second report was perhaps even more consequential. Using publicly available information on the economics of the gas diffusion process, he successfully predicted that with

702 Kistemaker, J., *De Geschiedenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991) http://laka.org/docu/boeken/pdf/1-01-8-30-19.pdf, websites checked 2-1-2017, p. 10.
703 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 13.
704 Kistemaker, J., *De Geschiedenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991) http://laka.org/docu/boeken/pdf/1-01-8-30-19.pdf, websites checked 2-1-2017, p. 10.
705 Ibid.
706 Ibid., p. 12.
707 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 13, Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) p. 142.
708 Ibid.

expected improvements in the available materials for building centrifuges, gas centrifugation would be 'a strong competitor' to the gas diffusion process to enrich uranium into the future. Zippe argued that future research should focus on efficiency gains in the currently developed machine, as well as study '"... cascade arrangements and development of necessary automatics"'.[709]

Hans Kronberger

Another attendee of Kistemaker's Amsterdam conference in 1957 was Hans Kronberger. Kronberger was a Jew who had fled his homeland Austria after the Germans annexed it in 1938, had arrived in England in 1939, and was sent to Australia for long term internment in 1940. He returned to England in 1942, switched his university degree to physics and completed it in 1944. Quickly inducted into the 'Tube Alloy Project' (the British nuclear weapon development program), he initially worked on developing the gas diffusion process but was also interested in other separation methods. Between '44 up to his departure to Harwell in 1946, due to the British government's decision to hold off on the decision to build a gaseous diffusion plant, he explored other methods such as thermal diffusion.[710] At Harwell, working with the General Electric Company, Kronberger worked on the gas centrifuge for the British program, enjoyed success in the fact that he was able to operate a centrifuge 'running consistently … at speeds over 450 m/s', but the work was mothballed when the decision was taken to construct the gaseous diffusion plant at Capenhurst in 1949.[711] Kronberger himself was moved there to help with its construction and operation. His interest in other separation methods never declined and while at Capenhurst he successfully used low temperature distillation to separate Boron isotopes, constructed a viable thermal diffusion process for separating tritium from hydrogen and came up with an effective process for the separation of lithium isotopes as well.[712]

Kronberger was at Capenhurst when he took note of the announcement of Kistemakers' 1957 Amsterdam conference. He attended the conference and chaired session seven (on diffusion), where he and Gerald Geoghegan delivered two papers on the subject.[713] He attended the ninth and last session of the conference on gas centrifugation with papers by both Beyerle and Groth as well as Kistemaker and Los. Inspired by what he heard Kronberger restarted

709 Ibid. pp. 13-14.

710 Rotherham, L., 'Hans Kronberger. 1920-1970', in *Biographical Memoirs of Fellows of the Royal Society*, Vol. 18 (November 1972) pp. 414-415.

711 Ibid., p. 419.

712 Ibid., pp.421-422. Source does not mention which method was used to separate lithium, possibly due to its military application and subsequent classification of his work.

713 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 16, Kronberger, H., 'Chairman's introductory remarks', in Kistemaker, J., Bigeleisen, J., Nier, A.,O.,C. (eds.), 'Proceedings of the International Symposium on Isotope Separation', 23-27 April, 1957, Amsterdam (North-Holland Pub. Co.: Amsterdam 1958) pp. 511-512, Kronberger, H., Geoghegan, G.,R.,H., 'Some aspects of the design theory for gaseous diffusion plant stages', in Kistemaker, J., Bigeleisen, J., Nier, A.,O.,C. (eds.), 'Proceedings of the International Symposium on Isotope Separation', 23-27 April, 1957, Amsterdam (North-Holland Pub. Co.: Amsterdam 1958) pp. 513-517.

centrifuge work at Capenhurst. The project was managed by Stan Whitley, who had worked on gas lubricated bearings for the diffusion plant and now started exploring their potential for the gas centrifuge. Kistemaker's presentation in Amsterdam had presented a machine with heavy rotors that still used the 'old' bearings and Kronberger saw the potential of using gas lubricated bearings instead. Kronberger had apparently picked up on the same thing Zippe had; the need for improved bearings (the reason Zippe had approached Kistemaker), but reportedly did not find out about Zippe's work until he visited the laboratory in Virginia where Zippe had constructed his latest machines, in 1960. Kronberger conveyed what he had seen to Whitley right away and immediately 'instructed him … to explore the type of centrifuge Zippe had pioneered'.[714] Though Kronberger had visited Degussa in 1958, meeting with the director of research Boettcher, 'evidently the details of Zippe's centrifuge and bearing system did not arise'.[715]

Zippe's publications in Virginia and move back to Germany, Kistemaker's 1957 conference and conversations with Zippe, Kronberger's attendance in Amsterdam and visit to Virginia; all these events narrowly beat the international classification of ultra-centrifuges at the request of the United States from 1960 on, with which eventually the relevant countries complied. The UK, FRG and the Netherlands had all chosen Zippe's design as the way forward in developing better centrifuges, which these countries in the foreseeable future would do on their own.[716]

The Dutch 'Nuclear Energy Brief', 1957

In 1958 a United Nations-sponsored Atoms for Peace conference was held in Geneva. The conference was a repeat of the conference held in August 1955, during which a relative abundance of scientific information had been shared and became publicly available concerning the application and implementation of nuclear energy, considering many countries had observed a high level of secrecy regarding their domestic programs.[717] An important development at the 1958 conference was the emergence of a general understanding that uranium enriched in U235, not plutonium or U233 from breeder reactors, would be the main source of fuel for nuclear power reactors for the next 25 years.[718] This was due to percentage of Light Water reactors that were expected to go into operation in the following period. The insight had great relevancy to the Netherlands, as in the previous year the Minister of Economic Affairs had presented the Nuclear Energy Brief (Nota inzake de kernenergie), which outlined the Dutch intention to construct multiple nuclear reactors and continue to build up its nuclear technology expertise. The brief paints a comprehensive picture of the Dutch

714 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) pp. 16-17.

715 Ibid. p. 17.

716 Ibid. More on the process of US-requested classification policies below and in Chapter 8.

717 Tweede Kamer Der Staten Generaal, Zitting 1956-1957 – 4227, 'Nota inzake de kernenergie (Opwekking van elektriciteit door middel van kernenergie), Nr. 1, Geleidende Brief, 3rd of July 1957, p. 21.

718 Kistemaker, J., *De Geschiedenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991) p. 14, http://laka.org/docu/boeken/pdf/1-01-8-30-19.pdf, websites checked 2-1-2017.

strategic position and its chosen policies towards nuclear energy.[719] The emerging understanding that enriched uranium would be the nuclear fuel of the future also had great relevancy to the Dutch centrifuge project, as RCN had tied the continuation of the project to the expected demand for enriched uranium in the European market.[720]

First the brief described the projected Dutch energy position and that of Western Europe up to 1975 as problematic. Domestic supplies of fossil fuels accounted for 55% of consumption in 1955 and is projected to decrease to only a third in 1975, due to an ongoing trend of increased consumption combined with stationary production. A similar trend was projected for the other members of the European Coal and Steel Community, the five other West-European countries that had recently committed themselves to a common energy market. For the wider area of the Organization for European Economic Co-operation (OEEC) the situation was similarly problematic; without a sharp increase in domestic production, a substantial percentage of energy resources would have to be imported. The brief questioned whether such volumes of imports could be reliably realized, if they could be realized at all.[721]

Second, nuclear energy had a role to play in reducing these strategic risks. Energy security could be improved by the addition of nuclear energy through the diversification of the energy mix, as well as through reliability of supply through storage; the much smaller volume of fissile materials needed in a nuclear energy program allowed strategic storage which protected against supply-side interruptions, with reference made to interruption of supply of oil and coal during the then recent 1956 Suez crisis.[722]

Third, the brief pointed to the need for a unified approach in Western Europe; most neighboring countries faced the same energy supply and security dynamic as the Netherlands and many shared in the perceived deficit in nuclear technology and infrastructure compared to the front-runners in this field. The Netherlands required fissile materials from abroad and facilities for uranium milling and purification, enrichment and possibly reprocessing were still absent. Educational opportunities were too few and the current pool of experts too small for a substantial nuclear program to be undertaken.[723] The pooling of resources and knowledge was needed. The Minister referred in the brief to agreements already negotiated to that effect in the EURATOM treaty, signed (but not yet ratified) earlier in March 1957.

EURATOM represented a substantial attempt at regional nuclear technological and legal integration, stimulating member-area research and the spreading of knowledge, protecting public health, regulating investments and stimulating common large-scale industrial projects that went beyond the capabilities of individual countries, creating common ownership through EURATOM of all fissile materials in the EURATOM zone and the safeguarding of those

719 Tweede Kamer Der Staten Generaal, Zitting 1956-1957 – 4227, 'Nota inzake de kernenergie (Opwekking van elektriciteit door middel van kernenergie), Nr. 1, Geleidende Brief, 3rd of July 1957, pp. 1-31.
720 Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) pp. 156, 165.
721 Tweede Kamer Der Staten Generaal, Zitting 1956-1957 – 4227, 'Nota inzake de kernenergie (Opwekking van elektriciteit door middel van kernenergie), Nr 1, Geleidende Brief, 3rd of July 1957, pp. 3, 6-7.
722 Ibid., p. 7.
723 Ibid., p. 20.

materials for strictly civilian use, creating a common market for nuclear products likened to the OEEC as well as the coordinating and negotiating of agreements with third parties.[724] Moreover, global cooperation was needed as well to 'ensure that sufficient security can be obtained that public health is adequately protected'.[725]

It should be noted here that a possible military dimension to EURATOM was very much alive in the minds of German Chancellor Adenauer and his French counterpart.[726] On West-German willingness to join the ECC and EURATOM, Paul Pitman argued,

> '… the German government's discussions of the EEC and Euratom really turned on two specific issues: Europe's place in the Atlantic Alliance and questions of nuclear strategy. First, the Europeans needed to unite in order to maintain support from the Americans. …. Second, Europe, rather than NATO, might be the best way for Germany to regain the right to produce atomic weapons. As the chancellor put it during a cabinet meeting on 19 December 1956: "Europe will have a longer life than NATO. It is now necessary to push ahead with the unification of Europe and to produce atomic weapons in the Federal Republic. The basic message was clear: the unreliability of transatlantic ties required tighter European economic and military cooperation. The strategic issues and the economic issues were thus very tightly bound up with each other.'[727]

Fourth, the Dutch government had a responsibility to make sure the Netherlands did not fall further behind in the nuclear research and industry. At the time of the brief the Government had not decided on one particular route towards nuclear energy exploitation but instead opted to keep its options open. While it is perceived as unlikely that the Netherlands could be a commercial supplier of all elements of the fuel cycle, it was important that the country invested in its nuclear infrastructure as the knowledge gained from this challenging route was invaluable in order to sooner rather than later gain market share in the fledgling but high-potential new industry.[728] The brief gave an overview of the most important tools and activities toward that end currently undertaken in the Netherlands. One such tool was the RCN, founded for the purpose of improving Dutch know-how on the peaceful applications of nuclear energy. RCN was a combined initiative of the national government, FOM, KEMA N.V. and an important selection of the Dutch business establishment.[729] RCN was given a broad set of tasks, from general nuclear research to the research and development of nuclear

724 Ibid., p. 22.

725 Ibid., p. 20.

726 Pitman, Paul M., '"A General Named Eisenhower": Atlantic Crisis and the Origins of the European Economic Community' in Trachtenberg, Marc (ed.) *Between Empire and Alliance: America and Europe During the Cold War* (Rowman and Littlefield, Oxford, 2003) pp. 51-52.

727 Ibid., p. 51.

728 Tweede Kamer Der Staten Generaal, Zitting 1956-1957 – 4227, 'Nota inzake de kernenergie (Opwekking van elektriciteit door middel van kernenergie), Nr. 1, Geleidende Brief, 3rd of July 1957, p. 17.

729 Tweede Kamer der Staten Generaal, Zitting 1954-1955 – 4026, 'Nota inzake het in Nederland te verrichten onderzoek op het gebied van kernreactoren en hun toepassingen', No. 1, 14th of July 1955, p. 2, Tweede Kamer Der Staten Generaal, Zitting 1956-1957 – 4227, 'Nota inzake de kernenergie (Opwekking van elektriciteit door middel van kernenergie), Nr. 1, Geleidende Brief, 3rd of July 1957, p. 18.

reactor systems.[730] RCN was directly responsible for the construction and exploitation of the American-imported High Flux Reactor (HFR) which was expected to provide Dutch scientists and engineers with a wealth of relevant information regarding the behavior of materials and constructed parts under extreme circumstances (such as a highly radioactive environment inside the HFR).[731] Another example given is the Arnhem-located KEMA, an institute of materials testing for the Dutch utility companies that developed and later constructed an aqueous homogeneous reactor in which fuel, moderator and coolant are all mixed together into a liquid. The project quickly aroused great interest from the United Kingdom, resulting in a cooperation agreement between RCN and the United Kingdom Atomic Energy Authority (UKAEA).[732] The worth of the Dutch-Norwegian JENER project was mentioned in the brief, as was the isotope-separation work at FOM and Werkspoor (directed by RCN).[733]

The Minister argued in the brief that in order to 'catch up', immediate procurement of a reactor abroad was needed as the domestic reactor development program was perceived as too uncertain of success and development would take too long in any case.[734] The municipalities and provinces, important decision-making actors in the Dutch 'layered' government system as well as the owners of the Dutch utility companies, had at the time of the Minister's brief already convened a committee that explored the economic merits of the different reactor-types for electricity production available for purchase abroad.[735]

The Minister's brief was in its economic analysis based on a closed nuclear cycle, one that was based on natural (unenriched) uranium fuel and the reprocessing and recycling of fuel, as these were the only reactor types for which (foreign) operational and economic data was available.[736] The decision between an open (non-reprocessing of fuel) and closed cycle had not been made and both options seemed possible given the Dutch work on isotope-separation and the Dutch-Norwegian experience with reprocessing.

Subsequent involvement by the Parliament in the issues relating the development of nuclear energy during the annual national budget deliberations, through parties represented in the Select Committee for Nuclear Energy (Vaste Commisssie voor Kernenergie), dealt with a myriad of issues. There were no tangible commitments or discussions about the position of RCN's isotope-separation program, but the larger issue of ministerial competence and responsibility came up for discussion. The initial nuclear energy brief was written by the Minister of Economic Affairs. The Select Committee observed that while some of the communications towards the Parliament had involved other ministries, it was the Ministry of

730 Tweede Kamer der Staten Generaal, Zitting 1961-1962 – 4727, 5300, 5851, 'Nota inzake de kernenergie (Opwekking van elektriciteit door middel van kernenergie), Nota inzake de opleiding op het gebied van atoomenergie (Rijksbegrioting voor 1958, 5300, hoofdstuk VI, nr. 16), Regelen met betrekking tot vrijmaking van kernenergie en de aanwending van radioactive stoffen en ioniserende stralen uitzendende toestellen (Kernenergiewet)', Nr. 7, Memorie van Antwoord, p. 7.

731 Tweede Kamer Der Staten Generaal, Zitting 1956-1957 – 4227, 'Nota inzake de kernenergie (Opwekking van elektriciteit door middel van kernenergie), Nr. 1, Geleidende Brief, 3rd of July 1957, pp. 18-19.

732 Ibid., p. 19.

733 Ibid., p. 19.

734 Ibid., p. 17.

735 Ibid., p. 18.

736 Ibid. pp. 10-11.

Economic Affairs that seemed to claim (or at least suggest) responsibility for the whole area of nuclear energy development, and thus a more comprehensive approach was needed to include and coordinate shared responsibilities between ministries (such as Foreign Affairs, Social Affairs and Public Health) regarding the development and governmental institutionalization of nuclear energy in the Netherlands.[737] The Nuclear Energy Act ('Kernenergiewet'), 'containing rules with relation to the exploitation of nuclear energy and the application of radioactive substances and ionic ray transmitting devices' was adopted in February 1963, but with only a part on advisory organs coming into effect, the rest of the law only doing so at the start of 1970.[738]

From the mid-1950s, the Dutch scientific work on enrichment acquired a more pronounced international dimension. International initiatives such as the Western European Union (WEU) and EURATOM were, in their initial setups, controversial and forced Dutch policy makers, diplomats and scientists to come to grips with the implications of the research undertaken in the Netherlands. Early proposals for technical collaboration between European countries and with the United States as well as non-proliferation and verification implications of international treaties carried with it the risk of Dutch research products spreading to commercial competitors as well as to other nation's military programs. While up to the late 1950s the Dutch nuclear science community was adamant to keep the products of its research open and available for the benefit of academia, by the early 1960s Dutch policy makers had become convinced classification and protection of intellectual property had become the more prudent course of action.[739]

The Western European Union

During the negotiation of the Troika common export policy during the mid to late 1970s (see chapter 11, *Toward a Common Export Policy for Urenco,* page 333), the conditions the FRG had committed itself to when in 1954 becoming a member of the Western European Union were never far from Dutch, British and German minds. The Western European Union was the continuation of the Western Union (or Brussels Treaty Organization, BTO), created by treaty

737 Tweede Kamer der Staten Generaal, Zitting 1961-1962 – 4727, 5300, 5851, 'Nota inzake de kernenergie (Opwekking van elektriciteit door middel van kernenergie), Nota inzake de opleiding op het gebied van atoomenergie (Rijksbegrioting voor 1958, 5300, hoofdstuk VI, nr. 16), Regelen met betrekking tot vrijmaking van kernenergie en de aanwending van radioactieve stoffen en ioniserende stralen uitzendende toestellen (Kernenergiewet)', Nr. 7, Memorie van Antwoord, pp. 1-2.

738 'Kernenergiewet', Overheid.nl, http://wetten.overheid.nl/BWBR0002402/2014-01-25, website checked 14-7-2017. 'Kernenergiewet in werking', De Geschiedenis van Kernenergie in Nederland, https://www.kernenergieinnederland.nl/taxonomy/term/256, website checked 14-7-2017.

739 Streefland unearthed an interesting episode illustrating Kistemaker's aversion to classification measures from Kistemaker's centrifuge archive at Enrichment Technology Company (ETC) in Almelo. When in 1956 RCN took over the responsibilities for the centrifuge research program, it started to implement a number of security and classification measures on access to locations and information. Kistemaker protested the resulting administrative burden and restrictions on contacts with third parties. RCN granted him a personal reprieve on the latter, on the condition he would report anyone he shared information with to RCN, to which Kistemaker, under further protest, consented, Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) pp. 117-119.

in 1948, was born out of the ashes of the European Defense Community (EDC) failure and was the institutional stepping stone that led to, when the United States joined this tool of European collective security, the North Atlantic Treaty and its associate organization, NATO.[740] Simultaneously with its accession to the WEU, '[t]he Federal Republic ... complied with the request [to] publicly ... renounce any production of atomic, biological and chemical weapons'.[741] This promise created controversy on whether the FRG was allowed to and should be able to pursue elements of the fuel cycle that (inherently) carried with it the promise of a latent nuclear weapon capability, such as an uranium enrichment plant on German soil, the avoidance of which would become one of the most important motivations for the Netherlands to join the Troika project.[742] For the sake of its allies and their wishes, the FRG would avoid that controversy for a time by buying into the Almelo plant on Dutch territory.

One of the intended functions of the WEU was to control armaments in the union, for which purpose the Armaments Control Agency was set up. This agency stayed dormant however when France refused to ratify a follow-up convention to the WEU as it did not want to allow its nuclear program to be inspected.[743] French policymakers were not alone in their opposition; one of the earliest moments Dutch policy makers were confronted with the consequences of its international non-proliferation diplomacy at home came when, at the WEU conference in London (in September 1954) Dutch diplomats out of solidarity went along with the German pledge to the WEU not to develop nuclear weapons.[744] After the conference,

> '… there was some consternation as policy makers realized what this nuclear non-proliferation principle … implied: it would not just be symbolic, but also enforceable. A newly created WEU control agency would gain virtually unlimited access to the Dutch nuclear research and development programmes. This was not acceptable to Dutch nuclear scientists and engineers, who feared for their competitive position'.[745]

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740 Haftendorn, Helga, 'Germany's Accession to NATO: 50 Years On', Nato Review website, http://www.nato.int/docu/review/2005/issue2/english/history.html, website checked 29-11-2017, http://www.nato.int/archives/1st5years/chapters/1.htm#f, Howlett, Darryl, A., *EURATOM and Nuclear Safeguards* (The Macmillan Press Ltd.: Basingstoke 1990) p. 18.

741 The FRG did so by a letter written by Chancellor Adenauer, annexed to the treaty, Howlett, Darryl, A., *EURATOM and Nuclear Safeguards* (The Macmillan Press Ltd.: Basingstoke 1990) p. 64, Haftendorn, Helga, 'Germany's Accession to NATO: 50 Years On', Nato Review website, http://www.nato.int/docu/review/2005/issue2/english/history.html, website checked 29-11-2017.

742 ARC 61-2, p. 4.

743 Howlett, Darryl, A., *EURATOM and Nuclear Safeguards* (The Macmillan Press Ltd.: Basingstoke 1990) p. 18.

744 The West-German WEU accession coincided with the FRG becoming a member of NATO and the West-German pledge to forego nuclear weapons can be seen as a commitment to the members of both organizations, according to Van Der Stoel, Van der Stoel, M., 'Het ultracentrifugeproject en de spreiding van kernwapens' in Kelling, F. E. T., Lindhout, A. H., Van de Wijngaert, B. H., Van der Stoel, M., *Uraniumverrijking in Nederland* (Reactor Centrum Nederland, The Hague 1973) p. 41.

745 Hellendoorn, Elmar, *Between the Devil and the Deep Sea - The Netherlands and the Struggle for European Nuclear Order,* Ph.D. Dissertation, Faculty of Humanities, Utrecht University (April 2016) p. 79.

The Western European Union Brussels Treaty specified that uranium enrichment was to be allowed to 2.1% in U235, a somewhat arbitrary percentage since developments in LWRs showed optimal enrichment grades to be higher than that, depending on the reactor.[746] This created some confusion later on, when the matter came up during the debates on the Treaty of Almelo in the Dutch Parliament (see chapter 9, *The Parliamentary Debate on the Treaty of Almelo in the Netherlands,* page 266).

Early Multinational Enrichment Initiatives

With the American-British monopoly on enriched uranium and overall lead in nuclear technology enduring into the 1950s, European initiatives were launched to reduce dependency and reduce the technological lead the Anglo-Saxons had on continental Europe. France took the lead during this period; already investing much more resources in establishing its nuclear infrastructure than the other nations of continental Western Europe, it was well known that much of those resources were dedicated to its military program, the pursuit of its *Force de Frappe*. At first, France had approached the UK to purchase its diffusion technology in 1954. The UK eventually rebuffed the French, arguing that the United States, with whom the technology was developed during the war, would prevent the transfer under the 1943 Quebec Agreement.[747] Franco-German talks in late April 1955 that envisioned an enrichment plant with Belgium, in which also possible Dutch participation was mentioned, did not yield results.[748]

Thus, during the Messina conference of 1955 and in subsequent meetings, negotiating the EURATOM Treaty, France pushed for a study group (syndicate) for the purpose of establishing a continental enrichment plant to aid the provision of the to-be-established EURATOM Supply Agency. This *Syndicat d'études pour une usine européenne de séparation istotopique*, established in 1956, failed to deliver and by the end of 1957 was a dead letter, partly due to the Germans and Dutch postponing an early decision on a plant by requesting to study which technology to employ and simultaneously the United States using the uncertainty during this period to dissuade the Europeans from pursuing enrichment independence by making available large quantities of cheap enriched uranium to their nuclear programs.[749] The

746 Western European Union – Brussels Treaty, as amended by the Protcol modifying and completing the Brussels Treaty, signed at Paris on October 23, 1954 -Text of the Treaty and its Protocols, p. 26 http://www.cvce.eu/content/publication/2003/11/26/7d182408-0ff6-432e-b793-0d1065ebe695/publishable_en.pdf

747 Hellendoorn, Elmar, *Between the Devil and the Deep Sea - The Netherlands and the Struggle for European Nuclear Order,* Ph.D. Dissertation, Faculty of Humanities, Utrecht University (April 2016) pp. 91, 111, Howlett, Darryl, A., *EURATOM and Nuclear Safeguards* (The Macmillan Press Ltd.: Basingstoke 1990) p. 43.

748 Hellendoorn, Elmar, *Between the Devil and the Deep Sea - The Netherlands and the Struggle for European Nuclear Order,* Ph.D. Dissertation, Faculty of Humanities, Utrecht University (April 2016) p. 97.

749 Ibid., pp. 85, 136, 170, 179, 190-191, 199-200. Kistemaker calculated that the decision to postpone a decision (voted 11 for, 1 against) in the Syndicat saved the Dutch state around 100 million guilders (around $ 26 million in 1957 dollars) which, when corrected for inflation, is the same amount spent on all centrifuge R&D in the Netherlands up to the Treaty of Almelo (1970), Kistemaker, J., *De Geschiedenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991)

British were discouraged by the United States from assisting their fellow Europeans under French leadership in constructing an enrichment plant (with its possible military application) by the clear threat of an American withdrawal from the UK-US nuclear weapon sharing-deal, agreed upon during the 1957 Bermuda Conference.[750]

The United States played an ambivalent and even divisive role during the EURATOM and *Syndicat* negotiations, on the one hand offering assistance to build a diffusion plant in continental Europe (and supporting EURATOM as a means to curtailing a FRG national nuclear program), on the other clearly intent on stopping any initiative towards that end. The US State Department was motivated by non-proliferation concerns because it was France that was keeping alive EURATOM's military dimension while aggressively pursuing the indigenous enrichment capability, while both the State Department and AEC both endeavored to maintain the US monopoly over the enriched uranium market for commercial and political leverage purposes.[751] The US strategy to undercut European nuclear cooperation was extended when the European nuclear market provided more commercial opportunities than initially anticipated and EURATOM countries developed plans to construct their own nuclear reactors, prompting the US to use a series of bilateral treaties and contracts to secure its dominance in the European nuclear fuel market. Classification of enrichment technology and an American unwillingness to share diffusion technology with the Europeans were partly inspired by non-proliferation concerns, but also part of this larger strategy to extend the duration of its market and technological dominance in Europe.[752]

An episode in which the AEC proposed collaboration between the US, FRG, Netherlands and EURATOM in 1958 can possibly be seen as part of this strategy. Contacts between Kistemaker and the AEC had been initiated in a September 1957 meeting between Kistemaker and Walter Libby (AEC), during which Libby proposed a cooperation on enrichment between their countries. Kistemaker in turn had, on his own account,

> '… visited the United States [in] 1958 in the hope of eliciting American financial support … in exchange for sharing information. On [the 24th] of January he spoke with Libby and Kratzer at the AEC headquarters. …. [T]he AEC appeared rather non-committal to Kistermaker's request …, mentioning the bureaucratic hassle that would

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http://laka.org/docu/boeken/pdf/1-01-8-30-19.pdf, websites checked 2-1-2017, pp. 8, 9, Officer, Lawrence, H., 'Exchange Rates Between the United States Dollar and Forty-one Currencies', MeasuringWorth website, http://www.measuringworth.com/exchangeglobal/, website checked 30-7-2018.

750 Hellendoorn, Elmar, *Between the Devil and the Deep Sea - The Netherlands and the Struggle for European Nuclear Order,* Ph.D. Dissertation, Faculty of Humanities, Utrecht University (April 2016) pp. 184. 190.

751 Ibid., pp. 114-118, 126-127, 198, Howlett, Darryl, A., *EURATOM and Nuclear Safeguards* (The Macmillan Press Ltd.: Basingstoke 1990) pp. 27-28. The European dependence on the American monopoly in enrichment services was one of the arguments used by proponents of the Dutch centrifuge program to argue for its continuation when the merits of the project and its continuation were considered in a March 1958 meeting of the main Dutch stakeholders, Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) p. 156.

752 'Crisis in Euratom: Kernontwikkeling naar tweede fase', in *Nederlands Dagblad*, 20th of December 1968, p. 2, A.H. Lindhout, 'Geschiedenis van de ultracentrifuge-ontwikkeling' in Kelling, F. E. T., Lindhout, A. H., Van de Wijngaert, B. H., Van der Stoel, M., *Uraniumverrijking in Nederland* (Reactor Centrum Nederland, The Hague 1973) p. 26.

ensue if the AEC requested additional funding for a non-US project. One AEC-official, Ruark, even suggested that Kistemaker and his team should move their research to the United States.'[753]

Kistemaker caused quite a storm at the Ministry of Foreign Affairs on his return. He had not been authorized to propose any sort of bilateral cooperation and the embassy in Washington DC was instructed not to follow up on his proposals. Instead, Kistemaker was encouraged to seek cooperation in Europe, preferably with the FRG.[754] In June 1958, Dr. Kolstad traveled to Amsterdam for "informal contacts with German and Dutch experts ... about a possible collaboration ... within the scope of Euratom."[755] Dr. Kolstad proposed a "Steering Committee" toward that end that would be initiated by the US.[756] The Steering Committee never materialized. Streefland suggested that at this time, due to the intensification of US-West German contacts (of which Degussa's 'loan' of Zippe to Beams' program in Virginia was part), Dr. Boettcher of Degussa wanted to keep the Dutch on the outside for the time being.[757] This could explain why Dr. Kolstad's initiative never went anywhere.

During the work for the *Syndicat*, Dutch and German scientists working on centrifuge technology became closer acquainted and chose to take a common approach in promoting their technology to the group. Kistemaker's group coordinated reports and strategy with Groth and Beyerle, hoping to forestall the French push for a quick decision for their diffusion plant plans. A calculation by Kistemaker estimated the U235 per gram price of a Dutch-German centrifuge plant to be $ 23,50, whereas his calculation showed the French plant would produce it at $ 35 per gram. Officials from the two countries agreed in principle to a collaboration in a meeting on March 20th 1957, coming close to officiating a continuous exchange of technological data, but the German side rebuffed the Dutch, possible due to 'Groth's unwillingness to collaborate with Kistemaker on a 50/50 basis' as he had worked on the process for 20 years, against Kistemakers' 18 months.[758]

753 Hellendoorn, Elmar, *Between the Devil and the Deep Sea - The Netherlands and the Struggle for European Nuclear Order,* Ph.D. Dissertation, Faculty of Humanities, Utrecht University (April 2016) p. 327. Dr. Kolstad was also present during the meetings at the AEC headquarters in Germantown, Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) p. 162.
754 Hellendoorn, Elmar, *Between the Devil and the Deep Sea - The Netherlands and the Struggle for European Nuclear Order,* Ph.D. Dissertation, Faculty of Humanities, Utrecht University (April 2016) p. 328.
755 Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) pp. 162-163.
756 Ibid., p. 163.
757 Ibid., p. 169.
758 Hellendoorn, Elmar, *Between the Devil and the Deep Sea - The Netherlands and the Struggle for European Nuclear Order,* Ph.D. Dissertation, Faculty of Humanities, Utrecht University (April 2016) p. 197, Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) pp. 131-132, 134-135.

Chapter 8:

Classification of Centrifuge Technology

Centrifuge Development in the United States

As late as 1957, the proliferation risk of centrifuge technology did not have the American intelligence services' particular attention although interest in its commercial potential led Dr. Kolstad at the AEC to advocate a restart of the program as early as 1954. The AEC 'formed an ad hoc committee to manage centrifuge affairs' and set up several study domains based on Beams' design.[759] In report KOA-662, several requirements and proliferation aspects of the centrifuge enrichment infrastructure were discussed. Attention was drawn to the capital requirements, necessity of an available specialized workforce and means of covert procurement of special material and equipment. Proliferation aspects mentioned were the ability to physically hide a centrifuge plant, it's low power requirements and easy storage of produced wastes.[760]

The AEC had intensified its interest in the commercial utility of the centrifuge process after a AEC commissioned Union Carbide report on centrifuge economics was circulated in 1957. The report was followed by the reception of details through Beyerle's publication on the West-German Z-III machine and separately (through the Thor-Westcliffe company) on Groth's current machine (the Z-VII, which was currently 'an article of commerce'). Additionally, Zippe's early work simplifying centrifuge design in Virginia (which was 'impressive') and even more so, recognition of the centrifuge's potential peaked when the classified program at the University of Virignia (of which Zippe had no knowledge) managed to spin long-tube centrifuges through a number of critical vibrations, a problem that had stunted the project's

759 National Intelligence Estimate 100-6-57, "Nuclear Weapons Production in Fourth Countries - Likelihood and Consequences," June 18, 1957, http://nsarchive.gwu.edu/NSAEBB/NSAEBB155/prolif-2.pdf, website checked 20-12-2016, Kemp, Scott, 'The End of Manhattan: How the Gas Centrifuge Changed the Quest for Nuclear Weapons, *Technology and Culture*, Vol 53, No 2. (April 2012) https://www.jstor.org/stable/pdf/41475500.pdf?refreqid=excelsior%3A66274fb7af55b7b72a64f84198c92540, website checked 8-9-2018, p. 288. By 1960, it was considered to show clear commercial potential, as data from the 1959 Report KB-789, Emlet, L., B., 'Small Centrifuge Plant for Producing U-235 Weapons', Report, KB-789, 14th of December 1959 (Union Carbide Nuclear Company, Oak Ridge, Tennessee 1959), was used in the 1960 report by Union Carbide to the AEC, which it reported to the US intelligence community ('CIA, State Department, Defense Department, and White House') while 'the AEC was conducting its own studies.', Levin, S., A., Batch, D., E., Von Halle, E., 'Production of Enriched Uranium for Nuclear Weapons by Nations X, Y, and Z by Means of the Gas Centrifuge Process', Union Carbide Nuclear Company, Report Number KOA-662, 26th of February, 1960, *https://www.documentcloud.org/documents/399993-doc-4-union-carbide-report-1960.html*, Burr, William, 'The Gas Centrifuge Secret: Origins of a U.S. Policy of Nuclear Denial, 1954-1960', National Security Archive Electronic Briefing Book, No. 518, 29th of June 2015, *http://nsarchive.gwu.edu/nukevault/ebb518-the-gas-centrifuge-secret-origins-of-US-policy-of-nuclear-denial-1954-1960/index.html*, Websites checked 16-12-2016.

760 Levin, S., A., Batch, D., E., Von Halle, E., 'Production of Enriched Uranium for Nuclear Weapons by Nations X, Y, and Z by Means of the Gas Centrifuge Process', Union Carbide Nuclear Company, Report Number KOA-662, 26th of February 1960, *https://www.documentcloud.org/documents/399993-doc-4-union-carbide-report-1960.html*, website checked 19-2-2017, pp. 4-6.

progress up to that point.[761] This program had utilized special materials such as 'fiberglass overwrapped aluminum and composites', not available to Zippe's unclassified program (the materials made available through the US 'missile program').[762]

The US company Thor-Westcliffe meanwhile managed, with a license from the AEC, to purchase seven machines of the Z-VII design and its exclusive North-American rights from Groth, from which they derived its operational parameters and thus commercial feasibility.[763] When Dutch officials at the Ministry of Foreign Affairs Atomic Affairs-desk saw the October 1959 *Nucleonics* article on the deal they realized its relevance to the Dutch ultracentrifuge

761 Hayford, D., A., Levin, S., A., 'Competitive Economic Status of the Gas Centrifuge', K-1368, KOA-662, 9th of December 1957 (Union Carbide Nuclear Company: Oak Ridge, Tennessee, 1957) p. 7, Atomic Energy Commission, 'Gas Centrifuge Method of Isotope Separation; Note by the Secretary, AEC 610/15, 9th of April 1960, *https://www.documentcloud.org/documents/399995-doc-6-aec-april-1960-report.html*, website checked 2-1-2017, p. 12 (the date in the hyperlink is wrong), U.S. Congress, Joint Committee on Atomic Energy, Executive Session, 'Briefing on Gas Centrifuge Process', 30th of August 1960, Secret, RG 128. Records of the Joint Committees of Congress. Joint Committee on Atomic Energy, 1946-1977, box 45, File 6460: re centrifuge process, *https://nsarchive2.gwu.edu/nukevault/ebb518-the-gas-centrifuge-secret-origins-of-US-policy-of-nuclear-denial-1954-1960/doc%2023%208-30-60%20hearings%20%20JCAE.pdf*, website checked 4-9-2018, p. 58, in Burr, William, 'The Gas Centrifuge Secret: Origins of a U.S. Policy of Nuclear Denial, 1954-1960', National Security Archive Electronic Briefing Book, No. 518, 29th of June 2015, http://nsarchive.gwu.edu/nukevault/ebb518-the-gas-centrifuge-secret-origins-of-US-policy-of-nuclear-denial-1954-1960/index.html, website checked 16-7-2017, Kemp, Scott, 'The End of Manhattan: How the Gas Centrifuge Changed the Quest for Nuclear Weapons, *Technology and Culture*, Vol 53, No 2. (April 2012) *https://www.jstor.org/stable/pdf/41475500.pdf?refreqid=excelsior%3A66274fb7af55b7b72a64f84198c92540*, website checked 8-9-2018, p. 289, website checked 8-9-2018.

762 U.S. Congress, Joint Committee on Atomic Energy, Executive Session, 'Briefing on Gas Centrifuge Process', 30th of August 1960, Secret, RG 128. Records of the Joint Committees of Congress. Joint Committee on Atomic Energy, 1946-1977, box 45, File 6460: re centrifuge process, *https://nsarchive2.gwu.edu/nukevault/ebb518-the-gas-centrifuge-secret-origins-of-US-policy-of-nuclear-denial-1954-1960/doc%2023%208-30-60%20hearings%20%20JCAE.pdf*, website checked 4-9-2018, p. 58, in Burr, William, 'The Gas Centrifuge Secret: Origins of a U.S. Policy of Nuclear Denial, 1954-1960', National Security Archive Electronic Briefing Book, No. 518, 29th of June 2015, http://nsarchive.gwu.edu/nukevault/ebb518-the-gas-centrifuge-secret-origins-of-US-policy-of-nuclear-denial-1954-1960/index.html, website checked 16-7-2017, Atomic Energy Commission, 'Gas Centrifuge Method of Isotope Separation; Note by the Secretary, AEC 610/15, 9 April 1960, *https://www.documentcloud.org/documents/399995-doc-6-aec-april-1960-report.html*, website checked 18-12-2017, p. 2, Kemp, Scott, 'Gas Centrifuge Theory and Development: A Review of U.S. Programs', in *Science and Global Security*, Vol. 17, No. 1 (2009) *https://www.tandfonline.com/doi/pdf/10.1080/08929880802335816?needAccess=true*, website checked 8-9-2018. For an excellent overview of the US centrifuge programs up to early 1962 and instead of reproducing his work here, I refer the reader to the thoroughly comprehensive Kemp, Scott, 'The End of Manhattan: How the Gas Centrifuge Changed the Quest for Nuclear Weapons, *Technology and Culture*, Vol 53, No 2. (April 2012) *https://www.jstor.org/stable/pdf/41475500.pdf?refreqid=excelsior%3A66274fb7af55b7b72a64f84198c92540*, website checked 8-9-2018, pp. 276-279, 288-297.

763 Atomic Energy Commission, 'Gas Centrifuge Method of Isotope Separation; Note by the Secretary, AEC 610/15, 9 April 1960, *https://assets.documentcloud.org/documents/399995/doc-6-aec-april-1960-report.pdf*, website checked 18-12-2017, p. 11, U.S. Congress, Joint Committee on Atomic Energy, Executive Session, 'Briefing on Gas Centrifuge Process', 30th of August 1960, Secret, RG 128. Records of the Joint Committees of Congress. Joint Committee on Atomic Energy, 1946-1977, box 45, File 6460: re centrifuge process, *https://nsarchive2.gwu.edu/nukevault/ebb518-the-gas-centrifuge-secret-origins-of-US-policy-of-nuclear-denial-1954-1960/doc%2023%208-30-60%20hearings%20%20JCAE.pdf*, website checked 4-9-2018, p. 56, in Burr, William, 'The Gas Centrifuge Secret: Origins of a U.S. Policy of Nuclear Denial, 1954-1960', National Security

project and instructed the Bonn and Washington DC embassies to keep them abreast of further information received on the matter, picked up through the press or intelligence.[764]

The Push for Classification

In December 1959, in a memo to AEC Director Wells of the International Affairs division the AEC Director for Classification Marshall concluded, based on the work in the US and what was known to the AEC of the West-German and Dutch programs, that centrifuge technology 'could reasonably be used for the production of large quantities of U-235', which meant that the currently classified US work should remain so and the FRG and Netherlands should be approached with the request to classify their work as well. A complicating factor was 'that U.S. firms interested in the commercial potential of the gas centrifuge were unlikely to accept restrictions unless the Dutch and the West Germans accepted them.'[765] Director Marshall warned that China would be very interested in the centrifuge method for its low power consumption (operating a diffusion plant was because of its high power consumption deemed outside of China's feasible options) and classification could prevent proliferation of that technology to the Chinese.[766] He also pointed out that agreement on full cooperation with the FRG and the Netherlands would depend on economic considerations and possibly could involve purchasing 'the fruits of German and Dutch labor'.[767] He strongly recommended

Archive Electronic Briefing Book, No. 518, 29th of June 2015, http://nsarchive.gwu.edu/nukevault/ebb518-the-gas-centrifuge-secret-origins-of-US-policy-of-nuclear-denial-1954-1960/index.html, website checked 16-7-2017.

764 Memorandum, voor Minister van Buitenlandse Zaken, Bureau Atoomzaken, Adviseur voor Atoomzaken aan Ambassade Washington, Ambassade Bonn, 'Isotopenscheiding', AT-153399, 29th of November 1959, 2.03.01/6701.

765 Atomic Energy Commission, 'Gas Centrifuge Method of Isotope Separation; Note by the Secretary, AEC 610/15, 9 April 1960, https://www.documentcloud.org/documents/399995-doc-6-aec-april-1960-report.html, website checked 2-1-2017, pp. 52-53, Burr, William, 'To "Keep the Genie Bottled Up": U.S. Diplomacy, Nuclear Proliferation, and Gas Centrifuge Technology, 1962, 1972', in *Journal of Cold War Studies*, Vol. 19, No. 2 (Spring 2017) p. 119. The memo by Marshall contained some detailed information about the West-German centrifuge program, possibly obtained through the US collaboration with Degussa from 1958 on, Atomic Energy Commission, 'Gas Centrifuge Method of Isotope Separation; Note by the Secretary, AEC 610/15, 9 April 1960, *https://www.documentcloud.org/documents/399995-doc-6-aec-april-1960-report.html*, website checked 2-1-2017, p. 54.

766 Atomic Energy Commission, 'Gas Centrifuge Method of Isotope Separation; Note by the Secretary, AEC 610/15, 9 April 1960, *https://www.documentcloud.org/documents/399995-doc-6-aec-april-1960-report.html*, website checked 2-1-2017, pp. 52-53. This confirms that US intelligence had not formed an accurate picture of the extend of nuclear assistance China was receiving from the USSR. In fact, China had started centrifuge research as early as 1958, although it preferred the diffusion route to enrich its first HEU, Zhang, Hui, 'China's Uranium Enrichment Capacity: Rapid Expansion to Meet Commercial Needs', Managing the Atom Project, Belfer Center for Science and International Affairs, Harvard University, 20th of August 2015, *http://belfercenter.ksg.harvard.edu/files/chinasuraniumenrichmenntcapacity.pdf*, website checked 10-7-2017, p. 15, Report, 'China Today: Nuclear Industry', JPRS Report, Science & Technology China, JPRS-CST-88-002, Foreign Broadcast Information Service, 15th of January 1988, *http://fissilematerials.org/library/jprs88.pdf*, website checked 3-1-2017, p. 51. See *China*, chapter 6, page 164 and *Case: China* in chapter 10, page 443.

767 Atomic Energy Commission, 'Gas Centrifuge Method of Isotope Separation; Note by the Secretary, AEC 610/15, 9 April 1960, *https://www.documentcloud.org/documents/399995-doc-6-aec-april-1960-report.html*, website checked 2-1-2017, p. 53.

redefining the existing cooperation agreement with the UK and possibly with Canada as well so that these countries could be included in the cooperation and thus 'increase substantially the potential market for Dutch and German products', casting such initiatives as costs that could be offset by the '[enhanced] security of the nation'.[768] Marshall's suggestions for economic compensation for the FRG and the Netherlands were not taken up by the AEC or by the State Department in subsequent meetings with those countries, although including the UK in the coordination of classification was.

On February 19, 1960 AEC Division of International Affairs Director Wells wrote to Mr. Farley of the State Department that in the AEC's assessment centrifuge technology was going to be a proliferation risk and was equal if not slightly more attractive than the plutonium/reactor route. The answer to the question whether the US should classify all its centrifuge work would be dependent on the FRG and the Netherlands because there would be no point in US classification for non-proliferation purposes if the German or Dutch did not follow suit. By now, the AEC estimated the continuation of the US program would result in an economically competitive program in 5 years and seeing that the Dutch and German programs were roughly of equal technological advancement with the caveat that possibly, the Germans were 'enjoying a slight lead', it was imperative to attempt to the control the technology 'both in this country and abroad' by means of classification.[769] Additionally the Wells report mentioned the AEC was considering 'a recommended research and development program designed to advance gas centrifuge technology within the United States to a point where it could produce U-235 at a cost competitive with our published price schedule' and that justification for this program was principally to maintain the US technological lead in isotope separation technology, rather than to fulfill any foreseen demand; a summarizing and widely circulated AEC report dated April 9, 1960 also subscribed to the strategic importance of maintaining technological leadership in this area.[770] The economic component of this strategy should not be underestimated. As a telling assessment of perceived US interests at the time Myron Kratzer, back then working at the AEC's Division of International Affairs, explained in a 1998 interview,

> 'Our concerns [over the proliferation of enrichment technology] have migrated from concerns that the Russians would get our enrichment technology, which we considered superior, to concerns that the Third World countries would get it or, for that matter, any country that later is not a nuclear weapons state, especially a Third World country. That concern extended even to the possibility that the Russians might get it indirectly. We didn't even want countries like Britain, or especially France, to have it because of concern that they might be a source of leakage to the Soviets.
>
> There was a secondary reason, ... It was always there but probably rarely if ever stated. Enrichment had begun to appear to be both good business - we were selling

768 Ibid.

769 Atomic Energy Commission, 'Gas Centrifuge Method of Isotope Separation; Note by the Secretary, AEC 610/15, 9 April 1960, https://www.documentcloud.org/documents/399995-doc-6-aec-april-1960-report.html, website checked 2-1-2017, pp. 46-47.

770 Ibid., pp. 4, 47.

enriched uranium abroad - but also became very important in national security terms because we wanted countries to use enriched uranium, of which we were the sole source of supply, for their reactors as a national security measure. Because we were the sole source of supply, we could impose terms and conditions on its use and assure non-diversion to military uses. We couldn't do this if they chose competing fuel nuclear enrichment, which was natural uranium, which was available from many countries. We acknowledged this openly. That was always open. The fact that nuclear enrichment was also good business was the part that people would be inclined not to say.'[771]

The AEC asked the State Department for an opinion on the available options; the bottom line would be to pursue cooperation with the Europeans on centrifuge technology, whether bilaterally or through EURATOM, either on a classified or unclassified basis, in pursuit of both technological-commercial benefit and technology control. Mindful of the treaty commitments the FRG made to the WEU and the consequences of bilateral classification for inter-EURATOM technology sharing, as well as the fact that the research in the FRG was under the umbrella of private actors (universities and commercial companies) the AEC was confident other nuclear supplier nations would see the need for classification for non-proliferation purposes. Furthermore, possible proliferation of the technology to EURATOM partners as a result of a required agreement between the US and EURATOM in order to reach cooperation was preferable to no classification at all. However, the AEC staff thought the most prudent course of action was to explore bilateral agreements on classification with the Germans and Dutch first.[772]

The State Department responded in agreement as to the need for classification on the 23rd of March, 1960 but warned of a myriad of political problems the US could face in the process. First, the FRG might not want to classify its program because it could give the impression it was pursuing nuclear weapons and therefore could turn into a public relations disaster. Second, the US had denied its isotope separation technology to France in the past and concluding an agreement with the FRG could therefore 'encounter serious difficulties with Euratom'.[773] Third, EURATOM would likely want to be a party to the information shared between the US and FRG, considering the provisions in the EURATOM Treaty on dissemination of information. Fourth, if on US insistence EURATOM would push its member

771 Interview with Myron B. Kratzer, Association for Diplomatic Studies and Training - Foreign Affairs Oral History Project, Interviewed by: Charles Stuart Kennedy, September 25, 1998, https://memory.loc.gov/service/mss/mfdip/2004/2004kra01/2004kra01.pdf, website checked 3-1-2017. Interestingly, after his work for the US government, Kratzer went on to become director at Urenco Inc., Urenco's fully-owned marketing agent in the US in 1985, Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 123.

772 Atomic Energy Commission, 'Gas Centrifuge Method of Isotope Separation: Note by the Secretary', AEC 610/15, 9 April 1960, *https://www.documentcloud.org/documents/399995-doc-6-aec-april-1960-report.html*, website checked 2-1-2017, pp. 47-49.

773 Memorandum for Mr. Algie A. Wells, Director, Division of International Affairs, Atomic Energy Commission from Special Assistant to the Secretary of State Philip J. Farley, 23rd of March 1960, *https://assets.documentcloud.org/documents/399994/doc-5-farley-memo.pdf*, website checked 2-1-2017, pp. 1-2. Burr, William, 'To "Keep the Genie Bottled Up": U.S. Diplomacy, Nuclear Proliferation, and Gas Centrifuge Technology, 1962, 1972', in *Journal of Cold War Studies*, Vol. 19, No. 2 (Spring 2017) p. 119.

states to classify all information on centrifuge technology, it would in turn insist the US agree to a cooperation agreement with EURATOM. In the face of such an agreement, France would use the resulting political leverage (it would have to agree to such an agreement) to '[attain] its objectives', obtaining American diffusion technology or access to the latest in centrifuge technology.[774] Fifth, any cooperation agreement with EURATOM would require the US to check its security credentials; EURATOM's ability to keep classified information classified and to prevent its proliferation to military programs. Considering France had previously failed this US test it was unlikely that EURATOM would pass it 'as its 'security procedures [were] lax at best" and as its information would be shared with France.[775] Such a failure would seriously hurt EURATOM's status, which was undesirable. A check could therefore only be performed if the US would not object to information under a EURATOM-US cooperation agreement to be passed to France, probably ending up in the French military program.[776]

The State Department therefore considered bilateral approaches to the FRG and the Netherlands the only feasible option, without explicitly saying so. The US could ask the Germans and Dutch to impose export controls on their technology and resulting products. Individual German and Dutch 'commercial firms and universities … might also be prepared to restrict the circulation of information pertaining to their work; commercial restrictions of this nature might prove to be quite effective.'[777] The US Secretary of State meanwhile had informed Chancellor Adenauer on the matter.[778]

The AEC and State Department collaborated further and by April, 1960 the State Department was exploring how to overcome the 'serious procedural difficulties'. Already in March 1960, the US Secretary of State Herter had warned German Foreign Minister Von Brentano of the proliferation risk attached to commercially exporting centrifuges and the latter had agreed to stop these exports, of 'which he had been unaware'.[779]

On the 9th of April, 1960, in a widely circulated report within the US administration, the AEC presented its conclusions and recommendations, its analysis of the challenges largely in agreement with Wells' and Farley's earlier assessments, supporting their call to find a way to pursue collaboration but at the very least classification with the UK, FRG and Netherlands. It reported that the AEC had held 'informal discussions' with Dr. Boettcher, Professor Groth and Professor Kistemaker to explore possible collaboration but that this not result in any official

774 Memorandum for Mr. Algie A. Wells, Director, Division of International Affairs, Atomic Energy Commission from Special Assistant to the Secretary of State Philip J. Farley, 23rd of March 1960, *https://assets.documentcloud.org/documents/399994/doc-5-farley-memo.pdf*, website checked 2-1-2017, p. 2.
775 Ibid., Burr, William, 'The 'Labors of Atlas, Sisyphus, or Hercules? US Gas-Centrifuge Policy and Diplomacy, 1954-60' in *The International History Review*, Vol. 37, No. 3 (Routledge: 2015) p. 450.
776 Memorandum for Mr. Algie A. Wells, Director, Division of International Affairs, Atomic Energy Commission from Special Assistant to the Secretary of State Philip J. Farley, 23rd of March 1960, *https://assets.documentcloud.org/documents/399994/doc-5-farley-memo.pdf*, website checked 2-1-2017, p. 2.
777 Ibid.
778 Ibid., p. 3.
779 Memorandum of Conversation, 'Manufacture and Export of Ultra-Centrifuge Equipment', Secret, 15th March 1960, RG 59, Central Decimal Files 1960-1963, 862A.394/3-1560, http://nsarchive.gwu.edu/nukevault/ebb518-the-gas-centrifuge-secret-origins-of-US-policy-of-nuclear-denial-1954-1960/doc%2010%20%203-15-60%20herter%20and%20von%20brentano.pdf, website checked 2-1-2017..

proposals from those countries.[780] As a possible explanation for this rejection (as it was perceived by the Americans), Hellendoorn (2015) cited Kistemaker's 1957-1958 contacts with the Americans, during which they had not been able to commit to anything and had cited bureaucracy as an obstacle to come up with funding for a common project. Additionally, Kistemaker had been instructed to focus on possible European collaborations.[781]

In April, a meeting took place at the German Embassy in Washington DC to discuss the matter, during which German Commercial Councilor Dr. Ernecke informed the US officials that Professor Kistemaker was doing similar work as the Germans but that no cooperation had taken place and that he wasn't aware if the Dutch had also exported centrifuges. Mr. Menke of the AEC informed the Germans the US had two years prior classified its work on the centrifuge and both its scientists and interested companies were keen to explore means of cooperation with the Germans.[782]

During the meeting, the subject of centrifuge technology export also came up. Dr. Ernecke pointed out that German exports of centrifuges had taken place to Brazil before but had required licenses and there was now 'a disinclination to allow the ultra-centrifuge to be sent to non-NATO countries.' The successful import of West-German centrifuges by Brazil had been the Brazilians' second attempt, first ordering centrifuges from Sartorius-Werke AG in Göttingen in 1954 but that company was denied an export license for the transfer by the occupational allied command.[783] The sale to Brazil had taken place a few years after the 1954 denied sale and concerned an older model capable of about 300 m/s.[784]

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780 Atomic Energy Commission, 'Gas Centrifuge Method of Isotope Separation: Note by the Secretary', AEC 610/15, 9 April 1960, *https://www.documentcloud.org/documents/399995-doc-6-aec-april-1960-report.html*, website checked 2-1-2017, p. 2.

781 Hellendoorn, Elmar, *Between the Devil and the Deep Sea - The Netherlands and the Struggle for European Nuclear Order,* Ph.D. Dissertation, Faculty of Humanities, Utrecht University (April 2016) p. 327. Also see *Early Multinational Enrichment Initiatives*, page 212.

782 Memorandum of Conversation, 'German Development of Ultra-Centrifuge', 12th May 1960, RG 59, Central Decimal Files 1960-1963, 862A.394/5-1260, http://nsarchive.gwu.edu/nukevault/ebb518-the-gas-centrifuge-secret-origins-of-US-policy-of-nuclear-denial-1954-1960/doc%2012%205-12-60-%20memcon%20with %20germans.pdf, website checked 2-1-2017. This information is contradicted by a *Nucleonics* article (19th of May issue 1960), cited by the State Department, which stated that classification of the centrifuge program in the US was still under consideration, State Department Telegram 283 to U.S. embassies Bonn, London, The Hague, Brussels EUSEC, Confidential, 9th of August 1960l, RG 59, Bureau of European Affairs. Office of Atlantic Political and Economic Affairs, Records Relating to Atomic Energy Matters, 1960-1963, box 2, Centrifuge, http://nsarchive.gwu.edu/nukevault/ebb518-the-gas-centrifuge-secret-origins-of-US-policy-of-nuclear-denial-1954-1960/doc%2021.pdf, website checked 2-1-2017, p. 2.

783 Foreign Service Despatch from U.S. Commissioner Military Security Board Ray W. Smith to the Department of State, Washington D.C., 'Decisions Taken at the Meeting of the Commissioners of the Military Security Board on November 9, 1954.', Secret, 1048, 17th of November 1954, http://nsarchive.gwu.edu/nukevault/ebb518-the-gas-centrifuge-secret-origins-of-US-policy-of-nuclear-denial-1954-1960/doc%206%2011-17-54.pdf, website checked 15-3-2017, p. 1.

784 U.S. Congress, Joint Committee on Atomic Energy, Executive Session, 'Briefing on Gas Centrifuge Process', 30th of August 1960, Secret, RG 128. Records of the Joint Committees of Congress. Joint Committee on Atomic Energy, 1946-1977, box 45, File 6460: re centrifuge process, *https://nsarchive2.gwu.edu/nukevault/ebb518-the-gas-centrifuge-secret-origins-of-US-policy-of-nuclear-denial-1954-1960/doc%2023%208-30-60%20hearings %20%20JCAE.pdf*, website checked 4-9-2018, p. 23.

Dr Ernecke failed to mention to his counterparts that after initial contacts in 1958, Kistemaker and Director Boettcher of Degussa had had several discussions in late 1959 and early 1960 on the subject of a possible collaboration between their programs and Boettcher had gone as far as propose a phased plan towards that end. Besides using centrifuges to enrich uranium for nuclear fuel, an industrial area for which Degussa was well-positioned as a chemical industrial company that produced UF6 and fabricated nuclear fuel, the company also saw utility for the centrifuge in reprocessing uranium and plutonium from spent fuel. In the 22nd of December meeting between Kistemaker and Boettcher, the latter explained that not only was the centrifuge suited for re-enrichment of uranium in U235 and plutonium in Pu241, but it could possibly also for the larger part circumvent the hot chemistry process currently used in reprocessing (industrially only available in the UK and US at high cost), by fluoridating the spent fuel and separating the heavier elements from it, which could subsequently be re-enriched using centrifuges as well.[785] Boettcher wanted to exclude EURATOM (and the possibility of its financial assistance) from a German-Dutch collaboration most importantly because it would require sharing the results of technical cooperation with other EURATOM partners including France, which had come inquiring about the centrifuge at Degussa, and because it might jeopardize a possible collaboration that included the US, whose officials also had shown interest and who according to Boettcher were also less than enthusiastic about the possibility of technical information flowing to France's military program through EURATOM, or to other EURATOM members. Furthermore, Degussa had more than adequate financial means and could get additional funding from the FRG Government.[786] When Kistemaker later pressed Boettcher on the exchange of patents at the earliest possible opportunity, he found Boettcher to have become 'slow in answering Kistemaker's letters, and seemed reluctant to [him]', possibly because by now the US had made their démarche to Foreign Minister Von Brentano, of whose decision to cease exports Boettcher, as director at Degussa, probably had been informed. More likely, it was the first sign that Boettcher and Degussa wanted to go at it alone, feeling they had little to gain in cooperation with the other West-German programs or the Dutch.[787]

785 Report, Prof. Dr. Kistmaker, J, 'Bespreking over het U.C. Project met Dr. Boettcher (Degussa) in Düsseldorf op 22 december 1969 in Hotel Breidenbacherhof', FOM-7933, Vertrouwelijk, 2.03.01/6701, pp. 3-4. Kistemaker and Boettcher had first met in July 1957, shortly after Kistemaker's contacts with Zippe, Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) pp. 145, 168.

786 Streefland, Abel, 'Putting a Lid on the Gas Centrifuge: Classification of the Dutch Ultracentrifuge Project, 1960–1961', in Van Dongen, Jeroen (ed.), *Cold War Science and the Transatlantic Circulation of Knowledge* (2015, Brill, Leiden) pp. 87-88, 98, Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) p. 182, Hellendoorn, Elmar, *Between the Devil and the Deep Sea - The Netherlands and the Struggle for European Nuclear Order,* Ph.D. Dissertation, Faculty of Humanities, Utrecht University (April 2016) pp. 330-331, Burr, William, 'To “Keep the Genie Bottled Up”: U.S. Diplomacy, Nuclear Proliferation, and Gas Centrifuge Technology, 1962, 1972', in *Journal of Cold War Studies*, Vol. 19, No. 2 (Spring 2017) p. 120.

787 Streefland, Abel, 'Putting a Lid on the Gas Centrifuge: Classification of the Dutch Ultracentrifuge Project, 1960–1961', in Van Dongen, Jeroen (ed.), *Cold War Science and the Transatlantic Circulation of Knowledge* (2015, Brill, Leiden) pp. 88, 98, Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) p. 186, Hellendoorn, Elmar, *Between the Devil and the Deep Sea - The Netherlands and the Struggle for European Nuclear Order,* Ph.D. Dissertation, Faculty of Humanities, Utrecht University (April 2016) pp. 331, 333, 339.

The following July, a State Department-led joint team of officials from the AEC and the State Department traveled to Europe, visiting Bonn, The Hague and London.[788] Arriving first in Bonn, they found the Germans very aware of the proliferation problem and in the process of considering their options and that they deemed classification to be likely, because 'although functional gas centrifuge cascades did not yet exist in the West', 'present developments [in the FRG] were leading to cascade development'.[789]

The German officials meeting the American delegation were concerned about a number of things. First, the need and effects of a bilateral US-EURATOM agreement if exchange of information with US firms was pursued; EURATOM would likely require the information to run both ways, an issue the US delegation promised to support the FRG in vis-à-vis EURATOM. The potential political problem that the position of France presented in this regard was eluded to but not specifically articulated; and the parties agreed to be vague about the actual content of their current discussions to EURATOM and France. The German side said they were considering classifying the work before bringing the issue up with EURATOM. In any regard, the patents required to be filed with EURATOM under the EURATOM Treaty would not have to be published. Second, the Germans took the same view that the US had reached; classification only made sense if all the relevant countries (the US, UK, FRG and the Netherlands) would classify their work. The US agreed and pointed out that this work was already under classification with the UK and would be with Canada if they

788 The US delegation consisted of six members, and not four as Abel Streefland erroneously mentions on this subject in his 2015 article and 2017 book. The delegation members were: Charles Sullivan, Deputy Special Assistant to the Secretary of State for Disarmament and Atomic Energy; Edward J. Block, Assistant General Manager for Manufacturing (AEC); A.A. Wells, Director, Division of International Affairs (AEC); Wilbur A. Strauser, Deputy Director, Division of Classification (AEC); George A. Kolstad, Chief, Physicis and Mathematics Branch (AEC); Howard Meyers, Political Officer assigned to U.S. Mission to Euratom (State). Possibly, only the four delegation members mentioned by Streefland took part in the meeting at the Dutch MFA. Separately, Kistemaker mentioned of a four man semi-official US delegation under the leadership of K.P. Cohen, director of General Electric Nuclear, accompanied by a Dutch Ministry of Foreign Affairs official visiting his laboratory around the end of 1959 and start of 1960, telling him (Kistemaker) his group was publishing too much sensitive information, Streefland, Abel, 'Putting a Lid on the Gas Centrifuge: Classification of the Dutch Ultracentrifuge Project, 1960–1961', in Van Dongen, Jeroen (ed.), *Cold War Science and the Transatlantic Circulation of Knowledge* (2015, Brill, Leiden) pp. 82-83, Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) pp. 200-201, Memorandum, TMA aan DGES, 'Ultracentrifuge-project', TMA-1463, Geheim, 21st of July 1960, 2.03.01/6701, p. 2, Atomic Energy Commission, 'Report of U.S. Team Concerning the Gas Centrifuge Process in Germany, the Netherlands, and the United Kingdom, July 13-20, 1960,' AEC 610/24, Confidential, 8 August 1960, http://nsarchive.gwu.edu/nukevault/ebb518-the-gas-centrifuge-secret-origins-of-US-policy-of-nuclear-denial-1954-1960/doc%2019%208-4-60%20report%20on%20talks%20in%20Europe.pdf, p. 4, Kistemaker, J., *De Geschiedenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991) http://laka.org/docu/boeken/pdf/1-01-8-30-19.pdf, websites checked 2-1-2017, p. 16.

789 Atomic Energy Commission, 'Report of U.S. Team Concerning the Gas Centrifuge Process in Germany, the Netherlands, and the United Kingdom, July 13-20, 1960,' AEC 610/24, Confidential, 8th of August 1960, http://nsarchive.gwu.edu/nukevault/ebb518-the-gas-centrifuge-secret-origins-of-US-policy-of-nuclear-denial-1954-1960/doc%2019%208-4-60%20report%20on%20talks%20in%20Europe.pdf, website checked 2-1-2017, p. 5, Burr, William, 'To "Keep the Genie Bottled Up": U.S. Diplomacy, Nuclear Proliferation, and Gas Centrifuge Technology, 1962, 1972', in *Journal of Cold War Studies*, Vol. 19, No. 2 (Spring 2017) p. 118.

chose to enter the field. Third, the German side explained, the academic and industrial stakeholders in the FRG would likely demand compensation if the project was to be classified. Fourth, the German officials wanted to know what opportunities for information exchange would remain open after classification and were told such exchanges would be possible if the security standards of a party were 'adequate in US belief' and a legal basis for information exchange existed.[790] Resolution now hinged on how the Dutch would respond and the FRG officials gave permission for the US delegation to set out the German concerns to the Dutch and inform them of these US-German discussions. The content of classification was discussed briefly, with AEC's Kolstad setting out the main areas and qualifications.[791]

When meeting the US delegation in The Hague, the Dutch Ministry of Foreign Affairs officials present were briefed on the US-FRG talks and they also agreed on the need for classification. The Dutch legal system already had a basis to do so but the Ministry of Foreign Affairs needed to involve other relevant ministries before coming to any official agreement. They argued several points to the US delegation on several subjects. First, the Dutch officials conveyed their belief that considering its economic potential, industrial partners in the ultracentrifuge project would press to centrifuge sales and that it might be possible to come to an agreement to market the centrifuge. However, the Dutch were aware that responsible marketing could only extend to 'stable governments' and thus commercial opportunities would be limited.[792]

The Dutch officials informed the US delegation that the problem of EURATOM involvement might not be as large as anticipated. The French had in fact created a precedent for limited exposure of sensitive information to EURATOM when they demanded information on their uranium production figures, after Council approval of this arrangement, be kept confidential. Information with a military dimension was 'essentially excluded from the treaty requirements for reporting'.[793] EURATOM would need to be involved at some point, 'but detailed technical information could either be kept secret or not made available to [the] Euratom Commission.'[794] The Dutch officials proposed that the involved countries would agree on a common policy before contacting EURATOM. First the Netherlands would consult bilaterally with the FRG (the two EURATOM members) and the US would do so with the UK.[795]

790 Atomic Energy Commission, 'Report of U.S. Team Concerning the Gas Centrifuge Process in Germany, the Netherlands, and the United Kingdom, July 13-20, 1960,' AEC 610/24, Confidential, 8th of August 1960, http://nsarchive.gwu.edu/nukevault/ebb518-the-gas-centrifuge-secret-origins-of-US-policy-of-nuclear-denial-1954-1960/doc%2019%208-4-60%20report%20on%20talks%20in%20Europe.pdf, website checked 2-1-2017, pp. 5-6.
791 Ibid., pp. 6-7.
792 Ibid., p. 7.
793 Ibid.
794 Ibid.
795 Streefland (2015) credits the US delegation with this suggestion while the Americans seem to credit it to the Dutch officials present. Dutch officials were however forced into taking the initiative after the American Embassy in Bonn had 'jumped the gun' and had informed the Germans of the 15th of July meeting in The Hague and that the Dutch would contact them. Streefland, Abel, 'Putting a Lid on the Gas Centrifuge: Classification of the Dutch Ultracentrifuge Project, 1960–1961', in Van Dongen, Jeroen (ed.), *Cold War Science and the Transatlantic Circulation of Knowledge* (2015, Brill, Leiden) p. 83, Memorandum, TMA aan DGES, 'Ultracentrifuge-project', TMA-1463, Geheim, 21st of July 1960, 2.03.01/6701, p. 5.

Subsequently a multilateral 'four-power meeting' could be arranged, suggested the Dutch (the latter suggestion to which the US delegates reportedly were reserved).[796] Both the FRG and the Netherlands were sent the US classification guide shortly after the delegation returned to the US.[797]

The US delegation had a separate meeting at FOM with Professor Kistemaker and officials from RCN, Werkspoor and the Ministry of Foreign Affairs, in which some other concerns came to light. Kistemaker explained how the Germans had published much of what they had discovered, including information on cascades. It would be difficult to classify that information but possible to classify the 'know-how' the individual countries possessed. He concluded that the Dutch program was as far along as the West-German one, although he had little information on how far work at Degussa had progressed. He had over the past six months unsuccessfully attempted to come to an exchange of information with the Germans.[798] What Kistemaker failed to mention to the American delegation was that in his perception, at this time his project was ahead of the Germans 'in the fields of "know how" and experience' and just about ready to enter the development stage.[799]

Another Dutch concern was the contacts the FRG scientists at Frankfurt had with Steenbeck's group at Jena in the GDR (German Democratic Republic: East Germany). The US delegates conveyed that the FRG would cut all contact after classification. Comparing notes, Dr. Kolstad said that noticing developments in Western Europe, the USSR had restarted its centrifuge program and theoretical work had been published in Poland. Kistemaker informed his counterparts that Canada also had a program. After Mr. Wells cast doubt on the future size of the available market for enrichment, Kistemaker disagreed and pointed out that the commercial viability of the centrifuge might be better than anticipated, as he predicted that in the future, besides the anticipated growth of installed nuclear power and its enrichment

796 Atomic Energy Commission, 'Report of U.S. Team Concerning the Gas Centrifuge Process in Germany, the Netherlands, and the United Kingdom, July 13-20, 1960,' AEC 610/24, Confidential, 8th of August 1960, http://nsarchive.gwu.edu/nukevault/ebb518-the-gas-centrifuge-secret-origins-of-US-policy-of-nuclear-denial-1954-1960/doc%2019%208-4-60%20report%20on%20talks%20in%20Europe.pdf, website checked 2-1-2017, p. 8, Hellendoorn, Elmar, *Between the Devil and the Deep Sea - The Netherlands and the Struggle for European Nuclear Order,* Ph.D. Dissertation, Faculty of Humanities, Utrecht University (April 2016) p. 336.

797 Department of State Instruction CA-894 to embassies Bonn, London, The Hague, 'Gas Centrifuge Classification Guide', Confidential, 27th of July 1960, RG 59, Central Decimal Files 1960-1963, 103-AEC/10-1960.*http://nsarchive.gwu.edu/nukevault/ebb518-the-gas-centrifuge-secret-origins-of-US-policy-of-nuclear-denial-1954-1960/doc%2020A%207-27-60%20class%20guide.pdf*, Department of State Instruction CA-3641 to embassies Bonn, London, The Hague, 'Centrifuge Classification Guide – Revision', Confidential, 19th of October 1960, Source: RG 59, Central Decimal Files 1960-1963, 103-AEC/10-1960, http://nsarchive.gwu.edu/nukevault/ebb518-the-gas-centrifuge-secret-origins-of-US-policy-of-nuclear-denial-1954-1960/doc%2020B%2010-19-60%20rg%2059%2060-63%20dec%20file%20box%20129.pdf, websites checked 2-1-2017.

798 Atomic Energy Commission, 'Report of U.S. Team Concerning the Gas Centrifuge Process in Germany, the Netherlands, and the United Kingdom, July 13-20, 1960,' AEC 610/24, Confidential, 8th of August 1960, *http://nsarchive.gwu.edu/nukevault/ebb518-the-gas-centrifuge-secret-origins-of-US-policy-of-nuclear-denial-1954-1960/doc%2019%208-4-60%20report%20on%20talks%20in%20Europe.pdf*, website checked 2-1-2017, pp. 8-9.

799 Memorandum, TMA aan DGES, 'Ultracentrifuge-project', TMA-1463, Geheim, 21st of July 1960, 2.03.01/6701, p. 1.

requirements during the next decade, the centrifuge could be used to recover fuel elements from spent fuel, in line with Boettcher's (at Degussa) hopes. Lastly, the Dutch delegation at FOM had reached the same conclusion with regard to industrial partners as the West-Germans had; classification would very likely mean the industrial partners would cease to invest their own resources in the project.[800]

Finally, the US delegation visited London. After explaining the risk of proliferation of centrifuge technology and its applicability in making HEU (with 'ease' by 'changing [the] plumbing'), as they had done in Bonn and The Hague, the US delegation outlined the areas in which classification and safeguards were necessary as well as the content of their discussions with the Dutch and Germans.[801] The British had similar concerns as the US delegation had heard before; would classification be in time to prevent an Nth power from developing uneconomic but effective centrifuges for a bomb program, seeing Brazil was already operating a three centrifuge cascade in Sao Paolo with the German machines? How restrictive would classification be and would as a result British industry shun the project? What would the 'psychological-political reaction' be of allies who the technology would be restricted from and what would the British Parliament and public think of the matter, when it inevitably came out?[802] Like in the FRG and the Netherlands, the UK officials needed to coordinate with other ministries before discussions with the US could proceed. They appreciated being kept up to date on discussions between the other technology holders and welcomed the reception of the US classification guide as a possible basis for further discussions.[803]

The classification discussions were leaked to *Nucleonics* soon after and its publication on August 4 caused considerable embarrassment to the AEC and anger with the West-Germans. Furthermore, an Austrian diplomat approached Dr. Müller-Roschach of the FRG Foreign Ministry and colleagues a week after the *Nucleonics* revelations and informed them of more leaked information; that the Dutch had reservations about classification and the Dutch company Philips was set against it. When pressed, the Austrian official revealed the sources of this information had originated from 'Atomic Energy Commission circles in [the] American Embassy [of] Paris'.[804] The Dutch Embassy in Washington DC confirmed to its Ministry that

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800 Atomic Energy Commission, 'Report of U.S. Team Concerning the Gas Centrifuge Process in Germany, the Netherlands, and the United Kingdom, July 13-20, 1960,' AEC 610/24, Confidential, 8th of August 1960, http://nsarchive.gwu.edu/nukevault/ebb518-the-gas-centrifuge-secret-origins-of-US-policy-of-nuclear-denial-1954-1960/doc%2019%208-4-60%20report%20on%20talks%20in%20Europe.pdf, website checked 2-1-2017, pp. 8-9, Memorandum, TMA aan DGES, 'Ultracentrifuge', TMA-1464, Geheim, 21st of July 1960, 2.03.01/6701, pp. 2-4.

801 Atomic Energy Commission, 'Report of U.S. Team Concerning the Gas Centrifuge Process in Germany, the Netherlands, and the United Kingdom, July 13-20, 1960,' AEC 610/24, Confidential, 8th of August 1960, *http://nsarchive.gwu.edu/nukevault/ebb518-the-gas-centrifuge-secret-origins-of-US-policy-of-nuclear-denial-1954-1960/doc%2019%208-4-60%20report%20on%20talks%20in%20Europe.pdf*, website checked 2-1-2017, p. 9.

802 Ibid., pp. 10-11.

803 Ibid., pp. 9-10.

804 Bonn Embassy Telegram 294 to State Department, Secret, 19th of August 1960, RG 59, Central Decimal Files 1960-63, 862A.1901/8-1960, http://nsarchive.gwu.edu/nukevault/ebb518-the-gas-centrifuge-secret-origins-of-US-policy-of-nuclear-denial-1954-1960/doc%2022%20germans%20on%20leaks.pdf, State Department Telegram 283 to U.S. embassies Bonn, London, The Hague, Brussels EUSEC, Confidential, 9th of August 1960l,

the source of the leak came from inside the AEC.[805] 'If this is a sample of what you call classification, I cannot help but believe that our government might be better off without it.', Dr. Müller-Roschach reportedly told the American embassy in Bonn.[806]

While the *Nucleonics* article was premature (no work in the FRG had been classified yet) and contained faulty assumptions, Dutch and German media picked up on the story of the US classification request and as a result, separately Professor Kistemaker and Degussa felt it necessary to ensure the media and public that the work was entirely peaceful (Kistemaker did so in a single meeting with the entire Dutch press core). Within the Dutch Ministry of Foreign Affairs, the possibility was entertained that pressure from US industry had led to the *Nucleonics* article.[807] American newspapers, likely triggered by the *Nucleonics* article, published on the historic and contemporary centrifuge programs, using sensational headlines.[808]

After the US request for classification, Dutch officials discussed possible American motivations behind the request. Besides a genuine wish to stop the spread of centrifuge technology to more countries, the Cold War argument of proliferation to the USSR seemed somewhat overdrawn, as by now it was widely known that it had a working centrifuge program of its own. That the US was trying to keep the technology from other European countries such as France and Italy was also a possibility Dutch officials entertained, having been told so by the US delegation during the classification meetings and by US Embassy's secretary in Bonn.[809] Furthermore, economic interests could lie at the heart of US duality in

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RG 59, Bureau of European Affairs. Office of Atlantic Political and Economic Affairs, Records Relating to Atomic Energy Matters, 1960-1963, box 2, Centrifuge, http://nsarchive.gwu.edu/nukevault/ebb518-the-gas-centrifuge-secret-origins-of-US-policy-of-nuclear-denial-1954-1960/doc%2021.pdf, websites checked 2-1-2017, Burr, William, 'The 'Labors of Atlas, Sisyphus, or Hercules? US Gas-Centrifuge Policy and Diplomacy, 1954-60' in *The International History Review*, Vol. 37, No. 3 (Routledge: 2015) pp. 447-448.

805 Streefland, Abel, 'Putting a Lid on the Gas Centrifuge: Classification of the Dutch Ultracentrifuge Project, 1960–1961', in Van Dongen, Jeroen (ed.), *Cold War Science and the Transatlantic Circulation of Knowledge* (2015, Brill, Leiden) p. 94.

806 Bonn Embassy Telegram 294 to State Department, Secret, 19th of August 1960, RG 59, Central Decimal Files 1960-63, 862A.1901/8-1960, http://nsarchive.gwu.edu/nukevault/ebb518-the-gas-centrifuge-secret-origins-of-US-policy-of-nuclear-denial-1954-1960/doc%2022%20germans%20on%20leaks.pdf, website checked 2-1-2017.

807 Streefland, Abel, 'Putting a Lid on the Gas Centrifuge: Classification of the Dutch Ultracentrifuge Project, 1960–1961', in Van Dongen, Jeroen (ed.), *Cold War Science and the Transatlantic Circulation of Knowledge* (2015, Brill, Leiden) pp. 94-95, Burr, William, 'The 'Labors of Atlas, Sisyphus, or Hercules? US Gas-Centrifuge Policy and Diplomacy, 1954-60', in *The International History Review*, Vol. 37, No. 3 (Routledge: 2015) p. 447.

808 Burr, William, 'The 'Labors of Atlas, Sisyphus, or Hercules? US Gas-Centrifuge Policy and Diplomacy, 1954-60', in *The International History Review*, Vol. 37, No. 3 (Routledge: 2015) pp. 448-449.

809 Memorandum, TMA aan DGES, 'Ultracentrifuge-project', TMA-1463, Geheim, 21st of July 1960, 2.03.01/6701, pp. 2-3, Hellendoorn, Elmar, *Between the Devil and the Deep Sea - The Netherlands and the Struggle for European Nuclear Order,* Ph.D. Dissertation, Faculty of Humanities, Utrecht University (April 2016) p. 334, Streefland, Abel, 'Putting a Lid on the Gas Centrifuge: Classification of the Dutch Ultracentrifuge Project, 1960–1961', in Van Dongen, Jeroen (ed.), *Cold War Science and the Transatlantic Circulation of Knowledge* (2015, Brill, Leiden) p. 91, Burr, William, 'To "Keep theVan Dongen, Jeroen (ed.), *Cold War Science and the Transatlantic Circulation of Knowledge* (2015, Brill, Leiden) Genie Bottled Up": U.S. Diplomacy, Nuclear Proliferation, and Gas Centrifuge Technology, 1962, 1972', in *Journal of Cold War Studies*, Vol. 19, No. 2 (Spring 2017) p. 120.

this matter, with possibly 'American companies … the actual parties behind the request', using classification as a means to 'delay … German and Dutch programs' to gain a competitive advantage for their industrial partners.[810] The Dutch impression of the US position was not helped by the fact that 'on 19 October 1960, the US AEC announced that it would make 57 patents related to the centrifuge available to American industrial consortia', causing Meijer of the Atomic Affairs sections of the Ministry of Foreign Affairs to inquire with Kistemaker whether this action was in line with non-proliferation objectives.[811] Allowing Kistemaker and RCN more time to study the classification guide and possible consequences of its implementation and in order to further coordinate with the West-Germans (with resulting meetings late in September), the involved Dutch officials postponed a decision on classification.[812] Shortly after, Kistemaker's colleague Professor De Boer of RCN informed the PM's office that classification would have severe negative consequences for the centrifuge's industrial application.[813]

The FRG decided to classify their centrifuge work in early October, informing the US and Netherlands on the 4th and informing the press on the 12th of October, 1960.[814] The FRG and Netherlands held more meetings in October and December, agreeing to a system of secret patents to protect industrial interests (using NATO regulations), to interpret the US classification guide 'in a most limited way in order to safeguard industrial interests' and to conduct regular consultations 'to discuss secrecy matters and industrial developments'.[815] Possible forms of international cooperation were also discussed between the FRG and Netherlands, including the possibility of involving the UK, but excluding that of the possibility of any involvement by international organizations.[816] Meanwhile, starting in early

810 Hellendoorn, Elmar, *Between the Devil and the Deep Sea - The Netherlands and the Struggle for European Nuclear Order,* Ph.D. Dissertation, Faculty of Humanities, Utrecht University (April 2016) p. 335, Streefland, Abel, 'Putting a Lid on the Gas Centrifuge: Classification of the Dutch Ultracentrifuge Project, 1960–1961', in Van Dongen, Jeroen (ed.), *Cold War Science and the Transatlantic Circulation of Knowledge* (2015, Brill, Leiden) pp. 90-91.

811 Hellendoorn, Elmar, *Between the Devil and the Deep Sea - The Netherlands and the Struggle for European Nuclear Order,* Ph.D. Dissertation, Faculty of Humanities, Utrecht University (April 2016) pp. 335-336.

812 Streefland, Abel, 'Putting a Lid on the Gas Centrifuge: Classification of the Dutch Ultracentrifuge Project, 1960–1961', in Van Dongen, Jeroen (ed.), *Cold War Science and the Transatlantic Circulation of Knowledge* (2015, Brill, Leiden) pp, 91, 94.

813 Hellendoorn, Elmar, *Between the Devil and the Deep Sea - The Netherlands and the Struggle for European Nuclear Order,* Ph.D. Dissertation, Faculty of Humanities, Utrecht University (April 2016) p. 336.

814 Memorandum of Conversation, 'German Classification of Centrifuge Work', Confidential, 4th of October 1960, RG 59, SAE, box 298, 12.H Peaceful Uses Subject File.9 Gas Centrifuge 1960-62, http://nsarchive.gwu.edu/nukevault/ebb518-the-gas-centrifuge-secret-origins-of-US-policy-of-nuclear-denial-1954-1960/doc%2025%2010-4-60%20%20German%20decision.pdf, Memorandum for the Files, prepared by William Chapin, S/AE, 'Press Conference in Bonn on Ultra-Centrifuge Proces', Unclassified, 13 October 1960, RG 59, SAE, box 298, 12.H Peaceful Uses Subject File.9 Gas Centrifuge 1960-62, http://nsarchive.gwu.edu/nukevault/ebb518-the-gas-centrifuge-secret-origins-of-US-policy-of-nuclear-denial-1954-1960/doc%2026%2010-13-60%20fRG%20press%20conference.pdf, websites checked 2-1-2017.

815 Hellendoorn, Elmar, *Between the Devil and the Deep Sea - The Netherlands and the Struggle for European Nuclear Order,* Ph.D. Dissertation, Faculty of Humanities, Utrecht University (April 2016) p. 338, Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) p. 227.

816 Annex to letter, J.H. De Boer, 'Internationalisatie van het U.C. Project', 810 WA-B 4/11, 21st of December 1960, 2.06.101/E24099/839.

1960 started working with NATO's Coordination Committee (COCOM) to include centrifuge technology in its export-control system to deny the technology to the Communist world. COCOM accepted the ban on exports in May 1961, although only for centrifuge technology related to the nuclear industry, thanks to resistance from the UK, FRG and France.[817]

In late December the Dutch decided they were prepared for the ultracentrifuge project to 'be declared a state secret only if the Dutch-German talks with the US and the UK led to a satisfying agreement regarding the coordination of classification. Such quadripartite talks would serve to ensure a consistent interpretation of the classification guide in the four countries, ensuring 'a level playing field'.[818] In the view of Dutch officials, the quadripartite structure would also serve to tie the West-Germans securely to the US in this field, constraining its nuclear policy options regarding the centrifuge. With East-West pressures already approaching a boiling point over the status of Berlin following the USSR's aborted Berlin ultimatum of 1958-1959, risks attached to an unconstrained or unilateral West-German nuclear policy needed to be reduced.[819]

Dr. Boettcher attempted to initiate a collaboration between the four (the US, UK, FRG, and Netherlands) programs in January 1961, conditioned on participation by all. After inquiry with the US, the Dutch Ministry of Foreign Affairs found that the US had 'no plans whatsoever for any collaboration following the request for classification'.[820] An approach made by Kistemaker to Kronberger in the UK the next month, to establish a similar initiative was rebuffed; under the conditions of secrecy, only an international treaty would make collaboration possible, Kronberger replied.[821] During the same month, EURATOM also expressed its interest in participating in the ultracentrifuge (U.C.) project, either as a minority or majority partner, offering lenient conditions as to possibility of secret patents and reporting requirements to EURATOM.[822]

In a Council of Ministers meeting on the 6th of January 1961, the question of classification could not be resolved and was deferred back to the department level. Officials from the ministries of General Affairs, Foreign Affairs, Justice, Domestic Affairs, Economic Affairs as

817 Burr, William, 'The 'Labors of Atlas, Sisyphus, or Hercules? US Gas-Centrifuge Policy and Diplomacy, 1954-60' in *The International History Review*, Vol. 37, No. 3 (Routledge: 2015) p. 451.

818 Hellendoorn, Elmar, *Between the Devil and the Deep Sea - The Netherlands and the Struggle for European Nuclear Order,* Ph.D. Dissertation, Faculty of Humanities, Utrecht University (April 2016) pp. 336-337, Burr, William, 'The 'Labors of Atlas, Sisyphus, or Hercules? US Gas-Centrifuge Policy and Diplomacy, 1954-60' in *The International History Review*, Vol. 37, No. 3 (Routledge: 2015) p. 450.

819 'Shell, Philips, Werkspoor zien toekomst in procedé-Kistemaker: Drie concerns betrekken samen goedkoop uranium', in *De Volkskrant*, 22nd of February 1968, p. 1.

820 Streefland, Abel, 'Putting a Lid on the Gas Centrifuge: Classification of the Dutch Ultracentrifuge Project, 1960–1961', in Van Dongen, Jeroen (ed.), *Cold War Science and the Transatlantic Circulation of Knowledge* (2015, Brill, Leiden) p. 98, Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) p. 229.

821 Streefland, Abel, 'Putting a Lid on the Gas Centrifuge: Classification of the Dutch Ultracentrifuge Project, 1960–1961', in Van Dongen, Jeroen (ed.), *Cold War Science and the Transatlantic Circulation of Knowledge* (2015, Brill, Leiden) p. 98, Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) pp. 229-230.

822 Report, Prof. Dr. J. Kistemaker aan Ministerie van Economische Zaken Mr. H.K. Mani, 'Confidentieel Gesprek met Dr. Guéron op 26 januari', Geheim, 7th of February 1961, 2.06.101/E24099/839.

well as Education, Arts and Science had come to consensus by February the 1st, allowing Minister of Foreign Affairs Luns to direct the decision back the Council of Ministers with the advice to agree to classification.[823]

Finally, the Dutch Government, mostly for diplomatic reasons (not wanting to sour its relation to the US and intend to give the right impression to its allies) classified five centrifuge patents in March 1961, without consulting Kistemaker. Kistemaker was 'furious' but was told that '[s]ince the Netherlands had proposed multilateral classification talks, it could not remain behind in classifying the ultracentrifuge'.[824]

After Classification: International Patents and Evolution of Classification

The US Atomic Energy Commission's "'Classification Guide for the Gas Centrifuge [Programme]"' would serve as the foundation of the classification policies for the four countries until 1972.[825] Every couple of years, in March 1962 and 1964 and February 1967, 'quadripartite meetings' were held by officials from the four countries to resolve ongoing problems and to the greatest extent possible formalize a common classification policy. Attaining further uniformity in national secrecy procedures and classification systems (for example the procedure for depositing secret patents in other countries) wasn't pursued by the US and was according to the AEC not needed because it, aside from with Canada and the UK, did not have agreements in place with other countries allowing it to share information on this subject.[826] The Classification Guide considered secret,

> '… information relating to design, construction and operation of cascades, design of (pilot-) plants (both technical and economic data), information on design, construction and operation of fast centrifuges, data on hydraulics and bearings, information on new [research] developments. Classified as confidential is information on the scale of the program.'[827]

823 Letter, Minister van Buitenlandse Zaken Luns aan Minister-President, Voorzitter van de Raad van Ministers, 'Geheimhouding van het Ultracentrifuge-project', AT 15419/713GS, Secret, 1st of February 1961, 2.06.101/E24099/839.

824 Hellendoorn, Elmar, *Between the Devil and the Deep Sea - The Netherlands and the Struggle for European Nuclear Order,* Ph.D. Dissertation, Faculty of Humanities, Utrecht University (April 2016) pp. 336, 339.

825 Report, voor Ambassadeur, Ambassade Washington D.C. E.L.C. Schiff aan Minister van Buitenlandse Zaken, 'Ultracentrifuge', EA-4015-505-GS/1008, Geheim, 30th of March 1962, 2.06.101/E24099/840, pp. 2-3.

826 Report, voor Ambassadeur, Ambassade Washington D.C. E.L.C. Schiff aan Minister van Buitenlandse Zaken, 'Ultracentrifuge', EA-4015-505-GS/1008, Geheim, 30th of March 1962, 2.06.101/E24099/840, pp. 2-3, Note, Chef der Directie Raad van Europa en Wetenschappelijke Samenwerking, Ministerie van Buitenlandse Zaken Mr. A. Kruyt aan Ministerie van Economische Zaken Mr. H.K. Mani, 'Ultracentrifuge-project', DRW/AT-10043/365 GS, Geheim, 17th of January 1968, 2.06.101/E24099/842, pp. 1-2, Report, Head of Delegation, Octrooiraad Mr. J.B. Van Benthem, Ministerie van Defensie Mr. D. Wechgelser, Reactor Centrum Nederland Ir. J.J. De Kler, Nederlandse Ambassade Washington Ir. J.C. Diels, 'Opmerkingen van de Nederlandse delegatie inzake het verloop van besprekingen, die van 5-8 maart 1962 in Washington (USA) zijn gevoerd met een Amerikaanse en een Duitse delegatie inzake de geheimhouding van informati, die betrekking heeft op het z.g. Ultracentrifuge project.', F/4285/62a, 2.06.101/E24099/840, 9th of March 1962, p. 1.

827 Note, Directoraat-Generaal voor de Energievoorziening, Directie Kernenergie aan Minister van Ecnoomische Zaken, 'Ultracentrifugeproject', 259/EK, Vertrouwelijk, 29th of December 1967,

The first meeting in early March 1962 was organized by the AEC to answer questions forwarded by the Netherlands on the content of a confidential memorandum on the Classification Guide the Americans had distributed in December 1961 and was not attended by a full British delegation but merely the attaché for Atomic Energy from the British embassy in Washington D.C., who 'limited himself to just taking notes'.[828] In the memorandum, the Americans had pushed for a very strict interpretation that would have only allowed patent filings in the four countries and possibly Canada (because of that country had adequate security agreements in place with the US). The Dutch and West Germans delegations informally met ahead of the March 1962 meeting, and came to full consensus on the approach to be taken vis-à-vis the Americans.

During the meeting, the Dutch delegation voiced a strong rejection of the American interpretation regarding patent filings and pushed for a wider interpretation that would allow filings in all countries with adequate security arrangements, i.e. all NATO countries. Together, the Dutch and West Germans were of the opinion that third country patent filings could be allowed, conditioned on appropriate security arrangements agreed on with the third country prior to filings (Sweden and Switzerland were named as examples). An American request to consider prior consultations ahead of such an arrangement would be taken into consideration by the Dutch and West Germans. The Americans in turn took note of a request by the Dutch delegation to inform the Netherlands and FRG when the Americans received intelligence that indicated a NATO country was not observing agreed security arrangements or was misusing secret information from patents, in which case patent filings could be foregone for that

2.06.101/E24099/835, p. 7.

828 Report, voor Ambassadeur, Ambassade Washington D.C. E.L.C. Schiff aan Minister van Buitenlandse Zaken, 'Ultracentrifuge', EA-4015-505-GS/1008, Geheim, 30th of March 1962, 2.06.101/E24099/840, p. 1. This explains why William Burr found nothing on the UK position in the patent discussion in the US archives, Burr, William, 'To “Keep the Genie Bottled Up”: U.S. Diplomacy, Nuclear Proliferation, and Gas Centrifuge Technology, 1962, 1972', in *Journal of Cold War Studies*, Vol. 19, No. 2 (Spring 2017) p. 122. Aside from the British attaché Mr. Donal Avery, attending the meeting were, for the AEC; the chair of the meeting, Mr. Myron Kratzer, Deputiy Director of the Division of International Affairs; C. L. Marshall, Director of the Division of Classification; Wilbur A. Strauser, Deputy Director of the Division of Classification; A.A. Wells, Director of the Division of International Affairs; Roland Anderson, Assistant General Council for Patents. The German delegation consisted of Mr. Hase and Mr. Heyne of the Atomic Affairs Ministry and Mr. Pfanne of the Ministry of Defense. The Dutch delegation consisted of Mr. J.B. Van Benthem of the Dutch Patent Council and head of the delegation, Mr. D. Wechgelser of the Ministerie van Defensie, Ir. J.J. De Kler of Reactor Centrum Nederland and Ir. J.C. Diels of the Netherlands Embassy in Washington D.C., Report, voor Ambassadeur, Ambassade Washington D.C. E.L.C. Schiff aan Minister van Buitenlandse Zaken, 'Ultracentrifuge', EA-4015-505-GS/1008, Geheim, 30th of March 1962, 2.06.101/E24099/840, pp. 1-2, Report, Head of Delegation, Octrooiraad Mr. J.B. Van Benthem, Ministerie van Defensie Mr. D. Wechgelser, Reactor Centrum Nederland Ir. J.J. De Kler, Nederlandse Ambassade Washington Ir. J.C. Diels, 'Opmerkingen van de Nederlandse delegatie inzake het verloop van besprekingen, die van 5-8 maart 1962 in Washington (USA) zijn gevoerd met een Amerikaanse en een Duitse delegatie inzake de geheimhouding van informati, die betrekking heeft op het z.g. Ultracentrifuge project.', F/4285/62a, 9th of March 1962, 2.06.101/E24099/840, p. 20.

country.[829] Overall, while there wasn't agreement regarding patent-filing, the American delegation signaled understanding of the combined Dutch-West-German position.[830]

The four countries committed to number of points of common policy in a legally non-binding '"gentlemen's agreement"'.[831] The danger of centrifuge technologies' proliferation to countries 'outside [this] circle' was recognized among the four partners and they committed to its prevention (inadvertently creating a group of natural partners for future collaboration on the process).[832] They agreed that centrifuge-related patents would be filed as secret and would not be filed outside NATO-countries 'without consultation within the Quadripartite Group', but leaving open how to handle patent applications from 'third countries'.[833]

The Europeans and Americans each separately sought to keep the classification discussions out of their national press as much as possible. For example, after the US had proposed Washington D.C. as the location for the 1962 meeting, West-German officials for this reason sought agreement with the Dutch to jointly propose The Hague or Bonn instead. The US countered that a large American delegation traveling to Europe would draw more attention than the reverse, and that all its classification experts were more readily available when convening in the US. The meeting took place at the headquarters of the AEC in Germantown.[834]

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829 Report, Head of Delegation, Octrooiraad Mr. J.B. Van Benthem, Ministerie van Defensie Mr. D. Wechgelser, Reactor Centrum Nederland Ir. J.J. De Kler, Nederlandse Ambassade Washington Ir. J.C. Diels, 'Opmerkingen van de Nederlandse delegatie inzake het verloop van besprekingen, die van 5-8 maart 1962 in Washington (USA) zijn gevoerd met een Amerikaanse en een Duitse delegatie inzake de geheimhouding van informati, die betrekking heeft op het z.g. Ultracentrifuge project.', F/4285/62a, 9th of March 1962, 2.06.101/E24099/840, p. 1, 7-12, Burr, William, 'To "Keep the Genie Bottled Up": U.S. Diplomacy, Nuclear Proliferation, and Gas Centrifuge Technology, 1962, 1972', in *Journal of Cold War Studies*, Vol. 19, No. 2 (Spring 2017) p. 122.

830 Report, voor Ambassadeur, Ambassade Washington D.C. E.L.C. Schiff aan Minister van Buitenlandse Zaken, 'Ultracentrifuge', EA-4015-505-GS/1008, Geheim, 30th of March 1962, 2.06.101/E24099/840, p. 3.

831 Note, Chef der Directie Raad van Europa en Wetenschappelijke Samenwerking, Ministerie van Buitenlandse Zaken Mr. A. Kruyt aan Ministerie van Economische Zaken Mr. H.K. Mani, 'Ultracentrifuge-project', DRW/AT-10043/365 GS, Geheim, 17th of January 1968, 2.06.101/E24099/842, p. 1.

832 Note, Chef der Directie Raad van Europa en Wetenschappelijke Samenwerking, Ministerie van Buitenlandse Zaken Mr. A. Kruyt aan Ministerie van Economische Zaken Mr. H.K. Mani, 'Ultracentrifuge-project', DRW/AT-10043/365 GS, Geheim, 17th of January 1968, 2.06.101/E24099/842, pp. 1, 5.

833 Note, Chef der Directie Raad van Europa en Wetenschappelijke Samenwerking, Ministerie van Buitenlandse Zaken Mr. A. Kruyt aan Ministerie van Economische Zaken Mr. H.K. Mani, 'Ultracentrifuge-project', DRW/AT-10043/365 GS, Geheim, 17th of January 1968, 2.06.101/E24099/842, p. 3, Draft Minutes of Third Meeting of Quadripartite Group on Gas Centrifuges, held at U.K.A.E.A., London Office, Confidential, 15th of February 1967, 2.06.101/E24099/841, p. 7, Agreed Minutes of Third Meeting of Quadripartite Group on Gas Centrifuges, held at U.K.A.E.A., London Office, Confidential, 15th of February 1967, 2.06.101/E24099/841, p. 5.

834 Code, Ambassade Bonn Vredenburch aan Ministerie van Buitenlandse Zaken, 10696, Geheim, 19th of December 1961, 2.06.101/E24099/839, Code, Minister van Buitenlandse Zaken Luns aan Ambassade Bonn, DRW/AT-179059/9789 GS, Geheim, 29th of December 1961, 2.06.101/E24099/839, Report, voor Ambassadeur, Ambassade Washington D.C. E.L.C. Schiff aan Minister van Buitenlandse Zaken, 'Ultracentrifuge', EA-4015-505-GS/1008, Geheim, 30th of March 1962, 2.06.101/E24099/840, p. 1, Burr, William, 'To "Keep the Genie Bottled Up": U.S. Diplomacy, Nuclear Proliferation, and Gas Centrifuge Technology, 1962, 1972', in *Journal of Cold War Studies*, Vol. 19, No. 2 (Spring 2017) p. 121.

Even though the AEC pushed for formalization of the gentlemen's agreement and at one point the Netherlands did as well (soon backing off), the understanding between the four countries remained informal into the 1970s.[835]

West German Patents

During discussions by Dutch and German patent experts in June 1962, the German side announced that it would not feel bound by the EURATOM reporting requirement on secret patents applications because there were indications that France had taken the position that its CEA forbade secret patent applications. As such France would not deposit its secret patents in France and would not report them to EURATOM under the treaty requirements. Whether this meant the country sought to profit from foreign secret patents filed in its territory without reciprocation or it simply sought to avoid setting a precedent with regards to articles 16 and 25 of the EURATOM Treaty remained unclear into 1963.[836] The Dutch temporarily followed suit from the 13th of July 1962 to the 5th of September 1962, with the Dutch Patent Council halting the deposit of secret patents related to nuclear energy technology, including the ultracentrifuge.[837]

The matter came up again when at the beginning of 1965 Dutch officials noticed that the FRG had not deposited ultracentrifuge patents in the Netherlands for the past few years. This possible indication and the fact that the information the Dutch project was giving to 'foreign competitors' by dutifully reporting them to EURATOM, showing which line of research and development it pursued, combined with the strong suspicion that other EURATOM countries were not so dutiful in reporting on their nuclear energy projects, risked disadvantaging RCN at this crucial time in the project and lead RCN to request the Ministry of Foreign Affairs Atomic Affairs desk to suspend the depositing of patents and reporting to EURATOM as it had done in July 1962.[838] The ministry responded by suggesting two possible reasons for the absence of West German patents: first, the FRG Government had bought out Degussa and was in the process of centralizing all centrifuge projects, possibly leading to delays in the overall project, while second, since the West German state was now officially in charge of centrifuge research, due to political sensitivity it could have opted not to deposit patents at home or

835 Burr, William, 'To “Keep the Genie Bottled Up”: U.S. Diplomacy, Nuclear Proliferation, and Gas Centrifuge Technology, 1962, 1972', in *Journal of Cold War Studies*, Vol. 19, No. 2 (Spring 2017) pp. 123-124.

836 Letter, voor Minister van Buitenlandse Zaken, Raad van Europa en Wetenschappelijke Samenwerking Adviseur voor Atoomzaken Drs. S. Meijer aan Ambassadeur Parijs, 'Mededelingsplicht ex art.16 Euratomverdrag', DRW/AT-78225, Vertrouwelijk, 5th of June 1962, 2.06.101/E24099/840, Letter, voor Minister van Buitenlandse Zaken, Raad van Europa en Wetenschappelijke Samenwerking, Adviseur voor Atoomzaken Drs. S. Meijer aan Ambassadeur Parijs, 'Mededelingsplicht ex art. 16 Euratomverdrag', DRW/AT-119.233, Vertrouwelijk, 19th of August 1963, 2.06.101/E24099/840.

837 Letter, Reactor Center Nederland Drs. W. Reyseger aan Adviseur voor Atoomzaken, Octrooibureau, Ministerie van Buitenlandse Zaken Drs. S. Meijer, 'Ultra-centrifuge project', dK/1w 11 UC 002, Geheim, 10th of March 1965, 2.06.101/E24099/833, p. 2.

838 Letter, Reactor Center Nederland Drs. W. Reyseger aan Adviseur voor Atoomzaken, Octrooibureau, Ministerie van Buitenlandse Zaken Drs. S. Meijer, 'Ultra-centrifuge project', dK/1w 11 UC 002, Geheim, 10th of March 1965, 2.06.101/E24099/833, pp. 1-2.

abroad. As to RCN's request, the ministry said that it felt obligated to its commitments made to the classification partners and vice versa while also pointing out that foreign competitors were more likely to obtain the latest developments in the Dutch project from patents that RCN itself was depositing abroad than from the reports to EURATOM, as RCN was depositing patents abroad at most 12 months after doing so in the Netherlands, while the Dutch Patent Council waited the longest amount of time possible, 24 months, before reporting to EURATOM. If it was afraid of its competitive position, perhaps RCN should review its own policies first, the ministry suggested.[839]

On the 20th of July 1966 the West-German GkT (Gesellschaft für Kernverfahrenstechnik mbH) filed a request with the FRG's Patent Council ('Patentamt') to gain access to any and all secret patents and underlying documents relating to centrifuges in the FRG. RCN at the time had eight secret patents filed there and through its representative launced a furious protest with the Patentamt. Even though the patent representative for RCN in the FRG considered it unlikely the Patentamt would release the patents to GkT, RCN wrote to the Dutch Ministry of Defense on December 8, 1966 asking it to support its protest by taking the case up with the FRG's Ministry of Defense.[840]

East German Patents

At times the need for and formalization of the existing temporary classification guide came under scrutiny, triggered by outside events. For example when in September 1962 the FRG shared information with the Netherlands that Dr. Steenbeck of the East-German centrifuge program had filed for a number of patents on centrifuges in the FRG, causing some alarm as to what effect this would have on the multilateral classification process. The FRG committed itself to find out if the patents would indeed interfere with the process.[841] By May the next year, the Dutch officials were none the wiser, causing them to notify the Americans that this issue was keeping the Dutch from going forward with formalization of the temporary classification commitments currently in place and that American assistance in the matter would be appreciated. The AEC in response had recommitted to their wish to come to a formalization and left the Dutch officials in Washington with the impression they would

839 Letter, Adviseur voor Atoomzaken, Raad van Europa en Wetenschappelijke Samenwerking Drs. S. Meijer aan Directie Reactor Centrum Nederland, 'Ultra-centrifuge-project', DRW/AT-40739/1521GS, Geheim, 12th of April 1965, 2.06.101/E24099/833, pp. 1-2.

840 Note, Ministerie van Economische Zaken de Kler, 'Overzicht van de situatie in Duitsland met betrekking tot de geheime ultra-centrifuge octrooien van het R.C.N.', 11 UC 002, Geheim, January 1967, 2.06.101/E24099/841, pp. 7-9.

841 Coded Message, Minister van Buitenlandse Zaken Luns aan Ambassade Bonn, 'Ultracentrifuge', DRW/AT-549, Geheim, 31st of January 1963, 2.06.101/E24099/840.

handle the situation from their end, which was confirmed by the end of the same month.[842] By the 25th of July 1963, Dutch officials had received the contents of the East-German patents.[843]

Japan

During classification talks less than a year later, the American delegates informed the Dutch that Japan had also started a centrifuge program, which they reported had approximately the sophistication of the US program four years prior.[844] Director of Nuclear Energy of the Ministry of Economic Affairs Mr. Mani inquired with the Dutch Tokyo Embassy whether they could find out more about this program. Mr. Diels of the Tokyo Embassy, aided by a local AEC official, reported back that the program was not nearly as far along as the Americans had been four years ago, because the Japanese know-how on handling UF6 was virtually non-existent.[845] Furthermore, there was 'no great urgency' to their program, which was 'limited by budget and difficult development problems'.[846] The local AEC official Morris seems to have quoted directly from an internal AEC Union Carbide-authored report from around this time that described the Japanese program as having 'foundered'.[847]

In February 1967, the quadripartite partners agreed that the AEC would make a démarche to the Japanese to find out more about their program, inform them of the 'Quadripartite Control arrangements' and if 'appropriate, the U.S. would consult the other three countries with a view to inviting Japan to join the Group'.[848] The AEC extended the invitation in April 1967.[849] In the

842 Letter, voor de Minister van Buitenlandse Zaken, Raad van Europa en Wetenschappelijke Samenwerking Adviseur voor Atoomzaken Drs S. Meijer aan Minister van Economische Zaken Drs. Ing. W.L. Van Rijnberk, 'Ultracentrifuge', DRW/AT-51.188/2026GS, Secret, 6th of May 1963, 2.06.101/E24099/840, Coded Message, Ambassade Washington D.C. Van Roijen aan Ministerie van Buitenlandse Zaken, 4481, Geheim, 24th of May 1963, 2.06.101/E24099/840.

843 Letter, Ministerie van Buitenlandse Zaken, Raad van Europa en Wetenschappelijke Samenwerking Hoofd Bureau Atoomzaken aan Octrooiraad t.a.v. Mr. J.B. Van Benthem, Ministerie van Economische Zaken Drs. Van Rijnberk, Ministerie van Defensie Mr. Wechgelaer, 'Ultracentrifuge', DRW/AT-98535, 25th of July 1963, 2.06.101/E24099/840. After this date, communications on the East German patents cease in the documents released to the National Archive, leading to the assumption that after inspection the ultracentrifuge patents turned out to be not sophisticated enough to warrant any adaptation to the quadripartite classification guide nor any démarche towards the East German Government.

844 Letter, Directeur voor de Kernenergie, Ministerie van Economische Zaken Mr. H.K. Mani, aan Netherlands Ambassy p/a Ir. J.C. Diels, 'Ultracentrifuge', I.K.-364/2321, 24th of March 1964, 2.06.101/E24099/832. Spelling error in original.

845 Letter, Technisch Wetenschappelijk Attaché Ambassade Tokio Ir. J.C. Diels aan Ministerie van Economische Zaken t.a.v. Mr. H.K. Mani, 'Ultracentrifuge', TWA-240/D/ER, 6th of May 1964, 2.06.101/E24099/832.

846 Letter, USAEC Scientific Representative Peter A. Morris to Scientific Attache Dutch Embassy Mr. J.C. Diels, 17th of April 1964, 2.06.101/E24099/832.

847 Levin, S., A., Powers, L.,R., Von Halle, E., 'Nth Power Evaluation', Union Carbide Corporation Nuclear Division, Secret, 4th of March 1964, https://www.documentcloud.org/documents/399997-doc-8-centrifuge-report-1964.html, website checked 19-2-2017.

848 Agreed Minutes of Third Meeting of Quadripartite Group on Gas Centrifuges, held at U.K.A.E.A., London Office, Confidential, 15th of February 1967, 2.06.101/E24099/841, pp. 6-7.

849 Letter, Wnd. Chef der Directie Raad van Europa en Wetenschappelijke Samenwerking, Ministerie van Buitenlandse Zaken Mr. A. Kruyt aan Ministerie van Defensie Mr. B. Coops, Octrooiraad Mr. W. Neervoort,

same month, Dutch officials again received intelligence on the Japanese program after the Technical-Scientific attache of the Tokyo embassy had received a tour of the Atomic Fuel Corporation at Tokai-Mura. The centrifuge program there reported 400 m/s rotation speeds with machines of a 400mm diameter and measuring 1,50m and 1,80m in length respectively, made from aluminium alloy Alcoa 14-T. Bearings were proving a challenge to the program, currently employing synthetic rubber and gaseous lubrication. Nevertheless, Director Yasuji Nakamura estimated the project would yield 'useful results' within five years.[850]

While by law Japanese research results in the area of nuclear energy were openly available, 'the work on ultracentrifuge development [was] contained in unofficial classification.'[851] Mr. Kruyt, Chief of the Directorate Council of Europe and Scientific Cooperation (Ministry of Foreign Affairs), confirmed this and reported additional information from the AEC's Division of International Affairs on the matter less than a year later. The Americans were confident that, despite 'declarations to the contrary that Japanese authorities could possibly be forced to make in relation to those legal provisions' that stipulated complete openness on its nuclear research activities, they could count on full cooperation of the Japanese Government and 'using administrative means' the proliferation of sensitive knowledge could be prevented.[852] In September 1969, DRW officials were informed by the local West-German embassy that Mitsubishi Heavy Industries Co. had filed two open patents related to the centrifuge process in the FRG, Sweden, the US, the UK, France, the USSR and the Netherlands.[853] See for more on this topic, chapter 11, *Case: Japan*, page 402.

Australia

Late December 1970, after having coordinated with the Troika partners, the Dutch Ministry of Economic Affairs wrote to its Washington embassy that the Netherlands wished to expand its secret patent applications beyond that of NATO-countries. After coming to agreement on secret patents with Japan had failed, RCN now sought to limit the potential damage to its intellectual property position made possible by Australia's recent foray into centrifuge research. The embassy was asked to make a careful démarche to the US State Department and

Reactor Centrum Nederland Ir. J.J. De Kler, 'Classificatie van octrooien op het terrein van de ultracentrifuge', DRW/AT-125231/5647GS, Confidentieel, 13th of July 1967, 2.06.101/E24099/841.

850 Letter, voor de Minister van Buitenlandse Zaken, Hoofd van het Bureau Atoomzaken, Raad van Europa en Wetenschappelijke Samenwerking aan Minister van Economische Zaken t.a.v. Mr. H.K. Mani, 'Ultracentrifuge-project', DRW/AT-66669-2829, Strikt Vertrouwelijk, 28th of April 1967, 2.06.101/E24099/835, p. 1.

851 Ibid., p. 2.

852 Letter, Chef der Directie Raad van Europa en Wetenschappelijke Samenwerking, Ministerie van Buitenlandse Zaken Mr. A. Kruyt aan Ministerie van Defensie Mr. B. Coops, Octrooiraad Mr. W. Neervoort, Reactor Centrum Nederland Ir. J.J. De Kler,'Classificatie ultracentrifuge-project', DRW/AT-14007/489 GS, Confidentieel, 24th of January 1968, 2.06.101/E24099/842.

853 Letter, Hoofd van het Bureau Atoomzaken, Raad van Europa en Wetenschappelijke Samenwerking L.M.J. Van de Winkel aan Secretaris van de Octrooiraad, 'Japanse octrooiaanvragen U.C.-project', DRW/AT-162648, Confidentieel, 5th of September 1969, 2.06.101/E24099/842. The Japan episode from the American perspective, based on archival research, is described by William Burr in Burr, William, 'To “Keep the Genie Bottled Up”: U.S. Diplomacy, Nuclear Proliferation, and Gas Centrifuge Technology, 1962, 1972', in *Journal of Cold War Studies*, Vol. 19, No. 2 (Spring 2017) pp. 130-133.

AEC that assured the Americans of the Dutch ongoing commitment to the gentlemen's agreement while asking their comments on RCN's request.[854] Writing to the State Department, the Scientific Attache of the Netherlands embassy pointed out that Australia was likely to agree to classification of Dutch centrifuge patents and that some haste was in order because of expiring priority periods of those patents. In response, both the State Department's representative (Mr. Zook) and AEC's representative (Kratzer) sent their assurances they were sympathetic to RCN's request but dared not predict how others involved in the process would respond.[855] See more in chapter 10, *Uranium Enrichment Research in Australia*, page 371.

European Pushback

In January 1967, *Nucleonics* reported that the AEC was under pressure from private industry to open up centrifuge research in the US.[856] There was limited private research into centrifuges in the US, the AEC was not sharing its centrifuge work with private companies and when asked in a February 15 meeting reported to the quadripartite partners that it was considering 'stopping even the present limited private activity'.[857]

Domestic pressure on the AEC to forgo further tightening of secrecy around centrifuge technology was not new; *Nucleonics Week* December 2nd 1964 issue had reported that Representative Craig Hosmer, 'a ranking Republican House member' publicly stated that tighter controls on private centrifuge research would be ineffective, undercut US capabilities and was inconsistent with the US Government's stated wish to privatize uranium enrichment as soon as possible.[858] Dutch officials, aware of the *Nucleonics* article, informed with Dr. Seaborg of the AEC whether the intentions to add to the secrecy regulations had anything to do with progress made in the US centrifuge program, which Seaborg denied. However, as part

854 Letter, voor de Minister van Buitenlandse Zaken, de Directeur-Generaal Europese Samenwerking aan ambassadeurs in Washington D.C., Bonn, London, 'Procedure met betrekking tot geclassificeerde octrooiaanvragen op het terrein van het ultracentrifuge-project', DRW/AT-254901, Confidentieel, 30th of December 1970, 2.06.101/E24099/842.

855 Letter, Scientific Attache Royal Netherlands Embassy Washington D.C. C.H. Van Vierssen to Director Office of Atomic Energy Affairs Department of State Mr. Donovan Q. Zook, TWA/31, Confidential, 8th of January 1971, 2.06.101/E24099/842, Letter, voor de Ambassadeur, Ambassade Washington D.C. C.H. Van Vierssen aan Minister van Buitenlandse Zaken, TWA/650/220, DRW/AT-21127, Confidentieel, 27th of January 1971, 2.06.101/E24099/842. I've not been able to ascertain whether the US response was positive or negative, but seeing Kratzer's May letter pleasant tone I assume positive. Letter, Assistant General Manager for International Acitivities, United States Atomic Energy Commission Myron B. Kratzer to First Secretary/Scientific Officer of the Embassy of the Netherlands, Washington D.C. Mr. Herman C. Van Vierssen, 6th of May 1971, 2.06.101/E24099/842.

856 ´The Lure of Private Enrichment´, in *Nucleonics*, January 1967, 11 ORG 2.2.u, 2.06.101/E24099/841, 'Take the Wraps off Private Centrifuge Work, Hosmer Urges', in *Nucleonics Week*, 2nd of December 1964, Letter, voor Minister van Buitenlandse Zaken, Adviseur voor Atoomzaken Drs. Meijer aan Minister van Economische Zaken t.a.v. Mr. H.K. Mani, DRW/AT-159695-6531GS, Geheim, 17th of December 1964, 2.06.101/E24099/832.

857 Agreed Minutes of Third Meeting of Quadripartite Group on Gas Centrifuges, held at U.K.A.E.A., London Office, Confidential, 15th of February 1967, 2.06.101/E24099/841, p. 2.

858 'Take the Wraps off Private Centrifuge Work, Hosmer Urges', Nucleonics Week, 2nd of December 1964, 2.06.101/E24099/832.

of the same drive to tighten security, by 1965 the AEC had told the UK quite the opposite; that its discontinuation of nuclear information sharing on the centrifuge was because 'information now being generated in the U.S. development program represented production technology which was not transmissible under the bilateral.'[859]

The European partners informed the Americans that US companies had made an approach to join in a potential European enrichment plant using centrifuge technology at the FORATOM Meeting in Zurich in January of 1967, as reported in the press. The US delegation said they had no knowledge of this, that it would not support such a development and could put a stop to it.[860] On the 21st of March, 1967, the AEC publicly announced that 'in the interest of national security' all private centrifuge work would be discontinued.[861] This coincided with an American push in the quadripartite group for an amendment to the classification guide toward more stringent controls. The Netherlands gave strong pushback to the proposal in the form of an annexed statement to the agreed minutes, saying that,

> '... the Netherlands delegation has reached the conclusion that it [could not] accept the amendments proposed by the United States Delegation. The amendments [implied] quite a considerable extension of the classification obligation in the Ultra centrifuge programme, which the Netherlands Government undertook voluntarily at an earlier date. The Netherlands delegation does not believe that it has been conclusively established that the amendments are necessary in the light of any practical shortcomings in the existing classification guide'.[862]

The UK and FRG delegations were more mild in tone but the latter also clearly indicated the American proposal went too far. The US delegation backed down and responded to the Dutch statement that it had merely sought to 'clarify rather than modify or extend the previous guide'.[863]

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859 Letter, Atomic Energy Commission Glenn Seaborg to National Security Adviser McGeorge Bundy, enclosing summary of "Nth Country Evaluation,", Secret, 23rd of November 1965, https://www.documentcloud.org/documents/399998-doc-9-1965-summary.html, website checked 16-7-2017, Burr, William, 'To "Keep the Genie Bottled Up": U.S. Diplomacy, Nuclear Proliferation, and Gas Centrifuge Technology, 1962, 1972', in *Journal of Cold War Studies*, Vol. 19, No. 2 (Spring 2017) p. 126.

860 Agreed Minutes of Third Meeting of Quadripartite Group on Gas Centrifuges, held at U.K.A.E.A., London Office, Confidential, 15th of February 1967, 2.06.101/E24099/841, p. 2.

861 Letter, Ambassade Washington D.C., C.H. Van Vierssen aan Minister van Buitenlandse Zaken, 'gascentrifuge', TWA/4236/849, 28th of March 1967, 2.06.101/E24099/841.

862 Agreed Minutes of Third Meeting of Quadripartite Group on Gas Centrifuges, held at U.K.A.E.A., London Office, Confidential, 15th of February 1967, Annex 2: Subsequent Statement by Mr. A. Kruyt (Netherlands), 11th of April 1967, 2.06.101/E24099/841.

863 Agreed Minutes of Third Meeting of Quadripartite Group on Gas Centrifuges, held at U.K.A.E.A., London Office, Confidential, 15th of February 1967, Annex 1: Subsequent Statements by Mr. D.E.H. Peirson (UK), 16th of March 1967, 2.06.101/E24099/841, Agreed Minutes of Third Meeting of Quadripartite Group on Gas Centrifuges, held at U.K.A.E.A., London Office, Confidential, 15th of February 1967, Annex 3: Subsequent Statement by Mr. M.B. Kratzer (U.S.), 24th of July 1967, 2.06.101/E24099/841, Agreed Minutes of Third Meeting of Quadripartite Group on Gas Centrifuges, held at U.K.A.E.A., London Office, Confidential, 15th of February 1967, Annex 4: Subsequent Statement by Mr. C. Hinz on behalf of German Delegation, 23rd of August 1967, 2.06.101/E24099/841.

Over the course of years Dutch officials from the Ministry of Foreign Affairs had attempted without success to 'weaken or at least bring in line with contemporary developments' the classification obligations. By November 1967, Dutch officials concluded that recently American resistance to proposals by the Netherlands and FRG delegations for liberalization of the classification guide was increasing, leaving them to wonder whether 'political or commercial interests were prevailing' seeing that inspection of the industrial application of gas centrifuges was not expected to be problematic in the context of the upcoming NPT.[864] While the American declassification of much information on diffusion technology in this context was considered discriminatory by the Dutch, the US was very stringent in its monitoring of the classification partners, leading Dutch officials to be particularly careful and coordinate with West-German officials in what both countries reported on their centrifuge program to international fora such as FORATOM and in the media.[865] For example, when 'the project management' of the Dutch program disclosed to *Atomwirtschaft* details of the status of the program for an article on the Dutch centrifuge program, that included expectations based on '[t]echnical progress studies', which subsequently were published in the June 1967 issue, by September the AEC wrote that this information 'does extend beyond the published state' agreed upon of before August 1st 1960 and as such was classified.[866] Within a month, the acting Chief of DRW on behalf of the Minister of Foreign Affairs requested the Directorate of Nuclear Energy at Economic Affairs to remind the project leadership of this fact.[867]

American 'Maximum Delay'

From 1965 onward, American policies toward the European enrichment projects became increasingly suspect to the Europeans and as it turned out, such suspicion was well-founded. William Burr has convincingly shown that US policies of sabotage and delay, publicly presented as serving non-proliferation goals while also privately designed to preserve the American nuclear fuel monopoly and its commercial and political benefits, became red line in its diplomacy during the next decade.

The Union Carbide's 'Nth power' report of March 1964 warning of proliferation by developed states using gas centrifuge technology, served as the rationale that led the AEC's 'chairnman Glenn Seaborg [to support] a policy of “achieving maximum delay.”' This policy, supported by the ACDA (Arms Control and Disarmament Agency) on non-proliferation grounds and by

864 Report, Ministerie van Economische Zaken, Directie Kernenergie, 'Verslag bespreking Classificatie gascentrifuge op 14 November 1967´, Confidentieel, 20th of November 1967, 2.06.101/E24099/841, p. 2.

865 Note, Directoraat-Generaal voor de Energievoorziening, Directie Kernenergie aan Minister van Ecnoomische Zaken, 'Ultracentrifugeproject', 259/EK, Vertrouwelijk, 29th of December 1967, 2.06.101/E24099/835, pp. 6-7, Concept Letter, Directorate Nuclear Energy Ministry of Economic Affairs to Directorate Council of Europe and Scientific Cooperation Ministry of Foreign Affairs, 'Gas Centrifuge Project', Confidential, 20th of November 1967, 2.06.101/E24099/841.

866 Letter, Director Atomic Energy Commission Division of Classification C.L. Marshall to Embassy of the Netherlands Washington D.C. Mr. Rudolph van Dijk, 20th of September 1967, 2.06.101/E24099/841.

867 Letter, Wnd. Chef der Directie Raad van Europa en Wetenschappelijke Samenwerking, Ministerie van Buitenlandse Zaken A. Kruyt aan Minister van Economische Zaken, t.a.v. Directie Kernenergie, DRW-180455/7705-GS, Secret, 12th of October 1967, 2.06.101/E24099/841.

Secretary of Defense McNamara because it would preserve American nuclear leadership, would seek through 'disincentives and security controls', combined with low nuclear fuel prices (set by the AEC) to retard foreign countries' drive toward nuclear fuel self-sufficiency.

US companies received no additional centrifuge technology but were allowed to continue their research and development, but from 1967 only designated contractors in the US were allowed to continue centrifuge work, leaving the West Germans under the impression, despite American denials (since 1965), that the US program had made some kind of breakthrough in centrifuge technology. The United Kingdom was cut off as well, given the excuse that American technology had now reached 'production technology' maturity.[868] In order,

> '[t]o discourage other countries from establishing enrichment facilities and possibly to preserve the value of the huge U.S. investment in an older technology, the AEC had been following, as McNamara had suggested, a liberal reactor fuel supply policy to forestall the creation of enrichment facilities overseas.'[869]

From 1964 to December 1966, the AEC lowered its price level for enriched uranium to $ 26 per SWU.[870] However, instead of discouraging the development of foreign enrichment technology, the low price level merely encouraged Dutch engineers to make their centrifuges run even faster (see page 245). By 1968, with the tripartite project taking shape and the US State Department becoming convinced of the project's (non-proliferation) merits and believing 'the AEC's position was based on narrow commercial and nonproliferation considerations', the AEC did not change tack, afraid 'to lose existing U.S. reactor fuel markets and revenue streams and seeing a proliferation threat in almost any overseas enrichment project', its Division of International Affairs wanting to do '"everything we can to discourage the construction of an isotope enrichment plant"' and one of its Commissioners considering 'a policy to "prevent, delay, or limit" European plans.[871] These type of considerations stayed on the AEC agenda into the 1970s (also see chapter 9, *French and American Diffusion Initiatives,* page 278).[872]

At the start of 1968, with a decision on entering the industrial phase of centrifuge exploitation fast approaching, Dutch officials revisited the gentlemen's agreement and concluded that its weak legal status was irrelevant as it was inconceivable for political reasons the Netherlands

868 Burr, William, 'To "Keep the Genie Bottled Up": U.S. Diplomacy, Nuclear Proliferation, and Gas Centrifuge Technology, 1962, 1972', in *Journal of Cold War Studies*, Vol. 19, No. 2 (Spring 2017) pp. 125-126, 129-130.
869 Ibid., p. 127.
870 Note, Directoraat-Generaal voor de Energievoorziening, Directie Kernenergie aan Minister van Ecnoomische Zaken, 'Ultracentrifugeproject', 259/EK, Vertrouwelijk, 29th of December 1967, 2.06.101/E24099/835, pp. 4-5. 'Separative Work (SW) stands for the effort necessary to separate U235 and U238. It is measured in kilograms of separative work (kg SW). The term Separative Work Unit (SWU) is also used where 1 SWU equals 1 kg SW. As a larger unit, 1 metric ton of separative work (1 tSW = 1,000 kg SW) is used. The capacity of enrichment plants is measured in tonnes SW per year (tSW/a).', 'SWU', Urenco website, https://urenco.com/about-us/business-activity/nuclear-fuel-supply-chain/separative-work-unit/, website checked 20-12-2017.
871 Burr, William, 'To "Keep the Genie Bottled Up": U.S. Diplomacy, Nuclear Proliferation, and Gas Centrifuge Technology, 1962, 1972', in *Journal of Cold War Studies*, Vol. 19, No. 2 (Spring 2017) pp. 136, 139, 141
872 Ibid., pp. 136, 139,

'would no longer abide by [its] terms or propose to terminate' the agreement.[873] The Dutch side would have to move to adapt the existing agreement, which could not be denied by the partners but which 'no doubt' would face 'serious objections' from the Americans, at least partly because of 'commercial considerations'; '[t]he construction of an U.C.-plant could only negatively affect the market for enrichment plants in America.'[874] It was expected that privatization of the Dutch centrifuge project would also face objections from all the other classification partners, whereas a state-run national program or collaborative undertaking with one or more of the classification partners would not.[875]

Advertisement, not to find potential partners but to make those European customers outside EURATOM aware of the attractiveness of the Dutch program, was also considered challenging due to classification. Without such outreach, customers could not be made aware of the economic superiority of the centrifuge vis-à-vis diffusion, potentially causing plans for new diffusion plants to become so ambitious in capacity that an international market for the centrifuge product would be severely compromised.[876]

By May 1971, as a result of 'conversations with representatives of the United Kingdom in particular' the AEC acknowledged the need for the Troika to publicly make available some information on 'the scale and general nature of their centrifuge efforts.' and chose to follow suit by making some general information known about the AEC's program.[877]

Additional security and classification procedures were agreed upon within the Troika in the marge of the conclusion of the Treaty of Almelo in 1970 in the Interim Agreement on Security Procedures and Classification. The document also served as a bridge that would allow the Troika to intensify data sharing in light of the ensuing industrial phase of the Troika project.[878] On the 17th of June 1970 the Tripartite Preparatory Committee 'agreed that the U.K.A.E.A.

873 Note, Chef der Directie Raad van Europa en Wetenschappelijke Samenwerking, Ministerie van Buitenlandse Zaken Mr. A. Kruyt aan Ministerie van Economische Zaken Mr. H.K. Mani, 'Ultracentrifuge-project', DRW/AT-10043/365 GS, Geheim, 17th of January 1968, 2.06.101/E24099/842, p. 4.

874 Note, Chef der Directie Raad van Europa en Wetenschappelijke Samenwerking, Ministerie van Buitenlandse Zaken Mr. A. Kruyt aan Ministerie van Economische Zaken Mr. H.K. Mani, 'Ultracentrifuge-project', DRW/AT-10043/365 GS, Geheim, 17th of January 1968, 2.06.101/E24099/842, p. 5.

875 Note, Chef der Directie Raad van Europa en Wetenschappelijke Samenwerking, Ministerie van Buitenlandse Zaken Mr. A. Kruyt aan Ministerie van Economische Zaken Mr. H.K. Mani, 'Ultracentrifuge-project', DRW/AT-10043/365 GS, Geheim, 17th of January 1968, 2.06.101/E24099/842, pp. 5-6.

876 Note, Directoraat-Generaal voor de Energievoorziening, Directie Kernenergie, Ministerie van Economische Zaken aan Minister van Economische Zaken, 'Classificatie ultracentrifuge-project', 24/EK, Confidentieel, 25th of January 1968, 2.06.101/E24099/842, p. 1.

877 Letter, Assistant General Manager for International Acitivities, United States Atomic Energy Commission Myron B. Kratzer to First Secretary/Scientific Officer of the Embassy of the Netherlands, Washington D.C. Mr. Herman C. Van Vierssen, 6th of May 1971, 2.06.101/E24099/842, Burr, William, 'To “Keep the Genie Bottled Up”: U.S. Diplomacy, Nuclear Proliferation, and Gas Centrifuge Technology, 1962, 1972', in *Journal of Cold War Studies*, Vol. 19, No. 2 (Spring 2017) p. 147.

878 ARC 124-8, p. 11, Letter, Hoofd van het Bureau Atoomzaken, Raad van Europa en Wetenschappeiljke Samenwerking, Ministerie van Buitenlandse Zaken L.M.J. van de Winkel aan Ministerie van Economische Zaken Ch.F. Bouvy, 'Interim-Overneenkomst Nederland – Verenigd Koninkrijk – Bondsrepubliek Duitsland inzake veiligheidsprocedures en classificatie met betrekking tot het UC-project', DRW/AT-49969, 13th of March 1969, 2.06.101/E24099/842.

should co-ordinate the arrangements for meetings on classification and security.' Within months, the British started making proposals towards uniformity in tripartite classification schemes relating to the joint enterprise as well as coordinating the tripartite approach to upcoming discussions on quadripartite classification talks with the United States.[879] By November 1971 the Troika's Joint Committee had accepted a proposal to establish 'a governmental Working Group for Security.[880]

In late 1971, the tripartite partners signalled the US that the classification arrangement needed to become less strict.[881] In 1972, the Troika initiated talks with the US to come to a new agreement, as the quadripartite agreement was so restrictive in its classification that it could not be maintained in the industrial phase of the enrichment project. As a result, the Troika-US talks were 'problematic' in that both parties were now in different places; the Troika had moved into the industrial phase, the US had not despite its claim to possess production technology.[882] No agreement was reached during the meeting but the Troika agreed to amend a draft classification guide that the Americans had distributed ahead of the meeting. They amended the draft into the Tripartite Classification Guide, which they sent back to the Americans in early 1973. The AEC 'accepted the tripartite classification guide and produced a parallel document for directing U.S. classification decisions' in August of 1973.[883]

The Troika project was now starting to look like competition to the Americans, reported a DRW official. A new formal agreement could not be concluded but both parties agreed that they would consult one another when they would implement changes in classification and would continue regular meetings. The last such meeting took place in January 1979, in which the Troika delegation 'stated clearly that they considered that they were observing the guide, and it was concluded that no changed in the guide were desirable.'[884] An associated Classification List was agreed on in 1981. In October 1983 the US informed the Troika by letter of it declassifying a number of items as it had now also entered the industrial phase. In it, the US pressed for a renewal of the quadripartite agreement to which the British Joint Committee (JC) chair gave a positive response. DRW considered the response somewhat too enthusiastic, but 'considering the foregoing history' it would prove difficult to maintain a rejection to the American request.[885]

In March 1987, 'after years' of negotiation, the Troika agreed on amendment of the 1973 Tripartite Classification Guide and the 1981 Classification List. The British-Dutch-promoted

879 Aide Memoire, British Embassy The Hague to Chief of Directorate Council of Europe and Scientific Cooperation, Ministry of Foreign Affairs Mr. A. Kruyt, Confidential, 7th of August 1970, 2.06.101/E24099/842.
880 Letter, Security Branch United Kingdom Atomic Energy Authority R.E.R. Lees to Netherlands Ministry of Economic Affairs Mr. Ch.F. Bouvy, SB.1/73/1, 8th of November 1971, 2.06.101/E24099/842.
881 Burr, William, 'To “Keep the Genie Bottled Up”: U.S. Diplomacy, Nuclear Proliferation, and Gas Centrifuge Technology, 1962, 1972', in *Journal of Cold War Studies*, Vol. 19, No. 2 (Spring 2017) p. 147.
882 ARC 124-8, pp. 11-12.
883 Burr, William, 'To “Keep the Genie Bottled Up”: U.S. Diplomacy, Nuclear Proliferation, and Gas Centrifuge Technology, 1962, 1972', in *Journal of Cold War Studies*, Vol. 19, No. 2 (Spring 2017) pp. 147-148.
884 Coded Message, Secretary of State, Washington D.C. To United States Embassy, Bonn, 'Access of IAEA inspectors to uranium enrichment facilities', Confidential, 22th of October 1979, 275372, https://wikileaks.org/plusd/cables/1979STATE275372_e.html, website checked 20-8-2018.
885 ARC 125-10, p. 1, ARC 124-8, p. 12.

restrictive line was largely continued; while the FRG advocated declassifcation on several items under discussion, it eventually relented and joined the position of the two partners and Urenco.[886] The DRW official present noticed and reported back the contradiction between the German permissive attitude towards classification and reverse position when it came to safeguards inspection policy, in reference to the ongoing *Hexapartite Safeguards Project,* see chapter 11, page 477.[887]

886 ARC 124-8, p. 12., ARC 125-10, p. 1.
887 ARC 125-10, p. 1.

Chapter 9:

Toward the Treaty of Almelo

Centrifuge Development in the Netherlands

The Dutch program had made steady progress in a variety of areas during the 1958-1960 period. In December 1958, the laboratory had a stable centrifuge running at 350 m/s. By June 1960, UF6 was introduced into the centrifuge model UCI-R100 that ran at 320 m/s at 1020 hz and the first Dutch uranium enrichment by centrifuge was a fact. Models UCII-R100 and UCIII-R100 followed soon after and included the latest innovations, and model UCGI-R100 represented the first experimental segmented centrifuge model.[888]

During the first half of 1961, the Commission Tromp (after its chairman, Director of Philips Th.Ph. Tromp) had been established by the Ministry of Economic Affairs and RCN to evaluate the viability of the Dutch centrifuge project. An earlier commission also lead by Tromp had been tasked with evaluating the whole of nuclear industrial potential in the Netherlands, and had already formulated a tentatively positive conclusion about the centrifuge project in December 1960, while recommending a more thorough evaluation, particularly regarding the Dutch patent position. In the second commission's work that followed the next year, Tromp involved a number of the largest Dutch industrial companies, that together made available a team of experts to evaluate every aspect of the project, 'including engineering techniques, patent position and economic prospects'.[889] On the 28th of July 1961 the Commission advised the continuation of the project, both its research and development.[890] The Tromp Commission's advise included a financial stimulus of 5 million guilders ($ 1.4 million) that would make it possible in the next three years to construct test installations in a small pilot plant. A third advisory commission followed, this time chaired by H. Rinia, a colleague of Tromp, which produced another positive advice to the Government by May 1962. Among other things it advised the establishment of dedicated advisory commission for the project. On the first of July 1962, an Advisory Commission (Commissie van Bijstand), chaired by Prof. Bogaardt of Eindhoven University that included experts from RCN, FOM and TNO (the Dutch Organization for Applied Physics Research) and that included Kistemaker, was established to guide the (now classified) work. On the same day, Kistemaker retired as leader of the project.[891]

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888 Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) pp. 173, 191-195. Also starting in June 1960, the centrifuge project moved into its own laboratory at the Kruislaan in Amsterdam, Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) p. 198.

889 Kistemaker, J., *De Geschiedenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991) http://laka.org/docu/boeken/pdf/1-01-8-30-19.pdf, websites checked 2-1-2017, p. 18, Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) pp. 186-187, 190, 215, 236.

890 Kistemaker, J., *De Geschiedenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991) http://laka.org/docu/boeken/pdf/1-01-8-30-19.pdf, websites checked 2-1-2017, p. 18.

891 Ibid., p. 19, Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) pp. 240, 251-253, Officer, Lawrence, H., 'Exchange Rates Between the United States Dollar

The next four years saw several advances in the technology as aluminum and maraging steel rotors were tested and supercritical-design trials were held.[892] Longer rotors have lower critical frequencies and that's why these need to be reinforced and measures must be taken to 'damp out the flexural vibrations' that occur when passing through critical frequencies, meaning the ability of the rotor to bend but not break during high-stress moments of operation.[893]

The planned research program had to be considerably altered by June 1964 when projected results for the aluminum-alloy sub-critical centrifuge for the 1962-1965 period were not met. Theoretical work was restarted to help find the cause of this and research into alternative materials and centrifuge length (a +100cm casing was now considered although the idea of very long centrifuges was rejected) also had to contribute to better results. The program had come under additional pressure during this period when the AEC had lowered its SWU sales-price from $ 30/kg to $ 26/kg for enriched uranium, in itself raising the program's required benchmark for productivity of centrifuges (tied to the AEC price) by 20%.[894] Realization dawned that higher speed centrifuges would now need to be seriously considered in order to reach the productivity and reliability benchmarks, as the original goal of 1200 Hz was insufficient.

> 'Speed was an extremely important parameter as the separative power of a centrifuge increases in proportion to the fourth power of the peripheral speed of the rotor. Thus a mere 20% increase in speed would more than double the separative output from the same length of rotor.'[895]

The team knew that 1300 Hz was attainable because two centrifuges in the US had spun for a year at that speed as early as 1958-1959, possibly using a titanium alloy. Next to the already existing sub-critical centrifuge and articulated centrifuge, a third type of machine was added to the research work, the toll-centrifuge (a machine based on the sub-critical design that has elements to create a gyroscopic effect that increases the limits of the machine). Research into the behavior of centrifuges with titanium casings was in preparation, and maraging steel had

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and Forty-one Currencies', MeasuringWorth website, http://www.measuringworth.com/exchangeglobal/, website checked 30-7-2018. TNO is a governmental institute that stimulates the practical application of scientific research.

892 Not to be confused with the earlier mentioned 'supercriticality'; supercritical centrifuges are able to reach very high rotation speeds because the machines can push through the so called critical frequencies when accelerating, able to withstand the transverse vibrations that occur at such moments.

893 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 24.

894 Letter, Directeur Reactor Centrum Nederland Drs. W. Reyseger aan Minister van Economische Zaken, 'UC-project 1964', R/vdVl 4.4.2.1.1., 25th of June 1964, with attached 'Memorandum Commissie van Bijstand van het Ultracentrifugeproject omtrent de voortgang van de werkzaamheden met herziene begroting voor 1964', 2.06.101/E24099/832, pp. 2-3, 8, Memorandum, Prof. Dr. M. Bogaardt aan Mr. Mani, Mr. Star Busmann, Drs. Dee, 'Memorandum betreffende de toepassing van de Ultra-Centrifuge voor de scheiding van uranium-isotopen', Vertrouwelijk, 29th of December 1967, 2.06.101/E24099/835, p. 3.

895 Ibid., pp. 22-23.

only just reached the open market and had the project's interest. Research into a superior aluminum-alloy (dubbed x 20-20) had been ceased after it had become clear it could not be purchased at the required quality from producers.[896] Cascade research was initiated, though a working cascade producing useful research data was not expected before the end of 1965. Halfway 1964, RCN still could not offer a definitive answer whether the ultra-centrifuge would be economically viable for uranium enrichment but considered that if given the additional needed resources, it would be able to make that assessment by the end of 1965.[897]

When in 1964 the first two deliveries of finished titanium casings arrived from the US, these turned out not to be usable. A rougher, unfinished version was ordered and this time Werkspoor did the metalworking and construction which led to a titanium centrifuge that spun at 1350 Hz without complications, a record for the Amsterdam laboratory. Procurement in the US could be somewhat tricky, as its officials had blocked earlier efforts to buy composite materials for centrifuges. Asked by Mr. Mani of Economic Affairs about this ability of the Americans to block progress in Dutch centrifuge research, Ir. Verduin of RCN assured him that Werkspoor had left out any reference to centrifuges in subsequent orders with alternative US companies and had had no further problems acquiring materials via its European contacts. The glass-fiber enforced composite materials turned out too difficult to work with, and its use was abandoned. By 1966 it had become clear titanium was too uneconomic to mass fabricate centrifuges with. Maraging steel meanwhile was considered a very promising material.[898]

Work on a small cascade was initiated in 1965 and it became operational in 1967, followed in the next year by a larger test cascade.[899] In the years '66-'67, challenges in metallurgy and bearing construction were successfully met by Werkspoor and TNO.[900] RCN reported in March 1967 that successfully testing of the 3-segmented centrifuge showed that centrifuges could be made longer and rotation speeds could be increased, substantially increasing the separation factor and thus AEC-prices could be equaled or even beaten.[901]

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896 Letter, Directeur Reactor Centrum Nederland Drs. W. Reyseger aan Minister van Economische Zaken, 'UC-project 1964', R/vdVl 4.4.2.1.1., 25th of June 1964, with attached 'Memorandum Commissie van Bijstand van het Ultracentrifugeproject omtrent de voortgang van de werkzaamheden met herziene begroting voor 1964', 2.06.101/E24099/832, pp. 3-4, 9.

897 Ibid., pp. 2-3, 9.

898 Letter, Ministerie van Economische Zaken Directeur Kernenergie Mr. H.K. Mani aan Reactor Center Nederland Ir. A. Verduin, 366/4176/EK, 21st of February 1966, 2.06.101/E24099/834, Letter, Reactor Center Nederland, Project Leader Ir. A. Verduin aan Ministerie van Economische Zaken Ir. H.K. Mani, 366/4176/EK, Vertrouwelijk, 24th of February, 1966, 2.06.101/E24099/834, pp. 2-4. Ir. A. Verduin took over leadership of the centrifuge project from interim manager De Haas van Dorsser, who temporarily took over from Kistemaker on his retirement. De Haas van Dorsser subsequently joined the Advisory Commission, Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) p. 254.

899 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 25.

900 'Shell, Philips, Werkspoor zien toekomst in procedé-Kistemaker: Drie concerns betrekken samen goedkoop uranium', in *De Volkskrant*, 22nd of February 1968, p. 1.

901 Letter, Reactor Centrum Nederland R.W.R. Dee aan Directeur voor de Kernenergie, Ministerie van Economische Zaken Mr. H.K. Mani, 'UC-project', 4.4.2.1.1., Vertrouwelijk, 10th of March 1967, 2.06.101/E24099/835.

A second evaluation of the project in 1965-1966 by RCN deemed the project to have commercial potential and recommended to provide additional funding to bring the project into 'the industrial sphere as quickly as possible.'[902] The Scientific Advisory Council underwrote the RCN conclusions of the evaluation unequivocally and advised that no international cooperation was initiated as long as a purely national project with industrial collaboration was possible and conditioned continuation of the project on industry interest to stay involved. It furthermore envisioned the economic prospects to be sound, with demand for enriched uranium growing both in the LWR market as well as fast-breeder reactor market.[903] Kistemaker wrote that during 1966, almost nothing happened with the advice to provide funding as RCN decided to wait on the Minister of Economic Affairs Den Uyl, whom was expected to solicit an advice on the project from Shell, but this turned out to be a false assumption. By November, the Government had fallen and (without elections) a new Government was formed and a new Minister of Economic Affairs had taken Den Uyl's place (Minister J. A. Bakker).[904]

In May 1967, the Industrial Council for Nuclear Energy (a group representing industrial interests with the Government) advised to continue but temporize the project in light of then current insufficient financial means. Reasons for continuation included the projection that enrichment needs would be greater than expected availability, the process' low energy usage was isolated from market electricity prices, it was competitive with the AEC's price and had garnered interest from potential industrial partners. The Council expected that if commercial exploitation was eventually pursued, for political reasons this would happen with international partners. However, it advised that such internationalization should first be pursued in the pilot plant-phase.[905]

On the 31st of July 1967, incoming Minister De Block of Economic Affairs finalized an agreement with industrial partners Shell, Philips and Werkspoor for financial participation in

902 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 25, Report, ´De ultracentrifuge. Een goudmijntje of een gevaar voor de vrede?´, Verbond van Wetenschappelijke Onderzoekers, Afd. Twente (1970) p. 4-1, Kistemaker, J., *De Geschiedenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991) http://laka.org/docu/boeken/pdf/1-01-8-30-19.pdf, websites checked 2-1-2017, p. 21.

903 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 25, Report, ´De ultracentrifuge. Een goudmijntje of een gevaar voor de vrede?´, Verbond van Wetenschappelijke Onderzoekers, Afd. Twente (1970) p. 4-1, Kistemaker, J., *De Geschiedenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991) http://laka.org/docu/boeken/pdf/1-01-8-30-19.pdf, websites checked 2-1-2017, p. 21, Advies, Wetenschappelijke Advies-Raad Voorzitter Prof. Dr. J.H. de Boer aan Voorzitter van Bestuur van Reactor Center Nederland, 'Ultracentrifugeproject', Vertrouwelijk, WAR 2162, Advice nr. 257, 14th of April 1966, 2.06.101/E24099/834, pp. 1-5. During the 1960s, the closed nuclear fuel cycle based on enriched uranium and plutonium reprocessed fuels, using breeder reactors, was perceived as economically viable and likely to be part of the international nuclear industry in the future.

904 Kistemaker, J., *De Geschiedenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991) http://laka.org/docu/boeken/pdf/1-01-8-30-19.pdf, websites checked 2-1-2017, p. 21.

905 Letter, Industriële Raad voor de Kernenergie Voorzitter H.H. Wemmers aan Minister van Economische Zaken, 'Voortzetting ultracentrifugeproject/begroting en werkplan 1967', IRK 945, 30th of May 1967, 2.06.101/E24099/835, pp. 1-3.

the first pilot plant pending the outcome of experimental research, estimated to cost around 300 million guilders (around $ 83 million).[906] By October 1967, Shell reported it considered the project economically viable, leading to the provision of additional funds from the Ministry. Work on the construction of a 70-machine test cascade started immediately afterward, as well as on the design of a 25-ton SWU pilot plant.[907] On the 29th of December of the same year, the Directorate-General for Energy Supply's Directorate for Nuclear Energy informed the Minister of Economic Affairs of the current state of affairs and available options. To date, the ultra-centrifuge project had cost the state about 15 million guilders ($ 4.2 million). The current four-year program, running from '67 to '71 would cost an additional 11 million guilders ($ 3 million), of which RCN was contributing nearly 1 million guilders ($ 278.000) a year. Soon, a pilot plant would have be constructed housing about 10.000 centrifuges which would cost an estimated 15 million guilders ($ 4.17 million). If the Netherlands decided to 'go at it alone' and construct a national plant, a 100.000 centrifuge plant would cost about 75 million guilders ($ 21 million). The process was deemed economically competitive at this time as it required 1/20th of the required investments and 1/10th of the required electricity (when operational) compared to the diffusion process, and 'can operate under normal electricity prices and [didn't] require – as in the US – an artificially low electricity price level.'[908] The US feared competition and were essentially subsidizing its diffusion-based enrichment industry resulting in a 1967 SWU price-level (set in December 1966) of $ 26, which the Dutch were determined to beat (see chapter 8, *American 'Maximum Delay'*, page 239).[909] Compared to a Dutch choice for a national centrifuge plant, if,

> '… the Six [members of the European Community] would build a gaseous diffusion plant for 100% of the 1980 [European enrichment] requirements, the cost including plants would be about 5 billion guilders. The Dutch share on the basis of the Euratom-share (currently 6,9%) would be about 350 million. A national UC-plant for the Dutch requirement in 1980 would only cost 115 million.'[910]

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906 Report, ´De ultracentrifuge. Een goudmijntje of een gevaar voor de vrede?´, Verbond van Wetenschappelijke Onderzoekers, Afd. Twente (1970) p. 4-1, 'Shell, Philips, Werkspoor zien toekomst in procedé-Kistemaker: Drie concerns betrekken samen goedkoop uranium', in *De Volkskrant*, 22nd of February 1968, p. 1, Officer, Lawrence, H., 'Exchange Rates Between the United States Dollar and Forty-one Currencies', MeasuringWorth website, http://www.measuringworth.com/exchangeglobal/, website checked 30-7-2018.

907 Kistemaker, J., *De Geschiedenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991) http://laka.org/docu/boeken/pdf/1-01-8-30-19.pdf, websites checked 2-1-2017, pp. 22-23.

908 Note, Directoraat-Generaal voor de Energievoorziening, Directie Kernenergie aan Minister van Ecnoomische Zaken, 'Ultracentrifugeproject', 259/EK, Vertrouwelijk, 29th of December 1967, 2.06.101/E24099/835, pp. 1-2, Officer, Lawrence, H., 'Exchange Rates Between the United States Dollar and Forty-one Currencies', MeasuringWorth website, http://www.measuringworth.com/exchangeglobal/, website checked 30-7-2018.

909 The move to further lower the price-level of enrichment services 'was seen by some Europeans as a move intended to undersell prospective foreign plants.', Wonder, Edward, F., *Nuclear Fuel and American Foreign Policy* (Westview Press: Boulder 1977) p. 8, Note, Directoraat-Generaal voor de Energievoorziening, Directie Kernenergie aan Minister van Ecnoomische Zaken, 'Ultracentrifugeproject', 259/EK, Vertrouwelijk, 29th of December 1967, 2.06.101/E24099/835, pp. 4-5. This European view turned out to be correct, see Chapter 8, Box: *American 'Maximum Delay',* page 239.

Additionally, a European gaseous diffusion plant would need 'cheap money and cheap electricity' to compete with the AEC's services.[911] Furthermore, a national plant could provide the availability of HEU fuel for the Ministry of Defense's nuclear submarine ambitions and could provide the Italians with fuel for the nuclear supply ship they had under construction. The Italians had informally made inquiries to that end, with the US refusing to supply them.[912]

Centrifuge Development in the FRG

During the same period, the UK and the FRG programs also made significant progress. In the FRG, work on the centrifuge was being conducted at 'the Universities of Bonn and Kiel, the Max Planck Institute at Aachen, and at the commercial companies Degussa and AEG.[913] After classification, Degussa's employee Zippe had returned from the US mid-1960 and continued his centrifuge program at the company.

Near the end of 1962, Werkspoor NV received a request for polyester cylinders from Zippe. Werkspoor contacted the Deputy Director for Nuclear Energy Drs. Ing. W.L. Van Rijnberk at the Dutch Ministry of Economic Affairs, who in turn informed officials at the Ministry of Defense. He explained to them the specialized nature of the polyester material as well as its benefits for centrifuge building, to be obtained from a number of US firms. Werkspoor had been instructed to request additional specifications from Zippe in an attempt to gain intelligence for the benefit of the Dutch program. Van Rijnberk advised the Ministry of Defense not to contact Degussa until they felt sure they were in 'a strong position' as Degussa had in the past driven a hard bargain and also because the Dutch had become aware through contacts with the Canadians that the Degussa centrifuge program was not as advanced as theirs, so there was no rush in helping them to obtain superior materials.[914]

Degussa had years earlier received bad press about its role as supplier to the German military in WWII and feared a similar episode if and when more news (following the 1960 *Nucleonics* article, see chapter 8, *The Push for Classification*, page 217) of secret enrichment technology development at the company inevitable came out. It pressed the Government to take over the program before it would prove to be an embarrassment for Degussa. The FRG Government did, paying Degussa 5 million DM for its equipment, patents, and know-how and setting up

910 Note, Directoraat-Generaal voor de Energievoorziening, Directie Kernenergie aan Minister van Ecnoomische Zaken, 'Ultracentrifugeproject', 259/EK, Vertrouwelijk, 29th of December 1967, 2.06.101/E24099/835, pp. 4-5. In 1967, 5 billion guilders amounted to $ 1.38 billion, 350 million guilders to $ 97 million and 115 million guilders to $ 32 million, Officer, Lawrence, H., 'Exchange Rates Between the United States Dollar and Forty-one Currencies', MeasuringWorth website, http://www.measuringworth.com/exchangeglobal/, website checked 30-7-2018.

911 Ibid., p. 5.

912 Ibid., p. 6.

913 Atomic Energy Commission, 'Gas Centrifuge Method of Isotope Separation; Note by the Secretary, AEC 610/15, 9 April 1960, *https://www.documentcloud.org/documents/399995-doc-6-aec-april-1960-report.html*, website checked 2-1-2017, p. 46.

914 Letter, Ministerie van Economische Zaken Plv. Directeur voor de Kernenergie Drs. Ing. Van Rijnberk aan Ministerie van Defensie Mr. D. Wechgelaer, 'Ultracentrifuge Project', I.K.3790, 11th of December 1962, 2.06.101/E24099/840.

the new Gesellschaft für Kernverfahrenstechnik mbH.[915] 'The Government then found that neither the Gesellschaft für Kernforschung mbH Karlsruhe nor the Kernforschungsanlage GmbH (KfA) Julich was willing to accommodate the work because of the obligatory secrecy.'[916] Nevertheless, KfA was able to settle the new company on outskirts of its Jülich site. Essentially the same happened to the centrifuge programs at the universities of Bonn and Kiel where the heavier Groth-type centrifuge using mechanical bearings was under development; when the universities no longer wanted to host the programs because of the imposed secrecy and its accompanying demands, these were moved to the Jülich site as well.[917]

At Jülich, work on both the Zippe and Groth-types continued, though eventually work on the latter was discontinued. The program built a working cascade and started work on supercritical centrifuge designs such as the ones Zippe had worked on in the USSR. Eventually Zippe's progress with a needle bearing and aluminum rotors hit a ceiling at the rotational speed of 350m/s.

Zippe searched and found the superior maraging steel at the Messerschmidt Bölkow-Blohm (MBB) company that used it to produce tubes for rockets with it and started acquiring the material in 1965. It gave Zippe the confidence in the programme to advise entry into the industrial phase. The Government agreed in late 1967 and invited proposals from possible future industrial partners. With help from Dr. Schmidt-Küster at the Ministry for Atomic Affairs, development speeded up in 1968 as industrial partners were inducted into the project in short order. Dornier and Interatom GmbH would build a 200-centrifuge cascade and the company ERNO would build a 20-centrifuge one. Dornier took up centrifuge development, constructed a separation laboratory and was tasked with improving the magnetic and needle bearings. MAN Turbo, a division recently acquired by the MAN company from BMW and specialized in turbine technology, joined the group of companies to improve the rotors. Friedrich Laussermair (from MAN Turbo) proposed using carbon-fiber to reinforce an aluminum rotor. Development of the supercritical centrifuge now began in earnest.[918]

Centrifuge Development in the UK

The British Ministry of Defense had used the diffusion plant at Capenhurst to create the nuclear material needed for its nuclear weapons programme. In the early 1960s, the plant's operations were halted and the plant was on standby for possible future separation work, while receiving a refitting to adapt the plant to low enrichment production. In 1965, plans were announced to expand the diffusion plant to provide fuel for the newly announced Advanced Graphite Reactor (AGR) fleet.[919]

915 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 22.
916 Ibid., p. 23.
917 Ibid., p. 22.
918 Ibid., pp. 23-24.
919 Twigge, Stephen, 'A Baffling Experience: Technology Transfer, Anglo-American Nuclear Relations, and the Development of the Gas Centrifuge 1964-70', in *History and Technology*, Vol. 19, No. 2 (2003) p. 153.

The centrifuge-team at Capenhurst had worked out how to make gas bearings work and had constructed several test machines by 1961. Late in 1960, Hans Kronberger was invited to visit Degussa, 'to discuss centrifuge development and to consider taking a license in respect to Degussa's rights.'[920] During his visit in January of 1961 Gernot Zippe made sure to only talk about progress made before classification to Kronberger (while the latter didn't share anything about British progress), which led Kronberger to conclude that the British were as far in development as the Germans and had nothing to gain through obtaining a Degussa license.[921] Nevertheless, the UKAEA took on research to verify a new design concept that Zippe had claimed would be 'technically feasable and cost effective' in a 1960 published paper that narrowly beat classification.[922] In 1967 the result of a review on the research verified Zippe's claim and led the British to conclude that the centrifuge economics were superior to those of the diffusion process and would allow cheaper enriched uranium for the civil market.[923] Further technical improvements to the British centrifuge design, such as carbon-fiber covered rotors and supercritical spinning speeds were shown to be 'real future possibilities.'[924]

Nevertheless, until a final decision between diffusion and centrifuge was taken (as the country could not afford to singlehandedly build full-scale plants for both), the economic viability of the centrifuge was kept secret while diffusion was being shopped around. In early 1967, the British approached the West Germans (Nukem) with an offer to take part in the expansion of Capenhurst's diffusion plant, who after a careful review declined. As late as October 1967, a British official presented ambitious plans for expansion of its diffusion capability at an event organized by the Swiss Association for Nuclear Energy, hoping to secure contracts for future export that would help finance a larger and thus more economic diffusion plant.[925]

Shortly after the US requested classification and the UK, FRG and Netherlands complied, the Americans proposed that the UK and US should hold regular meetings on centrifuge technology development. The British agreed and 'a number of meetings' took place on the subject between 1961 and 1965, but only scientific development was on the agenda; design and operation of pilot-plants were included, plant design and construction were not.[926]

But, as R.B. Kehoe writes:

> 'In 1965 the Americans terminated the exchange arrangements with the British, apparently wishing to increase security yet further. In retrospect, it seems likely that they wished to keep confidential advances they felt they were making and downplay

920 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 26.
921 Ibid.
922 Twigge, Stephen, 'A Baffling Experience: Technology Transfer, Anglo-American Nuclear Relations, and the Development of the Gas Centrifuge 1964-70', in *History and Technology*, Vol. 19, No. 2 (2003) p. 153.
923 Twigge, Stephen, 'A Baffling Experience: Technology Transfer, Anglo-American Nuclear Relations, and the Development of the Gas Centrifuge 1964-70', in *History and Technology*, Vol. 19, No. 2 (2003) p. 153, Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 28.
924 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 28.
925 Ibid., p. 29.
926 Ibid., p. 27

> their very serious interest in the technology as an eventual successor to diffusion plant technology. They also desired to keep confidential the type of centrifuges towards which their work must have then have been leading them. These centrifuges were very large in comparison to the size of machines the British were developing.'[927]

The British had, ever since WWII, attempted to come to a strategically cooperative relationship with the Americans, including 'a close nuclear relationship'.[928] After the McMahon Act of 1946, 'forbidding the United States government to share information about nuclear technology with any other power.', the British spent years, through military and political diplomacy, developing the relationship that eventually would lead to the Americans providing the British with an effective nuclear delivery system (the Polaris missiles, the main British nuclear delivery vehicle by 1968), coordination in nuclear strategy and American enriched uranium for British plutonium-swaps.[929]

'[B]y amending the 1954 Atomic Energy Act and by signing bilateral agreements with Britain in July 1958 and May 1959 allowing the transfer of nuclear technology' (The 1958 agreement replacing the earlier 1955 Agreement for Cooperation Regarding Atomic Information for Mutual Defense Purposes) the US Government under Eisenhower was 'effectively able to repeal the McMahon Act'.[930] The AEC refused to share sensitive information with the British following a request by the Department of Defense but its blockade was ignored by the military establishment, which considered the Department of Defense “the sole judge of what is disclosed” to further the security of the United States.[931] The Americans in turn had over the course of the 1950s, following the British success in detonating their own nuclear explosive, attempted and succeeded in making the British nuclear weapon infrastructure dependent on US cooperation.[932]

Other aspects the British took a careful look at during the late 1960s were the non-proliferation implications of the centrifuge, the long term technical and economic implications of exploitation of centrifuges, as well as 'the means by which Britain could best exploit its nuclear capability to achieve membership of the European Common Market'. The latter was 'particularly salient' as Britain had tried to join the Common Market in 1967 and had failed, following a French veto. After looking into this challenge, Sir Solly Zuckerman, Chief Scientific Advisor to the Government, 'strongly recommended full and effective European collaboration in all phases of centrifuge development including the production of enriched uranium' in March 1968.[933] Even though France was the most advanced nuclear nation on the

927 Ibid., p. 27

928 Ball, S., J., 'Military Nuclear Relations Between the United States and Great Britain under the Terms of the McMahon Act, 1946-1958', in *The Historical Journal*, Vol. 38, No. 2 (June 1995) p. 440.

929 Ibid., pp. 440. 441, 450-453, Wilkie, Tom, 'Chevaline's Empty Heads', in *New Scientist*, 2nd of February 1984, p. 5.

930 Ball, S., J., 'Military Nuclear Relations Between the United States and Great Britain under the Terms of the McMahon Act, 1946-1958', in *The Historical Journal*, Vol. 38, No. 2 (June 1995) p. 452.

931 Ibid., p. 450.

932 Ibid., p. 453.

933 Twigge, Stephen, 'A Baffling Experience: Technology Transfer, Anglo-American Nuclear Relations, and the Development of the Gas Centrifuge 1964-70', in *History and Technology*, Vol. 19, No. 2 (2003) p. 154.

continent and thus technically a natural partner, its veto had turned its relationship with the UK sour. The FRG and the Netherlands were also suitable, with centrifuge programs of their own. A collaboration with them would prevent them pooling their know-how and resources into EURATOM which would 'severely [reduce] the UK's influence over the future direction of the centrifuge project.'[934]

Following a ministerial meeting in November, officials from the three countries met in The Hague in December 1968 to discuss the future collaboration. From a British perspective, 'more was better'; in a report by Minister of Technology Tony Benn outlining objectives for the meeting it was argued that intensive collaboration was preferred, not just on design and manufacture but 'joint construction, ownership, and operation of centrifuge enrichment plants'[935] Such a joint venture, if kept outside of the European institutional infrastructure, would 'offer greater marketing and sales potential' as well as 'isolate France with its high cost, low efficiency, nuclear technology, and secure … a commanding position in the nuclear field in the Six might be a powerful political weapon.'[936]

The Dished End-cap Challenge

Initiating the technical footing of the enrichment collaboration with the Dutch and Germans turned out to be problematic. Internal discussions ensued on whether the British Mk 1 production model centrifuge had American propriety information worked in to it. The UK Ministry of Technology was 'adamant' that this was not the case, providing a written assurance to the Americans.[937] Eventually the Attorney General Sir Elwyn was asked for an opinion and, also informed by the opinion of UKAEA's chairman Sir John Hill, found that 'only information of a general nature had been derived from the United States.'[938] However, the Attorney General added that the purely legal interpretation was that should the British share the design of their 'dished end-cap' with others, they would be in breach of the 1955 agreement with the US.[939]

The UK then sent Sir Zuckerman to the US to find a solution that was acceptable to the Americans and would not damage relations with the future Troika partners;

934 Ibid.

935 Twigge, Stephen, 'A Baffling Experience: Technology Transfer, Anglo-American Nuclear Relations, and the Development of the Gas Centrifuge 1964-70', in *History and Technology*, Vol. 19, No. 2 (2003) p. 154. Twigge mistakes the December meeting as a ministerial meeting, while his 2002 article with Schrafstetter makes clear this meeting was 'delegated to officials', Schrafstetter, Susanna, Twigge, Stephen, 'Spinning into Europe: Britain, West Germany and the Netherlands: Uranium Enrichment and the Development of the Gas Centrifuge 1964-1970', in *Contemporary Europaen History*, Vol. 11, No. 2, (May 2002) pp. 264-265.

936 Ibid., p. 154.

937 Schrafstetter, Susanna, Twigge, Stephen, 'Spinning into Europe: Britain, West Germany and the Netherlands: Uranium Enrichment and the Development of the Gas Centrifuge 1964-1970', in *Contemporary Europaen History*, Vol. 11, No. 2, (May 2002) p. 267.

938 Twigge, Stephen, 'A Baffling Experience: Technology Transfer, Anglo-American Nuclear Relations, and the Development of the Gas Centrifuge 1964-70', in *History and Technology*, Vol. 19, No. 2 (2003) p. 155.

939 Ibid.

> [Sir Zuckerman] was bluntly informed that to ensure the terms of the 1955 agreement were upheld, Britain was required to meet three conditions. First the AEC was to be granted visual access to the Mk 1 production model to confirm that it corresponded to the British description and did not reveal any US research and development furnished under the 1955 agreement. Second, that a firm procedure was established for informing the American authorities in advance of any research and development information to be transferred to the Dutch and West Germans. Third, that Britain provided an assurance that any action in relation to the centrifuge did not establish a precedent for future action.'[940]

Stephen Twigge found an excellent quote by Tony Benn that summarizes the situation and British attitude towards it:

> "What came out of the meeting, which I had suspected but had never been properly told, was that we have an arrangement with the Americans under which we are absolutely tied hand and foot to them, and we can't pass any of our nuclear technology over to anybody else without their permission … the harsh reality is that De Gaulle is right."[941]

The reference to De Gaulle is apt because he had warned that the British were tying themselves too closely to the Americans (in general geopolitical terms), an argument that served De Gaulle's vision of a European project under French leadership.[942]

In March 1969, a team of AEC and State Department officials were shown some blueprints of the British centrifuge. Some details in these blueprints put AEC anxieties to rest, because the level of sophistication of the machine caused them to condescendingly call it a '"... 'model T'"', in reference to the first production car in history (the model T Ford) reducing fears that the technology would contribute to competition from the tripartite cooperation in '"... the next four to five years."'[943]

> 'The intransigence of the AEC and the contention that Britain could not transfer technology without Washington's agreement infuriated senior British officials. Similar problems had been encountered in nuclear reactors and computers …. Officials in London contended that the episodes were not unrelated but represented an attempt by the US administration to protect commercial markets and penalize Wilson's Labour government for not supporting more fully the US position in Vietnam.'[944]

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940 Ibid., p.156.

941 Benn, Tony, *Office without Power: Diaries 1968-72* (London, Hutchinson, 1988), p. 127, quoted in Twigge, Stephen, 'A Baffling Experience: Technology Transfer, Anglo-American Nuclear Relations, and the Development of the Gas Centrifuge 1964-70', in *History and Technology*, Vol. 19, No. 2 (2003) p. 156.

942 Berstein, Serge, *The Republic of de Gaulle 1958-1969* (Cambridge University Press: 1993) p. 170, Stromseth, Jane, E., *The Origins of Flexible Response; NATO's Debate over Strategy in the 1960s* (The MacMillan Press : London 1988) pp. 160-161.

943 Burr, William, 'To "Keep the Genie Bottled Up": U.S. Diplomacy, Nuclear Proliferation, and Gas Centrifuge Technology, 1962, 1972', in *Journal of Cold War Studies*, Vol. 19, No. 2 (Spring 2017) pp. 143-144.

944 Twigge, Stephen, 'A Baffling Experience: Technology Transfer, Anglo-American Nuclear Relations, and the Development of the Gas Centrifuge 1964-70', in *History and Technology*, Vol. 19, No. 2 (2003) p. 156.

In a provisional conclusion on the matter, the UK's Official Committee on Nuclear Policy advised the Government in May 1969 that access to the British centrifuge should be denied for commercial reasons, as it was believed the Americans sought access to the Mk 1 machine to improve their own centrifuge design to further their policy to attempt to dominate the international nuclear fuel market. The British Ambassador in Washington also supported this denial. Sir John Hill (UKAEA) concluded that the Americans were out to protect their own industry instead of acting out of concern over classified data.[945]

A later inquiry in May-June 1969 under Lord Penny unequivocally stated that the dished end-cap design was indeed based on American restricted data.[946] The British were torn between two strategic interests; maintaining a good relationship with the US that among other things made the British nuclear deterrent possible while pulling out of the Troika collaboration which 'would have a disastrous effect on our European policy', or antagonizing the Americans by sharing information covered under Article IX of the aforementioned 1955 agreement between the UK and US with the Dutch and West Germans.[947]

The British chose to once more approach the Americans but this time targeted the State Department in hope of a more reasonable response. Explaining how the situation could potentially sabotage Britain's European policy and arguing that the technological exchanges that took place under Article IX of the 1955 agreement should not then 'bring all subsequent work in either country within the scope of Article IX(c).'[948] As a sign of good faith, in July 1969 supervised access was given to a team of Americans led by AEC Commissioner Thompson to Risley and Capenhurst, where they received presentations on not only the Mk 1 model, but also 'of UKAEA's production plans, trial programs, and experimental workshops.'[949]

The information shown once again confirmed to the Americans that the British technology did not constitute a 'near-term commercial threat'.[950] On October 1, 1969, the State Department agreed with the British argument and announced it would not object to its course of action. To placate the AEC, the British promised 'to consult with [the] US on future designs.'[951]

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945 Twigge, Stephen, 'A Baffling Experience: Technology Transfer, Anglo-American Nuclear Relations, and the Development of the Gas Centrifuge 1964-70', in *History and Technology*, Vol. 19, No. 2 (2003) pp. 157, 158, Schrafstetter, Susanna, Twigge, Stephen, 'Spinning into Europe: Britain, West Germany and the Netherlands: Uranium Enrichment and the Development of the Gas Centrifuge 1964-1970', in *Contemporary Europaen History*, Vol. 11, No. 2, (May 2002) pp. 267-268.

946 Twigge, Stephen, 'A Baffling Experience: Technology Transfer, Anglo-American Nuclear Relations, and the Development of the Gas Centrifuge 1964-70', in *History and Technology*, Vol. 19, No. 2 (2003) p. 158.

947 Ibid., pp. 156-157, Schrafstetter, Susanna, Twigge, Stephen, 'Spinning into Europe: Britain, West Germany and the Netherlands: Uranium Enrichment and the Development of the Gas Centrifuge 1964-1970', in *Contemporary Europaen History*, Vol. 11, No. 2, (May 2002) p. 267.

948 Twigge, Stephen, 'A Baffling Experience: Technology Transfer, Anglo-American Nuclear Relations, and the Development of the Gas Centrifuge 1964-70', in *History and Technology*, Vol. 19, No. 2 (2003) p. 158.

949 Ibid., p. 159.

950 Burr, William, 'To “Keep the Genie Bottled Up”: U.S. Diplomacy, Nuclear Proliferation, and Gas Centrifuge Technology, 1962, 1972', in *Journal of Cold War Studies*, Vol. 19, No. 2 (Spring 2017) p. 144.

951 Twigge, Stephen, 'A Baffling Experience: Technology Transfer, Anglo-American Nuclear Relations, and the Development of the Gas Centrifuge 1964-70', in *History and Technology*, Vol. 19, No. 2 (2003) p. 159.

Negotiation of the Treaty of Almelo

In October 1964, the RCN's Advisory Committee asked whether Dutch officials could contact the West-Germans and see what prospects there were for the Dutch and German ultracentrifuge project groups to cooperate.[952] As early as 1964 and 1965 Dutch and German officials met multiple times to discuss a possible collaboration, without result.[953] In a January 25th 1965 meeting in Bonn, Dutch and West-German officials found much common ground but shared in the perception that, due to classification, a formal agreement would be required before talks could progress further. The German side also indicated they were in the process of centralizing all centrifuge work to one location, which needed to be finalized before cooperation could take place.[954]

After the AEC caught wind of the Dutch-German talks, it "'attempted to dissuade the two Governments from proceeding … by stressing the mutual desirability of restricting the dissemination of centrifuge technology.'"[955] The Dutch and West-Germans assured the AEC that any joint collaboration 'would follow the 1960 classification agreement.'[956]

When Bob Wansink, Director-General for Energy of the MFA visited the Jülich research site around 1967 (as he recalled it), when walking by the closed-off secret centrifuge development area, Alfred Boettcher (then Director of the Jülich center) suggested that the Dutch and Germans again look at cooperation in the centrifuge field.[957] At another occasion, German Dr. Meusel (Director of GkT) and Prof. Bogaardt of RCN discussed the idea of an international collaboration. From a German perspective it seemed more prudent to internationalize the project because a domestic centrifuge program might give the wrong impression to both allies (who had troops stationed in the FRG) and the USSR, which had installed a loyalist regime in the GDR and had shown during the Berlin Crisis that it was not afraid to escalate tensions to make a political point that served their European strategy. Thus, the innovative and politically sensible idea of a German plant on Dutch soil was born.[958]

The Directorate of Nuclear Energy in late December 1967 reported a similar démarche; Government officials of the FRG had 'pressed for cooperation' between the two countries because it had doubts whether, due to political concerns, it could build its own enrichment plant.[959] If cooperation was not possible they preferred the Netherlands to go ahead with plant construction so that the FRG could buy its product at a competitive price. Because at that time

952 Letter, Directeur voor de Industriële Ontwikkeling aan Directie Kernenergie, 'U.C. Project', 104 I.O., 10th of October 1964, 2.06.101/E24099/832.
953 'Shell, Philips, Werkspoor zien toekomst in procedé-Kistemaker: Drie concerns betrekken samen goedkoop uranium', in *Volkskrant*, 22nd of February 1968, p. 1.
954 Letter, Directoraat-Generaal voor de Energievoorziening, Directie Kernenergie aan Minsiter van Economische Zaken, 'Ultracentrifugeproject', EK/13, 1st of February 1965, 2.06.101/E24099/833, Note, TMA aan S, via DGES, 'Ultracentrifuge', 31/65, Geheim, 8th of February 1965, 2.06.101/E24099/833.
955 Burr, William, 'To "Keep the Genie Bottled Up": U.S. Diplomacy, Nuclear Proliferation, and Gas Centrifuge Technology, 1962, 1972', in *Journal of Cold War Studies*, Vol. 19, No. 2 (Spring 2017) p. 128.
956 Ibid.
957 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 31.
958 Ibid.

the Dutch Government was uncertain whether the project would continue on a national basis (possibly with participation from the State Mines) or the Shell company would take it over into private industry, exploring a possible cooperation with the FRG would have to wait.[960] Professor Bogaardt implored Dutch officials to make haste; he thought the West Germans would partner with whoever decided to construct a Western European plant first.[961]

In January 1968, Dutch officials again discussed contacts with the FRG, by this time acutely aware that while the gentlemen's agreement on classification allowed contact, West-German federal law stipulated that a government-to-government agreement needed to be in place before further discussions could take place.[962] A concept agreement towards that end had been prepared by the Ministry of Foreign Affairs and had a limited duration of one year, avoiding a requirement of parliamentary approval. The Ministry of Foreign Affairs was waiting on a decision by Economic Affairs to move forward.[963]

International Developments

Geo-strategic considerations had so far bound the Europeans fairly close to US policies, but by 1967-1968 European-US relations were at a new low. European nations as well as other developed nations around the world with nuclear power programs or plans realized that they could not continue to place important aspects of their energy security in the hands of the Americans.[964]

The Europeans had over the past decades seen their interests marginalized for the benefit of American strategic policy and commercial interest. American explanations on why early non-proliferation initiatives such as the Baruch Plan failed were viewed with suspicion or dismissed outright as self-serving.[965] Thus, from the European point of view,

959 Note, Directoraat-Generaal voor de Energievoorziening, Directie Kernenergie aan Minister van Ecnoomische Zaken, 'Ultracentrifugeproject', 259/EK, Vertrouwelijk, 29th of December 1967, 2.06.101/E24099/835, p. 4.

960 Ibid., pp. 6-7.

961 Memorandum, Prof. Dr. M. Bogaardt aan Mr. Mani, Mr. Star Busmann, Drs. Dee, 'Memorandum betreffende de toepassing van de Ultra-Centrifuge voor de scheiding van uranium-isotopen', Vertrouwelijk, 29th of December 1967, 2.06.101/E24099/835, pp. 2, 4.

962 Note, Directoraat-Generaal voor de Energievoorziening, Directie Kernenergie, Ministerie van Economische Zaken aan Minister van Economische Zaken, 'Classificatie ultracentrifuge-project', 24/EK, Confidentieel, 25th of January 1968, 2.06.101/E24099/842, p. 1.

963 Note, Directoraat-Generaal voor de Energievoorziening, Directie Kernenergie aan Directeur-Generaal voor de Energievoorziening, 'U.C.', 9/EK, 17th of January 1967, 2.06.101/E24099/841, pp. 1-2.

964 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 29, Schrafstetter, Susanna, Twigge, Stephen, 'Spinning into Europe: Britain, West Germany and the Netherlands: Uranium Enrichment and the Development of the Gas Centrifuge 1964-1970', in *Contemporary Europaen History*, Vol. 11, No. 2, (May 2002) p. 264.

965 Ebinger, Charles, K., *The Washington Papers Vol. VI: International Politics of Nuclear Energy* (The Center for Strategic and International Studies: Sage Publications, Beverly Hills & London 1978) p. 29. Charles K. Ebinger made a significant contribution in helping us understand the contemporary perspectives of these particular stakeholders in international nuclear industry vis-à-vis United States policies. In a series of interviews in the summer and fall of 1977, Ebinger spoke to many state officials tasked with nuclear energy policy for their

> 'U.S. tenders of technical assistance, assured deliveries of low-cost enriched uranium supplies, and Export-Import Bank financing for U.S. firms selling nuclear reactors abroad [appeared] to be designed to maintain commercial dominance of the European nuclear market rather than to limit the proliferation of European enrichment plants from which bombs can be manufactured. (Interviews, French and German Embassies, Washington, D.C., October 1977).'[966]

Japan also faced this challenge and the Europeans found an ally in that country, as together,

> '[t]hey refused to acquiesce in continued U.S. dominance of the valuable international civil nuclear sector. Having been thwarted in their efforts to implement a non-U.S.-dominated nuclear energy program, the Europeans and Japanese were determined not to allow the NPT regime to be used against their interests. They moved to ensure that the NPT would not be used (1) to thwart their implementation of a peaceful nuclear research program, (2) to restrict their access to advanced nuclear technology (e.g. centrifuge enrichment) that could lead to valuable commercial sales, and (3) to deny or curtail the supply of fissionable materials needed both for their domestic and export requirements. …. From the European and Japanese perspective, the continued U.S. dominance of enrichment technology served to perpetuate American control of the international nuclear market since the best available nuclear reactor technology still relied on enriched uranium. Although the United States had effectively blocked the construction of a European enrichment plant during the 1950s and 1960s, and had exerted diplomatic pressure to have British, Dutch, and German centrifuge technology research classified in 1960-1961, by the late 1960s the European Community moved to end the preeminent U.S. position.'[967]

FORATOM, the trade association for the European nuclear industry, had a meeting on the 17th of January 1967 where it initiated two subgroups that were to study European enrichment needs to 1985 and the cost and financing of a possible European enrichment plant respectively. The attending Dutch representative noted that the interest in a European enrichment plant appeared to be motivated by a strong political current that sought less dependency on the US in this area. At the same time, the thirteen Western European countries taking part were not necessarily prepared to pay more for enrichment services to further that goal. In the meeting, the UK was promoting its diffusion technology, claiming that under the

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respective countries. Particularly salient for the purpose of this study are the views of European diplomats stationed in Washington DC that he collected.

966 Ebinger, Charles, K., *The Washington Papers Vol. VI: International Politics of Nuclear Energy* (The Center for Strategic and International Studies: Sage Publications, Beverly Hills & London 1978) p. 29. For example, the German press accussed the Americans of foul play when the US Government through its Export-Import bank undercut a German financing offer for a Yugoslavian reactor by 2%, allegedly causing the NPP supplier KWU to lose the tender, in 1973, Wonder, Edward, 'Nuclear Commerce and Nuclear Proliferation: Germany and Brazil, 1975', in *Orbis* (Summer 1977) p. 293.

967 Ebinger, Charles, K., *The Washington Papers Vol. VI: International Politics of Nuclear Energy* (The Center for Strategic and International Studies: Sage Publications, Beverly Hills & London 1978) pp. 37-38.

right circumstances it could compete with the AEC's price. France claimed the same and both voiced their skepticism over the centrifuge process being able to compete in the same way.[968]

In April 1969, with Troika negotiations having made public and European discussions on a multilateral diffusion plant ongoing, the United States managed to stimulate the European push for enrichment independence further when the Joint Committee on Atomic Energy took an openly hostile stance towards the initiatives under discussion and negotiation in Western Europe;

> 'Congressman Craig Hosner, a leading member of the committee, seemed to confirm the wisdom of the policy enrichment independence when he observed that "there is not a single solitary reason for retaining such an incredibly generous policy for a foreign customer once that customer's own country decides to establish its own enrichment facilities." He then went on to recommend charging such customers a higher price. This suggested that the United States might discriminate between foreign and domestic customers; it also portended a reversal of the philosophy of encouraging peaceful uses of nuclear energy which had underpinned American policy from the mid-1950s onward. The larger policy significance of the joint committee's reaction was that a very important group in the policy-making process would be very skeptical of any attempt to cooperate with countries allegedly violating the "rules of the game."'[969]

Awareness of this significance among allies undercut the potency of the flawed multilateral enrichment initiatives that the United States Nixon administration would launch in following years, in 1971 and 1974 respectively (see *French and American Diffusion Initiatives*, page 278). Moreover, Hosner's criticism showed a complete lack of appreciation for the position of US allies, casting a policy of market control as 'generous'. In fact, as Edward Wonder documented based on 'numerous interviews conducted … in Europe this statement [by Hosner] was cited as confirming the judgment behind European plants.'[970] European governments perceived the Joint Committee on Atomic Energy as 'hostile towards European nuclear independence' and were thus 'reluctant to make their nuclear plans contingent upon the good graces of [it]'.[971]

Enter the British

The British, who had kept their restarted centrifuge program under strict secrecy (now code-named 'Acarus') so as to not encourage the Dutch and West-Germans in their efforts, were jolted into action after they received intelligence on the ongoing Dutch-German discussions, a joint Dutch-German paper presented at FORATOM in March 1968 which argued the benefits of the centrifuge process over diffusion, and during the same month, the conclusions of a

968 Report, Ir. M. Muysken, 'Kort verslag van een door Foratom georganiseerde bespreking over een Europese fabriek voor het verrijken van uranium, gehouden op 17 januari 1967 te Zùrich´, 2.06.101/E24099/841, pp. 1-3.
969 Wonder, Edward, F., *Nuclear Fuel and American Foreign Policy* (Westview Press: Boulder 1977) p. 12.
970 Ibid., pp. 69-70.
971 Ibid., p. 70.

study group looking at ways to translate British nuclear capabilities into EC membership, which advised that the Dutch Government should be told 'confidentially, and without delay' of British progress in centrifuge technology development and that discussions should be started on possible collaboration that could contribute to breaking of the US monopoly on the supply of enriched uranium.[972] British engineers had by this time also become convinced of the superiority of the centrifuge process.[973]

The first démarche to the Netherlands was made when Minister of Foreign Affairs Luns visited London in April 1968, who responded positively to the idea of British-Dutch cooperation and informed the British of the secret Dutch-German talks to establish a plant in the Netherlands near the West-German border.[974] Another British-Dutch discussion took place on the 15th of May 1968 when Solly Zuckerman met with Minister of Economic Affairs Leo De Block in The Hague.[975] Zuckerman also met with FRG officials on July 9th. He revealed the Acarus program to them and conveyed the British wish to become a part of the Dutch-German centrifuge talks. During the summer and autumn of 1968, the three countries intensified contacts.[976] According to Kistemaker, when in October an American delegation at the CNEN (the Italian National Committee for Nuclear Energy) conference in Turin saw RCN's presentation on its 25 ton SWU pilot plant and heard that the Dutch were considering collaborating with the West-Germans, 'they did everything in their power to include the British in this project', which led to 'contact with N.L. Franklin' (a British engineer working on Acarus) and resulted in a ministers of Economic Affairs meeting in November in The Hague.[977] The American dimension is absent in Kehoe's narrative, who frames that first official November meeting as solely a result of those intensified contacts from April on.[978]

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972 Schrafstetter, Susanna, Twigge, Stephen, 'Spinning into Europe: Britain, West Germany and the Netherlands: Uranium Enrichment and the Development of the Gas Centrifuge 1964-1970', in *Contemporary Europaen History*, Vol. 11, No. 2, (May 2002) p. 259. This followed PM Wilson's 1967 initiative to establish the European Technological Community (ETC) to reduce European reliance on US high technology, Schrafstetter, Susanna, Twigge, Stephen, 'Spinning into Europe: Britain, West Germany and the Netherlands: Uranium Enrichment and the Development of the Gas Centrifuge 1964-1970', in *Contemporary Europaen History*, Vol. 11, No. 2, (May 2002) p. 256, Ebinger, Charles, K., *The Washington Papers Vol. VI: International Politics of Nuclear Energy* (The Center for Strategic and International Studies: Sage Publications, Beverly Hills & London 1978) p. 38.

973 Krige, John, 'The Proliferation Risk of Gas Centrifuge Enrichment At The Dawn Of The NPT', in *The Nonproliferation Review*, Vol. 19, No. 2 (2012) pp. 222-223, Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 29.

974 Schrafstetter, Susanna, Twigge, Stephen, 'Spinning into Europe: Britain, West Germany and the Netherlands: Uranium Enrichment and the Development of the Gas Centrifuge 1964-1970', in *Contemporary Europaen History*, Vol. 11, No. 2, (May 2002) pp. 259-260.

975 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 33. Kehoe mistakingly writes that De Block is Minister of Foreign Affairs while later on the same page correctly stating that he is the Minister of Economic Affairs.

976 Ibid.

977 Kistemaker, J., *De Geschiedenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991) http://laka.org/docu/boeken/pdf/1-01-8-30-19.pdf, websites checked 2-1-2017, p. 23, Krige, John, 'The Proliferation Risk of Gas Centrifuge Enrichment At The Dawn Of The NPT', in *The Nonproliferation Review*, Vol. 19, No. 2 (2012) p. 223.

978 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 33.

On the 25th of November, 'the first publicly announced meeting' between an assortment of ministers of the three countries took place in The Hague.[979] At this meeting, the three governments came to general agreement and decided to cooperate on centrifuge research, construction and commercial exploitation. Non-proliferation policy would be brought in agreement with the commitments already made by the three countries. Other countries would be welcome to join in this cooperation, but 'participation in the joint venture would be limited initially to the United Kingdom, West Germany and the Netherlands.'[980] A series of follow-up meetings by officials started the following December and exposed initial disagreement on a myriad of issues, from the structure of the company (the Dutch at first balked at the idea of a two-company structure), the timetable (the British wanted to make a flying start, the other two countries were hesitant), location of enrichment plants (the British proposed a pilot plant in the Netherlands but a full-scale plant in the UK along with the company headquarters, while the Dutch wanted all centrifuge construction to take place in a Dutch plant), as well as ownership and investment levels.[981]

Negotiating Non-proliferation Goals

Dutch officials and politicians showed to be conscientious on the opportunities the Treaty of Almelo negotiations presented to further international non-proliferation goals. During negotiation of the Troika's interim agreement in London in March 1969, the Dutch delegation requested that a paragraph on the non-proliferation of nuclear weapons would be moved from the preamble to the main agreement to make it legally binding, to which the partners agreed.[982] The location of the first plants was agreed on as well; the UK and Netherlands would host the first two centrifuge plants of the tripartite partnership, the Dutch plant located in Almelo, right on the border with the FRG.[983] In May 1969, Ministers De Block and Luns (Economic and Foreign Affairs) told the Select Committee on Economic Affairs that the three

979 Ibid. These were for the Netherlands: Minister Leo De Block, Economic Affairs and Secretary H.J. de Koster, Foreign Affairs; for the UK: Minister Tony Benn, Technology and Fred Mulley, Minister of State for the Foreign Office; for the FRG: Minister Dr. Gerhardt Stoltenberg, Scientific Research and Secretary R. Lahr of, Foreign Affairs, Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 33, 'Engeland, W.-Duitsland, Nederland: Samenwerking bij Productie Verrijkt Uranium', in *Algemeen Handelsblad*, 26th of November 1968, p. 3. Kehoe (2003) reports Minister Luns attending instead of Secretary de Koster, but that is a mistake.

980 Schrafstetter, Susanna, Twigge, Stephen, 'Spinning into Europe: Britain, West Germany and the Netherlands: Uranium Enrichment and the Development of the Gas Centrifuge 1964-1970', in *Contemporary Europaen History*, Vol. 11, No. 2, (May 2002) p. 265, Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) pp. 33-34.

981 Schrafstetter, Susanna, Twigge, Stephen, 'Spinning into Europe: Britain, West Germany and the Netherlands: Uranium Enrichment and the Development of the Gas Centrifuge 1964-1970', in *Contemporary Europaen History*, Vol. 11, No. 2, (May 2002) pp. 265, 269-270, Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 34-35, 37.

982 Letter, Hoofd van het Bureau Atoomzaken, Raad van Europa en Wetenschappeiljke Samenwerking, Ministerie van Buitenlandse Zaken L.M.J. van de Winkel aan Ministerie van Economische Zaken Ch.F. Bouvy, 'Interim-Overneenkomst Nederland – Verenigd Koninkrijk – Bondsrepubliek Duitsland inzake veiligheidsprocedures en classificatie met betrekking tot het UC-project', DRW/AT-49969, 13th of March 1969, 2.06.101/E24099/842.

countries had agreed that 'the export of enriched uranium to third countries would only take place under solid guarantees' that the receiving countries would only use the material for peaceful purposes and that 'a committee from the three countries would supervise' this.[984] The ministers also reported that a decision had been taken to first finalize an agreement between the FRG, UK and Netherlands before starting formal talks for participation with additional countries.[985]

In press coverage around the June 9 1969 tripartite meeting, a Dutch newspaper reported a division within the Dutch Government, with some ministers advocating to use the negotiations to push the UK to commit itself not to use technology developed within the tripartite project for the benefit of its nuclear weapons program, whereas a majority of ministers thought Dutch national security would be compromised if it sought to impose military constraints on its ally.[986] It was reported that one minister (Klompe) was even willing to resign over the matter, which the Government denied. Another point of contention originated from the Select Committee for Nuclear Energy which had told the Government 'the treaty should contain clear stipulations that will constrain West-Germany from exploiting the centrifuge process on its own territory as long as Bonn had not signed the international treaty against the proliferation of nuclear weapons' and that any failure to include such a stipulation would impose a 'large responsibility' on the Government.[987] Reportedly the British were much less forceful in setting that condition to the West-Germans.[988] Additionally, as on the meeting's agenda was the need to come to a structure of political decision-making for the collaboration, it was vital that the Dutch delegation would hold unto its demand for the condition of unanimity in all political decisions made in the project, including decisions on the locations of

983 'Verdere besprekingen noodzakelijk: Geen overeenstemming ultracentrifugeproject', in *Nieuwe Rotterdamse Courtant*, 10th of June 1969, 'Ook België en Italië bij besprekingen: Akkoord bereikt in Londen over ultracentrifuge', *Leeuwarder Courtant*, 26th of November 1969, p. 3. Following the agreement on locations, Philips immediately bought a stretch of land next to its machine factory in Almelo, Kistemaker, J., *De Geschiedenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991) http://laka.org/docu/boeken/pdf/1-01-8-30-19.pdf, websites checked 2-1-2017, p. 25. Later that March, Minister De Block informed the Select Committee(s) on Nuclear Energy and Foreign Affairs that the state would rougly take a 2/3 ownership share of the first phase of industrial development of the project (36 million guilders, about $ 10 million) with industrial partners Werkspoor, State Mines, Philips and Shell sharing in the remainder (15 million guilders, about $ 4 million), 'Splijtstoffabriek mogelijk groter: Vijftig miljoen in UC-project',in *De Tijd*, 21st of March 1969, p. 5, Officer, Lawrence, H., 'Exchange Rates Between the United States Dollar and Forty-one Currencies', MeasuringWorth website, http://www.measuringworth.com/exchangeglobal/, website checked 30-7-2018.

984 'Luns en De Block over ultracentrifugeproject: Eerst samenwerking met Bonn en Londen, dan met anderen formeel overleg', in *Leeuwarder Courtant*, 22nd of May 1969, p. 27.

985 'Luns en De Block over ultracentrifugeproject: Eerst samenwerking met Bonn en Londen, dan met anderen formeel overleg', in *Leeuwarder Courtant*, 22nd of May 1969, p. 27.

986 'Ultracentrifugeverdrag nog lang niet rond', in *Nieuwe Rotterdamse Courtant*, 9th of June 1969.

987 'Ultracentrifugeverdrag nog lang niet rond', in *Nieuwe Rotterdamse Courtant*, 9th of June 1969, 'Bonn politieke hindernis: Geen overeenstemming over ultracentrifuge', in *Algemeen Handelsblad*,10th of June 1969, p. 1. Already in February 1969 a spokesman for the West-German Ministry of Science had said that the first tripartite ultracentrifuge plant would definitely not be located in the FRG, 'Spoedig overeenkomst ultracentrifugeproject', in *Algemeen Handelsblad*, 4th of February 1969, p. 1.

988 'Overeenstemming nauwelijks mogelijk: Politiek remt gesprek over ultra-centrifuge', in *De Volkskrant*, 9th of June 1969.

future centrifuge plants. Even though the Netherlands was in many respects the 'small bufferpartner', the Dutch Government considered its negotiating position strong because it thought it had a technical advantage over the other two countries, even though full technical data had not been exchanged yet and a preliminary exchange had shown the three countries were roughly technologically at par with one another. Furthermore, the West-Germans were seen to clearly have more faith in their Dutch than their British negotiation partners. Considering these factors, the Dutch ministers Luns (Foreign Affairs) and De Block (Economic Affairs) deemed they could be tough in negotiating, 'having the freedom to risk the entire collaboration' as alternatives with EURATOM or Italy and Belgium (which were 'eagerly awaiting' the outcome of tripartite talks) were available for the Dutch centrifuge program.[989] After negotiating for thirteen hours agreement could not be reached but the tripartite partners reported 'clear progress' and had agreed to meet again within the next month.[990] Around this time, Minister Luns abandoned the idea of a tripartite agreement conditioned on the FRG's signing of the NPT, amid what were rumored to be serious tensions within the Dutch government on this subject and a clear West-German intransigence to sign the NPT.[991] According to a 1971 newspaper article giving an overview of the negotiations, the tripartite partners would have none of this Dutch 'moralizing' and thus the Netherlands delegation was to blame for the impasse in negotiations during this period.[992]

Tripartite Agreement

By October 1969, negotiations were ongoing as delays were caused by the formation of a new FRG Government and the unresolved issue of possible British use of tripartite centrifuge technology in its nuclear weapons program, as well as the FRG's unwillingness to move its centrifuge construction operation to Almelo in the Netherlands, the designated location for the Dutch/West-German plant.[993] During the formation of the new government by the social-democrat and liberal parties however, there were strong indications that the FRG would stop trying to gain additional guarantees from the US and USSR and sign the NPT, against the

989 'Overeenstemming nauwelijks mogelijk: Politiek remt gesprek over ultra-centrifuge', in *De Volkskrant*, 9th of June 1969. The Italian CNEN had shown interest in the Dutch centrifuge program two years earlier, when in July 1967 Dr. Ing. Scuricini was sent to the Netherlands to learn more about its potential ability to provide enriched uranium for the Italian nuclear energy program and nuclear-powered ship project, the latter for which the US had refused to supply fuel. During the negotiation process, the Italians signalled their interest to join the tripartite project when Dutch Minister of Foreign Affairs Luns visited Rome in March 1969, and again the following July. Following the signing of the Almelo treaty, the Italians and Belgians once again met with the tripartite partners on the 15th of April 1970, discussing possible ascension to the treaty, Report, M. Bogaardt, 'Ultra-centrifuge Project', Confidential, 13th of July 1967, 2.06.101/E24099/835, 'Italië wil meedoen aan kernonderzoek', in *De Telegraaf*, 19th of March 1969, p. 11, 'Italië wil in ultracentrifuge', in *Limburgs Dagblad*, 2nd of July 1969, p. 9, 'België en Italië overleggen lidmaatschap van „ultracentrifuge'", in *Limburgs Dagblad*, 16th of April 1970, p. 3.

990 'Verdere besprekingen noodzakelijk: Geen overeenstemming ultracentrifugeproject', in *Nieuwe Rotterdamse Courant*, 10th of June 1969.

991 Van den Berg, 'Kernenergie ligt regering-De Jong zwaar op de maag', in *Limburgs Dagblad*, 5th of July 1969, p. 7.

992 'De harde noten van de ultra-centrifuge', in *Het Vrije Volk*, 27th of February 1971, p. 22.

993 'Wachten is op Duits kabinet: Uranium-overleg vordert traag', in *De Volkskrant*, 7th of October 1969, Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 36.

wishes of the christian-democratic party, now in the opposition.[994] The future partners had also started exploratory talks with Italy and Belgium.[995]

On the 4th of November 1969, Ultra-Centrifuge Nederland N.V. (UCN) was founded, its initial board of directors consisting of staff members from RCN, Philips, Shell Nuclear, the State Mines, Verenigde Machine Fabrieken (VMF), Rijn-Schelde and officials from the Dutch state. During the summer of 1969 with negotiations ongoing, some of these Dutch companies had already started construction of a centrifuge construction plant in Almelo.[996]

> 'By the end of October ... the position of the parties had relaxed, the strengths and weaknesses of each having been flushed out. The national companies had been formed and everything was prepared for a meeting of senior officials on 11 November. The meeting was a success. Each side offered compromises, agreement was reached and the terms of the forthcoming treaty were almost settled. Among many other points it was agreed that the Prime Contractor, as it was termed, would be based in the area of Cologne, with GnV, UCN and the UKAEA (BNFL when it was later formed) each holding one third of its shares. Similarly the Enrichment Organisation, the operating company, to be owned in equal parts by UCN, Uranit and the UKAEA (later by BNFL) would have its location in the London area/'[997]

Agreement was partly made possible by the FRG's indication it intended to sign the NPT a week later, which it did, removing an important obstacle for the Dutch delegation.[998] Later in November, responsible ministers from the three countries signed off on the agreement and instructed officials to begin drafting a treaty. In a meeting on the 25th of November in London, representatives from Italy and Belgium were also present to discuss a 'possible association' of those countries to the impending partnership.[999]

A common statement was prepared and sent out on the 19th of December announcing the 'approval of terms of an agreement for collaboration in the development and exploitation of the gas centrifuge process for enriching uranium.'[1000] The statement described the Prime

994 'CDU wil debat over non-proliferatieverdrag', in *Nieuwe Rotterdamse Courtant*, 21st of October 1969.

995 'Wachten is op Duits kabinet: Uranium-overleg vordert traag', in *De Volkskrant*, 7th of October 1969, Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 36.

996 Kistemaker, J., *De Geschiedenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991) http://laka.org/docu/boeken/pdf/1-01-8-30-19.pdf, websites checked 2-1-2017, p. 27, Den Haan, Frederik, M., *De Urenco-kwestie: De leverantie van verrijkt uranium aan Brazilië* (Instituut voor Internationale Studiën – Rijksuniversiteit Leiden: Leiden 1985) p. 6.

997 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 37. BNFL is British Nuclear Fuels Ltd.. GnV is Gesellschaft fur nukleare Verfahrenstechnik mbH.

998 'Vorderingen bij overleg ultracentrifugeproject', in *Algemeen Handelsblad*, 21st of November 1969, p. 1.

999 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 37, 'Ook België en Italië bij besprekingen: Akkoord bereikt in Londen over ultracentrifuge', in *Leeuwarder Courant*, 26th of November 1969, p. 3.

1000 Telex, Ministerie van Buitenlandse Zaken aan ambassades en missies in Rome, Parijs, Wenen, Luxemburg, Brussel, Washington D.C., 'UC-project', 908.668, 17th of December 1969, 2.05.273/154, p. 1, 'Nederland, Engeland, Duitsland – Drie landen samen in uranium-project: Almelo krijgt voorrang bij uitbreiding', in *De Volkskrant*, 20th of December 1969, p. 7, 'Drie landen akkoord over uraniumproject', in *Trouw*, 20th of December

Contractor (later given the name Centec, from Centrifuge Technology) as having the function to 'design and construct plants for the enrichment of uranium' and 'design and manufacture centrifuges for this purpose.'[1001] The Enrichment Organization (later given the name Urenco, from Uranium Enrichment Company) would 'establish subsidiary companies to own and operate the initial plants at Almelo and Capenhurst and further plants to be established in the future'.[1002] The 'initial program of collaboration' would be to create a 350 tonnes SWU per year enrichment capacity with initial plants at Capenhurst and Almelo each at a capacity of 50 tonnes SWU/year by 1972, with expansion of capacity beyond 350 tonnes jointly decided upon.[1003] The tripartite partnership would establish a Joint Committee that would 'consider and decide upon questions regarding safeguards in respect of non-proliferation security and classification and agreements with other states or with international organisations' with decisions taken with unanimity by representatives from the three countries (for more on the Joint Committee, see chapter 10, page 289).[1004] Besides claiming a positive role for the tripartite collaboration in furthering European technological integration and cooperation, with regards to their non-proliferation obligations the partners stated that,

> 'The three governments fully recognize their responsibility with regard to the non-proliferation of nuclear weapons, to which they attach the greatest importance and their collaboration will be entirely consistent with their policies and with their international obligations in this field. Appropriate international safeguards will be applied; these will include the procedures of the safeguards system established by the European atomic energy community and the procedures resulting from any additional obligations pursuant to an agreement concluded with the International Atomic Energy Agency. The three governments will take all appropriate steps to continue to protect the security of the sensitive technology involved. They take the view that the establishment of international enterprises to develop and exploit the gas centrifuge

1969, p. 5.

1001 Telex, Ministerie van Buitenlandse Zaken aan ambassades en missies in Rome, Parijs, Wenen, Luxemburg, Brussel, Washington D.C., 'UC-project', 908.668, 17th of December 1969, 2.05.273/154, p. 1, 'Nederland, Engeland, Duitsland – Drie landen samen in uranium-project: Almelo krijgt voorrang bij uitbreiding', in *De Volkskrant*, 20th of December 1969, p. 7, 'Drie landen akkoord over uraniumproject', in *Trouw*, 20th of December 1969, p. 5, Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 45.

1002 Telex, Ministerie van Buitenlandse Zaken aan ambassades en missies in Rome, Parijs, Wenen, Luxemburg, Brussel, Washington D.C., 'UC-project', 908.668, 17th of December 1969, 2.05.273/154., p. 1, 'Nederland, Engeland, Duitsland – Drie landen samen in uranium-project: Almelo krijgt voorrang bij uitbreiding', in *De Volkskrant*, 20th of December 1969, p. 7, 'Drie landen akkoord over uraniumproject', in *Trouw*, 20th of December 1969, p. 5, Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 43.

1003 Telex, Ministerie van Buitenlandse Zaken aan ambassades en missies in Rome, Parijs, Wenen, Luxemburg, Brussel, Washington D.C., 'UC-project', 908.668, 17th of December 1969, 2.05.273/154, p. 1,'Nederland, Engeland, Duitsland – Drie landen samen in uranium-project: Almelo krijgt voorrang bij uitbreiding', in *De Volkskrant*, 20th of December 1969, p. 7, 'Drie landen akkoord over uraniumproject', in *Trouw*, 20th of December 1969, p. 5.

1004 Telex, Ministerie van Buitenlandse Zaken aan ambassades en missies in Rome, Parijs, Wenen, Luxemburg, Brussel, Washington D.C., 'UC-project', 908.668, 17th of December 1969, 2.05.273/154, p. 1,'Nederland, Engeland, Duitsland – Drie landen samen in uranium-project: Almelo krijgt voorrang bij uitbreiding', in *De Volkskrant*, 20th of December 1969, p. 7.

> process will be a substantial contribution not only to the development of peaceful uses of atomic energy but also to the cause of non-proliferation. The three governments will ensure that information, equipment and material which may be at their disposal for the purpose of or as a result of the collaboration will not be used by or to assist any non-nuclear-state to manufacture or otherwise acquire nuclear weapons or other nuclear explosive devices.'[1005]

In this one statement, the future Troika committed the to-be-established enterprise to EURATOM safeguards and when they became available, IAEA safeguards. They signaled, particularly to the US, their intention to continue to observe the quadripartite classification ('continue to protect the security of sensitive technology') and then argued that the tripartite collaboration was an act of non-proliferation policy in itself. Near the end of the quoted statement they signal that they would require their 'non-nuclear-state' (NNWS) customers to commit to certain controls (more implicitly also recommitting the FRG to its WEU-pledge of foregoing nuclear weapons), while also signaling that the UK will be able to use the shared technology for its military enrichment needs.[1006]

The three governments of the tripartite collaboration signed the Treaty of Almelo on the 4th of March 1970.

The Parliamentary Debate on the Treaty of Almelo in the Netherlands

The Government took questions from Parliament and prepared additional information leading up to a debate on the treaty the next year, which the Dutch Parliament's Second Chamber held on the 3rd of March 1971 and which Minister Luns of Foreign Affairs and Minister Nelissen of Economic Affairs attended.[1007] Several motions were tabled, some accepted and some dismissed.[1008] The main opposition party, the Labour Party (PvdA) through its representatives Oele and Van der Stoel as well as the other party representatives asked clarifications on several subjects in the debate ahead of the vote on the two laws, one for ratification of the Treaty of Almelo, the second to accept the state's participation in Ultra-Centrifuge Nederland N.V., which would hold the shares of the Dutch participation in the tripartite enterprise.[1009]

1005 Ibid.

1006 Ibid.

1007 The debate as summarized below is in my view very insightful as to the contemporary concerns and attitudes members of Parliament had regarding the intended tripartite collaboration, for which reason I have included it in somewhat comprehensive form.

1008 Motions that are accepted by a majority of the Second Chamber are non-binding to the Government, but become harder to ignore when passed by a great majority of the vote or when the Government has declared that it considers itself bound by it. For a Government minister to declare a motion binding but later act against it is a serious violation of the political norm that governs political relations between the Government and Parliament in the Netherlands and can result in a vote on a motion of disapproval (censure) against a member of Government or the whole Government, or a vote on a motion of distrust (no confidence) in a member of Government.

1009 Tweede Kamer der Staten Generaal, Zitting 1970-1971, Handelingen Tweede Kamer, 'Deelneming in het aandelenkapitaal van Ultra-Centrifuge Nederland N.V.', 3rd of March 1971, p. 3087.

Mr. Oele (PvdA) voiced a concern that if the tripartite partnership would be successful and be turned over into the hands of industry, it could create a monopoly which could negatively affect the interest of consumers of electricity. To safeguard against this situation, Oele asked for more transparency regarding the Joint Committee meetings and decision-making that the Government had committed to in its foregoing answers to questions (which was, that the Government would explore the possibilities towards this end)[1010] For this reason as well as to act as guarantor of peaceful use, the state should stay involved into the commercial phase of the project. In his contribution, Representative Van der Spek (Pacifistic Socialist Party – PSP) added that such transparency would be much harder to maintain if the company was done over to industry[1011]. For Van der Spek, this was part of a larger argument against privatization of state assets in general, suggesting that instead ownership of all nuclear energy facilities should be turned over to the United Nations.[1012] Oele argued that a decision to expand beyond 350 tonnes capacity should therefore be put to Parliament. This would also allow at that time to review the state's share in both the projected 'costs and benefits' of the project. To this effect, Representative Oele tabled a successful motion (together with Representative De Goede of D66 – Democrats-66 – the motion Oele/De Goede) asking the Government to commit to a vote by Parliament when the time came to expand beyond 350 tons, which was welcomed by Minister Nelissen.[1013]

The goal of breaking the US technological monopoly benefited from the project's success, Oele thought. There was a need for competition with the US and with the newly arrived USSR in the uranium enrichment market said Oele, and export to countries outside the tripartite partnership would aid gaining that competitive position added Representative Van Rossem (Reformed Protestant (Calvinist) Party – SGP), as the USSR was now offering the FRG cheap enriched uranium in an effort to break the US monopoly as well as sabotaging the tripartite initiative.[1014]

1010 Ibid., p. 3089.

1011 Ibid., pp. 3090, 3099.

1012 Ibid., p. 3099.

1013 Ibid., p. 3090. Oele's motion nr. 9 was slightly edited for clarification and in its altered form became motion nr. 11. Mr. Domsdorf in his 1976 treatise on the Almelo treaty pointed out that by January 1974 the FRG and UK utilities had put in orders for a combined 1800 tons of enrichment labor, legally negating Oele/De Goede's motion as the treaty article III, clause 1, sub b stipulates: '(b) The joint industrial enterprises shall use their best endeavours to meet all orders for uranium enrichment services placed with them by customers in the territory of any of the Contracting Parties. whether or not the fulfillment of such orders would involve the installation of new enrichment capacity. The joint industrial enterprises shall, however. be bound to meet such orders if the Contracting Party concerned or entities within its territory agree to provide such portions of the extra finance involved as are not forthcoming from the joint industrial enterprises and the other Contracting Parties.' 'Agreement between the United Kingdom of Great Britain and Northern Ireland the Federal Republic of Germany and the Kingdom of the Netherlands on Collaboratino in the Development and Exploitation of the Gas Centrifuge Process for producing Enriched Uranium', Almelo, 4 March 1970, Treaty Series No. 69 (1971), Cmnd. 4793 (London: Her Majesty's Stationary Office) pp. 4-5, Domsdorf, E. P. M. W., *Het Verdrag van Almelo* (W.E.J. Tjeenk Willink: Zwolle 1976) p. 13.

1014 Tweede Kamer der Staten Generaal, Zitting 1970-1971, Handelingen Tweede Kamer, 'Deelneming in het aandelenkapitaal van Ultra-Centrifuge Nederland N.V.', 3rd of March 1971, pp. 3087, 3089, 3105, 3109-3110.

The primary goal of making the centrifuge project a success was in the interest of energy security and Parliament should not undercut efforts towards that goal, Oele added.[1015] Along with De Goede (D66), the Liberal Party (Representative Portheine) wanted to know if the US was likely to retaliate in some way to the new tripartite competition, for example (as De Goede suggested) through dumping cheap uranium on the European market using a dual pricing system, which Minister Nelissen thought unlikely because the American consumers would probably reject such a policy.[1016]

Oele also pressured the Government to do more to give the project a more communitarian character; with a conference ongoing in Paris on the availability of European enrichment capacity, had the tripartite partners been welcoming enough to Italy and Belgium and their possible participation? Parliament had been informed they had received a proposal from the tripartite partners and had not reacted yet. Italy was known to be in discussions with France as well, regarding the diffusion plant the French had been pushing for in Europe. Delegating the Italians (and Belgians) to second-tier partners had not been smart, a representative of D66 argued, to which Minister Luns responded that these countries now had the option to join the partnership, although the Government had deliberately not given information under what conditions as to not negatively affect the tripartite negotiation position.[1017] The Government should try harder to broaden the partnership to other EC countries, the D66 representative concluded; as Oele had said, turning the tripartite partnership into a broader European Community project would also be a safeguard against the company exploiting a possible monopoly position. Minister Nelissen reacted by explaining that Italy's reaction to the offer had left a positive impression and had prompted further negotiations on modalities whereas Belgium had not yet responded to the offer.[1018] Minister Nelissen added that with regard to risk of the tripartite partnership turning into a European monopoly, this was very unlikely with the US probably active in the enrichment market for decades to come and with the possibility of other new suppliers entering the market as well.[1019]

Parliament also wanted to know about contacts with Australia and South Africa, both countries with access to large amounts of natural uranium, that were seen as potential partners to join the tripartite collaboration. Besides the UK, did the tripartite countries had contacts with these countries? Minister Nelissen answered that the tripartite countries had indeed had contact with Australia, after that country had inquired in Europe for the construction of a nuclear power plant and discussions had been about whether Australia could purchase its own uranium enrichment facility to create its own fuel for that plant or plants. The tripartite countries had, during informal discussions, explained to Australian representatives that in their view, economically it would make no sense for it to construct its own enrichment facility only to provide for its own fuel needs. On South Africa and its alleged research in enrichment

1015 Ibid., p. 3090.

1016 Ibid., pp. 3090, 3113, 3122-3123.

1017 Ibid., pp. 3089, 3107-3108. The Belgians and Italians had been offered a minor participation in the collaboration combined with a 'considerable joining fee to cover past R&D and the cost of the initial plants, Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 178.

1018 Tweede Kamer der Staten Generaal, Zitting 1970-1971, Handelingen Tweede Kamer, 'Deelneming in het aandelenkapitaal van Ultra-Centrifuge Nederland N.V.', 3rd of March 1971, pp. 3109, 3122.

1019 Ibid., pp. 3090, 3122.

technology, the Government could offer no information. The tripartite collaboration had had no contacts to discuss any collaboration with South Africa, Luns said.[1020]

Concerns about how the project affected the prospects of a European nuclear weapons force were voiced, to which Minister Luns replied that the Government categorically rejected the idea of such a force.[1021] Representatives were aware that the Treaty text reflected that the UK was allowed to enrich uranium in its tripartite Capenhurst installation for its military program, which it could then re-enrich to weapon-grade material in a separate military installation. The relevance of this was downplayed by Representative Van der Stoel (PvdA), who pointed out that challenges to the British and a potential European nuclear force were of a different nature, for example in the availability of rocket-technology; the availability of cheap uranium would not be a deciding factor to such programs starting or continuing, a point the D66 representative subscribed to. The alternative, not accepting this situation and the resulting non-participation by the Netherlands would make a centrifuge enrichment plant in the FRG much more likely.[1022] Participation and the Dutch position in the JC should be used to promote Dutch non-proliferation goals argued Van der Stoel, to which Minister Luns agreed, adding that non-proliferation considerations would be given priority in Dutch decision-making in the JC.[1023]

Regarding safeguards, Van der Stoel pointed out that while Article VI of the treaty text provided a number of safeguards and controls to prevent horizontal proliferation and enrichment to military grade in tripartite plants, it also contained a back-door through the non-EURATOM partner, the UK. The UK had promised it would accept voluntary EURATOM safeguards on its civilian facilities as soon as it became a member, but if that membership didn't materialize was there any guarantee it would accept voluntary IAEA safeguards? What was the Government going to do to make sure this gap in the safeguarding of Capenhurst could not be exploited as long as IAEA safeguards were not in place?[1024] Minister Luns explained that the Dutch Government had pushed hard for the implementation of IAEA safeguards ahead of the British coming to full agreement with the IAEA, but that the UK had strongly resisted this. Likewise the Dutch negotiators had tried to exclude military use of uranium enriched in the tripartite installation by the UK, but had had to give up this point in negotiations.[1025]

1020 Ibid., pp. 3089, 3120, 3122. The contact with Australia concerned the Jervis Bay-tender. The Troika and Australia would continue what would evolve into intensive discussions on possible forms of collaboration, see chapter 10, *Case: Australia*, pages 371 and 376.

1021 Ibid., pp. 3087, 3092, 3097, 3118.

1022 Tweede Kamer der Staten Generaal, Zitting 1970-1971, Handelingen Tweede Kamer, 'Deelneming in het aandelenkapitaal van Ultra-Centrifuge Nederland N.V.', 3rd of March 1971, pp. 3091, 3111, Van der Stoel, M., 'Het ultracentrifugeproject en de spreiding van kernwapens' in Kelling, F. E. T., Lindhout, A. H., Van de Wijngaert, B. H., Van der Stoel, M., *Uraniumverrijking in Nederland* (Reactor Centrum Nederland, The Hague 1973) p. 42.

1023 Tweede Kamer der Staten Generaal, Zitting 1970-1971, Handelingen Tweede Kamer, 'Deelneming in het aandelenkapitaal van Ultra-Centrifuge Nederland N.V.', 3rd of March 1971, pp. 3091, 3119.

1024 Ibid., p. 3091.

1025 Ibid., p. 3118.

D66 spokesman De Goede noted that GCEP safeguard modalities were underdeveloped and the Netherlands had an obligation to correct this and be a leader in the development of technical safeguards for GCEPs.[1026] Van der Stoel put pressure on the Government to conclude a safeguards agreement with IAEA now that the IAEA-EURATOM negotiations were nearly concluded, as well as conclude ratification of the NPT as soon as possible after, to which Minister Luns responded he could see no reason why ratification by the Netherlands wouldn't happen soon. Adding to his wish-list, Van der Stoel asked the Government to start moving the other five EC members that had signed NPT and had agreed to IAEA safeguards in the safeguards committee to each start bilateral negotiations to conclude safeguard agreements sooner rather than later, in order to create political goodwill and to put pressure on France. France had refused to approve the IAEA-EURATOM agreement as long as it allowed IAEA inspections of its nuclear imports and exports, for which an exemption for France was now included in the agreement, so in Van der Stoel's mind, the country could now come into the fold.[1027] On this topic, Minister Luns informed the Parliament that besides agreement by the safeguard committee members, the IAEA Board of Directors had by now also approved the EURATOM-IAEA safeguards agreement, but full agreement would have to wait at least a couple of months pending negotiations on the financial aspects.[1028] Representative Van der Spek (PSP) supported this drive to IAEA safeguards through his criticism of EURATOM safeguards, arguing that the latter were essentially a form of self-control.[1029]

Export to France could present a problem because France had not signed or signaled an intention to sign the NPT but was a member of EURATOM and membership of EURATOM had been inserted into the Treaty text as an exception to the NPT-membership condition for exports. Van der Stoel argued that with France already undermining EURATOM by trying to extract itself as much as possible from its requirements, the Netherlands should facilitate that country further by allowing an opening in the Almelo treaty that could allow France to re-export enriched materials or technology from the tripartite partners to third non-NPT parties. Concern about this was echoed by the spokesperson for the Christian parties (Catholic People's Party – KVP, Anti-Revolutionary Party – ARP, and Christian Historic Union – CHU which in 1980 merged together into the Christian Democratic Appeal – CDA) Representative Westerterp (who brought up the fact that all special fissile material produced in the EC automatically became property of EURATOM and EURATOM wasn't allowed to discriminate against exports to its members. Minister Luns responded that the tripartite countries could and would set strict conditions to France about re-export of tripartite special materials.[1030]

1026 Ibid., p. 3110.

1027 Tweede Kamer der Staten Generaal, Zitting 1970-1971, Handelingen Tweede Kamer, 'Deelneming in het aandelenkapitaal van Ultra-Centrifuge Nederland N.V.', 3rd of March 1971, pp. 3091-3092, ARC-61-6, p. 4, Domsdorf, E. P. M. W., *Het Verdrag van Almelo* (W.E.J. Tjeenk Willink: Zwolle 1976) p. 28. For more on this topic, see chapter 11, *EURATOM, the IAEA and NPT Safeguards*, on page 456.

1028Tweede Kamer der Staten Generaal, Zitting 1970-1971, Handelingen Tweede Kamer, 'Deelneming in het aandelenkapitaal van Ultra-Centrifuge Nederland N.V.', 3rd of March 1971, p. 3118.

1029 Ibid., p. 3099.

1030 Ibid., pp. 3093, 3102, 3117.

Van der Stoel wanted to put such guarantees on a more solid footing and tabled a motion, seconded by Representative Visser (D66) that asked the Dutch Government's commitment that,

1. The JC would not agree to exports to non-NPT countries.

2. An amendment to the Treaty through Article XIII procedure would be proposed that the tripartite countries would not export materials or technology to non-NPT countries.[1031]

The motivations behind the motion garnered support during the debate from the Christian parties and Democrats-66, who saw a strong role for the JC in safeguarding Dutch non-proliferation goals and prevention of exports to non-NPT countries.[1032] Minister Luns discouraged Van der Stoel to pursue the first point of his motion because it was unworkable precisely because of Dutch and West-German EURATOM commitments and France's status as non-NPT country. The Minister added that in any case, additional conditions would be demanded of France to make sure tripartite special materials would not end up in its nuclear weapons program. Regarding export to other non-NPT countries, prompted by a list of 'ten commandments' presented by representative Westerterp, Minister Luns promised that the Government would involve the relevant parliamentary select committees before making a decision whether such an export was acceptable.[1033] After Minister Luns explained that the NPT allowed exports to non-NPT countries under condition of applied safeguards and encouraged by the minister's proposal to have an exchange of letters between the tripartite countries, as using Article XIII to amend the treaty to would open the entire thing up for negotiation again, Representative Van der Stoel changed the wording of his motion, in the adapted version not requiring NPT-membership but requiring the application of safeguards in the importing country and dropping the request for an Article XIII procedure to bind the partners to this commitment by treaty.[1034] Minister Luns pointed out that the unanimity required in the JC would safeguard the agreed upon conditions of supply and that those conditions went beyond what NPT-countries committed to.[1035] If the tripartite countries had doubts about a customer's trustworthiness export would not take place and if an importing

1031 Ibid., pp. 3093-3094.

1032 Ibid., pp. 3103, 3111-3112.

1033 Tweede Kamer der Staten Generaal, Zitting 1970-1971, Handelingen Tweede Kamer, 'Deelneming in het aandelenkapitaal van Ultra-Centrifuge Nederland N.V.', 3rd of March 1971, pp. 3117, 3119, Domsdorf, E. P. M. W., *Het Verdrag van Almelo* (W.E.J. Tjeenk Willink: Zwolle 1976) p. 18. Additionally, during negotiations the UK had resisted putting a NPT-requirement for supply into the treaty, as it still had a number of bilateral commitments with third states that excluded such a requirement, which the Government had informed Parliament of in its Memoire of Answers ahead of the debate, Tweede Kamer der Staten Generaal, Zitting 1970-1971 – 10469, 10733, Nr. 7, Memorie van Antwoord, p. 4, Domsdorf, E. P. M. W., *Het Verdrag van Almelo* (W.E.J. Tjeenk Willink: Zwolle 1976) p. 29.

1034 Tweede Kamer der Staten Generaal, Zitting 1970-1971, Handelingen Tweede Kamer, 'Deelneming in het aandelenkapitaal van Ultra-Centrifuge Nederland N.V.', 3rd of March 1971, pp. 3117, 3128. The original motion by Van der Stoel/Visser was motion nr. 10, the altered version became motion nr. 12, Domsdorf, E. P. M. W., *Het Verdrag van Almelo* (W.E.J. Tjeenk Willink: Zwolle 1976) pp. 17-18.

1035 Tweede Kamer der Staten Generaal, Zitting 1970-1971, Handelingen Tweede Kamer, 'Deelneming in het aandelenkapitaal van Ultra-Centrifuge Nederland N.V.', 3rd of March 1971, pp. 3092, 3116.

country would violate the export conditions after the fact, it would be the last time the tripartite partnership would export to that country. The Government would not allow export to NPT-countries that had violated the treaty, Minister Luns added.[1036]

Speaking for the Dutch Communist Party (CPN), Representative Wolff contextualized the debate as part of a twelve-year battle against attempts to drag the Netherlands into the nuclear arms race, bringing a European nuclear force closer and aiding the 'capitalistic competition' that would 'deepen the disharmony within the capitalistic world'.[1037] Wolff characterized the information the Government provided Parliament ahead of the debate as muddled and shady and suggested common cause between Shell and the Government in nuclear matters, the economic drivers of big companies being the main motivation for the ultracentrifuge project.[1038] He continued by accusing the Government of since 1960 obscuring the fact that ultracentrifuge technology could be used for military purposes, something the communists had been able to prove in the face of 'NATO propaganda' and that classification requested by Americans proved this fact[1039] Wolff deplored the absence of ratification of the NPT, the Government instead having given priority to the negotiation of the tripartite agreement. The CPN wanted to reverse that order and wait with ratification of the Almelo Treaty until after the next elections.[1040]

Both Representative Wolff and Representative Goedhart (Groep Goedhart) questioned the stated intention of the Government to reduce its role in the project when industry could take it over, just when profits were about to be made. Wolff added that such an exit would also make the program run out of control, with corporations calling the shots, and questioned the government-made assurances regarding the to-be-established security system within and between the countries and individual companies.[1041] Minister Nelissen responded by explaining that the state would receive dividends from its shares in the companies as well as one-off royalties whenever technology would be sold.[1042]

Wolff objected that the treaty allowed the UK to use a plant partly financed by the Dutch state for enriching uranium that would end up in its military program. Instead, the Government should have sought internationalization outside of NATO, as a step that ought to lead to 'letting go of the NATO-pattern' and pursuing political neutrality.[1043] On this subject he drew attention to a recent *Nucleonics Week* article based on statements made by Prof Kistemaker at a symposium in Leiden (in the Netherlands) that the Americans would join the tripartite collaboration shortly, an assertion which Minister Luns then strongly denied. In responding to the CPN's representative's questions and comments, Minister Luns made a point to categorically reject Mr. Wolff's entire contribution.[1044]

1036 Ibid., pp. 3117, 3119.
1037 Ibid., pp. 3094-3095.
1038 Ibid., pp. 3094-3095.
1039 Ibid., p. 3094.
1040 Ibid., pp. 3095, 3097.
1041 Ibid., pp. 3096, 3115.
1042 Ibid., p. 3126.
1043 Ibid., pp. 3096-3097.
1044 Ibid., pp. 3097, 3120.

Pacifistic Socialist Party Representative Van der Spek questioned the guarantees that WEU Treaty offered to keep the FRG from developing nuclear weapons, a concern his colleague from D66 shared. Minister Luns disagreed with Van der Spek's definition of nuclear weapons; even though the WEU-treaty allowed enrichment above 2.1%, this did not automatically mean such material could be classified a nuclear weapon, he explained.[1045] The PSP representative voiced his disappointment that the export of centrifuge technology wasn't prohibited in the treaty text.[1046] Van der Spek brought up a recent publication by journalist Wim Klinkenberg in which Professor Kistemaker was connected to the Paris-based Cellastic company during WWII, which functioned as a German espionage office. He then tabled a motion to have the Institute for War Documentation (Rijksinstituut voor Oorlogsdocumentatie) make public any documents in its possession relating to this so-called Cellastic affair.[1047]

With regard to the tripartite partnership's relationship with EURATOM, the Christian parties spokesperson Westerterp (KVP) wanted to know if the partnership could attain the status of 'joint enterprise' of EURATOM, seeing that EURATOM itself had on the 17th of December 1970 taken the decision to establish a European enrichment plant.[1048] Could the tripartite plants serve to fulfill this European goal once the UK joined the EC, Westerterp asked. Ministers Luns and Nelissen answered they had every intention of exploring that option.[1049]

Representative Van Rossum (SGP) introduced a new concern, that of knowledge proliferation, made possible through whatever personnel would leave for other jobs after working at the tripartite companies. Minister Luns and Nelissen acknowledged that risk and shared Van Rossum's concern. Legal sanctions were possible on persons staying in the country, but much harder to enact with those that left to go work abroad.[1050]

Both motions, motion nr. 11 by Oele/De Goede and motion nr. 12 by Van der Stoel/Visser, in their altered forms, were passed by the Second Chamber.[1051] It then accepted the proposed laws, with only CSP (Christelijke-Sociale Partij – Christian Social Party) and PSP voting

1045 Ibid., pp. 3097-3098, 3111, 3120.

1046 Ibid., p. 3099.

1047 Ibid., pp. 3100, 3129. The Cellastic-affair was a long-running smear-campaign by Klinkenberg and Communist newspaper *De Waarheid*, aided by P.S.P. Representative Van der Spek. The claim of Kistemaker's collaboration with the nazis has since been thoroughly debunked and was already condemned during the debate by Representative Goedhart, who classified it as Russian propaganda, as well as by authority on WWII Professor de Jong and after an investigation in classified sources by the Parliament's Select Committee on Intelligence and Security Services, which cleared Kistemaker of any wrongdoing during the war, Tweede Kamer der Staten Generaal, Zitting 1970-1971, Handelingen Tweede Kamer, 'Deelneming in het aandelenkapitaal van Ultra-Centrifuge Nederland N.V.', 3rd of March 1971, pp. 3114-3115, Klinkenberg, Wim, *De Ultracentrifuge 1937-1970, Hitlers Bom voor Strauss* (Van Gennep, Amsterdam 1971), 'Klinkenberg herhaalt oude beschuldiging: Kistemaker zou nazi's hebben geholpen met atoombom', in *Leeuwarder Courant*, 3rd of March 1971, p. 7, 'Prof. Kistemaker: ‚Ik heb nooit gewerkt voor NAZI'S', in *Het Vrije Volk*, 3rd of March 1971, pp. 3-4, 'Dossiers over Cellastic bij kamerleden', in *De Tijd*, 17th of April 1971, p. 4, 'Cellastic 1', in *De Tijd,* 23rd of May 1973, p. 3. For a more detailed account of the affair (in Dutch), see Streefland, Abel, *Jaap Kistemaker en uraniumverrijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) pp. 217-226.

1048 Tweede Kamer der Staten Generaal, Zitting 1970-1971, Handelingen Tweede Kamer, 'Deelneming in het aandelenkapitaal van Ultra-Centrifuge Nederland N.V.', 3rd of March 1971, p. 3104.

1049 Ibid., pp. 3104, 3120, 3123.

1050 Ibid., pp. 3105-3106, 3125.

against, on the 9th of March 1971.[1052] Discussion in the First Chamber was uneventful and it also passed the laws, leading to ratification of the Treaty of Almelo by the Netherlands on the 27th of April 1971.[1053] The United Kingdom ratification was deposited on the 26th of March 1971, the West-German Parliament gave its assent to the treaty the following June and it came into force on the 19th of June 1971.[1054] In a written evaluation published in 1976, legal expert Domsdorf LLM considered that 'the construction of treaties and agreements, placed alongside particularly articles I, II, VI and VII of the U.C.-treaty and taken together with the motion Van der Stoel, warrant the conclusion, that misuse of the U.C.-project need not be feared.'[1055]

International Reactions

From the moment tripartite negotiations were made public, it received criticism from a variety of national and international actors, but it also caused shifts in inter-European relations. There was surprisingly little reaction from US officials towards the Troika governments considering that, as Edward Wonder documented based on extensive interviews conducted with US officials from 1974-1975,

> '[i]f the Treaty of Almelo had not violated the letter of the 1961 classification agreement, many in the Atomic Energy Commission and State Department regarded it as a violation of the agreement's spirit.'[1056]

The USSR had voiced its criticism as early as 1969, with the publication *Pravda* calling the tripartite project a violation of both WEU-treaty commitments and NPT commitments.[1057] Shortly after the ratification by the Second Chamber of the Netherlands Parliament, Russian

1051 Tweede Kamer der Staten Generaal, Zitting 1970-1971 – 10469, 10733, 'Gewijzigde motie van de heren Oele en De Goede ter vervanging van die gedrukt onder nr. 9', nr. 11, 3rd of March 1971, Tweede Kamer der Staten Generaal, Zitting 1970-1971, – 10469, 10733, 'Gewijzigde motie van de heren Van der Stoel en Visser ter vervanging van die gedrukt onder nr. 10', nr. 12, 3rd of March 1971.

1052 'Kamer akkoord met project ultracentrifuge', in *Nieuwe Rotterdamse Courant*, 4th of March 1971, pp. 1, 3, 7, 'Kamer akkord met Ultra-centrifuge', in *Limburgs Dagblad*, 10th of March 1971, p. 3.

1053 Eerste Kamer der Staten Generaal, Zitting 1970-1971, Handelingen Eerste Kamer, 'Deelneming in het aandelenkapitaal van „Ultra-Centrifuge Nederland N.V.", 27th of April 1971, pp. 1057-1065.

1054 'Bondsdag keurt ultracentrifugeproject goed', in *De Telegraaf*, 25th of June 1971, p. 9, 'Agreement between the United Kingdom of Great Britain and Northern Ireland the Federal Republic of Germany and the Kingdom of the Netherlands on Collaboratino in the Development and Exploitation of the Gas Centrifuge Process for producing Enriched Uranium', Almelo, 4 March 1970, Treaty Series No. 69 (1971), Cmnd. 4793 (London: Her Majesty's Stationary Office) p. 1.

1055 Domsdorf, E. P. M. W., *Het Verdrag van Almelo* (W.E.J. Tjeenk Willink: Zwolle 1976) p. 35. Article I sets out the goals of the collaboration; Article II establishes the Joint Committee; Articles VI stipulates non-proliferation commitments, for instance committing the collaboration not to enrich to weaponsgrade uranium for weapons or explosive devices and VII stipulates safeguards obligrations, also with regards to exports, 'Agreement between the United Kingdom of Great Britain and Northern Ireland the Federal Republic of Germany and the Kingdom of the Netherlands on Collaboratino in the Development and Exploitation of the Gas Centrifuge Process for producing Enriched Uranium', Almelo, 4 March 1970, Treaty Series No. 69 (1971), Cmnd. 4793 (London: Her Majesty's Stationary Office) pp. 2-4, 6.

1056 Wonder, Edward, F., *Nuclear Fuel and American Foreign Policy* (Westview Press: Boulder 1977) p. 12.

1057 ´Kernproject krijg Russische kritiek´, in *Nederlands Dagblad*, 8th of February 1969, p. 9.

press-agency Tass cast the decision to ratify the treaty as a result of elite decision-making that had not taken into account the 'rational voices' of the political opposition.[1058] The USSR already had signed an agreement for supply of enriched uranium with a West-German firm in November 1970, conditional on the FRG ratifying the NPT. On March the 15th, 1971 it also agreed to supply France with 80 tonnes of enriched uranium for a new French power-station of American design.[1059]

Late January 1970 the European Commission issued an advice in which it announced it would contact the Netherlands and the FRG to discuss whether the tripartite agreement was in agreement with Dutch and German commitments to the EC. In the advice to the European Council of Ministers the Commission referred to the long-term security of supply of enriched uranium for the community and drew attention to the EC member's commitment to community-based solutions to community problems. Furthermore it wondered if the JC decision structure could lead to discrimination of supply to EURATOM members, which was not allowed under the EURATOM-treaty.[1060] The Dutch and West-Germans issued a response to the advice in which they promised that the tripartite partnership would not detract from their EURATOM commitments. Regarding a possible British JC veto to export to other EURATOM members, the two governments ensured the Commission that the draft-treaty text contained Article X, which the UK had accepted, which stated that their EURATOM-commitments could not be compromised by the tripartite collaboration.[1061] The European Commission subsequently gave its approval to the Treaty of Almelo on the 19th of February 1970.[1062]

United Nations Secretary General Thant reacted in February 1970 to delegations at the Conference on Disarmament (CD) drawing his attention to 'the possible military applications of the gas centrifuge method of producing enriched uranium' leading him to suggest that perhaps the CD had a role to play in 'this area of technological research and development'.[1063] On the same day, the UK delegation at the CD had issued a press release stating that other nuclear technology was just as suitable for military use, that this was why the NPT system was so important, that the tripartite partners had negotiated an agreement using this technology, and that using the IAEA safeguards system was a good way to ensure 'effective verification of … obligations under the treaty'; it would not be effective to duplicate those efforts in the CD. Furthermore, the tripartite partnership itself was supporting 'the cause of

1058 'Kritiek Tass op ultracentrifuge', in *Limburgs Dagblad*, 12th of March 1971, p. 5.

1059 Redeker, J.A., 'The US and European Uranium', *New Scientist and Science Journal*, 12th of August 1971, p. 351, 'Pers-Schouw: Machtsstrijd', in *Nederlands Dagblad*, 20th of March 1971, p. 13.

1060 'Ultracentrifuge-akkoord wellicht in strijd met Euratomverdrag', in *Algemeen Handelsblad*, 29th of January 1970, p. 5, Domsdorf, E. P. M. W., *Het Verdrag van Almelo* (W.E.J. Tjeenk Willink: Zwolle 1976) pp. 21-22.

1061 'Ultracentrifuge-overeenkomst niet in strijd met Euratomverdrag', in *Nieuwe Rotterdamse Courant*, 14th of February, 1970, 'Agreement between the United Kingdom of Great Britain and Northern Ireland the Federal Republic of Germany and the Kingdom of the Netherlands on Collaboratino in the Development and Exploitation of the Gas Centrifuge Process for producing Enriched Uranium', Almelo, 4 March 1970, Treaty Series No. 69 (1971), Cmnd. 4793 (London: Her Majesty's Stationary Office) p. 7.

1062 Domsdorf, E. P. M. W., *Het Verdrag van Almelo* (W.E.J. Tjeenk Willink: Zwolle 1976) p. 22.

1063 Code, Permanente Vertegenwoordiging Geneve Moerel aan Ministerie van Buitenlandse Zaken, 'Uitspraak Thant over implicaties gas-centrifuge-project', 30471, 20th of February 1970, 2.05.273/154.

non-proliferation' as internationalization of the process makes misuse much less likely.[1064] Asked for a comment by the press a few days later, Minister Luns said that Thant '"had not been well informed"' on the matter.[1065]

France, as a member of EURATOM and the EC and with its leadership having enrichment plant ambitions of their own, attempted to create complications by means of considerable diplomatic effort. When tripartite negotiations ensued, there existed a strong German-French collaborative political current that from the French perspective served among other benefits of cooperation (such as the West-German/French Airbus program), to exclude the UK from European projects and maintain European neutrality towards the Russians under French leadership as much as possible.

In EURATOM, up to 1969 French officials held unto a narrow nationalistic view of their interests, investing in its Pierrelatte diffusion plant that served its nuclear weapons program but rejecting EURATOM initiatives and refusing to share its diffusion technology. EURATOM had finished its last five-year plan in 1967 and its members had since only been able to agree interim-plans on a yearly basis. When France was hit by a financial crunch caused in part by the May-1968 events in Paris, it proposed to cut research funding for EURATOM's research centers in Petten (the Netherlands) and Ispra (Italy), triggering a political fight over the budget of all EURATOM's research centers.[1066]

Under pressure from initiatives by other members in the WEU following French rejection of British membership of the EEC (as an international forum once again relevant because the UK was member of the WEU, leading France to boycott its meetings), the positive development of the tripartite partnership negotiations as well as financial markets abandoning the French franc and buying the West-German mark, President De Gaulle of France signalled his willingness to open discussions with the FRG to expand the membership of the EEC, during summit talks between him and FRG's Chancellor Kiesinger.[1067]

The French leadership had a strong dislike, and were even '"angry"' about the tripartite project because of West-German participation and its competition to the French enrichment plans; mere days after the Franco-German summit, De Gaulle had the President of the National

1064 Ibid.

1065 Telex, Ministerie van Buitenlandse Zaken Celer aan Permanente Vertegenwoordiging Verenigde Naties in New York, 'Ultracentrifuge-project', 619.414, 26th of February 1970, 2.05.273/154.

1066 'Buitenlands Overzicht: France taktiek in W.E.U.', in *Nederlands Dagblad*, 20th of October 1968, p. 2, 'Crisis in Euratom: Kernontwikkeling naar tweede fase', in *Nederlands Dagblad*, 20th of December 1968, p. 2, 'Tegenover Kiesinger: De Gaulle herhaalt groot Europa-plan', in *Algemeen Handelsblad*, 15th of March 1969, p. 5, 'Euratom', in *Algemeen Handelsblad*, 29th of October 1969, p. 4, Van der Putten, 'Manoeuvres van Pompidou', in *De Tijd*, 22th of November 1969, p. 5.

1067 'In Gesprek met Kiesinger: De Gaulle houdt vast aan boycot van WEU, blijvende reserve tegenover Engeland', in *De Tijd*, 14th of March 1969, p. 5, 'Tegenover Kiesinger: De Gaulle herhaalt groot Europa-plan', in *Algemeen Handelsblad*, 15th of March 1969, p. 5. The French were not just under pressure by events, but also politically by a newly confident West-Germany. On the same day as the start of a summit between French and West German leaders in Paris, the West-German Minister of Finance Strauss called for a 'radical re-assessment' of European leadership, pointing out that now France needed West-German (financial) help, and so did the rest of Europe, 'Franz-Josef Strauss: Tijd is rijp voor Duits leiderschap in West-Europa', in *De Tijd*, 14th of March 1969, p. 3.

Assembly deliver an oral message to President Nixon communicating his concerns and calling it a '"devious game"' between the British and West Germans, pointing to proliferation risks with regards to the FRG.[1068] The Nixon administration instead saw the collaboration as a safeguard against proliferation as it would avoid a West-German national enrichment project (and favored British closeness to Europe) and told the French they could not interfere. President De Gaulle again voiced French concerns over German ambitions and what in the French historical experience history had shown it could lead to, when he met President Nixon at President Eisenhower's funeral later the same month. The tripartite collaboration could bring West Germany closer to a nuclear weapon capability, a scenario France was determined to avoid. More French inquiries followed and led the White House to put out a statement to guide the administration's policy of non-opposition to the project. Subsequent complaints by the French Atomic Energy Commission to its American counterpart the AEC did not yield results, with Chairnman Seaborg taking the White House directed line.[1069]

The period was a reflection of a shifting balance of power within the EC, the FRG made assertive by domestic political pressures and the political isolation and financial vulnerability of France. The West-Germans now made work of their wish to have the UK join the European project (formally promising British PM Wilson to back its candidacy to the EEC) while rejecting French wishes to weaken the EC into a 'loose free trade association' and form a European defense system outside of NATO.[1070] Following General De Gaulle's electoral defeat in 1969 President Pompidou, who had run on a pro-Europe platform and inherited a politically less prominent country, negotiated British support for the French wish for the protectionist subsidizing of the common EC agricultural market, in exchange for France giving up its refusal to initiate EEC accession talks for the UK, Denmark, Norway and Ireland.[1071] France still undermined the EURATOM Supply Agency however, when following its circumvention of the agency in concluding an uranium deal with South Africa it interpreted the member state's requirement to go through the agency as void since the Council of Ministers had failed to reinforce the stipulations under Chapter VI of the EURATOM treaty in 1964, after the initial seven year period of the program. The French announced their above-mentioned deal with the USSR days after the European Commission decided to challenge this French interpretation and consult the European Court of Justice, which ruled in the Commission's favor in December 1971.[1072]

1068 Burr, William, 'To "Keep the Genie Bottled Up": U.S. Diplomacy, Nuclear Proliferation, and Gas Centrifuge Technology, 1962, 1972', in *Journal of Cold War Studies*, Vol. 19, No. 2 (Spring 2017) p. 140.
1069 Ibid., pp. 141-142.
1070 Van der Putten, Jan, 'Vriendschap bekoeld', in *De Tijd*, 14th of March 1969, p. 5.
1071 The British had only wanted to accept a weaker common agricultural policy before, one that individual members could opt out of, 'Buitenlands Overzicht: Verdeeldheid bij de „vijf", in *Gereformeerd Gezinsblad*, 12th of December 1967, p. 2, Van der Putten, Jan, 'Manoeuvres van Pompidou', *De Tijd*, 22th of November 1969, p. 5.
1072 Domsdorf, E. P. M. W., *Het Verdrag van Almelo* (W.E.J. Tjeenk Willink: Zwolle 1976) pp. 27-28.

French and American Diffusion Initiatives

In February 1971, 'France announced its readiness to make its gaseous diffusion uranium enrichment technology available to other nations prepared to join France in building a European enrichment plant. The same month the US Nixon administration did the same in its Multilateralization Initiative, although the latter was so ill-conceived that it did more to stimulate foreign enrichment initiatives than offer an alternative to them, which had been one of its intentions.[1073] The American initiative excluded the possibility of using centrifuge technology in a multilateral project even though American private industry had previously gained access to that technology[1074] and European countries were particularly interested in it;

> '… the administration could not, without appearing deceitful, state that its centrifuge technology was in such a low stage of development as to be of no interest abroad and in almost the same breath open both areas to domestic firms which, as the next year would show, considered the centrifuge very interesting indeed. The exclusion of the centrifuge made the proposal a "nonstarter." It was out of tune with foreign technological realities.[1075]

The US proposal's restrictive terms with regards to technological sharing were inspired by a protectionist and commercially minded AEC. Partners in a multilateral enrichment project would only know what they 'bought' after they had firmly committed to the project, even though the AEC would 'find out' about all the European technologies contributed to the multilateral plant before that moment, whether this was British or French diffusion technology or 'European' (Troika) centrifuge technology, or both (as some European plans contemplated a dual-technology plant at this time).[1076] Furthermore, such a multilateral plant in Europe would be kept from taking over any exiting US market share, even that which had been contracted by participating European countries' utilities. Edward Wonder thus described an AEC perspective that at least in part seems to have been out of touch with realities of developments in Europe, whereas the State Department wanted to use the Multilateralization Initiative to salvage whatever influence it could in the enrichment market, both in terms of market share for the AEC Production Division and US political influence over prospective US-European multilateral plants.[1077] The terms of the 1971 proposal were negotiable, stated the US, but unsurprisingly no European country showed any interest. Instead, the initiative reinforced the negative perception among European countries that the US was only out to maintain and shore up its hegemony in technology and the European enrichment market.[1078] Tellingly, the

1073 Redeker, J.A., 'The US and European Uranium', in *New Scientist and Science Journal*, 12th of August 1971, p. 351, Wonder, Edward, F., *Nuclear Fuel and American Foreign Policy* (Westview Press: Boulder 1977) pp. 14-16, 23. First conceiving the AEC proposal in 1969, the stated purpose was to '"deflect … major investments in gas centrifuge facilities" by sharing gaseous diffusion technology, an area in which Washington had distinct advantages.', Burr, William, 'To "Keep the Genie Bottled Up": U.S. Diplomacy, Nuclear Proliferation, and Gas Centrifuge Technology, 1962, 1972', in *Journal of Cold War Studies*, Vol. 19, No. 2 (Spring 2017) p. 149.

1074 Finney, John, W., 'Tighter Secrecy for Uranium Process', in *The New York Times*, 28th of June 1964, p. 42.

1075 Wonder, Edward, F., *Nuclear Fuel and American Foreign Policy* (Westview Press: Boulder 1977) p. 13.

1076 Ibid., pp. 17, 22-23.

1077 Ibid., pp. 16-17.

1078 Research by William Burr has shown that this was exactly what the AEC's Chairman Seaborg had in mind, hoping that a sharing deal with the Europeans would delay the tripartite project by five to ten years and

November 1971 conference in Washington during which clarifications on the conditions of the proposed initiative were offered to foreign interested parties was dubbed by one European representative 'the “Subterfuge Conference”', '[attesting] to the damage done.'[1079]

Other American policies during this period, such as Nixon's directive to his Treasury Secretary Connally (on the advice of the latter) to release the dollar from the gold-standard in 1971, causing 'the Connally shocks', and 'ill-conceived initiatives [such] as (1) the Access permit Program of 1973, which allowed American commercial firms direct access to technology classified by the Atomic Energy Commission, but denied such information to the European and Japanese firms, and (2) the Atomic Energy Commission's revised contract policy of September 1973, which increased the lead time for ordering AEC-enriched uranium to such an extent that allied investors were forced to commit themselves to buying uranium for reactor projects that had not yet been approved' greatly alarmed the US allies and to them 'represented an attempt by the United States to dominate the enriched uranium market of the 1980ss', causing 'both Urenco and Eurodif [to redouble] their efforts to acquire new enrichment capacity.'[1080] Reviving the 1971 proposal in March 1974 in general terms and this time including an offer of centrifuge technology, the Nixon administration therefore found itself confronted with continued disinterest from its European allies, most by now occupied with the challenging task of setting up their own multinational ventures (Urenco and Eurodif) and '[t]he disruptive potential of new negotiations at this juncture [leading] European enrichers to suspect the United States might indeed want to cause such disruption.'[1081]

A joint European study for Eurodif was announced on the 3rd of March 1972 for the construction of a European plant based on French diffusion technology that included participation of the tripartite countries as well as France, Italy, and Belgium. Continued American refusals to share its diffusion technology on equal terms, the maturity of the French technology and some delays in anticipated production of the tripartite plants rationalized the decision for this initiative.[1082] Spain and Sweden joined the collaboration and in May 1973 the tripartite countries withdrew. Developments were accelerated in late 1973 following the AEC enriched uranium price-hike to over $ 38/SWU combined with mandatory paid-up-front

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'“preserve our market as long as possible”', Burr, William, 'To “Keep the Genie Bottled Up”: U.S. Diplomacy, Nuclear Proliferation, and Gas Centrifuge Technology, 1962, 1972', in *Journal of Cold War Studies*, Vol. 19, No. 2 (Spring 2017) p. 150, Wonder, Edward, F., *Nuclear Fuel and American Foreign Policy* (Westview Press: Boulder 1977) pp. 23-25.

1079 Wonder, Edward, F., *Nuclear Fuel and American Foreign Policy* (Westview Press: Boulder 1977) p. 24.

1080 Ebinger, Charles, K., *The Washington Papers Vol. VI: International Politics of Nuclear Energy* (The Center for Strategic and International Studies: Sage Publications, Beverly Hills & London 1978) pp. 39-41.

1081 Wonder, Edward, F., *Nuclear Fuel and American Foreign Policy* (Westview Press: Boulder 1977) pp. 44-45, 52. At this time, the AEC still exhibited its protectionist pre-occupation. As Wonder writes, '[t]he AEC hoped to retain 60 percent of the foreign enrichment market. Justifying a decline in the share of what the AEC considered dubious foreign policy reasons was a very difficult task for those supporting international collaboration. At the same time, escaping the political leverage that market dominance was supposed to provide was one of the principle reasons propping up foreign project's rationales. The tension between multilateralization and market dominance had fundamental policy ramifications, as the AEC successfully compromised the meaning of multilateralization to minimize its impact on market dominance.', Wonder, Edward, F., *Nuclear Fuel and American Foreign Policy* (Westview Press: Boulder 1977) p. 50.

1082 'Europees project uraniumverrijking door gasdiffusie', in *NRC Handelsblad*, 3rd of March 1972, p. 11.

contracts with 10-year lead times for foreign clients, when the OPEC oil cartel announced its intention to impose a 100% price-hike on its consumers ahead of its 8 October meeting with the major oil companies and after things really escalated during the second week of the Yom Kippur War (with the Netherlands the only European country particularly singled out for its pro-Israel stance).[1083] The tripartite partners invited France to join the project and establish a centrifuge plant in France in November 1973, an offer that was generally perceived more as a tactical move rather than a serious offer. In reaction and almost simultaneously, France announced its intention to use its diffusion technology to build a 9 million SWU capacity plant, alone if need be but inviting other countries to join, which the remaining four members of Eurodif did.[1084]

1083 Kenward, Michael, 'Nuclear Establishment at the Watershed?', in *New Scientist*, 8th of March 1973, p. 539, 'Gemeenschappelijke energiepolitiek dringend gewenst: Europa bouwt een nucleaire boterberg', in *De Tijd*, 28th of December 1973, p. 4, 'Bedrijfsleven: Kernenergie', in *Limburg Dagblad*, 10th of May 1973, p. 7, 'EG steekt Amerikaans uraniumbeleid loef af', in *NRC Handelsblad*, 15th of June 1973, p. 9, Hellema, Duco, Wiebes, Cees, Witte, Toby, *The Netherlands and the Oil Crisis: Business as Usual* (Amsterdam University Press: Amsterdam 2004) pp. 46, 58-62

1084 'Franse steun voor ultracentrifuge?', in *Nederlands Dagblad*, 23th of November 1973, p. 3, 'Fransen worden concurrent van ultracentrifuge', in *NRC Handelsblad*, 24th of November 1973, p. 15. Sweden would leave Eurodif in 1974, with Iran taking over its share through an alternative construction negotiated with France in 1975.

Chapter 10:

The Uranium Enrichment Company (Urenco)

Activities in the Troika were split up between the Centec and Urenco companies; Centec was the construction company responsible for developing and building production plants and Urenco was responsible for enriched uranium production. Over time these roles were adapted and augmented, eventually leading to a new division of responsibilities that had Centec focusing on technology development (R&D) and developing clients for technology transfers, whereas Urenco focused on 'marketing, contract negotiations and coordination of the uranium production.'[1085] Initial shareholders of Centec were UCN, BNFL and GnV and initial shareholders of Urenco were UCN, BNFL and Uranit.[1086]

'The cooperation as set down in the Almelo Treaty has the explicit purpose of commercial exploitation of the gas-centrifuge process in order to gain and maintain a competitive position towards other suppliers of enriched uranium in the market.' writes Den Haan.[1087]

The Machine and Plant Negotiations and a Short History of R&D and Capacity Build-up

For UCN, Philips N.V .and VMF N.V. would initially be responsible for the construction of centrifuges, for which purpose a construction plant came online in November 1970. Early contacts (1971) with potential customers for enriched uranium showed that the newly established companies needed to demonstrate their capability as soon as possible, with working enrichment plants becoming operational at the earliest possible date. With each country not wanting to give up their machine design in favor of one of the others and the culture of classification still bearing out on the collaboration it was decided to finance and build three separate pilot plants, each operating with their own latest (nationally developed) centrifuges. The Dutch pilot plant would house the segmented aluminum SNOR (Scientific Nuclear Orbital Rotor) machine (with its successor, the Cultivated Nuclear Orbital Rotor - CNOR already in development), the German one using the segmented maraging steel G-2 design and the British one the sub-critical aluminum P1 (later known as LEC) design.[1088]

Perhaps even more than demonstrating their capabilities to potential customers, the partners wanted to show to the others what their machines could do. Centec was made responsible for merging the technologies of the three shareholders and subsequently design and construct

1085 Den Haan, Frederik, M., *De Urenco-kwestie: De leverantie van verrijkt uranium aan Brazilië* (Instituut voor Internationale Studiën – Rijksuniversiteit Leiden: Leiden 1985) p. 7.

1086 Kistemaker, J., *De Geschidenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991) p. 29, Domsdorf, E. P. M. W., *Het Verdrag van Almelo* (W.E.J. Tjeenk Willink: Zwolle 1976) p. 7.

1087 Den Haan, Frederik, M., *De Urenco-kwestie: De leverantie van verrijkt uranium aan Brazilië* (Instituut voor Internationale Studiën – Rijksuniversiteit Leiden: Leiden 1985) p.7.

1088 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002), pp. 54, 56, 60, Kistemaker, J., *De Geschidenis van het Nederlandse Centrifuge Project: Hoe een Nieuwe Industrie Ontstond* (FOM-Instituut voor Atoom- en Molecuulfysica: 1991) p. 29

plants for Urenco to utilize the merged technology.[1089] The pooling of technical papers started in August 1971, a process which was carefully managed and could be cast as a trust-building exercise; first the national histories of development but omitting technical details were shared, then the next four papers in mid-September, followed by the remaining papers a few weeks later. Two series of future centrifuge plants were planned, the 'Series A' incorporating the best of each existing centrifuge design and the 'Series B' utilizing 'more advanced centrifuge concepts'.[1090]

By mid-1972,

> 'working groups and committees, and also the Urenco board and the Centec [board], were coming to the conclusion that the G-2 centrifuge would be the best choice for use in an early plant. …. However the board was reluctant to rely upon that machine alone and decided to back the British P1 centrifuge as a sub-critical option.'[1091]

Early operational problems included the challenge of making personnel from the national companies available to the tripartite companies, delays caused by common decision-making (while the national companies were still committed to the national projects, the pilot plants) and the early cross-national use of technical data from the national pilot plants. Each national program was researching successor centrifuges and delayed decisions on final pilot plant planning and construction, hoping to incorporate the latest state of the art of their programs and lessons learned from the other two programs. Following the choice for the G-2 and P1, the Dutch centrifuge construction plant had to be altered to accommodate the MAN's know-how and manufacturing process, since it would have to build G-2 machines for the next plant or go out of commission, its personnel sent home to their parent companies.[1092]

In March 1973 a decision was made to stick to two locations, Almelo and Capenhurst, for the construction of two 200t/SWU/a demonstration plants. This was done partly for strategic reasons as well as to retain jobs at both locations. Almelo would employ the G-2 centrifuge, Capenhurst the LEC design, leaving UCN Director Bogaardt, who had pushed for the now completed CNOR design, disappointed but determined; his centrifuge research team continued work on the 6M and later the SLM designs. UCN negotiated compensation in exchange for its acceptance of the two plant program, including financial compensation for retooling its construction plant, full access to MAN's and Uranit's relevant technology and the commission for construction of half the centrifuges for the new plant in Almelo, safeguarding the share envisioned for Dutch industry.[1093]

1089 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002), p. 54.

1090 Ibid,, pp. 51-52.

1091 Ibid., p. 56.

1092 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002), pp. 52-53, 56-57, 59. For example, a Dutch newspaper reported in January 1973 that while the Dutch pilot plant was the first in operation, the German machine was delayed but thought to be superior but the Germans still wanted to incorporate some of the stronger points of the Dutch machine in their design, 'Nederland verrijkt uranium', in *NRC Handelsblad*, 26th of January 1973, p. 1.

1093 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002), pp. 60, 69.

Leading up to and surrounding the decision and subsequent planning of the two 200 t/SWU/a plants, the decision-making and legal structure of Centec and Urenco came under scrutiny when particularly the German side did not deem Centec fit to tackle the plant construction and associated challenges. The structure was overhauled, placing one managing director and management team in charge of both companies and one central company (Urenco) holding all the technology. This overhaul triggered another reorganization towards decentralization, with the shareholding companies seizing back control, proposed and accepted by the Joint Committee in September 1974. From now on, Urenco would become a 'marketing body', with responsibility for the 'specification, purchasing, ownership and operation of the centrifuge plants' falling to the shareholder companies; Centec lost its intended function as 'designer and constructor of centrifuge enrichment plants' and became responsible for the industrial and licensing rights of the company and retained responsibility for the joint R&D program.[1094]

The decentralization allowed the national centrifuge research programs and construction plants to continue side-by-side. Centrifuges for the E21 Capenhurst 200 t/SWU/a plant were constructed on site, centrifuges for the B21 (later designated SP3, with SP1 and SP2 being the Dutch and German pilot plants respectively) 200 t/SWU/a plant in Almelo were constructed in both the Dutch-operated Centrifuge Fabriek (Centrifuge Factory) on site as well as at MAN in Munich.

By 1975, The British program, with MAN assisting, was developing the 3LC design. The Germans were improving their G-2 design in their G-3 and G-4 series and UCN was testing its 4M design. The Dutch and German programs had committed to a program of further integration of design and Centec was pushed to initiate a long-term research program covering 'longer term' aspects of centrifuge research than accounted for in the individual shareholders programs.[1095]

At the end of 1976, having completed the pilot plant phase with Urenco's capacity totaling 450 t/SWU/a, UCN and Uranit jointly undertook the design and construction of the industrial-scale SP4 (also dubbed FP-1) plant of around 1000 t/SWU/a. The decision on a centrifuge design still proved contentious with UCN defending its developed metal-rotored 4M and future 6M designs and Uranit in the process of proving the G-3, qualifying the G3S and nearing completion of the design of the G-4. Eventually it was decided that initial tranches of centrifuges in SP3 would be both 4M and G-3 with the British employing the 3LC design in what would become the parallel E22 plant in Capenhurst. By 1980, the matter of a single Urenco centrifuge was still unresolved, now with the Dutch lobbying for their successor of the 4M, the SLM (now designated TC-10, having skipped over the 6M and with a 75% higher separating capability than its predecessor) that still employed a metal rotor, with the Germans and British having intensified their cooperation in segmented all-carbon composite rotors. The current German machine (the long GS4) led to an even longer design in 1981, dubbed the TC-11, which the British came to see as possible successor of their own 3LC, leading Uranit and

1094 Ibid., pp. 62-65, 68-69, 74. Another major restructuring took place during 1990-1993, outside the scope of this research; for more information see Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002), Chapter 11 (pp. 147-158).
1095 Ibid., pp. 88-89.

BNFL to further intensify collaboration on the design and testing of this machine into 1983. During this period, the new director of UCN Hootsmans gave up the now isolated line of Dutch R&D (as the Dutch TC-14 model was being qualified) and agreed to have the TC-11 be used to add all new capacity in the late 1980s and the future TC-X/TC-12 design serve as the common tripartite design going forward into the 1990s.[1096]

Commercial Development and Signing Clients

Commonly enrichment of uranium is marketed as a service contract, in which the client purchases natural or depleted uranium ('tails' from an earlier enrichment process) which it supplies to an enrichment company for enrichment. The owner of the uranium does not change; merely the service of enrichment of a client's uranium is contracted. Other type of contracts can include the supply of natural uranium feed.

At the start of the 1970s, the world nuclear fuel market was effectively divided along Cold War lines; the USSR provided the Eastern bloc countries and others in its sphere of influence with enriched uranium and took spent fuel back from them. The US had a near-monopoly of supply to the rest of world, although it's relationships with its clients were sometimes slightly less-straightforward in that its client's were more assertive than the USSR's in how they wished to purpose the materials they purchased from the US, for example to designate spent fuel for their planned reprocessing programs. The US also did not provide a spent fuel take-back option.[1097]

To diversify supply, as early as 1970 the USSR's enrichment company Techsnabexport (TENEX) had successfully entered the Western enrichment market by contracting 'considerable quantities of enrichment services to be delivered between 1974 and 1990' to a number of European countries; mainly those anticipating the production of Urenco and Eurodif in which they were participants (the FRG, UK for Urenco, Sweden, Spain, France, Belgium and Italy for Eurodif) as well as Austria and Finland.[1098] By 1975, already 8.8% of Europe's enrichment needs were supplied from the USSR.[1099]

1096 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002), pp. 89-90, 113-114, *Verslag over het Jaar 1983,* Ultra-Centrifuge Nederland N.V. (UCN NV: Almelo) p. 12, *Verslag over het Jaar 1984,* Ultra-Centrifuge Nederland N.V. (UCN NV: Almelo) p. 11, *Verslag over het Jaar 1985,* Ultra-Centrifuge Nederland N.V. (UCN NV: Almelo) pp. 9-10, Tweede Kamer der Staten Generaal, Zitting 1977-1978 – 14261, 'Ultracentrifuge-project', Nr. 4, Lijst van feitelijke vragen, p. 4, Tweede Kamer der Staten Generaal, Zitting 1977-1978 – 14261, 'Ultracentrifuge-project', Nr. 6, Antwoorden op schriftelijke vragen, pp. 4-5.

1097 And thus, nuclear association contracts were also an expression of the Cold War spheres of influence, with a supply of technology and material in exchange for some level of political and/or economic allegiance. France also had a spent fuel take-back arrangement attached to the reactor it supplied to Spain, from 1972 on, Albright, David, Berkhout, Frans, Walker, William, *World Inventory of Plutonium and Highly Enriched Uranium 1992* (Oxford University Press for Stockholm International Peace Research Institute: Oxford 1993) pp. 85-88.

1098 Neff, Thomas, L., Jacoby, Henry, D., *Nuclear Fuel Assurance: Origins, Trends, and Policy Issues*, M.I.T. Energy Laboratory Report No. MIT-EL 79-003, February 1979, p. 43.

1099 Bannink, Dirk, Diehl, Peter, *Uranium Mining and (In)transparency: Urenco's Role in the Nuclear Fuel Chain* (World Information Service on Energy: Amsterdam 2014) p. 13.

During the middle 1970s,

> '[t]he decisions to create both URENCO, the British-Dutch-German enrichment venture, and Eurodif, the French-run enrichment partnership, were validated by U.S. difficulties in meeting contractual obligations to supply LEU fuel.'[1100]

These were partly caused by Westinghouse selling more uranium along its reactor contracts than it had contracts for with primary producers of enriched uranium[1101] and so,

> '[i]n June 1974, the U.S. Atomic Energy Commission (AEC) "closed the books" on enrichment and made some existing contracts "conditional," as it discovered U.S. enrichment capacity would not be able to meet demand. Reportedly, the AEC even returned checks for services. One year later, reorganization of the AEC into the Nuclear Regulatory Commission and the Energy Research and Development Administration (ERDA) threw U.S. nuclear exports into a tailspin. The United States did not export any LEU for nine months while the NRC and ERDA sorted out their responsibilities and regulations.'[1102]

For four years following the order stop, the US did not accept new orders for enrichment services.[1103] In this climate of uncertainty around the Western world's largest supplier of enrichment services, Urenco's commercial operation started approaching and contracting interested parties.

Association for Centrifuge Enrichment

As soon as the tripartite negotiations were first made public, considerable attention from other countries was garnered, many of which approached the Troika. While Urenco and Centec did not want to alienate potential future partners and customers, the startup of the two companies was sufficiently challenging to initially want to keep 'fourth countries' at an arm-length during this phase. To keep those countries informed and involved while the tripartite partners worked out their start-up problems, the Association for Centrifuge Enrichment (ACE) was established as a parallel to the Eurodif study group (see previous chapter, page 279).[1104]

1100 Squassoni, Sharon, 'Looking Back: The 1978 Nuclear Nonproliferation Act', in *Arms Control Today*, Vol. 38 (December 2008) https://www.armscontrol.org/print/3470, website checked 7-4-2017.

1101 Neff, Thomas, L., Jacoby, Henry, D., *Nuclear Fuel Assurance: Origins, Trends, and Policy Issues*, M.I.T. Energy Laboratory Report No. MIT-EL 79-003, February 1979, p. 43.

1102 Squassoni, Sharon, 'Looking Back: The 1978 Nuclear Nonproliferation Act', in *Arms Control Today*, Vol. 38 (December 2008) https://www.armscontrol.org/print/3470, website checked 7-4-2017.

1103 Bannink, Dirk, Diehl, Peter, *Uranium Mining and (In)transparency: Urenco's Role in the Nuclear Fuel Chain* (World Information Service on Energy: Amsterdam 2014) p. 13. The supply insecurity caused by US policies during this period were compounding upon by its adoption of the NNPA (see *The 1978 Nuclear Non-Proliferation Act*, page 341).

1104 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) pp. 177-178.

A number of national nuclear energy companies, organizations, research centers, private nuclear companies and banks joined ACE, which held its first meeting on the 1st of June 1973 and held a total of six meetings over the next year, culminating in group visits to the pilot plants in Almelo and Capenhurst. National nuclear energy organizations from Italy, Belgium, Sweden, Spain and France joined to learn more about and keep abreast of developments in the centrifuge field, even though they would commit to Eurodif's plans not much later. Australia's AAEC (Australian Atomic Energy Commission) already had a well-developed centrifuge program of its own and had made inquiries with the tripartite countries during 1970-1972 and so immediately joined when ACE was announced. Canadian companies Eldorado Nuclear and Brinco joined, as well as Japan's Enrichment Survey Committee. A number of British and Dutch banks interested in the business of financing future centrifuge plants joined, which led to several of them being involved in the financing of investments in Troika plants later on. A preliminary ACE meeting in March 1973 was also attended by representatives of General Electric, but that company was not allowed by its government to join the ACE amid fears its executives might inadvertently share classified information. Brazil's Commissao Nacional de Energia Nuclear (CNEN) joined ACE meeting series near its conclusion.[1105]

In these ACE Phase-I meetings, '[f]inding the right balance of information to help the participants to form their own judgments about centrifuge technology, engineering and costs was difficult' as they were not authorized to receive classified information and Urenco was reluctant to give up too much details on costs to its potential future customers.[1106] Phase-II individual meetings under stricter conditions and government approval could give those with serious interest in joining the company a deeper understanding with access to sensitive information but none of the participants pursued this option. Nonetheless, the meetings were very useful for Urenco's future activities in the ACE participant's countries and its participants understanding of the subject matter. In August 1974, the organization was disbanded.[1107]

Urenco's first contract was finalized with the Gemeenschappelijke Kernenergie Centrale Nederland NV (GKN NV) for a 9 tSW (27 TeSW) supply to the Dodewaard reactor in the Netherlands, signed in 1974, the first delivery for this contract to take place in 1975. The first delivery of enriched uranium was to the UKAEA, for use in the SGHW reactor in Winfrith.[1108] Two additional contracts were signed in 1974, one for the Isar-2 reactor (with Nordwestdeutsche Kraftwerke - NWK) and one for the planned Wyhl reactor (with Energie-Versorgung Schwaben (EVS) and Badenwerk) which was later canceled. Negotiations were ongoing with several other utilities in the tripartite countries and outside the treaty area, discussions were started with Swiss and US utilities and Nuclébras (the Brazilian atomic

1105 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) pp. 178-182, Tweede Kamer der Staten Generaal, Zitting 1977-1978, 14261, nr. 4, 'Ultracentrifuge-project', Lijst van feitelijke vragen, zie ook stuk nr. 3, p. 3, Tweede Kamer der Staten Generaal, Zitting 1977-1978 – 14261, 'Ultracentrifuge-project', Nr. 6, Antwoorden op schriftelijke vragen, pp. 4-5.

1106 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 183.

1107 Ibid.

1108 *Urenco 20 Years* (Urenco Ltd, Marlow) corporate brochure p. 13, Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002), pp. 75, 85, 'Urenco levert verrijkt uranium', in *De Ingenieur*, Vol. 88, No. 13, 25th of March 1976.

energy commission, see *Case Brazil* below) and an exploratory Urenco mission was sent to the major Japanese utilities, with many potential clients eager to explore an opportunity to diversify their supplies away from the AEC. A contract for the Carnsore Point reactor was agreed upon with the Electricity Supply-Board of Ireland and signed in 1975.

Not all letters of intentions and contracts led to actual business because of reactor cancellations and delays; the Carnsore Point contract was canceled, after an extension, triggered by public pressure following the rising levels of radioactivity in the Irish Sea caused by BNFL's Sellafield reprocessing plant. Marketing efforts also suffered from the unproven status of Urenco. However, '[b]y the end of 1975 substantial contracts had been signed with major utilities in the United Kingdom and the Federal Republic of Germany which laid the foundation for Urenco's commercial operation.'[1109]

From 1977 onward and after the demonstration plants came on line, VDEW's (Verband der Elektrizitätswirtschaft e. V., the organization of German electricity utilities) recognized the value of supporting Urenco and exchanged some of its AEC contracts for Troika ones in 1978, helping Urenco's further consolidate its domestic market share.[1110] In its report on the years 1975-1979, UCN reported Urenco Ltd. had contracted commitments for 2000 t/SW at a value of six billion guilders ($ 3.17 billion), boasting that it had been the only enrichment company worldwide that had signed new contracts during this period.[1111]

1109 *Urenco 20 Years* (Urenco Ltd, Marlow) corporate brochure p. 13, Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002), pp. 75-76, 83-84, 115.
1110 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002), pp. 93, 95-96, 98.
1111 *Verslag over de Jaren 1975 tot en met 1979,* Ultra-Centrifuge Nederland N.V. (UCN NV: Almelo) pp. 9, 20, 'Netherlands – Spot Exchange Rate, Guilders/US$', 1st of January 1980, Historical Data, H.10 Foreign Exchange Rates, Federal Reserve Statistical Release (United States Federal Reserve Bank) https://www.federalreserve.gov/releases/H10/hist/dat89_ne.txt, website checked 30-7-2018.

Table 1:

Urenco estimation of its contractual obligations as of November 1977[1112]

Table I

Urenco Supply Commitments
(te SW at tails 0,25% U-235)

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Dodewaard GKN-D	10	10	10	10	10					
CEGB/FC 1				151	201	201	201	220	226	226
SSEB/FC 1				72	96	96	96	96	96	96
KRB II B						215	150	115	140	140
KRB II C							215	150	115	140
Nuclebras					223	223	223	207	223	223
Projects: (								75	225	-
BAG 82; KBR; KWB (									75	225
										75
Biblis C; (										140
RWE 82 A (										
RWE 83 B; (										
84 A; (										
84 B (										
CEGB/FC2					75	175	275	375	400	400
VDEW: Requirement contracts for German reactors (1200 and 800MW)						125	205	205	205	205
Total	10	10	10	233	605	1035	1365	1443	1705	1870

In 1977, Urenco contracted Myron Kratzer, former head of the nuclear energy office at the State Department and partner in the International Energy Associates consultancy, to advise the company on making inroads in the US market.[1113] In 1980, the company developed contacts in Mexico, the US, South Korea, Yugoslavia, continued to explore opportunities in Japan and Australia's UEGA (Uranium Enrichment Group of Australia) approached Urenco to discuss the possibility of building an enrichment plant in that country. Its order portfolio consisted 50% of West German, 34% of British, 16% of Brazilian and 0.2% of Dutch utilities with Urenco's market-share in the FRG at about 35%.[1114]

The Swiss utility NOK (Nordostschweizerische Kraftwerke), frustrated with AEC's restrictions that kept it from reprocessing its spent fuel, contracted with Urenco in 1981 for the Beznau-2 reactor.[1115] Around this time,

1112 Letter, Chairman Urenco UK P. Jelinek-Fink to Atomic Energy Division, Department of Energy C. Herzig, 30th of December 1977, including paper 'Urenco contractual commitments and the need for decisions', (n.d., est. end of November 1977), 2.03.01/10859, p. 7.

1113 Fishlock, David, 'Urenco bids for U.S. enrichment market', in *The Financial Times*, 7th of July, 1977.

1114 *Jaarverslag 1980*, Ultra-Centrifuge Nederland N.V. (UCN NV: Almelo) pp. 7-8. See *Urenco and Australia*, page 376; *Urenco and Japan*, page 406, *Urenco and Yugoslavia*, page 424;*Case: Mexico*, page 436.

1115 *Jaarverslag 1981*, Ultra-Centrifuge Nederland N.V. (UCN NV: Almelo) p. 7, Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002), p. 116.

'[t]he company had major contracts with the CEGB and SSEB in the UK, and in Germany with RWE, BAG, NWK, Preussenelecktra, and Kernkraft Philippsburg for its nuclear unit-1, which together amounted to about 80% of its delivery commitments in the 1980s. In 1983 a further Dutch contract was added, namely with PZEM for the 400MW PWR at Borssele'[1116]

From 1983-1986, Urenco secured contracts in the US (Boston Electric Company for the Pilgrim-1 reactor and with the utility company SMUD for a reactor in Sacramento, CA), Sweden (with the Swedish State Power Board or Vattenfall and OKG - Oskarshamns Kraftgrupp), Switzerland (with NOK, for 100% of Beznau-1) and in the FRG (with Gemeinschaftkernkraftwerk Neckar (GKN) for its GKN-1 reactor and with Vereinigte Elektrizitätswerke Westfalen (VEW) for its Emsland reactor).[1117] The entrance into the US market was partly stimulated by a recent change in AEC contract policy, which under a longer term 'Utility Services Contract' allowed client utilities to contract up to 30% of their needs elsewhere, in an attempted assault on the secondary and cheaper enrichment market that had come into existence.[1118] In its yearly report of 1985, UCN reported Urenco's order portfolio to have grown to about 10 billion guilders ($ 3.64 billion).[1119]

The Joint Committee

Article II of the Almelo Treaty specifies the constitution and general responsibilities of the Joint Committee. The members of the Joint Committee, one from each country (although advisors can accompany a representative in JC meetings) each holds one vote and all votes need to be unanimous, with the chairmanship rotating each year (clauses 2 and 3). As to the responsibilities of the JC, the first part of clause 5 of Article II states that,

'(5) The Joint Committee shall:

1116 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002), p. 116. CEGB stands for Central Electricity Generating Board, SSEB for South of Scotland Electricity Board, RWE for Rheinisch-Westfälisches Elektrizitätswerk AG, BAG for Bayernwerk AG and PZEM for Provinciale Zeeuwse Energie Maatschappij. See also *Verslag over het Jaar 1983,* Ultra-Centrifuge Nederland N.V. (UCN NV: Almelo) p. 7.

1117 *Urenco 20 Years* (Urenco Ltd, Marlow) corporate brochure p. 13, Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002), pp. 116, 122-125, *Verslag over het Jaar 1983,* Ultra-Centrifuge Nederland N.V. (UCN NV: Almelo) p. 8, *Verslag over het Jaar 1984,* Ultra-Centrifuge Nederland N.V. (UCN NV: Almelo) p. 8, *Verslag over het Jaar 1985,* Ultra-Centrifuge Nederland N.V. (UCN NV: Almelo) p. 8, Van Wesel, Jaap, 'Urenco sleept in Amerika miljoenen-order in de wacht', in *Trouw*, 25th of October 1984, 'Urenco boekt grote Amerikaanse order', in *NRC Handelsblad*, 25th of October 1984, 'Urenco boekt opdrachten van een miljard gulden', in *De Volkskrant*, 12th of November 1985, '"Bedrijf kan concurreren met VS": Grote Zweedse order voor Urenco-groep' in *Reformatorisch Dagblad*, 12th of January 1985.

1118 *Verslag over het Jaar 1983,* Ultra-Centrifuge Nederland N.V. (UCN NV: Almelo) p. 8, *Verslag over het Jaar 1984,* Ultra-Centrifuge Nederland N.V. (UCN NV: Almelo) p. 8, 'Netherlands – Spot Exchange Rate, Guilders/US$', 1st of January 1986, Historical Data, H.10 Foreign Exchange Rates, Federal Reserve Statistical Release (United States Federal Reserve Bank) https://www.federalreserve.gov/releases/H10/hist/dat89_ne.txt, website checked 30-7-2018.

1119 *Verslag over het Jaar 1985,* Ultra-Centrifuge Nederland N.V. (UCN NV: Almelo) p. 8.

(a) consider and decide upon any questions concerning the safeguards provided for in Article VII;

(b) consider and decide upon questions arising out of the classification arrangements and. security procedures to be observed in accordance with Article V;

(c) advise the Contracting Parties as to the conditions upon which any agreement of the kind referred to in Article IX might be concluded;

(d) consider and decide upon any proposals for: (i) the transfer outside the territories of the Contracting Parties of information derived as a result of the collaboration described in Article I of this Agreement or of information, rights in which have been assigned to the joint industrial enterprises pursuant to this Agreement; (ii) the granting of licences or sub-licences for the use outside the territories of the Contracting Parties of any of the information referred to in sub-paragraph (i) of this paragraph or of any inventions arising in the course of the collaboration described in Article I of this Agreement; (iii) the export outside the territories of the Contracting Parties of equipment or materials developed, produced or processed under the collaboration described in Article I of this Agreement;'[1120]

Additionally, subs (e) through (j) of clause 5 authorize the JC to approve 'the instruments establishing the joint industrial enterprises and ... composition of those enterprises …, proposals of the joint industrial enterprises for the siting of major installations ..., make arrangements for the assessment and payment of royalties ... concerning Patents and other Industrial Rights, … research and development programmes and ... decide upon or recommend ... appropriate measures to be taken if technical or economic developments occur which are likely to affect significantly the commercial exploitation of the gas centrifuge process by the joint industrial enterprises; [and] … determine any question concerning the interpretation of this Agreement.'[1121] Clause 7 then stipulates that '[t]he Joint Committee may at any time issue to the joint industrial enterprises directives pursuant to decisions taken by it under paragraph (5) ... of this Article, which directives it shall be the duty of the joint industrial enterprises to put into effect'.[1122]

1120 Article V concerns the application of security procedures and classification measures of the Interim Agreement on that subject. Article IX reads: 'The Contracting Parties may jointly conclude agreements for collaboration with European or other States, or international organisations. Any proposal for the conclusion of an agreement of this kind shall be considered by the Joint Committee.' This article thus places the responsibility for the contracting of customers with the tripartite partners, following approval of the JC of a proposal toward that end, *Agreement between the United Kingdom of Great Britain and Northern Ireland the Federal Republic of Germany and the Kingdom of the Netherlands on Collaboration in the Development and Exploitation of the Gas Centrifuge Process for producing Enriched Uranium, Almelo, 4 March 1970, Treaty Series No.* 69 (1971), Cmnd. 4793 (London: Her Majesty's Stationary Office) pp. 3-4, 5, 7.

1121 *Agreement between the United Kingdom of Great Britain and Northern Ireland the Federal Republic of Germany and the Kingdom of the Netherlands on Collaboration in the Development and Exploitation of the Gas Centrifuge Process for producing Enriched Uranium, Almelo, 4 March 1970, Treaty Series No.* 69 (1971), Cmnd. 4793 (London: Her Majesty's Stationary Office) p. 4.

1122 Ibid.

The implementation of safeguards obligations toward EURATOM and 'pursuant to an agreement or agreements' with the IAEA set out in Article VII are also the responsibility of the JC.[1123] Besides having the final say on major investment and siting decisions for the tripartite companies (and relevant for the country case studies below), the treaty thus put the JC in charge of all political and international legal judgments required with regards the tripartite partnerships' obligations to safeguards implementation, classification and exports of material and technology. In practice, the evaluation of the political status and trustworthiness of potential customers therefore became the responsibility of the JC;

> 'Marketing and therefore Urenco's relations with utilities in fourth countries were always subject to Joint Committee review and approval as were any resulting contractual negotiations. This did not apply to the contracts themselves or the commercial terms, but to the suitability of the customers and their countries in respect to non-proliferation and other political considerations.'[1124]

In an argument for intergovernmental supervision of multinational enrichment plants to deal with the political nature of non-proliferation decisions and a vindication of the type of governmental structure that the Troika had opted for, Krass *et al.* wrote;

> 'From a non-proliferation point of view it has been strongly argued that a multinational consortium limited to corporations is inadequate; the political nature of non-proliferation issues demands participation by the governments of the states involved .... It follows that the multinational organization should be established by a treaty which contains provisions for intergovernmental supervision, for example, by a political council, consisting of ministerial representatives .... Such a political council should deal with and have responsibility for all matters relevant to proliferation questions, such as changes in consortium membership, policies on safeguards, classification of technology, research and development, plant location and so forth. This council would be analogous to the so-called 'Joint Committee' as it exists within Urenco. Adding such a bureaucracy to an industrial collaboration is unquestionably cumbersome, but the political stakes are high enough to make it necessary.'[1125]

Membership of the JC was usually reserved for senior national representatives from the respective ministries or departments 'responsible for nuclear energy matters'; in the Netherlands the Director-General of the Directorate for Nuclear Energy of the Ministry of Economic Affairs, in the FRG the Ministry for Research and Development and in the UK whatever ministry was in charge of energy.[1126] Members would be accompanied by a small

1123 Ibid., p. 6.

1124 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002), p. 224.

1125 Krass, Allen, *et al*, *Uranium Enrichment and Nuclear Weapons Proliferation* (Stockholm International Peace Research Institute, Taylor & Francis Ltd: London and New York 1983) https://www.sipri.org/sites/default/files/files/books/SIPRI83Krass/SIPRI83Krass.pdf, website checked 3-9-2017 p. 62.

1126 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002), p. 223, Den Haan, Frederik, M., *De Urenco-kwestie: De leverantie van verrijkt uranium aan Brazilië* (Instituut voor Internationale Studiën – Rijksuniversiteit Leiden: Leiden 1985) p. 31.

staff 'and a member of the Ministry of Foreign Affairs was usually present, especially when matters relating to fourth countries were scheduled for discussion.'[1127] For the Netherlands, the delegate from the Ministry of Foreign Affairs had the 'role of 'country coordinator', meaning the official had responsibility for 'all those aspects that involve domestic- or foreign-political considerations.'[1128] The informal division of tasks that evolved over time between the ministries and departments also involved a far-going measure of autonomy for the involved officials; while the ultimate political decisions were brought to the responsible minister(s), officials had a certain freedom to interpret which decisions required ministerial approval and which didn't.[1129]

The meetings would take place in the current Chair's home country (the Chair rotated every year between the three countries) and after starting the meeting with just the governmental representatives present, 'a senior Urenco representative was invited to join the meeting to hear the outcome of the matters discussed', a structure which resulted in '[a]n excellent understanding of each other's outlooks and difficulties'.[1130]

The Working Group for Security and Classification, a standing subgroup of the Joint Committee, created the Joint Committee Handbook of Security and Classification Procedures that laid out the proper procedures and requirements for such things as screening of personnel and access to the plants by visitors. The rules for visitors, the so-called 'Thompson Rules', evolved over time, for example when for public relations purposes groups of the general public (such as schoolchildren) started receiving tours of the plants.[1131]

Case Studies of Potential Customers

The following case studies show how Urenco's commercial exploitation, growth realization and future potential to position itself strategically demanded appropriate policies to be negotiated between the partners in the JC as well as at the political level above. Many of the political challenges centered on the type and strength of demands made on potential clients with regard to non-proliferation obligations, particularly when negotiating contracts with non-allied and politically non-aligned clients. Urenco's first important customer and the JC's first important test in this respect, came with potential client Brazil; a non-allied NAM (Non-Aligned Movement) aspiring leader.

The contract with Brazil's Nuclébras represented the first successful commercial opportunity for Urenco's enrichment services outside of the Troika countries. While general company

1127 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002), p. 223.

1128 Den Haan, Frederik, M., *De Urenco-kwestie: De leverantie van verrijkt uranium aan Brazilië* (Instituut voor Internationale Studiën – Rijksuniversiteit Leiden: Leiden 1985) p. 31.

1129 Ibid., pp. 31-32.

1130 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002), p. 225.

1131 ARC 123-20b, ARC 123-20c, Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002), p. 86.

policies and decision-making procedures were put in place by the Treaty of Almelo, contingencies were not always anticipated, resulting particularly during the first years of operation in political issues spilling over out from the JC to the ministerial and even into the parliamentary level.

Case: Brazil

A nuclear research infrastructure was started in Brazil in the first half of the 1950s. In 1954, the Institute for Radioactivity Research (IPR, later renamed Center for Nuclear Technology Development (CDTN-CNEN) was established at Belo-Horizonte-Minas Gerais. In 1956, the Institute for Atomic Energy (IEA, later renamed Institute for Energy and Nuclear Research (IPEN-CNEN)) was created in São Paolo and the National Nuclear Energy Commission (CNEN|) was established in Rio de Janeiro.[1132] Utilizing its considerable deposits of uranium deposits,

> 'Between 1951 and 1955 … Brazil had aggressively pursued a policy of uranium exportation in exchange for nuclear technologies and had committed to the acquisition of nuclear reactors. The program came to a halt coinciding with—or with the aid of—the Atoms for Peace initiative, with a combination of local political turmoil affecting decision-making and explicit pressures and maneuvering from the USAEC and the State Department.'[1133]

Brazil's Atoms for Peace participation resulted in its first three reactors. Construction on the IEA-R1 light-water graphite-moderated research reactor started in 1956 by the American Babcock & Wilcox company, financed through Atoms for Peace. Its initial start-up was in September 1957. Additional research reactors IPR-R1 at Belo Horizonte (TRIGA Mark-1 250 Kw by General Atomics) and Argonauta at Rio de Janeiro (ARGONAUT 500w by US Department of Energy, redesigned and built almost completely by Brazilian nuclear scientists and engineers) came online in 1960 and 1965 respectively. Meanwhile, from 1955 to 1960 the CDTN-CNEN researched the potential of a thorium-based nuclear power industry, of which it also had sizable deposits. From the late 1960s on, following the 1967 decision to pursue nuclear technology and fuel independence, the country invested heavily in development of its nuclear know-how in research groups, studying different reactor types.[1134] Brazil acquired its

1132 Barroso, A.C.O., Dieguez, J.A.D., 'Nuclear Power Energy Development in Brazil – Future Perspectives', IAEA-CN-114/A-5, National Nuclear Energy Commission / CNEN contribution to International Conference on Fifty Years of Nuclear Power – The Next Fifty Years, p. 1, http://repositorio.ipen.br:8080/xmlui/bitstream/handle/123456789/18298/11012.pdf?sequence=1&isAllowed=y, website checked 15-3-2017.

1133 Mateos, Gisela, Suárez-Díaz, Edna, 'Atoms for Peace in Latin America', in *Oxford Research Encyclopedia of Latin American History*, Subject: 1945–1991, Diplomatic History, Science, Technology, and Health (Oxford University Press USA: April 2016) p. 5. The authors acknowledge Carlo Patti's 'The Origins of the Brazilian Nuclear Programme, 1951–1955' in *Cold War History*, Vol. 15, No. 3 (2015), pp. 353-373.

1134 Barroso, A.C.O., Dieguez, J.A.D., 'Nuclear Power Energy Development in Brazil – Future Perspectives', IAEA-CN-114/A-5, National Nuclear Energy Commission / CNEN contribution to International Conference on Fifty Years of Nuclear Power – The Next Fifty Years, pp. 1-2, http://repositorio.ipen.br:8080/xmlui/bitstream/handle/123456789/18298/11012.pdf?sequence=1&isAllowed=y,

first power reactor (ANGRA-I, a 626 MW PWR) from Westinghouse on which construction started in 1971 halfway between São Paolo and Rio de Janeiro and its first successful start-up was achieved 11 years later.[1135]

Brazil's earliest known research in uranium enrichment dates from when they imported three centrifuges from the FRG in 1958. This followed failures to earlier acquire centrifuges from the FRG in 1954 while it was still under post-WWII allied occupation and diffusion technology from France.[1136] The machines imported by Brazil were of the Groth design (see *Start of the Dutch and Troika Partners' Gas Centrifuge Tracks*, page 200) and the Brazilians were unable to improve them sufficiently to make industrial application cost-effective. For the eventually successful centrifuge enrichment program that was initiated in secret in 1979 at IPEN and run by CNEN together with the military, Zippe's public designs were likely used as an alternative starting point to the Groth design, argued David Albright in 1989.[1137]

In 1961 EURATOM and Brazil concluded an agreement for peaceful nuclear assistance. West-German approaches to Brazil started in June 1968, shortly after West-German company Siemens had secured the order for the Argentinian Atucha-I reactor, winning the contract away from the Americans. In 1969 the two countries officially agreed to a research and technological development partnership, with Brazilian engineers familiarized themselves with

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website checked 15-3-2017, Saxeno, R.N., 'The IEA-R1 Research Reactor: 50 Years of Operating Experience and Utilization of Research, Teaching, and Radioisotopes Production', International Conference on Research Reactor Safe Management and Effective Utilization (Research Reactor Center IPEN-CNEN/SP-Brazil: 2007) p. 5, http://www-pub.iaea.org/mtcd/meetings/PDFplus/2007/cn156/cn156presentations/cn156_Saxena.pdf, website checked 16-3-2017, Figueroa da Silva, Eduardo, *National Report of Brazil for the Research Reactor Decommissioning and Demonstration Project (R2D2P)* (Comissão Nacional de Energia Nuclear: June 2006) http://www-ns.iaea.org/downloads/rw/projects/r2d2/workshop1/national-reports/Brazil/R2D2P-national-report-brazil2006.pdf, website checked 17-4-2017, Patti, Carlo, 'Origins and Evolution of the Brazilian Nuclear Program (1947-2011)', Nuclear Proliferation International History Project (Wilson Center: November 2012), https://www.wilsoncenter.org/publication/origins-and-evolution-the-brazilian-nuclear-program-1947-2011, website checked 17-4-2017, Wonder, Edward, 'Nuclear Commerce and Nuclear Proliferation: Germany and Brazil, 1975', in *Orbis* (Summer 1977) p. 287.

1135 Barroso, A.C.O., Dieguez, J.A.D., 'Nuclear Power Energy Development in Brazil – Future Perspectives', IAEA-CN-114/A-5, National Nuclear Energy Commission / CNEN contribution to International Conference on Fifty Years of Nuclear Power – The Next Fifty Years, p. 3. http://repositorio.ipen.br:8080/xmlui/bitstream/handle/123456789/18298/11012.pdf?sequence=1&isAllowed=y, website checked 15-3-2017

1136 Memorandum of Conversation, 'German Development of Ultra-Centrifuge', 12th May 1960, RG 59, Central Decimal Files 1960-1963, 862A.394/5-1260, http://nsarchive.gwu.edu/nukevault/ebb518-the-gas-centrifuge-secret-origins-of-US-policy-of-nuclear-denial-1954-1960/doc%2012%205-12-60-%20memcon%20with%20germans.pdf, website checked 2-1-2017, p. 1, Wonder, Edward, Nuclear Commerce and Nuclear Proliferation: Germany and Brazil, 1975', *Orbis*, Summer 1977, p. 287. Streefland erroneously mistakes the 1954 abortive attempt with the 1958 successful export of German centrifuges to Brazil, Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) p. 169, Geier, Stephan, *Schwellenmacht - Kernenergie und Außenpolitik der Bundesrepublik Deutschland von 1949 bis 1980*, Ph.D. Dissertation, Faculty of Arts, Friedrich-Alexander University Erlangen-Nürnberg (December 2011) pp. 265-266, Gall, Norman, 'Atoms for Brazil, Dangers for All', in *Foreign Policy*, Vol. 23 (Summer 1976) p. 181. See also chapter 8, *The Push for Classification*, page 217.

1137 Albright, David, 'Bomb Potential for South America', in *Bulletin of Atomic Scientists*, May 1989, pp. 18-20, Perera, Judith, 'Brazil's 'Parallel' Nuclear Industry', in *New Scientist*, 17th of September 1987.

the many aspects of nuclear technology while visiting the FRG and German engineers were sent to Brazil to study the prospects for a nuclear industry there.[1138] In addition to agreements with Bolivia and Paraguay to complement its energy security with gas and hydro-electric power respectively, the Brazilians started negotiations with Westinghouse for the supply of more nuclear power reactors, the need for which was underlined by the 1973-1974 oil crisis.[1139] The deal was scuttled when the AEC changed its enriched uranium supply policy in 1974 revoking her guarantee for fuel included in the deal.

> 'Testifying that the enrichment cutback was a trigger to the Brazil-German deal, the top U.S. State Department science official told Congress: "We have run out of capacity. We saw that coming. We did not take action". According to a spokesman for Westinghouse which is building Brazil's first nuclear power plant and was negotiating to build more:
>
> We thought that we pretty well had that business locked up until the question of contracts between Brazil and the U.S. government for the slightly enriched uranium for fuel came to a sudden halt, and the Brazilians were denied firm contracts for the slightly enriched fuel, and at that point, any further industrial discussions between ourselves and the Brazilians ceased and Brazil started discussions with West Germany ...'[1140]

As Charles Ebinger, in a personal capacity as Latin American desk officer for the Federal Energy Administration during 1975-1976 observed that, while the Brazilian decision to walk away from the US deal was partly motivated by its wish for technological independence from the US, 'U.S. policy vis-à-vis Brazil's energy needs, …, bordered on the inept'; 'the curtailment of enrichment services in 1974, the abrogation of coal export contracts by firms in West Virginia and Virginia, and the Nuclear Regulatory Commission's denial of nuclear fuel to Angra I and Angra II after March 1975 all contributed to a growing perception in Brasilia that the United States was indifferent to Brazil's interests.'[1141] Nevertheless, it was mostly the

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1138 'Agreement between the European Atomic Energy Community (Euratom) and the Government of the United States of Brazil for cooperation concerning the peaceful uses of atomic energy', https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1536075316957&uri=CELEX:21961A0109(01), website checked 4-9-2018, Van Ginkel, J., Neuman, H.J., Visser, C.J. *Almelo en de Non-proliferatie (*Nederlands Instituut voor Vredesvraagstukken, Staatsuitgeverij: The Hague 1977) pp. 23-24, which is clearly based on Gall, Norman, 'Atoms for Brazil, Dangers for All', Published jointly in *Foreign Policy,* Vol. 23 (Summer 1976) and *Bulletin of the Atomic Scientists* (June 1976) http://www.normangall.com/brazil_art18eng.htm Website checked 13-3-2017, Wonder, Edward, 'Nuclear Commerce and Nuclear Proliferation: Germany and Brazil, 1975', in *Orbis* (Summer 1977) p. 288. A similar agreement had already been signed between France and Brazil in 1967, Wonder, Edward, 'Nuclear Commerce and Nuclear Proliferation: Germany and Brazil, 1975', in *Orbis* (Summer 1977) p. 287.

1139 Gall, Norman, 'Atoms for Brazil, Dangers for All', in *Foreign Policy*, Vol. 23 (Summer 1976) p. 161, Solingen, Etel, *Industrial Policy, Technology, and International Bargaining: Designing Nuclear Industries in Argentina and Brazil* (Stanford University Press: Stanford CA, 1996) p. 33. In her book, Solingen elaborates on the constitution of Brazil's domestic consensus based on public and private interests that helped provide the rationale for its nuclear energy policy, Solingen, Etel, *Industrial Policy, Technology, and International Bargaining: Designing Nuclear Industries in Argentina and Brazil* (Stanford University Press: Stanford CA, 1996) pp. 31-34.

1140 Gall, Norman, 'Atoms for Brazil, Dangers for All', in *Foreign Policy*, Vol. 23 (Summer 1976) pp. 163-164.

US unreliability as a fuel supplier that caused the Brazilians to turn to the FRG to acquire a vast nuclear infrastructure, concluded Ebinger.[1142]

In June 1975, West-Germany and Brazil signed the largest nuclear transaction concluded since the dawning of the nuclear age, in a bid by the Brazil to become fully energy independent using nuclear power. The $ 4 billion deal included two large LWRs (1275 MW ANGRA-2 and 1224 MW ANGRA-3) with an option for six more, an initial pilot and eventual commercial-scale fuel fabrication plant, a pilot reprocessing plant, a enrichment technology demonstration plant that would later be expanded to a commercial-scale plant, as well as intensified exploration and mining activities undertaken by the partners, the German utilities and Nuclébras (the new Brazilian nuclear authority founded for this purpose that included a number of subsidiaries that partnered up with German firms).[1143] The contract structured the cooperation in such a way that Nuclébras would do most of the actual work, gaining valuable expertise in order to eventually become 'self-sufficient in all phases of the nuclear cycle'.[1144]

Brazil was at the time of the German-Brazil deal a non-NPT member (Brazil joined the NPT only much later, in 1998). In 1961-1963, Brazil's civilian government had been diplomatically active to initiate a nuclear weapon free zone for Latin America. When the military took power in 1964, diplomatic activities in that area ceased, although neither did the military government actively oppose the initiative Brazil had helped start, but it did set very strict conditions for the resulting 1967 Treaty for the Prohibition of Nuclear Weapons in Latin America (the Treaty of Tlatelolco) to enter into force, requiring unanimous ratification before entry-into-force, even though all the other signatories waived that condition (Brazil ratified the treaty in 1994). It also claimed an exception for peaceful nuclear explosives for both the NPT as well as the treaty of Tlatelolco.[1145] Besides to safeguard its potential use of peaceful explosives in the future, Brazil also opposed the NPT to avoid nuclear dependency. Such dependency could express itself in national security, compromising the right to self-defense. Brazil furthermore

1141 Ebinger, Charles, K., *The Washington Papers Vol. VI: International Politics of Nuclear Energy* (The Center for Strategic and International Studies: Sage Publications, Beverly Hills & London 1978) p. 54.
1142 Ibid., p. 55.
1143 Wonder, Edward, 'Nuclear Commerce and Nuclear Proliferation: Germany and Brazil, 1975', in *Orbis* (Summer 1977) p. 285, Barroso, A.C.O., Dieguez, J.A.D., 'Nuclear Power Energy Development in Brazil – Future Perspectives', IAEA-CN-114/A-5, National Nuclear Energy Commission / CNEN contribution to International Conference on Fifty Years of Nuclear Power – The Next Fifty Years, pp. 3-4, http://repositorio.ipen.br:8080/xmlui/bitstream/handle/123456789/18298/11012.pdf?sequence=1&isAllowed=y, website checked 15-3-2017, Solingen, Etel, *Industrial Policy, Technology, and International Bargaining: Designing Nuclear Industries in Argentina and Brazil* (Stanford University Press: Stanford CA, 1996) p. 26.
1144 Wonder, Edward, 'Nuclear Commerce and Nuclear Proliferation: Germany and Brazil, 1975', in *Orbis* (Summer 1977) p. 285.
1145 Rost Rublee, Maria, 'The Nuclear Threshold States: Challenges and Opportunity Posed by Brazil and Japan', in *Nonproliferation Review*, Vol. 17, No. 1 (March 2010) pp. 50-51, Rosenbaum, Jon, H., Cooper, Glenn, M., 'Brazil and the Nuclear Non-Proliferation Treaty', in *International Affairs*, Vol. 46, No. 1. (January 1970) p. 77. On the possible uses for peaceful nuclear explosives the Brazilian Government considered, see Rosenbaum, Jon, H., Cooper, Glenn, M., 'Brazil and the Nuclear Non-Proliferation Treaty', in *International Affairs*, Vol. 46, No. 1. (January 1970) pp. 78-79.

opposed the NPT on the grounds that the US and USSR had not properly consulted non-nuclear weapon states in its negotiation.[1146]

Brazil had approached Urenco before about acquisition of its enrichment technology but was turned away 'at Dutch insistence'.[1147] In fact, the Dutch hadn't needed to insist; '[w]ith regards to possible technology-export to Brazil, the Netherlands hasn't been compelled to use its right to veto as its partners were well aware of its strict views regarding the matter'.[1148] The same had happened when the Brazilians had approached the Americans around the same time; American unwillingness to export enrichment technology and inability to 'offer long-term supply contracts as an alternative since domestic enrichment capacity was exhausted' led the Brazilians to keep looking.[1149] In order to go ahead with the larger deal and avoid or at least undercut major national and international criticism, West-Germany and Brazil negotiated a trilateral agreement with the IAEA in 1975 that provided for the necessary safeguard requirements in line with what the NPT demanded;

> 'Brazil agreed not to use any equipment or materials supplied on a cooperative basis, or any of the relevant technological information, or any derivative information, to manufacture any sort of nuclear explosive device, even a peaceful one.' Brazil further undertook to subject all equipment, materials and know-how supplied under the agreement to the safeguards established by the IAEA .., and not to reexport such items without German permission and an additional safeguards commitment to the IAEA.'[1150]

What the agreement lacked was the ability to safeguard all nuclear activities in Brazil, in line with the developments in the NSG. While the parties agreed that for the next 20 years Brazil would not replicate the German technology unless under IAEA safeguards, Wonder referenced a valid argument provided to him by Lawrence Scheinman, which points to the extensive availability of relevant information in the public domain with which the Brazilians could 'build a facility they could claim was not a replication' of the German technology, circumventing the German-Brazilian-IAEA trilateral agreement.[1151]

The enrichment technology sold to Brazil was the German commercially-unproven and power-intensive jet nozzle technology (or Becker process, after it's inventor E.W. Becker). Until the jet nozzle enrichment plant would be ready for production, enriched uranium to fuel the first two reactors would have to be procured elsewhere. After reaching agreement in the JC, German negotiators offered Brazil to provide the enriched uranium through Urenco.[1152] In February 1976 Nuclébras agreed to a 10 year, 2000 tonnes enriched uranium contract that

1146 Rosenbaum, Jon, H., Cooper, Glenn, M., 'Brazil and the Nuclear Non-Proliferation Treaty', in *International Affairs*, Vol. 46, No. 1. (January 1970) pp. 80-82.
1147 Wonder, Edward, 'Nuclear Commerce and Nuclear Proliferation: Germany and Brazil, 1975', in *Orbis* (Summer 1977) p. 299.
1148 ARC 61-2, p.10
1149 Wonder, Edward, 'Nuclear Commerce and Nuclear Proliferation: Germany and Brazil, 1975', in *Orbis* (Summer 1977) p.299.
1150 Ibid., p. 286. The restrictions on re-export had become relevant after India reinterpreted its safeguard agreements with suppliers and claimed to have exploded a 'peaceful' nuclear device in 1974
1151 Ibid.
1152 ARC 61-3, p.1

would run from 1981-1991. Urenco would get an attractive rate-hike of 50% on the contract, due to its short term nature. The JC agreed to the contract the following March 1976. Minister of Economic Affairs Lubbers agreed shortly after and Foreign Affairs Minister Van der Stoel did so in July 1976, with the caveat that a number of conditions would still need to be met.[1153] The official signing took place in September.

What followed were 'lengthy negotiations' between Brazil and the Netherlands, as complementary to the existing private law contract a public law contract needed to be concluded, in line with the requirements of article 13, paragraph 2 of the Urenco/Nuclébras contract regarding the safeguards that would be applied to the deliveries.[1154] These negotiations focused on the establishment of an ad hoc plutonium storage regime. The resulting safeguards would have to be in line with the Brazil-FRG-IAEA agreement.[1155] The Dutch had been critical of the safeguards agreed in the trilateral agreement and were a long-time proponent of an international plutonium storage regime; in its unique negotiating position it recognized an opportunity to act as a 'crowbar' to, in the context of the German-Brazilian deal, get such a storage regime established.[1156] With regards to safeguards, the German/Urenco's proposal on enrichment services to Brazil included the following text:

> 'The customer shall ensure that any product material supplied under this contract shall be used exclusively for peaceful, non explosive purposes. All product material delivered to the customer under this contract shall be subject to IAEA-safeguards in conformity with the Safeguards Agreement of February 1976 between the IAEA, the Federative Republic of Brazil and the Federal Republic of Germany, including any amendments thereto. The trilateral agreement shall be applied after confirmation of the Federal Republic of Brazil to the FRG'[1157]

The safeguards agreement was considered quite strict by Dutch officials. While they deplored that the agreement made it possible for a non-NPT member to procure nuclear materials and technology, the safeguards agreement 'went further than any previous safeguards agreement'.[1158] Additionally, the Brazilians committed to options on enriched uranium that they pledged not to reduce in favor of deliveries from other sources. This meant that for the foreseeable future, all deliveries of enriched uranium would fall under the agreed strict regime of supply conditions.[1159]

1153 Den Haan, Frederik, M., *De Urenco-kwestie: De leverantie van verrijkt uranium aan Brazilië* (Instituut voor Internationale Studiën – Rijksuniversiteit Leiden: Leiden 1985) p. 15.
1154 Ibid., p. 8.
1155 Ibid.
1156 Ibid., p. 14.
1157 ARC 61-3, p. 1. English in original.
1158 ARC 61-4, p. 1.
1159 Ibid.

Exchange of Notes

Left open was the question of how, without an international legal agreement, the stipulations above would be effectuated. British and Dutch representatives in the JC preferred to become party of the Brazil-FRG-IAEA trilateral agreement but the nature of the existing agreement prevented that. Concluding separate trilateral agreements for the UK and the Netherlands with Brazil and the IAEA were considered and would turn out to be too time consuming.[1160] Brazil forcefully rejected this suggestion as well.[1161] Instead the UK researched and found the possibility of a 'formal exchange of notes' between the UK and Brazil and the Netherlands and Brazil respectively. The notes would stipulate that all deliveries to Brazil resulting from the contract would fall under the existing trilateral agreement between Brazil, West-Germany and the IAEA.[1162] Dutch officials considered the matter resolved and on July 8th 1976 advised the Minister of Foreign Affairs to accept the exchange-of-notes arrangement, arguing that since the UK and FRG (both members of the nuclear export club) found it acceptable, the Netherlands should as well.[1163]

West German-US Tensions over the Brazil Deal

Kraftwerk Union AG (KWU) was the result of a government-induced 1969 merger of Siemens' and AEG's nuclear divisions, each acquiring a 50% stake in the new company. Siemens had held a license for the Westinghouse PWR/LWR design since the 1950s, which expired in 1969. AEG's license for the General ElectricWest German-US Tensions over the Brazil Deal BWR/LWR expired soon after.[1164] The combination was an attempt to more effectively compete with Westinghouse and General Electric in the international reactor market, but the assault on the American companies' entrenched position proved a greater challenge than anticipated; '[f]rom 1969 to 1973, American companies sold twenty-one reactors, while KWU had only sold three and had a letter of intent for two more.'[1165] Domestic orders to offset the struggling export division didn't materialize, as the anti-nuclear movement and local governments had successfully slowed down the domestic nuclear power program.[1166]

From its inception, KWU found itself competing with what essentially was an entrenched monopoly of American companies. Other countries had reactors for sale but with the LWR quickly becoming the industry standard in the early 1970s, the enriched uranium fuel services the Americans could offer as part of reactor packages were hard to compete with, so only a few other countries managed to export Nuclear Power Plants (NPPs). Nevertheless, partly

1160 ARC 61-3, p. 1.
1161 Den Haan, Frederik, M., *De Urenco-kwestie: De leverantie van verrijkt uranium aan Brazilië* (Instituut voor Internationale Studiën – Rijksuniversiteit Leiden: Leiden 1985) p. 8.
1162 ARC 61-3, p. 1.
1163 Ibid., p. 2.
1164 Thomas, S.,D., *The Realities of Nuclear Power: International Economic and Regulatory Experience* (Cambridge University Press: Cambridge 1988) p. 247.
1165 Wonder, Edward, 'Nuclear Commerce and Nuclear Proliferation: Germany and Brazil, 1975', in *Orbis* (Summer 1977) p. 297.
1166 Ibid., pp. 297, 300.

thanks to the uncertainty created by the Americans about their ability to provide fuel services as well as their refusal to sell other fuel-cycle technologies to Brazil, KWU managed to secure the contract (narrowly avoiding a break-up of the company after years of sizable losses, although two years later, AEG did exit the combination by selling its shares to Siemens).[1167] The Brazilian order with KWU represented 'the first large-scale breakthrough of a non-American reactor vendor into the world export market, previously an American preserve.'[1168]

Whereas the initial American diplomatic response to the deal by the Ford administration was quite mild, trying to convince the Germans to abrogate the contract, and when met with stiff resistance, opting to push for strong safeguards (and active German involvement in those) on the to-be supplied technology instead, the US media and Congress were much more vocal. A series of articles on the impending deal in *the Washington Post* and the *New York Times* culminated in the latter eventually calling it 'Nuclear Madness' in a June 1975 editorial, while Senator Pastore, the Chairman of the Joint Committee on Atomic Affairs 'decried Bonn's behavior as outright treachery: while demanding the on-going presence of US troops to defend them in Europe, the Germans were abetting a "peril ... in our own backyard', thus making 'a mockery of the Monroe Doctrine'.[1169] Senator Ribicoff provided the more level-headed commentary, noting that,

> '[h]ard economic times and [the] high price of oil have combined to establish a desperate need to sell and a desperate need to buy nuclear power reactors. Nothing less than balanced international payments and energy self-sufficiency are at stake. The resulting cutthroat nuclear competition is leading to the spread of plutonium reprocessing and uranium enrichment capabilities. …. In truth, the United States must assume a major share of the responsibility for the present nuclear proliferation problem. We pioneered the civilian nuclear power technology, made it available to other nations through our atoms for peace program and still clearly dominate the worldwide nuclear power industry. Closer attention should have been given to safeguards over the years, particularly to safeguards conditions on the re-export of U.S. nuclear technology by nations like France and West Germany.'[1170]

The German unwillingness to bend to American pressure was an expression of the FRG's strategic intent, during the period leading up to the NPT and following its conclusion, to not let its ability to fight its way into the international nuclear trade arena be compromised by international constraints under non-proliferation initiatives often championed by, what was perceived as, a self-serving United States 'moral' policy. The FRG had actively defended this position during the NPT negotiations and had since wielded a minimalist and legalistic

1167 Ibid., pp. 282, 298.
1168 Ibid., p. 284.
1169 'Nuclear Madness' in *The New York Times*, 13th of June, 1975, http://www.nytimes.com/1975/06/13/archives/nuclear-madness.html, website checked 6-6-2017, p. 16, Gray, William, Glenn, 'Commercial Liberties and Nuclear Anxieties: the US-German Feud over Brazil, 1975-7', in *The International Historical Review*, Vol. 34, No. 3 (2012) pp. 457-458, Wonder, Edward, 'Nuclear Commerce and Nuclear Proliferation: Germany and Brazil, 1975', in *Orbis* (Summer 1977) p. 288.
1170 Statement by U.S. Senator Ribicoff, as quoted inGall, Norman, 'Atoms for Brazil, Dangers for All', in *Foreign Policy*, Vol. 23 (Summer 1976) pp. 156-157.

interpretation of its obligations under the treaty and now pointed to Brazil's acceptance of IAEA safeguards and the inevitability of its acquisition of the technology it desired by other means, if refused by nuclear suppliers. Arguably, the German-Brazil deal undermined the United States ability to dictate (non-proliferation and technology) terms to its nuclear trade partners, such as it did to Iran in a $ 7 billion reactor deal under negotiation during the same period. However, from a German perspective, the fear of losing the deal to the French or Germans seemed to a large extent inspire the American protestations; the German press and parliamentarians cast the American outrage as originating from "interested US companies and their lobbyists" and their representatives in Congress attempting to 'stymie Germany's commercial breakthrough in nuclear sales'.[1171] Based on a number of previous experiences, West-German officials had adopted the 'conviction that U.S. companies, and possibly even the U.S. government, had stooped to very shady tactics in order to "steal" orders from Kraftwerk Union.'[1172] Edward Wonder collected a number of these cases that seem to legitimize that conviction:

> 'In 1973, Kraftwerk Union considered a sale to Yugoslavia all but clinched when Westinghouse abruptly and unexpectedly won it instead. This, and a similar case in Spain, led to stories that the U.S. firms had told Yugoslavian and Spanish authorities they could not expect to receive American enriched uranium if they did not buy American reactors. This only reinforced German appreciation of the commercial necessity for an independent enrichment plant. There were also charges that the United States had threatened to withhold economic assistance from Argentina if it bought another German reactor, and that American interests had spread rumors regarding imminent liquidation of the financially troubled Kraftwerk Union just as that company was negotiating to sell two reactors to Iran.'[1173]

Finally, with the imminent enrichment technology transfer being a pivotal point of protest voiced by the US,

> 'American double-dealing again seemed to be the case in April 1975, when Brazilian authorities apparently got the impression that an American firm had offered to build an

1171 Gray, William, Glenn, 'Commercial Liberties and Nuclear Anxieties: the US-German Feud over Brazil, 1975-7', in *The International Historical Review*, Vol. 34, No. 3 (2012) pp. 457-458, Wonder, Edward, 'Nuclear Commerce and Nuclear Proliferation: Germany and Brazil, 1975', in *Orbis* (Summer 1977) pp. 286, 288-291. Gray has cast the German press' suspicion of US politicians' motivations as 'lazy', but only supported that statement by pointing to a lack of evidence of commercial interests corrupting politician's motivations and the convictions of a single German diplomat; in hindsight we can safely state that protecting strategic American commercial interests, particularly if this economically affected a particular politician's constituency, is not something members of the US Congress have historically shied away from. Nevertheless, the US Congress did make a noticeable shift towards appreciating the importance of non-proliferation policies, something FRG Chancellor Schmidt failed to appreciate, Gray writes. Schmidt therefore continued to conceptualize 'nuclear sales as a fundamental expression of West German sovereignty, a position that was hard to back down from in years to come, Gray, William, Glenn, 'Commercial Liberties and Nuclear Anxieties: the US-German Feud over Brazil, 1975-7', in *The International Historical Review*, Vol. 34, No. 3 (2012) pp. 458-549.

1172 Wonder, Edward, 'Nuclear Commerce and Nuclear Proliferation: Germany and Brazil, 1975', in *Orbis* (Summer 1977) p. 293.

1173 Ibid.

> enrichment plant in Brazil. The Bechtel Corporation was the guiding force in the now defunct United Enrichment Associates, a consortium which intended to use gaseous-diffusion technology to build, within the "privatization policy" the next American enrichment plant. …. The State Department had given the go-ahead in January 1975 for corporate-level, unclassified exploratory discussions with potential foreign collaborators in new enrichment plants, and the Bechtel-Brazil discussions coincided with the final negotiations between Brazil and Germany. This awkward timing lent itself to the interpretation that Washington was a bit two-faced – urging Bonn to refrain from offering a package deal while at the same time American companies were making a last-ditch effort to save the work for themselves by including "sweeteners" of their own. Bechtel's letters to the Brazilian Nuclear Energy Commission could have given the impression ERDA was supporting Bechtel, and to the extent the Germans were aware of the letters, the Bechtel episode was likely seen as additional evidence of America's lack of integrity. The State Department quickly squelched Bechtel's apparent initiative, and Bechtel denied that anything more than a feasibility study was intended. Nonetheless, American credibility certainly had become suspect.'[1174]

As aforementioned, the Ford administration quickly backed off a confrontational line, with Secretary of State Kissinger and his German interlocutors Scheel and Genscher agreeing to disagree, a result celebrated as a victory by the German press. Under President Carter however, a second round of confrontation started (see below on page 337 in the discussion on *The London Club/The Nuclear Suppliers Group*).[1175]

German Pressure and Parallel Issues

The West-German partner of the Troika meanwhile increased the pressure on Dutch officials to green-light the commitment to the Brazil-deal as well as put the future of the entire Ultracentrifuge Project on a more solid footing. The West-Germans had considerable economic and political interests at stake as,

> '[t]he deal would generate contracts for some 300 German firms and "now assures for the first time the stability" of 13,000 jobs in [Kraftwerk Union AG]'s own offices and factories. A leading German weekly observed that "the Federal Government already had invested DM 15 billion ($5 billion) in nuclear energy research out of tax monies – of which at least half was for basic research—and now this was finally to pay off". To obtain these benefits for West Germany, Bonn has assumed the entire financial risk for the deal through a consortium of five big banks lending $1 billion for KWU's first two Brazilian power plants ...'[1176]

1174 Ibid., pp. 293-294. The Germans were probably made aware of the Bechtel letters by Brazilian officials who, according to Gray, 'exploited these unfounded offers in order to intensify pressure on West Germany to sign the nuclear treaty as soon as possible', Gray, William, Glenn, 'Commercial Liberties and Nuclear Anxieties: the US-German Feud over Brazil, 1975-7', in *The International Historical Review*, Vol. 34, No. 3 (2012) p. 455. On the US 'privatization policy', see page 177.

1175 Gray, William, Glenn, 'Commercial Liberties and Nuclear Anxieties: the US-German Feud over Brazil, 1975-7', in *The International Historical Review*, Vol. 34, No. 3 (2012) pp. 458, 460, 462.

1176 Gall, Norman, 'Atoms for Brazil, Dangers for All', in *Foreign Policy*, Vol. 23 (Summer 1976) p. 158.

On the 11th of March 1976, the German Ambassador had an *aide memoire* delivered to the Dutch Ministry of Foreign Affairs in which he expressed the concern of his government over the delays caused by Minister Lubbers' efforts to have Dutch industry buy the Dutch Government's shares in UCN.[1177] Foreign Affairs Minister Van der Stoel communicated the German concerns to Lubbers, as well as his own. His information indicated that Dutch industry had lost all interest in participating in the UC project (because of the long return-on-investment period and media exposure) and that Minister Lubbers therefore decided to 'temporize' the expansion to 200 tonnes of the Almelo plant, as well as shelve the proposed expansion to 2000 tones.[1178] Lubbers acted in accordance with the earlier decision of July 1st, 1975 taken by Ministers Lubbers, Duisenberg (Finance) and Trip (Science Policy), which in turn was in line with the spirit of what Lubbers' Energy Note of 1974 had stated on the subject; to stop the project if and when the biggest industrial partners for commercialization Shell and DSM decided not to participate.[1179]

Van der Stoel warned Lubbers on the possible consequences of a negative decision. First, the substantial energy security interests involved for the UK and West-Germany would certainly see them decide to go ahead with the expansion regardless of whether the Dutch participated and might '[strengthen] the German wish to have an enrichment plant on German soil', a scenario the Dutch Government had sought to avoid by participating in the project. Second, a Dutch exit might severely sour the relationship with the partner countries as it could negatively affect the perception of the viability of the project in the eyes of clients and competitors and thus its marketing prospects.[1180] Third, a myriad of political problems could result from the Netherlands taking only a minority share in the plant in Almelo while continuing to bear full responsibility for all Almelo exports/deliveries.[1181]

In considering these circumstances, Van der Stoel implored Lubbers to reconsider the Dutch position, 'in order to avoid the Dutch delegate in the JC having to take a negative position with regards to the expansion'.[1182] Finally, he proposed Lubbers would look at alternative

1177 Letter, Minister van Buitenlandse Zaken via Raad van Europa en Wetenschappelijke Samenwerking aan Minister van Economische Zaken Lubbers, 'Nederlandse deelneming in u.c.-project', DRW-72637, 24th of March 1976, 2.03.01/10861, p. 4.
1178 Ibid., p. 1.
1179 Letter, Minister van Economische Zaken aan Minister President, 'U.C.-project', 276/IV/6086, 20th of September 1976, includes Report, 'UC-Project' opgesteld door een interdepartementale werkgroep Financiën – Economische Zaken (met medewerking van het Directoraat-Generaal Wetenschapsbeleid, 10th of June 1976, 2.03.01/10861, p. 6, Den Haan, Frederik, M., *De Urenco-kwestie: De leverantie van verrijkt uranium aan Brazilië* (Instituut voor Internationale Studiën – Rijksuniversiteit Leiden: Leiden 1985) p. 11.
1180 Letter, Minister van Buitenlandse Zaken via Raad van Europa en Wetenschappelijke Samenwerking aan Minister van Economische Zaken Lubbers, 'Nederlandse deelneming in u.c.-project', DRW-72637, 24th of March 1976, 2.03.01/10861, p. 2, Letter, Minister van Economische Zaken aan Minister President, 'U.C.-project', 276/IV/6086, 20th of September 1976, includes Report, 'UC-Project' opgesteld door een interdepartementale werkgroep Financiën – Economische Zaken (met medewerking van het Directoraat-Generaal Wetenschapsbeleid, 10th of June 1976, 2.03.01/10861, p. 3.
1181 Letter, Minister van Buitenlandse Zaken via Raad van Europa en Wetenschappelijke Samenwerking aan Minister van Economische Zaken Lubbers, 'Nederlandse deelneming in u.c.-project', DRW-72637, 24th of March 1976, 2.03.01/10861, pp. 2-3.
1182 Ibid., p. 3.

financing options (by means of state-guaranteed loans) if industry remained unwilling to invest in the project.[1183]

Early in July 1976 Von Neubronner of the German Federal Foreign Office contacted the Dutch Foreign Office by phone with a confidential message, conveyed to the Dutch Minister of Foreign Affairs by his official, that if the Netherlands objected to the arrangement (the exchange of notes with Brazil), the other Troika partners intended to solely use the Capenhurst plant to provide for the deliveries to Brazil. 'Theoretically speaking the Netherlands could veto this in the JC, but politically this would be unimaginable' considered the official from DRW that was documenting the call. The deal with Brazil was 'essential to the future of the UC-project' due to its size and modalities.[1184] Von Neubronner (Auswartige Amt – the FRG's foreign office) had called DRW/AT by phone on the 8th of July to say that the German side therefore considered the Dutch response as a touchstone on which to judge the Dutch commitment to the UC-project. Faced with a negative response to the proposed safeguards solution, the FRG would build an enrichment plant on German soil, possibly near the town of Gronau (Dutch officials had received similar information on the German position from UCN).[1185] Furthermore, the decision by the Dutch Government to again push Dutch industry to enlarge its stake in the UC-project, resulting in further delays in Troika decision-making, had had a severe negative impact on the partner's perceptions. A Dutch official from the DRW warned the Minister that this situation would only worsen as it was expected that results from consultations with industry would only emerge halfway September at the earliest.[1186]

Dutch officials, in consultation with their British counterparts on the matter in December 1976, learned that the they would consider the disintegration of the Troika a severe blow, that they were sympathetic to the Dutch perspective but were also unlikely to veto the deliveries themselves. They thought a follow-through of the German threat to build its own enrichment plant in Gronau was likely however, if push came to shove.[1187] The German side communicated an additional argument for going ahead with the Brazil deliveries; from a letter sent by Mr. Schmidt-Küster Dutch officials had learned that the French competition had had contacts with the Brazilians.[1188] The Brazilians would almost certainly opt for French enriched uranium if Urenco refused the contract. Dutch officials at the DRW assumed that the French would demand safeguards on nuclear materials supplied by them that would be considerable less strict than the arrangement that the Troika had negotiated.[1189] Furthermore, competition in the enriched uranium market was already fierce and was at risk of becoming more intense because of French plans to build a new enrichment plant with substantial capacity.[1190] In summary, the transaction with Brazil was deemed of vital importance to the future of the Troika.

1183 Ibid.
1184 ARC 61-3, p. 2.
1185 Ibid.
1186 Ibid.
1187 ARC 61-5, p. 1.
1188 ARC 61-4, p. 1.
1189 Ibid., pp. 1-2.
1190 Ibid. p. 1.

Dutch officials were unsure whether the German's would follow through on their threats. What was clear was that the stakes were high in their push for additional conditions in the Nuclébras-Urenco contract.[1191]

A Pending Decision

By September 1976 Minister Lubbers had received a final (negative) decision by the Dutch industrial partners and had to conclude that continued Dutch involvement in Urenco's growth would only be possible if the state took on the Dutch investment requirements.[1192] On the 20th of September he sent the PM (with copies to his colleagues) an overview of the project with an interdepartmental economic evaluation study dated 10 June 1976 attached.

The main industrial partners, Shell and DSM, after having seen the evaluation study prepared by the interdepartmental work-group (Economic Affairs, Finance, Science Policy and Foreign Affairs) communicated their reasons for not wanting to continue; Shell no longer wanted to be involved in a project with such a strong political dimension for several reasons, as reported to the PM by his departmental adviser J.P. Kieboom. After seeing strong negative public reactions to fellow Dutch companies Stevin-groep and Amro-bank developing business with regimes of questionable reputation in Chili and South Africa respectively, the company had become increasingly risk-averse.

The Brazil-order in particular could hurt Shell's reputation, it believed. With Urenco pursuing a global order portfolio, Shell wanted to avoid responsibility over the question which country should and shouldn't be supplied with enriched uranium. Additionally, itself a Dutch-British company, Shell did not feel comfortable with supporting the further integration of the Dutch and West-German parts of the company, perhaps anticipating political complications to result from that. Neither was the field of industry close enough to Shell's core business (oil and gas) and the project's lead time would be much longer than Shell (out of experience) wanted to expose itself to.[1193] Furthermore, the nuclear energy production and uranium enrichment markets were dominated by governments, resulting in what Shell considered price-levels that did not conform to real values, thus making a market-oriented approach impossible.[1194]

1191 Den Haan, Frederik, M., De Urenco-kwestie: De leverantie van verrijkt uranium aan Brazilië (Instituut voor Internationale Studiën – Rijksuniversiteit Leiden: Leiden 1985) p. 14.

1192 Letter, Minister van Economische Zaken aan Minister President, 'U.C.-project', 276/IV/6086, 20th of September 1976, includes Report, 'UC-Project' opgesteld door een interdepartementale werkgroep Financiën – Economische Zaken (met medewerking van het Directoraat-Generaal Wetenschapsbeleid, 10th of June 1976, 2.03.01/10861, pp. 1, 3.

1193 Letter, Minister van Economische Zaken aan Minister President, 'U.C.-project', 276/IV/6086, 20th of September 1976, includes Report, 'UC-Project' opgesteld door een interdepartementale werkgroep Financiën – Economische Zaken (met medewerking van het Directoraat-Generaal Wetenschapsbeleid, 10th of June 1976, 2.03.01/10861, p. 1, Note, Drs. J.P. Kieboom aan Minister-President, 'Ultra-centrifuge (MR 22 oktober 1976 punt 20l)', No. 584, 22nd of October 1976, 2.03.01/10861, p. 1, Note, Drs. J.P. Kieboom aan Minister-President, 'ultracentrifuge-project', No. 577, 20th of September 1976, 2.03.01/10860, p. 1, Note, 'Kanttekeningen ultracentrifuge', No. 82, 21st of September 1976, 2.03.01/10860.

1194 Note, Drs. J.P. Kieboom aan Minister-President, 'Beslissing voortzetting UCN', No. 587, 29th of October 1976, 2.03.01/10861, p. 2.

Lubbers noted that Shell's disengagement was not based on the economic merits of the project.

DSM had linked its participation in the project to that of Shell. It communicated that the project was entirely outside of the company's scope. As an additional reason, DSM cited heavy investments in other projects that as a result excluded the possibility of making new commitments to the UC project.[1195] Officials commenting on DSM's decision characterized its policy in the matter as 'a bit cowardly', 'lacking vision' and being 'out of step'.[1196] Other potential industrial partners RSV (Rijn-Schelde-Verolme) and VMF were reported at this time to be 'in the red' and unable to invest.[1197] Philips, one of the other Dutch industrial powerhouses, had in frustration withdrawn from the nuclear energy sector altogether after it had developed a nuclear fuel assembly division in anticipation of supplying fuel to the Dutch Borssele NPP, after which the involved Dutch utility SEP had given the order to Siemens instead.[1198]

Lubbers sketched out the two main scenarios to the PM, which were continuation, or an exit from the UC project. Continuation would result in projected earnings of an estimated 10% after taxes, could be financed with outside money and would guarantee 350 jobs at the site. Indirect jobs as a result of continuing fabrication and operation in Almelo would match the number of direct jobs involved and continued expansion of operations over the next decade would see those numbers rise further. Tax income for the state would be substantial and positive balance of payments for the Netherlands could be expected.[1199] Lubber's positive assessment reflects a consensus previously arrived at by officials from the ministries of Economic Affairs, Foreign Affairs, Finance and Science Policy, and agreed upon in a interdepartmental meeting on the 18th of June 1976. Following the decision by industry to pull out however, the Ministry of Finance had altered its assessment; whereas Minister of Finance Duisenberg had voiced his support for the project to Lubbers in meetings on the 10th and 17th of June, by September 1976 he had a negative outlook, pessimistic about the ability of the state to provide proper management for the project. Economic Affairs countered by arguing it

1195 Letter, Minister van Economische Zaken aan Minister President, 'U.C.-project', 276/IV/6086, 20th of September 1976, includes Report, 'UC-Project' opgesteld door een interdepartementale werkgroep Financiën – Economische Zaken (met medewerking van het Directoraat-Generaal Wetenschapsbeleid, 10th of June 1976, 2.03.01/10861, pp. 1-2.

1196 Note, 'Kanttekeningen ultracentrifuge', No. 82, 21st of September 1976, 2.03.01/10860, p. 3.

1197 Note, Drs. J.P. Kieboom aan Minister-President, 'ultracentrifuge-project', No. 577, 20th of September 1976, 2.03.01/10860, p. 1, Note, 'Kanttekeningen ultracentrifuge', No. 82, 21st of September 1976, 2.03.01/10860, p. 3. See *Case: South Africa* on RSV, page 364.

1198 Note, Drs. J.P. Kieboom aan Minister-President, 'ultracentrifuge-project', No. 577, 20th of September 1976, 2.03.01/10860, p. 1, Note, 'Kanttekeningen ultracentrifuge', No. 82, 21st of September 1976, 2.03.01/10860, p. 1.

1199 Letter, Minister van Economische Zaken aan Minister President, 'U.C.-project', 276/IV/6086, 20th of September 1976, includes Report, 'UC-Project' opgesteld door een interdepartementale werkgroep Financiën – Economische Zaken (met medewerking van het Directoraat-Generaal Wetenschapsbeleid, 10th of June 1976, 2.03.01/10861, p. 2. PM Den Uyl faced some domestic pressure to protect the project's jobs in Almelo, when city council member and alderman for Economic Affairs E.R. Wieldraayer, a fellow PvdA member and former parliamentary member, asked him for his support in the face of Lubber's temporizing the project in early 1976, Letter, Wethouder Economische Zaken Gemeente Almelo E.R. Wieldraayer aan Minister President J.M. Den Uyl, 22nd of September 1976, 2.03.01./10860.

had experience in several comparable projects and that considering 'such a sensitive subject matter' as this, intensive state involvement would be an asset.[1200]

Discontinuation in the project would carry considerable financial risks, wrote Lubbers. The evaluation study stated that the cancellation of deliveries under contract could result in a payoff in the order of 1.000 million guilders ($ 366 million) in money terms (260 million guilders ($ 95.24 million) in real terms (adjusted for inflation).[1201] The Netherlands, to honor its commercial commitments, would possibly have to purchase enriched uranium from the Russians, officials commented.[1202] In contrast, continuation by investing in the SP-4 factory would require financing in the order of 505 million guilders ($ 185 million) in money terms and 324 million guilders ($ 119 million) in real terms.[1203]

Political repercussions could also be substantial if the Netherlands chose to exit the project; West-Germany would almost certainly build an enrichment facility on its own soil; the Dutch ability to veto questionable exports to outside the Troika would cease to exist; a Dutch exit would be interpreted by the market as a Troika lack of faith 'in its ability to meet its requirements on deliveries' and finally it would also be detrimental to the Netherlands' reputation as a reliable partner in international technological projects, negatively affecting Dutch industry.[1204]

While Lubbers did not explicitly advice the PM to favor continuation, his arguments made that case. Lubbers argued that continuation of UCN as a state-owned company was not only possible but very viable. The Dutch share of the expansion to 2000 tons was projected to be sufficiently profitable to cover the funds needed for the expansion with outside financing (and

1200 Note, 'Kanttekeningen ultracentrifuge', No. 82, 21st of September 1976, 2.03.01/10860, p. 1, Note, Drs. J.P. Kieboom aan Minister-President, 'ultracentrifuge-project', No. 577, 20th of September 1976, 2.03.01/10860, p. 2.

1201 Letter, Minister van Economische Zaken aan Minister President, 'U.C.-project', 276/IV/6086, 20th of September 1976, includes Report, 'UC-Project' opgesteld door een interdepartementale werkgroep Financiën – Economische Zaken (met medewerking van het Directoraat-Generaal Wetenschapsbeleid, 10th of June 1976, 2.03.01/10861, p. 10, Den Haan, Frederik, M., *De Urenco-kwestie: De leverantie van verrijkt uranium aan Brazilië* (Instituut voor Internationale Studiën – Rijksuniversiteit Leiden: Leiden 1985) p. 18, 'Netherlands – Spot Exchange Rate, Guilders/US$', 9th of July 1976, Historical Data, H.10 Foreign Exchange Rates, Federal Reserve Statistical Release (United States Federal Reserve Bank) https://www.federalreserve.gov/releases/H10/hist/dat89_ne.txt, website checked 30-7-2018.

1202 Note, 'Kanttekeningen ultracentrifuge', No. 82, 21st of September 1976, 2.03.01/10860, p. 1. As departmental councilor on financial and socio-economic affairs Van de Graaf concluded in a note to the PM the following November, by agreeing to have Urenco make contractual commitments for 2000 tons of enrichment capacity, the Ministry of Economic Affairs had 'more or less' committed the Government to continue the project as well, Note, Drs. T. van de Graaf aan Minister-President, 'Voortzetting UC-project (MR 12 november 1976, punt 14)', No. 1037, 11th of November 1976, 2.03.01/10861.

1203 Letter, Minister van Economische Zaken aan Minister President, 'U.C.-project', 276/IV/6086, 20th of September 1976, includes Report, 'UC-Project' opgesteld door een interdepartementale werkgroep Financiën – Economische Zaken (met medewerking van het Directoraat-Generaal Wetenschapsbeleid, 10th of June 1976, 2.03.01/10861, p. 10, 'Netherlands – Spot Exchange Rate, Guilders/US$', 9th of July 1976, Historical Data, H.10 Foreign Exchange Rates, Federal Reserve Statistical Release (United States Federal Reserve Bank) https://www.federalreserve.gov/releases/H10/hist/dat89_ne.txt, website checked 30-7-2018.

1204 Ibid., pp. 10-11. Lubbers might have been overstating the consequences of an exit here, as there is an argument to be made that the Netherlands Government would still have a say over exports from Almelo, as those would require Dutch export licenses.

thus not burdening the Government budget). He mentioned the quality of the current generation centrifuges, the positive market outlook of supply and demand of enrichment services, the risk-free policy towards new contracts (capacity would only be build after it has been profitably sold) and finally Urenco's insulation from fluctuations in natural uranium prices (because clients provided their own uranium; Urenco only provided the enrichment service and would never be owner of the resource or product).[1205] Finally, Lubbers mentioned the future possibility of the Troika to engage in structural cooperation with countries such as Australia.[1206] Lubbers urged haste on account of the impatient partners and proposed the matter be discussed at the next Council of Ministers meeting, on the 24th of September. At that time, he would brief the Government on the meeting he will have days before with his Troika counterparts.[1207]

In a Dutch memorandum to the tripartite ministerial discussion on the UC project of 21 September 1976 several proposals with regard to the next project phase of commercial exploitation were forwarded. The Dutch memo explained that the discontinuation of participation by industry created a situation for the Dutch Government that would cause some delay.[1208] Lubbers voiced confidence in the ability of the Dutch partner to overcome the current problems and proposed the reform of the organization system towards a 'strictly commercially oriented' form and set out a number of conditions; the extension of the Almelo treaty to 1991; renegotiation of existing contracts; conditions for future contracts and integration of German and Dutch 'research and development, centrifuge-fabrication and enrichment plants' in a holding company in which ownership would be shared equally between the two.[1209] In the tripartite meeting the ministers agreed to review the situation, as well as set a number of conditions to Lubbers' integration proposal to safeguard the three government's interests. Lubbers, writing to his fellow ministers involved (Van der Stoel for Foreign Affairs, Duisenberg for Finance and Trip for Science Policy), estimated the West-German side would not find his proposal easy to swallow and at most a principle agreement could be expected. Now a vocal proponent of continuation of the project, Lubbers argued that whereas the political dimension had caused the industrial partners to forgo participation, it was that same dimension that brought arguments for continued Government involvement; his colleagues should weigh the value of a positive return on investment, regional job creation, Dutch ability to control the project up to 1991 and prevention of a plant on German soil against the effects of discontinuation.[1210]

1205 Ibid., p. 3. However, years later Urenco would offer to supply part of the natural uranium as part of an enrichment contract, to Japan. See *Case: Japan*, page 407.

1206 Ibid.

1207 Ibid., pp. 3-4.

1208 Memorandum, 'Tripartite ministerial discussion regarding the ultra centrifuge enrichment programme to be held in Bonn, 21 September 1976: Netherlands policy and position', 21st of September 1976, 2.03.01/10861, p. 2.

1209 Ibid., pp. 3-4. On the Dutch-German integration of R&D effort already underway, see above, page 283.

1210 Letter, Minister van Economische Zaken aan Minister van Buitenlandse Zaken M. Van der Stoel, Minister van Financiën Dr. W.F. Duisenberg, Minister van Wetenschapsbeleid F.H.P. Trip, 20th of October 1976, 2.03.01/10860, Conclusion by Joint Committee, 18th of October 1976, 2.03.01/10861, p. 1, Note, Drs. J.P. Kieboom aan Minister-President, 'Ultra-centrifuge (MR 22 oktober 1976 punt 20l)', No. 584, 22nd of October 1976, 2.03.01/10861. The strict conditions set by Lubbers on behalf of the Dutch Government towards the

The following month Uranit followed up with its own memorandum on further integration which, it was decided by the partners, was considered 'a reasonable basis for … integration'.[1211] The JC furthermore agreed that before the end of the year 'Netherlands and German decisions for joint investment in the infrastructure of the FP-1 plant at Almelo for a 1000 t/a capacity as well as for a first 400 t/a of its separative capacity [would] be taken'.[1212]

In October 1976 Ministers Lubbers and Van der Stoel met with the Parliamentary Select Committees on respectively Foreign Affairs, Economic Affairs and Nuclear Energy in a joint session. The Government could make a decision soon, estimated Lubbers at this time. Following press reports of that meeting, the industrial workers councils of ECN and UCN jointly wrote to the Council of Ministers expressing their incomprehension that discontinuation of the project was even being considered, that this had caused great anxiety with their personnel and that in light of the foregoing history of the project, the Government should make a positive decision soon to end the now existing uncertainty. The Government was divided over the question of expansion. The Political Party of Radicals (PPR – Politieke Partij Radikalen, a progressive left-leaning party), represented in the Government by its ministers Trip and Van Doorn, considered a decision for expansion and essentially making UCN a state corporation unacceptable, moreover because they considered it a covert choice for the use of nuclear energy. In a last-minute meeting with the PPR leadership including their ministers on the 9th of November, Prime Minister Den Uyl sought clarity on their position, leaving PPR parliamentary faction leader De Gaay Fortman expressing trust in the Government coming to 'responsible decision'.[1213]

In the Ministerial meeting on the 12th of November 1976 however, the Government was still unable to make a decision. According to the PM Den Uyl, additional technical and commercial data were needed before a decision was possible.[1214] Despite the very positive evaluations by his departmental councilor Kieboom, who as late as October had described the project as a 'spearhead-industry of importance', Den Uyl wanted to obtain advice from a wider range of experts.[1215] It seemed a play for time by the PM, trying to avoid the implosion of his coalition government. '"Almelo" lays under the Government like a time-bomb', the leading Dutch newspaper *NRC Handelsblad* headlined on the 17th of November, the day before the

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Troika partners were partially meant to placate the PPR ministers in the Government and their parliamentary faction, 'De PPR en "Almelo"', in *Nederlands Dagblad*, 22nd of December 1976, p. 1.

1211 Conclusion by Joint Committee, 18th of October 1976, 2.03.01/10861, p. 1.

1212 Ibid., p. 2. FP-1 refers to SP-4.

1213 'PPR slikt geen uitbreiding ultracentrifuge', in *NRC Handelsblad*, 10th of November 1976, p. 1, '"Almelo" ligt als tijdbom onder kabinet', in *NRC Handelsblad*, 17th of November 1976, p. 1, 'Landelijke kerngroep besluit: PPR moet uit kabinet bij uitbreiding van UC-project in Almelo', in *Leeuwarder Courant*, 20th of December 1976, p. 3.

1214 Den Haan, Frederik, M., *De Urenco-kwestie: De leverantie van verrijkt uranium aan Brazilië* (Instituut voor Internationale Studiën – Rijksuniversiteit Leiden: Leiden 1985) p.15, Telex, Ondernemingsraden van ECN en UCN aan de Ministerraad, 254746, 15th of November 1976, 2.03.01/10860, pp. 1-2.

1215 Note, Drs. J.P. Kieboom aan Minister-President, 'Beslissing voortzetting UCN', No. 587, 29th of October 1976, 2.03.01/10861, p. 2, Note, Drs. J.P. Kieboom aan Minister-President, 'Nader advies Ultra centrifuge', No. 596, 25th of November 1976, 2.03.01/10860.

Select Committee meeting, in the article drawing attention to the PPR ministers hard-line stance and their threat to withdraw their support of the Government.[1216]

On the 18th of November 1976 the Select Committees of Economic Affairs, Foreign Affairs and of Nuclear Energy met in a joint session to discuss the Ultra-centrifuge Project. Minister Lubbers communicated the view of the Government on the current situation to those present. Lubbers announced the withdrawal of the Dutch industrial partners from the project and summarized their reasons for not wishing to continue. Interestingly, Lubbers mentioned that the companies, besides the political and economic uncertainties that he had already reported on internally to the PM, also saw the veto power of the Troika partners to stop technology transfers as an unattractive economic aspect.[1217] The Minister briefed the parliamentarians on the economic merit of the project, potential of the project to create jobs and financing requirements in the form of loan guarantees. He also reported on the 'wish-list' the Government had communicated to the Troika partners as a condition of continuation in the project, which the Dutch wished to tie to the required financial commitment for the expansion of the Almelo plant to 2000 ton capacity. The Troika partners had responded in a 'cautiously positive' manner to this proposal.[1218] As such, a decision to financially guarantee the expansion would entail all the partners to sign off on an extension of the Almelo treaty by 10 years (to 1991). On the financial risks that a Dutch discontinuation could have the Netherlands be exposed to, that Lubbers had reported to his colleagues on the 20th of September, he made no mention.

The Minister of Foreign Affairs in turn warned against risking the loss of Dutch veto power in the JC if the Government decided to discontinue its involvement in the project, which would be detrimental to its 'active non-proliferation policy'. He added that this could mean that the Troika partners would continue on without the Dutch, even though they preferred to continue with the Netherlands as their partner.[1219]

That the pressure was on the Dutch to make a decision was confirmed in a 26th of November meeting between executives from UCN, Uranit and BNFL, also attended by R.W.R. Dee, Government representative on the board of UCN. Uranit official Dr. Wirths (also Chairman of the Urenco Ltd. and Centec G.m.b.H. boards) and C. Allday of BNFL stressed that the delays caused by the Dutch were already tarnishing the '"image" of Urenco … and her shareholders, Uranit, BNFL (and UCN).'[1220] They pointed out that further delay would increase this reputation damage and was endangering Urenco's contractual commitments to supply its clients. The German partner furthermore explained it was under 'great pressure' to build an

1216 '"Almelo" ligt als tijdbom onder kabinet', in *NRC Handelsblad*, 17th of November 1976, p. 1.

1217 Tweede Kamer der Staten Generaal, Zitting 1976-1977 – 14261, Nr. 1, Verslag van een mondeling overleg, 18th of November 1976, p. 3.

1218 Ibid.

1219 Ibid., pp. 3-4.

1220 Letter, Ultra-Centrifuge Nederland N.V. H. Hooykaas aan Ministerie van Algemene Zaken Drs. J.P. Kieboom, Ho/fjj/1574/76, 26th of November 1976, 2.03.01/10860, p. 1. A Dutch newspaper reported that during this period Uranit was inquiring on a daily basis with the Dutch Ministry of Foreign Affairs whether a decision had yet been taken, 'Kamer krijgt kans over Almelo te spreken', in *NRC Handelsblad*, 30th of November 1976, p. 3.

enrichment plant next to a planned reprocessing plant just over the Dutch border near Gronau.[1221]

In December, the discussion within the Dutch Government shifted towards the Brazil contract. In an advice to Minister Lubbers, departmental councilor Kieboom informed him that a number of factors pleaded for continuation of the Troika. Influence over the Brazil contract and controls it would be subject to could only be ensured if the Netherlands and Urenco stayed with the deal. Using the Dutch veto in the JC over the Brazil contract might just as soon cause one or both of the other partners to quit the collaboration, also considering the fact that the Dutch Government had previously given explicit permission for Urenco to both start negotiations and conclude it's contract with Brazil. This probably also meant that UCN was fully legally liable for any Dutch failure to honor the contract. In the case of a denial of service to Brazil by Urenco, Kieboom estimated it would either enrich its own uranium of contract it elsewhere. In this context he noted it was telling that the French Embassy council had already contacted him, 'implicitly looking for' clarifications on what effect a Dutch veto would have on the Brazil-contract, and continued to inform themselves daily on whether the Dutch Council of Ministers had made a decision yet.[1222] Additionally, a refusal by the Netherlands to supply Brazil with enriched uranium could mean a violation of the 1961 EURATOM-Brazil Agreement, to which the Netherlands, as EC member, was bound.[1223]

The concluded trilateral safeguards agreement between Brazil, the FRG and the IAEA went far beyond what the relevant NPT stipulations demanded, according to IAEA Inspector General for Safeguards Rometsch, reminded Kieboom. Though officials from the Ministry of Foreign Affairs apparently shared the view that bringing most of Brazil's nuclear program under safeguards was a positive development, other departmental councilors in advice to the PM considered this a 'meager' boon, and the IAEA safeguards system itself, 'not uncontroversial'.[1224]

A decision of principle for the continuation and expansion of the UC project was finally made on the 17th of December 1976. A final decision by the Council of Ministers was pending the positive results of further talks between the Troika economic affairs ministers on the 'financial-economic side of the ultracentrifuge industry.'[1225] Additionally, Minister Van der

1221 Letter, Ultra-Centrifuge Nederland N.V. H. Hooykaas aan Ministerie van Algemene Zaken Drs. J.P. Kieboom, Ho/fjj/1574/76, 26th of November 1976, 2.03.01/10860, pp. 1-2.

1222 Note, Drs. J.P. Kieboom aan Minister van Economische Zaken R.F.M. Lubbers, 'Urenco-Nuclébras Contract', No. 602, 15th of December 1976, 2.03.01/10860, pp. 1-2, Note, Drs. J.P. Kieboom aan Minister-President, 'enkele aspecten van de kernenergieproblematiek (formatie)', No. 673, 27th of July 1977, 2.03.01/10860, p. 4.

1223 Note, Drs. J.P. Kieboom aan Minister van Economische Zaken R.F.M. Lubbers, 'Urenco-Nuclébras Contract', No. 602, 15th of December 1976, 2.03.01/10860, pp. 1-2.

1224 Ibid., Note, Mr. J.P.M.H. Merckelbach en Drs. J.W. Holtslag aan Minister-President, 'nucleaire export: artikel Der Spiegel 15-3-1076 en Vrij Nederland 8-1-1977 (Maurits Groen)', No. 729/112, 7th of January 1977, 2.03.01/10860, p. 2. The Inspector General of the Department of Safeguards would later more commonly be addressed as the Deputy Director General (DDG) for Safeguards.

1225 Formal Proposal, Minsiter of Economic Affairs, 'voortzetting deelneming in het tripartite Ultra-Centrifuge project', 276/IV/6086, 20th of September 1976, 2.03.01/10861, Den Haan, Frederik, M., *De Urenco-kwestie: De leverantie van verrijkt uranium aan Brazilië* (Instituut voor Internationale Studiën – Rijksuniversiteit Leiden:

Stoel had to negotiate further safeguards commitments with the Brazilians 'as a pre-condition for a final decision on expansion of the plant in Almelo and deliveries to Brazil.'[1226] He furthermore was asked by the Council of Ministers to initiate talks with the Troika partners to come to a safeguards policy with regards to supplies to fourth countries.[1227]

Following the announcement of the Government's decision on the 17th, at a PPR core group meeting on the 18th of December, a large majority voted in favor of a motion that directed the PPR ministers to leave their posts if the Government made a definitive decision in favor of the expansion of Almelo. Ministers Trip and Van Doorn had argued against adopting any motions, asking for more time from their party. Some core group members argued that the ministers should hand in their portfolios right away; the fact that they hadn't already could result in the loss of members for the party, seeing the surge of vocal support the principled stance of its ministers had yielded the party so far.[1228]

The dissatisfaction that the German partner felt towards the Dutch and the delays their decision-making process were causing continued on into December 1976. In a memo dated the 21st of December 1976, the delegate from DRW to the latest JC meeting reported back to the Minister that the Germans had not altered their critical stance and outside of session continued to attempt to convince the Dutch officials of the threat of French competition and the merits of the trilateral safeguards agreement between the FRG, Brazil and the IAEA.[1229] Meanwhile, the UK side seemed to be more understanding of the Dutch position and exerted no additional pressure.[1230] Hearing a summary of the Dutch ministerial decision of the 17th of December, the Germans requested a JC meeting between the foreign affairs ministers of the Troika.[1231]

Going into January 1977, PM Den Uyl received warning that the attitude of the Germans but now also the British towards the Dutch partner had worsened considerably in the absence of any definite decision. Director Hooykaas of UCN (on loan from Shell) signaled the alarm in a letter to Minister Van der Stoel, saying that further delay would trigger a 'breach' in the

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Leiden 1985) p. 15, Letter, Minister van Economische Zaken en Minister van Buitenlandse Zaken aan de Voorzitter van de Tweede Kamer der Staten Generaal, 276/IV/6368, 17th of December 1976, 2.03.01/10859, p. 1.

1226 Den Haan, Frederik, M., *De Urenco-kwestie: De leverantie van verrijkt uranium aan Brazilië* (Instituut voor Internationale Studiën – Rijksuniversiteit Leiden: Leiden 1985) p. 15, 'Kabinet besluit „voorlopig" tot groter Almelo', in *NRC Handelsblad*, 18th of December 1976, p. 1, Letter, Minister van Economische Zaken en Minister van Buitenlandse Zaken aan de Voorzitter van de Tweede Kamer der Staten Generaal, 276/IV/6368, 17th of December 1976, 2.03.01/10859, p. 1.

1227 Note, Drs. J.W. Holtslag aan de informateurs d.t.k. mr. H.D. Tjeenk Willink, 'UCN uitbreiding', No. 256, 5th of September 1977, 2.03.01/10859, p. 1.

1228 'PPR: Positief besluit 'Almelo' betekent breuk', in *NRC Handelsblad*, 20th of December 1976, pp. 1-2, 'De PPR en "Almelo"', in *Nederlands Dagblad*, 22nd of December 1976, p. 1. The willingness of the PPR to 'let the Government fall' over nuclear related matters was also exhibited during the Koeberg affair. See *Case: South Africa*, page 366.

1229 ARC 61-5, p. 1.

1230 Ibid.

1231 Ibid., pp. 1-2.

Troika.[1232] Officials from the ministries of Foreign Affairs and Economic Affairs had gotten the same impression from their colleagues in the Joint Committee. Departmental councilor Kieboom informed PM Den Uyl that while Minister Lubbers seemed to have his house in order, Minister Van der Stoel had failed to inform his officials 'of the results of his trips to Vienna, Bonn and London' and that the PM would do well to personally inform himself with Van der Stoel as to state of progress of his mission.[1233]

Mixed signals from the IAEA

In July 1976, DRW officials were under the impression that the IAEA considered the trilateral safeguards agreement as 'very positive' as it went beyond what any previous safeguards agreement demanded.[1234] As reflected in above-mentioned assessment by Kieboom referencing IAEA Inspector General Rometsch, that perception persisted in December 1976.[1235] By January 1977 that picture had to be nuanced. Foreign Minister Van der Stoel had invited IAEA Director Eklund for a visit and they discussed a number of ongoing non-proliferation issues in two meetings on the 28th of December and the following January.[1236] Van der Stoel reported that Eklund made clear he could only speak in a personal capacity, not his official capacity as Director-General of the IAEA.

Eklund was not at all happy with the Brazil deal. In his opinion, West-Germany should not have moved along as far as it did without demanding safeguards on all nuclear activities in Brazil. When the Germans had failed to make such a demand, the IAEA secretariat had had no options left other than to attempt and come to the most satisfying safeguards agreement possible at that point. This had led to '"unpleasant discussions" with the FRG.'[1237]

Eklund considered the German-Brazilian agreement 'a dangerous precedent for nuclear export to countries that are not party to the NPT'.[1238] '"Unless the situation is rectified within the next three to five years, the entire NPT-system may break down."'.[1239] Particularly countries like Argentina and Brazil constituted the greatest proliferation risk and the only satisfying answer to this problem was to bring them into the fold of the IAEA safeguards system, Eklund argued.[1240] The particular risk that Eklund detected in the proposed safeguards solution was

1232 Note, Drs. J.P. Kieboom aan Minister-President, 'spoed inzake beslissing UCN', No. 627, 20th of January 1977, 2.03.01/10859.
1233 Ibid.
1234 ARC 61-4, p. 1.
1235 Note, Drs. J.P. Kieboom aan Minister van Economische Zaken R.F.M. Lubbers, 'Urenco-Nuclébras Contract', No. 602, 15th of December 1976, 2.03.01/10860, p. 2.
1236 Den Haan, Frederik, M., *De Urenco-kwestie: De leverantie van verrijkt uranium aan Brazilië* (Instituut voor Internationale Studiën – Rijksuniversiteit Leiden: Leiden 1985) p. 16.
1237 ARC 61-6, p. 1.
1238 Ibid.
1239 Ibid., pp.1-2.
1240 Ibid., p. 2. Argentina had already been provided with proliferation-sensitive nuclear technology in the form of a heavy water reactor by the FRG, which came online in 1974, 'Nuclear Power in Argentina', World Nuclear Association, http://www.world-nuclear.org/information-library/country-profiles/countries-a-f/argentina.aspx, website checked 19-4-2017.

that Brazil could construct nuclear facilities on its own without even using the German technology. It could construct its own reactor for the production of plutonium and use publicly accessible sources to build a reprocessing facility (as the Indians had done). Even if the Germans would not go ahead with transferring of enrichment and reprocessing technologies, the problem would persist.[1241] Furthermore, '[t]he IAEA would have no ability to detect such Brazilian activities as long as Brazil would not accept safeguards on the totality of its nuclear energy activities.'.[1242]

When Minister Van der Stoel argued that if Urenco would withdraw its offer to Brazil another supplier would move in, Eklund was forced to agree that while he did not think the US or USSR would supply Brazil, it could not be discounted that France would when Eurodif's capacity expanded.[1243] Eklund was dealing with a challenge that existed before the Brazil deal and that would exist after. He was forced to manage a system in which existed two trade arenas that each operated under different rules and conditions, that had come into existence after the long-term non-universality of the NPT became apparent and the make up of NSG's membership and its discussions increasingly reflected that dichotomy. Eklund despaired because the current trend in trade, with the FRG and France leading the way, undercut the norm that the NPT-system sought to impose on signatories and non-signatories alike. With reprocessing technology already in the open literature, in a literal sense the Brazil-deal did not reduce the IAEA's and supporting countries' ability to try and pull the non-signatories into the fold. The deal would however augment the creation of a legitimate space, helped by the IAEA's involvement and sanctioning of the safeguards commitments made in the deal, that could serve as a precedent of how principled non-signatories with strong grievances toward the NPT-system could attract nuclear technological assistance but still operate outside of it. It should be noted that at no point during the conversation Eklund denied the legitimacy of those grievances.

At multiple occasions, the Den Uyl Government had suggested that the Netherlands could act as an initiator to get the international plutonium storage regime established. By May 1978 however, in discussions with Dutch parliamentary representatives Ter Beek and Van Houwelingen, IAEA officials were 'very explicit as to the impossibility of the establishment of an international plutonium storage regime (IPS) before Urenco deliveries to Brazil would ensue in 1981'.[1244]

Changing Perceptions

Up to the start of 1977, the Dutch side had attempted to keep separate the economic (the expansion of capacity) and political (acceptable safeguards in the Brazil contract) issues and decisions during meetings of the Troika. In early 1977 however, the German and British

1241 Ibid., pp. 2-3. See *Case: India*, page 439.
1242 Ibid., p. 2.
1243 Ibid., p. 3.
1244 Den Haan, Frederik, M., *De Urenco-kwestie: De leverantie van verrijkt uranium aan Brazilië* (Instituut voor Internationale Studiën – Rijksuniversiteit Leiden: Leiden 1985) p. 24.

delegates to the JC insisted that the next meeting include both trilateral ministers of energy and foreign affairs, as it had become impossible to separate the 'financial-economic aspects from the political'.[1245] By the end of the year, the Dutch had come to see it the same way. Moreover, it had become clear to the Dutch MEA (and most likely the MFA too) that to its partners in the Troika the issues had become conditionally linked; a failure to approve the Brazil order would have the same effect as a decision against expansion; the joint UC project would dissolve altogether or continue into its commercial phase without the Dutch participation.[1246]

Only hours before Carter's inauguration on January 20, 1977, the US Ambassador to Brazil, John Crimmins, reported that the FRG Ambassador to Brazil had said that his government would "brook no third country interference in the Brazilian-German agreement, although this attitude does not preclude 'clarifications'." The FRG Ambassador had assured a group of European journalists that Brazil, although not a signatory to the Non-Proliferation Treaty, "had made clear several times' in various international forums' Brazil's intention not to fabricate nuclear devices" and "reportedly cited as one example Brazil's signature of the Tlatelolco Treaty," the 1967 pact that outlawed nuclear weapons in Latin America and the Caribbean (which it had not ratified since).[1247] In other words, Brazil's non-proliferation standing was good, even though the country had not signed or ratified the NPT.

Minister of Foreign Affairs Van der Stoel met up with US Vice President Mondale in Bonn on the 25th of January 1977 to discuss, among other issues, non-proliferation policy. Van der Stoel told Mondale that,

> '[t]he Dutch are considering vetoing this fuel sale, because they want no part of the West German-Brazilian deal to transfer sensitive reprocessing and enrichment technology, however, they are concerned over West German threats to pull out of the consortium if the Dutch veto the sale and are disturbed at the profound political confrontation that might ensue.'[1248]

Consequently, the Dutch sought help in resolving the issue with the Germans and.

1245 ARC 61-8a, p. 1.

1246 ARC 61-13, p. 4, Den Haan, Frederik, M., *De Urenco-kwestie: De leverantie van verrijkt uranium aan Brazilië* (Instituut voor Internationale Studiën – Rijksuniversiteit Leiden: Leiden 1985) pp. 17-18. Den Haan was aware of the existence and makes mention of ARC 61-13, the DRW briefing for the incoming Minister, but did not have access to its contents, Den Haan, Frederik, M., *De Urenco-kwestie: De leverantie van verrijkt uranium aan Brazilië* (Instituut voor Internationale Studiën – Rijksuniversiteit Leiden: Leiden 1985) p. 21.

1247 Memorandum From Jerry Oplinger of the National Security Council Staff to the President's Assistant for National Security Affairs (Brzezinski), Washington, 23rd of December 1980, in *Foreign Relations of the United States, 1977–1980, Volume XXVI, Arms Control and Nonproliferation,* https://s3.amazonaws.com/static.history.state.gov/frus/frus1977-80v26/pdf/frus1977-80v26.pdf, website checked 22-2-2017, p. 1015.

1248 Backchannel Message From Vice President Mondale to the President's Assistant for National Security Affairs (Brzezinski), 1139Z, Bonn, 25th of January 1977, in *Foreign Relations of the United States, 1977–1980, Volume XXVI, Arms Control and Nonproliferation,* https://s3.amazonaws.com/static.history.state.gov/frus/frus1977-80v26/pdf/frus1977-80v26.pdf, website checked 22-2-2017. p. 788.

'… were probing for U.S. support. In this connection, they urged the U.S. to adopt the Canadian position on international safeguards (no sale of nuclear fuel unless the purchasing company has all of its nuclear facilities under safeguards)'.[1249]

A couple of days before, Carter had 'instructed Vice President Walter Mondale, during Mondale's upcoming European visit, to "confirm to Chancellor [Helmut] Schmidt that provision of nuclear fuel reprocessing technology to Brazil [would] create a major crisis in US-German relations."'.[1250] At that moment in time, the alignment of Dutch and US interests was perfect and the 'Canadian position' the Dutch had urged the Americans to adopt would later be reflected in the US NNPA (see *The 1978 Nuclear Non-Proliferation Act*, page 341).[1251]

Schmidt and his Cabinet had been presented a negotiated deal that included the fuel-cycle technologies by his Ministry of Research after a process that had included 'little input from the Foreign Office and its Disarmament Division', while receiving plenty from the private companies involved.[1252] Mondale's pressure to have the FRG 'withhold fuel technologies or to place them in multinational hands' had been anticipated and à priori dismissed by the Research Division and its corporate partners as 'simply sour grapes over lost business.'[1253] Now that the Brazilians had been sold on the need for a waste disposal system in the form of reprocessing infrastructure, like the West-Germans had envisioned for their domestically controversially waste problem, most involved ministries did not see a viable way to withdraw the offer to Brazil without suffering major political fallout both abroad and at home, and advised Schmidt so. Schmidt decided to stick with the deal and wait and see. Meanwhile, Mondale's démarche to Schmidt, approaching the FRG before approaching Brazil was taken by the Brazilians in the worst possible way, even swinging domestic opponents of the nuclear program behind it, 'if for no other reason than national pride', closing off all routes for the Americans to influence the contents of the deal on that side of it.[1254]

Following his discussions with the Americans, Minister Van der Stoel asked and received a new negotiating mandate from the Dutch Council of Ministers on the 4th of February 1977. In this mandate, Van der Stoel would try to extract a number of far-going concessions from the Troika partners, of which the most important one was that the IAEA would determine the

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1249 Ibid.

1250 Memorandum From Jerry Oplinger of the National Security Council Staff to the President's Assistant for National Security Affairs (Brzezinski), Washington, 23rd of December 1980, in *Foreign Relations of the United States, 1977–1980, Volume XXVI, Arms Control and Nonproliferation,* https://s3.amazonaws.com/static.history.state.gov/frus/frus1977-80v26/pdf/frus1977-80v26.pdf, website checked 22-2-2017, p. 1015.

1251 Backchannel Message From Vice President Mondale to the President's Assistant for National Security Affairs (Brzezinski), 1139Z, Bonn, 25th of January 1977, in *Foreign Relations of the United States, 1977–1980, Volume XXVI, Arms Control and Nonproliferation,* https://s3.amazonaws.com/static.history.state.gov/frus/frus1977-80v26/pdf/frus1977-80v26.pdf, website checked 22-2-2017, p. 788.

1252 Wonder, Edward, 'Nuclear Commerce and Nuclear Proliferation: Germany and Brazil, 1975', in *Orbis* (Summer 1977) p. 300.

1253 Ibid.

1254 Ibid., pp. 300-301, Gray, William, Glenn, 'Commercial Liberties and Nuclear Anxieties: the US-German Feud over Brazil, 1975-7, in *The International Historical Review*, Vol. 34, No. 3 (2012), pp. 462-463.

location of the storage of plutonium extracted from Urenco-supplied fuel, as reprocessed by Brazil, pursuant to Article 12, Clause 5 of the IAEA Statute and agreed to by treaty. Three additional goals were formulated; a Troika moratorium on the export of sensitive technology, a Troika diplomatic push in the Nuclear Suppliers Group to ban exports of enriched uranium to non-NPT countries that refused to accept Full Scope Safeguards, as well as an extension of the Treaty of Almelo by 20 instead of 10 years. The Council also noted that it was acceptable to lose on some of these points in negotiation.[1255]

Minister Van der Stoel made an unexpected visit to Brazil on the 21nd of February, 1977, meeting up with his colleague Azeredo da Silveira, and tried to move the Brazilians from their position.[1256] Van der Stoel reported back the conversations had been 'fruitful', with the Brazilians making a commitment to do their part in combating proliferation.[1257] From diplomatic contacts that followed it became apparent however that Brazil was not willing to provide further commitments regarding the plutonium regime, which it considered discriminatory.[1258]

Even so, Minister Lubbers reported to the Parliament on the 5th of April that both for him and Minister Van der Stoel negotiations had proved satisfactory, but while his colleague had booked 'important progress', he had not yet been able to finalize an agreement on safeguards.[1259] Lubbers also reported that neither had the Government been able to come to a definite agreement with its partners on the non-proliferation aspects of a common export policy and the Almelo Treaty's extension by another 10 years.[1260] Nevertheless, a consensus had emerged that the expansion to 1000 tons would take place in Almelo and that further integration of the Dutch and German research and centrifuge construction capacities would be pursued, provoking a metaphorical sigh of relief from UCN's industrial workers council.[1261]

On the 22nd of March 1977, the Dutch government (Den Uyl, 1972-1977) resigned over an unrelated issue. It would stay resigned until the 19th of December when after the then longest formation in Dutch history the new Government took office (Van Agt, 1977-1981). In Dutch political tradition, a resigned government stays in office until a new government is formed but

1255 Note, Drs. J.W. Holtslag aan de informateurs d.t.k. mr. H.D. Tjeenk Willink, 'UCN uitbreiding', No. 256, 5th of September 1977, 2.03.01/10859, p. 2.
1256 Den Haan, Frederik, M., *De Urenco-kwestie: De leverantie van verrijkt uranium aan Brazilië* (Instituut voor Internationale Studiën – Rijksuniversiteit Leiden: Leiden 1985) p. 16.
1257 Ibid.
1258 Ibid., pp. 16-17.
1259 Tweede Kamer der Staten Generaal, Zitting Tweede Kamer 1976-1977 – 14261, 'Ultracentrifuge-project', Nr. 5, Brief van de Minister van Economische Zaken, 5th of April 1977.
1260 Den Haan, Frederik, M., *De Urenco-kwestie: De leverantie van verrijkt uranium aan Brazilië* (Instituut voor Internationale Studiën – Rijksuniversiteit Leiden: Leiden 1985) pp. 16-17, Tweede Kamer der Staten Generaal, Zitting Tweede Kamer 1976-1977 – 14261, 'Ultracentrifuge-project', Nr. 5, Brief van de Minister van Economische Zaken, 5th of April 1977.
1261 Tweede Kamer der Staten Generaal, Zitting Tweede Kamer 1976-1977 – 14261, 'Ultracentrifuge-project', Nr. 5, Brief van de Minister van Economische Zaken, 5th of April 1977, Letter, Sekretaris van de ondernemingsraad van Ultra Centrifuge Nederland N.V. G. Hengstman aan Minister-President J. Den Uyl, 4386-GH/jk, 27th of April 1977, 2.03.01/10859.

refrains from making any controversial decisions, and thus during the intermediary period there was hardly any progress on political issues relating to Urenco's Brazil order.

By the 22nd of September 1977, non-proliferation attitudes among the partners were perceived to have shifted. In a memo to the Minister of Foreign Affairs by an official from the DRW the change is described as follows:

> 'It is clear that both the UK as well as the FRG now support a more cautious policy than was previously the case. The Urenco board's eyes have opened as well and gives the impression it now fully appreciates the complications that can result from deliveries to third countries.'[1262]

A combination of factors explains this shift. Arguably the most important contextual factor was the election of President Carter in the US and the resulting shift in American policies to do with nuclear energy. Combating proliferation was one of the spearheads of Carter's nuclear policy and American diplomats wasted no time applying pressure on nuclear suppliers (mainly France and the FRG) to practice restraint and self-denial.

Another important factor was the ongoing discussions that were being held within the Troika for the purpose of defining a comprehensive export policy for Urenco . Discussions in early 1977 towards creating such a policy served to clarify the views of each delegation to the others and stimulated insights into the inter-relatedness of technical and political considerations when commercially exporting enriched product or technology (see:*Toward a Common Export Policy for Urenco,* page 333*).*

Further Delay, More Band-aids

In the absence of a final decision on continuation and expansion of the U.C. project, Minister Lubbers of Economic Affairs meanwhile attempted to, using a couple of largely symbolic measures, to placate the Troika partners. On the 10th of October 1977 he wrote the PM that intended to release 2 million guilders (about $ 820.000) in funding for 'precision engineering' by Comprimo (an engineering firm) related to the project on the condition that first Uranit would commit to matching the amount.[1263] This engineering work had previously been halted because the project had run out of funding. He voiced the hope that this gesture could act as an insurance to keep Netherlands in the partnership, and that the amount was insignificant in comparison to the claims that the country could face in case of a break-up.[1264] Departmental councilor Kieboom backed him up toward the PM, arguing that the partners had not been encouraged by the current state of the Government's formation, which had reached a

1262 ARC 61-10, p. 2.
1263 Letter, Minister van Economische Zaken aan Minister-President Drs. J.M. Den Uyl, 'uitbreiding Almelo', 377/II/971/EEK, 10th of October 1977, 2.03.01/10859, 'Netherlands – Spot Exchange Rate, Guilders/US$', 7th of October 1977, Historical Data, H.10 Foreign Exchange Rates, Federal Reserve Statistical Release (United States Federal Reserve Bank) https://www.federalreserve.gov/releases/H10/hist/dat89_ne.txt, website checked 30-7-2018.
1264 Ibid.

preliminary accord that included only the intention to form a preliminary position on the Troika matter. The money released by Lubbers could signal to the Germans that 'at least something was being done.'[1265]

The formation of a new Government turned out to be longest in the history of the Netherlands. Early November the PvdA exited the formation process and a new formation negotiator ('informateur') was appointed. It caused the board of UCN to make a last ditch appeal to outgoing PM Den Uyl (with copies of the letter to Lubbers and Van der Stoel) to make a decision in favor of expansion of Almelo, arguing that the international credibility of UCN was at stake and it was becoming impossible to expect the partners to accept further delay of a definitive decision by the Netherlands. At the point now arrived at, UCN wrote,

> '[t]he created distrust does not limit itself to the direct partners of UCN, but has spread to foreign electricity-utilities and foreign governments. Potential customers are now openly stating that, as long as Dutch participation in Urenco is not settled, no business can be conducted. Urenco and partners are witnessing several thousands of millions in orders evaporate and have left no doubt that they consider the Dutch partner to blame. You are well aware that potential claims in damages from our Urenco partners would not be insubstantial.'[1266]

UCN added that the subsequent doubt over whether the Dutch partner would be able to fulfill its supply commitments had now caused the FRG Government to approve the definitive location of a German enrichment plant in Gronau, just over the border near Almelo. Taking UCN's warning to heart but with limit options Minister Lubbers proposed that, with the licenses for the expansion of Almelo now ready for signature by the relevant ministers, he would release another 6 million guilders ($ 2.47 million) for groundwork in Almelo. He expressed the hope, as before, that this would keep open the option of 'the expansion of UCN in the Netherlands', but that he was unable to determine whether this would prevent 'the "Alleingang" of Germany'.[1267]

1265 Note, Drs. J.P. Kieboom aan Minister-President, 'detail-engineering Almelo', No. 687, 13th of October 1977, 2.03.01/10859.

1266 Letter, Chairman Board of Directors UCN N.V. Dr. Ir. H. Hoog aan Minister-President Drs. J.M. Den Uyl, 'Besluit ten aanzien van uitbouw verrijkingsinstallaties Almelo', Hg/fjf/1268/77, 11th of November 1977, 2.03.01/10859, pp. 1-2. 'Potential customers such as Japan and Australia are currently being worked on by France and the United States', reported Kieboom soon after, Note, Drs. J.P. Kieboom aan Minister-President, 'UCN-overleg met collega's op 23 november a.s.', No. 693, 22nd of November 1977, 2.03.01/10859/10860.

1267 Letter, Minsiter van Economische Zaken aan Minister-President J.M. Den Uyl, 15th of November 1977, 2.03.01/10859/10860, 'Netherlands – Spot Exchange Rate, Guilders/US$', 15th of November 1977, Historical Data, H.10 Foreign Exchange Rates, Federal Reserve Statistical Release (United States Federal Reserve Bank) https://www.federalreserve.gov/releases/H10/hist/dat89_ne.txt, website checked 30-7-2018. The Germans had requested screenings for members of the Gronau town council to visit the Almelo plant, which had been perceived by UCN as an 'extraordinary irritating request', and the screenings had been denied by the Dutch MFA via its ambassador, Note, Drs. J.P. Kieboom aan Minister-President, 'beslissing inzake Almelo (MR 18-11-1977, punt 8)', No. 691, 17th of November 1977, 2.03.01/10860, p. 2. The 6 million guilders for groundwork was not released by Lubbers, Letter, Minister van Economische Zaken aan Minister President, 'uitbreiding verrijkings-capaciteit Almelo', 377/II/1298/EEK, 21st of December 1977, 2.03.01/10859, p. 6.

Both of Lubber's symbolic gestures had failed to make any meaningful impression on the partners, Kieboom reported back several days later, after having conducted informal consultations. The Dutch ministries of Economic Affairs or Foreign Affairs had now spend all their political capital on the appeasement efforts, to the point that the Troika partners were now only accepting statements from the PM's office, he added. A last 'test-case' was now maturing, with the deadline for the Dutch Credit Insurance Company (Nederlandse Credietverzekering Maatschappij: NCM) and Dutch banks to participate in the credits and guarantees connected to the Nuclébras contract expiring on the 18th of November. Expected interest-based income of the 1 billion guilder ($ 413 million) financing package was in the order of a 100 million guilders ($ 41.32 million).[1268] Failure to make the accompanying export-license non-conditional on further political developments would be 'counter-productive' as it risked triggering an alternative plan for financing by the Germans and British, warned an interdepartmental note on the subject.[1269] Kieboom, following advice from UCN's H. Hooykaas, argued that an unconditional 'green light' for the credit insurance (without reservations made with regards to the issuance of an export license) could restore some goodwill towards the Netherlands and possibly buy more time before the partners would set an early hard deadline on which they would demand a final Dutch decision on the expansion.[1270] The Minister of Finance agreed to grant the NCM the export credit guarantee on the 17th of November 1977, but under conditions, thus failing to take away the partners' doubts over Dutch commitment to the project.[1271]

When Urenco finalized a report requested by the JC outlining its contractual obligations and connected deadlines for construction of capacity, the deadline for a Dutch decision was confirmed to be the 31st of December 1977, as the Dutch had hoped. Absence of a decision on the expansion at that date, explained Chairman Hoog of UCN, would be interpreted by the partners as a negative decision.[1272] Subsequent démarches by the Dutch MFA asking for more time so that the new Government could get its bearings on the matter were rebuffed, yet on the ministerial level Dutch officials found some sympathy, but no promises.[1273]

1268 Note, Drs. J.P. Kieboom aan Minister-President, 'beslissing inzake Almelo (MR 18-11-1977, punt 8)', No. 691, 17th of November 1977, 2.03.01/10860, pp. 1-2, 'Netherlands – Spot Exchange Rate, Guilders/US$', 17th of November 1977, Historical Data, H.10 Foreign Exchange Rates, Federal Reserve Statistical Release (United States Federal Reserve Bank) https://www.federalreserve.gov/releases/H10/hist/dat89_ne.txt, website checked 30-7-2018.

1269 Note, Bureau Atoomzaken Drs. A.J. Van Galen Last aan Minister van Buitenlandse Zaken, 'Konklusies interdepartementaal overleg inzake financiering leveringskontrakt van verrijkt uranium aan Brazilie', 15th of November 1977, 2.03.01/10860, pp. 2-3.

1270 Note, Drs. J.P. Kieboom aan Minister-President, 'beslissing inzake Almelo (MR 18-11-1977, punt 8)', No. 691, 17th of November 1977, 2.03.01/10860, p. 2, Aide Memoire, UCN N.V. H. Hooijkaas aan Ministerie van Algemene Zaken J. Kieboom, 'Deadlines UCN', Confidential, 17th of November 1977, 2.03.01/10860, pp. 1-2.

1271 Letter, Minister van Economische Zaken aan de Voorzitter van de Tweede Kamer der Staten Generaal, 'Ultra-centrifuge project', 377/II/1302/EEK, 16th of January 1978, 2.03.01/10859/10860, p. 2.

1272 Letter, Chairnman Board of Directors UCN NV Dr. Ir. H. Hoog aan Minister-President Drs. J.M. Den Uyl, 'Uitbreiding Urenco Almelo', H/fjf/1475/77, 15th of December 1977, 2.03.01/10859, Letter, Chairman Urenco UK P. Jelinek-Fink to Atomic Energy Division, Department of Energy C. Herzig, 30th of December 1977, including paper 'Urenco contractual commitments and the need for decisions', (n.d., est. end of November 1977), 2.03.01/10859, pp. 1-2, 5.

Minister Van der Stoel, continuing his safeguards diplomacy, seemed to be taking considerable risks in the process of getting concessions from Brazil during this period. Kieboom reports in November that,

> 'Minister Van der Stoel, until recently, had reached agreement with his Brazilian colleague. Apparently he has now once again sent a letter to Brazil to confirm the [agreement reached in those] discussions but once more adding additional demands. Our English and German partners are, as reflected in the report of the Joint Committee "highly irritated" about this. Particularly about the fact that he has been acting unilaterally and without any consultation with the English and German colleagues.'[1274]

Neither did Van der Stoel choose to involve his own departmental officials, instead conducting a 'personal diplomacy'.[1275] He did however have an extensive correspondence with his fellow PvdA parliamentarians, from which it appeared he 'at least created the impression' that 'many more concessions' could be extracted from the Brazilians.[1276] Officials at the Ministry of Foreign Affairs, only uncovering the correspondence after Van der Stoel's departure as minister, considered that impression 'entirely unattainable'.[1277] Furthermore, with the parliamentary PvdA now entertaining unrealistically high expectations, Van der Stoel had set the next Government up for failure in getting a majority in Parliament to accept any result short of the mark.[1278]

Departmental councilor Kieboom had picked up that the Brazilians had no intention to respond to the Minister's letter, but then Van der Stoel managed to convince them that waiting on the installation of the new (more favorable) right-wing government in the Netherlands was pointless, because they would still be dealing with the same Parliament. A Brazilian response by letter from Minister of Foreign Affairs Da Silveira arrived on the 24nd of November 1977 and contained concessions on some but not all of Van der Stoel's conditions.[1279]

1273 Note, Drs. J. P. Kieboom aan Minister-President, 'uitbreiding UCN Almelo (MR 23 december 1977, punt 11)', No. 696, 22nd of December 1977, 2.03.01/10859/10860, p. 1.

1274 Note, Drs. J.P. Kieboom aan Minister-President, 'beslissing inzake Almelo (MR 18-11-1977, punt 8)', No. 691, 17th of November 1977, 2.03.01/10860, p. 2.

1275 Note, Drs. J.P. Kieboom aan Minister-President, 'UCN-overleg met collega's op 23 november a.s.', No. 693, 22nd of November 1977, 2.03.01/10859/10860.

1276 Note, Drs. J. P. Kieboom aan Minister-President, 'uitbreiding UCN Almelo (MR 23 december 1977, punt 11)', No. 696, 22nd of December 1977, 2.03.01/10859/10860, pp. 1-2.

1277 Note, Drs. J. P. Kieboom aan Minister-President, 'uitbreiding UCN Almelo (MR 23 december 1977, punt 11)', No. 696, 22nd of December 1977, 2.03.01/10859/10860, p. 2.

1278 Ibid.

1279 Note, Drs. J.P. Kieboom aan Minister-President, 'UCN-overleg met collega's op 23 november a.s.', No. 693, 22nd of November 1977, 2.03.01/10859/10860, Message Received by Telephone, Van Ginkel, 22nd of November, 2.03.01/10859, Letter, Minister van Economische Zaken aan Minister President, 'uitbreiding verrijkings-capaciteit Almelo', 377/II/1298/EEK, 21st of December 1977, 2.03.01/10859, p. 2.

Agreement with Brazil and a Decision by the New Government

At the beginning of December 1977, outgoing PM Den Uyl told reporters that there was agreement with the Brazilians on several points and that a conclusion of negotiations was imminent. He said he suspected a final decision on supplying Brazil with enriched uranium could be expected within the month.[1280] It was reported that Brazil agreed to the plutonium regime that the Netherlands had proposed, which would place plutonium separated from Urenco-enriched spent fuel produced in Brazil into an IAEA administered and safeguarded storage facility. Particular modalities needed to be further agreed upon, but the principle agreement now reached was expected to receive support from a majority of Parliament. Minister Van der Stoel's ability to bring Brazil to agreement was lauded by a leading newspaper.[1281]

Ahead of the Joint Committee meeting in London on December 21st, the Chairman of the JC sent out a proposal for a Troika counter-proposal towards Brazil, to be discussed during the meeting.[1282] In the meeting, at Dutch insistence, it was decided that the Netherlands would cease its unilateral negotiations with Brazil and that the Troika would from now on take common action. The agreed basis of negotiations with Brazil consisted of the following targets the Troika would attempt to reach with Brazil; the four countries would agree to 'pursue' the establishment of a non-discriminatory plutonium regime in conformity with with Article 12, Clause 5 of the IAEA Statute; that, in case such a regime did not exist 'at the time Urenco is ready to supply enrichment services (around 1984), all plutonium connected to the Urenco enrichment process would be stored under an ad hoc storage regime, established by the four involved governments and based on the same principles as aforementioned Article 15, Clause 5 of the IAEA Statute.'[1283] The IAEA would be invited to assist with the establishment of such an ad hoc regime. These measures would be set down in an exchange of protocols and 'incorporated in the Exchange of Notes required to bring the supply of material to Brazil by URENCO under the aegis of the Trilateral Safeguards Agreement concluded between the Federal Republic of Germany, Brazil and the IAEA.'.[1284]

On the 21st of December 1977, the same day as the JC meeting in London, incoming Minister Van Aardenne wrote to the PM and advised the Council of Ministers to agree to the delivery

1280 'Almelo overleg schiet op', in *De Nieuwe Krant*, 3rd of December 1977.

1281 'Brazilië gaat akkoord met garanties opslag plutonium', in *Reformatorisch Dagblad*, 2nd of December 1977, p. 7, 'Wapenfeit', in *NRC Handelsblad*, 9th of December 1977, p. 7, 'Brazilië wijkt voor uranium uit naar Urenco', in *NRC Handelsblad*, 13th of October 1981, pp. 1, 11.

1282 Letter, Minister van Economische Zaken aan Minister President, 'uitbreiding verrijkings-capaciteit Almelo', 377/II/1298/EEK, 21st of December 1977, 2.03.01/10859, pp. 2-3.

1283 Note, Drs. J.P. Kieboom aan Minister-President, 'beslissing over Almelo (MR 30 december 1977, punt 7)', No. 697, 29th of December 1977, 2.03.01/10859/10860, pp. 1-2, Memorandum, Drs. J.P. Kieboom aan Drs. W.H.J. Tieleman, 'Bericht aan Kamer over Almelo', No. 698, 2nd of January 1978, 2.03.01/10859/10860.

1284 Note, Drs. J.P. Kieboom aan Minister-President, 'beslissing over Almelo (MR 30 december 1977, punt 7)', No. 697, 29th of December 1977, 2.03.01/10859/10860, p. 2, Letter, Minister van Economische Zaken aan de Voorzitter van de Tweede Kamer der Staten Generaal, 'Ultra-centrifuge project', 377/II/1302/EEK, 16th of January 1978, 2.03.01/10859/10860, p. 5 (which is also Tweede Kamer der Staten Generaal, Zitting 1977-1978 – 14261, 'Ultracentrifuge-project', Nr. 7, Brief van de Ministers van Economische Zaken en van Buitenlandse Zaken, 16th of January 1978, p. 5).

to Brazil and the expansion of Almelo; agree to the financing of that expansion; agree to allow the relevant ministers to issue a license under the Nuclear Energy Act required for the expansion; release to UCN the 6 million guilders in funding for groundwork in Almelo; agree that continuation in the Troika meant the Netherlands would not quit the treaty before 1991, and to inform the Troika partners and the Second Chamber of the Government's decision.[1285] On the 30th of December, the Government agreed to the supply to Brazil, on the condition Brazil would accept the Troika's negotiation points on the plutonium regime. The Brazil Government did so on the 13th of January 1978.[1286]

On the 16th of January, Minister of Economic Affairs Van Aardenne and Minister of Foreign Affairs Van der Klaauw informed Parliament by letter of the Government's decision to give the deal with Brazil and the expansion of Almelo and Capenhurst to a total of 2000 tons capacity the go-ahead. They explained that there had been no time left for any further delay; that the partners had set a deadline for the end of the year, that Urenco had done so for the 1st of January and that in order for Urenco to meet its commercial obligations the expansion to 2000 tons capacity was necessary and failing to approve the expansion carried the risk of severe financial penalties and the political disintegration of the Troika partnership. Although formally the expansion of capacity in Almelo and Capenhurst were not linked to the Brazil contract, politically and economically they were, the ministers explained, as a failure to approve the Brazil export would negatively affect the profitability of the project in such a way that even with an approval for the expansion, the partners would have found no remaining basis for continued industrial cooperation.[1287]

1285 Letter, Minister van Economische Zaken aan Minister President, 'uitbreiding verrijkings-capaciteit Almelo', 377/II/1298/EEK, 21st of December 1977, 2.03.01/10859, p. 6.

1286 Letter, Minister van Economische Zaken aan de Voorzitter van de Tweede Kamer der Staten Generaal, 'Ultra-centrifuge project', 377/II/1302/EEK, 16th of January 1978, 2.03.01/10859/10860, p. 4 (which is also Tweede Kamer der Staten Generaal, Zitting 1977-1978 – 14261, 'Ultracentrifuge-project', Nr. 7, Brief van de Ministers van Economische Zaken en van Buitenlandse Zaken, 16th of January 1978, p. 4). The letter actually dates the Brazilian agreement on the 12th of January, but subsequent correspondence by Van Agt and his officials consistently date the agreement to the 13th of January 1978, e.g., Letter, Minister-President A.A.M. Van Agt to Prime Minister Rt. Hon. L.J. Callaghan, M.P., Nr. 270316, 18th of April 1978, 2.03.01/10859/10860.

1287 Letter, Minister van Economische Zaken aan de Voorzitter van de Tweede Kamer der Staten Generaal, 'Ultra-centrifuge project', 377/II/1302/EEK, 16th of January 1978, 2.03.01/10859/10860, pp. 2-3 (which is also Tweede Kamer der Staten Generaal, Zitting 1977-1978 – 14261, 'Ultracentrifuge-project', Nr. 7, Brief van de Ministers van Economische Zaken en van Buitenlandse Zaken, 16th of January 1978, pp. 2-3). 'Urenco and hoe Jan Van Houwelingen omzwaaide', in *Leidsch Dagblad*, 23rd of May 1981, p. 23, 'Brazilië wijkt voor uranium uit naar Urenco', in *NRC Handelsblad*, 13th of October 1981, pp. 1, 11, Letter, Minister van Economische Zaken aan de Voorzitter van de Tweede Kamer der Staten Generaal, 'Ultra-centrifuge project', 377/II/1302/EEK, 16th of January 1978, 2.03.01/10859/10860, Tweede Kamer der Staten Generaal, Zitting 1977-1978 – 14261, 'Ultracentrifuge-project', Nr. 7, Brief van de Ministers van Economische Zaken en van Buitenlandse Zaken, 16th of January 1978, pp. 2-3. In contrast, Den Haan paraphrases Head of the Atomic Affairs Desk of the Directorate Council of Europe and Scientific Cooperation (DRW) Van Galen Last, who in a November 1983 interview with that author stated that the German and British partners had impressed upon the Dutch the advantages of the common project, but had 'hardly exerted pressure and certainly hadn't made threats', Den Haan, Frederik, M., *De Urenco-kwestie: De leverantie van verrijkt uranium aan Brazilië* (Instituut voor Internationale Studiën – Rijksuniversiteit Leiden: Leiden 1985) pp. 17, 76.

Additionally, the letter referenced the IAEA's Board of Governor's unanimous approval of the 1975 deal. Even IAEA experts expressed gratitude towards the Dutch for the negotiated result and for taking the commercial risks involved, somewhat contrasting Director Eklund's earlier private attitude towards the deal.[1288] Van der Klaauw's worked to present the current state of affairs in the best possible light.

The Motion(s) Van Houwelingen

During the debate on the new Government's declaration of policy, a set piece in Dutch parliamentary procedure, PM Van Agt defended the Government's decision on Brazil. The Government had been confronted with a situation in which a decision was required within weeks, explained Van Agt. Nevertheless, if Parliament decided the Government had been wrong in its decision, promised the PM, his government would respect any accepted motion decided upon in the upcoming debate on the matter.[1289] Parliament, with the accepted 1971 motion Oele/De Goede in mind, felt itself passed over because it had not been allowed to vote on the expansion beyond 350 tonnes, despite the fact that the Treaty of Almelo had already legally obligated the Troika to expand beyond that capacity, after receiving substantial domestic orders from British and West-German utilities.[1290]

In the Parliamentary debate on the Government's decision on Urenco's expansion and the conditions under which the supply of enriched uranium to Brazil could take place, on the 31st of January 1978, Parliament again attempted to carve out a more expansive role for itself in the matter. A collection of parliamentary motions was tabled of which only those of representative Van Houwelingen *et. al.* (numbered 19 and 20) were accepted. Minister of Foreign Affairs Van der Klaauw had right before informed Parliament that the Government did not find any of the motions demanding a Dutch refusal to expand the Almelo plant acceptable, but would entertain those of Van Houwelingen. The first motion Van Houwelingen/Mommersteeg/Portheine (commonly referred to as the motion Van Houwelingen nr. 19) as well as the second motion Van Houwelingen/Mommersteeg/Portheine (motion Van Houwelingen nr. 20) were accepted by the Second Chamber with support of the governing political factions. Motions that sought to block the expansion of Almelo were defeated. In motion nr. 19, Parliament judged that supplies of enriched uranium should not take place to non-NPT countries unless under conditions of a comprehensive plutonium

1288 Letter, Minister van Economische Zaken aan de Voorzitter van de Tweede Kamer der Staten Generaal, 'Ultra-centrifuge project', 377/II/1302/EEK, 16th of January 1978, 2.03.01/10859/10860, pp. 3-4 (which is also Tweede Kamer der Staten Generaal, Zitting 1977-1978 – 14261, 'Ultracentrifuge-project', Nr. 7, Brief van de Ministers van Economische Zaken en van Buitenlandse Zaken, 16th of January 1978, pp. 3-4), ARC 61-12. which is, 'Wapenfeit', in *NRC Handelsblad*, 9th of December 1977, p. 7.

1289 Tweede Kamer der Staten Generaal, Handelingen Tweede Kamer, Zitting 1977-1978, 18th of January 1978, p. 418. The promise by PM Van Agt partially explains why the Government felt bound by the motion Van Houwelingen and made a substantial effort to uphold it during the following months, Memorandum, DRW aan M via S, DGES, 'UC project in Staten-Generaal', No. 136, 26th of May 1978, 2.03.01/10859.

1290 Den Haan, Frederik, M., *De Urenco-kwestie: De leverantie van verrijkt uranium aan Brazilië* (Instituut voor Internationale Studiën – Rijksuniversiteit Leiden: Leiden 1985) p. 10. See page 267 for motion Oele/De Goede, with Domsdorf's comment on the treaty obligation in the accompanying footnote.

storage regime, preferably in the context of an international regime of such a nature, but in the absence of such a regime, under an ad hoc regime negotiated with Brazil. Additionally, Parliament wished to be consulted 'in a timely and regular manner' on the negotiation of such a regime with Brazil.[1291] In motion nr. 20, the Second Chamber called on the Government to, together with the Troika partners, 'in the short term develop additional initiatives to bind nuclear supplies to the acceptance of IAEA full-scope safeguards in the recipient country', and to keep Parliament informed on progress towards this goal. Furthermore, it voiced the expectation that expansion of Urenco enrichment capacity up to 2000 tons would be realized in Almelo and Capenhurst and that it considered non-disbandment of the Treaty of Almelo for at least another 10 years to be necessary.[1292]

Ahead of this debate, the original (secret) agreement of 14 July 1976 between Urenco and Brazil was made public by the incoming Van Agt government, which revealed that the Dutch Government had already committed itself to the go-ahead for the deliveries to Brazil at that time. Van der Stoel, no longer a minister now and replaced at Foreign Affairs by Van der Klaauw, defended the decision by pointing to the competition's non-proliferation credentials: if Urenco hadn't closed the deal the French would have and would have demanded considerable less stringent guarantees from its fellow NPT non-signature party.[1293] Moreover, according to Van der Stoel, he had been in negotiations with Brazil to specify the exact conditions of the plutonium regime when the Government fell and blamed the new Government for not continuing those negotiations, having instead just accepted the status quo.[1294] In the 31st of January 1978 debate, Minister Van Aardenne echoed Van der Stoel's sentiments that a careful balance had to be sought between extracting the maximum non-proliferation commitments from clients while not taking this so far as to sabotage the attractiveness of Urenco as a supplier. In this context, the use of the veto power in the JC also deserved careful consideration.[1295]

More rounds of discussions with the Troika partners led to little tangible results; during a JC meeting on the 28th of February 1978 the FRG and the UK were not willing to deviate from the earlier made commitments to Brazil in the face of the motion Van Houwelingen.[1296] The Germans and British thought it was 'undesirable' to go back and propose amendments to 'firm proposal by the three partners' that Brazil had unconditionally accepted in January as such a move could 'adversely affect the viability and reliability of Urenco and the three partners' towards Brazil and future customers.[1297] Furthermore, 'allowing the maximum time possible before formulating the details of either a universal or an ad-hoc plutonium storage regime'

1291 Tweede Kamer der Staten Generaal, Zitting 1977-1978 – 14261, 'Ultracentrifuge project', Nr. 19, Motie van het lid Van Houwelingen C.S., 31st of January 1978. Tweede Kamer der Staten Generaal, Handelingen Tweede Kamer, Zitting 1977-1978, 1st of February 1978, pp. 606, 623.

1292 Tweede Kamer der Staten Generaal, Zitting 1977-1978 – 14261, 'Ultracentrifuge project', Nr. 20, Motie van het lid Van Houwelingen C.S., 31st of January 1978.

1293 'Van der Stoel overzag gevolgen niet: Vorig kabinet bond zich al aan uranium-levering', in *Trouw*, 25th of January 1978, pp. 1, 3.

1294 Ibid.

1295 Tweede Kamer der Staten Generaal, Handelingen Tweede Kamer, Zitting 1977-1978, 31st of January 1978, p. 592.

1296 'PvdA vraagt v.d. Klaauw: 'Hoe zit dat nu met die uranium?', in *Het Vrije Volk*, 2nd of March 1978, p. 5.

would allow the partners to 'take account of possible developments in international thinking' during the following period.[1298] Considering these arguments, the only 'logical conclusion' was that the Dutch Government would have to go 'back to Parliament on this matter', thought the British and Germans.[1299] However, without reopening the negotiations with Brazil, at Dutch insistence, the Troika agreed it could try to convince Brazil to join them in an effort to push for an international plutonium storage regime in the context of INFCE. '[S]uch action' 'would provide a sufficient basis for the issue of export-licenses, at once and without further conditions, thereby removing the commercial uncertainties.'[1300]

During a follow-up debate in the Dutch Parliament in March, under pressure and to the surprise of the governing parties, Minister of Foreign Affairs Van der Klaauw declared that the Government considered itself bound to the motion Van Houwelingen.[1301] Yet paradoxically, in a note to the Council of Ministers on the 15th of March 1978, the ministers of Foreign Affairs and Economic Affairs concluded that a situation had now developed that meant further pursuit of the conditions in the motion Van Houwelingen would mean the end of the Troika cooperation. Consequently, they warned, the Netherlands would be a 'less interesting discussion partner' for the United States in the field of non-proliferation, relations with Brazil and other third-world countries would be damaged, its international status as a reliable (commercial) partner would be tarnished and this could have negative effects on Dutch exports, it could no longer block the export of ultra-centrifuge technology to other countries outside the Troika, and its call for international nuclear cooperation would lose all credibility.[1302] Jobs would be lost in the region of Twente and claims could be substantial. The ministers advised that the Government would try to move Parliament to no longer demand implementation of Van Houwelingen's motion.[1303]

At this point PM Van Agt stepped in and wrote his ministers of Economic Affairs and Foreign Affairs, asking about the state of affairs including to what extent the Netherlands had committed itself legally to the Nuclébras contract, which concessions had been made with regards to a plant in Gronau and what effects a refusal of intent of export license for supplies to Brazil would have on the other Troika partners. He also asked about what kind of conditions the United States were setting on their delivery of enriched uranium to Brazil. Van

1297 Letter, Minister van Buitenlandse Zaken aan Minister-President, 'Samenwerking met BRD en VK bij verrijking van uranium', DRW-74008, 15th of March 1978, including 'Nota voor de Ministerraad betreffende de samenwerking met het Verenigd Koninkrijk en de Bondsrepubliek Duitsland inzake de verrijking van uranium', 2.03.01/10859, p. 12. English in original.

1298 Ibid.

1299 Ibid., p. 13. English in original.

1300 Ibid., Letter, Minister-President A.A.M. Van Agt to Prime Minister Rt. Hon. L.J. Callaghan, M.P., Nr. 270316, 18th of April 1978, 2.03.01/10859/10860, p. 2.

1301 'V.d. Klaauw praat z'n mond voorbij', in *Het Vrije Volk*, 10th of March 1978, p. 9, Den Haan, Frederik, M., *De Urenco-kwestie: De leverantie van verrijkt uranium aan Brazilië* (Instituut voor Internationale Studiën – Rijksuniversiteit Leiden: Leiden 1985) p. 22, ARC 123-7, p. 2.

1302 Letter, Minister van Buitenlandse Zaken aan Minister-President, 'Samenwerking met BRD en VK bij verrijking van uranium', DRW-74008, 15th of March 1978, including 'Nota voor de Ministerraad betreffende de samenwerking met het Verenigd Koninkrijk en de Bondsrepubliek Duitsland inzake de verrijking van uranium', 2.03.01/10859, pp. 8-9.

1303 Ibid., p. 9.

Agt seemed to be looking for the door, but considering his legal background he more likely was trying to determine the implications of every possible decision. In response to his letter, his minister of Foreign Affairs said that the Netherlands was tied hand and foot by the previous commitments the Government and its delegates in the JC had made to the partners in the context of the Nuclébras contract and on the subject of Gronau. Backing out now would result in the partners going ahead with the supply of Brazil while finding a way to have the Netherlands exit the partnership. Foreign Affairs considered the Netherlands would risk being in breach of the Treaty of Almelo if it refused its contractual obligations at this point and that while the Netherlands would not be legally liable, as shareholder of UCN it would be morally obligated to honor damage claims against the company. Economic Affairs also considered it possible that the state would have to honor claims.[1304]

An Interpretative Statement

During a Troika meeting on the margins of the European Council meeting of 9-10 April 1978, PM Van Agt made the 'secret' suggestion to the partners that the Netherlands could agree to the deliveries to Brazil if Brazil could agree that '*at the time of reprocessing* of the plutonium a storage and safeguards regime would be available.'[1305] This suggestion was at odds with the motion Van Houwelingen, that required such a regime to be available prior to reprocessing, but was in line with what the Americans were demanding of Brazil. Departmental councilor Kieboom had made the argument to the PM the week before that extracting an 'interpretative declaration' from the partners along these lines, to go alongside the January 13th agreement with Brazil, would require no re-negotiations and Brazil would then only have to take notice and silently accept it.[1306]

PM Van Agt followed up by writing the British PM Callaghan and West-German Chancellor Schmidt on the 18th of April. Referencing the motion Van Houwelingen, he explained that the interpretative statement reflected the already current state of understanding between the four governments and would circumvent the need for amendment of the 13th of January agreement with Brazil and following Brazil's acceptance would prompt the Dutch Government to 'be able to pledge that necessary licences for the export to Brazil of uranium from Almelo will be issued in good time.'[1307] Van Agt proposed that, 'the following passage be included in the Notes to be exchanged with Brazil in order to confirm the agreement signed on 13 January:

1304 Letter, Minister-President Mr. A.A.M. Van Agt aan Minister van Buitenlandse Zaken Dr. C.A. Van der Klaauw en Minister van Economische Zaken Drs. G.M.V. Van Aardenne, 'Ultra-centrifuge', 269362, 22nd of March 1978, includes 'Antwoorden op de vragen gesteld door de Minister-President in brief aan zijn Ambtgenoten van Buitenlandse Zaken en Economische Zaken, kenmerk 269362 d.d. 22 maart 1978.', 2.03.01/10859, pp. 1-4, 7, 11-13, Letter, Minister van Economische Zaken aan Minister-President, 'Gesprek inzake UC op 30 maart', 378/II/270/EEK, 31st of March 1978, 2.03.01/10859, p. 2.

1305 Den Haan, Frederik, M., *De Urenco-kwestie: De leverantie van verrijkt uranium aan Brazilië* (Instituut voor Internationale Studiën – Rijksuniversiteit Leiden: Leiden 1985) p. 23.

1306 Note, Drs. J.P. Kieboom aan Minister-President, 'Briefing voor topoverleg over Brazilië contract', No. 726, 5th of April 1978, 2.03.01/10859/10860, pp. 1-2, Note, Drs. J.P. Kieboom aan Minister-President, 'Urenco-gesprek minister-president, de ministers Van Aardenne en Van der Klaauw en de heren Kruyt, Tieleman, Merckelbach en Kieboom', No. 727, 5th of April 1978, 2.03.01/10859/10860, p. 3.

> "The four Governments understand that it follows from paragraph 2 (of the agreement) that used fuel enriched by Urenco and to be reprocessed in Brazil will be stored until an IAEA plutonium storage regime or ad hoc storage arrangement have been agreed upon."[1308]

As Mr. Mani of the Directorate Power Supply and Nuclear Energy commented, such a measure could be read as going beyond what the motion Van Houwelingen required, as the period in which a diversion of the non-reprocessed irradiated fuel elements could be detected would be considerably lengthened.[1309]

On INFCE, Van Agt pointed out that a pledge to merely take 'early initiatives' to move along discussions on a plutonium storage regime in that forum was not very substantive and proposed that,

> '… the four governments undertake, should no agreement have been reached by 1980 in INFCE on a general storage régime based on Article XII A 5, to open negotiations on an ad hoc régime with the aim of establishing that régime before the first deliveries are made to Brazil from Almelo (probably not before the end of 1981).'[1310]

If INFCE could not bring an international regime about, argued Van Agt, there was plenty of possibility 'for reasonable parties to prepare satisfactory arrangements'.[1311] Shortly after, during an April visit to Washington D.C., Minister Van der Klaauw was informed by US Secretary of State Vance that the Americans wanted to see the Netherlands remain in the Troika, for fear of a dissolution resulting in more nationally operated enrichment plants, notably in the FRG.[1312]

The British and West-German leaders responded by letter on the 2nd and 11th of May respectively, in clearly coordinated fashion; the letters' content were almost identical. Callaghan and Schmidt underlined that they would in no way revisit the January agreement with Brazil, but would be prepared to coordinate an 'oral statement', which after agreement

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1307 Letter, Minister-President A.A.M. Van Agt to Bundeskanzler der Bundesrepublik Deutschland Helmet Schmidt, Nr. 270315, 18th of April 1978, 2.03.01/10859/10860, pp. 1-2, Letter, Minister-President A.A.M. Van Agt to Prime Minister Rt. Hon. L.J. Callaghan, M.P., Nr. 270316, 18th of April 1978, 2.03.01/10859/10860, pp. 1-2.

1308 Letter, Minister-President A.A.M. Van Agt to Bundeskanzler der Bundesrepublik Deutschland Helmet Schmidt, Nr. 270315, 18th of April 1978, 2.03.01/10859/10860, p. 1, Letter, Minister-President A.A.M. Van Agt to Prime Minister Rt. Hon. L.J. Callaghan, M.P., Nr. 270316, 18th of April 1978, 2.03.01/10859/10860, p. 1.

1309 Nota, Directoraat-Generaal voor de Energievoorziening Directie Electriciteit en Kernenergie H.K. Mani aan Minister/Staatssecretaris, 'Amerikaanse levering aan Brazilië: oplossingen voor motie Van Houwelingen', EEK/173/EEK, 6th of April 1978, 2.03.01/10859, p. 3.

1310 Letter, Minister-President A.A.M. Van Agt to Bundeskanzler der Bundesrepublik Deutschland Helmet Schmidt, Nr. 270315, 18th of April 1978, 2.03.01/10859/10860, p. 2, Letter, Minister-President A.A.M. Van Agt to Prime Minister Rt. Hon. L.J. Callaghan, M.P., Nr. 270316, 18th of April 1978, 2.03.01/10859/10860, p. 2.

1311 Letter, Minister-President A.A.M. Van Agt to Bundeskanzler der Bundesrepublik Deutschland Helmet Schmidt, Nr. 270315, 18th of April 1978, 2.03.01/10859/10860, p. 3, Letter, Minister-President A.A.M. Van Agt to Prime Minister Rt. Hon. L.J. Callaghan, M.P., Nr. 270316, 18th of April 1978, 2.03.01/10859/10860, p. 3.

1312 Den Haan, Frederik, M., *De Urenco-kwestie: De leverantie van verrijkt uranium aan Brazilië* (Instituut voor Internationale Studiën – Rijksuniversiteit Leiden: Leiden 1985) p. 23.

from Brazil on the draft, would be read out by the Troika ambassadors to Brazil.[1313] The oral statement, given at the time of the exchange of notes between the four countries, would declare that the four countries would stimulate the establishment of an international plutonium regime and in the absence of such a regime, per the text of the oral statement as proposed by the UK and FRG, 'by a date no less than two years before Urenco supplied fuel is due to be reprocessed in Brazil, the four parties will work together to establish an ad hoc regime.'[1314]

This was a clear concession towards the Netherlands, judged Foreign Affairs official Kruyt, as the partners had previously never wanted to commit to clear time-frame for discussions on an ad hoc regime. Kruyt also argued that the proposed British/German text's stipulation that 'one or other of these schemes will be ready for operation by the time that any such reprocessing takes place' could be interpreted to mean that 'no reprocessing will take place, if a storage-regime is not ready'; another concession towards the Dutch partner.[1315] Departmental councilor Merckelbach and Kruyt wrote that there was no doubt this was as far as the FRG and UK were prepared to go, and the former advised the PM to accept the oral statement proposal, ´come what may´, but to be sure to have consultations with Van Houwelingen's Christian Democratic parliamentary faction before the parliamentary debate on the subject.[1316] The Dutch Government gave its definitive ascent to the Brazil deliveries on the 9th of June 1978. Brazil was informed of the decision on the 16th of June.[1317]

On the 20th of June 1978, the Government wrote to Parliament that the motion Van Houwelingen nr. 19 could not be implemented and that it considered the current state of agreement with Brazil satisfactory in order to give out an export license for deliveries to that country. This meant that a plutonium storage regime should only be in place when Brazil started reprocessing spent fuel to separate plutonium.[1318] In reaction to the (governing) Christian Democrat faction's statement that this was unacceptable and that the Government

1313 Letter, Prime Minister Jim Calaghan to His Excellency Mr. Andreas A.M. Van Agt, 2nd of May 1978, 2.03.01/10859, pp. 1-2, Letter, Der Bottschafter der Bundesrepublik Deutschland to Ministerpräsidenten der Königreichs der Niederlande Mr. A.A.M. Van Agt, 13th of May 1978, includes Letter, Bundesrepublik Deutschland der Bundeskanzler Helmet Schmidt to Ministerpräsident, 11th of May 1978', 2.03.01/10859, pp. 2-3.

1314 Letter, Der Bottschafter der Bundesrepublik Deutschland to Ministerpräsidenten der Königreichs der Niederlande Mr. A.A.M. Van Agt, 13th of May 1978, includes Letter, Bundesrepublik Deutschland der Bundeskanzler Helmet Schmidt to Ministerpräsident, 11th of May 1978', 2.03.01/10859, p. 5.

1315 Note, Ministerie of Foreign Affairs Kruyt to Council of Ministers, 'Nota voor de Ministerraad betreffende de samenwerking met het Verenigd Koninkrijk en de Bondsrepubliek Duitsland inzake de verrijking van uranium', Zeer geheim, 26th of May 1978, 2.03.01/10859, pp. 3-4, Letter, Der Bottschafter der Bundesrepublik Deutschland to Ministerpräsidenten der Königreichs der Niederlande Mr. A.A.M. Van Agt, 13th of May 1978, includes Letter, Bundesrepublik Deutschland der Bundeskanzler Helmet Schmidt to Ministerpräsident, 11th of May 1978', 2.03.01/10859, p. 5.

1316 Note, Mr. J.P.M.H. Merckelbach aan Minister-President, 'Behandeling Urenco-zaak in MR (MR 19 mei 1978, punt 2)', No. 816, 18th of May 1978, 2.03.01/10859/10860, Note, Mr. J.P.M.H. Merckelbach aan Minister-President, ´Urenco-gesprek met ministers Van der Klaauw en Van Aardenne (Alg. Zaken, 24 mei 1978, 17.00 uur)', No. 818, 24th of May 1978, 2.03.01/10859/10860, Note, Ministerie of Foreign Affairs Kruyt to Council of Ministers, 'Nota voor de Ministerraad betreffende de samenwerking met het Verenigd Koninkrijk en de Bondsrepubliek Duitsland inzake de verrijking van uranium', Zeer geheim, 26th of May 1978, 2.03.01/10859, p. 4.

1317 Den Haan, Frederik, M., *De Urenco-kwestie: De leverantie van verrijkt uranium aan Brazilië* (Instituut voor Internationale Studiën – Rijksuniversiteit Leiden: Leiden 1985) pp. 24-25.

should go back to talk to the Troika partners and Brazil, a day before the matter would be debated on the 28th of June, PM Van Agt stated that 'not even with a switch would you be able to get us back to the negotiating table'.[1319]

In the 28th and 29th of June debate, Minister of Foreign Affairs Van der Klaauw echoed Van Agt's sentiment and that of the officials at the MFA; further negotiations were pointless and only carried considerable risks to the integrity of the Troika with it. The Government would attempt to implement Van Houwelingen's motion nr. 19, but would offer no guarantees.[1320] During the debate, PM Van Agt explained why, in the Government's opinion, there could be no further delay; the British and German partners demanded clarity on the Dutch position and could not be made to wait for it until 1981, because the Government estimated they would sooner continue without Dutch participation. Worse than the Urenco partnership disintegration, the Dutch credibility in international politics would suffer a severe blow and nothing tangible would be achieved, as Brazil would still be supplied with enriched uranium, 'from Capenhurst and/or Gronau, with France waiting in the background and the USSR presiding backstage.'[1321] Van Agt furthermore argued that the Netherlands would 'lose [its] position in the several non-proliferation *fora'* as well as 'a flagship industry, a technological innovation and employment' in the province of Twente.[1322] Van Agt concluded his argument by stating that considering these factors the Government would not obediently follow Parliament in whatever position it would choose to adopt. With the debate running into the night, in the end a full rebellion by the CDA parliamentary faction under Van Houwelingen's leadership (in which it would vote for a PPR motion that demanded the Government cancel the Brazil order) was averted when a compromise in the spirit of Van Houwelingen's motion was reached; the parliamentary factions of the governing parties agreed to deliveries of enriched uranium to Brazil now in principle but before deliveries would commence in 1981, the Government would revisit the matter with Parliament and consider whether there was a 'reasonable outlook' on the agreed plutonium regime at that time.[1323] Another concession Van Agt made was to promise the inclusion of a "*rebus sic stantibus*" clause in the forthcoming

1318 'Eis aan Brazilië voldoende: Regering: geen bezwaar tegen uraniumexport', in *NRC Handelsblad*, 20th of June 1978, pp. 1, 3.

1319 'Meerderheid Kamer: Garanties bij uraniumexport onvoldoende', in *NRC Handelsblad*, 28th of June 1978, p. 1, 'Urenco en hoe Jan Van Houwelingen omzwaaide', in *Leidsch Dagblad*, 23rd of May 1981, p. 23, http://leiden.courant.nu/issue/LD/1981-05-23/edition/0/page/23, website checked 24-4-2017.

1320 'Debat Urenco', in *Trouw*, 30th of June 1978, http://leiden.courant.nu/issue/NLC/1978-06-30/edition/0/page/3, website checked 4-7-2017, p. 3, Tweede Kamer der Staten Generaal, Handelingen Tweede Kamer, Zitting 1977-1978, 28th of June 1978, p. 3050.

1321 Tweede Kamer der Staten Generaal, Handelingen Tweede Kamer, Zitting 1977-1978, 28th of June 1978, p. 3051. France had already proven itself a schrewd competitor, using the summer of 1977 (as a new Dutch Government was under formation) to send a large delegation to Brazil, attempting to convince officials there that Urenco was proving itself to be an unreliable supplier and Brazil should opt for French enriched uranium instead, Note, Drs. J.P. Kieboom aan Minister-President, 'enkele aspecten van de kernenergieproblematiek (formatie)', No. 673, 27th of July 1977, 2.03.01/10860, p. 4.

1322 Tweede Kamer der Staten Generaal, Handelingen Tweede Kamer, Zitting 1977-1978, 28th of June 1978, p. 3051. In a leading Dutch newspaper, the editorial echoed Van Agt's argument that such a disintegration of the Troika would reduce considerably Dutch ability to positively influence ongoing international initiatives such as the NSG and INFCE with regards to non-proliferation goals, 'Urenco', in *NRC Handelsblad*, 20th of June 1978, p. 7.

Letter of Intent, which meant that fundamental changes in circumstances surrounding the contract could remove the legal obligation of the Dutch Government to be bound by it.[1324] The majority of the Second Chamber grudgingly accepted these concessions, unwilling to force a crisis of Government.[1325]

On the 5th of July 1978, a Letter of Intent was sent to Urenco, and on the 31st of July to the Parliament.[1326] The opposition PvdA expressed its dismay that enriched uranium would be delivered to Brazil without a plutonium storage regime in place, while the governing Christian Democrats faction expressed it was happy with the content of the Letter of Intent and thought that Parliament still had the option of stopping the supplies to Brazil in case adequate guarantees towards a plutonium storage regime were absent at the moment of first delivery, an assumption the PvdA disputed.[1327] On the 8th of July, the Brazilian ambassador communicated that his Government had no objections to the conditions and *rebus sic stantibus* clause. On the 14th of July the JC put the finishing touches on the concept exchange of notes which was handed to Brazil on the 21st. Following some clarifications, the Brazilian Government accepted the concept on the 24th of August.[1328] On the 1st of September 1978, the exchange of notes between the four countries took place in Brazil's capital Brasilia. A third motion by Van Houwelingen was accepted in the parliamentary debate that followed, asking the Government to once again involve Parliament when it had the intention to give out export licenses for the deliveries to Brazil.[1329]

Even though Urenco received a license for the building of SP4, a 1000 ton SWU extension of the Almelo plant on the 8th of February, 1978, and a license to put the factory in operation on the 17th of July, 1981, the company (with permission from UCN) decided that for the first five years of the contract, Brazil would be supplied with enriched uranium from the Capenhurst plant. The reason given by Urenco was that the Dutch export-insurance wasn't ready in time and the British one was, but probably the main motivation was to reduce opportunity for meddling by the Dutch Parliament that carried the risk of endangering the deliveries to Brazil. This change was not communicated to Parliament and only years later on the 31st of March 1981 Minister of Economic Affairs Van Aardenne told Parliament that the enriched uranium for Brazil would be supplied entirely from the Capenhurst plant and not from Almelo. Minister Van Aardenne repeated Urenco's motivation for the decision (the export-insurance) when informing Parliament. This arrangement would be in effect for the first five years of

1323 'Spanning rond uraniumlevering bleef: Broos akkoord tussen kabinet en CDA-fraktie', in *Trouw*, 30th of June 1978, http://leiden.courant.nu/issue/NLC/1978-06-30/edition/0/page/1, website checked 20-4-2017, pp. 1-3.
1324 Den Haan, Frederik, M., *De Urenco-kwestie: De leverantie van verrijkt uranium aan Brazilië* (Instituut voor Internationale Studiën – Rijksuniversiteit Leiden: Leiden 1985) p. 25.
1325 Ibid.
1326 Tweede Kamer der Staten Generaal, Zitting 1977-1978 – 14261, 'Ultracentrifuge-project', Nr. 36, Brief van de Minister van Economische Zaken, 31st of July 1978.
1327 '"Brazilië zeker van uranium" – PvdA: Voorbehoud Urenco is Nihil', in *De Volkskrant*, 2nd of August 1978, pp. 1, 10.
1328 Tweede Kamer der Staten Generaal, Zitting 1977-1978 – 14261, 'Ultracentrifugeproject', Nr. 38 (herdruk), Verslag van een mondeling overleg, 11th of September 1978, p. 1.
1329 Den Haan, Frederik, M., *De Urenco-kwestie: De leverantie van verrijkt uranium aan Brazilië* (Instituut voor Internationale Studiën – Rijksuniversiteit Leiden: Leiden 1985) p. 25.

deliveries to Brazil.[1330] This was merely the confirmation of Urenco's earlier plans regarding the matter; the deliveries to Brazil through Capenhurst had already been reported as early as 1978.[1331] In reaction to Minister Van Aardenne's explanation representative Lansink (CDA) voiced a suspicion as to the actual reason for shifting the deliveries to take place from the UK; hadn't political reasons been the deciding factor?[1332]

In August 1981, the US Government had initiated talks with Brazil to overcome the American blockade of nuclear fuel deliveries to that country and to generally improve relations. By September-October 1981 Brazilian officials were signaling that they saw no future in continuing negotiations with the Americans over enriched uranium for additional fuel-loads for Angra-1, which after the NNPA of 1978 (see *Nuclear Non-proliferation Act*, page 341) had become the focus of a new dispute between the countries following Brazil's refusal to submit to full-scope safeguards (FSS). Though Urenco denied any substantial talks taking place, Brazilian officials said they were considering expanding the Urenco contract to cover fuel needs for Angra-1 as well. However, the talk of shutting down American supply altogether quickly turned into an American-Brazilian understanding agreed to during Vice-President Bush's visit to Brasilia mid-October that would allow a first fuel-load for Angra-1, soon to become operational, to use Urenco-enriched uranium with subsequent loads provided again by the Americans. Brazil did not have to agree to additional safeguard obligations, in a reversal of American nuclear non-proliferation policy toward Brazil by the incoming Reagan administration.[1333]

Brazil came back on the Dutch MFA's agenda after the country suffered a financial crisis in the early 1980s and its nuclear plans were downsized and delayed. In the period October-December 1983, Brazil was contractually obligated to receive 119 tonnes of enriched uranium that by now it had no need for in the short term. Furthermore, the Banco di Brazil refused to provide the foreign currency for the transaction. Urenco met Brazilian needs by allowing a revision of the delivery dates and amounts to better accommodate Brazil's reduced fuel requirements. An agreement was finalized that would see Urenco produce and store the 119 tons of enriched uranium. Brazil would receive 10 tons per year over the next three years from this store. The remaining amount would be available to Nuclébras, but Urenco was allowed to make use of it when confronted with special circumstances. Brazil would eventually take on the entire amount, but under the new schedule deliveries would only be concluded at the end

1330 ARC 123-7, pp. 2-3, Tweede Kamer der Staten Generaal, Zitting 1980-1981 – 16256, 'Verlening van een machtiging als bedoeld in artikel 40 van de Compatibiliteitswet 1976 tot vergroting van de deelneming in Ultra-Centrifuge Nederland N.V.', Nr. 9, Nota naar aanleiding van het eindverslag, 31st of March 1981, pp. 5-6, 'Brazilië wijkt voor uranium uit naar Urenco', in *NRC Handelsblad*, 13th of October 1981, pp. 1, 11, 'UCN werkt niet voor Brazilië', in *Het Vrije Volk*, 2nd of April 1981, p. 9.

1331 'Opheldering over onderhandelingen geëist: Kamer vraagt duidelijkheid aan Minister over 'Almelo'', in *Trouw*, 3rd of March 1978, http://leiden.courant.nu/issue/NLC/1978-03-03/edition/0/page/1, website checked 14-6-2017.

1332 Tweede Kamer der Staten Generaal, Handelingen Tweede Kamer, 29th of April 1981, pp. 4823, 4832.

1333 Hurrell, Andrew, James, *The Quest for Autonomy: The Evolution of Brazil's Role in the International System, 1964-1985*, Ph.D. Dissertation, Faculty of Social Studies, University of Oxford, 1986, pp. 256-257, 'Brazilië wijkt voor uranium uit naar Urenco', in *NRC Handelsblad*, 13th of October 1981, pp. 1, 11, 'Uranium mag toch naar Brazilië', in *NRC Handelsblad*, 16th of October 1981, p. 14.

of the 1990s. Under the agreement, Nuclébras also committed itself to exclusively contract enrichment services with Urenco until the year 2000. The adjusted contract would be finalized in two new agreements. DRW warned that the developments with Brazil would have a negative effect on Urenco's cash-flow situation and thus UCN's profits in the near future.[1334]

Toward a Common Export Policy for Urenco

The Brazil case exposed the absence of a coherent export policy for Urenco. Motivated by potential gains in efficiency and avoidance of 'problems such as the Netherlands had caused' the UK proposed to start negotiations on the subject.[1335] The Netherlands were similarly motivated by the 'bitter aftertaste of the Brazil-affair' to come to a predictable set of conditions under which Urenco could evaluate potential customers.[1336] Furthermore, a push to 'anchor' the Troika's exports in an official policy was in line with the development of Dutch domestic policy and its own institutionalization of its responsibilities on the subject in the Disarmament Note of 1975.

Negotiations between the partners were initiated and produced an outline of an export policy contemporaneously with the negotiations with Brazil. Before, during and after the Brazil deal entered JC discussions, actively evolving contextual constraints shaped the negotiation space for the partners. Negotiations on a common export policy started in early 1977, but besides earlier commitments such as the FRG's WEU commitments, contemporary processes such as the Nuclear Suppliers Group deliberations and tougher American non-proliferation policy that culminated in the US NNPA affected the process and its outcome profoundly. The international norms of what was permissible and what was responsible were shifting, as were the partners' perceptions of their own and each others' interests and limits with regards to these.

The London Club/The Nuclear Suppliers Group

The '"Western Nuclear Suppliers Group"' had existed 'for some time' when in January 1967 the Netherlands was invited to take part in its upcoming February meeting.[1337] Through the Dutch embassy in London, Dutch officials sought clarification on this initiative and which subjects it had under discussion. London embassy official Van Roijen informed the Ministry of Foreign Affairs that the group's discussion were 'informal' and of a '"fairly wide range"' as both technical and economic aspects of nuclear supply were discussed although the technical aspects, particularly as they applied to the '"safeguards system"', were most important.[1338] The group's informal nature meant that usually an '"agreed record"' was established but that any

1334 ARC 124-8. p. 6, *Verslag over het Jaar 1983,* Ultra-Centrifuge Nederland N.V. (UCN NV: Almelo) pp. 8, 15.
1335 ARC 123-1, p. 3.
1336 ARC 124-2, p. 1.
1337 Memorandum, D.W. Van Lynden aan J. Tjaardstra, 'Western Nuclear Suppliers Group', 18th of January 1967, 2.05.262/1734.

consensus reached within the group was of a non-binding nature.[1339] The group's main purpose was to be a 'forum of discussion for producing countries' that could serve as a precursor organ to a future non-proliferation agreement for which the IAEA was unsuitable as it also represented non-producer countries.[1340] UK Under Secretary for Technology Michaels advised the Dutch delegation via the London embassy official ahead of the meeting to inform themselves of the established list of '"trigger items"', which was non-binding.[1341]

In connection to the coming into force of the NPT, the Zangger committee was created in 1971 to clarify what constituted 'equipment or material especially designed or prepared for the processing, use or production of special fissionable material' as mentioned in the NPT text.[1342] In 1974 the Zangger Committee (through the IAEA) published two memoranda, labeled A and B and a set of guidelines; the memoranda A and B list nuclear (source and special) materials and nuclear equipment (and non-nuclear materials for construction) respectively and the agreement describes associated minimal export guidelines. The two memoranda consisted of lists of items that would 'trigger' export controls and were later consolidated into a single 'Trigger list'. The accompanying agreement urged suppliers;

> 'a) to obtain the recipient's assurance excluding uses of the exported items for a nuclear explosion;
>
> b) to subject those items, as well as the material on the Trigger List produced through their use, to IAEA safeguards;
>
> c) to ensure that Trigger List items are not re-exported to a third party unless the third party recipient meets the conditions of a) and b).'[1343]

President Nixon of the United States ordered a series of studies in the early 1970s that focused on proliferation concerns associated with nuclear trade of materials and equipment and whether current measures to prevent the diversion of those, both bilateral and multilateral, were adequate. These studies were followed by three relevant presidential policy directives by Nixon, known as National Security Decision Memoranda. The first (of October 1973) ordered a 'case-by-case review "without a priori presumption of supply" for transfers of HEU fuel for

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1338 Sent Coded Message, Ambassade Londen Van Roijen aan Ministerie van Buitenlandse Zaken, 'Western nuclear suppliers group vergadering', 6058, Confidentieel, 19th of January 1967, 2.05.262/1734.

1339 Sent Coded Message, Ambassade Londen Van Roijen aan Ministerie van Buitenlandse Zaken, 'Western nuclear suppliers group', 6072, Confidentieel, 25th of January, 2.05.262/1734.

1340 Ibid.

1341 Ibid.

1342 Strulak, Tadeusz, 'The Nuclear Suppliers Group' in *The Nonproliferation Review*, Vol. 1, No. 1 (Fall 1993) https://www.nonproliferation.org/wp-content/uploads/npr/strula11.pdf, website checked 1-4-2017, p. 2, 'The Treaty on the Non-Proliferation of Nuclear Weapons (NPT)', 2005 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), 2-27 May 2005, New York,http://www.un.org/en/conf/npt/2005/npttreaty.html, website checked 2-5-2017.

1343 Strulak, Tadeusz, 'The Nuclear Suppliers Group' in *The Nonproliferation Review*, Vol. 1, No. 1 (Fall 1993) https://www.nonproliferation.org/wp-content/uploads/npr/strula11.pdf, website checked 1-4-2017, p. 2, 'Multilateral Nuclear Supply Principles', Working paper by the Zangger Committee, 1995 Review and Extension Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, NPT/CONF.1995/21, 20th of April 1995, http://www.un.org/Depts/ddar/nptconf/21ca.htm, website checked 19-4-2017.

foreign nuclear power reactors, or "precondition" that fuel fabrication or spent fuel reprocessing take place in the United States.'[1344] Future transfers of HEU would require the AEC to seek the State Department's view prior to making any commitment, and to refer any proposal for transfer to the President (though the European Community had been informed supplies to its member states would receive a sympathetic review). Additionally, the directive asked the relevant US agencies to come up with a multilateral effort, particularly targeted at other supplies, to initiate consultations on the potential dangers transfers of HEU posed.

A second directive of March 1974 instructed US officials to act neutrally toward the USSR entering the Western enrichment market, while also consulting with allies to make sure dependence upon its supplies would not become too great. The June 1974 third directive ordered the US administration to start consultations with other countries to establish 'agreed international guidelines, preferably based on U.S. practice, to ensure [the] physical security of weapons usable and highly toxic materials whether internationally transferred or indigenously produced' and to reach 'some common principles regarding the supply of sensitive enrichment technology or equipment' as well as promote 'multinational enrichment, fuel fabrication and reprocessing facilities.'[1345]

Although increased international concern for nuclear proliferation was caused by the explosion of a nuclear device by India in 1974[1346], Christian Kessler has convincingly argued that it was the earlier Nixon administration studies and directives (possibly partly inspired by concern over the pre-detonation developments in the Indian nuclear program) that had before the 1974 Indian test set up the diplomatic ground work ahead of the establishment of the London Suppliers Club.[1347] A US multilateral initiative proposed under President Nixon by Secretary of State Kissinger, in line with later initiatives such as the International Security Assistance Act and Nuclear Nonproliferation Act (both of 1978), the London Club was an American attempt to multilaterally push for much stricter non-proliferation requirements on nuclear transfers.[1348] At this point, the United States 'preferred secret diplomacy among those who were technically capable of becoming significant suppliers to the open diplomacy of the [1975 NPT] review conference, which (predictably) degenerated into a confrontation between the nuclear "haves" and "have-nots."'[1349] To the US, a secret agreement among suppliers was preferable to a conference-sanctioned set of limitations that involved direct input by consumer-countries, so this chimed well with the 'French and Soviet insistence', that the

1344 Kessler, Christian, J., 'Technical Negotiations in a Political Environment', in *The Nonproliferation Review*, Vol. 20, No. 3 (2013) p. 496. Underline in original.

1345 Ibid., pp. 496-497.

1346 India had diverted technology and materials from a safeguarded Canadian-built plant and used these in a clandestine parallel nuclear weapon program. See *Case: India*, page 439.

1347 Kessler, Christian, J., 'Technical Negotiations in a Political Environment', in *The Nonproliferation Review*, Vol. 20, No. 3 (2013) pp. 495-497.

1348 Krass, Allen, *et al*, *Uranium Enrichment and Nuclear Weapons Proliferation* (Stockholm International Peace Research Institute, Taylor & Francis Ltd: London and New York 1983) https://www.sipri.org/sites/default/files/files/books/SIPRI83Krass/SIPRI83Krass.pdf, website checked 3-9-2017 pp. 55, 204, 206-207.

1349 Wonder, Edward, 'Nuclear Commerce and Nuclear Proliferation: Germany and Brazil, 1975', in *Orbis* (Summer 1977) p. 303.

meetings of the group would be kept secret, as to not give the impression that the participants were in the process of building a cartel.[1350] The United States, Canada and the UK made proposals that sought to constrain nuclear supplier states and NWS further, whereas France and the FRG resisted proposals toward 'a more comprehensive agreement', focusing 'on the discriminatory nature of a cartel and the threat that export restraints would pose to their industries; indeed their views became almost indistinguishable.'[1351]

The London Club was soon named the Nuclear Suppliers Group (NSG) and,

> '[e]arly in 1976, the original seven members (the United States, the Soviet Union, the United Kingdom, France, the Federal Republic of Germany, Japan, and Canada) agreed on the first version of "Guidelines on Nuclear Transfers." This version was then further discussed with eight new members (Belgium, Czechoslovakia, the German Democratic Republic, Italy, the Netherlands, Poland, Sweden, and Switzerland) that joined the group during 1976/1977. The Guidelines were finally accepted by all fifteen members of the Group in September 1977 and transmitted to the IAEA Director General in January 1978 to be published the next month as the IAEA's document INFCIRC/254.'[1352]

The consensus eventually reached by the NSG had exposed clashing positions on nuclear trade. On one side of the debate were the US, which had mostly refrained from exporting enrichment and reprocessing facilities (President Ford recommitted to that policy in 1976) and the USSR, which had followed a similar policy ever since its experience with China in the early 1960s.[1353] On the other side were the second generation nuclear exporters France and the FRG as well as Japan. Of particular immediate concern and an ongoing diplomatic battle that became part of the NSG meetings were the West-German contract with Brazil that intended to transfer both enrichment and reprocessing technologies and French contracts with South Korea and Pakistan (and Taiwan gaining an option) to transfer reprocessing technology.[1354]

The US put heavy pressure on France and the FRG to forgo these sensitive technology transfers but was partially rebuffed; while the two countries agreed to go along with a stricter regime that forewent sensitive technology transfers (France in 1976, the FRG in 1977), they

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1350 Ibid.

1351 Ibid.

1352 Strulak, Tadeusz, 'The Nuclear Suppliers Group' in *The Nonproliferation Review*, Vol. 1, No. 1 (Fall 1993) https://www.nonproliferation.org/wp-content/uploads/npr/strula11.pdf, website checked 1-4-2017, pp. 2-3.

1353 Although the US had, as part of its strategic objectives, further enticed countries' interest in sensitive nuclear technology such as when in 1955 it put up a full nuclear technology exhibition in India that included 'hot 'laboratories' or hot cells, which featured 'Magic Hands'; mechanical hands used to handle irradiated fuel elements in the process of plutonium reprocessing, Lavoy, Peter, R., 'The Enduring Effects of Atoms for Peace' in *Arms Control Today*, Vol. 33 (December 2003) https://www.armscontrol.org/act/2003_12/Lavoy, website checked 26-3-2017, Wulf, Andrew, James, *U.S. International Exhibitions during the Cold War: Winning Hearts and Minds through Cultural Diplomacy* (Rowman & Littlefield: Lanham 2015) p. 101.

1354 Krass, Allen, *et al*, *Uranium Enrichment and Nuclear Weapons Proliferation* (Stockholm International Peace Research Institute, Taylor & Francis Ltd: London and New York 1983) https://www.sipri.org/sites/default/files/files/books/SIPRI83Krass/SIPRI83Krass.pdf, website checked 3-9-2017 pp. 55, 202, 204.

would only do so for new contracts. Turning to the recipients, South Korea and Taiwan, dependent on the US for their national security, canceled their contracts with France, but 'Pakistan and Brazil resisted US pressure' as their respective suppliers had done before.[1355] The FRG would supply Brazil with jet nozzle enrichment technology (having been blocked by the Netherlands from transferring Urenco centrifuge technology) that would prove unworkable in the Brazilian Resende facility. France would for a while go ahead with helping Pakistan construct its reprocessing plant but eventually pulled out of the deal.[1356]

Part of the resistance towards the US with regards to its assault on reprocessing technology transfers came in the context of President Carter's 1977 wholesale rejection of the plutonium economy and his call for a moratorium on reprocessing technology transfers in order to support non-proliferation efforts; this concerned the closed fuel cycle based on breeder reactors, an area of technology in which the US was clearly lagging behind the Europeans and Japan. Selling nuclear infrastructure packages that linked 'reactor sales to fuel-cycle transfers and other inducements, became a precondition for gaining significant export business' and 'blunting the USA's commercial advantage' for the second generation nuclear exporters (France and the FRG) at a time when 'due to its established links with utilities and industries in importing countries, and its greater scale and experience in nuclear production', '[t]he US industry was still a formidable opponent'.[1357] The US was accused of trying to maintain its dominant position in the market while it enjoyed the luxury to reject the plutonium fuel economy because of its large natural uranium reserves and initial resistance was maintained in France, the UK and Japan, as these countries continued or initiated reprocessing projects. Eventually, the FRG canceled the construction of its Gorleben plant however, officially because of domestic pressure and unofficially possibly because of continued US pressure.[1358] Customers such as the Swiss utilities, tied to US supply contracts, grew 'increasingly

1355 Ibid., pp. 203-204. But there is more to the South Koreans giving up the French contract, as Gray has documented using declassified sources; '[i]n late 1975, French officials displayed a genuine commitment to the new co-operative regime by abandoning a major sale to South Korea – the supply of a fuel reprocessing plant by chemical giant Saint-Gobain. The IAEA had raised no particular objections, and was on the verge of completing a trilateral safeguards treaty with France and South Korea; but French officials changed course after concluding that politicians in Seoul were primarily interested in acquiring nuclear-weapons capability. Paris saved face by avoiding a direct rebuff to the South Koreans. Instead, French diplomats [signaled] their intentions to the State Department, which then took it upon itself to browbeat Seoul into abandoning its quest for reprocessing technology.', Gray, William, Glenn, 'Commercial Liberties and Nuclear Anxieties: the US-German Feud over Brazil, 1975-7', in *The International Historical Review*, Vol. 34, No. 3 (2012), pp. 460-461.

1356 Krass, Allen, *et al*, *Uranium Enrichment and Nuclear Weapons Proliferation* (Stockholm International Peace Research Institute, Taylor & Francis Ltd: London and New York 1983) https://www.sipri.org/sites/default/files/files/books/SIPRI83Krass/SIPRI83Krass.pdf, website checked 3-9-2017 p. 203, Squassoni, Sharon, Fite, David, 'Brazil as Litmus Test: Resende and Restrictions on Uranium Enrichment' in *Arms Control Today*, Vol. 35 (October 2005) https://www.armscontrol.org/print/1898, website checked 3-4-2017.

1357 Walker, William, Lönnroth, Måns, *Nuclear Power Struggles: Industrial Competition and Proliferation Control* (George Allen & Unwin: London 1983) p. 35.

1358 Krass, Allen, *et al*, *Uranium Enrichment and Nuclear Weapons Proliferation* (Stockholm International Peace Research Institute, Taylor & Francis Ltd: London and New York 1983) https://www.sipri.org/sites/default/files/files/books/SIPRI83Krass/SIPRI83Krass.pdf, website checked 3-9-2017 p. 205, Ebinger, Charles, K., *The Washington Papers Vol. VI: International Politics of Nuclear Energy* (The Center for Strategic and International Studies: Sage Publications, Beverly Hills & London 1978) pp, 60-61.

frustrated by the restrictions placed by Americans on the Swiss freedom to reprocess spent fuel and to make use of the plutonium derived from it in further reactor fuel', leading them to switch to less restrictive suppliers (in the Swiss case: Urenco).[1359]

A common restraint on the Troika partners came from their participation in the London Club/NSG. The UK and FRG were two of the seven original members in this group of nuclear suppliers and when still a non-member the Netherlands deferred to its partners when evaluating safeguard proposals.[1360] After attaining NSG membership however, the Netherlands started to assert a more independent position. US President Carter's push for more stringent non-proliferation policies exposed divergent views within the Troika. For example when evaluating the Dutch input to a European Commission reaction to Carter's proposals, Dutch officials from the Ministry of Foreign Affairs (DRW and DIO – Directorate International Organizations) realized Dutch non-proliferation policy aligned more with the US than with those members of the European Commission such as the FRG and Belgium that sought a reaction along the lines of a wholesale rejection of the American proposals and that appeared to want to use this political opportunity to shore up the EURATOM Treaty's standing and relevance. The Dutch MFA also realized that the Dutch Ministry of Economic Affairs with which it shared competency in this dossier was not completely on board with the MFA's positive evaluation of Carter's proposals. Nonetheless, DIO commented that in this policy-area of national non-proliferation efforts, the European Commission was not competent and in its combative attitude towards the US proposals it was overstepping its mandate; the Netherlands would not have itself bound by a common European position that it perceived not to be in the interest of its national non-proliferation policies.[1361]

The Guidelines of the NSG incorporated the Zangger Trigger List while expanding on it by also including 'heavy-water production plants, and “major critical components' of various enrichment processes'.[1362] Initially only included sparingly, in time (after 1990) the NSG adopted a wholly separate list of *dual-use* items that could both be used in 'regular' industrial applications as well as sensitive nuclear activities, and as such posed a potential proliferation threat. The original NSG Guidelines demanded 'recipient's assurances on non-explosive use, IAEA safeguards, and control on re-transfer' as well as requiring 'physical protection of nuclear materials and facilities in order to prevent their unauthorized use and handling'.[1363] The Guidelines went beyond the Zangger and the NPT; it created a more stringent system of 'principles and rules', though with room for interpretation; the requirement of members to

1359 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 116.

1360 ARC 61-3, p. 2.

1361 Memorandum, DRW/AT via Chef DRW, DGES, Chef DIO, DGPZ en S aan M en T, 'Toekomstig beleid der Europese Gemeenschappen op nucleair gebied', DRW/AT-143, 23rd of May 1977, http://resources.huygens.knaw.nl/watermarker/pdf/europa/S03182.pdf, website checked 8-4-2017.

1362 Krass, Allen, *et al*, *Uranium Enrichment and Nuclear Weapons Proliferation* (Stockholm International Peace Research Institute, Taylor & Francis Ltd: London and New York 1983) https://www.sipri.org/sites/default/files/files/books/SIPRI83Krass/SIPRI83Krass.pdf, website checked 3-9-2017, p. 56.

1363 Strulak, Tadeusz, 'The Nuclear Suppliers Group' in *The Nonproliferation Review*, Vol. 1, No. 1 (Fall 1993) https://www.nonproliferation.org/wp-content/uploads/npr/strula11.pdf, website checked 1-4-2017, p. 2.

implement these rules and principles into their national legislation and enforcement mechanisms would produce different results depending on local attitudes and understandings.[1364] Furthermore, it required safeguards on facilities that had been constructed using transferred technology as well as on facilities of the same type (such as enrichment and reprocessing plants), not having used transferred technology, during an agreed period of usually 20 years. The same would be required of a recipient country if it would re-transfer any of the safeguarded equipment, facilities or technology and would need the original supplier's consent. Regarding the export of enrichment technology or facilities, the Guidelines stipulated that the recipient nation should agree to not use those facilities or facilities based on the transferred technology to enrich uranium beyond 20% in U-235 without the supplier's consent and without notifying the IAEA. An accompanying consultation system was meant for members to coordinate when engaging with 'special cases and violations of supplier-recipient understandings'; the NSG would meet to discuss these. Alternatively, countries could seek bilateral contact with fellow-members to coordinate. In practice, only the latter happened, and then only sporadically.[1365] During the NSG deliberations, France successfully resisted proposals by Canada to make the application of IAEA FSS on all nuclear facilities a condition of nuclear supply.[1366]

The published Guidelines faced heavy criticism from mainly developing nations that cast the NSG consensus as a cartel and its restrictions on exports a violation of suppliers' NPT article IV obligations to participate in the '"fullest possible exchange of equipment, materials, and scientific and technological information for the peaceful uses of nuclear energy"'.[1367] Developing nations 'used the Guidelines, and other disputed issues in nuclear relations, as pretexts for bringing nuclear trade into the North-South debate'; [b]y linking nuclear relations to other grievances – aid, food, minerals, trade – the Third World sought to strengthen its bargaining position *vis-à-vis* the major industrial countries.'[1368] From 1977 to 1991 there were no NSG meetings with full attendance. Following the developing nations' criticism of the group's work, France and the FRG deemed further meetings would only worsen the political situation. As a result, challenges that came up during this period, particularly on dual-use technology transfers, were hard to address.[1369]

1364 Ibid., p. 3.

1365 Ibid., p. 3, Krass, Allen, *et al*, *Uranium Enrichment and Nuclear Weapons Proliferation* (Stockholm International Peace Research Institute, Taylor & Francis Ltd: London and New York 1983) https://www.sipri.org/sites/default/files/files/books/SIPRI83Krass/SIPRI83Krass.pdf, website checked 3-9-2017, p. 56, Mandelbaum, Michael, 'A Nuclear Exporters Cartel', in *Bulletin of Atomic Scientists*, Vol. 33, No. 1, p. 43.

1366 Burr, William, 'The Making of the Nuclear Suppliers Group, 1974-1976', Wilson Center Nuclear Proliferation International History Project, 16 April 2014, https://www.wilsoncenter.org/publication/the-making-the-nuclear-suppliers-group-1974-1976, website checked 6-4-2017.

1367 Krass, Allen, *et al*, *Uranium Enrichment and Nuclear Weapons Proliferation* (Stockholm International Peace Research Institute, Taylor & Francis Ltd: London and New York 1983) https://www.sipri.org/sites/default/files/files/books/SIPRI83Krass/SIPRI83Krass.pdf, website checked 3-9-2017, p. 57.

1368 Walker, William, Lönnroth, Måns, *Nuclear Power Struggles: Industrial Competition and Proliferation Control* (George Allen & Unwin: London 1983) p. 41 (Italics in original). The 'cool reception' a suppliers' agreement such as the NSG would face was predicatable, Mandelbaum, Michael, 'A Nuclear Exporters Cartel', in *Bulletin of Atomic Scientists*, Vol. 33, No. 1, p. 45.

Illustration 2:

A caricature of the NSG in the North-South debate[1370]

The 1975 Disarmament Note

Another predetermined constraint on Urenco's policy was Dutch national policy. Of major influence to the Dutch negotiating position within the JC was the 'Note on the Question of Disarmament and Security' commonly known as the Disarmament Note of 1975.[1371] In it, besides a variety of other security subjects, policy was laid out on the subject of non-proliferation of ultra-centrifuge technology. The Netherlands committed itself to a policy that *under no circumstance would export of ultra-centrifuge technology be allowed except to countries with their entire nuclear cycle under IAEA safeguards*.[1372]

In the Note, the Dutch Western Nuclear Suppliers Group membership was presented as the country being part of a 'sort of gentleman's agreement' that specified which transfers require appropriate (IAEA) safeguards.[1373] It considered the measures the Western Nuclear Suppliers Group had taken to be welcome (creating a list of export items that 'triggered' mandatory safeguards) but inadequate, as non-NPT parties currently occupied a privileged position compared to the NNWS in the NPT, who accepted full scope safeguards on all their nuclear activities, whereas the outsiders only had to accept safeguards on the imported technology and materials. 'With non-parties [of the NPT] it is an urgent requirement to safeguard the peaceful

1369 Van Ham Peter, *Managing Nonprolfieration Regimes int he 1990s: Power, Politics and Policies* (Pinter Publishing Ltd.: London 1993) p. 16. The NSG finally reconvened again in 1991 in the context of revelations about Iraq's covert nuclear program. See Chapter 7, *The Smyth Report,* page 193.
1370 Michael, 'A Nuclear Exporters Cartel', in *Bulletin of Atomic Scientists*, Vol. 33, No. 1, p. 42.
1371 Tweede Kamer der Staten Generaal, Zitting 1974-1975 – 13461, 'Nota over het vraagstuk van ontwapening en veiligheid', Nr. 2, Nota, 19th of June, 1975.
1372 Ibid., p. 57, (italics mine).
1373 Ibid.

use of U.C.-technology and the fissile materials enriched with it'.[1374] The Dutch Government considered this new policy in line with the conclusions of the first NPT Review Conference and voiced its support for a push towards stricter export policies, particularly the application of FSS in all countries that received nuclear technology and materials.[1375]

The 1978 Nuclear Non-Proliferation Act

The United States Congress under Carter's leadership managed to deepen the conflict with its allies and the developing world by proposing in 1977 and in 1978 voting into law the Nuclear Non-Proliferation Act (NNPA), an amendment of the 1954 act which made IAEA Full Scope Safeguards a condition of supply for its enriched uranium supplies, combined with an off-setting effort to expansion of its enrichment facilities (including expansion of enrichment technology research) to guarantee dependable supplies to its customers. The NNPA also required customers to acquire US consent before they were allowed to reprocess fuel containing American uranium. Furthermore, re-transfers of 'US-supplied nuclear materials' (not just the sensitive ones) as well as equipment, facilities and technology also required consent, and all these conditions would be retro-active; controversially applying the new restrictions to not just future exports but current agreements as well.[1376] Customer countries were allowed a two year period to renegotiate existing contracts into compliance with the NNPA, and afterwards could only obtain an export license for nuclear exports under very special circumstances with a Presidential waiver. The NNPA also advocated the establishment of an international fuel authority that, under strict non-proliferation conditions and a customer's commitment not to establish national enrichment or reprocessing facilities, could provide for a dependable supply of fuel against a reasonable price.[1377]

The US wasn't the first to attempt to force its customers into non-proliferation commitments in such a way. In 1977 Canada had imposed an natural uranium embargo on the EURATOM countries following its rejection of a Canadian demand for prior consent on European decisions to reprocess or enrich Canadian materials, as part of a renegotiation of contracts following a 1976 reorientation of Canadian export policy that required these additional non-proliferation commitments of its customers. Canadian PM Trudeau had reached an interim agreement with Chancellor Schmidt (FRG), promising notification and consultation on the sensitive issues, that led to the lifting of the embargo toward the end of 1977 and a interim (pending the outcome of INFCE) Canada-EURATOM agreement on reprocessing in 1978,

1374 Ibid.

1375 Ibid.

1376 Walker, William, Lönnroth, Måns, *Nuclear Power Struggles: Industrial Competition and Proliferation Control* (George Allen & Unwin: London 1983) p. 39, Krass, Allen, *et al*, *Uranium Enrichment and Nuclear Weapons Proliferation* (Stockholm International Peace Research Institute, Taylor & Francis Ltd: London and New York 1983) https://www.sipri.org/sites/default/files/files/books/SIPRI83Krass/SIPRI83Krass.pdf, website checked 3-9-2017, pp. 58, 206-207.

1377 Krass, Allen, *et al*, *Uranium Enrichment and Nuclear Weapons Proliferation* (Stockholm International Peace Research Institute, Taylor & Francis Ltd: London and New York 1983) https://www.sipri.org/sites/default/files/files/books/SIPRI83Krass/SIPRI83Krass.pdf, website checked 3-9-2017, pp. 206-207.

with a final resolution reached in December 1981.[1378] The final agreement reiterated EURATOM's non-proliferation commitments made to Canada in 1978 but the requirement of constant notifications on a case by case-basis on reprocessing and plutonium storage was removed. Enrichment of Canadian uranium beyond 20% would continue to be subject to consultation however.[1379]

When the US NNPA was announced, countries dependent on US enriched uranium with an intention to process their spent nuclear fuel such as France, the UK, Japan and the FRG immediately voiced strong protests (though the Netherlands took a favorable view) and had EURATOM take a political stand by having it refuse to renegotiate US contracts subject to the NNPA, to which the US immediately responded with the threat of an embargo of enrichment supplies, of which the EURATOM countries were still dependent for reactor operations at this time (with both Eurodif and Urenco still building up their respective capacities). A compromise was reached when EURATOM 'affirmed its willingness to enter into negotiations within thirty days' and 'although this deadline lapsed without agreement, a modus operandi was finally established that postponed, at least until March 1980, any firm actions stemming from the NNPA'; 'American and German officials agreed that the European Community would enter into "talks" with the United States which would be more or less non-binding, not making an issue over the subtle difference between "talks" and negotiations".'[1380] The March 1980 date had been picked to fall after the conclusion of the International Nuclear Fuel Cycle Evaluation (INFCE) that ended in February 1980; the US however made no effort to 'revive the embargo' after INFCE was concluded.[1381] The US-EURATOM and Canada-EURATOM exchanges were thus mirrored in their onsets and resolutions; refusal by EURATOM to conform to unilaterally altered supply-conditions followed by a threat of embargo or actual embargo, followed by a political compromise and a failure by suppliers to stand their ground.

Not just Western countries had a falling out with the US over the NNPA; for example, amid India's refusal to accept full-scope safeguards, President Carter had to lobby Congress to allow fuel shipments to proceed after 1980, although only for the initial fuel load for the Tarapur reactor (see *Case: India* below, page 439).

Criticism in the wake of the NNPA mirrored the arguments heard during the NSG negotiations; American policy was threatening energy supplies when markets were already

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1378 *Annual Report for 1978*, AA/16/79, EURATOM Supply Agency, http://aei.pitt.edu/33249/1/A35.pdf, website checked 4-4-2017, p. 8, Legault, Albert, Fortmann, Michel, *A Diplomacy of Hope: Canada and Disarmament, 1945-1988* (McGill-Queen's Press – MQUP: Montreal & Kingston, London, Buffalo 1992) pp. 275-276.

1379 *Annual Report for 1981*, EURATOM Supply Agency (Office for Official Publication of the European Communities: Luxembourg 1982) http://aei.pitt.edu/33248/1/A34.pdf, website checked 4-4-2017, pp. 48-49.

1380 Hatch, Michael, T., *Politics and Nuclear Power: Energy Policy in Western Europe* (The University Press of Kentucky: Lexington 1986) p. 130, Walker, William, Lönnroth, Måns, *Nuclear Power Struggles: Industrial Competition and Proliferation Control* (George Allen & Unwin: London 1983) p. 167, Tweede Kamer der Staten Generaal, Handelingen Tweede Kamer, Zitting 1978-1979, 8th of February 1979, p. 3181.

1381 Krass, Allen, *et al*, *Uranium Enrichment and Nuclear Weapons Proliferation* (Stockholm International Peace Research Institute, Taylor & Francis Ltd: London and New York 1983) https://www.sipri.org/sites/default/files/files/books/SIPRI83Krass/SIPRI83Krass.pdf, website checked 3-9-2017, p. 58.

under strain, the imposition of unilateral policies constituted 'invasion of sovereignty in energy planning' and protected the US' fast-fading monopoly on enriched uranium supplies while sabotaging the development of the fast breeder cycle in Western European countries and Japan.[1382] Perhaps most politically damaging, the US was perceived to have,

> '… devalued the NPT by denying signatories their 'inalienable rights' to nuclear technology and materials, and implicitly by reinterpreting the NPT to mean that NNWS should henceforth forgo the capability, let alone renounce the intention, to produce nuclear weapons. It would encourage independent development of fuel cycles. It replaced the assumption of qualified trust that underlay the NPT with the assumption of unqualified mistrust'.[1383]

While as shown above, the Carter's strict interpretation of the NNPA was toned down toward the end of the administration, the 'enshrinement' in law meant that successive administrations were to a degree bound by 'its fundamentals'.[1384] The US would for the near future continue to 'price itself out of the market', allowing competitors, such as Urenco in the enriched uranium market, to gain ground.[1385] The combination of US contract conditions changing, the 1974 order stop and reorganization combined with stricter non-proliferation policies such as the NNPA saw the world market share of US enrichment services decline from a near-monopoly in 1970 to under 60% by 1982.[1386]

The UCN Common Export Policy Proposal

Against this international background during the second half of the 1970s, the process of creating a common (multinational) export policy for Urenco started with the partners sharing their views with one another through papers presenting their respective national perspective on the subject. UCN researched a possibly future export policy and early January 1977 sent a letter to Urenco outlining a proposal for guidelines for export. The proposal, titled 'Guidelines for approval of exports by Joint-Committee' presented an ambitious starting point for discussion. The UCN proposal covered both 'the export of enrichment services in the form of lightly enriched uranium and of technology'.[1387] In the general export conditions section three requirements were listed: First, the customer country should have or be willing to acquire a binding agreement with both the Troika countries and the IAEA; second, unilateral

1382 Walker, William, Lönnroth, Måns, *Nuclear Power Struggles: Industrial Competition and Proliferation Control* (George Allen & Unwin: London 1983) p. 39

1383 Walker, William, Lönnroth, Måns, *Nuclear Power Struggles: Industrial Competition and Proliferation Control* (George Allen & Unwin: London 1983) p. 39. The NPT of course commits NNWS to not build nuclear weapons, but does not require them to forgo the nuclear infrastructure that would make that possible, also perceived to be needed for an independent nuclear power program.

1384 Ibid., p. 167.

1385 Ibid.

1386 Bannink, Dirk, Diehl, Peter, *Uranium Mining and (In)transparency: Urenco's Role in the Nuclear Fuel Chain* (World Information Service on Energy: Amsterdam 2014) p. 13.

1387 ARC 61-7, p. 2. English in original.

termination of such an agreement would not be possible; third, '[e]ffective inspection and control by the IAEA' should be guaranteed.[1388]

On export conditions for enrichment services, additional requirements were listed. First, Urenco would only export low enriched uranium. Second, the supplied uranium should be used in designated reactors 'under normal conditions (high burn-up)'.[1389] Third, unless with express consent, re-export of supplied product would not be allowed. Fourth, the burned-up product (which includes plutonium) could not be (re-)exported to third parties and could not be reprocessed except under IAEA safeguards. Reprocessed uranium with higher than 2% enrichment should only be introduced in designated reactors under normal conditions. Plutonium '– whether or not in the original fuel element –' had to remain under constant IAEA control.[1390]

On export conditions for technology, in addition to the requirements listed above, a further two conditions were proposed. First, the receiving country should have IAEA full-scope safeguards in place (with all civilian nuclear activities subject to inspection). Second, the customer should 'have or be willing and able to introduce effective security measures for technology received'.[1391]

In the proposal's notes, the contract with Brazil is mentioned multiple times, showing the importance of the experience gained in the process of negotiating the contract with that country; '[t]he agreement concluded between [Brazil], West-Germany and the IAEA, fulfilling conditions 1 to 4 above, could be the model for further agreements' the UCN proposal suggested.[1392] However, the proposal also pointed to an unfulfilled requirement in that agreement that needs 'urgently be rectified'; the absence of the UK and the Netherlands from the safeguards agreement with Brazil.[1393]

In a bold testimony of foresight, UCN also includes the following note:

> 'It is wondered whether a condition with respect to “political stability” of the customer country would also be required.'[1394]

Only after several major proliferation events and decades of enhanced insight, and when the safeguards system had evolved from strictly a materials-based accountancy to a comprehensive approach, did the IAEA's 'State Level Concept' officially introduce political

1388 Ibid. English in original.
1389 Ibid. English in original.
1390 Ibid., pp. 2-3. English in original.
1391 Ibid., p. 3. English in original.
1392 Ibid., p. 2. English in original.
1393 Ibid. p. 3. English in original.
1394 Ibid., p. 1. English in original.

considerations in the evaluation of a state's safeguards credentials.[1395] The evolution of safeguards will be more thoroughly discussed in Chapter 12.

UCN's 'Guidelines for approval of exports by Joint-Committee' reflected a compromise between the very principled non-proliferation stance of the Dutch Government's largest party, the PvdA, and its smaller political partners. The PvdA's parliamentary faction had argued its position during the Ministry of Foreign Affairs-chapter of the national budget deliberations in November 1976, when it's representative Ter Beek argued that NPT-membership should be a prerequisite condition met by any future customer of enrichment services or technology from Urenco. Ter Beek pointed out that,

> '[i]n the context of the Almelo agreement the Netherlands has at its disposal a veto-right. This means, that the Government, to effectuate this position, is not dependent on international cooperation and can put the principle of 'no deliveries to non-NPT-countries' into practice by itself. My faction has repeatedly voiced its conviction that if countries can obtain nuclear knowledge, equipment and materials without the need to be party to the NPT, this reduces the meaning and value of the NPT as well.'[1396]

The argument referred back to the motion Ter Beek, accepted in November the previous year, which had sought to bind the Government to the above view. The PvdA's parliamentary faction at this time seemed unaware or uncaring that unqualified use of the Dutch veto could have unintended political consequences to the Troika partnership. Their inflated impression of Dutch influence would only be fanned in the following year by Minister Van der Stoel's briefings to the party on Brazil.

Though a compromise position, the Dutch were still confronted with resistance facing UCN's proposal; its Troika partners did not want to set conditions that went beyond what the NSG had agreed to. In a JC meeting on the 21st of January 1977, Dutch representative Mr. Burgers reiterated the most important points of the Dutch position; UC technology should not be exported and exported enriched uranium should only take place if and when the recipient country had all its nuclear activities under safeguards.[1397] The two other delegations argued against the Dutch position; they pointed to the lack of economic and political efficacy of such a move; '[p]recisely the countries, whom when supplying enrichment services set the lightest (political) conditions would profit from our policy' and 'Urenco would not survive such an economic policy' argued the German delegation.[1398] The UK representative agreed. The German representative furthermore contended that it would be an '"entirely new view"' should the Troika position itself as stricter than the other suppliers.[1399] A Dutch representative

1395 Rockwood, Laura, 'The IAEA's State-Level Concept and the Law of Unintended Consequences', in *Arms Control Today*, Vol 44 (September 2014) https://www.armscontrol.org/print/6413, website checked 24-11-2017, 'IAEA Safeguards Overview: Comprehensive Safeguards Agreements and Additional Protocols', International Atomic Energy Agency website, https://www.iaea.org/publications/factsheets/iaea-safeguards-overview, website checked 24-11-2017.
1396 Tweede Kamer der Staten Generaal, Zitting 1976-1977, Handelingen Tweede Kamer, 2nd of November 1976, p. 848
1397 ARC 61-8b, p. 1.
1398 ARC 61-8a, p. 2.
1399 Ibid., 61-8b, p. 1.

disagreed with the German remark, reminding the partners the Netherlands had committed itself to this policy of requiring full scope-safeguards in the Disarmament Note of 1975. The Troika partners were not aware of this commitment and somewhat surprised they hastened themselves to become familiar with the text of the Disarmament Note (See *The 1975 Disarmament Note*, above).[1400]

A Package Deal

At the Netherlands' request, a ministerial-level JC meeting took place on the 3rd of February 1977 to resolve the outstanding issues, on which the Minister of Economic Affairs Lubbers briefed Parliament by letter on the following 5th of April. In the meeting, the Netherlands asked for more economic concessions. It proposed that expansion of capacity to a 1000 tons (other than the earlier agreed 600 tons) would be realized in Almelo. The rationale behind the proposal was that greater capacity at Almelo would make the future expansion of capacity at the same plant more economically sensible, reducing incentive for a German plant elsewhere. Further integration of the Dutch and German activities in Almelo would also support that goal.[1401] Lubbers reported that the discussions 'on a number of commercial, economic and organizational guidelines' had had a 'satisfactory' result seeing that a number of previously non-official JC agreements dating from September 1974 were reconfirmed.[1402] The 1974 agreement had included a Dutch conditional offer to not stand in the way of an Urenco plant in the FRG in exchange for the extension of the Almelo treaty until at least 1991, of which the Dutch Parliament had not been informed (but was informed by Minister Van Aardenne in February 1979, see below). In the February 1977 JC meeting the partners did not yet commit to an expansion in Almelo as proposed but in subsequent discussions consensus emerged on a set of conditions: the upcoming expansion (after completion of capacity in Almelo to 600 tons) of Dutch-German 1000 tons capacity in Urenco would be installed in Almelo and the 10-year extension of the Almelo treaty would be tied to the to-be-negotiated Troika agreement on 'non-proliferation policy regarding exports' i.e. the common export policy.[1403]

The JC discussions led to an impasse that deferred decisions on the more contentious issues (FSS and IPS – the International Plutonium Storage regime proposal, see below under *The International Nuclear Fuel Cycle Evaluation (INFCE)*, page 355).[1404]

1400 ARC 61-8b, pp. 1-2.
1401 Letter, Minister van Economische Zaken aan Minister President, 'uitbreiding verrijkings-capaciteit Almelo', 377/II/1298/EEK, 21st of December 1977, 2.03.01/10859, pp. 3-4.
1402 Tweede Kamer der Staten Generaal, Zitting Tweede Kamer 1976-1977 – 14261, 'Ultracentrifuge-project', Nr. 5, Brief van de Minister van Economische Zaken, 5th of April 1977, p. 1.
1403 Tweede Kamer der Staten Generaal, Zitting Tweede Kamer 1978-1979, 14261, nr. 43, 'Ultracentrifuge-project', Brief van de Minister van Economische Zaken, 2nd of February 1979, p. 2, Tweede Kamer der Staten Generaal, Zitting Tweede Kamer 1976-1977 – 14261, 'Ultracentrifuge-project', Nr. 5, Brief van de Minister van Economische Zaken, 5th of April 1977, p. 1, Letter, Minister van Economische Zaken aan Minister President, 'uitbreiding verrijkings-capaciteit Almelo', 377/II/1298/EEK, 21st of December 1977, 2.03.01/10859, p. 3.
1404 ARC 124-2, p. 1.

Following a German proposal in the JC meeting of the 13th of January 1978, the FRG delegation drew up a list of 'measures which [would] have to be taken in order to secure a satisfactory continuation of the tripartite cooperation' that were to be discussed in the upcoming 28th of February JC meeting.[1405] These measures were with regards to 'capacity build-up';

1. A 'firm decision on the expansion of the Almelo capacity up to 600 t/a', along with 'assurance of financing' and 'satisfactory agreement on the construction and operation of a plant with different types of centrifuges', 'based on the construction of an infrastructure for 1000 t/a in which Uranit will be prepared to take its share';

2. '[C]onfirmation of approval by the [JC] and establishment by the partners of [Urenco Deutschland] which shall build a third enrichment plant at a site in the [FRG] (Gronau) to go on stream in a way commensurate with an early build up of the 600 t capacity in accordance with 1. above.';

3. '[O]fficial confirmation by the [Dutch Government] that

-there will be no restrictions to the availability of the plants in Almelo for deliveries to the customers in the three countries

-under no circumstances in and exports of uranium (natural, enriched or depleted) to and from the Troika countries shall be restricted.'[1406]

With regards to export policy, the FRG required 'a decision in principle to be taken by the [JC] that [U]renco may export enrichment services to fourth countries under conditions required by the [NSG] guidelines.'[1407] Finally, the three governments would agree to 'in good faith refrain from exercising their right of withdrawal from the treaty by 1981' on the condition that above measures would be 'realized and maintained.'[1408]

In the fall of 1978, Urenco itself made a proposal in the JC to establish Urenco-Deutschland in preparation for a plant in Gronau. The UK and the Netherlands had some objections to this proposal, but also realized that the eventual establishment of an enrichment factory on German soil under the Treaty of Almelo umbrella was unavoidable. This had been reflected by Dutch Minister of Economic Affairs Van Aardenne's remarks during a pair of parliamentary debates in which matter of a plant on German soil came up, in January 1978. Pressed by several parliamentarians whether a third Urenco plant in Gronau or somewhere else in the FRG was likely to result from the next expansion of Urenco's capacity and whether

1405 Telex, Der Bundesminister fuer Forschung und Technologie van Hees to Ministry of Foreign Affairs A. van Galen Last and Department of Energy M. Aitchison, 221-9427-3-5/78, 22nd of February 1978, 2.03.01/10859, p. 1.
1406 Telex, Der Bundesminister fuer Forschung und Technologie van Hees to Ministry of Foreign Affairs A. van Galen Last and Department of Energy M. Aitchison, 221-9427-3-5/78, 22nd of February 1978, 2.03.01/10859, pp. 1-2.
1407 Ibid., p. 2.
1408 Ibid.

the Dutch Government had already given its consent to such a scenario, the Minister sought to create the impression that a decision on a plant to be built in the FRG would not come up for several more years and thus likely not be his decision. He said a plant on German soil was a very likely scenario but refused to commit the Government further at this time.[1409]

In a parliamentary debate in April on Urenco, Foreign Affairs Minister Van der Klaauw told Parliament that 'in essence' the Dutch had relinquished their veto-power in the JC already, which resulted in a failed motion of distrust of the minister by the PPR.[1410] Later that year, in November, Parliament was more forceful when during a debate on Urenco's future export policy, the Second House accepted a motion by PPR representative Jansen, which demanded that the Government would consult with Parliament before committing itself to further expansion of the Almelo plant beyond 2000 tonnes. Moreover, it forbade the Government to agree to further sales of enrichment services by Urenco. When asked, Minister Van Aardenne doubted whether this motion could be observed by the Government.[1411]

In the 8th of December JC meeting, the UK countered the Urenco request and earlier German proposal by proposing to solve the three major outstanding issues in a new package deal; the establishment of a plant in Gronau, the extension of the Almelo Treaty for another 10 years and the conclusion of negotiations on a common export policy. The coupling of the first two issues was particularly important; the combination of a factory on German soil and extension of the Troika cooperation for another ten years would prevent a German '"Alleingang"'.[1412] A related issue that also needed to be included was the cross-investments of the three partners (a German and Dutch share in the Capenhurst plant, a British share in the German-Dutch plant in Almelo).[1413] 12,5% cross-investments proved unworkable; it created a sizable financial commitment while not resulting in tangible influence. A rate of 2% was agreed as part of the package deal.[1414]

The necessary elements of the package deal were agreed upon in the JC meeting of 16 January 1979.[1415] The agreement allowed the establishment of Urenco Deutschland and the

1409 Tweede Kamer der Staten Generaal, Handelingen Tweede Kamer, Zitting 1977-1978, 31st of January 1978, pp. 596-597.

1410 'Motie in Urenco-zaak: PPR wantrouwd Van der Klaauw – Minister: "Veto-recht in 1976 weggeven"', in *De Volkskrant*, 27th of April 1978, p. 1.

1411 'Tweede Kamer eis overleg over Urenco', in *Het Parool*, 29th of November 1978, p. 1, 'Van Aardenne weer in problemen over Urenco', in *De Telegraaf*, 29th of November 1978, p. 6, 'Van Aardenne: Wantrouwen bij Urenco partners', in *NRC Handelsblad*, 15th of February 1979, p. 1.

1412 ARC 123-1, p. 3. Alleingang means 'to go at it alone', in German.

1413 Ibid.

1414 Ibid., the Select Committee for Nuclear Energy of the Dutch Parliament was confidentially informed by the Minister of Economic Affairs of the state of negotiations with the partners and the inclusion of the possibility of a third, FRG-based Urenco plant in those. When informing Parliament of these discussions with the minister, the Select Committee Chairman Van Houwelingen did not share any of the details the minister had disclosed, Tweede Kamer der Staten Generaal, Zitting Tweede Kamer, 1978-1979 – 14261, Nr. 42, Brief van de Voorzitter van de Vaste Commissie voor de Kernenergie, 20th of December 1978.

1415 ARC 123-1, p. 3. Krass *et al.* dates the JC decision to allow the Gronau plant to 1978, Krass, Allen, *et al*, *Uranium Enrichment and Nuclear Weapons Proliferation* (Stockholm International Peace Research Institute, Taylor & Francis Ltd: London and New York 1983) https://www.sipri.org/sites/default/files/files/books/SIPRI83Krass/SIPRI83Krass.pdf, website checked 3-9-2017,

designation of Gronau as the future location of the new Urenco plant but at the same time kept the JC involved in future steps; 'the JC "should be consulted as to the timing of the commencement of construction of the 3rd enrichment plant etc."'[1416] The intention was to successfully complete negotiations on the package deal in 1979.[1417] As for the negotiation of a common export policy, in February 1979 the Troika established 'an expert group under the Joint Committee to continue discussions on a clearer definition of the principles under which Urenco should provide enrichment services to fourth countries.'[1418]

Minister Van Aardenne informed Parliament of the agreement reached on the package deal by letter on the 2nd of February, also reporting the previously undisclosed deal of 1974. The Minister explained that Urenco had in September 1978 requested permission from the JC to establish Urenco Deutschland and that seeing the conditions set in 1974 had been met, the Troika had granted Urenco's request. In the ongoing negotiations on the common export policy, Van Aardenne assured Parliament that the Government would strive to implement the motions Van Houwelingen.[1419]

Foreign Affairs Minister Van der Klaauw briefed Parliament during the February 9th session on the current state of the agreed common export policy of the Troika. He summarized the Troika would consider itself bound by its NPT obligations under Article 3 and interpretation the Zangger Committee had given to section 2 of that article (the Trigger List). Additionally, the Guidelines of the NSG would be observed and the Troika was attempting to as much as possible to speak with one voice in the IPS deliberations. Van der Klaauw explained that although the Government thought the push for universality of full-scope safeguards on all exports would be best pursued in the context of the NSG, since that body was not likely to meet for some time to come, it had been introduced as a Dutch wish in deliberations with the Troika partners on the common export policy, in observance of the motion Van Houwelingen nr. 20. Asked by representative Ter Beek (PvdA) whether the Government was also pursuing NPT-membership as a condition for nuclear exports (in accordance with the accepted motion Ter Beek), Van der Klaauw reminded Parliament that he had informed Parliament before that after extensive consultations with other countries, the United States among them, politically such a condition on export was not realistic and the Government would not be pursuing it at this time, although universalizing the NPT membership was a general policy goal.[1420]

On the 13th of February, the Dutch Parliament's House of Representatives voted on and accepted a motion by representative Ter Beek that required the Government to not commit itself to a common Troika export policy without first having consulted with the House.[1421] In

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p. 64.

1416 ARC 123-1, p. 3. English in original.

1417 Ibid.

1418 ARC 123-1, p. 4, 123-2, p. 2. English in original.

1419 Tweede Kamer der Staten Generaal, Zitting 1978-1979 – 14261, 'Ultracentrifuge-project', Nr.43, Brief van de Minister van Economische Zaken, 2nd of February 1979, pp. 1-2.

1420 Tweede Kamer der Staten Generaal, Handelingen Tweede Kamer, Zitting 1978-1979, 8th of February 1979, pp. 3179-3180.

1421 ARC 123-1, p. 4, 'Fabriek uraniumverrijking: Kamer ongelukkig met bouw Gronau', in *De Volkskrant*, 15th of February 1979, p. 3, 'Kamer wil greep op export Urenco', in *Leidse Courant*, 14th of February 1979, p. 11,

anticipation of the parliamentary vote on the motion, Minister Van der Klaauw had called it unwanted, as it weakened the Government's negotiating position.[1422] The debate continued the following day and into the day after, with representatives from most of the involved parties (the PvdA, Christian Democrats (CDA), Liberal Democrats (D66) and Radicals (PPR)) heavily criticizing the Government for only disclosing the 1974 JC agreement to Parliament at this late hour and criticizing the content of that agreement, most importantly the way it had opened the door to an enrichment plant located in the FRG.[1423] An Urenco plant on German soil would allow the FRG to subtract itself from the influence of the United States, argued the PPR.[1424] The D66 faction wondered whether a secret commitment like that made in 1974 was even legal and accused Minister Van Aardenne of informing Parliament incorrectly and insufficiently. It argued that the Government had misled Parliament in 1978 when presenting a vote for the expansion of the Almelo plant as a vote that could prevent a German plant. In the most favorable view the Government had been strong-armed or even blackmailed by the FRG into its current position, the Liberal Democrats thought.[1425] Van Aardenne in turn blamed the former government for creating the lasting uncertainty with the Troika partners that had fed the German wish for their plant inside the FRG. Additionally, the motion Jansen (PPR) that had been accepted by Parliament in November 1978 had strengthened the German resolve.[1426]

The CDA faction agreed that Parliament had received insufficient information when asked to make a decision back in January 1978 and the Government had created the impression that all foreseeable capacity expansions in the near future would be realized in Almelo and Capenhurst. Additionally, its spokesperson Van Houwelingen lamented the continued absence of the ten-year extension as pressed for in the motion Van Houwelingen nr. 20, as in his faction's perception it continued to undercut the Government's ability to negotiate a common export policy.[1427] Whereas the VVD was mildly critical of above events and cautioned Parliament that it could be getting in the way of the Government as it was negotiating with the Troika, the PvdA representative Ter Beek summarized the episode as having resulted in the Government misleading Parliament, having shown incompetence in the negotiations which had led to a bad result and he subsequently tabled a motion of disapproval (nr. 45), which was defeated. A second motion tabled by Ter Beek (nr. 47) asked the Government to demand full-scope safeguards of all Troika customers and to refuse nuclear supplies if the customer-country seemed likely to act contrary to the non-proliferation regime and if prior to supply the

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Tweede Kamer der Staten Generaal, Handelingen Tweede Kamer, Zitting 1978-1979, 8th of February 1979, p. 3199. Tweede Kamer der Staten Generaal, Handelingen Tweede Kamer, Zitting 1978-1979, 13th of February 1979, p. 3267.

1422 Tweede Kamer der Staten Generaal, Handelingen Tweede Kamer, Zitting 1978-1979, 8th of February 1979, p. 3219, 'Kamer wil greep op export Urenco', in *Leidse Courant*, 14th of February 1979, p. 11.

1423 Tweede Kamer der Staten Generaal, Handelingen Tweede Kamer, Zitting 1978-1979, 14th of February 1979, pp. 3342-3352.

1424 Ibid., p. 3343.

1425 Ibid., pp. 3345-3346, 3356, 3359, See above, *The Motion(s) Van Houwelingen*, page 324.

1426 'Van Aardenne: Wantrouwen bij Urenco partners', in *NRC Handelsblad*, 15th of February 1979, p. 1.

1427 Tweede Kamer der Staten Generaal, Handelingen Tweede Kamer, Zitting 1978-1979, 14th of February 1979, pp. 3346-3347, 3361.

Troika and a recipient country failed to come to agreement on an IAEA plutonium storage regime. That motion was accepted.[1428]

In his defense, Minister Van Aardenne responded that he had not anticipated the growth of enrichment business for Urenco to develop the way that it had and that he had not immersed himself fully enough in the dossier to be aware of the 1974 JC agreement when he spoke about the matter with Parliament in 1977, as due to developments between 1974 and 1977, it had 'faded into the background'.[1429] Honoring the 1974 agreement and allowing a West-German plant had however mended relations with the Troika partners, argued Van Aardenne, and had created a measure of certainty that for example helped West-German utilities looking to contract enrichment services to make a choice for Urenco as their supplier.[1430] Summarizing the matter in 1980, DRW/AT wrote that Parliament had not been pleased with the concessions made to the Germans regarding the Gronau plant and in exchange had pressured the Government to ensure that the Almelo Treaty would be continued for at least ten years, as well as that an 'immaculate' future Troika export policy would be negotiated.[1431]

An Interim Export Policy

After several meetings, the JC expert group reached a measure of consensus and on the 10th of June 1980 the JC decided to present the (interim) result to the relevant Ministers who later approved it.[1432] The purpose of the common policy was twofold; 'to clarify the non-proliferation policy of the Troika in this area', and 'to provide both a reliable indication to potential customers of non discriminatory export conditions required by the three governments and a clear guideline for Urenco's conduct in discussion with potential customers in fourth countries.'[1433] The interim report made note of the unique normative example the Troika played, and the responsibility that it implied:

> 'The cooperation at governmental and industrial levels under the Treaty of Almelo is one of the prime examples world wide of integrated, multinational fuel cycle service organizations and it is therefore crucial that Troika export policy should reflect the continuing support of the three governments for non-proliferation.'[1434]

New conditions on the transfer of enrichment technology weren't deemed necessary at this time; it was considered enough to maintain the amount of restraints that the NSG guidelines asked for, while considering each potential customer on its own merit. Furthermore, transfer of technology would always have to take place 'in terms of cooperation between the Troika

1428 Ibid., pp. 3349-3352, 3363.
1429 Ibid., pp. 3353-3354.
1430 Ibid., p. 3357.
1431 ARC 123-1, p. 5, Tweede Kamer der Staten Generaal, Handelingen Tweede Kamer, Zitting 1978-1979, 14th of February 1979, pp. 3345, 3350.
1432 ARC 122-12, p. 6, ARC 123-2, p. 2, ARC 124-2a, p. 1.
1433 ARC 123-2, p. 4. English in original.
1434 Ibid., p. 3. English in original.

and fourth countries, rather than in terms of a mere export of centrifuge plants or technology.'[1435] In the listing of 'main elements' of the new policy, the compromise the Netherlands and its partners reached on FSS and IPS becomes clear. On full-scope safeguards it stated that,

> '(I) the Governments will continue to take initiatives to promote the acceptance of full scope safeguards on civil nuclear activities by all states and thus will give priority to countries being members of the NPT or having committed themselves to full scope safeguards.'[1436]

The policy would not demand full scope safeguards or NPT-membership from the customer, but the Troika would act with preference to those that did.[1437] On the establishment of an international plutonium regime,

> '(II) the three governments will continue to work towards the establishment of an IAEA plutonium storage regime on a non discriminatory and universally applicable basis in conformity with article XIIa5 of the IAEA Statute. They will therefore seek the cooperation from Governments of countries to which Urenco will supply enrichment services for the establishment of such a regime under Article XII a 5 of the IAEA Statute. If such a scheme has not been established by the time Urenco supplied fuel is ready for reprocessing in the recipient country, in view of the precedent set by the Troika contract with Brazil, the three governments will seek the agreement of the customer's government for interim arrangements for the storage of excess plutonium derived from the reprocessing of Urenco enriched material.'[1438]

In other words, Urenco would demand more of customers than was strictly required under the Troika's NPT obligations, but did not demand more than it already had of previous customers (Brazil). The Troika required customer's governments to subscribe to the obligations set forth in articles 2, 3 and 10 of the NSG Guidelines, on 'non explosive uses, security and control on retransfer'.[1439] Additional safeguards measures should be agreed upon between the Troika and the customer government, before deliveries, if the customer intended to further enrich the

1435 Ibid., p. 4. English in original. A testimony to the continued adherence to this policy are the enrichment plants based on Urenco technology in France and the USA.
1436 Ibid. English in original.
1437 Ibid.
1438 Ibid., pp. 4-5. English in original. The text of article XII a 5 reads: 'To approve the means to be used for the chemical processing of irradiated materials solely to ensure that this chemical processing will not lend itself to diversion of materials for military purposes and will comply with applicable health and safety standards; to require that special fissionable materials recovered or produced as a by-product be used for peaceful purposes under continuing Agency safeguards for research or in reactors, existing or under construction, specified by the member or members concerned; and to require deposit with the Agency of any excess of any special fissionable materials recovered or produced as a by-product over what is needed for the above- stated uses in order to prevent stockpiling of these materials, provided that thereafter at the request of the member or members concerned special fissionable materials so deposited with the Agency shall be returned promptly to the member or members concerned for use under the same provisions as stated above.', 'The Statute of the IAEA', International Atomic Energy Agency website, https://www.iaea.org/about/statute#a1-12, website checked 10-3-2017.
1439 ARC 123-2, p. 5. English in original.

supplied material to 20% or above.[1440] Furthermore, if the customer's government 'terminates, abrogates, or materially breeches safeguards obligations' on the delivered material, Urenco would suspend or cancel deliveries and require the already delivered material to be returned.[1441] Finally, review of current and the implementation of additional measures could be initiated by the JC, should the current policy prove inadequate, in the interest of non-proliferation.[1442] FSS and the IPS as official Urenco policy objectives (but not conditions) was the maximum negotiated result the Dutch could achieve at this time.[1443]

The International Nuclear Fuel Cycle Evaluation (INFCE)

To contrast purely supply-sided policy initiatives such as the NSG, the US Carter administration initiated the multilateral INFCE in an effort to reach some particular and some general objectives. General objectives were: first, to repair some of the diplomatic damage done by previous supply policies and anticipated damage by (and offset anticipated reactions to) upcoming supply policies (such as the NNPA); second to alleviate some of the tension that had come to dominate international nuclear diplomacy due to American policies and the rifts between on the one side the superpowers and on the other side the second generation nuclear suppliers and others that were focused on the plutonium breeder cycle; third, to address the wider tensions caused by the North-South rift in the international political landscape. In particular, President Carter's administration sought to find a neutral forum that could vindicate some of the current US ideas on non-proliferation policy, most importantly the rejection of the (closed) nuclear cycle that would use plutonium as fuel or fuel-addition (in thermal reactors). At the conclusion of the INFCE though, its final report concluded just about the opposite.[1444]

President Carter launched the initiative in April and May 1977, opening it up to all IAEA members. This would allow both signatories and non-signatories of the NPT, as well as a wide selection of participants in nuclear matters, from countries that had considerable nuclear infrastructure to those developing nations just starting to acquire nuclear technology and from both sides of the East-West divide, as well as neutral countries, to attend.[1445] The evaluation was to consider three main areas: first, the ways in which nuclear energy could be made widely available to meet the global energy requirements; second, measures that could be taken to reduce the proliferation risks of nuclear energy while safeguarding energy supplies; third, how in developing solutions to these challenges, the needs of developing nations could be given special consideration.[1446]

1440 Ibid.
1441 Ibid. English in original.
1442 Ibid.
1443 Ibid.. In the view of DRW/AT officials writing in 1980, ARC 123-1, p. 5.
1444 Gummett, Philip, 'From NPT to INFCE: Developments in Thinking about Nuclear Non-Proliferation' in *International Affairs*, Vol. 57, No. 4 (1981) pp. 553, 561.
1445 Ibid., p. 554.
1446 Ibid., pp. 553-554.

After a preparatory conference in October 1977 (Washington D.C.) the INFCE continued in a series of conferences, with the first conference held in November 1978 and the final conference in February 1980, both in Vienna.[1447] As a forum to exchange views, the INFCE was successful in providing a space for open debate and fostering mutual understanding of the different national positions on nuclear energy; though the conference was mainly attended by scientists, these all to some degree functioned as representation for their respective governments and their respective political positions.[1448] Topics under discussion varied from the availability of uranium sources and assurances of supply, comparisons of proliferation risks of various fuel cycles, inherent proliferation-resistant fuel cycles (such as the still largely theoretical thorium-U-233 fuel cycle) and multilateral fuel initiatives to nuclear waste storage solutions such as the concept of IPS.[1449]

The INFCE was successful in reaching most of the general objectives the Carter administration had pursued by initiating the forum; as mentioned above, participants used attendance as an opportunity to inform themselves on other perspectives than their own and although it was meant as a technical forum, for a minority of states it was an opportunity to voice political grievances.[1450] In the latter sense, it perhaps helped galvanize the political North-South dissent toward the upcoming NPT review conference later that year, as the original NPT bargain increasingly suffered criticism as,

> '… some developing countries [had] … a strong sense of being denied sufficiently free and unrestricted access to nuclear technology, and hence they continued to feel discriminated against, distrusted and kept permanently in an underdeveloped state. …. Neither has INFCE (nor could it have) reduced the resentment of the near-nuclear states (and others) about what they regard as double standards over vertical proliferation: the super-power attitude, in other words, of 'you must trust us with our huge arsenals, but we won't trust you with small ones', which in terms of the inherently inequitable nature of power politics, it is hard to see how to escape. Both grievances carried over into the NPT review conference in August-September 1980 and resulted in a discordant meeting which broke up without agreement on a final declaration.'[1451]

Nevertheless, with the US as initiator of INFCE being 'honor-bound to accept its conclusions', such as those on the plutonium cycle it didn't like, as well as the attention the forum gave to developing-world concerns, the conference helped relax some of the built-up antagonism towards it.[1452] Following the INFCE, the IAEA set up three consultant groups to have experts

1447 Ibid.

1448 Ibid., pp. 555-556.

1449 Ibid., pp. 556-560, 563, Imai, R., 'International Plutonium Storage Schemes' in *IAEA Bulletin*, Vol. 22, No. 3, 4, p. 51. See chapter 11, page 473, *INFCE Working Group 2 on GCEP Safeguards* for an additional discussion on the specifics of safeguarding GCEPs.

1450 Gummett, Philip, 'From NPT to INFCE: Developments in Thinking about Nuclear Non-Proliferation' in *International Affairs*, Vol. 57, No. 4 (1981) p. 564.

1451 Ibid., p. 565.

1452 Brenner, Michael, 'Carter's Bungled Promise' in *Foreign Policy*, No. 36 (Autumn 1979), p. 91, Gummett, Philip, 'From NPT to INFCE: Developments in Thinking about Nuclear Non-Proliferation' in *International Affairs*, Vol. 57, No. 4 (1981) pp. 557-558, 561, Walker, William, Lönnroth, Måns, *Nuclear Power Struggles:*

address some of the particular concerns raised in the evaluation. One would study the possibility of IPS, one would study International Spent Fuel Management and 'most relevant to the enrichment industry' the CAS (Committee on Assurance of Supply) 'was created in 1980 to discuss and make recommendations on issues relating to international supply of nuclear material and equipment' in the hope that a guaranteed assurance of supply could reduce the incentive for countries to pursue national enrichment and reprocessing capabilities, as it would reduce the risk that a 'single supplier could unilaterally disrupt nuclear power generation.'[1453] The aim of IPS was 'to investigate ways of setting up international centers where all plutonium from civil reprocessing plants would be stored for release (under safeguards) for civil purposes.'[1454] Successful implementation of such a scheme could reduce the proliferation risk of nationally operated reprocessing plants outside the NWS.[1455]

More delay was suffered in finalizing the Troika common export policy. On the 13th of March 1980 and unanticipated by the Dutch representatives in the JC, the British proposed to delay a final decision on the common export policy for the period of 1 year. The German representative seconded the proposal right away. The UK representative argued that overall agreement at the ministerial level would be daunting, also considering the role the Dutch Parliament had chosen to take in the matter. Another argument for delay was that of timing; international perceptions on this subject seemed to be shifting, now that INFCE had been concluded and discussions commenced to come to an international consensus based on INFCE's results. One such discussion took place in the Committee on Supply Assurances, which commenced right after INFCE ended. The upcoming NPT Review Conference (1980) was also important in this context. Presentation of a new Troika export policy at this time 'could in this context be interpreted as moving ahead of, [respectively] hindering upcoming international consultations'.[1456] With INFCE having exposed much animosity, this was not the time to draw attention to an Urenco policy that could be perceived as restrictive.

The delay would not compromise customer relations, it was expected. By 1980 the market for enrichment services was weak due to overcapacity; 'it seems at present unlikely that Urenco will need to enter into substantive negotiations for the supply of enriched uranium to new customers in fourth countries in the near future.'[1457]

Dutch representatives to the JC were nervous about possibly unintended consequences of the delay; what if over time the consensus now reached broke down? In order to sanction the planned delay, the Dutch representatives to the JC asked the partners for some assurances; a

Industrial Competition and Proliferation Control (George Allen & Unwin: London 1983) p. 41

1453 Krass, Allen, *et al*, *Uranium Enrichment and Nuclear Weapons Proliferation* (Stockholm International Peace Research Institute, Taylor & Francis Ltd: London and New York 1983) https://www.sipri.org/sites/default/files/files/books/SIPRI83Krass/SIPRI83Krass.pdf, website checked 3-9-2017, p. 210, Walker, William, Lönnroth, Måns, *Nuclear Power Struggles: Industrial Competition and Proliferation Control* (George Allen & Unwin: London 1983) p. 127.

1454 Walker, William, Lönnroth, Måns, *Nuclear Power Struggles: Industrial Competition and Proliferation Control* (George Allen & Unwin: London 1983) p. 127.

1455 Ibid., p. 128.

1456 ARC 123-1, pp. 4-5, ARC 122-12, p. 6, 123-2, p. 3.

1457 ARC 123-2, p. 5. English in original.

resumption of discussions on the export policy after the upcoming NPT Review Conference at the earliest, but right after the IAEA BoG meeting of February 1981 at the latest. Progress made in the interim in CAS and another post-INFCE initiative, the ad hoc IPS group, could be included when discussions resumed, argued DRW/AT.[1458] Furthermore, they requested confirmation of the interim negotiated result; with Parliament taking a skeptical view of the Troika's efforts to 'stimulate' improvements to the non-proliferation regime, the Dutch delegation to the JC desired something tangible to show the Parliament as testimony of their efforts.[1459] The Dutch hoped that another unintended consequence of the delay would be that progress on the several non-proliferation initiatives under international consideration would catch up with Dutch ambitions with regards to FSS and IPS.[1460]

That hope was dashed when a year later the 1980 Review Conference had failed and consultations in CAS and the consultants group on IPS were ongoing and without end in sight. Resumption of negotiations on the common export policy were further delayed.[1461] The Dutch consented to this; further delay of the extension of the Almelo Treaty should not be problematic as none of the partners wanted to discontinue the collaboration, and meanwhile Australia had presented itself as a potential new customer that could help the Netherlands reach its non-proliferation policy objectives vis-à-vis the other partners in the Troika. The Troika agreed that an 'integrated cooperation with Australia would require a common export policy'.[1462] Australia, the Dutch MFA reported to the Select Committee on Foreign Affairs, would under no circumstances weaken its own export policies that required from customers NPT-membership, full scope safeguards and 'prior consent or later IPS', meaning the customer required Australia's consent prior to reprocessing spent fuel made from Australian uranium, and IPS would become a requirement when negotiations on it were concluded (See *Case: Australia*, below).[1463]

An Offer to CAS

An opportunity to provide the Dutch Parliament with a tangible non-proliferation result came several years later in 1983, when in the context of CAS the Troika was able to take a pro-active role in moving the project forward while at the same time further defining the common export policy. The Troika decided during an ad hoc meeting on the 29th of November to make

1458 ARC 123-1, p. 6.
1459 Ibid.
1460 Ibid.,, p. 5.
1461 ARC 123-7, p. 1. IPS would never become the universally observed addition to the non-proliferation regime the Dutch had hoped for; by 1989 Dutch MFA officials discussing a possible Urenco-Argentina deal concluded that asking Argentina for IPS-type guarantees akin to those asked of Brazil years ago would be 'unserious' and should not be pursued, ARC 127-8b, p. 2.
1462 ARC 123-7, p. 1
1463 Ibid., Harris, Marty, 'The origins of Australia's uranium export policy', Parliamentary Library Background Note, 2nd of December 2011, http://parlinfo.aph.gov.au/parlInfo/download/library/prspub/1267617/upload_binary/1267617.pdf;fileType=application/pdf#search=%22background%20note%20%28parliamentary%20library,%20australia%29%22, website checked 26-6-2017.

an internal offer for the supply of enrichment services in the context of the CAS Emergency and Back-up Mechanism ahead of the upcoming IAEA BoG meeting of February 1984. That meeting would decide whether the Troika offer would be taken up; DRW/AT expected the BoG to decide to not take up the offer and wait and so the offer itself was relatively free of risk of complications. The Germans initially were anything but enthusiastic about the initiative but had ceased their opposition after the previous meeting.[1464]

Conditions for the supply were agreed to be based on three principles; the Troika committed itself (in accordance with article 3b of the Mechanism) to not set export conditions that went beyond what the Troika was currently committed to through first, national legislation ('licenses [and such]' and second, membership of international agreements.[1465] While not specifically named in the draft letter to the IAEA, DRW was mindful to point out that these memberships included the NPT, the EURATOM Treaty, the Treaty of Almelo, the Nuclear Suppliers Guidelines and others. Third, the letter to the IAEA would paraphrase 'the second accepted CAS-principle' that allowed suppliers to retain 'an important measure of freedom to act', as relevant to 'situations, in which the Troika is not prepared, regardless of conditions, to supply a particular country.'[1466]

DRW/AT added that it was hopeful these developments would help avoid a 'substantial and probably hopeless discussion on Troika export issues'.[1467] The Dutch MFA leadership decided to have DIO write a paper that would investigate how the current interim-export policy related to Urenco's embattled position in the market, seeing that France was dumping its excess enrichment capacity (mainly from Eurodif) in an already weak international market, made possible by a weak franc against the dollar, which could possibly lead to the Dutch revisiting their wish to continue to push the IPS as an export criterion.[1468]

FSS and IPS never became official Urenco export conditions.[1469] Progress in CAS stalled again and its principles did not transfer to the (interim) Troika export policy. By 1982, views within the study group on IPS had 'polarized on the fundamental issue of release, and what to do with countries' excess plutonium', besides having made little progress on the issue of siting.[1470] By mid-1986, the formal situation with regard to a common export policy was unchanged from that described in the British note of 13 March 1980 (which had proposed to delay a final decision on a common export policy).[1471] That interim-report became 'essentially a important benchmark for decision making regarding enrichment contracts to be concluded

1464 ARC 124-8, pp. 10-11.
1465 Ibid., p. 10.
1466 Ibid.
1467 Ibid., p. 11.
1468 Ibid., p. 4.
1469 ARC 124-2, p. 1. For the researched period. FSS became a NSG condition of nuclear export in 1992, but the IPS never materialized, Hibbs, Mark, 'A More Geopoliticized Nuclear Suppliers Group', in *Strategic Trade Review*, 17th of December 2019, https://carnegieendowment.org/2017/12/14/more-geopoliticized-nuclear-suppliers-group-pub-75027.
1470 Walker, William, Lönnroth, Måns, *Nuclear Power Struggles: Industrial Competition and Proliferation Control* (George Allen & Unwin: London 1983) p. 128.
1471 ARC 125-3, p. 1.

with third countries.' and in the continued absence of a final policy that followed, the interim-report became the *de facto* Urenco export policy.[1472]

The A.Q. Khan Affair

Abdul Qadeer Khan is a Pakistani national that received his Master's from Delft Technical University in metallurgical engineering and his Ph.D. from Leuven Catholic University in metallurgy after which in 1972 he was hired by the Dutch Fysisch Dynamisch Onderzoek (FDO), subsidiary of Verenigde Machine Fabrieken (VMF), a contractor for UCN. Khan obtained classified access and in 1974 became tasked with translating G-2 centrifuge documentation.[1473]

After the Indians conducted their first nuclear test, amid a lax security culture at his place of work, Khan started stealing centrifuge secrets and approached the Pakistani Government with plans for nuclear weapon development using the enrichment route. After initially being oblivious to the danger Khan posed and ignoring warnings by a close colleague of his, when Pakistani officials started ordering parts with the exact specifications as the G-2 design with Urenco's subcontractors, Dutch authorities started an official investigation into Khan's activities. The whistle-blowing colleague Veerman was harassed and even arrested, and afterwards told to keep quiet. When Dutch intelligence informed the CIA it intended to arrest Khan, they were requested not to. When Minister of Economic Affairs Lubbers questioned this course of action the Americans advised him to block Khan's sensitive access instead, Lubbers later declared. Instead of confronting Khan, his superiors promoted him to a function without access to centrifuge technology.[1474]

Khan, probably by now suspecting he was under surveillance, left the Netherlands in December 1975. During his work in the Netherlands, Khan had managed to inform himself of the network of contractors and subcontractors that provided Almelo with centrifuge parts. From Pakistan he started using this knowledge and his personal contacts to order parts for the Pakistani enrichment program and to co-opt some former colleagues into helping him. He would later exploit the same network for personal gain, as a black market smuggler of nuclear technology.[1475]

1472 ARC 124-2, p. 1.

1473 Tweede Kamer der Staten Generaal, Zitting 1979-1980 – 16082. 'De zaak-Khan', Nr. 2, Rapport, p. 18.

1474 MacCalman, Molly, 'A.Q. Khan Nuclear Smuggling Network', in *Journal of Strategic Security*, Vol. 9, No. 1 (2016) p. 105, Levy, Adrian, Scott-Clark, Catherine, *Deception: Pakistan, the United States, and the Secret Trade in Nuclear Weapons* (Walker & Company: New York 2007) p. 44, Armstrong, David, Trento, Joseph, J., *America and the Islamic Bomb: The Deadly Compromise* (Steerforth Press: Hanover NH 2007) pp. 54, 66-67.

1475 Slijper, Frank, 'Project Butter Factory: Henk Slebos and the A.Q. Khan nuclear network', Briefing 2007/01, Transnational Institute in association with Campagne against Arms Trade (Amsterdam, September 2007) pp. 11-12. A good overview of Khan's black market activities is given in, Fitzpatrick, Mark (ed.) *Nuclear Black Markets: Pakistan, A.Q. Khan and the rise of proliferation networks - A net assessment*, IISS Strategic Dossier series (International Institute for Strategic Studies: London 2007).

The episode of Khan's theft in the Netherlands was first reported in the media in March 1979 when the German broadcaster ZDF (Zweites Deutsches Fernsehen) reported that Khan had managed to get his hands on classified centrifuge technology, prompting parliamentary questions to both the Dutch and UK governments. Additional media reports disclosed more details of Khan's exploits and his work in Pakistan, such as that by the weekly publication '8 Days', triggering an intensification of the Dutch investigation. Up to 1979, the Dutch Government had kept the initial Khan investigation quiet, and when informing Parliament on the investigation that was started after the ZDF report, the Government failed to disclose the 1975 initial investigation (though hinting at it) and the original intent to arrest Khan.[1476]

On June 19th 1979, the Joint Committee was given an update on the ongoing investigation the Dutch Government was conducting on the matter of Khan's activities in the Netherlands and a translated version of the Government report on the matter was provided the following September.[1477] The Joint Committee reviewed the security procedures of Urenco in the wake of the first episode of the Khan affair in 1979.[1478] As to how the episode had affected its relation with the Troika partners, the Netherlands reported to Parliament that while there had been disappointment at the episode, the fallout had been minimal. Likewise the Government felt that its non-proliferation credentials internationally had not been severely compromised, at that moment still oblivious to the immense help the centrifuge designs would prove to be to the Pakistani enrichment efforts, and well as to their eventual proliferation to third countries.[1479]

The Khan Affair however would internationally become renowned as a prime example of how lapses in security could allow individual actors to contribute to nuclear proliferation. In 2004 and 2005 it was reported that Khan probably had had access to much more sophisticated design information than previously thought (the 4M centrifuge design) and that this information had been kept from Parliament by the Dutch Government.[1480] In 2009 it emerged that as part of a Pakistani-Chinese nuclear collaboration, Khan had shared the stolen

1476 'How Pakistan fooled the World and got the Bomb', in *8 Days*, 23rd of June 1979, pp. 8-11, 13, 'Bomb: rush to plug the Pakistan gap', in *8 Days*, 30th of June 1979, p. 4, Tweede Kamer der Staten Generaal, Zitting 1979-1980 – 16082, 'De zaak-Khan', Nr. 2, Rapport, pp. 14, 18-19.

1477 Minute, Head of Atomic Affairs Desk, Drs. A.J. Van Galen Last, Council of Europe and Scientific Cooperation to Ambassador Bonn, 'UC-samenwerking', DRW/AT-124845-1785GS/820, 27th of June 1979, part of a collection of internal Government documents collected by the Dutch campaign against arms trade, that also contains the reports by 8 Days, http://www.stopwapenhandel.org/sites/stopwapenhandel.org/files/imported/projecten/Khan/openbaar/Khan57.pdf, website checked 8-10-2017, Tweede Kamer der Staten-Generaal, Zitting 1980-1981 – 16082, 'Onderzoek zaak-Khan', Nr. 4, Antwoord van de Ministers van Economische Zaken, van Binnenlandse Zaken, van Buitenlandse Zaken en van Justitie, 26th of November 1980, p. 4.

1478 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 225.

1479 Tweede Kamer der Staten-Generaal, Zitting 1980-1981 – 16082, 'Onderzoek zaak-Khan', Nr. 4, Antwoord van de Ministers van Economische Zaken, van Binnenlandse Zaken, van Buitenlandse Zaken en van Justitie, 26th of November 1980, p. 1.

1480 'Atoomspion Khan Stal Veel Geavanceerdere Nederlandse Nucleaire Technologie Dan Tot Nu Toe Bekend', VPRO Argos Radio program, Radio 1, 14th of January 2005, MacCalman, Molly, 'A.Q. Khan Nuclear Smuggling Network', in *Journal of Strategic Security*, Vol. 9, No. 1 (2016) p. 105.

centrifuge technology with Chinese officials and in 1982 the Pakistanis actively helped China set up an enrichment plant that employed it.[1481]

Anti-nuclear Energy Protests and a National Debate

Urenco and UCN in Almelo were the target of anti-nuclear protests in April 1977, March of 1978 and in June and December 1981. On the 2nd of April 1977, some 5000 people protested the expansion of Almelo and the supply to Brazil, which in March 4th of 1978 had increased to some 30.000 protesters (the protest movement itself estimated 40.000 protesters). These protests were, despite some minor incidents, very peaceful in nature.[1482] Also in 1977, a protest against a planned nuclear plant at the West-German town of Kalkar near the Dutch border also drew tens of thousands of protesters, many from the Netherlands. Protests in June 1978 also targeted the Parliament in The Hague as well as Urenco's Capenhurst plant.[1483] From the 18th to 20th of June 1981, protesters blockaded the entrances of the Urenco plant in Almelo. The atmosphere between the 700 protesters and the police was described in one newspaper as extremely friendly, almost a '"flower-power"-state of affairs'.[1484]

Another protest started on the following December 24th, and it experimented with a different form; protesters invited the general public to come discuss the issue of nuclear energy and the position of the Almelo plant with them.[1485] This invitation didn't just draw in members of the general public; UCN reported in its 1981 annual report that while in June 1981 the protests at Almelo had led to a full blockade of the Urenco facility, in December it led to a dialogue with the protesters, which was later continued. Corporate and Personnel boards of UCN and Urenco in the Netherlands subsequently reached out to the broader public through advertisements and interviews with the press regarding their position in the nuclear energy debate.

These anti-nuclear protests came at a time when continued use of nuclear energy in the Netherlands was under scrutiny. The Government had in 1978 launched a national debate and had established a steering committee in 1979 to accommodate this 'Broad Societal Discussion' ('Brede Maatschappelijke Discussie') which officially started in 1981. A too broadly structured 'information-phase' was only followed by a 'discussion-phase' in 1983. In a written testimony to the committee, UCN argued that the continuation of uranium enrichment should be seen as

1481 'China Supplied Weapon-Grade Uranium to Pakistan, Khan Asserts', Nuclear Threat Initiative, 13th of November 2009, http://www.nti.org/gsn/article/china-supplied-weapon-grade-uranium-to-pakistan-khan-asserts/, website checked 4-7-2018.

1482 'Protest van 30.000 mensen tegen uitbreiding ultracentrifugefabriek: Massale demonstratie in Almelo bijzonder vreedzaam verlopen' in *Leeuwarder Courant*, 6th of March 1978, p. 8, 'De geschiedenis van het protest tegen kernenergie', Landelijk Kernenergie Archief (LAKA), http://www.laka.org/geschiedenis.html, website checked 8-4-2017.

1483 'Tweede UC-protest in Den Haag', in *Nieuwsblad van het Noorden*, 19th of June 1978, p. 2.

1484 Cordia, J., 'Demonstreren in Almelo: weinig belangstelling', in *Nederlands Dagblad*, 19th of June 1981, p. 5, 'Na Urenco-demonstratie schade van f100.000', in *Nieuwsblad van het Noorden*, 22nd of June 1981, p. 5.

1485 Jonge demonstranten praten in tent te Almelo met bezoekers: Nieuw actiemodel bij poort Urenco', in *Leeuwarder Courant*, 28th of December 1981, p. 7.

separate from the question whether electricity would be generated using nuclear energy in the Netherlands.[1486] When the steering committee published its final report in the same year concluding a preliminary 'no' against nuclear energy in the Netherlands, incoming PM Lubbers had already preempted its conclusions and had declared that the Dutch NPPs in Borssele and Dodewaard would stay open.[1487]

Case: South Africa

South Africa's nuclear history started with a request for a survey of South African uranium deposits by Winston Churchill to South Africa PM Jan Smuts in 1944. By the summer of 1945, reports 'that South Africa might possess some of the world's largest uranium deposits were welcomed in London where there were high hopes that the resources of the Empire/Commonwealth would continue to strengthen Britain in the nuclear age.'[1488] The establishment of the South African Atomic Energy Board (AEB) followed in 1948 and by 1955 the country operated 16 mines and provided the United Kingdom's and United States' nuclear weapons programs with uranium.[1489] The AEB constructed a nuclear research facility at Pelindaba near Pretoria and began general nuclear research and development there in 1961. Among its initial program was the development of heavy water technology, which was moderately successful. The program was eventually made redundant by South Africa's decision to only work with proven reactor concepts and its confidence in acquiring enriched uranium through its own enrichment program, see below.

Under Atoms for Peace and a 1957 10-year cooperation agreement with the United States (renewed in 1967 for another 10 years along with South African assurances to the US regarding uranium sales), South Africa acquired the HEU-fueled 20MW Safari-1 research and isotope production reactor from the Allis Chalmers Corporation, which reached first criticality in 1965. To safeguard the 90% enriched fuel for the plant, the US, South Africa and the IAEA concluded a trilateral agreement.[1490] In 1967, the Pelinduna critical facility, a domestically

1486 *Jaarverslag 1981*, Ultra-Centrifuge Nederland N.V. (UCN NV: Almelo) p. 9.

1487 Van Hengel, Guido, 'De Brede Maatschappelijke Discussie over kernenergie', in *Historisch Nieuwsblad*, No. 4 (2007) https://www.historischnieuwsblad.nl/nl/artikel/6918/de-brede-maatschappelijke-discussie-over-kernenergie.html, website checked 12-12-2017.

1488 Asuelime, Lucky, 'Uranium Politics of Gatekeeping: Revisiting the British Government's Policy vis-à-vis South Africa, 1945–1951', in *Historia*, Vol. 58, No. 1 (May/Mei 2013) pp. 34-35.

1489 Masiza, Zondi, 'A Chronology of South Africa's Nuclear Program' in *The Nonproliferation Review*, Vol. 1, No. 1 (1993) p. 36. Thomas Cochran reported the establishment of 19 mines (and 12 extraction plants) by 1955, and possibly this is due to gold mines that also produced uranium, Cochran, Thomas, B., 'Highly Enriched Uranium Production for South African Nuclear Weapons', in *Science & Global Security*, Vol. 4, No. 2 (1994) p. 162, 'South African Nuclear Chronology', Nuclear Threat Initiative, https://www.nti.org/media/pdfs/south_africa_nuclear.pdf?_=1316466791, last updated May 2007, website checked 1-7-2017, p. 81.

1490 Masiza, Zondi, 'A Chronology of South Africa's Nuclear Program' in *The Nonproliferation Review*, Vol. 1, No. 1 (1993) pp. 36-37, Cochran, Thomas, B., 'Highly Enriched Uranium Production for South African Nuclear Weapons', in *Science & Global Security*, Vol. 4, No. 2 (1994) p. 162, 'South African Nuclear Chronology', The Nuclear Threat Intiative, https://www.nti.org/media/pdfs/south_africa_nuclear.pdf?_=1316466791, last updated May 2007, website checked 1-7-2017, p. 79, Report, 'South Africa's Turn to Heavy Water Technology: History and Implications', US Central Intelligence Agency, Directorate of Intelligence, partially declassified (14th of August 1997), 8th of April 1984, https://www.cia.gov/library/readingroom/docs/DOC_0000112752.pdf, website

constructed heavy-water moderated, sodium-cooled reactor, started operating on near-natural uranium (2% enriched) that together with the heavy water was supplied by the United States. David Albright suggested in 1994 that the reactor had the purpose of producing plutonium for South Africa's nuclear weapons program but because it drained resources from the more successful enrichment program it was soon after commissioning abandoned.[1491] However, a decision to pursue 'preliminary investigations' into nuclear explosives (for peaceful uses, at first) was only taken in 1971.[1492]

South African Uranium Enrichment Program

In 1967, the first small amount of enriched uranium was produced in a laboratory setting at Pelindaba. A pilot plant was secretly commissioned after a review of the project.[1493] The process, 'based on a stationary wall vortex tube', uses the same principle as Becker's jet nozzle technique and was domestically developed.[1494] In July 1970, South Africa's Prime Minister Vorster informed Parliament of this development and South Africa's intention to conditionally accept IAEA safeguards on an enrichment plant based on the process, construction on which started in 1971 at Valindaba, close to Pelindaba. The pilot plant, known as the Y Plant, started operating its first enrichment stages in 1974. Its higher stages of enrichment were commissioned in 1977 and highly enriched uranium was first extracted from the plant in 1978.[1495]

South Africa, a founding member of the IAEA, refused to sign and ratify the NPT, objecting to the fact that 'the treaty did not obligate the weapon-states to reduce their arsenals' and 'expressing concern over the treaty's impact on the commercial aspects of nuclear energy in South Africa.'[1496] Despite its earlier signals to the contrary, South Africa also failed to bring the Valindaba enrichment plant under IAEA safeguards, citing the country's strong interest in

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checked 1-7-2017, Report, 'South African-United States' Nuclear Relations', South African Department of Foreign Affairs, 20th of March 1981, South African Foreign Affairs Archives, Brand Fourie Personal Papers, Nuclear Energy, Top Secret, 1 January 1981 to 8 May 1981, Vol V., http://digitalarchive.wilsoncenter.org/document/114183, website checked 5-9-2018, p. 1.

1491 Albright, David, 'South Africa and the Affordable Bomb', in *Bulletin of Atomic Scientists*, Vol. 50, No. 4 (July/August 1994) p. 40.

1492 Stumpf, Waldo, 'Birth and Death of the South African Nuclear Weapons Programme', Presentation at 50 Years after Hiroshima Conference, Castiglioncello, Italy 28 September-2 October 1995, https://fas.org/nuke/guide/rsa/nuke/stumpf.htm, website checked 1-7-2017.

1493 'South African Nuclear Chronology', The Nuclear Threat Intiative, https://www.nti.org/media/pdfs/south_africa_nuclear.pdf?_=1316466791, last updated May 2007, website checked 1-7-2017, p. 79, which concerning this bases itself on Albright, David, *South Africa's Secret Nuclear Weapons*, ISIS Report (Intitute for Science and International Security: May 1994) http://www.isis-online.org/publications/southafrica/ir0594.html, website checked 1-7-2017, Cochran, Thomas, B., 'Highly Enriched Uranium Production for South African Nuclear Weapons', in *Science & Global Security*, Vol. 4, No. 2 (1994) p. 162.

1494 Stumpf, Waldo, 'Birth and Death of the South African Nuclear Weapons Programme', Presentation at 50 Years after Hiroshima Conference, Castiglioncello, Italy 28 September-2 October 1995, https://fas.org/nuke/guide/rsa/nuke/stumpf.htm, website checked 1-7-2017.

1495 Ibid.

1496 Cochran, Thomas, B., 'Highly Enriched Uranium Production for South African Nuclear Weapons', in *Science & Global Security*, Vol. 4, No. 2 (1994) p. 162.

protecting the commercial sensitivity of its indigenous produced enrichment technology.[1497] Despite US pressure, the Valindaba enrichment plant would not be subject to safeguards during the time it was operational until 1990. The Safari-1 IAEA-safeguarded reactor had been used as legitimization (or cover) for its production of HEU, that was also used in the South African nuclear weapons program, as the outside world had no information on how much HEU was produced at Valindaba.[1498]

Nuclear Trade with South Africa

Since the massacre at Sharpeville, South Africa in 1960, anti-Apartheid protests in the Netherlands had been on the rise (the massacre had been an important factor for the UK to expel South Africa from the Commonwealth). From disturbing official Dutch-South African events to successfully boycotting Outspan's 'blood oranges' (gaining momentum after the success of the campaign against Angolan coffee), the protests took many forms.[1499]

Although official political protest was largely absent in the 1950s and 1960s, an increasingly critical attitude toward the white South African government became a fixture of the Dutch national (political) landscape from halfway the 1970s on. The majority of Parliament until then had remained uncommitted to substantive action:

> 'The government of Christian Democrats and right-wing liberals maintained its chosen line: denouncing apartheid on principle, but rejecting sanctions and promoting dialogue with white South Africa.'[1500]

In the early 1970s Shell, a Dutch-British oil company of strategic value to both the Netherlands and South Africa was shown by the Dutch Anti-Apartheid Movement to structurally violate United Nations sanctions on Ian Smith's Rhodesia with a scheme that ran through South Africa. Shell initially denied responsibility but was eventually condemned by evidence of the scheme. The episode sparked a world wide call for Shell to leave the Apartheid countries Rhodesia and South Africa. The Dutch PvdA-led Government took its first

1497 Memorandum, Executive Secretary of the Department of State Tarnoff to the President's Assistant for National Security Affairs Brzezinski, 'Nuclear Team Visit to South Africa', 330, 11th of February 1978, in *Foreign Relations of the United States, 1977–1980, Volume XVI, Southern Africa*, https://history.state.gov/historicaldocuments/frus1977-80v16/d330#fn:1.5.4.4.18.230.11.2, website checked 2-7-2017.

1498 Albright, David, Zamora, Tom, 'South Africa Flirts with the NPT', in *Bulletin of Atomic Scientists*, Vol. 47, No. 1 (January/February 1991) pp. 27-28, Memorandum, Executive Secretary of the Department of State Tarnoff to the President's Assistant Secretary for National Security Affairs Brzezinski, 'Nuclear Team Visit to South Africa', 330, 11th of February 1978, in *Foreign Relations of the United States, 1977–1980, Volume XVI, Southern Africa*, https://history.state.gov/historicaldocuments/frus1977-80v16/d330#fn:1.5.4.4.18.230.11.2, website checked 2-7-2017. By 1976, there had been several indications, including statements from South African officials, that South Africa was working on a nuclear weapons program, Van Wyk, Anna-Mart, 'South Africa's Nuclear Programme and the Cold War', in *History Compass*, Vol. 8, No. 7 (2010) pp. 564.

1499 'The Netherlands against Apartheid – 1970s (1)', *The Netherlands and Apartheid 1948-1994* (Social History Institute) https://socialhistory.org/fr/node/2090, website checked 2-7-2017.

1500 'The Netherlands against Apartheid – 1970s (2)', *The Netherlands and Apartheid 1948-1994* (Social History Institute) https://socialhistory.org/fr/node/2092, website checked 2-7-2017.

meaningful action on the subject by setting up the Kooijmans Commission in 1975 which 'concluded that it was impossible on the basis of current Dutch legislation to get a grip on firms which, in defiance of mandatory UN sanctions, illegally collaborated with Rhodesia.'[1501] Dutch sanctions against Rhodesia were delayed as a result of stalling tactics until 1980, only weeks before Zimbabwe gained its independence and white supremacist rule there ended.[1502]

As early as 1974, as part of an extension of the 1957 Agreement of Cooperation, the US had secured the contract to supply the proposed Koeberg reactor and existing Safari 1 research reactor with low and high enriched uranium respectively. The agreement would have ended in 1977 but was renewed at this time to run until 2007. The US supplied fuel and recipient reactors would be subject to IAEA safeguards.[1503]

Shell was also involved in attempts to sell nuclear reactors to South Africa. Shell held a 50 percent stake in General Atomics, and the former announced in June 1975 that the General Atomics' HTGR was particularly suitable for South Africa, but the program suffered major setbacks and no such reactor was sold to South Africa. Shell was also involved indirectly in the bid for a reactor deal in South Africa; a consortium of General Electric (US), Brown Boveri (Switzerland) and Benuco (a Dutch group consisting of RSV, Bredero and Comprimo) bid for a nuclear power reactor at Koeberg, South Africa.[1504] RSV's daughter company Rotterdam Nuclear, which was to be responsible for construction of the reactor vessels for Koeberg, was the last major nuclear power construction company in the Netherlands.[1505]

1501 'The Netherlands against Apartheid – 1970s (3)', *The Netherlands and Apartheid 1948-1994* (Social History Institute)https://socialhistory.org/fr/node/2094, website checked 2-7-2017.

1502 Ibid.

1503 Report, 'South African-United States' Nuclear Relations', South African Department of Foreign Affairs, 20th of March 1981, South African Foreign Affairs Archives, Brand Fourie Personal Papers, Nuclear Energy, Top Secret, 1 January 1981 to 8 May 1981, Vol V., http://digitalarchive.wilsoncenter.org/document/114183, p. 1. For more in depth accounts and analysis of the South Africa-US nuclear relations during this period and in the context of the Cold War, Anna-Mart van Wyck's work is particularly informative; Van Wyk, Anna-Mart, 'The USA and Apartheid South Africa's Nuclear Aspirations, 1949-1980', in Onslow, Sue (ed.), *Cold War in Southern Africa: White Power, Black Liberation* (Routledge: Abingdon 2009) pp. 58-83, Van Wyk, Anna-Mart, 'South Africa's Nuclear Programme and the Cold War', in *History Compass*, Vol. 8, No. 7 (2010) pp. 562-572.

1504 Compriso, the company that would have been responsible for technical matters and supervision, was 24% owned by Shell at the time, Bailey, Martin, *Shell and BP in South Africa*, Second Edition (Anti-Apartheid Movement and Haslemere Group: 1978) p. 17.

1505 Rotterdam Nuclear did not recover from the loss of the Koeberg order. By the start of 1977 owner RSV threatened closure of its daughter-company, prompting a state intervention by Minister Lubbers, taking a share in the company, which was reconstituted as a builder of heavy machinery in 1977 under the name of RSV-Zware Apparatenbouw (RSV-A). Nevertheless, with nuclear energy construction projects not materializing in the Netherlands any time soon because a strategic choice by the Government remained absent, RSV decided to shut down Rotterdam Nuclear at the end of 1979, which after conclusion of remaining commitments, occurred in 1980. RSV itself incurred heavy losses during its foray into the nuclear energy construction market, 'Kabinet-Den Uyl stemde daar in '75 aanvankelijk in toe: RSV kreeg voor Z-Afrika kredietgarantie', in *NRC Handelsblad*, 4th of May 1984, p. 10, 'RSV-dochter gaat nu toch dicht', in *De Telegraaf*, 29th of December 1979, p. T2, 'Apparatenbouw', in *Limburgs Dagblad*, 3rd of January 1980, p. 7, Tweede Kamer der Staten Generaal, Zitting 1984-1985 – 17817, 'RSV: Opkomst en ondergang van Rijn-Schelde-Verolme', Nr. 16, Verslag Parlementaire Enquêtecommissie RSV 1983-1984, pp. 133, 208-210.

In July 1974 the Dutch consortium members had applied for state-backed credit-insurance with the Netherlands Credit-insurance Company which deposited the request with the Ministry of Finance. During the same period the consortium also applied for export licenses. When in April 1975 they had not yet received a decision on either, they pressed the ministries for Foreign Affairs and Economic Affairs for one. On August 28, 1975, the Government told the companies it saw no reason to deny the export licenses, as long as the South Africans would accept IAEA safeguards on the exported materials. The Government also said it would wait with the issuance of licenses or guarantees (on the credit insurance) until it could be assured South Africa would accept these conditions, and it was clear the US would not set additional conditions.[1506]

In September 1975 the Dutch consortium members changed their application for the state-backed credit insurance from one to two nuclear power plants. The following November, the Ministry of Foreign Affairs discussed the collective applications during its annual budget meeting.[1507]

Also in November 1975, the Dutch Government's intention to help the US-Dutch-Swiss consortium to provide South Africa with its first power reactors came under scrutiny from Parliament. Members of Parliament and societal organizations lamented a reactor deal with South Africa on two general grounds; the official South African policy of Apartheid and the fact that South Africa hadn't signed the NPT, and hadn't signaled its intention to do so. The latter was more prominent in the political discussion in the US, the former in the Dutch political debate.[1508]

The public debate in the Netherlands on the matter saw a dichotomy between the left-leaning (PvdA, PPR, PSP) and religious parties that either fundamentally rejected any help given to the South African Vorster regime or feared the construction of the nuclear power plants would increase societal tensions in South Africa further, and those such as the Liberal Party and the Dutch Export Combination (representing 360 exporting companies) that Apartheid was essentially a domestic political matter and playing politics with exports was going to cost jobs and 'export goodwill' for the Netherlands.[1509]

In a motion by MP Ter Beek triggered by the affair, the Government was called upon to set the NPT as a mandatory requirement for the export of nuclear technology and materials and to actively encourage other countries to do the same. The motion was adopted by the Second Chamber of Parliament on the 18th of November 1975, but the Government, after consultations with fellow NPT countries (and also members of the Zangger Committee),

1506 Tweede Kamer der Staten Generaal, Zitting 1984-1985 – 17817, 'RSV: Opkomst en ondergang van Rijn-Schelde-Verolme', Nr. 16, Verslag Parlementaire Enquêtecommissie RSV 1983-1984, p. 202, 'Overzicht kabinet van contacten in RSV-zaak', in *NRC Handelsblad*, 2nd of June 1976, p. 3. The Dutch inclination to follow the American lead (and temporize decisions accordingly) also showed itself during the contemporaneous discussions in the NSG.

1507 'Overzicht kabinet van contacten in RSV-zaak', in *NRC Handelsblad*, 2nd of June 1976, p. 3.

1508 'Overzicht: Probleem rond kernenergie', in *Nederlands Dagblad*, 25th of May 1976, p. 3, Tweede Kamer der Staten Generaal, Zitting 1984-1985 – 17817, 'RSV: Opkomst en ondergang van Rijn-Schelde-Verolme', Nr. 16, Verslag Parlementaire Enquêtecommissie RSV 1983-1984, p. 202.

1509 'Kabinetsberaad', in *Nederlands Dagblad*, 25th of May 1976, p. 5.

considered there to not to be enough international support to successfully promote such a line of policy.[1510]

In January 1976 consortium-member RSV again pressed for a decision on the credit-insurance with the NCM. It is told by the Government that the credit-insurance must follow the issuance of export licenses for the project. Shortly after the consortium was told by Minister Lubbers of Economic Affairs that the inclusion of the reactor vessels could cause a problem later on.[1511] Reacting to this, the consortium changed the export license application again in April 1976, this time excluding the reactor vessels to avoid further political difficulty, moving the vessels into General Electric's portfolio and thus avoiding the need for an export license altogether. The credit-insurance application was adapted accordingly.[1512] This caused considerably irritation with the PvdA, whose party parliamentary chairman Van Thijn called the maneuver a 'sleight of hand' ('*wisseltruuk'*) to circumvent Parliament.[1513]

The following April, the consortium and the South African Electricity Supply Commission (ESCOM) signed a letter of intent. The consortium would win the contract if the involved Governments were able to issue further assurances regarding governmental assurances of continuity of supply and that the credit-insurance guarantee would be issued by the 17th of May, ESCOM communicated.[1514] Minister of Finance Duisenberg let the consortium know such additional assurances could not be issued at this time. The Dutch Government decided to wait for US congressional hearings to provide more clarity and the US Government to signal its intentions. Deliberations within the Dutch Council of Ministers first showed a majority in favor of the deal but when the wider government was informed, three PPR ministers and state-secretaries threatened to hand in their resignation if the requested guarantee was issued. The PPR party besides having a hard-line principled stance against nuclear energy, also was militantly against the South African white regime, its parliamentary faction and ministers pressuring the Government to refuse an export-license for the Koeberg reactor supply since October 1975, having joined a church-organized boycott against the Amro-bank in June 1976 (which had business in South Africa) together with the PvdA's and PSP's leaderships, and calling for a total boycott of South Africa in September 1976.[1515]

Even Foreign Affairs Minister Van der Stoel (PvdA) eventually turned against the deal on the 17th of May 1976 after having been pressured by his party chairman Van Thijn. Van der Stoel

1510 'Overzicht kabinet van contacten in RSV-zaak', in *NRC Handelsblad*, 2nd of June 1976, p. 3, Tweede Kamer der Staten Generaal, Zitting 1984-1985 – 17817, 'RSV: Opkomst en ondergang van Rijn-Schelde-Verolme', Nr. 16, Verslag Parlementaire Enquêtecommissie RSV 1983-1984, p. 202. The motion Ter Beek also played a role in the negotiation of the Troika common export policy, see *The UCN Common Export Policy Proposal*, page 345.
1511 'Kabinet Den-Uyl bleef ten koste van RSV overeind', in *Het Vrije Volk,* 26th of April 1984, p. 7.
1512 'Overzicht kabinet van contacten in RSV-zaak', in *NRC Handelsblad*, 2nd of June 1976, p. 3.
1513 'Wisseltruuk zit PvdA hoog', in *Leidsch Dagblad*, 24th of May 1976, p. 5.
1514 'Overzicht kabinet van contacten in RSV-zaak', in *NRC Handelsblad*, 2nd of June 1976, p. 3.
1515 Tweede Kamer der Staten Generaal, Zitting 1984-1985 – 17817, 'RSV: Opkomst en ondergang van Rijn-Schelde-Verolme', Nr. 16, Verslag Parlementaire Enquêtecommissie RSV 1983-1984, p. 204, 'Overzicht kabinet van contacten in RSV-zaak', in *NRC Handelsblad*, 2nd of June 1976, p. 3, 'De apartheid van de PPR', in *De Telegraaf*, 18th of October 1975, p. 3, 'Oproep politieke partijen: Boycot de AMRO-bank', in *Het Vrije Volk*, 24th of June 1976, p. 5, 'PPR wil gehele boycot van Zuid-Afrika', in *Reformatorisch Dagblad*, 25th of September 1976, p. 3.

hadn't changed his opinion, but was aware a positive decision would create a crisis in the Government and hoped a deadlock would avoid one.[1516] In turn, after another fruitless ministerial meeting on the 21st of May, Minister Lubbers announced he would hand in his resignation if the Government failed to provide the consortium with a guarantee, possibly to balance the PPR threats. The count was now eight ministers for and eight against, with the PM's tie-breaking vote on the latter side. The Government had reached deadlock and a serious crisis and the possible fall of the Government loomed because at the same moment, Minister of Justice Van Agt was 'creating havoc' over an unrelated issue (an abortion clinic).[1517] On the 22nd of May, Minister Lubbers made a public appeal to his PM Den Uyl in an interview on TV to break the deadlock and approve the export-credit guarantee. He called the last-minute refusal to approve the deal 'a selective indignation' and implored his fellow members of the Government to set aside party politics and support the work of their fellow ministers.[1518]

Despite considerable pressure from South Africa and RSV on behalf of the consortium, the Government kept delaying a decision because of the deadlock. Meanwhile, the South Africans had started negotiating with the French. On the 28th of May RSV urgently requested the PM to ask ESCOM for more time, which the PM did via embassy communications, but there was no answer.[1519] The next day, the consortium lost their bid and ESCOM announced a decision in favor of the bid by the French Framatom, 'allegedly because of South African impatience at the prolonged indecision of the Dutch Government on the question of whether the Dutch bidder would obtain the necessary government guarantees.'[1520] The Government had hid behind the Americans, a former member of the board of commissioners of RSV later deplored.[1521]

Within three weeks of the above episode, on the 16th of June 1976 in the township of Soweto, South African police opened fire on and killed schoolchildren and students protesting the mandatory lessons in Afrikaans in their schools. Sparking wider outrage that became known as the Soweto uprising, in weeks of violent riots and repression hundreds more were killed. A picture of a child shot dead during the initial Soweto protest was published in the world's newspapers, rallying support for the anti-apartheid movement in the UK and elsewhere.

The Soweto uprising marks a watershed moment for Great Britain in its relation with South Africa. Historically it had been an ally, and had vetoed UN resolutions against the South Africans before:

1516 Tweede Kamer der Staten Generaal, Zitting 1984-1985 – 17817, 'RSV: Opkomst en ondergang van Rijn-Schelde-Verolme', Nr. 16, Parlementaire Enquêtecommissie RSV 1983-1984, p. 204, 'Overzicht kabinet van contacten in RSV-zaak', in *NRC Handelsblad*, 2nd of June 1976, p. 3.

1517 'Hoe RSV zijn order kwijtraakte in het politieke bos: De rekbaarheid van een minister, in *NRC Handelsblad*, 19th of June 1976, p. Z1, Z4., 'Kabinet Den-Uyl bleef ten koste van RSV overeind', in *Het Vrije Volk,* 26th of April 1984, p. 7.

1518 'Lubbers dreigt met opstappen: Stem Den Uyl beslissend', in *Leidsch Dagblad*, 24th of May 1976, p. 5.

1519 'Kabinet Den-Uyl bleef ten koste van RSV overeind', in *Het Vrije Volk,* 26th of April 1984, p. 7.

1520 'Hoe RSV zijn order kwijtraakte in het politieke bos: De rekbaarheid van een minister, in *NRC Handelsblad*, 19th of June 1976, p. Z1, Z4, 'Kabinet Den-Uyl bleef ten koste van RSV overeind', in *Het Vrije Volk,* 26th of April 1984, p. 7, Stares, Rodney, 'The General Electric Company Limited: A Review of the Company's Relationship with South Africa' (Christian Concern for Southern Africa: London 1976) p. 18.

1521 'Kabinet Den-Uyl bleef ten koste van RSV overeind', in *Het Vrije Volk,* 26th of April 1984, p. 7.

> 'Despite the existence of British opposition to the apartheid regime in the mid-1970s, it remains true that from 1962 to 1975 there developed in Britain a considerable body of opinion content to tolerate apartheid in the interest of sustaining white rule and stability there. This development was encouraged by the belief that the South African government was becoming more moderate, pragmatic, and reformist; and by the hope that economic growth would, in any case, gradually transform the country politically without the need for sanctions which might only damage British interests. …. Events in South Africa in June 1976 would, for many in Britain, demonstrate that a continuation of apartheid rule was more likely to provoke than to prevent South Africa's descent into disorder.'[1522]

On the 19th of June, 1976 the UN Security Council condemned the violence against unarmed schoolchildren and students in resolution 392, with permanent member Great Britain voting in favor. Later, the UK ceased its opposition and voted in favor of making the voluntary UN weapons embargo on South Africa a mandatory one through UN Security Council resolution 418, under Chapter VII, the first time this measure was employed. The resolution was adopted on the 1st of November 1977.[1523]

After the Soweto uprising, the Black Caucus in the US Congress halted the export of fuel to the Safari 1 reactor through a Nuclear Regulatory Commission proceeding.[1524] By 1977 it had become clear to South Africa that the delays would persist, and it canceled its order for Safari-1 fuel with the US.[1525] Uranium from reprocessed fuel from Safari-1, paid for by South Africa, was held up by USDOE during this period, with South Africa receiving financial compensation in 1978. US treatment of South Africa under the NNPA, refusing it a waiver and demanding it accede to the NPT while also successfully rallying other nuclear suppliers to not provide the country with the fuel it needed, gives testimony to South Africa's increased political, economic and therefore nuclear isolation. It was initially not invited to INFCE, despite being one of the three largest uranium producers at the time; it was shunned from a project to research reduced-enrichment levels for research reactor fuels; its scientists were refused visas to the United States, even when invited by US institutions to attend conferences and seminars.[1526]

1522 Hyam, Ronald, Henshaw, Peter, *The Lion and the Springbok: Britain and South Africa Since the Boer War* (Cambridge University Press: Cambridge 2003) p. 330.

1523 United Nations Security Council, Security Council resolution 418 (1977), 'South Africa', 4 November 1977, S/RES/418 (1977) http://unscr.com/en/resolutions/418, website checked 8-9-2018, Mbata Mangu, André, 'The Historic Contribution of the United Nations to the Resolution of Conflicts in Southern Africa', in *African Journal of Conflict Resolution*, Vol. 11, No. 3 (2011) http://www.accord.org.za/ajcr-issues/the-historic-contribution-of-the-united-nations-to-the-resolution-of-conflicts-in-southern-africa/, website checked 6-9-2018, 'Hoe RSV zijn order kwijtraakte in het politieke bos: De rekbaarheid van een minister, in *NRC Handelsblad*, 19th of June 1976, p. Z4.

1524 Report, 'South Africa: Time Running Out: The Report of the Study Commission on U.S. Policy Toward Southern Africa', Study Commission on U.S. Policy Toward Southern Africa (University of California Press: 1981) p. 415.

1525 Report, 'South African-United States' Nuclear Relations', South African Department of Foreign Affairs, 20th of March 1981, South African Foreign Affairs Archives, Brand Fourie Personal Papers, Nuclear Energy, Top Secret, 1 January 1981 to 8 May 1981, Vol V., http://digitalarchive.wilsoncenter.org/document/114183, p. 2.

1526 Ibid., pp. 2-3.

When Urenco asked the Troika governments for a judgment on exploring a contract in South Africa near the end of 1976, all three governments were dismissive with the British ruling out 'all contacts' between Urenco and the South African authorities. The Dutch and German representatives agreed with this position.[1527] Following the successful nuclear fuel boycott by the US, South African Minister for Minerals and Energy Affairs F.W. De Klerk in 1981 was forced to conclude that 'for international political reasons, it was not possible for South Africa to obtain nuclear fuel for Safari-1 since 1976'.[1528]

Case: Australia

The nuclear chapter for Australia began with a 1944 request from the US and UK to explore for uranium on its territory. The Commonwealth Government offered rewards for those that found considerable uranium-ore deposits and saw its first phase of uranium mining from 1949 to 1971, after which period the Government temporarily embargoed uranium exports.[1529] In the context of the Cold War, the Australian uranium was contracted to 'the US-UK Combined Development Agency, for use in both countries' nuclear weapons programs.'[1530] By this policy, according to PM Menzies in 1954, Australia's 'security in the present tremulous condition of world safety depends upon the superiority of the Free World in terms of these dreadful instruments.'[1531] In September 1957 PM Menzies, in his first public statement on the subject of nuclear non-proliferation, he 'ruled out Australian interest in acquiring nuclear weapons 'for the present' but, and he emphasised this in a clarification the following day, the possibility of future acquisition could not be ruled out.'[1532]

Privately, nuclear weapon acquisition was actively considered by the Australian leadership, and promoted by its defense establishment in light of China's conventional strength and later its nuclear weapon capability.[1533] In light of the refusal of the British to go into discussions on nuclear weapon sharing and regional developments such as the British withdrawal from

1527 ARC 61-5, p. 2.

1528 Statement, South African Minister of Mineral and Energy Affairs F. W. de Klerk, 'Safari-1 to be Operated by Locally Manufactured Fuel', May 1981, South African Foreign Affairs Archives, Brand Fourie Personal Papers, Nuclear Energy, Top Secret, 1 January 1981 to 8 May 1981, Vol V., http://digitalarchive.wilsoncenter.org/document/114184, website checked 2-7-2017.

1529 Report, 'Australia's uranium - Greenhouse friendly fuel for an energy hungry world: A case study into the strategic importance of Australia's uranium resources for the Inquiry into developing Australia's non-fossil fuel energy industry', House of Representatives Standing Committee on Industry and Resources (The Parliament of the Commonwealth of Australia: Canberra 2006) http://www.aph.gov.au/Parliamentary_Business/Committees/House_of_Representatives_Committees?url=isr/uranium/report/fullreport.pdf, website checked 26-6-2017, pp. 93-94.

1530 Harris, Marty, 'The origins of Australia's uranium export policy', Parliamentary Library Background Note, 2nd of December 2011, http://parlinfo.aph.gov.au/parlInfo/download/library/prspub/1267617/upload_binary/1267617.pdf;fileType=application/pdf#search=%22background%20note%20%28parliamentary%20library,%20australia%29%22, website checked 26-6-2017, p. 2.

1531 Ibid.

1532 Reynolds, Wayne, Lee, David (eds.), *Australia and the Nuclear Non-Proliferation Treaty, 1945–1974*, Documents on Australian Foreign Policy series, Australian Department of Foreign Affairs and Trade (Commonwealth of Australia: 2013) p. xxx.

1533 Ibid., p. xxxii-xxxiii, xxxviii.

Malaysia and Singapore, the Australian Government started to refocus its defense posture from one that relied on its 'Free World' allies (the UK and US) to one of self reliance, looking more seriously at the possibility of acquiring its own nuclear deterrent. There are more indications that the Australian Government was considering this, for example when AAEC (Australian Atomic Energy Commission) Chairman Baxter noted in 1967:

> 'In a recent discussion, you [possibly Fairbaum, then Minister of Development] suggested that we need only be concerned with enough uranium to support the production of a limited number of atom bombs, and need not concern ourselves with supplies for the States for power production. …. If it was proposed to build reactors specifically for the production of Plutonium for weapons (which is different from producing plutonium in a reactor operated to produce electricity economically) - the former method of operation would be extremely expensive. We believe that the only reasonable way for Australia to produce nuclear weapons, if that should become the Government's policy, would be as a by-product of an economic power project conducted in association with a generating authority.'[1534]

Australia's Government took a diplomatic hedging position during negotiations on and was critical of the NPT at the completion of its negotiation in 1968. Its apprehension of the treaty seemed to have turned mostly about whether the treaty would prohibit Australia from acquiring a break-out capability. Additional reservations concerned the intrusiveness of the IAEA safeguards system and whether these 'would provide unparalleled opportunities for industrial, defence and commercial espionage by highly trained international inspectors, and whether enough countries of concern to Australia (mostly, those in the region) would also accede to the treaty.[1535] Australia signed the treaty in 1970, but did not ratify it at this time because of its shortcomings. As official reservations to the NPT are not possible, it gave out a Government statement conveying its concerns.[1536] In 1972, the new Labor Government ratified the treaty and in 1974 concluded a safeguards agreement with the IAEA.[1537]

1534 Binnie, Anne-Eugenia, *From Atomic Energy to Nuclear Science: A History of the Australian Atomic Energy Commission*, Ph.D. Dissertation, Department of Physics, Macquarie University (2003) https://webcache.googleusercontent.com/search?q=cache:fQ4IBRdZkUUJ:https://www.researchonline.mq.edu.au/vital/access/services/Download/mq:6293/SOURCE2+&cd=2&hl=en&ct=clnk&gl=nl, website checked 6-9-2018, pp. 194-195.

1535 Reynolds, Wayne, Lee, David (eds.), *Australia and the Nuclear Non-Proliferation Treaty, 1945–1974*, Documents on Australian Foreign Policy series, Australian Department of Foreign Affairs and Trade (Commonwealth of Australia: 2013) pp. xl-xlv.

1536 Senate Official Hansard, Commonwealth of Australia, No. 10, 1970, 4th of March 1970, Twenty-seventh Parliament, Second session – First period, pp. 42-43. A detailed account of Australia's diplomatic activities around and shifting political position on the NPT, and its signature and ratification by Australia can be found in Reynolds, Wayne, Lee, David (eds.), *Australia and the Nuclear Non-Proliferation Treaty, 1945–1974*, Documents on Australian Foreign Policy series, Australian Department of Foreign Affairs and Trade (Commonwealth of Australia: 2013) pp. xvii-xlix.

1537 'Agreement between Australia and the International Atomic Energy Agency for the Application of Safeguards in connection with the Treaty on the Non-Proliferation of Nuclear Weapons of 1 July 1968', Australian Treaty Series 1974, No. 16, (Vienna, 10 July 1974) http://www.austlii.edu.au/au/other/dfat/treaties/1974/16.html, website checked 26-6-2017.

Uranium Enrichment Research in Australia

Uranium enrichment research commenced in Australia in 1965, under the direction of the AAEC. It continued into the 1970s and 1980s as the largest single research program of the AAEC, focusing mainly on the gas centrifuge method. In addition to its own research, beginning at the start of the 1970s, it conducted a number of international research studies into enrichment with other countries;

> '-The 'Washington Talks' (November 1971), in which the US expressed interest in a multi-national plant in Australia using gaseous diffusion technology;
>
> -France-Australia study (1971–72) on the use of French gaseous diffusion technology for a plant in Australia;
>
> -Association for Centrifuge Enrichment (ACE) Study (1973–74) with the European Tripartite countries (UK, Germany and the Netherlands); and
>
> -Japan-Australia Study on Enrichment (1976–1978), for the possible establishment of a centrifuge enrichment plant in Australia for supply to Japan.'[1538]

The Jervis Bay Tender

The first commercial contacts Urenco had with Australia came on the heels of the UK (The Nuclear Power Group) and the FRG (Kraftwerk Union) preparing bids for a tender for the Jervis Bay power reactor that the Government of Australia had launched. If the offered power reactor required enriched uranium, 'tenders were to show how an enrichment program could be achieved in Australia.[1539]

The JC was consulted and it agreed to the supply of a UC plant to Australia in as early as February 1970, under condition that full IAEA safeguards as well as full classification of the technology would apply.[1540] When the Germans and British made their reactor bids, each

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1538 Report, 'Australia's uranium - Greenhouse friendly fuel for an energy hungry world: A case study into the strategic importance of Australia's uranium resources for the Inquiry into developing Australia's non-fossil fuel energy industry', House of Representatives Standing Committee on Industry and Resources (The Parliament of the Commonwealth of Australia: Canberra 2006) http://www.aph.gov.au/Parliamentary_Business/Committees/House_of_Representatives_Committees?url=isr/uranium/report/fullreport.pdf, website checked 26-6-2017, p. 632. The Washington Talks refer to the Washington Conference, connected to the US Multilateralization Initiative, see page 278. For the Association for Centrifuge Enrichment (ACE) Study, see page 285.

1539 Arthur, Ian, 'Nuclear Energy and Australia, Part 2', in *Newsletter of the Australian Society for History of Engineering and Technology*, Vol 8, No. 4 (October 2015) p. 5.

1540 ARC 122-2, p. 1. This offer predates the Treaty of Almelo and thus the offer was made by the predecessor of the JC. A DRW/AT reporting on this episode commented that such a transfer of sensitive technology to a non-NPT country, of which it was unsure whether it would join the treaty, would now be 'unthinkable' (in June 1980), Ibid.

included the transfer of 'enrichment technology' as part of their proposal.[1541] A shortlist of four suppliers was decided upon, of which two (including the Nuclear Power Group) were secretly approached by AAEC Chairman Baxter to submit revised bids based on a *turnkey* operation.[1542] The UK offer won the tender, after four suppliers had been shortlisted (among which the Germans). However,

> '[t]he Prime Ministers and politicians during this period were again looking at Australia's nuclear defence capabilities. References in Cabinet documents suggest that defence requirements influenced the Jervis Bay Project; these influences were known to only a handful of politicians, bureaucrats, and one scientist, Sir Philip Baxter [the AAEC Chairman]. The Commission scientists involved in the Jervis Bay Project believed they were working toward the introduction of a nuclear power generating reactor. …. As far as can be determined, no other member of the Commission was aware that such discussions with government were taking place let alone taking part in them. The discrepancy in the two different views came to a head when the selection of tenders for the project was made. The Commission scientists chose the 'wrong' reactor. They chose a reactor which could efficiently produce power but they were supposed to choose one that would produce plutonium for weapons.'[1543]

On 9 June 1970, incoming PM McMahon, who 'as Treasurer, had always opposed the Jervis Bay Project'.[1544] He directed the Minister for National Development Mr Swartz to conduct,

> '… an investigation in to the potential costs of developing a nuclear power station. This investigation was done without input from the AAEC and was based on the tender prices only. Swartz announced to Parliament on 18th August 1971, almost 8 weeks after McMahon's initial decision to defer the tender process, that the costs for the development of the power reactor were much higher than initially expected and consequently McMahon placed a moratorium on the Jervis Bay project for twelve months.'[1545]

The Jervis Bay project was deferred indefinitely in 1972, when the Whitlam Government entered office.[1546]

1541 Nineteenth Annual Report 1970-1971, Australian Atomic Energy Commission (Commonwealth of Australia) http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/02/014/2014463.pdf, website checked 6-9-2017, p. 16.

1542 A 'turnkey' operation means the customer outsources every aspect of the NPPs construction and operation to the vendor; it negates the need for a high level domestic nuclear knowledge base and infrastructure, but comes at a higher cost.

1543 Binnie, Anne-Eugenia, *From Atomic Energy to Nuclear Science: A History of the Australian Atomic Energy Commission*, Ph.D. Dissertation, Department of Physics, Macquarie University (2003) https://webcache.googleusercontent.com/search?q=cache:fQ4IBRdZkUUJ:https://www.researchonline.mq.edu.au/vital/access/services/Download/mq:6293/SOURCE2+&cd=2&hl=en&ct=clnk&gl=nl, website checked 6-9-2018, p. 187.

1544 Ibid., p. 186.

1545 Ibid., p. 256.

1546 Report, 'Australia's uranium - Greenhouse friendly fuel for an energy hungry world: A case study into the strategic importance of Australia's uranium resources for the Inquiry into developing Australia's non-fossil fuel energy industry', House of Representatives Standing Committee on Industry and Resources (The Parliament of

The Uranium Embargo

Australia's 1972 export embargo followed a collapse of the global uranium market in the 1960s and a global delay in commercial-scale nuclear energy.[1547] Minister Connor for Minerals and Energy 'felt that the growth in nuclear power capabilities and a squeeze on oil supply would see uranium prices rise dramatically, and wanted to wait till they did so before exporting large amounts of Australia's uranium.'[1548] It was his perception that previous Governments had not kept Australia's national interest front and center when negotiating mining and export contracts (for example, with the Japanese), and sought to remedy this situation.[1549] Connor saw himself confronted with a number of uranium export contracts concluded at the last minute by the outgoing Government, against very low prices. He decided to let the contracts stand, but to issue an embargo for any new contracts. The embargo proved visionary; the 1973 oil crisis saw energy prices rise, and the uranium price was further supported by positive developments in the civilian nuclear energy field.[1550] Also by 1973, the possibility of Australia enriching its own uranium before export had become part of the political discussion. In it, Minister Connor professed a preference for the gas centrifuge method.[1551]

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the Commonwealth of Australia: Canberra 2006) http://www.aph.gov.au/Parliamentary_Business/Committees/House_of_Representatives_Committees?url=isr/uranium/report/fullreport.pdf, website checked 26-6-2017, p. 631, Fitzpatrick, Mark (ed.), *Preventing Nuclear Dangers in Southeast Asia and Australasia*, IISS Strategic Dossier series (The International Institute for Strategic Studies: London 2009) p. 169, Ling, Ted, 'Government Records about the Australian Capital Territory, Part 1: Canberra: the national capital, Chapter 5: Suburbs still searching for a city, 1957-72, Jervis Bay nuclear power station' (Commonwealth of Australia: National Archives of Australia 2013), http://guides.naa.gov.au/records-about-act/part1/chapter5/5.7.aspx#chap5note113, website checked 28-6-2017.

1547 Ibid.

1548 Harris, Marty, 'The origins of Australia's uranium export policy', Parliamentary Library Background Note, 2nd of December 2011, http://parlinfo.aph.gov.au/parlInfo/download/library/prspub/1267617/upload_binary/1267617.pdf;fileType=application/pdf#search=%22background%20note%20%28parliamentary%20library,%20australia%29%22, website checked 26-6-2017, p. 5.

1549 House of Representatives Official Hansard, Commonwealth of Australia, No. 14, 1973, 3rd of April 1973, Twenty-eighth Parliament, First session – First period, pp. 968-970

1550 Harris, Marty, 'The origins of Australia's uranium export policy', Parliamentary Library Background Note, 2nd of December 2011, http://parlinfo.aph.gov.au/parlInfo/download/library/prspub/1267617/upload_binary/1267617.pdf;fileType=application/pdf#search=%22background%20note%20%28parliamentary%20library,%20australia%29%22, website checked 26-6-2017, p. 6.

1551 House of Representatives Official Hansard, Commonwealth of Australia, No. 20, 1973, 16th of May 1973, Twenty-eighth Parliament, First session – First period, pp. 2164-2165. Eventually, the prospective uranium enrichment plant became the minister's downfall, when he misinformed the Government over his attempts to secure outside finances for the project and was subsequently sacked. The 'Loans Affair' eventually led to the Government's dismissal by the Governor General, Hancock, Ian, 'The Loans Affair: The Treasury Files', 1974

By October 1974, uranium prices were high but the Minister was unrelenting. Pressure on the Government was building; 'Prime Minister (Mr Whitlam), ... was being besieged [by] governments wanting to buy uranium oxide but not Australian-enriched uranium.'[1552] Prospective buyers were Japan, Iran, Italy and the European Economic Community.[1553]

Under environmental activist and other domestic pressures, the Government announced the Ranger Uranium Environmental Inquiry, known as the Fox Commission after its Supreme Judge chairman, on 16 July 1975. The Fox commission was 'to inquire into the environmental implications of the development of uranium deposits in the Northern Territory of Australia.' The Government act establishing the inquiry took a very wide view of what 'environmental' meant, and the committee took that definition to heart:

> 'It heard evidence for more than a year, from the Australian Atomic Energy Commission, from the mining companies, from environmental organizations, from overseas experts, and … from the aborigines of the Northern Territory, under whose sacred land much of the uranium lies.'[1554]

After dismissal of the Whitlam Labor Government, the incoming Government of PM Fraser supported uranium mining but committed itself to waiting until the Fox commission finished its work. When the commission's initial report was finally presented on the 28th of October 1976, the media and the Government interpreted its findings as a 'yes' to uranium mining, even though the report urged the Government to hold off any decision on uranium mining in the Northern Territories until the publication of its second and final report.[1555]

Despite the Governments impatience, the two reports (the second was published the next year) and the Government policy it inspired went on to become instrumental in defining Australia's non-proliferation policy for three decades to come.[1556] The report produced a number of important analyses and recommendations on a number of issues. On the subject of non-proliferation efforts in the NPT system it lists of a number of concerns:

Treasury Records: Selected Documents, National Archives of Australia, http://www.naa.gov.au/Images/TheLoansAffair_tcm16-45426.pdf, website checked 28-6-2017, p. 9.

1552 Panter, Rod, Kay, Paul, 'Chronology of ALP Uranium Policy 1950-1994', Parliamentary Research Service Background Paper No. 17, 1994 (Department of the Parliamentary Library: 1994) http://www.aph.gov.au/binaries/library/pubs/bp/1994-95/95bp17.pdf, website checked 28-6-2017, p. 3.

1553 Harris, Marty, 'The origins of Australia's uranium export policy', Parliamentary Library Background Note, 2nd of December 2011, http://parlinfo.aph.gov.au/parlInfo/download/library/prspub/1267617/upload_binary/1267617.pdf;fileType=application/pdf#search=%22background%20note%20%28parliamentary%20library,%20australia%29%22, website checked 26-6-2017, p. 6.

1554 Patterson, Walt, 'Fox with a nuclear bite', in *New Scientist*, 18th of November 1976, http://www.waltpatterson.org/foxnuclear.pdf, website checked 8-4-2017, p. 1

1555 Ibid., p. 2.

1556 Harris, Marty, 'The origins of Australia's uranium export policy', Parliamentary Library Background Note, 2nd of December 2011, http://parlinfo.aph.gov.au/parlInfo/download/library/prspub/1267617/upload_binary/1267617.pdf;fileType=application/pdf#search=%22background%20note%20%28parliamentary%20library,%20australia%29%22, website checked 26-6-2017, p. 9.

> 'The failure of many states to become parties to the NPT; the inability of safeguards to prevent the transfer of nuclear technology from nuclear power production to the acquisition of nuclear weapons competence; the fact that many nuclear facilities are covered by no safeguards; the existence of a number of loopholes in safeguards agreements regarding their application to peaceful nuclear explosions, to materials intending for non-explosive military purposes, and to the retransfer of materials to a third state; the absence, in practice, of safeguards for source material; the practical problems of maintaining checks on nuclear inventories; the ease with which states can withdraw from the NPT and from most non-NPT safeguards agreements; deficiencies in accounting and warning procedures; and the absence of reliable sanctions to deter diversion of safeguarded material.'[1557]

And recommended:

> 'No sales of Australian uranium should take place to any country not party to the NPT. Export should be subject to the fullest and most effective safeguards agreements, and supported by fully adequate back-up safeguards applying to entire civil nuclear industry in the country supplied. Australia should work towards the adoption of this policy by other suppliers[1558]

The Fraser Government presented a Parliamentary Paper on the uranium export policy in May 1977. It made NPT-membership and FSS a condition of supply. It made the export of uranium to NWS conditional on safeguards on the exported material and required guarantees about non-diversion into a weapons program. It required so called 'fallback safeguards'; 'contingency arrangements to ensure the continued safeguarding of material already present in an importing country in case safeguards under the NPT at some stage cease to apply' (e.g. should a country leave the NPT under article X).[1559] It forbade without prior consent re-transfer, reprocessing or enrichment above 20% of supplied material.[1560] Australia furthermore committed itself to 'constructive multilateral efforts to strengthen safeguards' and 'to keep safeguards closely under review to take account of the future evolution of international thinking on the subject.[1561] Not unreasonably, the paper qualified Australia's new safeguards policy as 'more rigorous than that adopted to date by any other supplier country' in a full embrace of US policy under Carter that sought to undercut the plutonium economy by making

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1557 Fox Report, op. Cit. p. 147 in Harris, Marty, 'The origins of Australia's uranium export policy', Parliamentary Library Background Note, 2nd of December 2011, http://parlinfo.aph.gov.au/parlInfo/download/library/prspub/1267617/upload_binary/1267617.pdf;fileType=application/pdf#search=%22background%20note%20%28parliamentary%20library,%20australia%29%22, website checked 26-6-2017, pp. 8-9.

1558 Ibid., p. 9.

1559 'Uranium: Australian policy 1977', Parliamentary Paper 198/1977 (Australian Government Publishing Service: Canberra 1978) p. 101, quoted in Harris, Marty, 'The origins of Australia's uranium export policy', Parliamentary Library Background Note, 2nd of December 2011, http://parlinfo.aph.gov.au/parlInfo/download/library/prspub/1267617/upload_binary/1267617.pdf;fileType=application/pdf#search=%22background%20note%20%28parliamentary%20library,%20australia%29%22, website checked 26-6-2017, p. 10.

1560 Ibid.

1561 Ibid.

Australian uranium available; nuclear exports were possible now, but only under the strictest of non-proliferation conditions.[1562]

> 'Thus, Australia's uranium export policy was formalised and uranium exports were able to begin once again (subject to the above conditions). Exports of uranium ores and concentrates resumed in 1980, and by 1982, Australia had signed the required bilateral safeguards agreements with 10 parties or entities—South Korea, the UK, Finland, Canada, Sweden France, EURATOM ..., Philippines, Japan and the USA—allowing cooperation on the use of nuclear material. By 1986, exports were worth $373 million (current prices).'[1563]

Urenco and Australia

By 1974, it was clear Australia was not going to commence on nuclear power development any time soon. Creating its own uranium enrichment capability (now for large scale exports) remained an ambition however.[1564] In the 1974-1975 period the Troika continued discussions on possible enrichment cooperation with Australia and went so far as to draft a concept-agreement as well as an interim-agreement on classification and security measures for the technology.[1565] Progress was put on hold during the work of the Fox commission, but a few months after the new export policy was announced in May 1977, Urenco asked permission from the JC to approach Australia again and explore commercial opportunities. The Netherlands at this time signaled its partners in the JC that it was currently against a transfer of enrichment technology to Australia (perhaps in deference to the US its policy of discouraging the export of sensitive technology under President Carter, perhaps because of the imminent start of INFCE, or both) but must have relented.[1566]

Media reported on October 12, 1977 that Urenco-Centec had begun discussions with Australia on 'establishing its own uranium enrichment plant using Urenco-CENTEC technology.'[1567] Spokesman of Urenco Mr. Parry reportedly said '[n]ow that you in Australia have made your decision to mine uranium, we are here to explore with you how we can widen ou[r] international base on a fully safeguarded basis.'[1568] He further mentioned that a collaboration would be require two inter-governmental agreements with Australia; one to cover the technology transfer and another to cover safeguards. He told the press he was optimistic of the

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1562 Ibid., Clarke, Michael, Frühling, Stephan, *Australia's Nuclear Policy: Reconciling Strategic, Economic and Normative Interests* (Routledge: London & New York 2016) pp. 76-78

1563 Harris, Marty, 'The origins of Australia's uranium export policy', Parliamentary Library Background Note, 2nd of December 2011, http://parlinfo.aph.gov.au/parlInfo/download/library/prspub/1267617/upload_binary/1267617.pdf;fileType=application/pdf#search=%22background%20note%20%28parliamentary%20library,%20australia%29%22, website checked 26-6-2017, p. 11.

1564 ARC 122-2, p. 1.

1565 Ibid.

1566 ARC, 61-10, p. 1.

1567 'Urenco-Centec offers uranium knowhow', in *Business Times*, 12th of October 1977, http://eresources.nlb.gov.sg/newspapers/Digitised/Page/biztimes19771012-1.1.2.aspx, website checked 28-6-2017, p. 2.

1568 Ibid., Source spelled 'out', probably spelling error in original.

outcome because 'of the attitude of the public and the government are very similar, if not identical, to that held by our three countries'.[1569]

In a reversal of the initial policy stance, on the 17th of May 1978 (less than a year later) Foreign Ministers Van der Klaauw granted Urenco permission to commence 'explorative discussions with the Australian authorities on future cooperation in which the transfer of UC-technology would not be excluded', though further action would have to wait for the conclusion of INFCE.[1570]

In February 1979 the Troika was officially approached by the Australian Government to participate in a multinational feasibility study; it had also invited Japan, France and the US.[1571] Four Australian companies, 'the Broken Hill Proprietary Co. Ltd., CSR Ltd., Peko-Wallsend and Western Mining Corporation Holdings Ltd.', had 'formed a joint venture' in early1980, named the Uranium Enrichment Group of Australia (UEGA). The purpose of the venture was conduct the feasibility study.[1572] The Japanese and Australian governments had just completed a two-year study on the feasibility of a joint enrichment project, from which they concluded that Australia could construct a plant by employing centrifuge technology from several suppliers.[1573]

On the 23rd of March, the Dutch Minister of Foreign Affairs was informed by MFA officials of the Australian invitation as well as the need to come to an agreement to secure classification of any sensitive information Urenco might share with the Australians.[1574] On the 21st of May 1980, the JC members agreed on a note, subject to approval by the relevant Troika ministers, that set out the strategic commercial and non-proliferation dimensions of a possible technology-sharing agreement with Australia. The JC acknowledged that Australia has vast uranium ore reserves and was developing its own enrichment technology. Resulting horizontal proliferation of enrichment technology was highly likely and from a non-proliferation perspective not preferred. From a commercial standpoint, the Troika would be confronted with a strong new competitor, even more so if Australia would opt to develop its program with one of the Troika's competitors.[1575] The MFA memo warned:

> 'In particular the construction of sizable enrichment plant based on the French gaseous system could completely disturb the fragile balance of the enrichment market, which in turn would have negative consequences for nonproliferation considerations'.[1576]

1569 Ibid.
1570 ARC 122-2, p. 1.
1571 ARC 122-2, p. 1, ARC 122-3, p. 1.
1572 Arthur, Ian, 'Nuclear Energy and Australia, Part 2', in *Newsletter of the Australian Society for History of Engineering and Technology*, Vol 8, No. 4 (October 2015) p.7, ARC 122-4, pp. 7-9.
1573 Krass, Allen, *et al*, *Uranium Enrichment and Nuclear Weapons Proliferation* (Stockholm International Peace Research Institute, Taylor & Francis Ltd: London and New York 1983) https://www.sipri.org/sites/default/files/files/books/SIPRI83Krass/SIPRI83Krass.pdf, website checked 3-9-2017, p. 227.
1574 ARC 122-2, pp. 1-2.
1575 ARC 122-2, p. 2, ARC 122-12, p. 6.
1576 ARC 122-2, p. 2.

By 10 June 1980, MFA (DRW) officials pushed the Minister for a decision on what policy to pursue vis-à-vis Australia and its agenda. INFCE had been completed, Australia was ready to engage in substantive negotiations and Urenco's competitors, particularly the French, were 'developing considerable activities' towards Australia, warned the MFA.[1577] The MFA therefore advised that the Troika attempt to develop an 'intensive collaboration in the area of enrichment' with Australia.[1578] This presented the best chance to restrict the number of global enrichment plants, which was desirable from both a commercial and non-proliferation perspective DRW argued.[1579] Moreover, it was understandable Australia wanted to enrich its own uranium and the non-proliferation credentials of the country were considered to be impeccable, warranting a diversion from the now adopted NSG and INFCE-inspired policy objective of non-export of sensitive technology (even with IAEA safeguards applied).[1580]

From a non-proliferation perspective, a number of additional conditions needed to be met, in order 'to come to an agreement that is defensible internationally and can't lead to unwanted precedents' the MFA official argued.[1581] Aside from implementing the NSG guidelines, the INFCE principle of '"suppliers involvement"' needed to be pursued. A 'multinational construction' needed to be considered, 'even though the Troika is in fact the only example [of a multinational enrichment initiative] at the moment'.[1582] One option would be the accession of Australia to the Almelo Treaty, but for 'practical and political reasons' this was not a very attractive option to the Troika.[1583] Neither did Australia like this option, officials briefing the Minister judged. Other options for supplier(s) involvement would be considered.[1584] The Minister was advised to agree to three points of action:

> 1. '… progressive disclosure of the complete Troika technology and know-how should be offered to the Australians, provided they are prepared to meet the minimum conditions set out in this paper.' [referring to the non-included note]
>
> 2. 'URENCO-CENTEC should be authorized to continue negotiations with the Australians on the details of such a collaboration (keeping in close touch with the Joint Committee) … '
>
> 3. '[A] high level tripartite political approach to the Australian government should be organised as soon as possible, to assure the Australians that the Troika governments

1577 Ibid. pp. 1-2.
1578 Ibid. p. 2.
1579 Ibid.
1580 Ibid.
1581 Ibid.
1582 Ibid., pp. 2-3.
1583 Ibid. p. 3.
1584 Ibid. Ian Arthur wrote that UEGA ´concluded that the best arrangement would be for Australia to become a fourth member of CENTEC-URENCO´, but the interim-feasibility report does use such definitive wording, Arthur, Ian, 'Nuclear Energy and Australia, Part 2', in *Newsletter of the Australian Society for History of Engineering and Technology*, Vol 8, No. 4 (October 2015) p. 7, Cabinet Minute, 'Decision No. 19070 on Submission No. 5784 – Uranium Enrichment, National Archives of Australia, A12909, 5784, Barcode 30941997, 5th of October 1982, https://recordsearch.naa.gov.au/SearchNRetrieve/Interface/ViewImage.aspx?B=30941997, website checked 4-4-2017, pp. 6-7.

are fully behind Urenco's proposals to transfer centrifuge technology, and to initiate preliminary discussions on an appropriate intergovernmental agreement'.[1585]

The political approach was deemed necessary to inform the Australian Government that the Urenco was more than just an industrial entity and thus a future cooperation would have a political dimension that involved the Troika. From several Dutch MFA sources including from the Australian embassy and from correspondence of the Premier of South Australia Tonkin to the UK's PM Thatcher, it became clear that such an approach by the Troika would be appreciated.[1586] Tonkin wrote that discussions between South Australia's Government and Urenco-Centec had 'advanced to the stage where a final decision would now depend on the Commonwealth Government's approval of South Australia as the appropriate site'.[1587] Tonkin sought approval for a site in South Australia instead of in another state but revealed that a choice for Urenco technology has already been made. He invited Minister of State for Foreign and Commonwealth Affairs Blaker to visit during his upcoming visit as well as PM Thatcher to visit South Australia 'at any time'.[1588] PM Thatcher wrote back that she was 'delighted to hear that [he was] proposing to use Urenco/Centec technology if a uranium enrichment plant is built in South Australia' but did not commit to voicing a preference over siting.[1589] Neither did she commit to a visit herself, but she did tell Premier Tonkin that Mr. Blaker would accept his invitation and expressed the hope that 'his visit [would] be helpful to [him] in [his] plans.'[1590]

The MFA/DRW urged the Minister to make haste as the French Minister of Industry Giraud, visiting Australia in September, would be intent on making a strong pitch for Eurodif. Possibly the French action could be preempted by a visit to Australia by Minister Blaker in July, flanked by the local German and Dutch ambassadors.[1591] 'Urenco representatives should be available to the Australians on a stand-by basis, to provide any additionally required information'.[1592] Lastly, as contacts between Urenco and counterparts in Australia were bound to be noticed, and to avoid another '"Brazil-situation"', the Minister was urged to inform

1585 ARC 122-2, p. 3.

1586 ARC 122-2, p. 3, Letter, Premier of South Australia David Tonkin to Prime Minister Margeret Thatcher, 3rd of July 1980, Records of the Prime Minister's Office (PREM): Correspondence and Papers, 1979-1997: PREM 19/392 – Australia, Transfer of uranium enrichment technology to Australia, 1980 Jul 03 - 1981 Apr 29, The National Archives, Kew, p. 1.

1587 Letter, Premier of South Australia David Tonkin to Prime Minister Margeret Thatcher, 3rd of July 1980, Records of the Prime Minister's Office (PREM): Correspondence and Papers, 1979-1997: PREM 19/392 – Australia, Transfer of uranium enrichment technology to Australia, 1980 Jul 03 - 1981 Apr 29, The National Archives, Kew, p. 1.

1588 Ibid, pp. 1-2.

1589 Letter, Prime Minister Thatcher to Mr. David Tonkin, 1st of August 1980, Records of the Prime Minister's Office (PREM): Correspondence and Papers, 1979-1997: PREM 19/392 – Australia, Transfer of uranium enrichment technology to Australia, 1980 Jul 03 - 1981 Apr 29, The National Archives, Kew.

1590 Ibid., p. 1.

1591 ARC 122-2, p. 3. Mr. Blaker's visit toward that end is mentioned in, Letter, Foreign and Commonwealth Office Rodric M.J. Lyne to Prime Minister's Office M. O'D B. Alexander Esq, 28th of July 1980, http://09b37156ee7ea2a93a5e-6db7349bced3b64202e14ff100a12173.r35.cf1.rackcdn.com/PREM19/1984/PREM19-1236.pdf (page 20), website checked 28-6-2017.

1592 ARC 122-2, p. 3.

Parliament even before Mr. Blaker's visit. It was hard to conceive that Parliament would resist such contacts with Australia considering that its non-proliferation policies were so alike to those of the Netherlands, judged DRW.[1593] Minister of Economic Affairs Van Aardenne had received the same brief and had already agreed with all of the above. In a handwritten caption at the end of the document, Minister Van der Klaauw agreed as well.[1594]

In a common statement in confidence to the Select Committees for Foreign Affairs and for Nuclear Energy, the ministers of Economic and Foreign Affairs informed Parliament of the developments with Australia on the 19th of June 1980. 'At first this concerned a common feasibility study concerning a possible establishment of a commercial enrichment industry in Australia' and included 'similar contacts … with interested parties in other countries', but 'even though the studies have yet to be concluded, contacts between Urenco and Australia have progressed so far along that now [the Troika] needed to express its judgment on the matter'.[1595]

In the statement the ministers explained that Australia's own centrifuge program was still in an experimental phase and that a partnership with Urenco at this time would on the one hand hasten Australia's access to a commercially viable centrifuge technology considerably, while (considering the currently saturated international enrichment market) also serving Urenco's commercial interests.[1596] Moreover, it impressed upon the committee that in this case the Troika was faced with a 'with or without us' situation wherein a competitor with large reserves of uranium was intent on creating its own enrichment capacity, with or without Urenco's centrifuge expertise.[1597] The ministers explained to the committee that if Australia would end up choosing to employ the gaseous diffusion technology, which (instead of the modular installations of centrifuge cascades) requires the construction of a large factory with high quantity SWU capacity, this could cause a serious disturbance in an already saturated market that would be detrimental to all current suppliers, including Urenco.[1598]

The statement continued with an evaluation of Australia's non-proliferation credentials. The committee was reminded that article IX of the Almelo Treaty offered the possibility of 'collaboration of the three governments with European- or other states or with international organizations' and although the treaty partners had never made use of this option out of political prudence, Australia's policies toward nuclear energy and particularly with regards to non-proliferation showed a very high level of agreement with those of the Troika.[1599] With regards to Australia's foreign policy there was also much similarity, as Australia 'assigns high priority to stimulating the establishment of measures that curb the proliferation of nuclear weapons'.[1600] Australia had ratified the NPT and it was clear it subscribed to the guidelines of

1593 Ibid., p. 4.
1594 Ibid., p. 4.
1595 ARC 122-3, p. 1.
1596 Ibid.
1597 Ibid., p. 2. Non-quote.
1598 Ibid. p. 3.
1599 Ibid. p. 2.
1600 Ibid.

the NSG. Furthermore, during its participation of INFCE, it became clear that Australia pursued a 'well-considered and responsible policy to issues of nonproliferation'.[1601]

While the ministers did not commit to what form the possible collaboration with Australia would take, they argued that if the principle of 'supplier involvement' in a multinational framework was adhered to (as set down in the NSG guidelines and conclusions of INFCE), they saw no objection to furthering the collaboration and the transfer of sensitive technologies to Australia. Australia meanwhile had already signaled its interest in such a structure. However, such a transfer 'must be ruled out if not accompanied by a close collaboration between Urenco and eventual Australian partners'.[1602] In conclusion, the ministers state that the Troika had the intention to communicate their non-objection to the collaboration and 'would support it according to capacity'.[1603]

On the 24th of July 1980, the UK Secretary of State for Energy communicated the JC proposal on a political approach to PM Thatcher. 'The UK has a special part to play in this, this year', she wrote, 'as we hold the chair for the Joint Committee of the collaboration.'[1604] The Energy Secretary explained to the PM that Urenco's technology was 'highly appropriate to Australia's needs' and the Troika's non-proliferation requirements would 'unlikely … prove a problem' to the Australians.

There was cause for some urgency however, considering the competition Urenco was facing from the French and the imminent démarche Minister Giraud would be making to promote the French proposal with the Australian Government. The Secretary proposed the PM would send a personal message to Australia's PM Fraser supporting Urenco and wrote that 'your message could have a significant effect in helping URENCO counter [the French] proposal' as 'it is important to this collaboration's [Urenco's] future that the French should not persuade the Australians to build a very large diffusion plant, and greatly exacerbate the problem of world over-capacity.'[1605] PM Thatcher's took the Energy Secretary's advise and wrote PM Fraser on the 25th of July 1980 and had Mr. Blaker personally deliver the message on the following 4th of August. She wrote,

> 'Our three Governments fully support Urenco's participation in the study now in progress. Should you decide to go ahead with a plant we will be prepared to authorize the transfer of centrifuge technology to you.'[1606]

Considering non-proliferation aspects and particularly mindful of the conclusions of the INFCE, the Troika would 'wish to see some multinational element in the organisation',

1601 Ibid.
1602 Ibid.
1603 Ibid., p. 3.
1604 Note, Secretary of State for Energy to Prime Minister, 24th of July 1980, Records of the Prime Minister's Office (PREM): Correspondence and Papers, 1979-1997: PREM 19/392 – Australia, Transfer of uranium enrichment technology to Australia, 1980 Jul 03 - 1981 Apr 29, The National Archives, Kew, p. 2.
1605 Ibid., p. 1.
1606 Letter, Prime Minister Thatcher to Prime Minister Fraser, 25th of July 1980, Records of the Prime Minister's Office (PREM): Correspondence and Papers, 1979-1997: PREM 19/392 – Australia, Transfer of uranium enrichment technology to Australia, 1980 Jul 03 - 1981 Apr 29, The National Archives, Kew, p. 1.

Thatcher wrote.[1607] She expressed the opinion that '[b]ecause of Australia's own commitment to non-proliferation' this shouldn't be a problem.[1608] Lastly, she added that the Troika was ready to discuss possible arrangement 'in more detail' at Australia's Government's convenience.[1609] When PM Fraser read the UK PM's letter, 'which he described as most helpful' to Mr. Blaker, he said that a decision on enrichment technology could be expected by the end of the year.[1610] In a written response to PM Thatcher, PM Fraser's language is very neutral, explaining that other technology holders are still under consideration. He does welcome PM Thatcher's view on Australia's non-proliferation credentials however;

> 'I have noted your comments relating to multinational participation. Our countries share a strong non-proliferation concern and the support you expressed for Australia's non-proliferation stand is welcome.'[1611]

The Mission to Canberra

In December 1980, a Troika delegation led by Mr. Manley traveled to Canberra, Australia to 'provide the fullest possible explanation of their position, to assist in the eventual decision to be taken by the Commonwealth Government'.[1612] In a December 15 meeting, the delegation stressed to their Commonwealth Government interlocutor Mr. Ives of the National Energy Office that the Troika understood Australia was not yet ready to make a final decision, but were glad to convey their views on (what Mr. Ives' called) the 'possible inter-governmental arrangements that might apply to any transfer of Urenco Technology to Australian interests'.[1613] The Troika started out with a presentation on Urenco and the Treaty of Almelo and its arrangements, summarized as follows:

> 'These arrangements have enabled the three governments and the industrial enterprises to build up a successful and competitive enrichment venture. The industrial partners are able to take management decisions, as equal partners, in the closest co-operation, with constant interchange and cross-fertilisation of ideas, within a framework of central co-ordination of marketing and export efforts, non-proliferation and security arrangements and policy on research.'[1614]

1607 Ibid.
1608 Ibid.
1609 Ibid.
1610 Telegram, Embassy Canberra Mason Carruthers to Foreign and Commonwealth Office, 'Urenco uranium enrichment technology', No. 465, Confidential, 5th of August 1980, Records of the Prime Minister's Office (PREM): Correspondence and Papers, 1979-1997: PREM 19/392 – Australia, Transfer of uranium enrichment technology to Australia, 1980 Jul 03 - 1981 Apr 29, The National Archives, Kew, p. 1.
1611 Letter, Prime Minister Malcolm Fraser to Prime Minister Margaret Thatcher, No. T165/80, 21st of August 1980, Records of the Prime Minister's Office (PREM): Correspondence and Papers, 1979-1997: PREM 19/392 – Australia, Transfer of uranium enrichment technology to Australia, 1980 Jul 03 - 1981 Apr 29, The National Archives, Kew, p. 1.
1612 ARC 122-6, p. 1.
1613 Ibid.
1614 Ibid., p. 2. English in original.

Subsequently, the discussion turned to the transfer of technology. The Troika declared that it and the industrial enterprises 'were prepared to enter into a comprehensive agreement on co-operation with Australia covering technology transfer and [subsequent] access to R and D, marketing and production strategy, security and classification and relevant non-proliferation issues.'[1615] Considering Australia's non-proliferation credentials, there was no need to withhold any details of the Urenco technology; 'there would be no 'black boxes''; 'the principle of complete technology transfer' was accepted by the Troika.[1616] The Almelo Treaty provided for such fourth country cooperation in Article IX.[1617]

Next, the Troika delegation brought up the INFCE conclusion that called for supplier involvement when transferring sensitive technology. There were several ways to secure such involvement. Possible options could include cross investment (such as in the existing Troika plants), management involvement (having a Urenco member on the board of the Australian enterprise), reciprocal access to plants, access to technology of partners and lastly a 'co-ordination of marketing [e]fforts could also ensure that each partner is fully aware of the activities of the others.'[1618] Reacting to this, 'the Australian team saw attractions in supplier involvement and investment in an Australian plant'.[1619] It could, for example, open up better marketing opportunities' as well as have 'potential non-proliferation benefits'.[1620]

While not of immediate relevance to the case under discussion, noted the Troika team, a future deal between Urenco and Australia that included the transfer of centrifuge technology would have great international relevance, 'since the terms of a centrifuge technology transfer from the Troika to Australia are likely to be considered internationally as a precedent for any transfer of any sensitive technology in the future.'[1621]

On safeguards, non-proliferation and security issues, the participants were reminded that both the Troika and Australia were NPT members and subscribed to the NSG principles. The Troika delegation also noted with satisfaction that Australia 'is participating fully in inter-governmental consultations on safeguards practices in the hexapartite group.'[1622] The Troika team set out a number of requirements in these areas in the Treaty of Almelo that a new partner to the Troika (in whichever form) would have to adhere to; implementation of IAEA and EURATOM safeguards, no enrichment above 20% without mutual agreement, export of enriched uranium 'subject to adequate non-proliferation conditions including appropriate Supplier Group assurances from customers', implementation of 'existing security and

1615 Ibid.. English in original.
1616 Ibid. English in original.
1617 Ibid.
1618 Ibid., p. 3. English in original.
1619 Ibid. English in original.
1620 Ibid., p. 4. English in original.
1621 Ibid., p. 3. English in original. When eight months after the Canberra meeting a 'nuclear briefing' was prepared by DRW/AT officials for the soon to be-incoming Dutch Foreign Minister, the relevance of the INFCE conclusion were once again referenced, leaving the official to conclude that 'an integrated cooperation' is 'a necessity' which is 'considering the Australia pursued non-proliferation policy' 'very appealing' to the Netherlands, ARC 122-12, p. 6
1622 ARC 122-6, p. 4. English in original. For more on the Hexapartite Safeguards Project, see *The Hexapartite Safeguards Project (HSP)* on page 477.

classification procedures [as] annexed to [the] Treaty of Almelo' as well as a number of other related requirements.[1623]

'[O]n the possible shape of an inter-governmental agreement', still undecided pending the conclusion of commercial negotiations, it was clear to the Troika however that "[t]he inter-governmental and commercial agreements would have to be consistent, with the former providing the necessary political superstructure to the latter.'[1624] The Troika delegation pointed out that a possible future 'agreement should reflect the fact that Australia would be joining a well-established collaboration with existing contracts and customers, which could not be subject to amendment as a result of the extension of the agreement.'[1625] In other words, agreement between Australia and the Troika can not result in changes in agreements between the Troika and its existing customers.

A possible inter-governmental agreement would need to seek agreement on the following points: first, definition of the enterprise including its rights and obligations and those of its commercial entities; second, the authorization of technology transfer to Australia; third, agreement on exclusivity; full exchange of centrifuge technology between the partners but to no one outside the partnership; fourth, agreement that common policies on safeguards, physical, personnel and classification procedures would apply throughout the collaboration; fifth, agreement on non-proliferation arrangements; sixth, the establishment of a supervisory body consisting of the four governments (named Joint Commission, to avoid confusion with the Joint Committee) in which they 'could discuss questions thrown up by the industrial collaboration that affected government interests' such as deciding on 'safeguards, security and classification procedures', bringing new countries into the collaboration as well as the export of equipment, materials or technology outside the collaboration; an apparent duplicate function of the JC for the four governments.[1626] Finally, an inter-governmental agreement would require a dispute settlement mechanism, clauses on withdrawal and termination as well as stipulations to preserve 'Troika obligations under the EURATOM Treaty'.[1627]

The Troika did not intend to 'impose the contents of the present treaty [of Almelo] on Australia, but much of that was rather essential, for example the non-proliferation arrangements.'[1628] However, outside of purely a sale of enrichment technology, 'no possibility, including full integration of Australia into the co-operation was being excluded.'[1629] The Australian team in turn saw two broad possibilities; either an agreement that 'linked Australia to the Troika or a totally new agreement between four governments.';

> 'They [the Australian team] understood that the Troika was really suggesting the procedure of Article IX of the Treaty, namely an agreement between Troika and

1623 Ibid., pp. 4-5. English in original.
1624 Ibid., p. 5. English in original.
1625 Ibid., p. 5. English in original.
1626 Ibid., p. 6. English in original.
1627 Ibid. English in original.
1628 Ibid., p. 7. English in original.
1629 Ibid. English in original.

> Australia while maintaining the Treaty of Almelo, but expressed an early preference for a new quadripartite agreement should the choice be Urenco technology.'[1630]

In the Troika's perception, coming to a common export policy was considered a surmountable challenge considering the existing non-proliferation policies of the Troika and Australia were largely identical. Existing contracts would be exempt however; the Troika wished to shield all old customer's existing and future contracts from the quadripartite collaboration, to safeguard assurance of supply to those clients. The exception would be when 'an existing customer disqualified himself.'[1631] For new clients however, Australia's Government would be involved from the start, at the onset of discussions leading to supply contracts. Unchanging from how it was organized presently, there would be no allocation to particular plants when contracting new clients.[1632]

After the Troika made an aside to signal Urenco's interest in Australian feedstock (natural uranium), the discussion turned to the possibility of a 5th country extension of the agreement. Urenco had become aware of 'certain views from the Australian side on a possible Japanese involvement in the Urenco/Australia arrangement.'[1633] The Troika had not yet fully considered such a possibility, and politely inquired if Australia's team could shed some light on this. The bottom line for them, they responded, was getting the most attractive commercial deal. However, the multinational management aspects that the Troika had brought up in the current discussion 'could be an important influence'.[1634] After all, 'Japan would be Australia's major consumer country for years to come.'[1635] Japan's role was not yet clear; UEGA might be pursuing marketing and financial goals by involving Japan, or Japan might want to become part of the technological sharing (and if rebuffed, would call it discrimination, the Australian team warned). The Troika team explained that a distinction needed to be made between fifth country customers and technology holders; customer participation could shore up assurance of supply through advance payments for future orders or by financial participation in equity, possibly involving the customer in decisions on allocation of production. Access to technology or participation in plant management for such customers was ill-advised though, and thus customer's shouldn't become part of any inter-governmental agreement. However, if a 5th country possessed its own enrichment technology, 'it could make a difference', the Troika said in very cautious terms, leaving the door to Japan's involvement open.[1636]

Pre-feasibility Report UEGA

Just under two weeks later, an interim-version of the UEGA pre-feasibility study came out December 24, 1980 and the final version followed on the 30th of April 1981 and was presented to the Australian Cabinet on the 2nd of June. The report covered a range of aspects in order to

1630 Ibid., p. 6. English in original.
1631 Ibid., p. 7. English in original.
1632 Ibid.
1633 Ibid., p. 8. English in original.
1634 Ibid., p. 8. English in original.
1635 ARC 122-6, p. 8.
1636 Ibid.

best inform the UEGA partners and the Australian Government of whether and how an enrichment industry could be established in Australia.[1637]

Market prospects had been researched, and the UEGA team found that the market for enrichment services was suffering from over-supply, which should cease around 1990, depending on a myriad of factors such as the commissioning of additional power reactors worldwide, possible new suppliers in the enrichment services market, etc.[1638]

The report moved on by addressing the choice of enrichment technology. Under a heading of 'Unconventional Separation Technologies', chemical separation (the French Chemex and Japanese Asahi methods) were mentioned and not deemed to be 'serious commercial threats to an Australian enrichment plants based on proven technology' although a close eye should be kept on future developments, the report stated.[1639] The South-African and German-developed Brazilian jet-nozzle plants were mentioned, but not deemed competitive. Diffusion was discussed but also found wanting; the necessities of scale and the large power demands made it an unattractive technology for UEGA.[1640] In contrast, the low power demands and possibility of modular construction of the centrifuge method made it a much better choice. Moreover, 'with the exception of US [centrifuge] technology, the total plant and equipment could if desired be manufactured in Australia'.[1641]

As to who should provide the chosen technology, all indications pointed toward centrifuge technology, building centrifuges and operating cascades; preserving and expanding that expertise would be preferable, as Australia already had competence in that technology.[1642] The accompanying letter by UEGA's Chairman Ward is more explicit:

> 'We are now able to confirm advice in the Interim Report that centrifuge enrichment technology appears best suited to Australian needs. The centrifuge technology offered by Urenco is attractive commercially. Japanese centrifuge technology has potential to become so, but is not as well advanced at this time. The US is offering the least attractive centrifuge technology.'[1643]

On the topic of Government involvement, the report pointed out that the Australian venture would be the first private enrichment venture, as well as the first without a domestic market to

1637 ARC 122-4, which is Report, 'Pre-feasibility Study for the Establishment of a Uranium Enrichment Industry in Australia: Final Report', Confidential, in Cabinet Minute, 'Submission No 4836 - Uranium enrichment - related to Decision No 15341' (Attachment B), National Archives of Australia, A12909, 4836, 30837721, 2nd of June 1981, https://recordsearch.naa.gov.au/SearchNRetrieve/Interface/ViewImage.aspx?B=30837721, website checked 28-6-2017, p. 17.
1638 ARC 122-4, pp. 1-2.
1639 Ibid., p. 2.
1640 Ibid. pp. 2-3.
1641 Ibid., p. 4.
1642 Ibid.
1643 Letter, UEGA Chairman R.G. Ward to Prime Minister J.M. Fraser, 30th of April 1981, Cabinet Minute, 'Submission No 4836 - Uranium enrichment - related to Decision No 15341' (Attachment B), National Archives of Australia, A12909, 4836, 30837721, 2nd of June 1981, https://recordsearch.naa.gov.au/SearchNRetrieve/Interface/ViewImage.aspx?B=30837721, website checked 28-6-2017, pp. 15-16.

deliver to. R&D in all the existing enrichment plants received at least in part funding 'from their respective governments' and UEGA wondered if it could count on continued AAEC support.[1644]

The report warned that since all the other enrichment ventures were government controlled, competitors could artificially keep price-levels low, 'to achieve political objectives'.[1645] Also considered was a situation in which the Australian Government would reject certain overseas customers, potentially costing the venture business and also posing commercial risk to investors. In general, the project would require 'some form of Government identification with the project' to overcome such difficulties. UEGA puts it on the top of the agenda, to be 'explored early in the next stage of the studies', so that it could find out what support it might receive from the Australian Government.[1646]

Finally, commencement of the 'Full Feasibility Study', paid for by UEGA and with accompanying rights to access of information, was recommended.[1647] On the 2nd of June 1981 the Australian Government followed this recommendation and approved commencement of the Full Feasibility Study, and UEGA was authorized to carry it out.[1648]

The Full Feasibility Study

In August 1981, an UEGA delegation visited The Hague and presented a possible model for cooperation that could count on the endorsement of the Australian Government. The model would first pursue a cooperation between the Troika and Australia, and in a later stage involve Japan 'at a lower level' in the cooperation.[1649]

The first indicator of success the Netherlands received from the Troika's efforts towards Australia came unofficially at the CAS meeting in Vienna (9-11 November, 1981). The Dutch chief DRW/AT spoke to Peter Field (Uranium Division, Australian Department of Trade) and was told that 'the choice by UEGA for Urenco was clear' but that a public statement to that effect would have to wait until the ongoing safeguards-negotiations between Australia and Japan had been concluded.[1650] These negotiations were not progressing very smoothly because of differences of opinion on several matters, including over the prior consent for the reprocessing of plutonium that Australia required under the new Australian safeguards policy of 1977. Australia conceded this and other points to Japan and reached agreement in January 1982, providing a waiver on prior approval for reprocessing Australian uranium. Field

1644 ARC 122-4, p. 6.
1645 Ibid., p. 5. Reminiscent of the US AEC policies the Troika countries had faced in the 1960s and early 1970s.
1646 Ibid., pp. 5-6.
1647 Ibid., p. 6.
1648 Cabinet Minute, 'Submission No 4836 - Uranium enrichment - related to Decision No 15341', National Archives of Australia, A12909, 4836, 30837721, 2nd of June 1981, https://recordsearch.naa.gov.au/SearchNRetrieve/Interface/ViewImage.aspx?B=30837721, website checked 28-6-2017, pp. 1-6.
1649 ARC 122-16, p. 1.
1650 Ibid.

confided in his conversation partner that he expected a future Troika-Australia-Japan cooperation to 'suffer some complications' because of those differences as well.[1651]

The Ministry of Foreign Affairs reported the reason for the delay to Dutch officials involved, and to the German and British JC delegations. Foreign Affairs Minister Van der Stoel considered it 'plausible' that Field's assessment explained the 'long absence of an Australian decision' but that this would not have to be problematic; 'just as long as Australia does not go and find another enrichment partner' the Troika could wait.[1652] In an attempt not to embarrass or otherwise inconvenience the Australians, the Minister included instructions to all involved to keep this information to themselves.[1653] Van der Stoel considered the choice for Urenco's UC-technology by UEGA 'unofficially made' when he sent instructions to the Washington DC embassy a week later.[1654]

The latest Urenco mission to Australia had learned that with the recent nuclear export policy reversal in the US under President Reagan, the release of the proposed public statement on UEGA's choice for Urenco technology (to be released before the 1st of January 1982) could be interpreted as a '"slap in the [P]resident's face"', as it might signal an Australian refusal to include US technology in their further evaluation, a situation Australia sought to avoid.[1655] The statement would have to be delayed.

A proposed US bill that would significantly loosen US nuclear export rules would be submitted to Congress very soon and be under consideration by Congress for 60 days. This bill would make it possible for the US to export its enrichment technology, including its centrifuge technology, and the US had already made a démarche to Australia to make them aware of this.[1656] In reaction, Van der Stoel instructed the DC embassy to coordinate with British and German colleagues to follow the situation carefully and report anything of interest, without interfering or giving any sign of knowledge of the US démarche.[1657] The same day the Dutch Canberra mission responded by affirming that the Troika missions were following Australian instructions to keep quiet, but also implored the MFA on behalf of the collective Troika missions to make clear in no uncertain terms to Urenco manager Rooke that any public statements on Urenco's plans in Australia would seriously jeopardize the whole prospective cooperation, indicating Rooke had drawn too much attention to the negotiations.[1658]

France and the US were not yet conceding defeat. The French sent the 'second man from CEA' to give a technical presentation that pushed the French diffusion technology, arguing that it had significantly improved, with '"reduced costs, increased outputs"' as a result.[1659]

1651 Ibid., Rix, Alan, *The Australia-Japan Political Alignment: 1952 to the Present* (Routledge: London 1999) p. 88.
1652 ARC 122-16, pp. 1-2.
1653 ARC 122-16, p. 2.
1654 ARC 123-4, p. 1, ARC 123-3, p. 2.
1655 ARC 123-4, p. 1. English in original.
1656 Ibid.
1657 Ibid.
1658 ARC 123-5, p. 1. I've not been able to find out what Rooke said to which publication.
1659 ARC 123-3, p. 2. English in original.

They were considering sending the CEA director for further '"arm twisting"', but the tone and attitude of the French had displeased the Australians, so judged a meeting of Urenco and Dutch government officials.[1660] Nevertheless, Dr. Georges Verdreyes of CEA had given an 'effective' presentation of the French proposals which had triggered renewed interest in France's chemical exchange technology Chemex. The greater attraction originated in the costs, the size of a potential plant and, so hinted UEGA's Dr. King during a meeting with Dutch officials in December 1981 in Sydney, a guaranteed share of the (French) market.[1661] At the start of the meeting Dr. King had given the impression that UEGA's choice for Urenco was no longer a given, yet at the end of the meeting said 'considering the late stage to which the negotiations had progressed between UEGA and Urenco, short term finalizing of contracts is likely.'[1662] The motivation for creating this uncertainty became clear from what Dr. King said next. If Urenco's stance in the upcoming commercial-financial round of negotiations would be too tough, a 'turn to the benefit of the French competition could not be excluded', in the words of the Dutch official reporting.[1663]

The renewed US push was sparked by the November 12, 1981 authorization of President Reagan for US companies to 'bid under government auspices for participation in a joint venture with Australia'.[1664] The authorization, according to US Senate subcommittee testimony by Mr. Bengelsdorf, Director for Nuclear Affairs at the Department of Energy, allowed access to 'highly classified centrifuge technology … that until now [had] not been shared with foreign governments.'[1665] Dutch officials had unsuccessfully tried to locate the bill in question but Dr. King was confident the President had submitted a '"paper"' of which the contents were yet unknown.[1666]

UEGA had received classified information from DOE and Union Carbide that in 'importance' competed with the data provided by Urenco, Dr. King suggested in the December 1981 Sydney meeting. These did however not change the most important strategic consideration against a choice for US technology; a virtual global US supplier monopoly did not serve Australian interests. Dr. King argued that the Americans knew their technology would not be chosen and that this entire exercise was a 'stalling tactic' that might delay an official announcement of the choice of technology supplier as late as March 1982.[1667]

Japan remained relevant and important in this process because of Australian ambitions for future cooperation. Australia wanted to keep the political climate as optimal as possible and only wanted to publicly announce the choice for Troika technology after the Troika and

1660 Ibid., p. 2.
1661 ARC 123-8, p. 1.
1662 Ibid., p. 3.
1663 Ibid.
1664 ARC 123-6, p. 1, which is 'Australians May Get U.S. Nuclear Data: Reagan Reported Set To Offer Technology', in *International Herald Tribune*, 21-22 November 1981.
1665 Ibid.
1666 ARC 123-8, p. 2. English in original.
1667 Ibid.

Australia had briefed Japan on their plans. The intention was to right away involve Japan in those plans.[1668]

News of UEGA's choice for Urenco technology broke in Japan late December 1981, after 'Japanese parties concerned' had been informed.[1669] The proven reliability of Urenco's process was cited as the main reason for the choice. The Japan Economic Journal reported that,

> 'UEGA will eventually build a large enrichment plant with an annual capacity of 3,000 tons SWUs. Japanese electric utilities are expected to become the single most important client country. For that reason, Japanese industry leaders estimated that there still is a possibility of having UEGA utilize the Japanese enrichment know how.'[1670]

Concerns remained regarding the Americans and their contacts with UEGA. More information reached the Dutch MFA via the UK's embassy in Washington DC. Four companies, Boeing, Exxon, Garrett and Goodyear, had been authorized by the US Government to negotiate with UEGA, but by early 1982 Exxon and Boeing had bowed out (Boeing reportedly did so partly because the Australians required financial investment besides technology provision and also could not afford to get committed to the two year feasibility study).[1671] The US Government was serious about establishing a position in Australia and has set an inter-agency team to exploring possibilities to privatize the US enrichment industry to help make that possible.[1672] A British source in Washington informed the Troika partners that,

> '[t]his will enable it to place US end use restrictions on both the technology supplied to Australia and subsequently the product material produced from that technology. Such arrangements would enable the US to extend its control through the Nuclear Non-Proliferation Act'[1673]

UEGA had not yet received renewed proposals from the remaining US industrial partners but learned that 'two forms of proposal are being developed.'[1674] One package offered plant design and machine technology and the second offered plant design with limited machine technology. The second package was politically less risky and had economy-of-scale benefits for the Americans; it would see the centrifuge manufactured in the US and this would depress the construction cost per centrifuge for the US Portsmouth centrifuge plant, as well as produce revenue for the enrichment program through royalties.[1675] The US were holding off on renegotiating the US-Australia bilateral agreement (per requirement of the NNPA) until they knew one of their bids would be accepted, said a US State Department source.[1676]

1668 ARC 123-3, p. 2.
1669 ARC 123-9.
1670 Ibid.
1671 ARC 123-12, p. 1.
1672 ARC 123-12, p. 2, ARC 123-23.
1673 ARC 123-12, p. 1. English in original.
1674 Ibid., p. 2. English in original.
1675 Ibid.
1676 Ibid., p. 1. Whether this was interpreted as a matter of practicality or a form of political pressure does show from the document.

A possible reason why the US had entered and been able to remain in the competition for the Australian project, besides to bide the US President's new policy, was the counselor for Atomic Energy at the Australian Embassy in Washington DC, who had left by February 1982 but who had been 'very involved in stimulating the Americans to enter the arena and seemed to favour the US to Urenco.'[1677] This had created some difficulty in coming to 'worthwhile conversation' with representatives of the Australian Embassy, as the counselor had adopted an '"adversary" attitude'.[1678] Unclear when they could expect the US proposal(s), the Australians nevertheless '[were] insistent on seeing detailed proposals from the US before coming to an agreement with Urenco' and so 'considerable delay should be expected'.[1679]

On the 20th of January 1982, the Chief DRW received the Australian ambassador, at the latter's request. The Ambassador inquired about what he had been told by a Dutch national (who would remain anonymous) that the Treaty of Almelo included 'military arrangements'. The Chief DRW denied this and found out that the controversy came from a paragraph in the Treaty that said the UK was free to draw feedstock from Troika enrichment plants for 'defence purposes'.[1680] However, as far as this feedstock was required for 'nuclear weapons purposes' it would not be drawn from a Troika plant outside the UK.[1681] The Ambassador responded that with a view on the domestic political climate in Australia, it was inconceivable that after enrichment at Capenhurst Australian uranium would serve British 'defence purposes'.[1682] Reporting to the MFA on the issue, Minister Van der Stoel instructed his embassy officials in London to inform UK FCO's Haskell of the matter, in case the Australians turned there for more clarification. Haskell was thankful and added that the UK had never drawn feedstock from a Troika plant and that it was known that the UK did not produce its own HEU for military purposes. Haskell would do all he could, if the Australian High Commission contacted his office, to clarify this misunderstanding.[1683]

Negotiations between UEGA and Urenco had become focused on two issues; the height of royalties to be paid to Urenco, and the distribution of the global market for enriched uranium between the two parties.[1684] By April 1982, the Dutch MFA was worried about two complicating factors; the uncertainty the US had created by entering the competition with regards to the almost finalized Urenco-UEGA deal even though a potential US-Australian collaboration was unwanted by Australia, and the fact that UEGA had communicated by letter that now it was only interested in acquiring Urenco's technology and a cooperative relationship was not preferred. Reporting the above for DRW/AT, Van Galen Last considered that the US were indeed stalling, trying to postpone a definite Australian decision as long as possible. He also wondered whether all of this was part of Australian negotiation tactics, something that had proven hard to determine. If indeed Australia wanted to join with Japan in using Troika technology to set up their own venture, the Troika should use its diplomatic

1677 Ibid., p. 2. English in original.
1678 Ibid. English in original.
1679 Ibid. English in original.
1680 ARC 123-10, p. 1. English in original.
1681 Ibid. English in original.
1682 Ibid. English in original.
1683 Ibid., p. 2.
1684 ARC 123-18, p. 2.

channels to find out more about Japanese thinking on the matter. The Australian side also needed to be reminded of the Troika policy that stand-alone technology transfer was not an option. Possibly, after the Japan-Australia JC Subgroup (established to explore modalities for a possible Troika-Japan-Australia collaboration) had convened, a démarche could be prepared to address the outstanding issues and Australian concerns. At the same time, Urenco needed to be protected against itself, before 'as a result of Australian hesitations' it would make 'unacceptable concessions', warned Van Galen Last.[1685]

The same day Galen Last reported the above (6th of April), the Dutch MFA was informed by the Australian Embassy in The Hague that back in late February, Urenco had come up in parliamentary questions to the Australian Minister of Foreign Affairs Mr. Street. The Australian Labor Party had drawn attention to the supply of enriched uranium to Brazil and wanted to know if the Australian Government was prepared to allow the re-transfer of the (now) EURATOM uranium to Brazil. The Minister responded by pointing out that since Brazil was not a member of the NPT, it could not conclude a bilateral safeguards agreement that met Australian policy requirements, and therefore would not approve such a transfer,[1686]

By June 1982, the UEGA decision was still pending although it was expected in 'a month or two'.[1687] Australian Senator Carrick said so when he visited Mr. Mellor, UK's Parliamentary Under-Secretary of State at the Department of Energy. Since the centrifuge process had been chosen as the preferred technology by UEGA, only Urenco and the US were still in the competition. Besides hoping to clear up a number of misunderstandings between UEGA and Urenco, the senator shared news on the offer the Americans had made to UEGA. Reporting back to the JC, Peter Kelly of the UK Department of Energy wrote:

> 'Carrick told us that the US had offered the Australians a share of the American domestic enrichment market if they came in with the US. The Australians had invited their representatives in Washington to reaffirm the position , and, as a consequence, it had been rechecked with the State Department and with the US Department of Energy. As as result of this rechecking, the Australian Government [believed] that it had a firm commitment from the US Government to permit the marketing of Australian enriched uranium in the US.'[1688]

This aspect of the proposal would make the US offer much more attractive. The Dutch MFA was informed that inquiries had been sent to Washington by the British to find out how much truth there was to Carrick's report (as the Nuclear Fuel journal had also reported on the US offer), and to what extend the US Government could deliver on a promise for US market share.[1689]

The UK's Washington Embassy sent an official to talk to Bill Voigt, the DOE's Deputy Assistant Secretary for Uranium Enrichment. Voigt categorically denied the reports. The DOE

1685 Ibid.
1686 ARC 123-17, p. 2.
1687 ARC 123-21a, p. 1. English in original.
1688 Ibid., p. 2. English in original.
1689 ARC 123-21b, pp. 1-2, ARC 123-21c, p. 2.

had examined the possibility of buying Australian SWUs but would only be prepared to do so under market prices. Asked about the offer made to UEGA, Voigt replied that if such an offer had been made, 'they had done it without authority.'[1690] A market-sharing deal may have been offered by the American gas centrifuge manufacturers, but a couple of sizable obstacles remained. First, a full centrifuge technology transfer would be difficult to pass through Congress and second, it would cause the DOE problems 'in their continuing battle for the completion of the gas centrifuge add-on plant at Portsmouth' which would also require a share of the US market to be viable.[1691]

Minister of Economic Affairs Terlouw wholeheartedly agreed with British assessment of the situation, which was that the impression the Australians had of the US offer was 'without foundation' and showed 'poor judgment" by the Australians. To the British assessment based on Voigt's information he added that besides considering the weak enrichment market and the sheer impossibility of the US Government forcing American utilities to buy Australian product, there was the long-term nature of existing fueling contracts between DOE and utilities, the opposition in the US Congress to, and 'anti-trust implications' of an Australian deal along the proposed lines, that would make US Government authorization of such a deal very unlikely.[1692] Minister Terlouw knew his Troika colleagues shared his view and suggested it would not be a bad idea to point these 'complicating factors' out to the Australians.[1693]

A Technology Choice is Made

UEGA's interim full feasibility study report was sent to the Australian Government in September 1982. It published the report along with its public decision to choose Urenco-Centec technology going forward, on the 5th of October, 1982.[1694] The same day, the Australian ambassador to the Netherlands informed the Dutch MFA and the Troika partners were similarly informed.[1695]

The Investigation of the Establishment of an Australian Uranium Enrichment Industry Interim Report on Technology Choice and Plant Siting and Other Matters of September 1982 set out all the major selection criteria and the accompanying arguments. The criteria for technology selection were economic performance, technical and commercial viability, scale-requirements, market access, environmental considerations, prospects for local manufacturer involvement,

1690 ARC 123-21c, pp. 2-3. English in original.
1691 Ibid., pp. 3-4. English in original.
1692 ARC 123-21d.
1693 Ibid.
1694 ARC 123-24, Cabinet Minute, 'Decision No. 19070 on Submission No. 5784 – Uranium Enrichment', National Archives of Australia, Submission No 5784 - Uranium enrichment - related to Decision No 19070, A12909, 5784, Barcode 30941997, 5th of October 1982, https://recordsearch.naa.gov.au/SearchNRetrieve/Interface/ViewImage.aspx?B=30941997, website checked 4-4-2017, pp. 1-2, Clarke, Michael, Frühling, Stephan, *Australia's Nuclear Policy: Reconciling Strategic, Economic and Normative Interests* (Routledge: London & New York 2016) p. 87.
1695 ARC 123-24, pp. 1-2.

acceptability to customers, ability to cooperate with Japan and lastly, ability to provide support in research and development[1696]

Economically, the Urenco-Centec technology was superior as it was 'most competitive in terms of capital and operating costs' at the 1-3 million SWU initial capacity that UEGA proposed.[1697] The technical and commercial viability of the tripartite technology had been proven during several years of successful commercial operation, whereas the competing technologies had not. More than the other technologies the Urenco centrifuge allowed for greatest 'incremental increases in capacity', an important factor considering the uncertain future market conditions.[1698] The US technology 'expensive centrifuge machine manufacture and overhaul facilities' did little to advance the US bid in this selection criterion.[1699]

While the French Chemex process would come with access to a portion of the sizable French market, still UEGA found Urenco to be the better choice considering the potential market access in Japan it could result in, and a choice for US technology 'would not in UEGA's view guarantee any significant access to the U.S. markets.'[1700]

Urenco technology was most compatible with that of the Japanese, and UEGA hoped this potential for future collaboration could open up access to its market. Also, Urenco-Centec technology was most cost-competitive and that in itself could help secure future clients.[1701] Low requirement of water and electricity (less than with French or US technologies), low visual impact, low noise, and 'no significant effluent disposal problems' (possibly a reference to the chemical exchange process of the French) made Urenco the most environmentally acceptable choice of technology. The manufacture of equipment for Chemex and Urenco-Centec technology was possible in Australia, but American centrifuges used 'one strategic material' which the US Government restricted.[1702] Furthermore, 'complications in obtaining Congressional approval for technology transfer', as anticipated by the Troika, could still derail a US technology transfer later on.[1703]

Potential future customers would be motivated by supply diversification and strategic market considerations, UEGA asserted. With the current dominance of the US in the global enrichment market, Chemex and Urenco technology offered that possibility. Moreover, Urenco would be most acceptable for potential customers as, other than Chemex, it had a

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1696 Cabinet Minute, 'Decision No. 19070 on Submission No. 5784 – Uranium Enrichment, National Archives of Australia, A12909, 5784, Barcode 30941997, 5th of October 1982, https://recordsearch.naa.gov.au/SearchNRetrieve/Interface/ViewImage.aspx?B=30941997, website checked 4-4-2017, pp. 16-18.
1697 Ibid., p. 16.
1698 Ibid.
1699 Ibid., p. 18.
1700 Ibid., p. 17.
1701 Ibid.
1702 Most likely classified carbon-fiber technology.
1703 Cabinet Minute, 'Decision No. 19070 on Submission No. 5784 – Uranium Enrichment, National Archives of Australia, A12909, 5784, Barcode 30941997, 5th of October 1982, https://recordsearch.naa.gov.au/SearchNRetrieve/Interface/ViewImage.aspx?B=30941997, website checked 4-4-2017, p. 18.

'proven status'.[1704] Urenco-Centec offered centrifuge technology that was compatible with that of the Japanese and the AAEC, as opposed to US centrifuges that were much bigger and required regular maintenance. This familiarity would offer additional benefits when moving on to the next phase of the project, the 'detailed engineering and feasibility study based on Urenco-Centec technology'.[1705]

As to general market prospects for an enrichment operation, the UEGA was aware that,

> '[t]he market for enrichment services is complex, with non-proliferation constraints, national allegiances, long-standing trading relationships and contractual commitments restricting many potential customers' freedom of choice.'[1706]

In such a market, in which UEGA deemed supply would outstrip demand at least until the mid 1990s, a newcomer could only succeed if it could win customers from existing suppliers and conclude contracts from new demand.[1707] UEGA believed an enrichment plant based on Urenco-Centec technology to be commercially viable for several reasons. First, the technology itself was the most competitive. Second, such a plant would give access to Australian high quality but low cost uranium. Third, a centrifuge plant that offered equity to new customers could win those away from their old suppliers; UEGA advised that up to 50% of the future plant should be available for equity buy-in (of which Urenco-Centec had already indicated wanting to take a portion). Lastly, UEGA saw prospects to 'some access to the technology holder's market'.[1708]

UEGA set out a number of steps they considered necessary for proceeding with the project, in current or altered form. UEGA wanted Urenco closely involved; besides a 'detailed survey of potential markets in conjunction with Urenco-Centec', agreements with Urenco and the Troika needed to be finalized before UEGA (in current or altered composition) and Urenco-Centec could conduct a joint engineering and feasibility study 'that would take at least two years to complete at a cost of up to $5 million'.[1709]

The Australian Government decision largely mirrored UEGA's advice.[1710] An important element in its decision was the marketing outlook of an Australian plant. Following UEGA's proposed phased approach, the Government thought Urenco-Centec and UEGA should first complete a market study and subsequently submit their collaborative marketing and commercial plans before an engineering and feasibility study should commence.[1711] The Government furthermore decided that Japan '[would] be invited by UEGA and [Urenco-

1704 Ibid., p. 18.
1705 Ibid.
1706 Ibid., p. 20.
1707 Ibid., pp. 20-21, 24.
1708 Ibid., pp. 20-21.
1709 Ibid., pp. 21-24.
1710 Ibid., pp. 1-2, 5-9, ARC 123-24, pp. 1-2.
1711 Cabinet Minute, 'Decision No. 19070 on Submission No. 5784 – Uranium Enrichment, National Archives of Australia, A12909, 5784, Barcode 30941997, 5th of October 1982, https://recordsearch.naa.gov.au/SearchNRetrieve/Interface/ViewImage.aspx?B=30941997, website checked 4-4-2017, p. 6.

Centec] to participate in the detailed feasibility study, as its centrifuge technology is compatible with [Urenco-Centec]'s, and by involving Japan equity participation and market would hopefully be available to any Australian plant.'[1712] Australia's Government stated it was 'committed to the concept of multinational participation in an enrichment plant in Australia should such an industry proceed', revealing that for those countries with the right non-proliferation credentials, equity participation could be possible.[1713] It also decided that before any Government announcement of its decision, all technology-offering parties needed to be privately informed, especially those that weren't chosen, and those should be granted consultations if any foreign Governments so requested. Particularly the US was important in this respect, 'given the President's personal involvement to make available US technology'.[1714]

Commenting in the press on Urenco's success in winning the tender, UCN Director van Hasselt said, "'It's significant when it's those countries that drop off"', meaning France, Japan and the US.[1715] He added that this was therefore 'an important recognition of ultra-centrifuge technology.'[1716] Leading Dutch newspaper *NRC Handelsblad* commented that '[t]he choice in principle for Urenco-technology is so important because Urenco had been in a fierce competitive struggle with namely the Japanese and French.'[1717]

The Dutch MFA and the Australian Deal in the Media

Twice the Dutch MFA took an active role in exposing the prospective Australian deal in the media; once unintentional and once intentional. The first was an unintentional sharing of documents with the press on policy strategy with regards to Australia and the potential deal. The second was a defense of Urenco's non-proliferation credentials in response to a critical article by Smit, Elzen and Boskma in the *NRC Handelsblad* newspaper.[1718]

On the 12th of November 1982, Minister Van den Broek informed the MFA that the part of the 'introduction file' for the incoming Minister that was shared with the press had accidentally contained a couple of classified files. In one of those files, the Dutch strategic considerations for pursuing a deal with the Australians were set out. It contained the politically sensitive line of thought that the Netherlands would rather not see the Australians acquire an enrichment plant but considering alternative scenarios in which Australia would partner up with one of Urenco's competitors, it was preferable that Australia collaborated with Urenco.[1719] Another sensitive file that was unintentionally shared with the press was the recent UEGA interim report to the Australian Government, in which the choice for Urenco was laid out. While it had remained unclear whether the Australian Government wanted to share the report with

1712 Ibid., p. 7.
1713 Ibid., p. 12.
1714 Ibid., p. 7.
1715 'Australië kiest voor UCN-procédé', in *Reformatorisch Dagblad*, 8th of October 1982, p. 9.
1716 Ibid.
1717 'Australië kiest voor Urenco-procédé voor verrijken uranium', in *NRC Handelsblad*, 7th of October 1982, p. 1.
1718 ARC 123-26, ARC 123-27, pp. 6-7.
1719 ARC 123-26, p. 1.

their Parliament, Minister Van der Stoel told his officials that unsolicited, the Australian Embassy Council had communicated that they had gone ahead with publication of the UEGA interim report.[1720] A potentially very 'painful' and embarrassing episode had thus been avoided.[1721] The Minister left instructions with his embassies in Canberra, Bonn and London to exercise judgment in whether and how to inform locals of this episode (depending on whether the Australians had the report published already), which could be explained by the special situation of a change of government, but which was nevertheless very much regretted by the Dutch Government.[1722]

On the 2nd of December 1982, Technical College Twente's Professor Boskma and others at the College's in-house think-tank De Boerderij published an article in *NRC Handelsblad* newspaper, arguing that the expansion of Urenco to Australia heightened the risk of proliferation. Their article was a partial rebuttal to a November 4th article by An Salomonson in the same publication, who had lauded the choice of Australia for Urenco technology as a great success for the Troika and the Netherlands, among other reasons because Australia's non-proliferation policies would support the Dutch and British efforts to keep German commercialism in check and because of the potential linkage to the Japanese nuclear program and opening to other Asian nuclear fuel markets.[1723]

The December 2nd article by Boskma *et al* described the shifting technical reality of proliferation in the early 80s. No longer was the plutonium route the most proliferation-prone; the enrichment route had replaced it. Centrifuge technology was particularly problematic in this respect as, the authors argued, 'an ultra-centrifuge enrichment plant can … in short order be converted for the production of highly enriched uranium.'[1724] The diffusion process was inherently technically resistant to such a conversion. The authors set out five general conditions to which a multinational enrichment consortium should conform; first, such a consortium should not exploit more than one plant. Second, the plant should be under IAEA control with permanent residence of IAEA inspectors. Third, the participating countries should be bound by treaty and not have an option to leave the collaboration. Fourth, the individual countries should not be allowed to engage in uranium enrichment on a national basis, regardless of the technology used. Fifth, the consortium should not be allowed to produce HEU.[1725]

1720 Ibid., pp. 1-2.
1721 Ibid., p. 2.
1722 Ibid.
1723 Smit, W.,A., Elzen, B., Boskma, P., 'Uitbreiding Urenco verhoogt proliferatie-gevaar', in *NRC Handelsblad*, 2nd of December 1982, p. 7 (also ARC 123-27, p. 7.), Salmonson, An, 'Samenwerking met Australië geeft Urenco fijne lijn naar Azië', in *NRC Handelsblad*, 4th of November 1982, p. 7. Together with Allan S. Krass, these authors also authored, Krass, Allen, Boskma, Peter, Elzen, Boelie, Smit, Wim, A., *Uranium Enrichment and Nuclear Weapons Proliferation* (Stockholm International Peace Research Institute, Taylor & Francis Ltd: London and New York 1983) https://www.sipri.org/sites/default/files/files/books/SIPRI83Krass/SIPRI83Krass.pdf, website checked 3-9-2017.
1724 Smit, W.,A., Elzen, B., Boskma, P., 'Uitbreiding Urenco verhoogt proliferatie-gevaar', in *NRC Handelsblad*, 2nd of December 1982, p. 7 (also ARC 123-27, p. 7.).
1725 Ibid.

MFA official at DRW/AT B. Brands, writing on personal title, issued a reply to the *NRC Handelsblad* newspaper which was published on the 11th of January 1983. Reducing the amount of plants was nonsensical, he said, as the most important non-proliferation aspect of a multinational plant is that 'all partners are involved in decision making relating to all phases of production.'[1726] Referencing Ms. Salomonson's article, he repeated her argument that 'reciprocal control' through multi-nationality is the best guarantee against misuse of nuclear material.[1727] On the permanent presence of IAEA inspectors, of which Boskma *et al* said it was unlikely to materialize after EURATOM and IAEA concluded their negotiations on the subject, Brands pointed out that it was IAEA policy in the execution of her inspection tasks to make as much use of 'modern equipment' to 'aid, support and alleviate' the work of the inspector.[1728] The necessity of permanent inspectors had never been shown, argued Brands. As to the non-exit demand, Brands makes two points; first, that such a clause from an international law perspective would be 'highly irregular'. Second, it would make any multinational collaboration of this sort very unattractive and therefore would promote the national option (an alternative Boskma *et al* did not prefer, guessed Brands). The demand that countries should bind themselves to only enrich uranium within the collaboration, regardless of technology, Brands made short work of; 'it's a collaboration between autonomous states of which it cannot be expected to let themselves be bound hands and feet.'[1729] 'You don't demand participants in a collaboration to exploit wind turbines to cease all research relating to solar energy'.[1730] Lastly, on the demand to forbid any production of HEU, Brands reminded the reader that the Urenco plants are built to produce up to 5% enriched uranium, that a higher enrichment factor would require technical adaptions, of which the IAEA would instantly take note. While Brands acknowledges the risks inherent in HEU, he argued against Boskma *et al*'s proposed ban, reminding the reader that HEU is needed for scientific research, and to exclude multinational plants to produce it would be unwise.[1731] Brands closed with the reminder that 'in the current global situation' there is a demand for enriched uranium and 'no country can be denied the right to increase the worth of its natural resources'.[1732] Considering that 'in a divided world like ours exploitation under international control, mindful of the experiences of the Baruch plan and establishment of the IAEA, can be completely ruled out', Brands argued that Australia should be lauded for wanting to enrich its uranium in a multinational consortium.[1733]

1726 Brands, B., 'Proliferatie-gevaar wordt niet groter door uitbreiding Urenco', in *NRC Handelsblad*, 11th of January 1983, p. 7 (also. ARC 123-27, p. 7.)

1727 Brands, B., 'Proliferatie-gevaar wordt niet groter door uitbreiding Urenco', in *NRC Handelsblad*, 11th of January 1983, p. 7 (also. ARC 123-27, p. 7.), p. 2, Salmonson, An, 'Samenwerking met Australië geeft Urenco fijne lijn naar Azië', in *NRC Handelsblad*, 4th of November 1982, p. 7.

1728 Brands, B., 'Proliferatie-gevaar wordt niet groter door uitbreiding Urenco', in *NRC Handelsblad*, 11th of January 1983, p. 7 (also. ARC 123-27, p. 7.)

1729 Ibid.

1730 Ibid.

1731 Ibid.

1732 Ibid.

1733 Ibid.

Incoming Australian Labor Government Reverses Policy

A strong alliance between the Australian anti-nuclear movement and Australian Labor Party (ALP) had formed by the early 1980s. In the run up to the 1983 general election, 'it was widely assumed that the Labor Party would, if elected, place a much higher priority on arms control and disarmament objectives than had hitherto been the case.'[1734] Such assumptions would have been informed by a number of visible signs of what was coming; the ALP's mining policy, previous statements by the then leader of the opposition Hayden (replaced by Hawke right before the election), 'the depth of anti-nuclear sentiment within the Labor Party' and the 'upsurge of the disarmament campaign in much of the Western world, not least in Australia.'[1735]

The ALP's mining policy had for years been one of dis-allowance. During a July 1977 congress it had declared its party's policy to seek 'a moratorium on uranium mining and treatment in Australia; ... repudiate any commitment of a non-Labor government to the mining, processing or export of Australia's uranium; .. [and] not permit the mining, processing or export of uranium pursuant to agreement entered into contrary to Labor's policy.'[1736] Two years later, the ALP decided to retain the moratorium and expanded its policy to 'prohibit the establishment in Australia of nuclear power plants and all other stages of the nuclear fuel cycle'.[1737]

In the early 1980s, these policies came under pressure when important societal groups started shifting their own policies (such as the South-Australian Australian Workers Union chapter and the Australian Council of Trade Unions. During the 1982 ALP conference, the Hogg amendment was passed, which allowed existing mines to continue uranium mining and, important in light of the UEGA-Urenco collaboration, 'to phase out Australia's involvement in the uranium industry' if elected to office.[1738]

The Labor Party was elected and assumed office in March 1983. During its first year in office, the Government was 'keen to project a new image by adopting a higher profile on disarmament issues and undertaking a series of initiatives as evidence of good faith' that reflected their anti-nuclear stance.[1739]

1734 Camilleri, Joseph, *Nuclear Disarmament, and Emerging Issue in Australian Politics*, Working Paper 9 , Australian Studies Center, Institute of Commonwealth Studies, University of London (1986) http://www.kcl.ac.uk/artshums/ahri/centres/menzies/Publications/Workingpapers/WP9Camilleri.pdf, website checked 4-4-2017, p. 5.
1735 Ibid.
1736 Panter, Rod, Kay, Paul, 'Chronology of ALP Uranium Policy 1950-1994', Parliamentary Research Service Background Paper No. 17, 1994 (Department of the Parliamentary Library: 1994) p. 5.
1737 Ibid., p. 6.
1738 Ibid., p. 7.
1739 Camilleri, Joseph, *Nuclear Disarmament, and Emerging Issue in Australian Politics*, Working Paper 9 , Australian Studies Center, Institute of Commonwealth Studies, University of London (1986) http://www.kcl.ac.uk/artshums/ahri/centres/menzies/Publications/Workingpapers/WP9Camilleri.pdf, website checked 4-4-2017, p. 5.

UEGA had held off on the joint market survey that it planned to perform with Urenco. Originally the study was scheduled to be completed 'by the end of the year' but 'UEGA has now postponed its commencement on the basis that, until such time as the Government indicates its position, such a study would have no credibility.'[1740] In a 31st of October 1983 Cabinet Minute, the Government let UEGA know its position. It defined the issue as follows:

> 'In view of the Platform commitment against the enrichment of uranium in Australia, it is necessary to determine the position the Government should adopt with respect to the UEGA study'.[1741]

It considered several ways to block further progress by UEGA. It could not legally oblige UEGA to cease its activities as the Government was not a legal party to the UEGA collaboration. It could however block further progress in the UEGA-Urenco cooperation by refusing to negotiate inter-governmental agreements needed for the completion of the Full Feasibility Study. It could also refuse further assistance by withdrawing 'the technical advisory services of the AAEC and the BMR' (Bureau of Mineral Resources, Geology & Geophysics). In its considerations, the Government admitted the negative economic and non-proliferation effects of what they were about to do:

> 'Preventing the completion of the feasibility study would indefinitely delay any possibility of the development of a uranium enrichment industry in Australia, and the net economic benefits which may have resulted were an enrichment industry to be established in Australia would be foregone.'[1742]

And:

> 'A further indirect consequence of preventing completing of the UEGA study relates to the previous Government's commitment to the concept of multinational participation in any enrichment plant built in Australia. This commitment was based on nonproliferation grounds, following the INFCE deliberations, and the establishment of a multination facility in Australia was seen as a favourable international precedent for the future development of sensitive stages of the nuclear fuel cycle.'[1743]

The Government set out four options. First, to make no decision for now, which would be unfair to UEGA which had signaled it was waiting for a decision. Second, to aid UEGA in finishing the study as the previous Government had committed to, but 'this would not seem compatible with the Platform commitment'.[1744] Third, to ask UEGA to stop the study, which the Government could not legally do. Fourth, 'to inform UEGA that the Government [was] not prepared at this time to continue to facilitate the study nor enter into any Government-to-

1740 Cabinet Minute, 'Decision No. 2355 on Submission No. 246 – Uranium Enrichment – Uranium Enrichment group of Australia (UEGA)', National Archives of Australia, A13977, 246, Barcode 31405836, 31st of October 1983, https://recordsearch.naa.gov.au/SearchNRetrieve/Interface/ViewImage.aspx?B=31405836, website checked 4-4-2017, p. 6.
1741 Ibid., p. 7.
1742 Ibid., p. 7.
1743 Ibid., p. 7.
1744 Ibid., p. 8.

Government arrangements or agreements for the transfer of classified information required for the full feasibility study.'[1745]

It was a split decision on which option to pursue; Treasurer Keating (who would later challenge Hawke and eventually win the party leadership) had made sure his ministry's dissenting opinion was reflected in the Cabinet Minute;

> '[The Treasury Department] notes that the recommendation would effectively involve foregoing indefinitely the net economic benefits which might otherwise have resulted from any future development of uranium enrichment in Australia. Treasury considers that, while the Government should not become associated directly with this development, the Government should not now remove any possibility of this development proceeding on a commercial basis by refusing to enter into relevant Government-to-Government agreements. Treasure favours Option (b)[a continuation of the UEGA study].'[1746]

The majority in the Government decided to discontinue and informed UEGA formally that they no longer wished to facilitate the study and would not be negotiating relevant agreements with foreign Governments. Before making 'the advice given to UEGA' public, all the other parties involved in the study would be informed.[1747] Shortly after, the AAEC's research on uranium enrichment was wound down.[1748] How much the ALP Hawke Government sacrificed in terms of economic benefits and non-proliferation influence for Australia in order to stick to its principled anti-nuclear policies is unclear.

Several months later at the start of 1984, the Dutch MFA reviewed the situation in Australia in the context of assuming the JC chairmanship that year. In a note by DRW/AT, it was estimated that at the earliest, the question of domestic uranium enrichment in Australia would come up again three to four years from now and only after the Australians had resolved their stance on uranium mining. It was unclear what Urenco's market positions would be at that time, or what the market would look like; the possibility that the American Portsmouth plant (based on US centrifuge technology) would only be partially completed due to budgetary reasons meant that the world enrichment capacity would grow substantially less than previously assumed.[1749]

Urenco still had contacts with UEGA, as even though UEGA itself was about to be disbanded, DRW/AT was confident corporate contacts with the individual UEGA members would remain into the future. Concluded confidentiality agreements between UEGA and Urenco remained in force. DRW/AT judged that 'for the Troika/Urenco the only remaining course of action is to take a wait and see approach, to keep abreast of the situation in Australia and from time to time signal our [continued] interest.'[1750]

1745 Ibid., p. 8.
1746 Ibid., p. 6.
1747 Ibid., pp. 1-2, 9.
1748 Arthur, Ian, 'Nuclear Energy and Australia, Part 2', in *Newsletter of the Australian Society for History of Engineering and Technology*, Vol 8, No. 4 (October 2015) p. 7.
1749 ARC 124-8, p. 5.
1750 Ibid.

Case: Japan

Japan completed it's first cyclotron in 1937 (the first outside the United States) and during WWII, nuclear weapon pursuit was initiated in April 1941 with the *Ni-Go* project. Among other activities, *Ni-Go* pursued uranium enrichment by thermal diffusion at RIKEN's laboratories in Tokyo. In a separate project named *F-Go*, the Japanese navy developed centrifuge technology for uranium enrichment at Kyoto University. Neither project achieved notable success, although at RIKEN, Yoshio Nishina managed to complete a large cyclotron in 1944, which construction had started before the war with American help.[1751] Following the atomic bombing of Hiroshima and Nagasaki and the end of World War II for Japan shortly after, the US occupying authorities banned nuclear research for almost a decade. Domestically produced cyclotrons from the Institute of Physical and Chemical Research RIKEN and those from Kyoto and Osaka universities were dumped into the ocean by the American Occupation Force.[1752]

Following the 1951 Peace Treaty between Japan and the United States, academics expressed interest to restart nuclear research. After the occupation of Japan by American forces officially ended in 1952 (though American military bases remained) and stimulated by Eisenhower's Atoms for Peace speech and program, the Japan enacted the first post-war government budget to 'promote research on nuclear power for peaceful use only'.[1753] As early as 1953, University of Osaka's Professor Koreichi Ogata asked Kistemaker at FOM for the blueprints of the Dutch cyclotron.[1754] In 1954, Japan established the Japanese Atomic Energy Research Institute (JAERI), followed in 1955 by the Atomic Energy Basic Law (or Atomic Energy Basic Act), putting nuclear research in Japan on a permanent legal footing that guaranteed it to be peaceful, independent and transparent. Resulting from this was the establishment of the Atomic Energy Commission (AEC) on the 1st of January 1956.[1755] In addition it adopted the Law for the Regulations of Nuclear Source Material, Nuclear Fuel, Material and Reactors, which 'sets forth specific regulations for management and control of nuclear materials and

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1751 Japanese Atomic Bomb Project', Atomic Heritage Project, 25th of May 2016, http://www.atomicheritage.org/history/japanese-atomic-bomb-project, website checked 30-6-2017.

1752 Kimura, Motoharu, 'Reflections of a Japanese Physicist', in *Bulletin of Atomic Scientists*, Vol. 43, No. 9 (November 1987) pp. 7-8.

1753 Sugawara, Akira, 'Nuclear Power Development in Japan', Paper presented at regional seminar on nuclear energy for better life, Sofia, Bulgaria, 16-18 May 1994, INIS-MF-13971, http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/25/062/25062537.pdf?r=1, website checked 15-6-2017, p. 3.

1754 Whether this transfer took place is unknown, Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) p. 84.

1755 'Review and Analysis of Japan's efforts to Ensure Nuclear Non-proliferation', Presentation by Policy Research Office, Nuclear Nonproliferation Science and Technology Center, Japan Atomic Energy Agency, http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/25/062/25062537.pdf?r=1, website checked 15-6-2017, p. 9, Omoto, Akira, 'Japan's Nuclear Energy Development', Presentation IAEA NMS, June 2012, http://www.bioin.or.kr/fileDown.do?seq=17357, website checked 15-6-2017, p. 5, Japan Atomic Energy Commission website, About section, http://www.aec.go.jp/jicst/NC/about/index_e.htm, website checked 15-6-2017.

nuclear reactors to limit their uses only for peaceful purposes and for securing nuclear safety, and also for enforcing undertakings committed under international agreements.'[1756]

Cooperation agreements with the United States (1955), the United Kingdom (1958) and Canada (1959) followed soon after, with additional bilateral cooperation agreements concluded with France and Australia in 1972. As part of its first long-term program, the AEC in 1956 decided to import foreign nuclear technology to speed up its domestic program. In 1957, Japan's first research reactor, the light-water moderated and cooled JRR-1, achieved criticality, followed in 1960 by JRR-2, a heavy water moderated and cooled research reactor, both using foreign technology.[1757] The JRR-3 and JRR-4 research reactors came online in 1962 and 1965 respectively, Japan's first domestically produced reactors.[1758] The Japan Materials Testing Reactor (JMTR), a 50MW LWR, a research reactor built with a connected hot laboratory, came online in 1968.[1759]

Early on in its development program, in 1956, the Japanese AEC decided to develop nuclear power and sent an exploratory mission to witness the UK's Calder Hall reactor, the world's first NPP, go into operation. The mission considered the gas-cooled graphite-moderated Calder Hall-type a good fit for Japan, as well as the still experimental light-water NPP design. The AEC also made plans for development of a breeder reactor. In 1963, JAERI brought online the first nuclear power demonstration plant, the JPDR, a 12MW boiling-water reactor. The Tokai Power Station, a 166MW unit based on the Calder Hall reactor design started operations in 1966 and additional NPPs based on other designs did so in 1970 (Turuga Power Station Unit-1, a 357MW boiling-water reactor and Mihama Unit 1, a 340 MW pressured-water reactor) and 1971 (Fukushima Power Station 1, Unit 1, a boiling-water reactor with a 460 MW output).[1760] Japan's nuclear power infrastructure continued to rapidly expand during

1756 Haginoya, T., 'The National System of Safeguards: Experience in Japan', in *IAEA Bulletin*, Vol. 27, No. 2 (Summer, 1985) p. 19.

1757 'Review and Analysis of Japan's efforts to Ensure Nuclear Non-proliferation', Presentation by Policy Research Office, Nuclear Nonproliferation Science and Technology Center, Japan Atomic Energy Agency, http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/25/062/25062537.pdf?r=1, website checked 15-6-2017, p. 9, Sugawara, Akira, 'Nuclear Power Development in Japan', Paper presented at regional seminar on nuclear energy for better life, Sofia, Bulgaria, 16-18 May 1994, INIS-MF-13971, http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/25/062/25062537.pdf?r=1, website checked 15-6-2017, pp. 3-4.

1758 Sugawara, Akira, 'Nuclear Power Development in Japan', Paper presented at regional seminar on nuclear energy for better life, Sofia, Bulgaria, 16-18 May 1994, INIS-MF-13971, http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/25/062/25062537.pdf?r=1, website checked 15-6-2017, p. 3, Yamashita, Kiyonobu, 'History of Nuclear Technology Development in Japan', American Institute of Physics (AIP) Conference Proceedings 1659, 020003 (American Institute of Physics Publishing LLC: 2015) http://aip.scitation.org/doi/abs/10.1063/1.4916842, website checked 30-6-2017, pp. 2-3.

1759 Yamashita, Kiyonobu, 'History of Nuclear Technology Development in Japan', American Institute of Physics (AIP) Conference Proceedings 1659, 020003 (American Institute of Physics Publishing LLC: 2015) http://aip.scitation.org/doi/abs/10.1063/1.4916842, website checked 30-6-2017, p. 4.

1760 Sugawara, Akira, 'Nuclear Power Development in Japan', Paper presented at regional seminar on nuclear energy for better life, Sofia, Bulgaria, 16-18 May 1994, INIS-MF-13971, http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/25/062/25062537.pdf?r=1, website checked 15-6-2017, p. 4, Omoto, Akira, 'Japan's Nuclear Energy Development', Presentation IAEA NMS, June 2012, http://www.bioin.or.kr/fileDown.do?seq=17357, website checked 15-6-2017, pp. 5, 7.

the following decade, counting 23 NPPs by 1980 (41 NPPs by 1990), the Joyo fast breeder test reactor (1977), the Tokai Mura reprocessing plant (1977) and a pilot enrichment plant at Ningyo-Toge.[1761]

Japan became a member of the IAEA in 1956. It was subject to bilateral safeguards since 1955 (which it transferred to the IAEA in 1963) and was the first country to apply IAEA safeguards, in 1959 on its JRR-3. Japan signed the NPT in 1970, ratified it in 1976 and concluded the accompanying NPT safeguards agreement with the IAEA in 1977, replacing the 1963 agreement. Japan and was active in many of the safeguards related international forums such as SAGSI (The Standing Advisory Group on Safeguards Implementation) and HSP (Hexapartite Safeguards Project).[1762]

Enrichment in Japan

As mentioned above, uranium enrichment in Japan first began during World War II, at Yoshio Nishina's laboratory at RIKEN, '[b]ut American air raids in April 1945 destroyed two-thirds of RIKEN's buildings and facilities, including Nishina's [thermal diffusion] apparatus for enriching uranium, putting an end [to] the project.'[1763] Japan officials have reported that after an initial phase of theoretical work (dating from 1949) the post-war Japanese gas centrifuge program built its first machines in 1959.[1764]

From 1961 to 1967 under the Atomic Fuel corporation and then under the newly established PNC (Power Reactor and Nuclear Fuel Development Corporation), Japan worked on improving its centrifuges.[1765] From 1969, PNC requested multiple companies to commit to centrifuge research to increase research efficiency through competition.[1766] Also in 1969, the Japanese Atomic Energy Commission (JAEC) initiated research that over a three year period determined that between gaseous diffusion and centrifuge technology, the latter was the preferred enrichment technology for the Japanese fuel cycle.[1767] In January 1972 the Japanese Science and Technology ministry announced it had developed a usable centrifuge with

1761 'Review and Analysis of Japan's efforts to Ensure Nuclear Non-proliferation', Presentation by Policy Research Office, Nuclear Nonproliferation Science and Technology Center, Japan Atomic Energy Agency, http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/25/062/25062537.pdf?r=1, website checked 15-6-2017, p. 9

1762 Haginoya, T., 'The National System of Safeguards: Experience in Japan', in *IAEA Bulletin*, Vol. 27, No. 2 (Summer, 1985) p. 19. The late NPT ratification of Japan is better understood when seen in the context of the IAEA-EURATOM safeguards negotiation, see page 460.

1763 'The Riken Story', Riken website, About/History/Story section, http://www.riken.jp/en/about/history/story/, website checked 15-6-2017.

1764 ARC 124-7, p. 2, Watanabe, Takaaki, Takeo, Murase, 'Uranium Enrichment by Centrifuge in Japan', Presentation at International Conference on Nuclear Power and Its Fuel Cycle, Salzburg, Austria, 2-13 May 1977, IAEA-CN-36/160, p. 1.

1765 ARC 124-7, p. 2.

1766 Watanabe, Takaaki, Takeo, Murase, 'Uranium Enrichment by Centrifuge in Japan', Presentation at International Conference on Nuclear Power and Its Fuel Cycle, Salzburg, Austria, 2-13 May 1977, IAEA-CN-36/160, p. 7.

1767 ARC 124-7, p. 2. English in original. Also in 1969, Mitsubishi Heavy Industries Co. filed for two centrifuge technology patents in several European countries, the USSR and the US. See chapter 8, *Japan*, page 235.

promising potential.[1768] Subsequently a 'national project' to 'promote intensive R&D on [the] centrifuge process' was initiated that resulted in construction of a pilot plant in 1977 constructed by Ningyo-Toge Works that was fully operational by 1982 showing promising results.[1769]

Strategically the enrichment program was important to Japan. It was the first nuclear technology it had developed on its own, and besides a source of prestige, functioned as a political tool to signal its intentions with.[1770] With regards to the influence the US had over Japan's nuclear program,

> 'Japan's autonomous development of an enrichment capacity significantly weakens [American] control over Japan's nuclear fuel cycle since under a bilateral agreement the disposition of uranium enriched in the U.S. is under American veto constraints. For Japan, this was the main stumbling block in reaching an agreement with Canada on tightened safeguards since Japan was unwilling to accept a system of double Canadian and American safeguards on fuel mined in Canada but enriched in the U.S.'[1771]

Neither was Japan afraid to use the enrichment program to signal its attitude towards Carter's policies with regard to sensitive fuel cycle facilities. 'In the midst of the dispute over reprocessing in August 1977, [Power Reactor and Nuclear Fuel Development Corporation] Donen broke ground on the Ningyo Toge plant, a political gesture to inform the U.S. that Japan had no intention of deferring enrichment.'[1772]

> 'The projected completion date for the first pilot centrifuges was expected to be 1981, but has been moved forward to 1980 as a fait accompli when the INFCE issued its report on international enrichment policy. In a recent commentary, the Asahi Shimbun made the point that "few people [in the government and industry] think that the U.S. will have its own way over enrichment, as it did in the case of reprocessing. Unlike reprocessing ... the U.S. has no strong law to force restrictions on Japan.'[1773]

Research on uranium enrichment by chemical exchange process was started by the Asahi Chemical Industry Company in 1972. In September 1982, *Chemical Engineering* reported that the Japanese Asahi Chemical Industry company had sufficiently developed its process, called Asashi Chemical Exchange Process (ACEP), to warrant the construction of a demonstration plant. With government help, it was completed in May 1985 in Hyuga in Miyazaki prefecture. After preliminary tests, the plant achieved a reliable production of 3% uranium enrichment in 1988. According to the Asahi company the process was very proliferation secure as the process was not at all suitable to enrich uranium to a high grade.[1774]

1768 'Japan kan uranium verrijken', in *NRC Handelsblad*, 19th of January 1972, p. 1.
1769 ARC 124-7, p. 2-3.
1770 Gale, Roger, W., 'Nuclear Power and Japan's Proliferation Option', in *Asian Survey*, Vol. 18, No. 11, (November 1978) https://www.jstor.org/stable/pdf/2643296.pdf, website checked 15-6-2017, p. 1129.
1771 Ibid.
1772 Ibid.
1773 Ibid., p. 1130.
1774 ARC 124-1, Motohisa, Asano, Hatsuki Onitsuka, Kunihiko, Takeda, Tesuya, Miyake, 'ACEP semi-commercial plant constitution and equipment', Proceedings of the international symposium on isotope separation

Urenco and Japan

The first contact Urenco had in Japan were with the Japanese utilities and the Ministry of Industrial Trade and Industry when two representatives visited the country in 1974.[1775]

In the shadow of the 1974 American moratorium on nuclear fuel supply contracts, Japan was looking for enriched uranium to fuel its by then already sizable nuclear reactor fleet. Negotiations with American private companies had failed when the US Congress refused to license them to enrich uranium on a commercial basis.[1776] As a consequence and following another visit by Urenco representatives in early 1976, in December 1976 Urenco signaled it saw commercial opportunity in the Japanese market and requested the JC for a principal decision on whether supply to Japan could be allowed.[1777] The German and British representatives quickly consented.[1778] During the meeting, DRW reported, Dutch officials would not commit to not having objections and would take the matter to their minister, in response to which the other participants requested the Dutch officials to impress the minister with their wish for a quick decision on the matter.[1779]

Advising the Minister of Foreign Affairs, DRW set out the main considerations; Japan was 'very attractive commercially for Urenco', a member of the London Club and had ratified the NPT.[1780] It was inconceivable that if a common Troika export policy would be determined in the future that Japan would not fit whatever criteria would be set. DRW agreed with Urenco's representative(s) when they argued that a refusal of an export license to Japan would equal a lack of confidence in Urenco to operate on a responsible commercial basis. Urenco wondered if, when exports to Japan would face objections, any country at all could meet with approval for exports. DRW advised the minister to raise no objections and go along with Urenco's request. In DRW's opinion, 'it would leave a particularly bad impression on our partners if we *also* would make objections with regard to deliveries to Japan'.[1781] On the contrary, a positive decision would signal that the Netherlands was committed to the Troika and it would possibly improve the mood during future JC meetings.[1782] The mood had steadily worsened in recent months, concurrent with the developments in and the Dutch handling of the Brazil dossier, see *Case: Brazil*, page 312.

It can be assumed the Minister made no objections, as the next instance DRW reported on Japan (September 1977), it reported no substantial progress had been made by Urenco. Japan

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and chemical exchange uranium enrichment, Tokyo, Japan, 29 Oct - 1 Nov 1990 (Tokyo Institute of Technology: Tokyo 1992) https://inis.iaea.org/search/search.aspx?orig_q=RN:24053946, website checked 5-7-2018.

1775 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002), p. 98.

1776 ARC 51-5, p. 2.

1777 ARC 61-5, pp. 2-3.

1778 Ibid., p. 3.

1779 Ibid.

1780 Ibid.

1781 Ibid. Italics added.

1782 Ibid.

was developing its own ultra-centrifuge process and was committed to long-term supply contracts with the US. While it was unlikely the Japanese would be in the market for new supply soon, Urenco wanted to maintain regular contacts with Japan to make sure the French enrichment companies would not move in on this potential customer, at a time when Urenco was 'in danger of being completely dominated' by the French if they went ahead with their intention to build a second diffusion plant (Coredif).[1783] To aid that purpose, Urenco had contracted the Japanese trading house C.Itoh to consult and act as Urenco's permanent representation in Japan, which set up visits by representatives of the Japanese utilities to Almelo and Capenhurst.[1784]

It was possible that at some point Japan would want to diversify its supplies to reduce its dependency on the US. It was probable that Japan only had interest in Urenco's technology and know-how, but DRW reported the JC 'left no room for doubt' that at this time transfer of these was not an option.[1785] Urenco reported it was involved in merely 'exploratory talks' as it was still completely in the dark about Japanese intentions and that's what Minister Van Aardenne reported to Parliament when it asked about Urenco's contacts in Japan.[1786] DRW was aware of Australian-Japanese contacts however, and could not exclude the possibility the two countries would collaborate in the future.[1787] Between 1976 and 1978, Japan and Australia were conducting a study on a possible Australian enrichment plant that could supply Japan, see *Uranium Enrichment Research in Australia*, page 371.[1788]

Urenco was right to keep a close watch; Japan had decided to build up a stockpile of enriched uranium and to entertain offers. Urenco reported in November 1977 that it was 'in discussion with [Japanese] utilities for the delivery of 2500 tonnes as a fixed commitment between 1980 and 1990.'[1789] Eurodif and Urenco both made offers to supply Japanese utilities with a $ 275 million 'safety net' of enriched uranium supplies. Eurodif reportedly gave up its attempts to compete with Urenco early in 1978. Urenco made its a final offer in April of 1978, which included the novelty offer of delivery of a third of the required natural uranium for the

1783 ARC 61-10, p. 1. Urenco held several meetings with the French to assess future market requirements and attempted to persuade them to delay the construction of Coredif, Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002), p. 85.

1784 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002), p. 98.

1785 ARC 61-10, p. 1.

1786 ARC 61-10, p. 1, Tweede Kamer der Staten Generaal, Zitting 1977-1978, Aanhangsel, Nr. 584, 'Antwoord van Minister Van Aardenne (Economische Zaken)', 25th of January 1978, p. 1175.

1787 ARC 61-10, p. 2.

1788 Report, 'Australia's uranium - Greenhouse friendly fuel for an energy hungry world: A case study into the strategic importance of Australia's uranium resources for the Inquiry into developing Australia's non-fossil fuel energy industry', House of Representatives Standing Committee on Industry and Resources (The Parliament of the Commonwealth of Australia: Canberra 2006) http://www.aph.gov.au/Parliamentary_Business/Committees/House_of_Representatives_Committees?url=isr/uranium/report/fullreport.pdf, website checked 26-6-2017, p. 632.

1789 Letter, Chairman Urenco UK P. Jelinek-Fink to Atomic Energy Division, Department of Energy C. Herzig, 30th of December 1977, including paper 'Urenco contractual commitments and the need for decisions', (n.d., est. end of November 1977), 2.03.01/10859, p. 3.

enrichment services contract.[1790] In response to questions from PPR representative Leo Jansen, Minister Van Aardenne of Economic Affairs told Parliament that the Government did not find it necessary to consult with Parliament on possible deliveries to Japan.[1791]

Kehoe claimed Eurodif won a 1000tSW/a contract in Japan in 1978, and as part of the deal 'so the story went,' 'the French would lend the Mona Lisa from the Louvre in Paris to be exhibited in Japan for a year.' However the Mona Lisa was loaned to Japan in 1974 for two months, but the painting never returned to Japan. Kehoe also reported Urenco made a 'similar bulk offer involving a large downpayment, but this was not accepted by the Japanese.'[1792] It is likely that Eurodif won the contract instead, as Krass reported in 1983 that, '[c]urrently the Japanese enrichment demand is supplied through long-term contracts with the United States amounting to almost 70 000 t SWU in the period from 1979 to 2000' and '[a]nother contract has been signed with Eurodif for the supply of 10 000 t SWU between 1980 and 1989', roughly the same period for which Urenco had made its offer.[1793]

While the Troika's focus was on Australia, Japan was never far from consideration. By mid-1981, DRW/AT considered it to be likely that Australia would want to involve Japan in any possible collaboration with Urenco.[1794] Less than a year later, in the context of ongoing negotiations with Australia, DRW deemed it important to clarify 'Japanese ideas on collaboration with Australia on the subject of enrichment.'[1795] Although not overly optimistic about the prospects, DRW informed the Minister of Foreign Affairs it would attempt to gather more information on Japanese intentions via diplomatic channels and from the Troika partners.[1796] Meanwhile, the Australia JC Subgroup staffed with Troika officials was established to explore possible modalities of a collaboration with Australia so that 'the application of sensitive technologies preferably take place in a multilateral context' in line with INFCE conclusions.[1797]

When at the end of October 1983 the Labor Government in Australia blocked UEGA to proceed with its studies with Urenco, the latter wasted no time in moving its focus to the Japanese market. During a visit by Japanese Deputy Minister for Foreign Affairs Matsunaga, Dutch Minister for Foreign Trade Bolkestein communicated Urenco's ambitions to acquire a share of the Japanese market. Mr. Matsunaga took note and 'expressed understanding' at Urenco's wish to join French and American companies, which had already negotiated long-

1790 Ramsey, Douglas, 'Battle for $275m. Japanese uranium contract', in *Financial Times*, 2nd of May 1978.
1791 'Uranium zonder debat naar Japan', in *Het Vrije Volk*, 24th of August 1978.
1792 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002), p. 99, Nici, John, B., *Famous Works of Art and How They Got That Way* (Rowman & Littlefield: Lanham 2015) p. 99.
1793 Krass, Allen, et al, *Uranium Enrichment and Nuclear Weapons Proliferation* (Stockholm International Peace Research Institute, Taylor & Francis Ltd: London and New York 1983) https://www.sipri.org/sites/default/files/files/books/SIPRI83Krass/SIPRI83Krass.pdf, website checked 3-9-2018, p. 225.
1794 ARC 122-12, p. 5.
1795 ARC 123-18, p. 2.
1796 Ibid.
1797 ARC 122-12, p. 5.

term contracts on the Japanese market.[1798] He was aware Urenco's representatives were already in contact with Japanese utilities, notably the Kyushu Electric Power Company, which was in the process of constructing the Genkai-4 NPP. Mr. Matsunaga pledged that 'this matter would be subject to careful study.'[1799]

The Troika kept a close eye on Japan, exemplified by British officials from the Atomic Energy Division of the Department of Energy sharing a Japanese paper on Japan's enrichment program, picked up at the Pacific Basin Nuclear Conference of September, 1983, with Urenco (Mr. Rooke) and their Troika partners. The paper gave a good overview of Japanese efforts up to that point, and showed that its centrifuge program was in the pilot-plant phase and so far operating quite successfully (0,2% year failure rate, while the acceptable threshold had been set at 1%) and with a demonstration plant announced. This 200 tSWU/year demonstration plant would precede a commercial plant that was estimated to have a 1000 tSWU/a output by 1995 and a 3000 tSWU/a output by 2000. Japan also announced it had successfully re-enriched UF6 recovered from spent fuel in its Tokai reprocessing plant via its Ningyo-Toge conversion plant. The long-term contracts with the US and French utilities were mentioned, as well as the need to diversify supplies, a point the British drew attention to. A domestic capability, the paper said, 'is necessary for securing not only the steady supply of enriched uranium but the overall independence of [the] nuclear fuel cycle in Japan.'[1800]

Evaluating the progress made with regards to Japan in early 1984, officials concluded that Urenco was doing all it could to create inroads in the Japanese market but found it very challenging; '[a]lthough some Japanese institutions, as well as political figures are kindly disposed towards Urenco' it proved exceedingly difficult to acquire enrichment contracts there.[1801] Around the same time, Japan had adjusted downward its prognoses of nuclear power output. Continuation of Urenco's attempts to enter the market, backed by the Troika governments, would most likely not yield tangible results in the near future, it was feared.[1802]

SWUs for Technology

In 1984, Mikio Isetani, head of enrichment work at the PNC proposed the idea of an exchange of technical data on centrifuge technology, which Urenco's Inglis thought could help, 'raise Urenco's status with the Japanese utilities', even if it was on an unclassified basis.[1803]

An exchange of notes with the PNC for the duration twelve months was signed in September 1984, leading to visits from Urenco, BNFL and UCN to Japan's Ningyo Toge centrifuge plant in January 1985 and PNC officials visiting Capenhurst the following June. Another agreement towards centrifuge cooperation but this time with Japan Nuclear Fuel Industries Limited

1798 ARC 124-5, p. 1.
1799 Ibid.
1800 ARC 124-7, pp. 3-4. English in original.
1801 ARC 124-8, p. 7.
1802 Ibid.
1803 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002), p. 127.

(JNFI Ltd.) was enacted as an extension of the first, allowing the exploration to continue. During a visit by Urenco's Mr. Inglis to Japan in February 1986 Mr. Ohgaki, president of JNFI, launched the idea of 'SWU for Technology'; in which 'the Japanese utilities would ensure that a specific volume of business was concluded with Urenco, in return for which Urenco would supply technical information, including classified information, under suitable secrecy arrangements.'[1804]

In light of the above, Urenco communicated it's 'unwavering conviction' that the only avenue available to enter into business with Japan was to offer it a 'close cooperation in the area of enrichment in general'; a euphemistic way of requesting permission to offer ultra-centrifuge technology to Japan. DRW/AT officials wanted to inform themselves of the Troika partners' opinion and depending on their answer investigate the possibility further. Officials would prepare an internal note on this, which might eventually be shared with the JC.[1805]

Tangible progress remained absent until Dutch Prime Minister Lubbers decided to take an active role in promoting Urenco's interests with the Japanese. During the Tokyo Economic Summit Conference of 4-6 May 1986 PM Lubbers, present in his function as President of the European Council, 'brought to the attention of Prime Minister Nakasone the position of Urenco with regard to the Japanese enrichment market.'[1806] He subsequently sent a letter to the Japanese PM to follow-up on that conversation. With reference to their conversation back in the Akasaka Garden (at the Imperial Palace, Tokyo), PM Lubbers explained that 'after many talks between Urenco … and the relevant Japanese bodies and utilities' he felt that 'the time had come to request your personal attention for this matter.'[1807] Describing Urenco as 'a world leader in ultra-centrifuge enrichment technology' that would expand its lead into the future, he argued that it would be in Japan's interest to initiate a cooperation.[1808] Only thinly veiling an offer of technological cooperation, he continued by stating it was now necessary to define a mode of cooperation that 'takes account of the interests of both sides and which provides for Japan's wish to achieve a reasonable degree of self-sufficiency.'[1809] In closing, Lubbers asked Nakasone to make sure that 'the necessary talks … get under way.'[1810]

1804 Ibid. p. 128.
1805 ARC 124-8, p. 7.
1806 ARC 125-2, p. 1.
1807 Ibid.
1808 Ibid.
1809 Ibid., pp. 1-2.
1810 Ibid., p. 2.

Illustration 3:

Prime Minister Lubbers (front left) and Prime Minister Nakasone (front center) during the walk through the Akasaka Garden (at the Imperial Palace, Tokyo). In the background, among others (left to right), FRG Chancellor Helmut Kohl, UK Prime Minister Margaret Thatcher, US President Ronald Reagan - Tokyo Economic Summit Conference of 4-6 May 1986[1811]

Slightly less than a month later, in June 1986, the Dutch embassy in Tokyo reported that Lubbers's letter had had the desired effect. Ambassador Goedhart wrote to the ministries of Foreign Affairs and Economic Affairs that the intervention had gained Urenco 'a high level of prestige' and had been 'one of the reasons, if not the most important' that the Japanese had finally seriously listened to Urenco's proposals.[1812] To shore up this success, the Ambassador iterated that it was imperative 'for political effect' that Lubbers' letter would be followed up by that of his British and German colleagues.[1813]

Goedhart explained that in concordance with Japanese business customs, the initiation of a 'second phase' could be expected, which would establish a certain familiarity between the partners, without going into much detail, which had the purpose of creating a measure of consensus on the 'broad societal, political, economic and infrastructural consequences' of a possible collaboration.[1814] This would be a long draw-out process warned Goedhart, in which

1811 Photograph, 'Margaret Thatcher on the International Stage', *The Asahi Shimbun*, 5th of May 1986, http://www.gettyimages.com/license/166103032, website checked 2-8-2018.
1812 ARC 125- 3, p. 1.
1813 Ibid.
1814 Ibid.

anything that could jeopardize the rapprochement between the partners should be avoided. Only after this phase concluded would a third phase commence, in which the actual negotiations would take place and in which all the more challenging issues would be discussed.[1815]

From Ambassador Goedhart's missive, it becomes clear that Dutch officials had inquired, most likely in the JC, about the Japanese Government's ability to protect classified information should Urenco share it. Goedhart reported that according to the German and British ambassadors' experiences in Tokyo, the Japanese authorities had very effective indirect means to secure sensitive information. Goedhart strongly advised the MFA and MEA to not press this issue at this stage, as 'to raise the issue of tough-as-nails Japanese guarantees with regard to sensitive information would strike a deadly blow to the rapprochement between Urenco and Japan' and would seriously jeopardize the entire negotiation process.[1816] Mentioning security guarantees would be acceptable, but should only be raised in earnest in the third phase. Goedhart's advice was repeated several months later by Mr. Posthumus Meyjes, also from the Tokyo embassy.[1817]

Talks between Urenco and JNFI Ltd., 'which owns and operates Japan's domestic plants for enriching uranium ...', were initiated in the next few months. Urenco made a concept-offer that was warmly received.[1818] President of JNFI Mr. Ohgaki met with the managing director of Urenco Mr. Inglis in November 1986 to discuss how to proceed and Mr. Inglis conveyed this conversation to the Tokyo Embassy of the Netherlands. Mr. Ohgaki was 'very impressed' with Urenco's activities, results and its offer and was in the process of internally building a pro-Urenco consensus with the Japanese electricity utilities.[1819] He proposed continuation on the basis of a two phased-structure, with a first phase in which non-sensitive technology transfer could take place alongside a small order of 150 million British pounds (around $ 214.5 million) worth of enrichment services.[1820] The second phase would involve larger orders and sensitive technology transfer during a three to four year negotiating period.[1821]

As the discussion between Mr. Ohgaki and Mr. Inglis turned to market access, the former explained the Japanese situation. Contractually, long-term commitments with the US could only be reduced in favor of Japan's domestic enrichment program, not of foreign competitors. Considering it was unlikely that the commitments to French utilities would be reduced in favor of Urenco, only future market share, in the form of 'non-allocated stations' such as the Genkai 4 NPP on Kyushu, was expected to be available.[1822]

1815 Ibid., pp. 1-2.
1816 Ibid., p. 2.
1817 Ibid., ARC 125-4, p. 2.
1818 ARC 125-5, p. 1, English in original, ARC 125-4, p. 1.
1819 ARC 125-4, p. 1.
1820 Ibid., 'United Kingdom – Spot Exchange Rate, $US/Pound Sterling', 14th of November 1986, Historical Data, H.10 Foreign Exchange Rates, Federal Reserve Statistical Release (United States Federal Reserve Bank) https://www.federalreserve.gov/releases/h10/hist/dat89_uk.htm, website checked 31-8-2018.
1821 ARC 125-4, p. 1.
1822 Ibid.

Negotiations failed to move unto the next phase; possibly under American pressure, the Japanese backed away from the 'direct link between provision of technology and enrichment contracts' amid delays in the Japanese nuclear program for the business 'Ohgaki had envisaged Urenco could secure in Japan'.[1823] DRW officials reported by the end of March 1987 that due to 'negative developments of the Japan-dossier' no further action was required.[1824] At a meeting of the JC Subgroup on Security and Classification Matters, discussion point 'classification matters in the context of UC-technology transfer to Japan' was taken off the agenda and indefinitely deferred.[1825] Urenco did finalize an agreement with JNFI in April 1987 to assist its enrichment program with more general, non-classified help on 'safety and environmental matters, the physical protection of nuclear materials, and plant management questions' which led to additional meetings that year and the next.[1826]

In November 1987, Japan and the US signed a major nuclear deal for the supply of 'uranium and uranium-enrichment supplies and services' with a duration of 30 years. The deal, 'worth $250 million in 1988 alone, and could amount to as much as $1 billion per year in the next decade' gave Japan consent for the reprocessing of the included fuel, which led to considerable congressional protests.[1827] On the deal's rationale,

> '… the [US] administration contended the pact would increase U.S. control over Japan's use of plutonium. "If we do not have this kind of agreement, the Japanese will simply go elsewhere to buy their enriched uranium," said Fred McGoldrick, director of the State Department's Office of Non-Proliferation and Export Policy. "That not only has commercial implications — we would lose export revenues — it means we do not have the non-proliferation controls and influence that we have in this agreement."'[1828]

Up to 1992, the French and Americans reportedly remained the only suppliers of enriched uranium in Japan, which was the year Urenco finally brokered a contract with Tokyo Electric Power Company worth 300 million dollars, for the supply of enriched uranium for two new Japanese NPPs, 'Kashiwazaki 3 and 6 BWRs between 1996 and 2005.'[1829] Urenco, around the

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1823 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002), p. 128.
1824 ARC 125-10, p. 2.
1825 Ibid.
1826 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002), p. 128.
1827 'U.S.-Japan Nuclear Pact', in *CQ Almanac 1988*, 44th edition (Washington, DC: Congressional Quarterly 1989) pp. 548-49, http://library.cqpress.com/cqalmanac/cqal88-1142515, website checked 8-4-2017 (cached version).
1828 Ibid.
1829 Cramb, Gordon, Cookson, Clive, 'Urenco enters Japanese Market', in *Financial Times*, 28th of July 1992, 'Urenco breekt met contract van 500 mln door in Japan', in *NRC Handelsblad*, 28th of July 1992, https://www.nrc.nl/nieuws/1992/07/28/urenco-breekt-met-contract-van-500-mln-door-in-japan-7151106-a857373, website checked 30-6-2017, McMillan, M.,J., Silver, J.,M., 'Nuclear Developments in the Asia and Pacific Region', INIS-mf—13707 (Australian Nuclear Science and Technology Organization: July 1993) http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/24/067/24067579.pdf, website checked 30-6-2017, p. 20.

same time, also obtained a trial contract for the re-enrichment of 150 tonnes of reprocessed uranium from the Kansai PWR.[1830]

Cases: Iraq, Libya and Israel

Late in the second half of 1976 a number of countries appeared on Urenco's radar and the company asked the Troika for a Joint Committee judgment. The British representative in the JC rejected possible deliveries to Iraq, Libya and Israel. The Dutch delegation said that 'under the current political circumstances' the Dutch would 'doubtlessly resist the conclusion of contracts' with the three countries.[1831] The German representative also expressed a negative advice for these countries but wanted to 'at the appropriate time reconsider deliveries to Israel' pending the outcome of Israeli-American talks on nuclear transfers.[1832]

By 1970 the US Government had been assuming for two years that Israel possessed nuclear weapons or had the means to assemble these quickly, *the New York Times* had reported. Israel was suspected of having used a secretly constructed French-supplied research reactor and reprocessing facility at Dimona to acquire plutonium for a nuclear weapons program. France and Israel had developed nuclear relations as early as the late 1940s, signing a cooperation agreement in 1954 and agreeing to the supply of a large research reactor in 1956. *The New York Times*-article also cited multiple instances of Israel's attempts to acquire delivery vehicles for nuclear weapons, such as ballistic missiles and specialized fighter jets.[1833] Under pressure from the US Kennedy Administration, Israel had allowed only a cursory visit by American scientists in the early 1960s during Dimona's construction but subsequent requests for visits by US officials were rebuffed. By 1974, US Secretary of State Kissinger treated Israel's nuclear deterrent as a certainty.[1834] Near the end of 1974, Israel's President Ephraeim Katzir stated that it had always been intended to potentially prepare for acquiring a nuclear weapons capability, to defend Israel with all possible means.[1835]

The Dutch representative to the JC reported to the MFA that it was his impression that the Germans had not yet made up their mind about deliveries to Iraq.[1836] Iraq (under control of the

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1830 McMillan, M.,J., Silver, J.,M., 'Nuclear Developments in the Asia and Pacific Region', INIS-mf—13707 (Australian Nuclear Science and Technology Organization: July 1993) http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/24/067/24067579.pdf, website checked 30-6-2017, p. 20.

1831 ARC 61-5, p. 2.

1832 Ibid.

1833 Smith, Hedrick, 'US Assumes The Israelis Have A Bomb Or Its Parts', in *The New York Times*, 18th of July 1970, 'Buitenlands overzicht: Heeft Israel kernwapens?', in *Nederlands Dagblad*, 23th of July 1970, p. 2, Schneider, Mycle, 'Nuclear France Abroad: History, Status and Prospects of French Nuclear Activities in Foreign Countries', Report by Mycle Schneider Consulting (Paris: May 2009) p. 15.

1834 Keefer, Edward, C., Ahlberg, Kristin, L., Wieland, Alexander (eds.), *Foreign Relations of the United States, 1969-1976, Vol. XXXVIII, Part 1: Foundations of Foreign Policy, 1973-1976* (United States Government Printing Office: Washington D.C. 2012) p. 104, Jabber, Fuad, A., 'Israel's Nuclear Options', in *Journal of Palestine Studies*, Vol. 1, No. 1 (Autumn 1971) p. 33.

1835 'Israël verkiest stilte over atoombommen', in *NRC Handelsblad*, 28th of January 1978, p. 5.

1836 ARC 61-5, p. 2.

Baath regime since that party's coup in 1968) operated a Soviet-supplied IRT-5000 2 MW research reactor since 1967, had signed and ratified the NPT by the end of 1969, and had accepted IAEA safeguards by 1972. France had signed a nuclear cooperation agreement with Iraq's Saddam Hussein, then chief of the Iraqi nuclear program, in 1973. Following negotiations with France during 1974-1976, and even though Saddam Hussein told a Lebanese newspaper that the French reactors had the purpose of furthering the Iraqi nuclear weapon project, the countries concluded a contract under which ' The French [agreed] to supply a 40MWth MTR reactor … , a zero-power reactor … , a materials testing hot laboratory … , workshops, and a radioactive waste treatment station'.[1837] In 1981, Israel bombed the French-built Osirak reactor before it assumed operations.[1838]

Libya, since the coup by Muammar Gaddafi in 1969, had quickly turned itself away from the West, which had supported the previous monarchical regime. In the period following the Yom Kippur war between Arab states and Israel, it had nationalized banks and its oil industry, ex-appropriating assets from several Western companies. It had concluded a nuclear cooperation agreement with the Soviet Union in 1975 that included the supply of a research reactor. It had unsuccessfully sought nuclear power reactors from the United States and France and had tried to purchase calutrons from the latter in 1973. Following an imminent deal between France and Libya for the supply of a research reactor in early 1976, international concern over Libya's intentions and increasing US pressure on France over its nuclear export policies led to the cancellation of the deal, even though Libya had ratified the NPT in 1975. Hints by Gaddafi himself that Libya wanted to acquire nuclear weapons and statements that called upon the Arab world to become nuclear armed did little to alleviate suspicions.[1839]

After the JC meeting, Urenco representatives were told that permission could not be granted for these countries, and '"not to pursue its activities with regards to these countries"'. At West-German request, it was added that these countries remained '"under consideration"' for enrichment services, but that these cases would require ministerial level approval going

1837 'Iraq Nuclear Chronology', Nuclear Threat Initiative, http://www.nti.org/media/pdfs/iraq_nuclear.pdf?_=1316466791, last updated February 2009, website checked 3-7-2017, pp. 61-63, 65, Schneider, Mycle, 'Nuclear France Abroad: History, Status and Prospects of French Nuclear Activities in Foreign Countries', Report by Mycle Schneider Consulting (Paris: May 2009) p. 16.

1838 Israel bombed the reactor fearing it would be used in a nuclear weapons program. The bombing caused a shift in the Iraqi nuclear program, moving from the creation of a latent capability to a covert program of 'developing a uranium enrichment capability at undeclared facilities.', 'Iraq: Nuclear', Nuclear Threat Initiative, http://www.nti.org/learn/countries/iraq/nuclear/, last updated July 2015, website checked 3-7-2018. On the Iraqi use of calutrons in its covert enrichment program, also see Chapter 7, *The Smyth Report*, page 193.

1839 'Libya Nuclear Chronology', Nuclear Threat Initiative, http://www.nti.org/media/pdfs/libya_nuclear.pdf?_=1316466791, website checked 4-7-2017, pp. 51-52, Fitzpatrick, Mark (ed.), *Nuclear Programmes in the Middle East: in the shadow of Iran*, IISS Strategic Dossier series (The International Institute for Strategic Studies: London 2008) p. 98, 'Frankrijk levert Libië toch een kerncentrale', in *Nederlands Dagblad*, 24th of March 1976, p. 3, 'Parijs stopt voorlopig export van nucleaire opwerkingsfabrieken', in *NRC Handelsblad*, 17th of December 1976, p. 1, 'Zorgen over handel in kern-technologie: Aantal landen dat kernwapen kan maken neemt snel toe', in *Nieuwsblad van het Noorden*, 2nd of July 1975, p. 9. An article in the New Scientists by Judith Perera states that France lost the 1976 contract when it refused to supply Libya with a heavy water production plant and nuclear research facilities (although the article mentions a power reactor), and that a 1974 deal with the FRG for a heavy water plant was also aborted. Perara dates the attempted calutron purchase to 1971, Perera, Judith, 'Libya's Long March to Nuclear Power', in *New Scientist*, 29th of November 1984.

forward.[1840] Supply to each of these countries appeared to include considerable political risk or sensitivity, better avoided during this early commercial period of Urenco.

Cases: Spain, Iran

Spain had started its nuclear power program in the 1960s, with three turnkey reactor projects (a PWR, BWR and GCR – Gas Cooled Reactor) starting construction in 1964, 1966 and 1968 respectively. It settled on the PWR type and started construction of a second generation of power plants in the first half of the 1970s.[1841]

In 1977, Urenco wanted to conduct a market exploration in Spain as the country was constructing its second generation of reactors. Urenco expressed its awareness that since Spain was not party to the NPT, approval from the Troika governments was required and the appropriate safeguards would have to be negotiated if it ever needed to conclude a contract there. Spain had been a member of the Eurodif study group and became a member of its enrichment consortium in 1974, of which it owned a 11.1% stake. Spain contracted all the enrichment services it needed to fuel its reactor fleet from Eurodif.[1842]

Iran came up for discussion in 1977 because in the past it had shown an interest in participating financially in Urenco. Although Iran was party to the NPT, both Urenco and the JC were 'hesitant' towards this notion, considering Iran's financial participation in Eurodif which has proven to be quite problematic, and which problems had not yet been resolved at this time.[1843] Iran had taken over the 10% Swedish share in Eurodif when that country decided to discontinue its participation in the project in 1974.[1844] An Eurodif-majority second consortium for enrichment services called Coredif featured France and Iran as the other (minority) shareholders.[1845]

After the 1979 Iranian revolution and the US embassy hostage crisis that followed, its relationship with France and other Western countries became strained and its participation in Eurodif was in question, with the Islamic Republic leadership refusing to pay for its share of

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1840 ARC 61-5, p. 2. English in original.

1841 'Nuclear Power in Spain', World Nuclear Association, http://www.world-nuclear.org/information-library/country-profiles/countries-o-s/spain.aspx, updated June 2017, website checked 4-7-2017, Jiménez, Antonio, González, 'Nuclear generation of the electrical energy markets in Spain', Presentation at Ukranian Nuclear Forum Association, Kiev 2nd of July 2013, pp. 4-5.

1842 ARC 61-10, p. 2.

1843 Ibid.

1844 Report, 'Low Enriched Uranium from France', 731-TA-909 (Review), Publication 3967, U.S. Trade Commission (December 2007) p. IV-7.

1845 Levin, S.,A., Blumkin, S., 'Enrichment supply and technology outside the United States', K/OA-3094, Presentation American Nuclear Society Executive Conference on Uranium Fuel Supply, Monterey (CA), 26th of January 1977, https://fas.org/programs/ssp/nukes/fuelcycle/Documents/EnrichmentSupply77.pdf, website checked 6-9-2018, p. 4.

contracted SWU from Eurodif when under the Shah.[1846] Further contacts with Urenco remained absent.

Case: Indonesia

Indonesia concluded nuclear cooperation agreements with both the US and USSR in 1960. From the US, under Atoms for Peace, it received a TRIGA Mark II research reactor and accompanying LEU fuel load. The reactor was located at the Bandung Nuclear Complex, started operations in 1964 and was upgraded to 1 MW in 1971. The USSR in 1965 supplied equipment and materials for a 1-2 MWt research reactor for a facility at Serpong, which was never built and abandoned in 1971, and a sub-critical facility at Yogyakarta, which was.

After China's first nuclear weapon test in 1964 a high-ranking Indonesian officer and in 1965 General Sukarno, then leader of Indonesia, publicly spoke about acquiring nuclear weapons. Indonesian and Chinese officials started discussing nuclear (weapons) cooperation in the course of 1965, with intelligence of a Chinese weapon test on an Indonesian island (possibly to be presented as an Indonesian weapon test) scheduled to take place in October 1965 finding its way to American and Australian officials.[1847] Following the abortive coup by the September 30 Movement in early October 1965 and the events that followed, which resulted over the course of 1965-1966 in the decline of Sukarno's position and the rise to power of General Suharto amid a anti-Communist purge in which, according to estimates, at least 500.000 people were killed, the Indonesian-Chinese nuclear rapprochement ended. Suharto allowed IAEA safeguards on all nuclear sensitive materials and equipment in the country in 1967 (Indonesian leadership having already accepted them in principle in 1965 on US insistence), alleviating the international concerns raised under Sukarno. Indonesia signed the NPT in 1970 but ratified the treaty only in 1979.[1848]

As a potential customer for Urenco Indonesia came to the Dutch MFA's attention in the context of a German offer to provide Indonesia with a nuclear reactor package. The issue first came up in a DRW/AT memo dated 16 March 1981 to which Minister Van der Klaauw 'had responded positively', suggesting a 'go-ahead' for Urenco involvement in the German-Indonesian deal.[1849] In a later memo, Indonesia's ascension to the NPT is mentioned as the 'decisive' factor when positively assessing its suitability as an Urenco customer.[1850] The

1846 Albright, David, Hibbs, Mark, 'Spotlight shifts to Iran', in *Bulletin of Atomic Scientists*, Vol. 48, No. 2 (March 1992) p. 10.

1847 'Indonesia's Atomic Plans' ', No. 71, Secret, Record by Starey of conversation with Seki', Jakarta, 2nd August 1965, in Reynolds, Wayne, Lee, David (eds.), *Australia and the Nuclear Non-Proliferation Treaty, 1945–1974*, Documents on Australian Foreign Policy series, Australian Department of Foreign Affairs and Trade (Commonwealth of Australia: 2013) pp. 108-109, Cornejo, Robert, M., 'When Sukarno Sought the Bomb: Indonesian Nuclear Aspirations in the Mid-1960s', in *The Nonproliferation Review*, Vol 7, No. 2 (Summer 2000) pp. 34-35.

1848 Roosa, John, *Pretext for Mass Murder: The September 30th Movement and Suharto's Coup D'état in Indonesia* (The University of Wisconsin Press: Madison 2006) pp. 24-27. Fitzpatrick, Mark (ed.), *Preventing Nuclear Dangers in Southeast Asia and Australasia*, IISS Strategic Dossier series (The International Institute for Strategic Studies: London 2009) pp. 61-64, 76.

1849 ARC 122-7, p. 1, ARC 122-12, p. 7.

1850 ARC 122-12, p. 7.

Nuclear Suppliers Guidelines and the client-requirements set out in the Troika interim-export policy are also referred to.[1851]

When the Dutch Ambassador in Jakarta reported on a conversation with a high Indonesian official, Minister Van der Klaauw had to involve himself. Professor Baiguni, Director-General of the Indonesian nuclear authority BATAN had brought up details of a possible service by Urenco with the Dutch ambassador. Professor Baiguni was under the impression that '"Almelo was willing to supply 20% enriched uranium"' and that the Professor had received some sort of '"guarantee"' on the supply by Urenco. Seeing that the Professor so far only had had contacts with Urenco employees, Minister Van der Klaauw assessed that this perception could be explained by Urenco's staff assumption that supply to Indonesian would be able to proceed.[1852] Van der Klaauw further explained that at this time, 'considering the delicate nature of this matter' no action should be undertaken as long as there remained a lack of clarity on 'how the internal political situation concerning Dutch participation in the cooperation related to the Treaty of Almelo would develop.'[1853] At the start of June 1981, the Minister instructed the Ambassador in Jakarta to take no active role, but to keep the MFA informed of any other information he might receive on the matter.[1854]

Van der Klaauw's caution can be explained by a variety of factors. Elections had just taken place in the Netherlands in May, it was a year of continuing anti-nuclear protests and Urenco was weeks away from receiving a license for its expansion and the construction of the SP4 plant at the Almelo site. The license application was facing strong societal and political opposition. A decision on the future of nuclear energy in the Netherlands had not been made yet and was pending the outcome of the Broad Societal Discussion, which critics argued should come prior to any decision on Almelo.[1855] Another possible reason particular to the Indonesian request could be that his colleague Minister van Aardenne had in a parliamentary debate in April declared, in response to a question from PvdA member Zijlstra, that Urenco did not supply customers with highly enriched uranium (which is classified as 20% or more enriched in U235).[1856]

Indonesian misconceptions about Urenco remained though. In a letter to Ambassador Van Gorkom in Jakarta, Professor Baiquni informed him that Indonesia, 'does not want to make use of the Dutch offer for enriched uranium' as it would do business with the German Nukem company instead, unaware that 'in both cases it concerns the Urenco offer.'[1857] Reporting on the matter to the incoming Minister of Foreign Affairs an official from DRW wondered how Urenco would manage to supply uranium for a research reactor, seeing the lowest possible

1851 ARC 124-2, p. 2. On the Troika interim-export policy, see *An Interim Export Policy*, page 351.
1852 ARC 122-7, p. 1.
1853 Ibid.
1854 Ibid.
1855 'Urenco: vergunning voor SP4', De geschiedenis van kernenergie in Nederland, http://www.kernenergieinnederland.nl/node/223, website checked 4-7-2017. See *Anti-nuclear Energy Protests and a National Debate*, page 360.
1856 Tweede Kamer der Staten Generaal, Handelingen Tweede Kamer, Zitting 1980-1981, 29th of April 1981, pp. 4833, 4836.
1857 ARC 123-18, p. 3.

enrichment for this type of reactor was 19%. Urenco only had a license for enrichment up to 10%, and it would need to physically alter its cascade setup to be able to enrich to 19%. Doing so 'would not make sense in relation to the commercial benefits' of this contract. The Netherlands nevertheless supported a possible deal out of non-proliferation considerations, the DRW official explained.[1858] The Ambassador in Jakarta would be thoroughly briefed on the Indonesian contract, so he could 'eliminate all outstanding misconceptions' and the MFA would inquire with Urenco and the British how they intended to produce 19% enriched uranium.[1859]

In January 1984, DRW reported that a possible deal with Indonesia was not going to materialize any time soon.[1860]

Case: Egypt

In 1955, Egypt's President Nasser established the Atomic Energy Establishment (AEE, which included the Egyptian Board of Atomic Energy and the Egyptian Atomic Energy Authority (AEA)), the same year it cultivated its first international contacts during and following the 1955 Geneva Atoms for Peace conference. Contacts with the US and the Soviet Union resulted in the former constructing a radioisotope laboratory at Egypt's nuclear center at Inshas (operational in 1962), and the latter constructing Egypt's first research reactor ETTR-1, a 2 MWt LWR that started operations in 1961 at the same site. The required 10% enriched uranium fuel was supplied by the Soviet Union on a take-back basis. In the 1960s, Egypt developed its nuclear human infrastructure and gained experience with medical isotopes, heavy water and reprocessing.[1861]

Egypt unsuccessfully approached the Soviet Union, Germany and the US for a large reactor and then launched a tender with the help of the IAEA for a 150 MW nuclear desalination plant in 1964, which was won by FRG's Siemens, but was canceled over political differences. Westinghouse took over the contract but when the US refused Egypt's request for $ 100 million in financing, the project was stopped. A 1970 attempt to revive the project with Libyan assistance, and one from 1974 to 1976 with American help (following a tender that Westinghouse won) led to nothing. The project with Westinghouse failed because Egypt would not accept American conditions on the arrangements for spent fuel from the reactor (which had become more strict following India's 1974 test), raising concerns about Egypt's intentions.[1862]

Israel's activities at Dimona had caused consecutive Egyptian presidents Nasser, Sadat en Mubarak to warn that Egypt would obtain nuclear weapons if Israel did. However the country never had a sophisticated and dedicated nuclear weapons program, although under Nasser the

1858 Ibid.
1859 Ibid.
1860 ARC 124-8, p. 4.
1861 Fitzpatrick, Mark (ed.), *Preventing Nuclear Dangers in Southeast Asia and Australasia*, IISS Strategic Dossier series (The International Institute for Strategic Studies: London 2009) pp. 18-19, 21, 26.
1862 Ibid., pp. 19-21.

pursuit of particular nuclear infrastructure was planned so Egypt could keep its options open. Nasser sought reprocessing technology from India, heavy water technology from the Soviet Union and nuclear weapons from China and the Soviet Union, but was turned down by all. Egypt also made a proposal for a pan-Arabian nuclear weapon capability under its leadership, but nothing came of it. After the (for Egypt disastrous) 1967 Six-Day War with Israel, investments in the nuclear program were put on hold and prompted by earlier Soviet advice, Egypt signed the NPT in 1968. Egypt 'delayed ratifying the NPT as leverage in arms reduction negotiations in the Middle East' but eventually ratified it in 1981.[1863]

Following the Yom Kippur War in 1973, Egypt expanded its nuclear cooperation, signing agreements with France for an upgrade to the ETTR-1 and the Soviet Union for a 460 MW NPP that never materialized. For its pursuit of nuclear energy, it created the Nuclear Power Plant Authority (NPPA) in 1976. After the conclusion of a peace treaty with Israel in 1979, Egypt's relationships with Western countries improved and the US subsequently raised its financial and military aid to Egypt and the country approached the UK, France and the US to supply it with power reactors as part of an ambitious NPPA plan 'to build eight 1,000 Mwe power plants before 2000'.[1864] France and Egypt signed a letter of intent on nuclear development in February 1981 for the construction of two nuclear plants worth around 2 billion dollars.[1865] When Egypt ratified the NPT in February 1981 (an IAEA safeguards agreement followed the next year), this prompted the US to sell nuclear plants to the country, concluding an agreement the following March for up to two nuclear power reactors and accompanying fuel. West-Germany's KWU now also entered the commercial fray.[1866] In October 1981, the FRG and Egypt signed an accord for cooperation in nuclear research and development, 'opening the way for German participation in the construction of two nuclear reactors in Egypt'.[1867]

Urenco and Egypt

These reactor deals with Egypt were package deals that included fuel services. In that context the FRG in mid-1981 sought a short term assurance from its Troika partners that Urenco services could be included in the offer KWU would make to Egypt. Considering Egypt's NPT ratification earlier that year and the lack of US qualms to make nuclear transfers to Egypt, 'the current transaction should be a routine matter to the UC-Joint Committee', but the political

1863 Ibid., pp. 17-22, Bahgat, Gawdat, 'Nuclear Proliferation: Egypt', in *Middle Eastern Studies*, Vol. 43, No. 3 (May, 2007) p. 413.

1864 Fitzpatrick, Mark (ed.), *Preventing Nuclear Dangers in Southeast Asia and Australasia*, IISS Strategic Dossier series (The International Institute for Strategic Studies: London 2009) pp. 20-22,

1865 ARC 122-8, p. 1, Matthews, Roger, 'Egypt wants to buy two UK nuclear power stations', in *Financial Times*, 18th of February, 1981, 'French Nuclear Aid to Egypt', in *Daily Telegraph*, 13th of February 1981, Matthews, Roger, 'Egypt may buy British N-plants', in *Financial Times*, 18th of February 1981.

1866 McDermott, Anthony, 'Egypt and U.S. initial nuclear plants accord', in *Financial Times*, 23th of March 1981.

1867 'Nuclear Akkoord', in *De Volkskrant*, 27th of October 1981, Fitzpatrick, Mark (ed.), *Preventing Nuclear Dangers in Southeast Asia and Australasia*, IISS Strategic Dossier series (The International Institute for Strategic Studies: London 2009) pp. 21-22.

climate in the Netherlands meant that an unqualified decision of agreement by the Dutch representation could incur considerable criticism.[1868] DRW/AT advised their Minister to, considering the need for a quick decision, instead to provide a declaration of no objection, with a caveat that the incoming Government could take a different view; not so much as to the transaction under consideration, but as to the continuation of the entire Troika collaboration. At the same time, DRW/AT reminded the Minister that only recently he and the Minister of Economic Affairs had informed the Parliamentary Select Committee for Nuclear Energy that they had no intention of leaving the Troika collaboration. Moreover, considering that the Troika had so far required a not-so-intrusive regime of safeguards (full scope safeguards) from new clients, and Egypt had committed to the comparably more stringent NPT membership requirement, it would not be appropriate to refuse Urenco's services to Egypt. In a written comment below this DRW advice, the Minister reminded his officials that conform the interim-export policy of the Troika, 'consideration needs to be given to the situation in certain countries (for example, Libya), even if all remaining non-proliferation requirements are satisfied.'[1869] As to Egypt, continued the Minister, 'it's applicable that this country lies in a region, where tension reigns.'[1870]

By April 1982, the incoming Dutch Government had given the 'green light' for a contract with Egypt.[1871] It appeared Framatom's offer of nuclear reactors and accompanying fuel had been successful in securing the bid for the first two reactors for Egypt, but a second tender for two more units was being prepared by a Swiss consultancy firm.[1872] In May 1982, the US State Department announced that pending approval by the Egyptian Parliament, the US had secured enriched uranium contracts for the planned nuclear program, worth 1,5 billion dollars.[1873] Reactor contracts were secured by Canada, France, the US and the FRG, but by October 1984, it was clear that an Urenco contract with Egypt was not possible and wouldn't be in the near future as the country suffered from a lack of liquid assets and credits and was forced to downscale its nuclear program plans.[1874]

Case: Yugoslavia

Yugoslavia had started building a nuclear research infrastructure as early as 1948, establishing a nuclear research center in Vinča and a Nuclear Raw Materials Institute in Belgrade. Uranium ore was first discovered in Yugoslavia in 1949. Early in the same year, Yugoslavian officials privately discussed the acquisition of a nuclear weapon. The Rujer Boskovic Institute was established near Zagreb in 1950 and it started construction of a cyclotron in 1952.[1875] The

1868 ARC 122-8, p. 1, 122-12, p. 7.
1869 ARC 122-8, p. 1.
1870 Ibid.
1871 ARC 123-18, p. 2.
1872 'Egypt picks Motor-Columbus as consultant on nuclear power program', in *Nucleonics Week*, Vol 23, No. 12, 25th of March 1982.
1873 'Uranium VS voor Egypte', in *Trouw*, 21st of May 1982.
1874 ARC 124-8, p. 4, Botje, Harm, 'Egypte moet kernenergieplan bijstellen', in *NRC Handelsblad*, 30th of October 1984.

heavy investment and the types of nuclear activities Yugoslavia pursued left no doubt in a US 1954 report that Yugoslavia was pursuing nuclear weapon production capability.[1876]

Even before President Eisenhower's administration launched Atoms for Peace, the US attempted to draw Yugoslavia into the Western alliance using nuclear inducements. Denial of Yugoslavia to the Soviet Union sphere of influence was a US strategic objective in Eastern Europe. In 1951, it 'arranged' for Yugoslavia to become one of the founding members of the CERN research institute.[1877] Under Atoms for Peace, Yugoslavia received nuclear assistance from the US, Norway, France and the UK.

The Soviet Union, eager to restore good relations with Tito's Yugoslavia after Stalin had banned it from the Comintern (the Soviet-led organization of Communist countries) in 1948, and determined to counter the goodwill offensive from the Western countries, agreed in 1956 to supply Yugoslavia with a 6,5 to 10 MW research reactor. The reactor, using heavy water as moderator and coolant, constructed at Vinča, started operations in 1959 and used 2% enriched fuel until 1976, when it started using 80% enriched uranium dioxide fuel. In a collaborative project, Soviet and Yugoslavian scientists and engineers also built a zero power reactor, using heavy water and natural uranium, later converted to a 1-50 W experimental mode that went critical in 1958.[1878] Possibly because of the eased tensions and perceived reduction of the Soviet threat, Yugoslavia's leader Tito directed the nuclear weapons development program to be put on hold in the early 1960s.[1879]

Contacts were established with Norway in 1952, leading to an exchange program for nuclear scientists that same year, an aborted contract for heavy water and a 'close research collaboration with Norwegian counterparts, particularly in the area of plutonium reprocessing.'[1880] An exchange also took place between Dutch and Yugoslavian scientists in 1954.[1881] A spent fuel reprocessing department was established at Vinča in 1956. Yugoslavia

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1875 'Yugoslavia Nuclear Chronology', Nuclear Threat Initiative, http://www.nti.org/media/pdfs/yugoslavia_nuclear.pdf?_=1316466791, last updated September 2008, website checked 5-7-2017, pp. 15-16.

1876 Potter, William, Miljanic, Djuro, Slaus, Ivo, 'Tito's Nuclear Legacy', in *The Bulletin of the Atomic Scientists*, Vol. 56, No. 2 (March/April 2000) pp. 64-65.

1877 Hymans, Jacques, E., C., 'Proliferation Implications of Civil Nuclear Cooperation: Theory and a Case Study of Tito's Yugoslavia', in *Security Studies*, Vol. 20, No. 1 (March 2011) p. 89, Statement of Policy by the National Security Council, 'United States Policy Towards Yugoslavia', NSC 5406/1, 6th of February 1954, in Slany, William, Z., et al (eds.), *Foreign Relations of the United States, 1952-1954, Eastern Europe; Soviet Union; Eastern Mediterranean, Volume VIII*, https://history.state.gov/historicaldocuments/frus1952-54v08/pg_1373, website checked 5-7-2017, pp. 1373-1375.

1878 Yugoslavia Nuclear Chronology', Nuclear Threat Initiative, http://www.nti.org/media/pdfs/yugoslavia_nuclear.pdf?_=1316466791, last updated September 2008, website checked 5-7-2017, p. 13.

1879 Potter, William, Miljanic, Djuro, Slaus, Ivo, 'Tito's Nuclear Legacy', in *The Bulletin of the Atomic Scientists*, Vol. 56, No. 2 (March/April 2000) pp. 63-66.

1880 Yugoslavia Nuclear Chronology', Nuclear Threat Initiative, http://www.nti.org/media/pdfs/yugoslavia_nuclear.pdf?_=1316466791, last updated September 2008, website checked 5-7-2017, p. 14

1881 Streefland, Abel, *Jaap Kistemaker en Uraniumverijking in Nederland 1945-1962* (Prometheus: Amsterdam 2017) p. 92.

received blueprints for a reprocessing facility based on the Norwegian plant at Kjeller in 1962 following a 1960 request, and the laboratory-scale facility using the PUREX method, to which the US also supplied equipment, constructed at Vinča, first successfully separated plutonium in 1966.[1882]

US military aid to Yugoslavia in the first half of the 1950s cumulatively reached into the hundreds of million of dollars.[1883] In 1960, construction on a TRIGA Mark II 250 kW research reactor started, which achieved criticality in 1966. A program to explore nuclear power generation was initiated in 1961 in Yugoslavia, and after it signed and ratified the NPT in 1968 and 1970 respectively, it launched a tender for a NPP, which the American Westinghouse won over FRG's KWU in November 1973. In the following month, Yugoslavia concluded a safeguards agreement with the IAEA. The Westinghouse 664/632 MW PWR's located at Krsko in Slovenia, started operations in 1981.[1884]

Yugoslavia sought NAM leadership and had become a vocal critic of the nuclear weapon states and their nuclear testing, advocating nuclear disarmament. Yet, shortly after India, another NAM member with leadership aspirations, detonated its nuclear explosive in May 1974, President Tito wasted no time and in a series of meetings in 1974 and 1975 directed the restart of the country's nuclear weapons program. In the first of these meetings in June 1974, 'the participants were instructed by military representatives to utilize a dramatically expanded nuclear power program as a cover for a parallel military effort.'[1885] At international forums (such as the 1975 NPT Review Conference) Yugoslavia lamented barriers to nuclear energy technology exchange under Article IV and suggested it was reconsidering its membership of the NPT regime and in a state newspaper article in 1975 there was open speculation on whether the country should acquire a nuclear weapon, followed by public remarks by a government official along the same lines in 1977.[1886] Although the nuclear weapons program was on a slow-burner under President Tito's, following his death in 1980 the program became the responsibility of Admiral Branko Mamula, the new Secretary of Defense, who 'began to

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1882 Yugoslavia Nuclear Chronology', Nuclear Threat Initiative, http://www.nti.org/media/pdfs/yugoslavia_nuclear.pdf?_=1316466791, last updated September 2008, website checked 5-7-2017, pp. 11-13, Hymans, Jacques, E., C., 'Proliferation Implications of Civil Nuclear Cooperation: Theory and a Case Study of Tito's Yugoslavia', in *Security Studies*, Vol. 20, No. 1 (March 2011) p. 89.

1883 Report, 'Progress Report on NSC 5406/I: United States policy towards Yugoslavia', 241, 13th of April 1955, in (Glennon, John, P., et al (eds.), *Foreign Relations of the United States, 1955–1957, Central and Southeastern Europe, Volume XXVI* (United States Government Printing Office: Washington 1992) https://history.state.gov/historicaldocuments/frus1955-57v26/d241, website checked 5-7-2017.

1884 Yugoslavia Nuclear Chronology', Nuclear Threat Initiative, http://www.nti.org/media/pdfs/yugoslavia_nuclear.pdf?_=1316466791, last updated September 2008, website checked 5-7-2017, pp. 8-12.

1885 Potter, William, Miljanic, Djuro, Slaus, Ivo, 'Tito's Nuclear Legacy', in *The Bulletin of the Atomic Scientists*, Vol. 56, No. 2 (March/April 2000) p. 66. The same article describes the Yugoslavian effort to acquire nuclear weapons in more detail, Potter, William, Miljanic, Djuro, Slaus, Ivo, 'Tito's Nuclear Legacy', in *The Bulletin of the Atomic Scientists*, Vol. 56, No. 2 (March/April 2000) pp. 63-70, which can be found at http://www.nonproliferation.org/titos-nuclear-legacy/, website checked 5-7-2017.

1886 Potter, William, Miljanic, Djuro, Slaus, Ivo, 'Tito's Nuclear Legacy', in *The Bulletin of the Atomic Scientists*, Vol. 56, No. 2 (March/April 2000) pp. 65-67.

forcefully promote the weapons program' in 1982, Potter, Miljanic and Slaus wrote in 2000,[1887]

Urenco and Yugoslavia

Urenco first had contacts with the Yugoslavian authorities in 1979 after the Troika governments signaled their consent.[1888] Talks were initiated around the need for Yugoslavia to contract enrichment services for the planned second NPP, while it was mulling a more expansive nuclear power program. On December 19, 1980 members of the Dutch Parliament (Zijlstra and Ter Beek, both from the opposition PvdA) asked the Minister of Economic Affairs whether these talks included the possibility of Yugoslavia taking a share in Urenco or the construction of an enrichment plant in Yugoslavia. The Minister acknowledged that the Yugoslavian delegation had suggested a plant in Yugoslavia based on Urenco technology but that 'this suggestion [had] been rejected by Urenco.'[1889]

When talks between Urenco and the Yugoslavian authorities resumed in 1981 and Urenco's representatives initiated discussions by stating they only came to discuss enrichment supply, the Yugoslavian interlocutors 'left no doubt that there would be no discussions on Urenco supplies to Yugoslavia unless far-going commitments regarding an enrichment plant were made.'[1890] This suggests that the forceful promotion of the nuclear weapons program under Admiral Mamula was already underway in early June of 1981.

The necessity of Yugoslavia gaining access to this technology had been rationalized by one its top nuclear scientists as early as two years before, arguing that sharing of nuclear technology could put developing countries on 'equal footing' and could be a pivotal area in which the 'traditional "North-South impasse"' could be broken.[1891] Practical political reasons for the necessity of a domestic enrichment plant were also forwarded by the Yugoslavians; it would allow the country to preserve its independence from the Cold War blocs and shore up its position as a leader in the NAM.[1892] The Urenco delegation, reporting back to the Troika trade council, said that the Yugoslavian authorities had remaining concerns regarding '"assured supply"' in light of the problems that came up with the Americans (there had been some delays in the construction of the Westinghouse Krsko reactor) under President Carter, although they also expected these problems not to repeat themselves.[1893] This led Urenco to believe that a Yugoslavian offer to discuss (in six months time) whether 'there is cause to change suppliers for Krsko' was not genuine.[1894]

The French and Canadians were also chasing the Yugoslavian contracts, and Urenco's representative thought it 'not unlikely' that they would ultimately win them. The Canadians

1887 Ibid. pp. 67-68.
1888 ARC 124-2b, p. 1, 124-2c, p. 1.
1889 ARC 124-2c, p. 1.
1890 ARC 122-9, p. 2.
1891 ARC 122-1b, p. 3.
1892 ARC 122-9, p. 3.
1893 ARC 122-9, p. 2, 'Tito uit tegenover Mondale zorg over Afrika', in *NRC Handelsblad*, 23th of May 1977, p. 9.
1894 ARC 122-9, p. 2.

had already offered heavy water technology to Yugoslavia and the French were rumored to have offered '"access"' to their '"chemical exchange process"'.[1895] The Dutch Ambassador related that the French were acting commercially aggressive but expected they would not resort to price-dumping in order to get out on top.[1896]

The French were selling their chemical enrichment process as proliferation-resistant, but Urenco was aware of a soon-to-be-released report by American scientists that countered this claim. Furthermore, the technology wasn't ready for commercial implementation. The Canadian Ambassador to Belgrade, when asked by his Dutch colleague, said that it was the Canadian view that the Yugoslavians would be able to develop their own enrichment capacity in a couple of years and that Canada was 'content to sell her technology and know-how to Yugoslavia' because if they didn't, 'then another supplier would or the Yugoslavians would do it themselves.'[1897] The Dutch Ambassador's impression of the Canadian view was that accepting what they considered a virtual *fait accompli* early on would benefit Canadian policy and commercial interests.[1898]

The heavy competition from the French and Canadians prompted Urenco to request the local Troika representatives to at this time involve their national governments. Urenco would not itself propose to supply Yugoslavia with an enrichment plant but would appreciate the local Troika ambassadors to 'advise positively' on the matter to their national governments.[1899] The Dutch Ambassador had replied that the current outgoing ('*demissionair*') Dutch Government was likely to defer a decision on this controversial subject to the incoming Government.[1900]

The Dutch Ambassador in Belgrade took the liberty to inform the Dutch MFA of the strategic implications of a negative or positive judgment on the Yugoslavian requirement of technology transfer connected to a possible deal for Urenco to supply enrichment services. Yugoslavia was going into economic crisis, and it was expected to be a long one. The Yugoslavian relationship with Western Europe had deteriorated somewhat in recent years and even though the country was politically non-aligned, that relationship was important to invest in, reminded the Ambassador. 'Aside from the "sensitive" aspects in the Netherlands', a change in the current (interim) Urenco export policy in favor of technology exports to Yugoslavia would be 'very valuable' to Dutch-Yugoslavian relations, he advised.[1901] Eventually, possibly following a negative response to the Ambassador's missive, Urenco communicated a negative decision on technology transfer to the Yugoslavian authorities and contacts seized.[1902]

In April 1982, Dutch officials had no further information on any progress in the negotiations between KWU and Yugoslavia.[1903] On January 14, 1983, the Troika governments received a telex from Urenco's Managing Director Rooke in which he conveyed 'an urgent request' for

1895 Ibid., pp. 2-3.
1896 Ibid., p. 2.
1897 ARC 122-10, p. 1.
1898 Ibid.
1899 ARC 122-9, p. 3.
1900 Ibid.
1901 ARC 122-10, p. 1.
1902 ARC 124-2b, p. 1.
1903 ARC 123-18, p. 2.

the spot sale of a 500 SWU to Yugoslavia. The enriched product would be fabricated into fuel by KWU and then supplied to Yugoslavia 'to be used for a spare reload' for the Krsko reactor (normally fueled through Westinghouse).[1904] Urenco's Managing Director Rooke added that Yugoslavia wanted an confirmation of the KWU offer within days, so some haste was required in the Joint Committee coming to a decision whether it would have to object to this sale.[1905]

Three days later, on the 17th of January, DRW/AT advised the Minister on the matter. DRW/AT's perception was that although Yugoslavia had a less than stellar reputation in the international nuclear diplomacy, there were no 'formal objections' to provide it with enrichment services as the country had ratified the NPT.[1906] In a written comment on the note, the Minister asks whether this is 'the only relevant criterion for Urenco-exports'.[1907] The Minister was advised to let the Dutch representative in the JC communicate a position of no objection and considering the haste Urenco's Managing Director Rooke had requested, to allow a JC decision to be taken through correspondence instead of at a physical meeting. The UK and FRG had by this time already communicated their agreement to the sale.[1908]

In response to the Minister's margin question on whether NPT-membership was the only relevant criterion, DRW/AT set out the current status of Urenco's export policy and the reasons its formalization had only progressed to 'interim status'. Regardless, DRW/AT argued, the case of Yugoslavia was straight-forward, as 'this country is party to the NPT and therefore has placed all its nuclear activities already under IAEA safeguards.'[1909] Additionally, it was important to apply the NSG Guidelines, as they go beyond the NPT requirements, DRW/AT added, a requirement on assurances that the UK mentioned in its response to Urenco's request for permission.[1910] The Minister approved the sale and DRW/AT sent positive response to London and Bonn that drew attention to some of the more important non-proliferation requirements of the sale, such as those on safeguards and re-transfer conditions.[1911]

In August 1984 Urenco's marketing manager Pannier was in Yugoslavia to discuss the possibility of replacing American enriched uranium services with Troika ones. After reporting on the current plans regarding Yugoslavia's ambitious nuclear power program he reported on an opportunity for Urenco with regards to the existing reactor at Krsko. While the Yugoslavians had signed a long-term contract for fuel-deliveries with Westinghouse, there was a penalty clause of 3% if the customer wanted to discontinue. Pannier told the officials from the Troika embassies in Belgrade that Urenco could lower the price of supplied product by 30%, 'and even if the US dollar recovers by 1986 [it] would leave Urenco at least 10% cheaper.'[1912] Urenco could offer a no-requirement long term commercial commitment, leaving

1904 ARC 124-2b, p. 1, ARC 124-2d, p. 1.
1905 ARC 124-2d, p. 1.
1906 ARC 124-2b, p. 1
1907 Ibid.
1908 ARC 124-2a, pp. 1-2, ARC 124-2b, p. 1.
1909 ARC 124-2a, p. 1.
1910 Ibid.
1911 ARC 124-2e, p. 1.
1912 ARC 124-11, p. 1.

the Yugoslavians free to switch suppliers at any time in the future. Urenco was aware that the following October the Westinghouse contract was up for renewal and feared that the French would also move in on the Americans, and possibly might employ price-dumping to win the contract and help mediate Eurodif's sizable overcapacity.[1913]

Pitching Urenco's offer at the Yugoslavian federal level, Urenco's marketing manager Mr. Pannier was once again confronted with a Nuclear Energy Committee official 'aggressively insisting' on the transfer of Urenco technology for a Yugoslavian enrichment plant. A discussion ensued in which Mr. Pannier tried to convince those present that economically such a domestic plant would not make sense until the nuclear power program had at least 5 to 6 NPPs operational. Another official intervened and assured his fellow national that he was sure Mr. Pannier had received his message clearly.[1914] Yugoslavia renewed the Westinghouse contract for the the Krsko NPP after all and still uses American fuel.[1915]

Case: Taiwan

Nuclear research in Taiwan started with the construction of its first research reactor at National Tsinghua University in 1956 and the training of nuclear scientists. Shortly after China's nuclear weapon test in 1964, Taiwan's leader Chiang Kai-check ordered the establishment of the Chung-Shan Science Institute (CSSI), at which 'nuclear electronic, chemical and missile' research was predominantly funded by the military. Under the Hsin Chu Program at the CSSI, Taiwan acquired a 40 MWt heavy water moderated Canadian-supplied research reactor, fueled with natural uranium. Construction on the Taiwan Research Reactor began in 1969 and it started operating in 1973. The reactor was located on the grounds of the in 1965 established Institute of Nuclear Energy Research (INER), which shared its secured site with the CSSI. The Hsin Chu Program also acquired a heavy water production facility and a reprocessing facility. By 1974, the CIA was confident Taiwan was creating a nuclear weapon capability.[1916]

Taiwan's government had signed the NPT in 1968 but, as it at the time was considered the sole legitimate government of the Chinese by the West and the only China represented in the United Nations, Taiwanese officials thought this allowed them to have nuclear weapons. After

1913 Ibid.

1914 Ibid., p. 2. This continued 'aggressive' pursuit of enrichment technology by the Yugoslavian Nuclear Energy Committee official could be an indication of the country its continued pursuit of nuclear weapons as late as August 1984.

1915 Report, 'Nuclear Facilities and the Fuel Cycle', Report by Slovenia, Committee for Technical and Economic Studies on Nuclear Energy and the Fuel Cycle (NDC), 47th session, 12-14 June 2002, Paris, Organisation for Economic Co-operation and Development, NEA/NDC(2002)16/ADD1, 18th of July 2002, http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=NEA/NDC%282002%2916/ADD1&docLanguage=En, website checked 4-4-2017, p. 3, Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 116.

1916 'Nuclear Weapons', Federation of American Scientists, http://www.fas.org/nuke/guide/taiwan/nuke/, last updated 2012, website checked 5-7-2017, 'Taiwan: Overview', Nuclear Threat Initiative, http://www.nti.org/learn/countries/taiwan/, website checked 5-7-2017.

mainland China became a UN member in 1971 and as a consequence, Taiwan was expelled from the IAEA, this left nuclear safeguards in Taiwan (which had previously been negotiated with the IAEA) in limbo. 'Taiwan, the United States and the IAEA agreed informally that an existing trilateral agreement would provide the basis for applying nuclear safeguards on Taiwan's nuclear materials and facilities', but these were of the older, weaker model that provided too few inspection rights (INFCIRC 66/2).[1917] Canada broke off diplomatic relations with Taiwan when it recognized China in 1971, and as a result would no longer enforce the bilateral safeguards on the research reactor at INER. The trilateral agreement placed the responsibility of safeguarding it with the IAEA and US.[1918]

US pressure on Taiwan to have the country limit its nuclear program started as early as 1972 after the US discovered Taiwan had approached the FRG to inquire about the acquisition of plans and parts of a reprocessing plant. US diplomatic démarches to discourage any such acquisition were met by claims that the equipment was merely intended for experimental purposes. The Taiwanese seemed to have been warned off by the second half of 1973, yet were soon found caught trying and failing to acquire reprocessing technology from a Belgian firm.[1919]

Following discoveries by the IAEA of discrepancies in the reported activities at and design information of the Taiwanese nuclear facilities during 1976 and 1977, the US increased pressure on its Cold War client state to abandon its nuclear weapon program and sensitive nuclear activities. Taiwan signaled compliance but additional diplomatic pressure, including an engineered leak to *The Washington Post* in which the Taiwanese activities were exposed, was deemed necessary amid conflicting statements from Taiwanese officials and more discoveries of falsehoods in Taiwanese reporting to the IAEA. In 1978, the US performed more inspections and became suspicious that Taiwan was running a secret uranium enrichment program. In 1979, over a period of five years, Taiwan allowed the US to convert its Canadian heavy water reactor to low-enriched uranium use to reduce its inherent proliferation potential.[1920] Also in 1979, the US replaced a bilateral security agreement that provided Taiwan with an American security guarantee against outside aggression or coercion, with the Taiwan Relations Act, which provided more or less the same security.

1917 Albright, David, Gay, Corey, 'Taiwan: Nuclear Nightmare Averted', in *Bulletin of Atomic Scientists*, Vol. 54, No. 1 (January/February 1998) pp. 57-58.

1918 Ibid., p. 58

1919 Kogan, Eugene, B.,'Proliferation Among Friends: Taiwan's Lessons from 1970s-80s', Paper prepared for Nuclear Studies Research Initiative Conference, Austin (TX), October 2013, http://www.belfercenter.org/sites/default/files/legacy/files/kogan-nsri-oct-2013.pdf, website checked 5-7-2017, pp. 14-18, 21.

1920 Richelson, Jeffrey, *Spying on the Bomb: American Nuclear Intelligence from Nazi Germany to Iran and North Korea* (W. W. Norton & Company: New York 2007) pp. 274-277, Kogan, Eugene, B.,'Proliferation Among Friends: Taiwan's Lessons from 1970s-80s', Paper prepared for Nuclear Studies Research Initiative Conference, Austin (TX), October 2013, http://www.belfercenter.org/sites/default/files/legacy/files/kogan-nsri-oct-2013.pdf, website checked 5-7-2017, pp. 21, 22-29. William Burr has extensively documented the declassified materials that show the American-Taiwanese interactions during this period at the National Security Archive, Burr, William (ed.), 'The United States and Taiwan's Nuclear Program, 1976-1980: Intervention in the Nuclear Activities of a Vulnerable Ally', National Security Archive Electronic Briefing Book, No. 221, 15th of June 2007, http://nsarchive.gwu.edu/nukevault/ebb221/, website checked 7-7-2017.

A Taiwanese defector in 1988 revealed to the US that his country was once again constructing a secret plutonium separation facility. The US removed the heavy water from the Canadian reactor and stopped exports of heavy water to Taiwan. The separation facility, nearly completed, was dismantled.[1921]

Taiwan started construction on its nuclear power plants in the early 1970s, bringing the two-unit 636 MW Westinghouse BWR-4 type online in 1978 and 1979 at Chinshan, the two-unit 985 MW Westinghouse BWR-6 type in 1981 and 1983 at Kuosheng, and the two-unit 951 MW PWR supplied by General Electric at Maanshan in 1984 and 1985.[1922]

Urenco and Taiwan

In September 1981, KWU had received permission from the FRG government to sell reactors to Taiwan. KWU competed in the tender with American companies General Electric and Westinghouse and French FRAMATOM and intended to supply the Taiwan Power Company with 'materials and equipment' for construction of Taiwan's fourth NPP at Yenliao (dubbed Lungmen) that would house reactor units 7 and 8 and that included 'the required fuel assemblies for these units and a fuel fabrication facility'.[1923] The company wanted to be able to offer Urenco's services as part of the deal, as Taiwan made the sale of reactors conditional upon the issue of an export license for the initial fuel load.[1924] A request to do so reached the Troika governments via Urenco Managing Director Rooke, on September 23, 1981. Pressed for an 'early statement', the Managing Director had provided a letter to KWU 'assuring them of our positive and serious interest in the possibility of an enrichment business in Taiwan, in our willingness to enter discussions on commercial terms, subject to our receiving unequivocal political clearance from JC in respect of such business.'[1925] He also recalled from a JC meeting on September 10, in the context of a possible deal with Taiwan, that negotiations on possible '"umbrella" usage' of the US-Taiwan safeguards agreement was progressing positively.[1926] Urenco's Managing Director Mr. Rooke would send 'the formal request for

1921 Kogan, Eugene, B.,'Proliferation Among Friends: Taiwan's Lessons from 1970s-80s', Paper prepared for Nuclear Studies Research Initiative Conference, Austin (TX), October 2013, http://www.belfercenter.org/sites/default/files/legacy/files/kogan-nsri-oct-2013.pdf, website checked 5-7-2017, p. 42, 'Taiwan: Overview', Nuclear Threat Initiative, http://www.nti.org/learn/countries/taiwan/, website checked 5-7-2017.

1922 'Design Features of Nuclear Power Plants', Taiwan Atomic Energy Council, http://www.aec.gov.tw/english/nuclear/article02.php, website checked 5-7-2017.

1923 'Exchange of Letters Constituting an Agreement Between the Government of the United States of America and the Government of the Federal Republic of Germany Concerning the Listing of Reactors Supplied by the Federal Republic of Germany to the Taiwan Power company on the Inventory of the International Atomic Energy Agency Safeguards Agreement of 6 December 1971, Washington, 5 November 1981', United Nations Treaty Series, No. 26978, https://treaties.un.org/doc/Publication/UNTS/Volume%201552/volume-1552-I-26978-English.pdf, website checked 18-12-2017, p. 18, 'Economic milestones', in *Taiwan Review*, 1st of July 1981, http://taiwantoday.tw/news.php?unit=8,29,32,45&post=13356, website checked 18-12-2017.

1924 ARC 122-13, pp. 1-3, ARC 122-15, p. 1.

1925 ARC 122-13, p. 3.

1926 Ibid.

clearance at the appropriate time.'[1927] An official responded two days later that the Dutch delegation to the JC was not able to give an indication prior to the upcoming JC meeting.[1928]

Briefing the Minister of Foreign Affairs two weeks later, a DRW/AT official summarized the Dutch considerations as follows. Already after the September 10 JC meeting, the Minister had indicated that he was not willing to agree to enriched uranium supplies to Taiwan, for two reasons. First, coming on the heels of the damage that mainland Chinese-Dutch diplomatic relations had suffered as a result of the 'submarine controversy' (see Box *'The Submarine Affair': The Dutch export-drive clashes with China* below), this delivery had the potential to further sour relations with the Chinese Peoples Republic. The second reason was the 'shaky' and unclear basis for safeguards that existed in the island republic.[1929] Contact between the MFA and Economic Affairs showed that the Minister of Economic Affairs had similarly strong reservations along the same lines. Not directly related to the transaction under discussion but strategically important, DRW added that it would be most unwelcome if any discussion over a possible delivery to Taiwan would result in the re-opening of domestic discussions on the entire UC-cooperation between the Troika countries, and the intended inclusion of fourth member Australia in particular.[1930]

'The Submarine Affair': The Dutch export-drive clashes with China

Near the end of the 1970s RSV, the major Dutch shipbuilding and machine-construction company, was in economically dire straits. The conglomerate, the result of a partially government-forced fusion of shipbuilders and heavy machinery construction companies, suffered from much cheaper competition in Poland and East Asia in its shipbuilding divisions and its never-profitable nuclear division (see *Case: South Africa*, page 364). After RSV had cultivated a relationship with the Taiwanese Ministry of Defense from 1978 onward, the second half of 1980 saw it conclude a contract worth roughly 1 billion guilders ($ 485 million) in both civil and military orders, the latter consisting of two submarines.[1931]

The order was controversial within the Dutch ministries even before the Government was asked to make a decision on it. Proponents of the deal, such as officials from the Directorate-General of Industry, argued that the Dutch shipbuilders desperately needed the order, and that the existence of a sizable industry was essential for maintaining an independent Dutch navy. Those critical of the deal, among others the Director-General of Political Affairs at Foreign

1927 Ibid.
1928 Ibid., p. 4.
1929 Ibid., p. 1.
1930 Ibid.
1931 Tweede Kamer der Staten Generaal, Zitting 1984-1985 – 17817, 'RSV: Opkomst en ondergang van Rijn-Schelde-Verolme', Nr. 16, Verslag Parlementaire Enquêtecommissie RSV 1983-1984, p. 5, 102-106, 244, 415, 452, 483, 'RSV-order betekent zes miljoen uur werk', in *NRC Handelsblad*, 12th of November 1980, p. 13, 'Order RSV vrijdag in ministerraad', in *NRC Handelsblad*, 19th of November 1980, p. 13, 'Netherlands – Spot Exchange Rate, Guilders/US$', 12th of November 1980, Historical Data, H.10 Foreign Exchange Rates, Federal Reserve Statistical Release (United States Federal Reserve Bank) https://www.federalreserve.gov/releases/H10/hist/dat89_ne.txt, website checked 30-7-2018.

Affairs, warned that it was inconsistent with the Dutch one-China policy, would irritate China and would contribute to tensions in the region. Nevertheless, the Dutch Government gave its consent to the order on the 28th of November 1980 (citing among its motivations the positive effect the deal would have on RSV's overall financial and economic condition) and the Second Chamber of Parliament did as well shortly after.[1932]

Before the Government had given its consent, the spokesperson for the Chinese embassy in The Hague had warned that his Government considered the deal 'meddling in the internal affairs' of the People's Republic of China and would damage the good relations between that country and the Netherlands.[1933] A couple of days later an anonymous Chinese official in Beijing upped the ante and warned that the RSV order would damage to the Dutch-Chinese 'economic relations on the middle and long term'.[1934] By that time, the largest opposition parties (PvdA and D66) had taken positions against the order.[1935]

After the Government gave its permission for export and subsequent parliamentary approval, China threatened economic sanctions if the decision wasn't reversed.[1936] Early January 1981, the Dutch Ambassador in China, J. Kneppelhout, was summoned to the Chinese authorities. Shortly after, the Chinese Government did the same with the nine EC ambassadors to China, asking them to move the Netherlands to reverse its decision. The consequence of not doing so would mean lowering of diplomatic relations between China and the Netherlands to that of temporary *chargés d'affaires* or even lower to *chargé d'affaires*.[1937] A week later the Chinese Government followed through on its threat and lowered diplomatic relations with the Netherlands to the level of *chargé d'affaires*, although without sending the Dutch ambassador home just yet, but happened in late February 1981.[1938]

During the same week, economic sanctions were announced by a spokesperson of the Chinese embassy in The Hague, with news of a contract with Shell having been canceled as early as December, along with other Dutch industry contracts. Chinese ships would start avoiding the port of Rotterdam, and Chinese sports delegations were canceling their trips to the Netherlands and their collaborations with Dutch professional athletes.[1939] In a set of debates in

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1932 Tweede Kamer der Staten Generaal, Zitting 1984-1985 – 17817, 'RSV: Opkomst en ondergang van Rijn-Schelde-Verolme', Nr. 16, Verslag Parlementaire Enquêtecommissie RSV 1983-1984, pp. 313-315.

1933 'China ziet duikboten RSV als 'inmenging', in *NRC Handelsblad*, 21st of November 1980, p. 1.

1934 Van Kemenade, Willem, 'China: Order RSV schaadt betrekkingen' in *NRC Handelsblad*, 26th of November 1980, p. 13.

1935 'PvdA tegen vergunning duikboten voor Taiwan', in *NRC Handelsblad*, 26th of November 1980, p. 1.

1936 'Boos over levering aan Taiwan: Chinezen dreigen met tegenacties', in *Trouw*, 22nd of December 1980, p. 1, 'Peking woedend over Taiwan-order: China dreigt Nederland met economische sancties', in *Nieuwsblad van het Noorden*, 22nd of December 1980, p. 5.

1937 'EG-ambassadeurs ontboden: Chinese druk om RSV-order to herroepen', in *NRC Handelsblad*, 13th of January 1981, pp. 1, 3.

1938 'Peking eist terugroepen ambassadeur', in *NRC Handelsblad*, 27th of February 1981, p. 1, Tweede Kamer der Staten Generaal, Zitting 1984-1985 – 17817, 'RSV: Opkomst en ondergang van Rijn-Schelde-Verolme', Nr. 16, Verslag Parlementaire Enquêtecommissie RSV 1983-1984, p. 317.

1939 'Duikboten', in *Trouw*, 20th of January 1981, p. 10, 'Naast diplomatieke stap: China stuurt ook bedrijven weg – Attaché uit felle kritiek op Van Agt', in *De Volkskrant*, 20th of January 1981, pp. 3, 11, 'China slaat terug: geen zaken met Shell', in *Het Vrije Volk*, 20th of January 1981, pp. 1, 7, 15.

late January and early February 1981 the Dutch opposition in the Second Chamber managed to vote in the motion Brinkhorst (D66), which asked the Government to reverse its decision to grant the export license for the RSV order. The Government subsequently chose to ignore the motion, which stance the Second Chamber opposition then grudgingly had to accept when governing party Christian Democrats' parliamentarians, that had supported the Brinkhorst motion, conceded defeat.[1940]

Diplomatic relations between the Netherlands and the People's Republic of China would not be restored to ambassadorial level until 1984, and left Dutch politicians wary of sanctioning business with Taiwan. Dutch trade and shipping data showed a considerable dip in economic activity during the 'submarine affair', with Dutch exports to China dropping from 320,4 million guilders ($ 169.5 million) in 1979 to 177,5 million guilders ($ 67.7 million) in 1982, rising to 377,9 million guilders ($ 121.9 million) in 1983. The number of harbor visits by ships under the Chinese flags dropped from 193 in 1980 to 158 in 182, rising again to 217 in 1983. Manufactured goods revenue connected to China remained down from the 1979-1980 numbers as late as 1984 though.[1941] In 1987 and 1988, Wilton-Fijenoord, the Dutch company that had taken over the order from RSV, delivered the submarines to Taiwan.[1942]

From informal contacts it had become clear to DRW that the British appreciated Dutch concerns, but it was unclear if that would lead them to a negative position with regard to Urenco's Taiwan request. What was clear was that it 'would not be easy on' the German partners to have to accept a refusal from the JC, which (the DRW was aware) meant that an important nuclear transaction for the German industry would be 'hanging by a thread' at a time when it needed new orders.[1943] The West-German Government had already given approval to KWU's reactor transaction, DRW knew.

The important question, thought the DRW, was whether it was possible to convince the Germans to rescind the request to Urenco so that a Dutch veto in the JC could be avoided. If the conclusion of a contract for enrichment services could be postponed to a moment closer to the new reactors requiring fuel, the political situation might have changed favorably. Alternatively, it would leave West-Germany with enough time to find enriched uranium services elsewhere; possibly they could buy the required uranium. DRW judged that West-Germany should be able to pledge fuel to the new reactors even without a positive Troika decision. The Germans would not like this but for the Netherlands it would be preferable to

1940 'Premier Van Agt tijdens tweede RSV-debat: Tweede duikboot-order zal zeer onwaarschijnlijk zijn', in *Nederlands Dagblad*, 31th of January 1981, p. 5, 'Tweede Kamer neemt motie Taiwanorder aan', in *Nederlands Dagblad*, 4th of February 1981, p. 1, 'Van Agt: Besluit kabinet Taiwan juridisch bindend', in *NRC Handelsblad*, 27th of February 1981, p. 3.

1941 Tweede Kamer der Staten Generaal, Zitting 1984-1985 – 17817, 'RSV: Opkomst en ondergang van Rijn-Schelde-Verolme', Nr. 16, Verslag Parlementaire Enquêtecommissie RSV 1983-1984, p. 318, 'Netherlands – Spot Exchange Rate, Guilders/US$', 2nd of January 1980, 3rd of January 1983, 3rd of January 1984, Historical Data, H.10 Foreign Exchange Rates, Federal Reserve Statistical Release (United States Federal Reserve Bank) https://www.federalreserve.gov/releases/H10/hist/dat89_ne.txt, website checked 30-7-2018.

1942 'Sea Tiger ingedokt voor Taiwan', in *NRC Handelsblad*, 28th of October 1987, p. 3, 'Taiwanezen laaiend enthousiast over patrouillevaartuig van Wilton-Fijenoord: 'Dit is een kwalitatief uitstekend schip'', in *NRC Handelsblad*, 21st of May 1988, p. 17.

1943 ARC 122-13, p. 1.

the negative domestic consequences (a renewed debate on the UC-project) a positive JC decision could result in.[1944]

By October 15, 1981, it had become clear that the involved British ministers had communicated to their officials that the UK had no objection to the export to Taiwan. With that decision, any opportunity to 'hide behind the British' 'as had happened in the past' evaporated, lamented DRW/AT, making bilateral approaches to the British and Germans necessary.[1945] A discussion between the MFA and the MEA on how to instruct the respective ambassadors ensued, which exposed disagreement on whether to involve reference to the submarine affair. MEA argued that the affair was resolved and should not be revisited at all. Furthermore, MEA thought it would be 'undesirable to speculate on possible reactions by the [People's Republic of China] as both issues were not (entirely) comparable.'[1946] MFA officials responded by pointing out that at the very least the issues would be linked in national politics, which could cause all kinds of trouble. A well-coordinated approach by the two ministries was therefore important.

The Directorate for European Cooperation (DGES) of the MFA took note of the draft-telegram by DRW and joined the discussion with its own insights. The telegram to Bonn and London made it clear that the Netherlands would veto the supply to Taiwan if put in that position by its partners. It mentioned the possibility for the FRG to contract the initial fuel load from somewhere else but admitted that this must not be an attractive option to the Germans. DGES reminded the ministries that this 'confrontation' with the Germans would come at a very bad time. On the agenda were a MEA meeting with the Germans to negotiate Dutch relief from its financial obligations with regards to the Kalkar project, as well as the reorganization of the Estel corporation, a combined project of Dutch Hoogovens and German Hoesch, both steel giants. A hard-line tactic in the Taiwan case could backfire on these aforementioned cases, warned DGES. A better tactic might shore up the Dutch arguments for its unwillingness to go along with its Troika partners; by 'involving the Troika partners in a conversation about the Chinese response' we can possibly achieve more than by threatening to veto, argued DGES.[1947] The argumentation would be shored up even further if Dutch officials could 'show tangible indications of the to-be-expected Chinese expressions of displeasure.'[1948] The Minister replied that he saw no objection to a more cautious approach but reminded his officials that considering 'the shaky foundation' of IAEA safeguards in Taiwan, an eventual Dutch 'yes' to the deal was not in the cards.[1949] A confrontation in the JC that would force a decision (and thus, a Dutch 'no') was to be avoided though.[1950] In the final memo of instruction to Bonn and London, the 'CPR-aspect' was heavily emphasized and included a 'careful démarche' to inquire with the partners about the possible Chinese reaction.[1951]

1944 Ibid., pp. 1-2.
1945 ARC 122-14a, p. 1.
1946 Ibid.
1947 ARC 122-14b, pp. 1-2.
1948 Ibid., p. 2.
1949 ARC 122-14c, p. 1.
1950 ARC 122-15, p. 2.
1951 ARC 122-14b, p. 1, ARC 122-14d, p. 1.

The comprehensive German response by a BMFT (*Bundesministerium für Forschung und Technologie*, the FRG ministry dedicated to research and technology development) official in conversation with the Bonn embassy's economic affairs official was relayed back to the Dutch MFA in late October 1981. The Dutch Ambassador in Bonn related German clarifications on the Chinese position, a solution to the safeguards problem, KWU's competition and on an alternate source of supply for enriched uranium. German officials in Beijing had thoroughly sought clarification on any Chinese sensitivities towards the deal with Taiwan. The German Ambassador had met with high level Chinese officials twice and had not gotten a negative or positive indication. When long-time FRG Foreign Minister Genscher recently visited China, the Chinese had not raised the issue at all. The FRG, it was conveyed to the Dutch , interpreted the Chinese stance as one of 'silent approval' and wouldn't create difficulties down the road.[1952]

In the absence of official diplomatic relations with Taiwan, the Germans had come up with a two-tier approach to the safeguards conundrum. First, they had acquired the US assurance that the supplied enriched uranium could be subject to the trilateral safeguards agreement that Taiwan, the US and the IAEA had concluded in 1964 and 1971.[1953] As a '"fall-back position"', the Kernforschungzentrum Karlsruhe (almost entirely owned by the FRG) would create a entity that would open an office in Taiwan. This office would then safeguard the enriched uranium.[1954] BMFT relayed that it had been this solution that had convinced the FRG Government it could give its permission in the JC to the enriched uranium supply.

The French and American competition had already submitted offers that included an initial fuel supply. They had also negotiated the take-back of used fuel rods. The Germans were confident that, if Urenco could not supply, KWU could contract the enriched uranium from the French. The BMFT official added that it would however be a shame if this sizable order would pass Urenco by.[1955] In the end, the tender for Taiwan's fourth NPP was first delayed but a winning bid by American company General Electric was accepted in 1996.[1956]

News of a request in the JC to supply Taiwan with enriched uranium reached the Dutch press in January of 1983, at a time when officially the ministers of Foreign Affairs and Economic Affairs had not taken a position yet. The press reported however that Minister of Economic Affairs Van Aardenne was positively disposed towards this opportunity for Urenco to widen its portfolio, while Foreign Affairs Minister Van den Broek was expected to 'strongly resist negotiations with Taiwan on the supply of enriched uranium'.[1957] Parliamentary representatives

1952 ARC 122-15, p. 1.

1953 'The Text of a Safeguards Transfer Agreement Relation to a Bilateral Agreement Between the Republic of China and the United States of America', INFCIRC/158, 8th of March 1972, http://www.aec.gov.tw/webpage/policy/cooperation/files/cooperation_03_a-2.pdf, website checked 18-12-2017.

1954 ARC 122-15, p. 2.

1955 Ibid.

1956 ARC 126-1, p. 1, 'Lungmen (Dragon Gate) Nuclear Project', Power Technology website, http://www.power-technology.com/projects/lungmen/, website checked 18-12-2017.

1957 'Parlement in verlegenheid door plan uraniumlevering', in *Trouw*, 5th of January 1983, 'Taiwan wil uranium van Urenco', in *Het Parool*, 5th of January 1983, p. 3, 'Afwijzend besluit regering verwacht: Urenco wil uranium leveren voor kerncentrales Taiwan', in *De Volkskrant*, 5th of January 1983, pp. 1, 3.

commented to the press, voicing concerns over China's possible reaction and Taiwan's political status; the Netherlands did not recognize Taiwan and the country was not a member of the United Nations or the IAEA, and no safeguards agreement was in place.[1958] Nevertheless, IAEA inspections had continued following the removal of its status as representation of China in the UN, although those inspections had not prevented the Taiwanese to operate a small clandestine reprocessing facility that, after discovery and subsequent pressure from the US in 1976-1977 'resulted in Taiwan's agreement to terminate its experimental reprocessing, to accept tighter restrictions on the operation of a large research reactor, and to permit additional controls on its civilian nuclear program'.[1959] Spokespersons for both UCN Netherlands and the Taiwanese Government (the director of the office of nuclear matters for the state energy company Liu Pei-chun) both reacted by pointing out the contacts were merely in an exploratory phase at this point, and no negotiations were imminent.[1960]

Contacts between Urenco and Taiwan continued in the years after. In April 1988, Urenco asked the JC for a judgment on required safeguards and export licenses in the event it would win the supply contract for two to-be-decided-upon NPPs in Taiwan. Taiwan was prepared to start negotiations with Urenco when it could provide assurance that the Troika governments would be cooperative in establishing adequate safeguards and providing export licenses. It was unusual for the JC to be asked to decide on a hypothetical situation and so any decision it would take could not be considered definitive, judged the DRW when advising the Minister.[1961] Possible arrangements were discussed, including a three-way construction between Taiwan, the US and Urenco so that 'official contacts between the Troika and Taiwan concerning possible Urenco deliveries could be avoided'.[1962]

In many respects this was a repetition of the earlier episode, as the Dutch MFA's reservations mirrored those of seven years before (including attention to Chinese sensitivities), yet were slightly more informed. DRW reported Taiwan had shut down its research reactor and ceased its research on reprocessing; it was commonly thought that this had been done under US pressure, yet the US officially denied playing a role. The US had adopted the official position that Taiwan was living up to its non-proliferation obligations.[1963]

The Dutch MFA's Directorate of UN Political Affairs (DPV) official's comments contrasted with the US position. They reminded the Minister that a decision with regards to exports to Taiwan would also need to be a political one, because of Taiwan's non-proliferation record.

1958 'Parlement in verlegenheid door plan uraniumlevering', in *Trouw*, 5th of January 1983.

1959 Dunn, Lewis, A., 'Half Past India's Bang', in *Foreign Policy*, No. 36 (Autumn, 1979) http://www.jstor.org/stable/1148207, website checked 5-7-2017, p. 72. Colijn and Rusman date the reprocessing shutdown to 1978, Colijn, Ko, Rusman, Paul, 'Taiwan kan 'binnen zes maanden' een klein aantal kernwapens maken: De Nederlandse duikboten kwamen al goed van pas – nu het uranium nog', in *Vrij Nederland*, 15th of January 1983.

1960 'Urenco wil markt onderzoeken: Gesprek over uranium Taiwan is nog informatief', in *De Volkskrant*, 6th of January 1983.

1961 ARC 126-1, p 1.

1962 Ibid., pp. 2-3.

1963 Ibid., p. 2.

Based on past events the country could be seen, argued DPV, 'as an entity set on finding the loopholes in every non-proliferation arrangement and exploiting them'.[1964] Was the Minister willing to, 'in the case of a unexpected leak', defend the possibility of a positive decision with regards to Urenco's request, in Parliament, asked DPV.[1965]

The first Urenco contract with Taiwan would not materialize until 1998, at which time the Government gave its blessing to the supply of LEU.[1966]

Case: Mexico

Mexico's National Commission for Nuclear Energy (CNEN), later incorporated into the National Institute on Nuclear Energy (INEN), was founded in 1956, and was responsible for nuclear activities such as research, uranium exploration and regulations. Nuclear energy generation would be in the purview of the Federal Electricity Commission (CFE). INEN itself was split up in 1979 into three separate organizations, one responsible for research, one for uranium exploration and production and one for nuclear regulation and safeguards.[1967]

CFE and CNEN started investigations into potential nuclear power plant sites in 1966. A tender for its first NPP was launched in early 1969 and General Electric won the bid in 1972 (with an agreement reached in 1974) for what would become the Laguna Verde Nuclear Power Plant I and II, a 2-unit BWR, each 654 MW, on which construction started in 1976 and 1977 and which reached criticality in 1984 and 1994, although commercial operation would only start in 1990 and 1995 respectively.[1968]

Mexico had come into Urenco's view in the late 1970s as the construction of the Laguna Verde NPP was underway. Urenco had received permission from the JC to explore possibilities of enriched uranium supply with this potential customer and had done so. Politically there had also been contacts regarding possible supply, for example when Minister Van der Klaauw brought up the possibility of Urenco services during his visit to the country in 1980. Mexico was considered a politically important country in 'international nuclear and

1964 Ibid., p. 3.

1965 Ibid.

1966 'Urenco haalt in Taiwan grote vis binnen', in *NRC Handelsblad*, 25th of June 1998, https://www.nrc.nl/nieuws/1998/06/25/urenco-haalt-in-taiwan-grote-vis-binnen-7404545-a39580, website checked 6-7-2017, 'Urenco mag Taiwan licht verrijkt uranium leveren', in *De Volkskrant*, 25th of June 1998, http://www.volkskrant.nl/economie/urenco-mag-taiwan-licht-verrijkt-uranium-leveren~a458994/, website checked 6-7-2017.

1967 Country Nuclear Power Profiles: Mexico, International Atomic Energy Agency, https://cnpp.iaea.org/countryprofiles/Mexico/Mexico.htm, last updated 2016, website checked 7-7-2017.

1968 Country Nuclear Power Profiles: Mexico, International Atomic Energy Agency, https://cnpp.iaea.org/countryprofiles/Mexico/Mexico.htm, last updated 2016, website checked 7-7-2017, 'Background: Mexico Nuclear Program', Paper A-129, Nuclear Regulatory Commission website, https://www.nrc.gov/docs/ML0114/ML011440439.pdf, website checked 7-7-2017, p. 1. Cost overruns, frequent personnel changes and 'shoddy workmanship' combined with political and societal opposition caused the construction to take this long, Williams, Dan, 'Safety Fears Cloud Future of Mexico's First Nuclear Plant', in *Los Angeles Times*, 13th of January 1987, http://articles.latimes.com/1987-01-13/news/mn-4399_1_laguna-verde, website checked 7-7-2017.

non-proliferation discussions' as it was a NAM leader, depository of the 1967 Treaty for the Prohibition of Nuclear Weapons in Latin America (the Tlatelolco Treaty) and staunch anti-nuclear weapons-advocate that had ratified the NPT as early as 1969.[1969] Initially, Dutch and Troika efforts had not yielded results as Mexico was still undecided on the final structure of its nuclear program during this period.[1970]

In late 1981 Mexico opened a tender for the building of NPPs that also required the inclusion of fuel services in offers. The Dutch MFA was aware of seven companies that submitted offers: Framatom (France), ASEA-ATOM (Sweden), KWU (FRG), AECL (Canada) and three US companies that included Westinghouse. As expected, KWU approached Urenco to provide the enriched uranium for the fuel package, but so did the Swedes and surprisingly so did Westinghouse (resulting out of a collaboration with BNFL, the British shareholder of Urenco).[1971] Urenco had reacted positively to these requests ('rightly so', considering the JC had approved it, commented the Minister), of which the inclusion of Westinghouse caused some friction with the Germans, considering this would strengthen the competition against KWU.[1972]

Urenco overstepped its mandate, when on the 16th of December 1981 it sent a letter to KWU, ASEA-ATOM and Westinghouse in which it forwarded its proposal for collaboration, without prior consultation with the JC. The proposal included a thinly veiled offer for technology transfer to Mexico (something Mexico was interested in, related Minister Van der Stoel) as well as had made 'extensive and anticipatory' mention of the ongoing negotiations with Australia. Both the British and Dutch shared considerable unease about this and after consultations in the JC, Urenco was ordered to retrieve the letter and acquire JC permission before re-sending an adapted version.[1973]

INFCE had only concluded a year earlier and seeing all three Troika governments had subscribed to its recommendations regarding supply assurances, and considering the ongoing negotiations in the context of CAS, it was unseemly for Urenco to suggest 'intensive collaboration on uranium enrichment' at a time when the transfer of sensitive technologies was under intense international scrutiny.[1974] Yet, the unsanctioned offer by Urenco followed developments in another dossier (Yugoslavia) where competitors were clearly less scrupulous about exporting sensitive technologies; earlier in 1981 France and Canada had sweetened deals with enrichment and heavy water technology respectively (see *Case: Yugoslavia*, page 424).

The extensive mention of Australia in the offer to third parties also worried the JC. The negotiations with Australia had reached a delicate and critical stage (see *Case: Australia*, page 387) and the Troika was currently committed to a very 'reserved and low-key' profile to not in any way negatively influence the pending Australian decision. Sharing substantial information

1969 ARC 123-11, p. 1.
1970 Ibid.
1971 Ibid., *Jaarverslag 1981*, Ultra-Centrifuge Nederland N.V. (UCN NV: Almelo) p. 7.
1972 ARC 123-11, p. 1.
1973 ARC 123-11, pp. 1-2, ARC 123-28.
1974 ARC 123-11, p. 2.

with a 4th country (Mexico) via the Urenco offer was not what the Troika had in mind when it adopted this approach. Furthermore, the Troika had become aware that Urenco had discussed the Mexico file with UEGA, and wondered whether the Australian Government was aware of this, and whether it would appreciate discussions of this nature at this stage.[1975]

In the wake of the financial crisis that hit Mexico in 1982 and that had led to 'unprecedented austerity measures', in June the country canceled its $ 2 billion tender for a second nuclear power plant.[1976] Early in 1984, DRW reported that a possible Urenco deal with Mexico was off the table for now.[1977] In August 1985, Mexico announced it would recommence its nuclear power development program but no contracts materialized for Urenco in the case study period.[1978]

Case: India

India started its nuclear research program right after WWII, with its chief scientist Bhabha having visited Western institutions on fellowships before the war. The Government of India established its Department of Atomic Energy in 1954 and its first research reactor Apsara was built with UK assistance and achieved criticality in 1956 using British HEU fuel. Its location, Atomic Energy Establishment Trombay (AEET) near Mumbai, which became the Bhabha Atomic Research Center in 1967, saw the construction of several additional research reactors. Under the Atoms for Peace program and a bilateral Canadian-Indian agreement, India acquired a large heavy water-moderated research reactor named CIRUS (Canada India Research Utility Services) from Canada in 1956 that became operational at the site in 1960. The United States also supplied India with heavy water for its reactors, as did the Soviet Union. A nuclear cooperation agreement with the Soviet Union was signed in 1961. Also in 1961, the Zerlina natural uranium-fueled heavy water-moderated and -cooled research reactor came online, followed in 1972 by the 1 W experimental Purnima I research reactor using plutonium-oxide fuel.[1979] India rapidly expanded its nuclear infrastructure, commissioning a small heavy water plant in 1957, authorized a reprocessing plant in 1958 (completing it in 1964), constructed indigenous nuclear fuel by 1960, testing an uranium processing pilot plant in 1962, completed an isotope production unit and a hot cell facility in 1963, and commissioned an uranium mine in 1968.[1980]

1975 Ibid.

1976 Buchanan, Ronald, 'Mexico cancels $2bn nuclear plant contract', in *Financial Times*, 14th of June 1982, Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 115.

1977 ARC 124-8, p. 4.

1978 'Mexico hervat bouw kerncentrales', in *NRC Handelsblad*, 16th, of August 1985, 'Country Nuclear Fuel Cycle Profiles', Technical Reports Series, No. 404 (International Atomic Energy Agency: Vienna 2001) https://www-pub.iaea.org/MTCD/Publications/PDF/TRS404_scr.pdf, website checked 6-9-2018, pp. 50-51.

1979 'Bhabha Atomic Research Centre: Milestones', Bhabha Atomic Research Centre, http://www.barc.gov.in/about/milestones.html, website checked 7-7-2017, 'Research Reactors: Apsara,Cirus,Kamini,Purnima I,Purnima II,Purnima III and Zerlina', Bhabha Atomic Research Centre, http://www.barc.gov.in/reactor/index.html, website checked 7-7-2017.

1980 'India Nuclear Chronology', Nuclear Threat Initiative, http://www.nti.org/media/pdfs/india_nuclear.pdf?_=1316466791, website checked 7-7-2017, pp. 448, 460, 471, 473-475, 478, 481-482, 484.

India's first nuclear power reactor was the result of extensive Atoms for Peace aid from the United States and was constructed at Tarapur. The Tarapur reactor, a General Electric BWR that operates two reactor units of 160 MW each, reached criticality in 1969 and was initially under safeguards. At the Rajasthan Atomic Power Station, Canadian CANDU pressurized heavy water reactors (PHWRs) went critical in 1972 (Unit-1) and 1980 (Unit-2). Canada started work on a heavy water production plant in Kota in 1970, which started production in 1982-1983. Construction on another PHWR, the 2-unit Madras Atomic Power Station started in 1969 and, while its startup was delayed due to a heavy water shortage, the reactor units went critical in 1983 and 1985.[1981]

India's nuclear program gained infamy when it diverted fuel from its CIRUS research reactor, reprocessed the fuel and used the separated plutonium to construct and detonate their first nuclear explosive in 1974. Although the country claimed that its nuclear test was a PNE, internationally the explosion was seen as a watershed proliferation event requiring urgent coordinated action to prevent more countries from following India's example, detrimental as it was to the fledgling NPT regime. This perception gave impetus to the NSG deliberations in 1975-1976 and stricter national non-proliferation policies across the world, with the United States and Canada taking the lead.

India had always been opposed to strict international non-proliferation agreements, from its rejection of the Baruch plan to its opposition to and refusal to sign the NPT. It cited the economic impediments of safeguards and the discriminatory nature of the NPT, as well as NWS failure to cease nuclear weapon production as its reasons for doing so. In receiving nuclear aid and in nuclear trade, it consistently only accepted minimal safeguards, resisted any attempts for the strengthening of those later on, pressured suppliers for more a lenient safeguards burden, asked suppliers to help it circumvent safeguards, as well as refused to accept international safeguards on its indigenous facilities.[1982]

Following the US NNPA (1978) that required FSS on all US nuclear exports and American refusal to give India another Presidential waiver (pending Congressional approval), the first which had been used for the first shipment of fuel to the Tarapur reactor, India had taken the view that 'failure by the US to carry out its obligations to supply fuel as agreed under the trilateral US/India/IAEA supply arrangements will amount to a fundamental breach of those arrangements, rendering them invalid, freeing the Tarapur reactor from safeguards and releasing the Indians from their obligation to obtain US consent for the reprocessing of the spent fuel.'[1983]

1981 Lavoy, Peter, R., 'The Enduring Effects of Atoms for Peace' in *Arms Control Today*, Vol. 33 (December 2003) https://www.armscontrol.org/act/2003_12/Lavoy, website checked 26-3-2017, 'Tarapur Atomic Power Station (TAPS)', Nuclear Threat Initiative, http://www.nti.org/learn/facilities/77/, website checked 7-7-2017, 'India Nuclear Chronology', Nuclear Threat Initiative, http://www.nti.org/media/pdfs/india_nuclear.pdf?_=1316466791, website checked 7-7-2017, pp. 345, 376, 406, 438, 445, 447, 453, 'Madras Atomic Power Station (MAPS), Nuclear Threat Initiative, http://www.nti.org/learn/facilities/74/, website checked 7-7-2017.

1982 'India Nuclear Chronology', Nuclear Threat Initiative, http://www.nti.org/media/pdfs/india_nuclear.pdf?_=1316466791, website checked 7-7-2017, pp. 366, 372, 375, 412, 416, 476, 484-485, 487.

1983 ARC 123-15a, p. 1. English in original. On the NNPA (1978), see chapter 10, *The 1978 Nuclear Non-Proliferation Act, on* page *341*.

Urenco and India

At the start of 1982 (around the end of February) the Dutch MFA (DRW/AT) received an informal inquiry from the British regarding a request they had received for the export of enriched uranium. The client that was approaching Urenco through intermediary Rio Tinto was India, seeking fuel for the controversial Tarapur reactor. DRW/AT was shown an internal instruction regarding the offer, in which the British set out the main strategic and non-proliferation considerations. The British inquired with the Dutch how they would receive this request in the JC if it was made. They simultaneously added that they themselves were still in the process of coming to a position on the matter.[1984]

DRW/AT conveyed to the Minister that as an initial reaction, the British had been told that it would be very unlikely the Minister would be able to accede to a request by BNFL on behalf of India if it would be made in the JC. The controversy surrounding the Indian nuclear program as well as the source of the feed-product (South Africa, which meant it could be from Namibia and was thus controversial, since in the 1970s South Africa increasingly was perceived as illegally occupying Namibia and mining its natural resources) were the main obstacles, besides the facts that India refused to adopt FSS nor had it signed the NPT.[1985] A positive argument was added by DIO/PI to its Chief DIO; it clipped a note on the letter that included the argument that the US might be grateful if a possible Urenco supply to India kept that country from being 'rescued' by the USSR, although informal inquires with the Americans had not elicited a confirmation of this presumption. Chief DIO responded that the matter of South African or Namibian uranium being enriched for India was tricky and his officials should 'make a stand'.[1986]

DRW/AT decided to find out more about the British and German positions through informal inquiries during a diner for the British FCO and German AA held during an European Political Cooperation (EPS) non-proliferation workshop. The German delegation took, 'as in the EPS deliberations themselves', a position that it was important to come to a 'special relationship' with '"difficult"' countries like India and Argentina, for this would bear more fruit than sticking a 'formal and strict nonproliferation policy.'[1987] Similar to the Dutch perception, the British lacked enthusiasm about the inclusion of South African uranium in the deal, but would eventually agree with the export on strategic grounds related to the Indian subcontinent, DRW/AT speculated. If the British would decide positively and step up their inquiries to the official level, DRW/AT advised the Minister to preempt the discussion of this in the JC and convey the Dutch position to the British directly.[1988]

Urenco would never supply enrichment services to India. The US had found France willing to supply India with the fuel for Tarapur, so that the safeguards as part of the original supply of Tarapur could be maintained. France initially (in line with the then-current NSG consensus) pushed for more stringent safeguards on the French fuel than the original 1963 agreement

1984 ARC 123-15a, ARC 123-19, p. 1.
1985 ARC 123-15a, p. 1, ARC 123-19, p. 1.
1986 ARC 123-15b, ARC 123-15c.
1987 ARC 123-19, p. 1.
1988 Ibid.

between the US and India. Faced with a flat out refusal by India to go along and the threat of Indian withdrawal from the original agreement and IAEA safeguards at Tarapur, the parties reached an impasse that was eventually resolved by the personal intervention of President Mitterand, who dropped the demand for more stringent safeguards. Mitterand did not want the Tarapur issue to jeopardize French exports to India that included sizable arms exports.[1989]

On the 18th of October 1982, *The New York Times* reported that a French official in New Delhi had stated that France would supply India with enriched uranium fuel for its Tarapur reactor if the plant's operations were at risk of being compromised over a lack of fuel. If the situation became urgent, the French embassy official said his country "'could deliver the fuel and then again discuss the safeguards,".[1990] The statement came on the same day that India announced a French-Indian deal for 40 French Mirage-2000 fighter jets equipped with anti-ship missiles. On the 27th of November 1982, India and France signed the agreement for the supply of fuel for the Tarapur reactor.[1991] The US Reagan Administration sanctioned the deal that saw the French supply the fuel for the two Tarapur reactors for the next ten years. After France signed the NPT in 1992 and it committed itself in the context of the Nuclear Suppliers Group to demand full-scope safeguards on nuclear exports, Indian officials decided to switch suppliers again, this time contracting China to provide the plants with LEU.[1992]

Case: Turkey

In 1956, Turkey established the Turkish Atomic Energy Authority. The country acquired its first research reactor (1 MW) from American Machine and Foundry (AMF) on a turnkey basis. Construction on it at the Çekmece Nuclear Research and Training Center started in 1959 and it became operational in 1962, and was upgraded to 5 MW in the late 1970s,

1989 Chellaney, Brahma, Indo-American Nuclear Relations: A Case Study of the Tarapur Dispute, Ph.D. Dissertation, Center for International Politics, Organization and Disarmament, School of International Studies, Jawaharlal Nehru University New Delhi (1991) pp. 181-192.

1990 'Around the World; French Assure India of Nuclear Fuel Supply', in *The New York Times*, 19th of October 1982, http://www.nytimes.com/1982/10/19/world/around-the-world-french-assure-india-of-nuclear-fuel-supply.html, website checked 7-7-2017, 'India Nuclear Chronology', Nuclear Threat Initiative, http://www.nti.org/media/pdfs/india_nuclear.pdf?_=1316466791, website checked 7-7-2017, p. 379.

1991 'Around the World; French Assure India of Nuclear Fuel Supply', in *The New York Times*, 19th of October 1982, http://www.nytimes.com/1982/10/19/world/around-the-world-french-assure-india-of-nuclear-fuel-supply.html, website checked 7-7-2017, 'India Nuclear Chronology', Nuclear Threat Initiative, http://www.nti.org/media/pdfs/india_nuclear.pdf?_=1316466791, website checked 7-7-2017, p. 379. 'The supply agreement received considerable flak from European Commission officials, who complained France had ignored European Community rules that required Paris to first ask the Commission's approval of the deal and obtain the co-signature of the EEC supply agency.', Chellaney, Brahma, Indo-American Nuclear Relations: A Case Study of the Tarapur Dispute, Ph.D. Dissertation, Center for International Politics, Organization and Disarmament, School of International Studies, Jawaharlal Nehru University New Delhi (1991) p. 192.

1992 'Tarapur now has fuel for many years', in *The Hindu*, March 30th 2006, updated March 23rd 2012, https://www.thehindu.com/todays-paper/tarapur-now-has-fuel-for-many-years/article3171427.ece, Chellaney, Brahma, "India to Urge France to Extend Nuclear Fuel Contract', 28th of September 1992, United Press International Archives, https://www.upi.com/Archives/1992/09/28/India-to-urge-France-to-extend-nuclear-fuel-contract/8902717652800/, websites checked 16-7-2018, Cohen, Stephen, Philip. 'Right for the Right Reasons? The Reagan Administration and India', in *India International Centre Quarterly*, Vol. 15, No. 2 (1988) p. 38.

reaching criticality in 1981.[1993] A second research reactor, a TRIGA Mark II supplied by General Dynamics, started operations in 1979 at Istanbul Technical University. Besides 'sophisticated nuclear fuel-cycle research' at its nuclear research facilities, Turkish nuclear infrastructure doesn't include fuel-cycle facilities.[1994]

Turkey has hosted American nuclear weapons on its territory since 1961, after agreement was reached between the US and Turkey in 1959. At first, these were Jupiter-class MRBMs (Medium Range Ballistic Missiles), but these were removed as part of the resolution of the Cuban Missile Crisis. Other types of nuclear weapons have since been stationed at airbases in Turkey however.[1995] Turkey signed the NPT in 1969 but only ratified the treaty in 1980.

Turkey invited tenders for its first nuclear power plant in 1977, scheduled for commission in 1984.[1996] It had come to an agreement with Sweden for the supply of a nuclear power reactor in 1978 and another one with the USSR by June 1979.[1997] In 1981, Turkey launched a new tender after Sweden backed out of the contract it secured in 1978, unable to secure financing for the deal.[1998]

Press reports indicated that the Turkish Electricity Corporation had asked KWU to supply two nuclear power reactors, after which talks had been initiated in January 1982.[1999] In the context of the KWU offer to Turkey for the supply of a nuclear reactor, which was accepted by Turkey and was announced in November 1983, Urenco inquired with the JC whether any objections existed to uranium enrichment services for to-be-built Turkish reactor. It was unclear whether the 120 ton/year contract concerned a 10 year or lifetime supply of enriched uranium. At the moment of inquiry, it was also entirely unclear whether Urenco could acquire 'such a contract' and whether Urenco would get into trouble over financing it, considering it wouldn't qualify for a FRG's state export credit guarantee under the so-called 'Hermes Cover'.[2000] DRW judged that from 'general political and non-proliferation considerations' no objections existed to the contract, and added that this contract could be very beneficial to Urenco. Urenco received permission to go ahead in its pursuit of the contract.[2001]

1993 'Çekmece Nuclear Research and Training Center', Turkish Atomic Energy Authority, http://www.taek.gov.tr/en/institutional/affiliates/cekmece-nuclear-research-and-training-center.html, website checked 7-7-2017.

1994 'Overview: Turkey', Nuclear Threat Initiative, http://www.nti.org/learn/countries/turkey/, last updated April 2015, website checked 7-7-2017, Hibbs, Mark, 'Turkey, the Nonproliferation Treaty, and the Nuclear Suppliers Group', in Perkovich, George, Ülgen, Sinan (eds.), *Turkey's Nuclear Future* (Carnegie Endowment for Peace: Wasington DC 2015) p. 143.

1995 Criss, Nur, Bilge, 'Strategic Nuclear Missiles in Turkey: The Jupiter Affair, 1959–1963', in *Journal of Strategic Studies*, Vol. 20, No. 3 (1997) pp. 99, 107, 116-118, 'Overview: Turkey', Nuclear Threat Initiative, http://www.nti.org/learn/countries/turkey/, last updated April 2015, website checked 7-7-2017.

1996 ´Turkey Invites Tenders for First 600 MWe Unit´, in *Nuclear Engineering International* (March 1977) p. 38.

1997 'Russen bouwen kerncentrale in Turkije', in *NRC Handelsblad*, 6th of June 1979.

1998 'Nuclear Power Station Re-tendered', in *Middle East Economic Digest*, 21st of August 1981.

1999 'Turkey: German Nuclear Reactors Sought', in *Middle East Economic Digest*, 19th of February 1982.

2000 'Turkse regering wil drie kerncentrales laten bouwen´, in *De Volkskrant*, 5th of November 1983, ARC 124-8, p. 7.

2001 ARC 124-8, p. 7.

In June 1985 KWU had to cancel its offer to Turkey because the FRG Government refused to renew its export credit insurance of 1,4 billion marks. Subsequently, Turkey opted for the Canadian consortium AECL (Atomic Energy of Canada Limited) to build the reactor but following a preliminary agreement, talks foundered when neither the Turkish or Canadian governments wished to give the financial certainty needed to come to agreement.[2002]

Case: China[2003]

For the first several decades of the Chinese nuclear program, not much detail could be confirmed about it. Yet, by abstraction, using analysis of public statements by Chinese officials, statements by foreign officials on the Chinese program and observational data collected by other countries and entities (some no doubt through espionage), a general picture of its historic activities was publicly known by the end of the 1970s.[2004]

The fellow communist Soviet Union was instrumental to the start of the Chinese nuclear program, which during its first decade was mostly a nuclear weapons development effort. Soviet assistance started with the signing of the first Soviet-Chinese 'Treaty of Friendship, Alliance and Mutual Assistance' in 1950. Following the agreement, the Soviets helped China set up an uranium ore exploration program and after the Korean War Chinese scientists trained in the USSR. In 1955, after the '"Sino-Soviet Atomic Cooperation Treaty"' was signed, the Soviets provided the Chinese with a heavy water research reactor for the Institute of Atomic Energy of the Chinese Academy of Sciences in Beijing (also established with Soviet help in 1954), also providing a local Beijing institute with a cyclotron, and both started operations in 1958.[2005] Also in 1955, with Soviet assistance a reprocessing plant was constructed in Xinjiang province. Another nuclear infrastructure agreement followed between the two countries in 1956, and in 1958 the USSR agreed to provide China with 'a prototype nuclear bomb, missiles, and related data', a deal that would not be upheld by the Soviets amid Soviet-Chinese tensions during the late 1950s that would lead to the end of nuclear cooperation between the two countries by 1961.[2006] The nuclear program would years later again suffer delays from the societal fallout from Mao's own policies during 'the Great Leap

2002 'Geen Turkse kerncentrale voor Kraftwerk', in *NRC Handelblad*, 13th of June 1985, Kumbaroğlu, Gürkan, 'Turkey and Nuclear Energy', in Perkovich, George, Ülgen, Sinan (eds.), *Turkey's Nuclear Future* (Carnegie Endowment for Peace: Wasington DC 2015) pp. 10-11.

2003 Also see, *China*, in chapter 6, page 164.

2004 As exemplified by a *Bulletin of Atomic Scientists* special section on the Chinese nuclear test of 1965, which has David Inglis expressed the widely-shared surprise that the anticipated Chinese detonation of a nuclear device was based on uranium, not plutonium, and Robert Guillain's article that based on fragmented information speculates on the existence and location of particular facilities in the Chinese program, Inglis, David, R., 'The Explosion of October 16: The Chinese Bombshell', in *Bulletin of Atomic Scientists*, Vol. 21, No. 2 (February 1965) pp. 19-21, 'Guillain, Robert, 'Ten Years of Secrecy', in *Bulletin of Atomic Scientists*, Vol. 21, No. 2 (February 1965) pp. 24-25, reprint from a 1964 article in French newspaper *Le Monde*.

2005 Minor, Michael, S., 'China's Nuclear Development Program', in *Asian Survey*, Vol. 16, No. 6 (June 1976) p. 571, Suttmeier, Richard, P., 'China's Nuclear Power Program: Options for the U.S.', Presentation U.S.-East Asian Energy Security Seminar series, CONF-8510420-1/DE87 004155, 16th of October 1985, p. 4, 'China's Nuclear Chronology', Nuclear Threat Initiative, http://www.nti.org/media/pdfs/china_nuclear_3.pdf?_=1364257156, date checked 10-7-2017, pp. 129, 131.

Forward' and its resulting famine in 1960-1962, and during the height of the 'Cultural Revolution' in 1966-1968.[2007]

Before the Soviets left however, they shared gaseous diffusion technology with the Chinese, and between 1959 and 1963 the Langzhou gaseous diffusion plant was built, powered by a local 300 MW reactor. Started with Soviet technical assistance but finished without it, the plant produced its first HEU in late 1963 and significant quantities by early 1964.[2008] Construction of a UF6 production plant started in 1960 with production starting in 1962. China also built a number of large reactors and associated reprocessing facilities for the production and extraction of plutonium. The first of these was located in Gansu Province, a light-water cooled graphite moderated reactor build with Soviet help that achieved criticality in late 1966 and entered operations in 1967. Its first reprocessing facility, using the PUREX process, became operational in 1968 and provided plutonium for China's first thermonuclear weapon.[2009] Another gaseous diffusion plant produced HEU for the weapons program from 1970 to 1987 at Heping. Exploration for uranium ores had started in the early 1950s and uranium deposits were discovered in Jiangxi Province in 1954 and in Guangdong Province and Hunan Province, and the first uranium mine construction starting in 1958 in the latter, which opened for operations in 1960. An uranium oxide production plant was established the same year.[2010]

China detonated its first nuclear explosive on the 16th of October 1964, using HEU produced at Langzhou. By September 1969 it had tested 10 nuclear devices, included boosted,

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2006 Minor, Michael, S., 'China's Nuclear Development Program', in *Asian Survey*, Vol. 16, No. 6 (June 1976) p. 572, 'China's Nuclear Chronology', Nuclear Threat Initiative, http://www.nti.org/media/pdfs/china_nuclear_3.pdf?_=1364257156, date checked 10-7-2017, pp. 128, 130.

2007 Report, 'China Today: Nuclear Industry', JPRS Report, Science & Technology China, JPRS-CST-88-002, Foreign Broadcast Information Service, 15th of January 1988, *http://fissilematerials.org/library/jprs88.pdf*, website checked 3-1-2017, pp. 3-4, 15.

2008 Ibid., pp. 9-13, Minor, Michael, S., 'China's Nuclear Development Program', in *Asian Survey*, Vol. 16, No. 6 (June 1976) p. 573, 'China's Nuclear Chronology', Nuclear Threat Initiative, http://www.nti.org/media/pdfs/china_nuclear_3.pdf?_=1364257156, date checked 10-7-2017, pp. 125, 129.

2009 Zhang, Hui, 'China's Stockpile of Military Plutonium: A New Estimate', Paper presented at Institute for Nuclear Materials Management 52nd Annual Meeting, 17-21 July 2011, Palm Springs (CA), http://www.belfercenter.org/sites/default/files/legacy/files/Hui_INMM-PU.pdf, website checked 10-7-2017, pp. 1-2, Minor, Michael, S., 'China's Nuclear Development Program', in *Asian Survey*, Vol. 16, No. 6 (June 1976) p. 578, 'China's Nuclear Chronology', Nuclear Threat Initiative, http://www.nti.org/media/pdfs/china_nuclear_3.pdf?_=1364257156, website checked 10-7-2017, p. 127, Report, 'China Today: Nuclear Industry', JPRS Report, Science & Technology China, JPRS-CST-88-002, Foreign Broadcast Information Service, 15th of January 1988, http://fissilematerials.org/library/jprs88.pdf, website checked 3-1-2017, pp. 19-20, 21. 26-27.

2010 Lewis, John, Wilson, Litai, Xue, *China Builds the Bomb*, Illustrated Edition (Stanford University Press: Stanford 1988) pp. 80-81, 'China's Nuclear Chronology', Nuclear Threat Initiative, http://www.nti.org/media/pdfs/china_nuclear_3.pdf?_=1364257156, date checked 10-7-2017, pp. 127, 129, Zhang, Hui, *China's Uranium Enrichment Capacity: Rapid Expansion to Meet Commercial Needs*, Managing the Atom Project, Belfer Center, 20th of August 2015, *http://belfercenter.ksg.harvard.edu/files/chinasuraniumenrichmenntcapacity.pdf*, website checked 10-7-2017, p. 13.

thermonuclear and plutonium-based devices.[2011] China did not sign the NPT until 1992, rejecting the discriminatory nature of the treaty and during the Cold War repeatedly and consistently criticized the US and USSR for their failure to disarm while also making proposals to the international community for disarmament and security assurance agreements, and pledging that it would give up its nuclear weapons if the superpowers were willing to reduce their stockpiles.[2012] Meanwhile, China did not always take proliferation risks seriously, or furthered proliferation for strategic reasons, when it trained North-Korean scientists in nuclear science and engineering following its 1959 cooperation agreement with the DPRK and when in 1984 US intelligence emerged that seemed to indicate Chinese nuclear assistance to Pakistani had involved aid to that country's centrifuge program in Kahuta (see below, under *Chinese Uranium Enrichment Research*). Non-safeguarded nuclear export to Argentina, South Africa and Iran also caused international concern.[2013] In 1983 China signaled its willingness to join the IAEA and its application was accepted, becoming the 112th member of the Agency on the 1st of January 1984. In 1985, China announced its willingness to accept voluntary IAEA safeguards on some of its civilian nuclear facilities and pledged it would require IAEA safeguards on future exports, inserting IAEA safeguards requirements in recent export agreements to Brazil, Argentina and Japan.[2014]

Nuclear power had not figured prominently in China's energy policy until the 1970s. China's focus had been on the development of a power reactor suitable for use in its first nuclear submarine. Construction on a land-based test reactor for that purpose had started in 1965, on which successful testing completed in 1970; China's first nuclear submarine 'submerged' in September 1971. In 1972 under Zhou Enlai's leadership, work on an indigenous power reactor design started. In 1978, new impetus to nuclear power development was given when Chairman Deng Xiaoping announced the decision to import two French reactors, 900 MW each, a claim confirmed by the French President Giscard in 1980. The two countries concluded a nuclear cooperation agreement in 1982 and in May 1983 a Memorandum of Understanding for not two, but four 900 MW power reactors.

The US and UK were not far behind during this civilian reorientation of the Chinese nuclear program. The US, after having normalized relations with China in 1979, started exploration talks on a nuclear cooperation agreement with China in 1982 but negotiations lasted until July 1985 because of US concerns over the risk of its technology ending up in the Chinese military program or in third countries, without safeguards, and the Chinese refusal to give additional assurances. Meanwhile, the UK and France conclude agreements for the supply of NPPs with

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2011 'China's Nuclear Chronology', Nuclear Threat Initiative, http://www.nti.org/media/pdfs/china_nuclear_3.pdf?_=1364257156, date checked 10-7-2017, pp. 122-124.

2012 Ibid., pp. 105, 107, 115-119, 124, 126.

2013 Suttmeier, Richard, P., 'China's Nuclear Power Program: Options for the U.S.', Presentation U.S.-East Asian Energy Security Seminar series, CONF-8510420-1/DE87 004155, 16th of October 1985, p. 7, 'China's Nuclear Chronology', Nuclear Threat Initiative, http://www.nti.org/media/pdfs/china_nuclear_3.pdf?_=1364257156, date checked 10-7-2017, pp. 106, 121, 128.

2014 'China's Nuclear Chronology', Nuclear Threat Initiative, http://www.nti.org/media/pdfs/china_nuclear_3.pdf?_=1364257156, date checked 10-7-2017, pp. 102, 109, 111, Suttmeier, Richard, P., 'China's Nuclear Power Program: Options for the U.S.', Presentation U.S.-East Asian Energy Security Seminar series, CONF-8510420-1/DE87 004155, 16th of October 1985, p. 8.

China in 1983 and 1984 (among which, the Daya Bay reactor) and the FRG's KWU did so for equipment for nuclear reactors in 1985, following a 1984 cooperation agreement between the FRG and China. In 1985 Japan and Argentina also concluded cooperation agreements with China. Nuclear imports would serve China's growing need for electricity but was also 'premised on the acquisition of foreign technology' which would improve the indigenous reactor technology and eventually make the Chinese nuclear power program self-sufficient.[2015]

Chinese Uranium Enrichment Research

As above mentioned, gaseous diffusion plants for isotope separation provided China with the HEU for its weapons program and reactor fuel in the 1960s and 1970s at Langzhou and Heping. Langhzhou shifted from HEU to LEU production in 1979-1980 and Heping stopped producing HEU for the weapons program in 1987. The Langzhou plant was fitted with Soviet-supplied diffusers (membranes through which UF6 passes) but the Chinese managed to develop superior diffusers and installed them from the 1970s onward, increasing the separative capacity of its plants.[2016] In 1983, a Chinese official boasted that China had enough enriched uranium stock to supply its nuclear weapons program and (not yet existing) nuclear power capacity of 15 Gigawatt for the next thirty years.[2017]

Even though the Soviet assistance in the isotope separation field concerned just the diffusion technology, on which work on site selection for a plant started in 1957, Chinese scientists pursued research in the other industrially applicable processes as well. A Chinese source reported that from 1958, research was conducted on the centrifuge method, on laser enrichment and on isotope separation using chemical exchange. Research into the chemical exchange process started at Wuhan University, Beijing University and elsewhere from 1958 on. After 1970, government institutes researched chemical exchange processes with good results on an experimental scale by the mid-1980s. Work on laser enrichment started at several universities in the early 1970s and yielded promising results in the separation of sulfur

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2015 Report, 'China Today: Nuclear Industry', JPRS Report, Science & Technology China, JPRS-CST-88-002, Foreign Broadcast Information Service, 15th of January 1988, http://fissilematerials.org/library/jprs88.pdf, website checked 3-1-2017, pp. 3-4, Suttmeier, Richard, P., 'China's Nuclear Power Program: Options for the U.S.', Presentation U.S.-East Asian Energy Security Seminar series, CONF-8510420-1/DE87 004155, 16th of October 1985, pp. 5-7, 'China's Nuclear Chronology', Nuclear Threat Initiative, http://www.nti.org/media/pdfs/china_nuclear_3.pdf?_=1364257156, date checked 10-7-2017, pp. 102-103, 105-108, 110, 112-113, 115, 117-118.

2016 Report, 'China Today: Nuclear Industry', JPRS Report, Science & Technology China, JPRS-CST-88-002, Foreign Broadcast Information Service, 15th of January 1988, http://fissilematerials.org/library/jprs88.pdf, website checked 3-1-2017, pp. 9, 14-15, Zhang, Hui, *China's Uranium Enrichment Capacity: Rapid Expansion to Meet Commercial Needs*, Managing the Atom Project, Belfer Center, 20th of August 2015, *http://belfercenter.ksg.harvard.edu/files/chinasuraniumenrichmenntcapacity.pdf*, website checked 10-7-2017, pp. 13-14.

2017 'China's Nuclear Chronology', Nuclear Threat Initiative, http://www.nti.org/media/pdfs/china_nuclear_3.pdf?_=1364257156, date checked 10-7-2017, p. 113.

hexafluoride isotopes. A demonstration of uranium separation reported good measurements in 1985.[2018]

Centrifuge technology research and development began in 1958 at Qinghua (Tsinghua) and Beijing universities, 'the former Shanghai Light Bulb Plant' and elsewhere. A 1970 CIA intelligence estimate said that as part of the 1950s Soviet assistance program, the Chinese had received centrifuge technology as well. From the mid-1970s centrifuge work was 'reinforced', with investments in research staff resulting in 'many scientific research achievements' during the following decade, according to the Chinese source.[2019] This intensification of centrifuge work led China to construct its first centrifuge pilot plant at Plant 405 in Hanzhong (Hanzhun) in Shaanxi province in the mid-1980s. This plant 'apparently was equipped with supercritical centrifuges'.[2020]

In 2009, while under house-arrest in Islamabad, A.Q. Khan claimed that Pakistan had, following Mao's funeral in 1976, made a deal and provided China with help on its centrifuge program in exchange for uranium hexafluoride and later HEU for Pakistan's nuclear weapons program. The centrifuge technology Pakistan possessed was stolen by Khan from his employer and UCN's subcontractor Fysisch Dynamisch Onderzoek in the 1970s (See *A.Q. Khan*, page 358). Khan had apparently flown in plane loads of sensitive technology for a centrifuge plant in Hanzhong that he helped set up. The 11-page narrative written by Khan and obtained by the *London Sunday Times* and *The Washington Post* was confirmed for authenticity and largely corroborated 'through interviews in Pakistan and other countries' by reporters from the latter newspaper. Confronted by US officials hearing of the transfers in the 1980s, Chinese officials denied the reports.[2021] US officials then downplayed the intelligence on Chinese assistance to Pakistan's centrifuge program as 'inconclusive', on the eve of a major nuclear cooperation agreement between the US and China.[2022]

Following contacts with Urenco (see below), as part of a Chinese-Russian agreement on nuclear technology supply that that dates from 1991 or 1992, Russia supplied China with its

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2018 Report, 'China Today: Nuclear Industry', JPRS Report, Science & Technology China, JPRS-CST-88-002, Foreign Broadcast Information Service, 15th of January 1988, *http://fissilematerials.org/library/jprs88.pdf*, website checked 3-1-2017, pp. 8, 51-52.

2019 Ibid., p. 51, Kemp, Scott, R., 'Opening a Proliferation Pandora's box: The Spread of the Soviet-type Gas Centrifuge', in *The Nonproliferation Review*, Vol. 24, No. 1-2 (2017) p. 115.

2020 Zhang, Hui, *China's Uranium Enrichment Capacity: Rapid Expansion to Meet Commercial Needs*, Managing the Atom Project, Belfer Center for Science and International Affairs, Harvard University, 20th of August 2015, *http://belfercenter.ksg.harvard.edu/files/chinasuraniumenrichmenntcapacity.pdf*, website checked 10-7-2017, pp. 13-15, Zhang, Hui, 'China's Rapidly Expanding Centrifuge Enrichment Capacity', Bulletin of Atomic Scientists website, 7th of December 2015, *http://thebulletin.org/china%E2%80%99s-rapidly-expanding-centrifuge-enrichment-capacity8934*, website checked 11-7-2017.

2021 Smith, R., Jeffrey, Warrick, Joby, 'A nuclear power's act of proliferation: Accounts by controversial scientist assert China gave Pakistan enough enriched uranium in '82 to make 2 bombs', in *The Washington Post*, 13th of November 2009, http://www.washingtonpost.com/wp-dyn/content/article/2009/11/12/AR2009111211060_pf.html, website checked 11-7-2017.

2022 'China's Nuclear Chronology', Nuclear Threat Initiative, http://www.nti.org/media/pdfs/china_nuclear_3.pdf?_=1364257156, date checked 10-7-2017, p. 106.

sixth generation centrifuges in 1993.[2023] The initial Russian-provided plant (Hanzhong Centrifuge Enrichment Plant 1) replaced the Chinese-built centrifuge plant at Plant 405 in Hanzhong. As it was under construction, China offered the Hanzhong Enrichment Plant/Shaanxi Uranium Enrichment Plant to be safeguarded by the IAEA under its Voluntary Offer Safeguards Agreement (INFCIRC/369) with the agency. This offer was taken up by the agency in 1997 after completion of the 200.000 SWU plant in 1996 (operational in February 1997), see page 495. Another two Russian-built plants started operating there in January 1999 (Hanzhong Centrifuge Enrichment Plant 2, 300.000 SWU) and 2013 (Hanzhong Centrifuge Enrichment Plant 3, 1.200.000 SWU) respectively. A Russian-built plant in Lanzhou in Gansu province (Lanzhou Centrifuge Enrichment Plant 1, 500.000 SWU) started operating in 2001.[2024]

Chinese scientists and engineers of the CNNC (China National Nuclear Corporation) reverse-engineered (Hui Zhang refers to the process as 'localization') the Russian technology, constructing improved indigenous centrifuges from 2002 onward. Scott Kemp argued that Chinese know-how was well-developed at this point and their Xuan Feng-1 and Xuan Feng-2 centrifuges, while incorporating a number of insights from foreign technology, probably also relied on 'a range' of indigenous technical ideas.[2025] It is worth noting that 'according to a Rosatom official, the original agreement between Russia and China regarding construction of the first three centrifuge facilities, which goes back to 1991, did not have provisions that would prevent transfer of intellectual property (i.e. technology)'.[2026]

Construction on a demonstration plant using Chinese centrifuges started in July of 2008 at Plant 504 in Lanzhou (Lanzhou Centrifuge Enrichment Plant 2, 500.000 SWU) and successful enrichment was reported there in July 2010. Lanzhou Centrifuge Plant 3 (500.000 SWU) followed, producing its first LEU in June of 2013. Construction on Lanzhou Centrifuge Enrichment Plant 4 (1.200.000 SWU) was underway in 2015 and completed that year or the next. Another domestic plant (Hanzhong Centrifuge Enrichment Plant 4, North Expansion

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2023 'China is believed to operate indigenous enrichment plant', IPFM Blog, 25th of October 2010, International Panel on Fissile Materials website, http://fissilematerials.org/blog/2010/10/china_is_believed_to_oper.html, Kemp, Scott, R., 'Opening a Proliferation Pandora's box: The Spread of the Soviet-type Gas Centrifuge', in *The Nonproliferation Review*, Vol. 24, No. 1-2 (2017) p. 117, 'Hanzhong Enrichment Facility, Nuclear Threat Initiative website, http://www.nti.org/learn/facilities/726/, websites checked 8-8-2018.

2024 Zhang, Hui, *China's Uranium Enrichment Capacity: Rapid Expansion to Meet Commercial Needs*, Managing the Atom Project, Belfer Center for Science and International Affairs, Harvard University, 20th of August 2015, *http://belfercenter.ksg.harvard.edu/files/chinasuraniumenrichmenntcapacity.pdf*, website checked 10-7-2017, pp. 16, 24, 27, Panasyuk, A., et al, 'Tripartite Enrichment Project: Safeguards at Enrichment Plants Equipped with Russian Centrifuges', IAEA-SM-367/8/02, *http://fissilematerials.org/library/pan01.pdf*, website checked 7-9-2018, p. 1.

2025 Zhang, Hui, *China's Uranium Enrichment Capacity: Rapid Expansion to Meet Commercial Needs*, Managing the Atom Project, Belfer Center for Science and International Affairs, Harvard University, 20th of August 2015, *http://belfercenter.ksg.harvard.edu/files/chinasuraniumenrichmenntcapacity.pdf*, website checked 10-7-2017, pp. 15-16. Lewis, Jeffrey, 'China's New Centrifuge Plants', Arms Control Wonk, https://www.armscontrolwonk.com/archive/206826/chinas-new-centrifuge-plants/, website checked 8-8-2018. Kemp's assertion is made as a comment to Lewis' blog.

2026 'China is believed to operate indigenous enrichment plant', IPFM Blog, 25th of October 2010, International Panel on Fissile Materials website, http://fissilematerials.org/blog/2010/10/china_is_believed_to_oper.html,

Centrifuge Project, 1.200.000 SWU) was constructed at the Hanzhong site near the Russian-built plants and produced its first LEU in June 2013.[2027] At Emeishan's Plant 514, near the town of Shuangfu, another centrifuge enrichment plant (Emeishan Centrifuge Enrichment Plant 1, 800.000 SWU) was constructed between 2011 and 2013, which followed the construction there of a pilot plant which was operational since 2007. Construction on a second plant (Emeishan Centrifuge Enrichment Plant 2, estimated at also 800.000 SWU) was observed between 2014 and 2015 and suggests this plant will become operational in 2016.[2028] Near the end of 2016, commercial uranium enrichment by gas centrifuge capacity (the total of the Hanzhong, Lanzhou and Emeishan plants) in China was estimated at 5.4 million SWU.[2029]

Urenco and China

In the early 1980s contacts between Urenco and China, sanctioned by the JC, ensued. Urenco was targeting the fuel contract for a possible joint China-Hong Kong nuclear reactor (Guang Dong/Daya Bay) at the time.[2030] From the end of 1980 to 1982 the 'submarine affair' caused an economic depression in Dutch-Chinese relations as the result of a diplomatic confrontation that saw neither government back down, see *'The Submarine Affair': The Dutch export-drive clashes with China,* page 430.

In January 1984, DRW reported that it did not anticipate the contacts with the Chinese to lead to a contract in the near future. Framatom would build the reactor and provide the first fuel core for it (probably using French enriched uranium).[2031] Contacts intensified in September 1984 when the Chinese embassy in London invited Urenco to visit China for exploratory meetings. In anticipation, the JC had already decided in June that year that Urenco was allowed to 'explore possibilities for the supply of enrichment services and related questions', reminded a German official the Dutch MEA while kindly asking the Dutch to reconfirm this policy to Urenco (it had somehow not been included in the minutes of the June 20th JC).[2032]

2027 Xiaobo, Zhang, 'China develops own tech to enrich uranium', in *Global Times* 25th of June 2013, http://www.globaltimes.cn/content/791301.shtml#.UclTyj7k5YQ, Lewis, Jeffrey, 'China's New Centrifuge Plants', Arms Control Wonk, https://www.armscontrolwonk.com/archive/206826/chinas-new-centrifuge-plants/, websites checked 8-8-2018, Zhang, Hui, *China's Uranium Enrichment Capacity: Rapid Expansion to Meet Commercial Needs*, Managing the Atom Project, Belfer Center for Science and International Affairs, Harvard University, 20th of August 2015, *http://belfercenter.ksg.harvard.edu/files/chinasuraniumenrichmenntcapacity.pdf*, website checked 10-7-2017, pp. 24, 27.

2028 Zhang, Hui, *China's Uranium Enrichment Capacity: Rapid Expansion to Meet Commercial Needs*, Managing the Atom Project, Belfer Center for Science and International Affairs, Harvard University, 20th of August 2015, *http://belfercenter.ksg.harvard.edu/files/chinasuraniumenrichmenntcapacity.pdf*, website checked 10-7-2017, p. 29, Zhang, Hui, 'China's Fissile Material Production and Stockpile', Research Report No. 17, International Panel on Fissile Materials (2017) *http://fissilematerials.org/library/rr17.pdf*, website checked 7-9-2018, p. 13.

2029 Zhang, Hui, 'China's Fissile Material Production and Stockpile', Research Report No. 17, International Panel on Fissile Materials (2017) *http://fissilematerials.org/library/rr17.pdf*, website checked 7-9-2018, p. 17.

2030 ARC 123-18, p. 3.

2031 ARC 124-8, p. 4, *World Nuclear Industry Handbook 1997,* Nuclear Engineering International (Reed Business: 1997) p. 17.

2032 ARC 124-12a, p. 2. English in original.

The same missive asked the Dutch to remind Urenco that 'in matters of technology, they should take a very cautious approach, i.e. limit themselves to listening to the Chinese' which could inspire more thorough JC discussions on the Urenco delegation's return.[2033]

In an open note to the Troika the following October, Urenco's Managing Director Inglis stated that he understood Urenco should take a 'cautious line' in discussions on technical collaboration and leave the initiative to the Chinese.[2034] Inglis also explained that the limits to the Urenco mission should be clear to the Chinese; Urenco was only visiting China to explore 'technical collaboration' and that 'any proposed arrangement would have to be referred back for consultation with the [JC]'.[2035] He added that 'any form of joint venture would require some transfer of technology and therefore automatically require approval of the Troika government[s].'[2036] Also in October 1984, Urenco officially asked permission to visit China, which incidentally mentioned the 'possibility of technology transfer.'[2037]

In a trip by Minister of Foreign Affairs Van den Broek to China, during which he was accompanied by officials from the Ministry of Economic Affairs, Chinese officials informed the Dutch delegation that China was interested in acquiring Urenco's centrifuge technology, according to Director-General of Foreign Economic Affairs of the Ministry of Economic Affairs F.A. Engering. At this time, Chinese officials had already informed the other two Troika partners that their interest was in technology transfer and in enrichment services.[2038]

Great was the surprise and dismay in the JC when Urenco returned from China and presented the JC with a negotiated and 'more or less tangible proposal' for an joint venture enrichment plant based on Urenco technology in China. In the proposal, Urenco would take a stake of maximum 50% and all 'sensitive' elements would initially be constructed by Urenco, though gradually over time there would be a complete transfer of technology to China (meaning, a centrifuge construction plant). The plant would strictly supply the Chinese market.[2039]

Urenco was strongly admonished by the JC for having taken the relationship with the Chinese much further than mandated. British and Dutch delegates had serious doubts they could approve this proposal considering the non-proliferation aspects but with the proposal already on the table, the Troika had been put on the spot.[2040] Addressing this predicament, the JC established a China-subgroup that was to analyze the political implications of any possible transfer. After the subgroup's first meeting, a core issue had emerged: could a transfer of Urenco technology to China take place with, besides existing IAEA safeguards, adequate guarantees that Troika technology would not be applied for military uses by China itself, or

2033 Ibid., p. 2. English in original.
2034 ARC 124-12b, p. 1. English in original.
2035 Ibid. English in original.
2036 Ibid. English in original.
2037 ARC 124-12c, p. 1.
2038 Van Kemenade, Willem, 'Chinese belangstelling voor techniek Urenco', in *NRC Handelsblad*, 21st of January 1985, p. 1, Tempel, Wubbo, 'Interesse Volksrepubliek voor technologie ultracentrifuge: Afstand China-Urenco blijft groot', in *NRC Handelsblad*, 22nd of January 1985.
2039 ARC 124-12c, pp. 1-2.
2040 Ibid., pp. 1-2.

through transfer to third countries, namely Pakistan?[2041] At the same time, none of the JC delegations wanted to express a clear 'no' at this point. '[T]he other delegations would relish the chance to hide from the Chinese … behind such a veto', observed DRW.[2042]

Records show that China was still a subject of discussion into May 1985, with an entire meeting of the Joint Committee dedicated to a potential collaboration with China, planned for the 20th of May 1985. Preparatory meetings had taken place in the 'China working group' and had been attended by both DRW/AT and DPV officials, highly involved because of the non-proliferation and safeguards aspects of a potential deal, and subsequently DPV/NW asked permission for DPV and DPV/NW officials to attend the JC meeting.[2043] In the subsequent meeting, the JC 'viewed Urenco's Chinese proposals with considerable caution', which eventually prevailed over economic interest; 'in September 1985 the matter was addressed during a visit to China by Heinz Riesenhuber, the German Minister for Research and Technology, who indicated that the matter would not be taken any further.'[2044]

2041 Ibid., pp, 2-3.
2042 Ibid., p. 2.
2043 ARC 50-2.
2044 Kehoe, R., B., *The Enriching Troika: A History of Urenco to the Year 2000* (Urenco Ltd.: Marlow 2002) p. 129.

Chapter 11:

International Safeguards Developments and Urenco

The first IAEA safeguards came into effect as a result of the Japanese request for IAEA assistance to help arrange for it to receive nuclear fuel in the form of Canadian uranium in 1958. The agreement under which conditions for the supply to Japan would be established was based on the 'broadly worded' IAEA Statute.[2045] It became clear that for future agreements, a standardized agreement was needed that would provide countries with a predictable set of conditions that made clear what both states and the IAEA's rights and obligations were. Subsequently,

> '[w]ith difficulty and against much opposition from India, supported by the USSR and other countries, the [BoG] was able in January 1961 to approve a system of safeguards to cover reactors up to a capacity of 100/MW(th). In the same year the Board brought into force a document containing procedures for designating inspectors, arrangements for inspections and inspectors' rights of access. This document, GC(V)INF/39 … still governs IAEA inspections in states not party to the NPT or Tlatelolco Treaty.'[2046]

The 1961 document, known as INFCIRC/26, underwent several reviews and became the in 1965-approved set of rules known as INFCIRC/66, or 'The Agency's Safeguard System (1965)', with extensions added on in INFCIRC/66/Rev.2 These expanded IAEA safeguards, agreed to under Soviet-American leadership, applied to 'nuclear power reactors to chemical reprocessing facilities in 1966, and to conversion and fuel fabrication plants in 1968.'[2047] These were improvements but in no way 'fixed' the then-existing safeguards system. Pre-NPT US resistance to switch from bilateral safeguards agreements to multilateral ones under the IAEA umbrella 'prevented the IAEA from maintaining an effective "universal" safeguards system'; regime building was not always the main priority for the US.[2048]

INFCIRC/66 and its successor-document INFCIRC/66/Rev.2 had a number of defects and uncertainties. While forbidding application of transferred material and equipment 'to further a military purpose', the pre-NPT system did not expressly forbid nuclear explosions for peaceful purposes.[2049] INFCIRC/66/Rev.2 did not adequately provide for safeguards placed on fissile material produced from other safeguarded material, nor did it require 'the conclusion of subsidiary agreements and facility attachments (the need for which was not fully grasped in

2045 Goldblat, Jozef (ed.), Fischer, David, Szasz, Paul, *Safeguarding the Atom: A Critical Appraisal,* Stockholm International Peace Research Institute (Taylor & Francis, London 1985) p. 23.

2046 Ibid. The Tlatelolco Treaty is the Treaty for the Prohibition of Nuclear Weapons in Latin America.

2047 Ebinger, Charles, K., *The Washington Papers Vol. VI: International Politics of Nuclear Energy* (The Center for Strategic and International Studies: Sage Publications, Beverly Hills & London 1978) p. 28, Goldblat, Jozef (ed.), Fischer, David, Szasz, Paul, *Safeguarding the Atom: A Critical Appraisal,* Stockholm International Peace Research Institute (Taylor & Francis, London 1985) p. 23. Soviet leadership had not always been forthcoming in this field, see chapter 2, *Disarmament and Arms Control*, page 65.

2048 Ebinger, Charles, K., *The Washington Papers Vol. VI: International Politics of Nuclear Energy* (The Center for Strategic and International Studies: Sage Publications, Beverly Hills & London 1978) p. 30.

2049 Although since 1975, under strong opposition, this loophole has been 'negotiated out' of all agreements with non-NPT members, Goldblat, Jozef (ed.), Fischer, David, Szasz, Paul, *Safeguarding the Atom: A Critical Appraisal,* Stockholm International Peace Research Institute (Taylor & Francis, London 1985) pp. 76-77.

1964-1965)' or require parties to keep 'abreast of technological developments or for installation of the containment and surveillance instruments'.[2050] Neither was safeguarding facilities and equipment based on transferred, safeguarded technology properly covered under the pre-NPT system, but this was corrected later on. INFCIRC/66/Rev.2 furthermore didn't give 'explicit guidance on the safeguards to be applied to enrichment plants or to plants for the production of heavy water.'[2051]

After the coming-into-force of the NPT by 1970, the IAEA established the Safeguards Committee to design a new set of safeguards in line with obligations of states under the NPT. This committee concluded its work in March 1971 and produced INFCIRC/153, which the BoG approved the following April. INFCIRC/153 has since become the basis on which the IAEA Secretariat has negotiated most safeguards agreements with countries.[2052]

The differences between INFCIRC/66/Rev.2 and INFCIRC/153 ('full-scope') safeguard systems lie in several aspects, a fundamental one being that the former, pre-NPT system safeguards entire facilities and the latter safeguards nuclear material flows (in line with the preamble of the NPT). Whereas under INFCIRC/66/Rev.2 inspectors are allowed to go virtually anywhere in a nuclear facility under safeguards and do so for extensive periods of time, the post-NPT safeguards system, mindful of the safeguards burden and intrusiveness (not just for operational reasons, but also to reduce opportunity for industrial espionage by inspectors) uses a number of agreed strategic points in a facility which are the designated areas inspectors are allowed to be to discharge their duties, as well as capped the number of inspector days and hours. The duties of inspectors are based on essentially the same general principles of safeguards under both systems; material accountancy combined with containment and surveillance measures. States, under both INFCIRC/66/Rev.2 and INFCIRC/153, are required to submit to the Agency design- and other information relevant to safeguards, keep records of 'each facility or material balance area' and provide the Agency with those records.[2053] The verification process, according to the IAEA, consists of 'three main aspects',

> '(1) The examination of the information provided by the State in: Design information; Accounting reports; Special reports; Amplification and clarification of reports; and, Advance notification of international transfers
>
> (2) The collection of information by the IAEA in: Inspections for verification of design information; Ad hoc and routine inspections; and[,] Special inspections.

2050 This defect was also eventually corrected, Goldblat, Jozef (ed.), Fischer, David, Szasz, Paul, *Safeguarding the Atom: A Critical Appraisal,* Stockholm International Peace Research Institute (Taylor & Francis, London 1985) p. 77.

2051 Goldblat, Jozef (ed.), Fischer, David, Szasz, Paul, *Safeguarding the Atom: A Critical Appraisal,* Stockholm International Peace Research Institute (Taylor & Francis, London 1985) p. 77.

2052 Ibid., pp. 23-24.

2053 'The present status of IAEA safeguards on nuclear fuel cycle facilities', IAEA contribution to INFCE, INFCE/SEC/1, 1st of February 1979, pp. 7.

(3) The evaluation of the information provided by the State and collected in inspections for the purpose of determining the completeness, accuracy and validity of the information provided by the State.'[2054]

In its contribution to INFCE, the IAEA explained that material accountancy was its (then) current fundamental safeguards mechanism, with surveillance and containment serving as 'important complementary measures.'[2055] Accountancy, wrote the IAEA, consists of,

> '… the initial determination of physical inventory for a facility or material balance area; the perpetuation of a book inventory based on the original determination of subsequent measured inventory changes verification and updating of the book inventory and periodic physical inventory measurements and verification; and the submission of reports to the IAEA by the State.'[2056]

The IAEA keeps a parallel record independent of that of the state, which it regularly checks against the facility records. Measurement uncertainties, failures to measure parts of the inventory (for example, the impossibility of measuring some of the UF6 condensed in a GCEPs piping system), unmeasured loss or diversion can result in Material Unaccounted For (MUF), which because its based on measurements that contain uncertainties, itself constitutes to a degree an uncertain quantity of material.[2057]

Containment measures, such as the 'application of tamper-indicating seals or surveillance devices' (such as cameras), '[take] advantage of existing structural characteristics, such as containers, tanks or pipes to establish the physical integrity of an area or item by preventing the undetected movement of nuclear material or equipment.'[2058] Such measures would not usually be applied to 'areas or structures through which material would pass as a matter of routine plant activity.'[2059] In the case of breach of a containment measure, such as the damaging of a seal or loss of electricity to a camera (for example because of an accident at the facility) the operator must immediately notify the safeguarding agency so that it can in plan an inspection in short order to ascertain that no diversion of material has taken place and so that it can make reparations to its containment system. Surveillance, besides supporting containment measures using devices or human observation, can also be used to observe inventory changes and other operational processes at facilities.

In general, IAEA inspections include, 'examining pertinent records; making independent measurements on safeguarded nuclear material using IAEA equipment and also State's or operator's equipment , verifying its proper functioning, calibration and procedures; obtaining samples and ensuring their proper collection, treatment, handling and shipping; using and servicing IAEA surveillance equipment; and affixing, inspecting and removing IAEA seals.'[2060] Routine inspections, the most common form of inspection, have the main purpose of

2054 Ibid., pp. 6-7.
2055 Ibid., p. 8.
2056 Ibid.
2057 Ibid., pp. 8-9.
2058 Ibid., pp. 8.
2059 Ibid.
2060 Ibid., p. 9.

verifying 'the location, identity, quantity and composition of safeguarded materials and to verify information on the cause of shipper/receiver differences, book inventory uncertainties, and MUF' in a comparison between the state's reporting and the Agency's own records.[2061] Ad hoc inspections' function is to 'verify design information, initial reports and changes since the initial report and to verify the material involved in international transfers.'[2062] Special inspections are triggered by special reports or situations where information provided to the Agency through routine inspections or by the state is inadequate for it to verify non-diversion. Special inspections are almost never utilized by the IAEA but have been in the past on only two occasions, triggered by a special report made by Romania and performed in 1992, and by non-compliance by the DPRK, which subsequently refused the special inspection, in 1993.[2063]

The INFCIRC/153 system however employs a double-layered structure that relies on a State System for Accounting and Control (SSAC) which provides the,

> '… administrative and technical framework to enable the Agency to execute its safeguards functions in territories under the control of a State. It also ensures that organizational and functional responsibilities and the required safeguards infrastructure are defined or laid down (and maintained) at the level of a nuclear facility under safeguards in such a way that the Agency can carry out its activities in order to achieve its safeguards goals. It is also the responsibility of a SSAC to provide or make available all the relevant information and data'.[2064]

This information and data on the nuclear material flows is, through verification (using the aforementioned means of material accountancy, containment and surveillance) evaluated by the IAEA inspectorate after which it draws a conclusion on whether or not a diversion of nuclear material has taken place.[2065] This conclusion is reported to the Board of Governors, which in the case of noncompliance has the authority to inform the UNSC of its findings. INFCIRC/66/Rev.2 does not require a specific conclusion, but the IAEA Statute does require the Agency to make a 'determination of compliance' and report determined non-compliance to

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2061 Ibid.

2062 Ibid.

2063 'The present status of IAEA safeguards on nuclear fuel cycle facilities', IAEA contribution to INFCE, INFCE/SEC/1, 1st of February 1979, p. 9, Carlson, John, 'Special Inspections Revisited', Paper presented to Annual Meeting of the Institute of Nuclear Materials Management, Phoenix, Arizona, 10-14 July 2005, http://www.belfercenter.org/sites/default/files/legacy/files/uploads/INMM2005SpecialInspections.pdf, website checked 22-5-2017.

2064 Gupta, D., Heil, J., 'Design Features Relevant to Improved IAEA Safeguards', IAEA-SM-231/10, in *Nuclear Safeguards Technology 1978: Proceedings of a Symposium on Nuclear Material Safeguards Organized by the International Atomic Energy Agency*, Vol. 1 (IAEA: Vienna 1979) p. 117.

2065 'The Structure and Content of Agreements between the Agency and States Required in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons', INFCIRC/153 (Corrected) (International Atomic Energy Agency: Vienna June 1972) p. 3, Goldblat, Jozef (ed.), Fischer, David, Szasz, Paul, *Safeguarding the Atom: A Critical Appraisal,* Stockholm International Peace Research Institute (Taylor & Francis, London 1985) pp. 24-25, 79-80, Gupta, D., Heil, J., 'Design Features Relevant to Improved IAEA Safeguards', IAEA-SM-231/10, in *Nuclear Safeguards Technology 1978: Proceedings of a Symposium on Nuclear Material Safeguards Organized by the International Atomic Energy Agency*, Vol. 1 (IAEA: Vienna 1979) pp. 119-120.

the Board of Governors.[2066] The IAEA only has the power to inform other bodies, but not to sanction states for their safeguards violations.

EURATOM, the IAEA and NPT Safeguards

In the absence of a truly effective pre-IAEA safeguards system, which only safeguarded the products of export, and to reduce the exposure European nuclear programs were experiencing under the bilateral inspections as part of supplier agreements (see Chapter 6, *Atoms for Peace in Strategic Context,* page 176) the Europeans built their own safeguards system under EURATOM (See chapter 6, *The Creation of EURATOM*, page 181) This included a well-equipped safeguards inspectorate that in terms of resources rivaled (and rivals to this day) that of the IAEA. Much of the above described measures of material accountancy, containment and surveillance are applied in very similar ways by both the IAEA and EURATOM.

The EURATOM safeguards system is different from the IAEA's in that all nuclear materials in an EURATOM member-state are under safeguards and that it allows for military designation of certain materials; this accommodated France (and later the UK), both a NWS and EURATOM member. EURATOM safeguards are applicable to uranium ores in the form of concentrate or yellow-cake, whereas IAEA safeguards apply 'fully … higher up the fuel cycle, with uranium metal or oxide or UF6'.[2067] Furthermore, EURATOM safeguards are mandatory to its members whereas IAEA safeguards are not; NWS do not have to conclude a Comprehensive Safeguards Agreement (CSA) with the IAEA as part of their NPT obligations. They can however bring civil nuclear facilities under safeguards by concluding a Voluntary Offer Agreement (VOA) with the IAEA. Besides providing assurances to the international community, 'Euratom is about economics – safeguards contribute to a level playing field in Europe, ensuring that … France and the UK do not benefit economically from their nuclear weapons programmes.'[2068] EURATOM does not observe a minimum quantity of nuclear material that triggers the need for safeguards, such as the Significant Quantity (SQ) does in the IAEA system. Also, in contrast to some bilateral safeguards, EURATOM safeguards 'have no influence on the freedom to export from the [European] Community.'[2069]

2066 'The present status of IAEA safeguards on nuclear fuel cycle facilities', IAEA contribution to INFCE, INFCE/SEC/1, 1st of February 1979, p. 3.

2067 Goldblat, Jozef (ed.), Fischer, David, Szasz, Paul, *Safeguarding the Atom: A Critical Appraisal,* Stockholm International Peace Research Institute (Taylor & Francis, London 1985) p. 70. Also see Chapter 6: *The Creation of Euratom*, page 181.

2068 Downes, Robert, J., ´Safeguarding Britain's Nuclear Non-Proliferation Obligations After Brexit´, RUSI Commentary, 5th of February 2018, Royal United Services Institute, https://rusi.org/commentary/safeguarding-britain%E2%80%99s-nuclear-non-proliferation-obligations-after-brexit, website checked 16-7-18.

2069 Howlett, Darryl, A., *EURATOM and Nuclear Safeguards* (The Macmillan Press Ltd.: Basingstoke 1990) p. 136. For Significant Quantity, see below under *Establishment of the Black Box Principle*, page 466. The UK intends to fulfill its safeguards obligations after it leaves the EU (as it voted to do by referendum in June 2016 – the so-called 'Brexit' vote) by establishing a domestic safeguards regime and through the two new safeguards agreements with the IAEA, the latter which were concluded in June 2018. To avoid interruption in its nuclear cooperation, it concluded and intends to conclude bilateral nuclear cooperation agreements, such as it did with the United States in May 2018, as well as one with the EU, 'UK meeting milestones for Euratom exit: Nuclear safeguards legislation successfully passes through Parliament; UK on track to meet international obligations

EURATOM's Safeguards Inspectorate's first inspections were conducted in a facility in Mol, Belgium in April 1960. Verification by EURATOM through material accountancy took precedence over on-site inspection during this initial period, although with the types of facilities under safeguards becoming more diverse, physical on-site inspections became a more prominent part of the safeguards implementation. At the start of 1963, EURATOM had performed 34 inspections (20 in research facilities, 14 in industrial facilities). The same year, the first nuclear power plant came under EURATOM safeguards. By the start of 1965, EURATOM was safeguarding 168 facilities in the European Community area. Following the introduction of safeguards at reprocessing plants as well as other types of facilities EURATOM's methods evolved and became more intrusive; 'continuous' (also known as 'reinforced') safeguards would keep facilities under continuous observation by applying novel monitoring techniques that didn't require the inspectors' presence.[2070]

The NPT and its improved system of safeguards under INFCIRC/153 sought to address the failures of the earlier system and to promote a full-scope coverage but initial results of the NPT negotiations had not inspired much confidence in the Europeans. During the 1950s and 1960s, countries in the Western alliance had all politically accepted the use of EURATOM safeguards. The USSR and its allies considered EURATOM's safeguards a form of self-inspection and argued that it therefore did not provide credible assurance of non-diversion.[2071] The USSR saw EURATOM safeguards as a possible tool to be used to expand the Western alliance nuclear arsenal to include Germany and thus made a diplomatic push to resolve the issue and,

> '… by September 1966, events reached something of a climax as the Soviet Union persuaded Czechoslovakia, Poland and East Germany (a non-IAEA member) to offer to place all their nuclear facilities under IAEA safeguards if West Germany agreed to do the same.'[2072]

The offer, writes Charles Ebinger, was aimed at weakening NATO and undermining the European integration efforts by exploiting existing political divisions within the Western alliance. EURATOM wanted to retain its function as the primary safeguards organization in the EC area and envisioned the IAEA's role as that of an observer while the IAEA's in turn considered EURATOM obsolete as soon as the Agency could implement its safeguards system, preferring to deal with the five national safeguards systems of the EC NNWS instead. Internal division between EURATOM's NNWS members, with the Benelux (Belgium, Luxembourg, with the Netherlands in the lead) in favor of relinquishing regional safeguards in favor of the universal ones of the IAEA and Italy and the FRG along with the European

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from day one of exit', Press release, Department for Exiting the European Union, Department for Business, Energy & Industrial Strategy, Suella Braverman MP , and Richard Harrington MP, 7th June 2018, https://www.gov.uk/government/news/uk-meeting-milestones-for-euratom-exit, website checked 16-7-2018, 'Brexit: Ministers suffer nuclear defeat in Lords', *BBC News*, 20th of March 2018, https://www.bbc.com/news/uk-politics-43476337, website checked 16-7-2018.

2070 Ibid., pp. 113-114.

2071 Ibid., pp. 122-125.

2072 Ebinger, Charles, K., *The Washington Papers Vol. VI: International Politics of Nuclear Energy* (The Center for Strategic and International Studies: Sage Publications, Beverly Hills & London 1978) p. 33.

Commission resisting such a position, weakened the European negotiation position versus the IAEA. After several Benelux proposals a consensus was reached that would have the EURATOM members push for retention of the EURATOM system during the upcoming NPT negotiations.[2073]

During the NPT negotiations, the USSR 'eventually succeeded in ensuring that the NPT would only recognize IAEA safeguards.'[2074] EURATOM safeguards would be sacrificed in favor of a new system of NPT safeguards; only after heated discussions between the Americans and the Europeans was it agreed that EURATOM safeguards would co-exist parallel to NPT safeguards.[2075]

In arguments forwarded by EURATOM for its continued existence, one of the 'trump cards' was EURATOM's acquired experience with the set of 'continuous'/'reinforced' safeguards mentioned above.[2076] The hypothetical replacement of EURATOM safeguards by IAEA ones would also create a more discriminatory situation for the NNWS in the EC; France would no longer be safeguarded, resulting in an unfair competitive advantage that might see European nuclear industry transfer to France. Moreover, reflecting the Cold War distrust, it was argued that EURATOM states could not accept Soviet or Eastern European inspectors and that IAEA inspections in general widened the possibility of industrial espionage.[2077] The French argued that EURATOM was an integral part of the EC legal framework now and therefore needed to stay in place. EURATOM had assumed a form of transnational sovereignty when safeguards functions were ceded to it by the EURATOM member states. Its practical and symbolic role, as an institutional part of a new transnational actor, therefore had to be preserved and isolated from outside pressure. Strategically, part of the benefit of EURATOM meant the French could keep the FRG nuclear industry under close surveillance (in line with the argument to protect EURATOM as an important element of the European integration) as France had no intention to become party to the NPT at this time. EURATOM could also serve the function of a 'fallback mechanism' in case the IAEA system failed.

Officials at the IAEA meanwhile thought the EURATOM refusal to budge extremely unhelpful, delaying and even risking the conclusion of the NPT. Following the conclusion of negotiations, European states' continued insistence on special treatment for EURATOM earned them the criticism that this only shored up 'Western Europe's reputation in the eyes of the Third World as a a group of countries claiming and maintaining superior status and

2073 Howlett, Darryl, A., *EURATOM and Nuclear Safeguards* (The Macmillan Press Ltd.: Basingstoke 1990) pp. 122-124, 128.

2074 Goldblat, Jozef (ed.), Fischer, David, Szasz, Paul, *Safeguarding the Atom: A Critical Appraisal,* Stockholm International Peace Research Institute (Taylor & Francis, London 1985) p. 71, Howlett, Darryl, A., *EURATOM and Nuclear Safeguards* (The Macmillan Press Ltd.: Basingstoke 1990) p. 127.

2075 Ebinger, Charles, K., *The Washington Papers Vol. VI: International Politics of Nuclear Energy* (The Center for Strategic and International Studies: Sage Publications, Beverly Hills & London 1978) pp. 33, 37.

2076 Howlett, Darryl, A., *EURATOM and Nuclear Safeguards* (The Macmillan Press Ltd.: Basingstoke 1990) p. 113.

2077 Wonder, Edward, 'Nuclear Commerce and Nuclear Proliferation: Germany and Brazil, 1975', in *Orbis* (Summer 1977) p. 288. Howlett, Darryl, A., *EURATOM and Nuclear Safeguards* (The Macmillan Press Ltd.: Basingstoke 1990) p. 125-126, 128. These arguments are from Mohammed Shaker's *The Nuclear Nonproliferation Treaty: Origin and Implementation 1959-1979* (1980), quoted in Howlett (1990).

privilege within the society of states', reflective of the contemporary North-South political divide in world politics.[2078]

At its negotiated conclusion, the NPT kept the door open to a diplomatic resolution; it allowed for, under Article III, the possibility for the IAEA to negotiate safeguards agreements not just with individual states, but also with "a group of states', a phrase chosen to accommodate EURATOM.'[2079] The controversy had been resolved for the time being, but not without further souring US-European relations, as 'the Europeans had been distressed by the apparent U.S. willingness to sacrifice Euratom interests to achieve a safeguards agreement with the Soviet Union', prompting the Europeans to intensify their push 'for an independent nuclear posture.'[2080]

The expansion of the safeguards system under the NPT, which would result in additional burdens on the NNWS in the form of direct costs as well through the risk of leakage of commercial intellectual property (such as data on 'new processes and novel designs') for each additional facility safeguarded (but not on the NWS), combined with the ongoing US monopoly in enriched uranium for nuclear reactors while that country had blocked initiatives toward an independent European enrichment plant, created a level of distrust and animosity to US policies that kicked the Europeans and Japanese into action.[2081] Their newfound assertiveness expressed itself in the lead-up to the IAEA-EURATOM safeguards negotiation. When it turned out that the NPT would require 'both NWS and NWWS parties to ensure that IAEA safeguards were applied to their nuclear exports to NNWS' unless the recipient countries accepted IAEA safeguards, and thus supplies from for example the US, Canada and Australia to EURATOM countries were threatened as a result, the EURATOM countries (with Italy and the FRG in the vanguard) responded by, after signing the NPT, declaring they would not ratify the treaty (which would force them to accept IAEA safeguards) until such a time that the IAEA and EURATOM came to a 'satisfactory agreement that would take full account of EURATOM's own safeguards system.'[2082]

2078 Howlett, Darryl, A., *EURATOM and Nuclear Safeguards* (The Macmillan Press Ltd.: Basingstoke 1990) pp. 45, 128-129, 150, 220, 244-245.

2079 Goldblat, Jozef (ed.), Fischer, David, Szasz, Paul, *Safeguarding the Atom: A Critical Appraisal,* Stockholm International Peace Research Institute (Taylor & Francis, London 1985) p. 71, Ebinger, Charles, K., *The Washington Papers Vol. VI: International Politics of Nuclear Energy* (The Center for Strategic and International Studies: Sage Publications, Beverly Hills & London 1978) p. 33.

2080 Ebinger, Charles, K., *The Washington Papers Vol. VI: International Politics of Nuclear Energy* (The Center for Strategic and International Studies: Sage Publications, Beverly Hills & London 1978) pp. 33, 37.

2081 To reduce the illegitimacy of this already structurally unequal situation, and no doubt in an effort to reduce the criticism leveled at them, by 1985 four of the five NWS (US, USSR, the UK and France) had placed some or all of their civil nuclear industry under 'IAEA safeguards of a kind.', Ebinger, Charles, K., *The Washington Papers Vol. VI: International Politics of Nuclear Energy* (The Center for Strategic and International Studies: Sage Publications, Beverly Hills & London 1978) pp. 30, 38, Goldblat, Jozef (ed.), Fischer, David, Szasz, Paul, *Safeguarding the Atom: A Critical Appraisal,* Stockholm International Peace Research Institute (Taylor & Francis, London 1985) p. 31. Safeguards agreements with the IAEA based on their voluntary offers promised during the NPT negotiations came into force in France and the UK (EURATOM member since 1973) in 1978, Howlett, Darryl, A., *EURATOM and Nuclear Safeguards* (The Macmillan Press Ltd.: Basingstoke 1990) pp. 181, 187.

2082 Goldblat, Jozef (ed.), Fischer, David, Szasz, Paul, *Safeguarding the Atom: A Critical Appraisal,* Stockholm International Peace Research Institute (Taylor & Francis, London 1985) p. 71.

One of the West-German main objections during the NPT negotiations had been its discriminatory commercial nature, in that NNWS would be subjected to a higher safeguards burden than NWS. The FRG used its negotiation position during the NPT talks well by extracting concessions from allies in the form of voluntary offer-safeguards by the NWS (putting their civil nuclear industry under safeguards voluntarily) and by setting conditions for the ratification of the NPT (after signing it) that would restrict the intrusiveness of safeguards through a set of stipulations that became known as "the Karlsruhe Doctrine" (restricting material flow safeguarding using strategic points, for example).[2083] Japan negotiated that it would receive a similar deal with regards to a to-be-established 'functionally independent' domestic safeguards system, not having to accept a higher safeguards burden than EURATOM's members, in exchange for it ratifying the NPT.[2084]

After the conclusion of the NPT negotiations, the IAEA and EURATOM started negotiations on a inter-agency safeguards agreement, made necessary by the stipulation that NPT members could not export nuclear materials (including US fuel to European reactors) to 'a non-nuclear weapon State not party of the NPT, unless the nuclear material itself or or that resulting from the transaction was under IAEA safeguards.'[2085] Negotiations between the two organizations and the five EURATOM NNWS started in November 1971, after the IAEA Safeguards Committee had finalized the single member-state safeguards agreement, INFCIRC/153. On the 5th of April 1973 the IAEA and EURATOM concluded the IAEA/EURATOM agreement on the joint application of safeguards with additional protocols agreed with 'Belgium, Denmark, West-Germany, Ireland, Italy, Luxembourg, the Netherlands' and EURATOM and the IAEA, published as INFCIRC/193.[2086] The EC was still forced to approach the IAEA for a temporary solution as it proved impossible to ratify the EURATOM-IAEA agreement 'because France refused to agree to the required Council Regulation', told Dutch Foreign Minister Van der Stoel an impatient Dr. Eklund of the IAEA in a meeting on 28 December 1976.[2087] Minister Van der Stoel had done everything he could but failed to persuade France, and told Eklund the Netherlands was very committed to finding an 'alternative solution', as were the other eight countries.[2088]

Additional regulations were agreed between just the two agencies, which are confidential for commercial and other reasons because they contain specifications of nuclear facilities. The IAEA-EURATOM Safeguards Verification Agreement 'only entered into force in 1977 after

2083 Howlett, Darryl, A., *EURATOM and Nuclear Safeguards* (The Macmillan Press Ltd.: Basingstoke 1990) p. 129-132.

2084 Goldblat, Jozef (ed.), Fischer, David, Szasz, Paul, *Safeguarding the Atom: A Critical Appraisal,* Stockholm International Peace Research Institute (Taylor & Francis, London 1985) pp. 25, 73, Howlett, Darryl, A., *EURATOM and Nuclear Safeguards* (The Macmillan Press Ltd.: Basingstoke 1990) p. 155-160.

2085 Fischer, David, 'Nuclear Safeguards, the First Steps', reprinted out of the VERTIC's Verification Yearbook 2000, in *IAEA Bulletin*, Vol. 49, No. 1 (September 2007) https://www.iaea.org/sites/default/files/publications/magazines/bulletin/bull49-1/49103480711.pdf, website checked 7-9-2018, pp. 7-10.

2086 Domsdorf, E. P. M. W., *Het Verdrag van Almelo* (W.E.J. Tjeenk Willink: Zwolle 1976) p. 24, Goldblat, Jozef (ed.), Fischer, David, Szasz, Paul, *Safeguarding the Atom: A Critical Appraisal,* Stockholm International Peace Research Institute (Taylor & Francis, London 1985) p. 71.

2087 ARC 61-6, p. 4

2088 Ibid.

protracted and difficult exchanges between both organizations about the most minute details of safeguards arrangements'.[2089]

The resulting package agreement added some novel aspects to the international safeguards system. Per the agreement, EURATOM would be treated somewhat like a SSAC (State System for Accounting and Control), of which the IAEA had to be able to verify its 'functional independence', meaning the safeguards authority (EURATOM), the nation state and the operator were all independent from another.[2090] It made a distinction between sensitive and non-sensitive facilities, the former for example dealing with HEU and Pu. At these sensitive facilities, joint teams of inspectors would perform their duties so they could completely independently reach their conclusions. Because of the short possible diversion times, another novel aspect for IAEA inspections was the application of continuous monitoring at these facilities.[2091] Like in state-IAEA relations, there was a procedure which allowed the two organizations to determine which inspectors would have access to facilities, with EURATOM having the authority to refuse particular inspectors or inspectors of particular nationalities.[2092]

The agreement defined mutual obligations that covered the following areas of cooperation: Design Information Verification (DIV) including the determination of Material Balancing Areas (MBAs) and of strategic points (Key Measurement Points or KMP's) to monitor the flow of material; NMA done by EURATOM and reported to the IAEA in monthly facility inventory reports; inspections of facilities, performed by EURATOM and observed by the IAEA in what often resulted in joint visits although IAEA inspectors could perform inspection activities themselves, also separately mandated under Article 73 of the agreement which regulates IAEA's NPT right to perform its 'special inspections'.[2093] A conditional maximum number of 'routine inspection effort' at each facility was also negotiated.[2094] An important aspect of the agreement is that the cooperation between EURATOM and IAEA would make sure that both agencies wouldn't duplicate efforts, but would exchange experiences, coordinate inspections including required resources as well as study safeguards technology developments, in a liaison committee established for those purposes, with EURATOM's inspection effort always exceeding that of the IAEA.[2095] The IAEA inspectorate does have the

2089 Domsdorf, E. P. M. W., *Het Verdrag van Almelo* (W.E.J. Tjeenk Willink: Zwolle 1976) pp. 25-26, Goldblat, Jozef (ed.), Fischer, David, Szasz, Paul, *Safeguarding the Atom: A Critical Appraisal,* Stockholm International Peace Research Institute (Taylor & Francis, London 1985) p. 71.

2090 Howlett, Darryl, A., *EURATOM and Nuclear Safeguards* (The Macmillan Press Ltd.: Basingstoke 1990) pp. 150-151. This designation did not resolve whether the status of the EURATOM system would be subordinate to the IAEA's system or be 'an “international” safeguards inspectorate, equivalent to the IAEA'; that 'struggle' was ongoing during the HSP negotiations in the early 1980s, Kessler, Christian, J., 'Technical Negotiations in a Political Environment', in *The Nonproliferation Review*, Vol. 20, No. 3 (2013) p. 504.

2091 Howlett, Darryl, A., *EURATOM and Nuclear Safeguards* (The Macmillan Press Ltd.: Basingstoke 1990) p. 154.

2092 Ibid., p. 169. 'In the event of repeated refusals, however, the IAEA could take 'appropriate action', although this is not specified in [INFCIRC/193], Ibid.

2093 Domsdorf, E. P. M. W., *Het Verdrag van Almelo* (W.E.J. Tjeenk Willink: Zwolle 1976) pp. 25-26,

2094 Goldblat, Jozef (ed.), Fischer, David, Szasz, Paul, *Safeguarding the Atom: A Critical Appraisal,* Stockholm International Peace Research Institute (Taylor & Francis, London 1985) p. 61.

2095 Domsdorf, E. P. M. W., *Het Verdrag van Almelo* (W.E.J. Tjeenk Willink: Zwolle 1976) pp. 24-26, Goldblat, Jozef (ed.), Fischer, David, Szasz, Paul, *Safeguarding the Atom: A Critical Appraisal,* Stockholm International

option to duplicate efforts though in order to verify EURATOM's inspection's efforts accuracy, for example by independently checking duplicate samples of those samples provided to EURATOM by the facility operator and already checked by EURATOM, against both EURATOM's as well as the operator's records of sampling measurements.[2096]

To facilitate the implementation of the EURATOM/IAEA Safeguards Verification Agreement (INFCIRC/193), particularly the negotiation of two Subsidiary Agreements between the IAEA and EURATOM, Community Regulation 3227/76 was enacted and came into force in 1977. Nuclear operators in the EURATOM member-states had to adapt to a 'totally new process of nuclear materials reporting', for example by switching from a monthly reporting-system to a bi-yearly one.[2097] The 'Regulation required that the nuclear operator provide the European Commission with the Basic Technical Characteristics of its nuclear installation(s)' by completing a 'questionnaire for each type of installation', (including GCEPs) and which information would then be verified by inspectors.[2098] It also provided the guidelines for setting the Particular Safeguards Provisions, or PSPs; 'procedures drawn up by the Commission specifying the kinds of safeguards activities to be carried out by the nuclear operator.'[2099] These PSPs set out 'in detail the procedures through which the operators have to fulfill their safeguards obligations and define, in particular, material balance areas, key measurement points, specific accounting and reporting obligations, inventory frequencies and measures for containment and surveillance.'[2100] Finally, after twenty years of ambiguity, Regulation 3227/76 clarified the status of nuclear materials designated for military use, exempting them from safeguards altogether.[2101] Though 'closely related' to the Facility Attachment negotiated with the IAEA, the important difference is that PSPs only concern an obligation toward the European Commission, as their legal base is the EURATOM Treaty and regulation 3227/76.[2102]

Peace Research Institute (Taylor & Francis, London 1985) p. 71, Howlett, Darryl, A., *EURATOM and Nuclear Safeguards* (The Macmillan Press Ltd.: Basingstoke 1990) p. 168.

2096 Fischer, David, A.,V., 'IAEA/EURATOM Agreement: An Explanation', in *IAEA Bulletin*, Vol. 15, No. 3 (June 1973) https://www.iaea.org/sites/default/files/publications/magazines/bulletin/bull15-3/15303581016.pdf, website checked 1-5-2017, pp. 15-16.

2097 Schleicher, H., W., 'Nuclear Safeguards in the European Community – A Regional Approach', in *IAEA Bulletin*, Vol 22, No. 3 (August 1980) p. 47, Howlett, Darryl, A., *EURATOM and Nuclear Safeguards* (The Macmillan Press Ltd.: Basingstoke 1990) pp. 171-173.

2098 Howlett, Darryl, A., *EURATOM and Nuclear Safeguards* (The Macmillan Press Ltd.: Basingstoke 1990) p. 172. The EURATOM questionnaire would later be used to inform Urenco engineers on what information about their facilities would be shared with the IAEA, see below, page 470.

2099 Ibid.. While similar in nature and both facility-specific, an important difference between Particular Safeguards Provisions and Facility Attachments is that the FA is binding to EURATOM but not to the operator, whereas the PSP is, Howlett, Darryl, A., *EURATOM and Nuclear Safeguards* (The Macmillan Press Ltd.: Basingstoke 1990) pp. 215-216.

2100 Schleicher, H., W., 'Nuclear Safeguards in the European Community – A Regional Approach', in *IAEA Bulletin*, Vol 22, No. 3 (August 1980) p. 47

2101 Howlett, Darryl, A., *EURATOM and Nuclear Safeguards* (The Macmillan Press Ltd.: Basingstoke 1990) pp. 173-174.

2102 Schleicher, H., W., 'Nuclear Safeguards in the European Community – A Regional Approach', in *IAEA Bulletin*, Vol 22, No. 3 (August 1980) p. 47

Safeguards at Urenco

As early as late 1967, Dutch officials discussed future safeguards of to-be constructed centrifuge plants. Contemporary conceptions by the Directorate of Nuclear Energy of future EURATOM safeguards, and 'if the NPT comes about, … IAEA safeguards', were that 'inspections in the plants but not of the plants' would be possible; safeguarding a centrifuge plant would be relatively easy by inspection of "input" and "output" at strategic points in the facility.[2103] 'Inspection does not require access to technical or economic secrets', added Professor Bogaardt on the subject.[2104]

In September 1971, at a time when simultaneously UCN was negotiating a safeguards agreement with EURATOM and the Troika countries were doing so with the IAEA, the Board of Urenco presented the three countries with its view on safeguard modalities in 'The Safeguarding of Centrifuge Plants' document.[2105] Adequate safeguards could be applied without 'exposing sensitive data on design and operation', preventing the proliferation of sensitive technology and information.[2106] The amount of special material (UF6) inside the plant's operation at any given time was very small, in the order of 0.1 gram per centrifuge, meaning a plant of 100.000 centrifuges would have around 10 Kg inventory. The effective quantity of U235 would be less than 1 Kg, because a large amount of the UF6 would have less U235 in it than natural uranium has at 0.07% (the so called 'tails'), 'irrespective of the maximum U235 concentration in the installation, and hence any uncertainties in this can be neglected. In other words, the MUF in the cascade and piping of the plant would be negligible. Efficient operation of the plant required the installation of 'systems capable of measuring to high accuracy the mass flows and U235 concentration of the feed, product and waste', measuring what went in and came out of the cascade.[2107] For safeguarding purposes, storage vessels such as the bulk feed, product and waste vessels would have to be measured for quantity and isotope concentration. This led Urenco to define a number of principles:

> '(a) Inspectorate access to the centrifuges themselves and their arrangement in the cascade or cascades is not necessary for safeguards purposes, and is certainly not desirable since sensitive information could be disclosed.
>
> (b) The input and output of the plant will be accurately measured and will provide the basis of an accurate materials balance.

2103 Note, Directorate for Nuclear Energy, Directorate-General for Energy Supply to Minister of Economic Affairs, 259/EK, Confidential, 29th of December 1967, 2.06.101/E24099/835, p. 4.
2104 Memorandum, Prof. Dr. M. Bogaardt to Mr. Mani, Mr. Star Busmann, Drs. Dee, 'Memorandum Regarding the Application of the Ultra-centrifuge for the Separation of Uranium Isotopes', Confidential, 29th of December 1967, 2.06.101/E24099/835, p. 4.
2105 Letter, Ultra Centrifuge Nederland N.V. Prof. Dr. M. Bogaardt aan Ministerie van Buitenlandse Zaken Mr. A. Kruyt, c.c. Ministerie van Economische Zaken Mr. H.K. Mani, Bog/AH/1156, 13th of September 1971, 2.06.101/E24099/842, Document, Parry, J.,V.,L., 'The Safeguarding of Centrifuge Plants', Enrichment Organisation, EOB(71)18, September 1971, 2.06.101/E24099/842.
2106 Document, Parry, J.,V.,L.,'The Safeguarding of Centrifuge Plants', Enrichment Organisation, EOB(71)18, September 1971, 2.06.101/E24099/842, p. 1.
2107 Ibid.

(c) The process inventory in a centrifuge plant is mainly contained in the intermediate vessels between the cascade or cascades and the input and output stations. These can be made available for visual inspections, but no direct measurements of their contents or the flow into them will normally be available because of the need to ensure the integrity of the plant.

(d) The mass balance obtained by direct measurements of input and output can be supported by the plant mass balance records which will include calculated estimates of the process inventory.'[2108]

Urenco would make available all the plants operational records as well as all the information the operator needed for his/her own material balance records, such as that relating to 'sampling, sample analysis, mass determination, and process flow-rates … external to the cascade(s)', but not technical information relating to centrifuge operation and cascade control.[2109] Mass balance accountancy in designated mass balancing areas would be the 'prime element in the safeguarding practice', according to Urenco.[2110] The operator's production program would be made available as well as any information on material hold-up in vessels measured by the operator. However, because a centrifuge cascade system operates under an internal vacuum, direct measurements inside the balance boundary (meaning, on the 'factory floor' of plant) by inspectors could impact the integrity of the plant and would not be permitted. Centrifuge areas would be 'screened' to impede visual access and thus inspectors would have to make due by verifying proper use by examining whether the plant had any 'undeclared feed or take-off lines to the screened cascade(s).'[2111]

To assist the inspection process, '[i]n the event of a significant discrepancy in the mass balance, it would be relatively easy, at the operator's convenience, to perform a 'clean-out' operation on the intermediate hold-up vessels'.[2112] Furthermore, Urenco envisioned that,

'… ”on-line” sampling and analysis could be used to monitor the U235 concentration of gaseous UF6 as it passes along the plant output line under particular circumstances where there is sufficient line pressure, where the frequency of sampling justifies permanently installed expensive facilities, and where the increased chances of a vacuum integrity breach could be accepted.'[2113]

Additionally, Urenco said it would make general information about the plant, such as layout of the entire plant site as well as an internal plant schematic (example reproduced below) available to the IAEA and its inspectors. Such a schematic for a specific plant 'could include more detail of the plant arrangement (outside the cascade area) and also indicate specific flow rates.'[2114]

2108 Ibid., p. 2, Domsdorf, E. P. M. W., *Het Verdrag van Almelo* (W.E.J. Tjeenk Willink: Zwolle 1976) p. 23.
2109 Document, Parry, J.,V.,L.,'The Safeguarding of Centrifuge Plants', Enrichment Organisation, EOB(71)18, September 1971, 2.06.101/E24099/842, pp. 2-3.
2110 Ibid., p. 3.
2111 Ibid., p. 2.
2112 Ibid., p. 3.
2113 Ibid., Appendix I, p. 1.
2114 Ibid., Appendix I, p. 3.

Schematic Arrangement of Centrifuge Plant

With all this information made available to the inspectors, the operator view was that plant misuse would be relatively easy to detect. The re-arranging of pipework to and in the cascades would require a substantial off-line time and 'probably result in considerable loss of efficiency during subsequent cascade operation', resulting in detectable 'discrepancy in the material balance.'[2115]

From the start of pilot plant operation at the Almelo plant in the early 1970s EURATOM has inspected the Urenco enrichment plants. These inspections included access to the cascade hall.[2116] On a monthly basis, Urenco reported to the Safeguards Directorate of EURATOM:

'– a balance in kilograms uranium and in grams U-235,

– a inventory in kilograms uranium and in grams U-235,

– an overview of received quantities of uranium with a record of sender,

2115 Ibid., p. 3.

2116 ARC 61-11, p. 2, Christian Kessler wrote that Euratom Safeguards Directorate (ESD) inspectors 'had URENCO security clearances and were permitted access to cascade halls. To maintain the credibility of Euratom safeguards, the inspectors at URENCO plants were not nationals of the three URENCO countries, so centrifuge technology was being shared with inspectors from other Euratom states.' It should be noted that giving safeguards inspectors access to the cascade hall does not equal sharing centrifuge technology with those inspectors, although there is a risk of inspectors picking up classified details of the technology during inspections, Kessler, Christian, J., 'Technical Negotiations in a Political Environment', in The Nonproliferation Review, Vol. 20, No. 3 (2013) p. 500.

– an overview of sent quantities of uranium with record of recipient.'[2117]

During inspections at irregular intervals, EURATOM inspectors would visit Almelo during which they would check the 'uranium book-keeping', determine the inventory of uranium, take uranium samples to determine isotope assays at the EURATOM laboratory, check the listed weights of uranium storage and transport vessels and check the facility for modifications in comparison to design information previously supplied to EURATOM by Urenco.[2118] Additionally, when Urenco notified EURATOM of uranium transports of substantial volume, inspectors could travel to Almelo 'to take samples and/or determine weights.'[2119]

Establishment of the Black Box Principle

The Troika was invited to participate in the IAEA Standing Advisory Group on Safeguards Implementation (SAGSI) Meeting on Safeguards for Uranium Enrichment Facilities, held in Tokyo March 7-11, 1977. SAGSI had been established by the IAEA Director General in 1975 as an expert-group that could advice the IAEA Secretariat and DG on technical safeguards matters. One of its early tasks was 'to provide technical guidance in developing safeguards design parameters, through the interpretation of terms in INFCIRC/153 such as "timely detection", "significant quantity", and "risk of early detection"' as well as 'false alarm probability'; the so-called '"detection goals"', in order to create a foundation of understanding on the early NPT safeguards system.[2120] SAGSI's work led to the definition of what would become some of the 'safeguards regime' most fundamental concepts.[2121]

2117 Van Ginkel, J, Neuman, H.J., Visser C.J., *Kernenergie en Kernwapens: Nederland en het Non-proliferatiebeleid* (Nederlands Instituut voor Vredesvraagstukken, Staatsuitgeverij: The Hague 1977) p. 83.

2118 Ibid.

2119 Ibid.

2120 Carlson, John, 'SAGSI: Its Role and Contribution to Safeguards Development', Australian Safeguards and Non-Proliferation Office (2007) https://dfat.gov.au/international-relations/security/asno/Documents/SAGSI_role_contribution_safeguards_dev.pdf, website checked 1-5-2017, pp. 1-2, Transcript of Interview with Current and Former SAGSI1 Members: Jim Casterton, Dieter Tillwick, Roger Howsley, Kaoru Naito and Jim Tape, Interviewed in Tucson, Arizona by Tom Shea and Rich Hooper, Foundations of International Safeguards series, PNNL-SA-56894, National Nuclear Security Administration, July 13, 2007, p. 6, http://cgs.pnnl.gov/fois/doclib/5.0Tucsontranscript.pdf, website checked 1-5-2017.

2121 Following SAGSI's advice, 'the IAEA has set the 'significant quantity' [or SQ] at roughly the amount of material that a state would need to make the first nuclear explosive device, taking into account the waste and losses that the state would probably incur, namely (a) 8 kg of plutonium or (b) 25 kg of uranium-235 contained in uranium enriched to 20 per cent or more, or (c) 8 kg of uranium-233.' Additionally, '[f]or indirect-use material the SQ for low enriched uranium (enriched to less than 20%) is 75 kg of contained U-235, which is, for instance, the amount of U-235 contained in about 10 tonnes of natural uranium'. '[T]imely detection', or 'the estimated time that would be needed to convert diverted material into the components of a nuclear explosive device' was (on SAGSI's advice) set by the IAEA to '(a) 7-10 days for plutonium or highly enriched uranium in metallic form; (b) 1-3 months for plutonium in irradiated fuel; and (c) about one year for natural or low enriched uranium.' While the 'risk of early detection' to a proliferator cannot be quantified, the particular aim of probability of detection can be, and is set by the IAEA at a 90-95% probability that through material accountancy a diversion will be detected, including a maximum of 5% of such a detection be a false alarm. These aims were meant to serve as guidelines to help inform inspection goals at facilities and are based on 'rough approximations' on which (for the IAEA) achievable inspection goals are based, *IAEA Safeguards: Aims, Limitations,*

Expert members contribute to SAGSI on an individual, non-national basis although the DG selects members from nominations made by IAEA member states and as such they represent their own government's views, which is advantageous because it makes SAGSI's advice a 'consensus or majority view of the governments that have the greatest stake in safeguards.'[2122] Soon after it's inception however, technical positions in SAGSI reflected those of the political lines drawn in the '1970 Safeguards Committee that drew up the model NPT agreement' and experts from countries such as 'the USA, the USSR, the UK, the GDR (later replaced by Czechoslovakia), Canada, and Australia all pressed to ensure the most stringent safeguards – sometimes going unrealistically far' whereas 'FR Germany and Japan sought to keep the 'burden', 'intrusiveness' and cost of safeguards as low as they could and (in the case of FR Germany) advanced EURATOM's rather than the IAEA's interests.'[2123] EURATOM's members thought that some of the proposed criteria for *timeliness* that involved far-going IAEA access would be far too economically demanding on their nuclear industries and 'went beyond the terms of the INFCIRC/193 Agreement.'[2124] This entrenchment of positions 'finally came to a head when the two safeguards organizations got together to work out the individual safeguards requirements for each nuclear installation' (the Facility Attachment), an episode that is discussed below on page 470.[2125]

Ahead of the initiation of a safeguards regime for Urenco's Almelo plant saw these positions reversed however, with the UK advocating the most restrictive position now that the focus was on safeguards for GCEPs. In preparation for the March SAGSI meeting, the Troika's (safeguards) experts met at Urenco Ltd. Headquarters in Marlow on the 10th of February, 1977, with the mission to 'review the safeguards policy for Urenco enrichment plants, and to examine the IAEA documents.'[2126] Additionally the meeting served to practically determine a long-term strategy with regards to the expected safeguard demands made upon the company. A contentious point in these talks was the access to cascade areas granted to EURATOM, but which the Troika was unwilling to grant to the IAEA. The UK Chairman to the meeting set the tone by reminding those present, 'of the arguments which had lead to the principle of

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Achievements, IAEA/SG/INF/4 (International Atomic Energy Agency: Vienna 1983) pp. 27, 29, 31, 'The present status of IAEA safeguards on nuclear fuel cycle facilities', IAEA contribution to INFCE, INFCE/SEC/1, 1st of February 1979, pp. 4-5, Goldblat, Jozef (ed.), Fischer, David, Szasz, Paul, *Safeguarding the Atom: A Critical Appraisal,* Stockholm International Peace Research Institute (Taylor & Francis, London 1985) pp. 25-26, 29.

2122 Additionally, a political foundation of SAGSI lies in the Japanese push for 'an "oversight" committee of the Board on which those countries that would bear the full weight of safeguards would be amply represented and able to prevent undue superpower/Secretariat control of the safeguards operation.', Goldblat, Jozef (ed.), Fischer, David, Szasz, Paul, *Safeguarding the Atom: A Critical Appraisal,* Stockholm International Peace Research Institute (Taylor & Francis, London 1985) pp. 25, 67, Carlson, John, 'SAGSI: Its Role and Contribution to Safeguards Development', Australian Safeguards and Non-Proliferation Office, 2007, https://dfat.gov.au/international-relations/security/asno/Documents/SAGSI_role_contribution_safeguards_dev.pdf, website checked 1-5-2017, p. 1.

2123 Goldblat, Jozef (ed.), Fischer, David, Szasz, Paul, *Safeguarding the Atom: A Critical Appraisal,* Stockholm International Peace Research Institute (Taylor & Francis, London 1985) p. 67.

2124 Howlett, Darryl, A., *EURATOM and Nuclear Safeguards* (The Macmillan Press Ltd.: Basingstoke 1990) p. 215. For INFCIRC/193 see above, page 460.

2125 Ibid.

2126 ARC 61-9, p. 1. English in original.

regarding the cascade halls as *black boxes* with no technical reason for safeguards inspectors to gain access'.[2127]

The Dutch delegation pushed back and argued for a less restrictive access policy for safeguards inspections. The Dutch reasoned that a *black box* policy contrasted sharply with recent 'disarmament talks of an open door for inspection.'[2128] When they forwarded the argument that access to the cascade hall would not result in inspectors discovering technical secrets, Urenco disputed this. Another argument concerned the disproving of clandestine activities; if not for the verification of accountancy, access might be needed for that. The Dutch also reminded the meeting of the ghost of the future; 'the Urenco principle' would set the stage and other enrichers would 'seek to maintain the same principle for different reasons.'[2129] Counterarguments included the US classification under which centrifuge technology fell (and which made it almost impossible to share any information on the technology with others, see chapter 8, *After Classification: International Patents and Evolution of Classification*, page 230) and that the Urenco principle was acceptable as long as it was properly explained and the impression avoided that it didn't reflect an 'unwillingness to permit access.'[2130] It was asserted by a participant that most probably the IAEA would have anticipated the *black box* principle and 'consider the next step in diversion of material', but a review of the principle was nevertheless needed because of the discrepancy between EURATOM and IAEA access.

Additionally, the IAEA working papers were discussed, which led those present to formulate a number of points that answered the forwarded questions as well as inform the upcoming meeting in Tokyo. Among other points the Troika and Urenco Ltd. wanted to communicate 'the extreme difficulty of using diverted material for the production of high enrichment material because of the cascade shape.'[2131] Furthermore, they pointed out that a 'adequate and satisfactory material accountancy', 'small inventory' and a 'low level of MUF' ensured the effectiveness of safeguards at Urenco.[2132]

During the Tokyo meeting in March, safeguard approaches for facilities using gaseous diffusion and ultra-centrifuges were discussed. It soon became evident to the participants that 'design and operating characteristics of such facilities were highly dependent on process employed (diffusion, centrifuge, nozzle, etc.)' and that formulating a safeguards approach was only possible for each process individually. The participants decided to for this meeting focus on safeguards for centrifuge enrichment facilities and that diffusion would be discussed in a future meeting. Eight IAEA member states and EURATOM together came up with a safeguards approach for centrifuge plant and agreed unanimously that the *black box* principle was most suitable and access to the cascade halls was not necessary for adequate safeguarding there.[2133]

2127 Ibid. English in original, italics mine.
2128 Ibid., p. 2. English in original.
2129 Ibid. English in original.
2130 Ibid. English in original.
2131 Ibid., p. 3. English in original.
2132 Ibid., p. 4. English in original.

Dutch opposition to such a restrictive approach for a Troika safeguards strategy continued into November 1977, during the JC meeting ahead of the first combined EURATOM-IAEA inspection at Almelo to be conducted in early December. When the British Chair reminded those present of the Tokyo conclusions and subscribed to them, the Dutch delegation pointed out that this was a technical conclusion and not a legal or political one. They in turn reminded the others present of the Dutch position ahead of the Tokyo meeting, that could be summarized as a proposal for an '"open door policy"' that included access to the cascade hall to all inspectors, not just those of EURATOM.[2134] An official from DIO put forth the argument to the Troika partners that, '… in the area of international verification we should not create the impression that we have anything to hide and that, also taking INFCE's conclusions into consideration, there is an argument to be made for a (political) demonstration by making the cascade hall available to IAEA-inspectors, moreover as EURATOM-inspectors already enjoy this entitlement.'[2135]

The German delegation seemed to align itself with the Dutch position, confirming a shift that Dutch officials had noticed before with the Germans, although they argued their position much more on technical than political grounds. The British delegation rejected these arguments and pointed to the erosive effect of lifting restrictions; '"the sky is the limit"' once you open up the cascade halls, argued the British chair.[2136] This position, thought the DIO official reporting on the meeting, had clearly to do with Britain's NWS status in general and the status of the Capenhurst facility particularly, exemplified by the British reference to the fact that any example in transparency the Troika would set would not be followed by the French and Americans.[2137] British officials were already concerned by the 'level of access' the ESD had at Capenhurst and the other Urenco plants, they told US officials.[2138] Additionally, the British delegation referenced the conclusion Dr. Rometsch, Inspector-General and Head of Safeguards at the IAEA, had drawn in relation to cascade hall access; that proliferation of technology was inevitable when inspectors had access there.[2139] At the time of this meeting, Troika relations were somewhat strained and thus the Dutch delegation decided to (apart from voicing the Dutch view) not entrench in their own position. At the end of the debate on cascade-hall access, which took up almost the entire meeting, the British position was adopted

2133 *The Annual Report for 1977*, GC(XXII)/597, International Atomic Energy Agency (IAEA: Vienna 1978) https://www.iaea.org/About/Policy/GC/GC22/GC22Documents/English/gc22-597_en.pdf, website checked 4-4-2017, p. 45, ARC 61-11, p. 1.
2134 ARC 61-11, pp. 1-2.
2135 Ibid., p. 2.
2136 Ibid. English in original.
2137 Ibid.
2138 Kessler, Christian, J., 'Technical Negotiations in a Political Environment', in *The Nonproliferation Review*, Vol. 20, No. 3 (2013) pp. 499-500.
2139 ARC 61-11, p. 2. It is doubtful if this accurately reflected Rometsch position, as by July 1978 he proposed the IAEA be given access to the Almelo plant cascade halls, Coded Message, United States Embassy Vienna to Secretary of State Washington D.C., 'IAEA/EURATOM safeguards – Almelo enrichment plant', Confidential, 13th of July 1978, 06337 (1 of 2) 131651Z, https://wikileaks.org/plusd/cables/1978VIENNA06337_d.html, website checked 21-8-2018.

as Troika policy, with the caveat that the access policy would remain '"under continuous review"'.[2140]

During the same meeting, a suggestion was forwarded that perhaps the inspectors could be allowed 'visitors access' under the Thompson-rules protocol, which gave access to the cascade hall but without the ability to inspect. However, it was expected that when denied inspection rights to the cascade hall, IAEA inspectors would probably turn down such an offer and therefore not making it in the first place was preferred. Another alternative to avoid IAEA irritation over discrepancies between IAEA and EURATOM access rights was offered and positively decided upon; after agreement from the JC on this point, EURATOM would be asked to forego its cascade hall-access for the time being, with the exception of special circumstances that would require its inspectors to have access ('such as if during an industrial accident with suspicion of and opportunity to divert nuclear materials').[2141]

The second issue to be decided upon was on DIV and what amount of information should be shared with the IAEA inspectors ahead of the upcoming visits. It was decided that the IAEA would receive as much information as possible, with the exception of any information on the cascade hall. Engineers from the Capenhurst and Almelo plants would base themselves on the EURATOM Questionnaire and as together they worked out which information would be shared.[2142] In 1978, the first international safeguards on enrichment plants came into effect and these were '"ad-hoc" or limited-scope international enrichment plant safeguards', 'applied at the URENCO Almelo centrifuge enrichment facility in the Netherlands, and at the Japanese Ningyo Toge centrifuge enrichment facility.'[2143]

EURATOM-IAEA Facility Attachment Negotiation

It was during the negotiations on FAs initiated in 1978 that the strained relationship between EURATOM and the IAEA, adversely affected by years of difficult and adversarial negotiations on a variety of subjects that had exposed a fundamental difference in respective perceptions on which organization should have primacy safeguarding nuclear facilities in Western Europe, was clearly exposed. What had been expected to be a series of relatively straight-forward technical discussions became fraught with political-institutional questions on mandate and competency.

The IAEA position was that only if 'the verification rights that had been granted to the IAEA in the INFCIRC/193 Agreement were applied in a rigorous way' would the Agency be able to

2140 Ibid.
2141 Ibid., p. 3.
2142 Ibid.
2143 Swindle, D., W., Wheeler, L., E., 'An Overview of Enrichment Plant Safeguards', Paper for Presentation at the American Institute of Chemical Engineers Winter 1982 National Meeting, February 28 – March 3, 1982, Orlando Florida, K/OA—5072 DE82 000463, https://www.osti.gov/scitech/servlets/purl/5859084, website checked 2-5-2017, p. 12, Kessler, Christian, J., 'Technical Negotiations in a Political Environment', in *The Nonproliferation Review*, Vol. 20, No. 3 (2013) pp. 497-498.

sufficiently fulfill 'its verification role'.[2144] To the Agency, the FA negotiation presented an opportunity to press this point and extend its mandate as far as possible. Of particular interest to it were the inspections of the *sensitive facilities* as defined in INFCIRC/193. The IAEA argued that at these facilities it would need to perform 'roughly equivalent' inspections as EURATOM 'to fulfill its NPT role.'[2145] EURATOM had its reservations about duplicating efforts in general, let alone by means of joint teams to do the same amount of work at facilities. Concern within EURATOM that the IAEA was attempting to usurp EURATOM's safeguards mandate in piecemeal fashion was also prescient. The positions were so far apart that it took five years to reach a compromise, which singled out '12 especially sensitive facilities' for inspections by '"Joint Inspection Teams"', with separate EURATOM and IAEA teams performing inspections 'independently of eachother.'[2146] At the other EURATOM NNWS facilities, the IAEA would apply the principle of observation and verification to reach its conclusions. In practice, the compromise implied the need for the IAEA to find a balance, a 'trade-off', between its verification requirements and its need to avoid 'undue interference' that would unreasonably increase the economic burden of safeguards to the operator.[2147] Whether this intention of efficiency was adhered to can be doubted however. For example, as early as 1979 Belgian officials were complaining to United States officials that the IAEA was unnecessarily duplicating inspection efforts and thereby substantially increasing the economic burden on the Belgium nuclear industry while also undermining EURATOM's supranational role.[2148]

INFCE Working Group 2 on GCEP Safeguards

In INFCE's evaluation of proliferation risks of enrichment plants, technical and political solutions were considered (See chapter 11, *The International Nuclear Fuel Cycle Evaluation (INFCE)* for an introduction to INFCE, on page 353). Urenco at the time was the only example of an enrichment enterprise where safeguards were applied (with all the other existing plants in NWS), which allowed the Troika countries to actively participate and contribute in Working Group 2 of INFCE. Working Group 2 dealt with several interrelated issues, with the availability of enrichment services, assurances of supply and the proliferation aspects of enrichment the most politically relevant issues.[2149]

2144 Howlett, Darryl, A., *EURATOM and Nuclear Safeguards* (The Macmillan Press Ltd.: Basingstoke 1990) pp. 215-216.
2145 Ibid., p. 217.
2146 Ibid., pp. 217-218.
2147 A stipulation along these lines is found in Article 5 of INFCIRC/193, Howlett, Darryl, A., *EURATOM and Nuclear Safeguards* (The Macmillan Press Ltd.: Basingstoke 1990) pp. 217.
2148 Coded Message, United States Embassy Brussels to Secretary of State Washington D.C., 'EURATOM/IAEA safeguards negotiations discussions with Belgians', Confidential, 25th of January 1979, 01535 260745Z, https://wikileaks.org/plusd/cables/1979BRUSSE01535_e.html, website checked 20-8-2018. These complaints possibly were (partly) motivated by the episode Howlett mentions about the work of joint inspection teams at Belgo-Nucleaire's mixed oxide fuel fabrication facility at Dessel, Howlett, Darryl, A., *EURATOM and Nuclear Safeguards* (The Macmillan Press Ltd.: Basingstoke 1990) p. 217.
2149 Enrichment Availability: Report of INFCE Working Group 2', International Nuclear Fuel Cycle Evaluation, STI/Pub/534 (International Atomic Energy Agency: Vienna 1980) p. 65-91, 123-147. Reading the report, one can

The Troika countries submitted a common paper that in general terms set out the main institutional arrangements in the collaboration and devoted a significant portion of the paper to non-proliferation aspects.[2150] It promoted the multi-national structure of Urenco as helping to achieve proliferation resistance by pointing out some of the constraints inherent in the treaty arrangements (such as continued non-proliferation obligations if a country would leave the collaboration) as well as the three-way 'interaction in all phases of the enrichment process' guaranteeing good behavior by all the members, with a reminder that the participating countries had foregone successful national R&D programs in order to create Urenco.[2151]

A remarkable insight into post-proliferation strategy, the Troika paper also argued that if a customer violated its safeguard provisions, it 'would attract sanctions applied by a multi-national organisation acting in unison and using wider powers of persuasion and influence than would perhaps be the case with bilateral agreements.'[2152] Additionally, the paper drew attention to how multi-nationalism promotes non-proliferation, as a broad political base in such an organization helped to provide reliability in long-term contracts and thus furthered a healthy market, taking away 'the incentive to develop and construct additional nationally-controlled facilities'.[2153] An US contribution to Working Group 2 added a critical note to this aspect; 'the unanimity requirement for contractual commitments may be perceived as lessening the fuel assurance potential for nonmember states'; seeing that every member of Urenco could block potential customers.[2154] The Troika voiced its commitment to EURATOM and IAEA safeguards and its continued commitment in 'defining and improving safeguards inspection arrangements for application to Urenco plants.'[2155] Some of the Troika's points on the benefits of multilateral institutions for enrichment to promote non-proliferation goals were incorporated in Working Group 2's final report.[2156]

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not escape the impression that INFCE must have strongly contributed to increased transparency in the enrichment market, for example by listing the available enrichment services suppliers and their current and planned/expected capacities (pp. 65-75) or evaluating possible fuel cycle strategies (pp. 103-113).

2150 'The Urenco-Centec Organisation: Some non-proliferation considerations', Contribution from the Troika countries of Urenco-Centec to INFCE WG/2B, INFCE/DEP/WG.2/19, 7th of February 1979, pp. 1-4.

2151 Ibid., pp. 3-4. It is a promotional line that Urenco would continue to employ, most clearly articulated by Korbmacher et al (2014); '… the multinational structure of URENCO prevents any one plant from diverting nuclear material or associated technology in secret at the instruction of its national Government without the larger organisation being aware.', Korbmacher, Tim, Mann, Melissa, Meyering, Andreas, 'URENCO – A Multinational Contribution to Non-Proliferation', Paper presented at Symposium on International Safeguards: Linking Strategy, Implementation and People, IAEA CN-220, 20-24 October 2014, M Building, International Atomic Energy Agency Vienna International Centre, https://www.iaea.org/safeguards/symposium/2014/home/eproceedings/.../000108.pdf (cached) p. 3.

2152 Ibid., p. 3. As it had already turned out this multinational structure had not prevented nuclear technology proliferation through Urenco's contractors, both by the theft of classified intellectual property and human knowledge proliferation, see chapter 10, *The A.Q. Khan Affair*, page 358.

2153 Ibid., pp. 3-4.

2154 'Institutional arrangements for uranium enrichment', U.S. Contribution to INFCE Working Group 2', INFCE/DEP/WG.2/24, 15th of December 1978, p. 13.

2155 'The Urenco-Centec Organisation: Some non-proliferation considerations', Contribution from the Troika countries of Urenco-Centec to INFCE WG/2B, INFCE/DEP/WG.2/19, 7th of February 1979, p. 3.

2156 Enrichment Availability: Report of INFCE Working Group 2', International Nuclear Fuel Cycle Evaluation, STI/Pub/534 (International Atomic Energy Agency: Vienna 1980) pp. 141, 143.

The Japanese contribution included a paper that among other subjects specifically dealt with safeguarding challenges associated with the 'black box'-nature of GCEP cascade halls, which will be discussed in chapter 11, under *Establishment of the Black Box Principle* on page 466.

The final report of Working Group 2 set out in detail general and specific modalities for safeguarding enrichment plants. With the model safeguards agreement negotiated after the NPT (INFIRC/153) taken as a reference point, it set out the safeguarding objectives of uranium enrichment plants; material accountancy verified through surveillance at Key Measurement Points (KMPs) accompanied by assurance that the facility was configured to produce LEU as declared, by verification of design information. Design information of a plant is usually transmitted to the inspecting authority by the state in the Facility Attachment (FA), which is a document that is negotiated as part of a subsidiary arrangement which in turn is created in the process of coming to a Safeguard Agreement between state and the international safeguarding agency.[2157]

Ordinarily, a state submits a monthly report to the safeguarding authority containing detailed information on the material inventory of the facility. '[R]ecord audit activities' then allow the inspectorate to compare submitted reports to 'its accounting and operating records'. Material inventory information includes the 'location, identity, quantity and composition of safeguarded materials and information on the cause of shipper/receiver differences, book inventory' and MUF.[2158] MUF in a gas centrifuge facility is usually small (compared to for example, large quantities in reprocessing plants) but deposits do build up over time, as during operation UF-6 condenses in the piping of the cascades and associated transport systems.[2159] These deposits are 'uranium deposits (mainly from reactions of UF6 gas with water vapour) and very small Th deposits (directly resulting from the alpha-decay of the uranium in the UF6 gas and indirectly from the alpha-decay of the uranium deposit).'[2160]

Reporting is followed by physical verification of the reported information, for example by weighing containers containing UF-6 and taking samples of UF-6 and analyzing them using several methods, such as mass-spectroscopic techniques. Containment and surveillance

2157 Durst, Philip, Casey, 'IAEA Facility-Level Safeguards and Implementation', Presentation at International Nuclear Safeguards Policy and Information Analysis Course, Monterey Institute for International Studies, 23rd of May, 2011 (attended by the author) p. 9, Goldblat, Jozef (ed.), Fischer, David, Szasz, Paul, *Safeguarding the Atom: A Critical Appraisal,* Stockholm International Peace Research Institute (Taylor & Francis, London 1985) p. 27.

2158 Enrichment Availability: Report of INFCE Working Group 2', International Nuclear Fuel Cycle Evaluation, STI/Pub/534 (International Atomic Energy Agency: Vienna 1980) p. 138, Durst, Philip, Casey, 'IAEA Facility-Level Safeguards and Implementation', Presentation at International Nuclear Safeguards Policy and Information Analysis Course, Monterey Institute for International Studies, 23rd of May, 2011 (attended by the author) p. 13.

2159 Interview by telephone, Philip Casey Durst, Durst Nuclear Engineering and Consulting Inc., 10th of June 2011 (conducted by author), Minato, T., 'Safeguarding a gas centrifuge pilot plant in Japan', IAEA-SM-231/31, in *Nuclear Safeguards Technology 1978: Proceedings of a Symposium on Nuclear Material Safeguards Organized by the International Atomic Energy Agency*, Vol. 1 (IAEA: Vienna 1979) pp. 219, 222-223, 227.

2160 Packer, T., W., Lees, E., W., Aaldijk, J., K., Harry, R.,J.,S., 'Measurement of the Enrichment of Uranium-Hexafluoride Gas in Product Pipes in the Centrifuge Enrichment Plant at Almelo', Netherlands Energy Research Foundation (ECN: September 1987) http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/19/005/19005404.pdf?r=1, website checked 7-9-2018, p. V.

measures are applied 'to establish the physical integrity of an area or item by preventing the undetected movement of nuclear materials or equipment.'[2161] Containment can include measures such as using seals to ascertain containers were not tampered with between inspections, and surveillance can include 'mounting cameras or other devices at strategic points to monitor containment measures or observe inventory changes.'[2162] The main goal of applying all these measures is to get a comprehensive picture of a facilities' operations under normal circumstances and create certainty for the inspectorate that it has 'complete knowledge of the nuclear material flow' in a facility.[2163]

Particular to uranium enrichment facilities is the observance by inspectors of special areas, sensitive 'for commercial or non-proliferation reasons' to which no access could be allowed (see the discussion of *black box* areas below). If a state requested such a particular area to be shielded from inspection, such as the cascade halls in a gas centrifuge plant, INFCIRC/153 provides in the establishment of MBAs around that area, to verify what goes in and comes out of it, although additional surveillance and containment measures to verify such streams of nuclear material might then be necessary.[2164]

As the INFCE started in 1977, the IAEA had no experience safeguarding any enrichment plants, and the first enrichment plants designated for safeguards were GCEPs (with the first commercial diffusion plant (Eurodif) still under construction at the time of INFCE).[2165] In a contributing paper to INFCE the IAEA summarized a number of safeguards-relevant design features of enrichment plants in general and centrifuge enrichment plants specifically. It stated that several forms of feed material can be used, from natural uranium to tails of earlier enrichment, to reprocessed uranium from irradiated fuel. Enrichment plants can have several points where material can be fed or removed from the enrichment installation and usually operate on a continuous basis; 'both a constant feed and a constant product (and tails) removal are essential for efficient process operation.'[2166] Enrichment plants, like reprocessing plants, are considered highly proliferation sensitive because they can produce direct-use weapons-usable material.[2167]

The INFCE Working Group 2 final report's description of available safeguarding modalities in GCEPs appears to have drawn heavily on Urenco's and EURATOM's experiences in Almelo and based on those experiences considered material accountancy and balancing measures adequate and generally not requiring improvement. This was reflected in the IAEA's contribution on the subject, that considered the existing basic safeguards measures suitable to other bulk facilities adequate for GCEPs, though with minor alterations; design verification with special attention to piping penetrating the cascade area; establishment of an initial

2161 Enrichment Availability: Report of INFCE Working Group 2', International Nuclear Fuel Cycle Evaluation, STI/Pub/534 (International Atomic Energy Agency: Vienna 1980) p. 138.
2162 Ibid.
2163 Ibid., p. 139.
2164 Ibid., pp. 129-130, 137.
2165 'The present status of IAEA safeguards on nuclear fuel cycle facilities', IAEA contribution to INFCE, INFCE/SEC/1, 1st of February 1979, pp. 1, 52.
2166 Ibid., p. 52.
2167 Ibid., p. 53.

inventory and subsequent periodic verification using random sampling measurements; routine access to the entire facility outside the special MBAs (see below); containment and surveillance of special MBA boundaries; verification and sealing of feed, product and tails UF6 cylinders; evaluation of the operator's measurement systems (used by the inspectors); and routine access to all safeguards-relevant data in the operator's accountancy system, in order to maintain 'continuity of knowledge'.[2168]

Containment and surveillance measures however were considered to require further improvement, as were the cost effectiveness of safeguards. Furthermore, the 'testing, evaluation and demonstration of containment and surveillance measures and of their interaction with material accountancy measures' should be a set task of the IAEA as part of its safeguarding of uranium enrichment plants into the future, stated the report.[2169]

In the Working Group 2B questionnaire, the 'main technology holders' had provided their fellow INFCE participants with information on operating parameters regarding safeguards-relevant aspects such as process inventories, weight measurement accuracy and assay measurement accuracy (measurement of enrichment grade of isotopes). They furthermore provided estimates of HEU facility construction time, equilibrium time and construction cost for each of their respective applied enrichment technologies.[2170] On the alteration of an existing facility using centrifuge technology for the purpose of undeclared activities, the INFCE concluded that,

> '… an operation in a batch recycling mode would in principle be possible. But, because of criticality limitations, signification alterations in the design would be required, particularly in the material transfer equipment. A batch recycling mode would be subject to detection, because of the important change in the operations mode. With centrifuge enrichment, the LEU production facility would most likely compromise a number of unit cascades operating in parallel. One approach to the conversion of such a facility, in whole or in part, to the production of HEU would be the rearrangement of in-parallel operating cascades into a series operation of several cascades. The difficulty of making such a rearrangement for the production of a signification quantity of HEU depends strongly upon the size and the number of cascades involved and the specific design features of the plant. These changes would be subject to detection. Little flexibility exists for operation at higher than design

2168 Ibid., pp. 56-57.

2169 Enrichment Availability: Report of INFCE Working Group 2', International Nuclear Fuel Cycle Evaluation, STI/Pub/534 (International Atomic Energy Agency: Vienna 1980) pp. 139, Gummett, Philip, 'From NPT to INFCE: Developments in Thinking about Nuclear Non-Proliferation' in *International Affairs*, Vol. 57, No. 4 (1981) p. 562.

2170 Equilibrium Time: 'This time gives a good estimate of how long it takes either to start up a new plant, to enrichments in an operating plant, or to recycle enriched material through the plant for a second enrichment.', Krass *et al.* dates the JC decision to allow the Gronau plant to the year 1978, Krass, Allen, et al, *Uranium Enrichment and Nuclear Weapons Proliferation* (Stockholm International Peace Research Institute, Taylor & Francis Ltd: London and New York 1983) https://www.sipri.org/sites/default/files/files/books/SIPRI83Krass/SIPRI83Krass.pdf, website checked 3-9-2018, p. 109, Enrichment Availability: Report of INFCE Working Group 2', International Nuclear Fuel Cycle Evaluation, STI/Pub/534 (International Atomic Energy Agency: Vienna 1980) pp. 129-135.

separative work rates when full power is being used. By reducing product withdrawal rate, product assay can be increased. However, a significant assay increase could only be achieved for a fixed separative capacity by a substantial reduction of product rate, which would be subject to detection.'[2171]

A number of additional diversion strategies was identified: outside product feed could be introduced in the cascade; accidental losses of UF6 could be overstated or completely invented; during physical inventory taking, material from an MBA could be borrowed to conceal shortage at another MBA; inflation or duplication of items to falsify inventory listings; and measurement data could be overstated to inflate hold-up volumes beyond actual values.[2172]

Limitations to cascade-hall access also came up during the INFCE deliberations in Working Group 2. The IAEA acknowledged that INFCIRC/153 Section 45(b)(IV) provided for the establishment of '"special material balance areas"' that excluded inspectors access.[2173] INFCIRC/66/Rev.2 strictly did not, but the IAEA argued that this could be solved by including such areas in Subsidiary Agreements. Though such a *black box* area should be as small as possible, the IAEA thought that it was possible to safeguard a facility that used this modality, partly because 'the typical enrichment plant has the highest standards of material accountancy of any type of nuclear plant.'[2174] Careful measurement of any material entering or exiting the special MBA, as well as verification of any 'abnormal transfers such as may occur through transfers of equipment', aided by application of adequate containment and surveillance measures, could 'reduce the manpower effort' and importantly, ensure 'continuity of knowledge'.[2175] This creates a high level of certainty on 'whether material is missing but

2171 Enrichment Availability: Report of INFCE Working Group 2', International Nuclear Fuel Cycle Evaluation, STI/Pub/534 (International Atomic Energy Agency: Vienna 1980) pp. 131. The IAEA contribution to INFCE made a similar point on parallel to serial reconfiguration of cascades, 'The present status of IAEA safeguards on nuclear fuel cycle facilities', IAEA contribution to INFCE, INFCE/SEC/1, 1st of February 1979, p. 53. Though, as D.W. Swindle reported in 1990, using 'originally installed or specifically installed valving to obtain product assay levels higher than the declared cascade product assay', 'the operator could obtain significant quantities of HEU over a long period of time using existing process support equipment with little or no physical modification of the plant', with a high probability that verification by visual inspection would not detect such alterations (though other verification methods could), Swindle, D., W., 'Realities of verifying the absence of highly enriched uranium (HEU) in gas centrifuge enrichment plants', Paper presented at the meeting of the American Physical Society, March 12-16, 1990, Anaheim, California, K/ITP-327 DE91 006691, p. 10.

2172 'The present status of IAEA safeguards on nuclear fuel cycle facilities', IAEA contribution to INFCE, INFCE/SEC/1, 1st of February 1979, p. 54.

2173 Ibid.

2174 'The present status of IAEA safeguards on nuclear fuel cycle facilities', IAEA contribution to INFCE, INFCE/SEC/1, 1st of February 1979, p. 55. This high standard is possible because 'the process [involves] no chemical transformations, [demands] the highest standards of physical integrity and hence containment of nuclear materials, and the necessary measurement technologies (weighing and isotopic analysis) [are] capable of the highest standard of precision.', Brown, F., 'The Hexapartite Safeguards Project: a review by the Chairman', IAEA-SM-260/57, in *Nuclear Safeguards Technology 1982: Proceedings of a Symposium, Vienna, 8-12 November 1982, Vol.II* (International Atomic Energy Agency: Vienna 1983) p. 491.

2175 'The present status of IAEA safeguards on nuclear fuel cycle facilities', IAEA contribution to INFCE, INFCE/SEC/1, 1st of February 1979, p. 55.

also indicates whether the mode of operation is as declared, since a change to high enrichment output inevitably is reflected in a change in the tails, product and feed ratios.'[2176]

The *black box* principle was scrutinized by the Japanese delegation in a paper which presented a number of challenges associated with use of the closed-cascade hall model, as well as provided a number of suggestions to overcome those challenges. Three challenges were categorized and defined as,

> '1) Containment and surveillance: How to detect the transfer or re-transfer of uranium, by a facility operator who carries uranium in or out by concealing it in a covered container falsely declared as the centrifuge machine container.
>
> 2) Inspection: How to verify that the cascade has the same contents and capacity as declared and that those contents and capacity have not been changed after going into the operation of facilities.
>
> 3) Material control and Accountancy: How to detect the uranium inventory in the black box.'[2177]

The Japanese paper's proposed solutions to these challenges included: 1. elaborate surveillance and measuring equipment at the entrance/exists of the cascade halls (intensive portal monitoring); 2. inspection frequency and the scale of the *black box*-construction 'at the plant design state' should be considered; 3. the production of HEU at a commercial plant can be detected by improving the accuracy of material accountancy, resulting in reduced MUF and simplified material inventory-taking.[2178]

The INFCE Working Group 2 final report also entertained the feasibility of undeclared enrichment facilities. With regard to the operation and concealment of a clandestine centrifuge enrichment facility, the report worked on the assumption that such an operation would be based on 'less sophisticated' technology operating at 'low efficiency compared with a commercial facility'.[2179]

The Hexapartite Safeguards Project (HSP)

Following the SAGSI meeting in Tokyo in 1977 and partially contemporaneously with the INFCE deliberations, 'numerous bilateral and multi-lateral discussions and consultations' on the subject of safeguards at GCEPs took place. One such meeting took place between a US delegation that included officials from the State Department and ACDA, and three delegations from the Troika countries on the 28th of July 1978.[2180]

2176 Ibid.

2177 'Nonproliferation aspects of uranium enrichment', Contribution from the delegation of Japan to INFCE WG2, INFCE/DEP/WG.2/22, 27th of December 1978, pp. 6-7.

2178 Ibid., pp. 7-9.

2179 Enrichment Availability: Report of INFCE Working Group 2', International Nuclear Fuel Cycle Evaluation, STI/Pub/534 (International Atomic Energy Agency: Vienna 1980) pp. 144-145.

In this meeting, the Troika stuck to the agreed line that cascade access during IAEA safeguards inspections would not be acceptable, in accordance with the Tokyo meeting's conclusions. Bruyns, on behalf of the Troika stated that agreement had been reached with the IAEA on an exclusion area, but not on its dimensions. The reason given for the restriction of access was for non-proliferation reasons as access would reveal sensitive information. This was different and a broader category of information than the classified information as specified in the quadripartite classification guide (see page 230), which was not the 'limitation on access and is not [the] impediment of access that would otherwise be agreed.'[2181] It was this category of sensitive information that would determine the exclusion area. Two weeks earlier, IAEA DDG for Safeguards Rometsch had told US officials that there was a basic agreement between the Troika and the IAEA that,

> '(A) The exclusion area should be defined in such a way as to prevent access to sensitive technology and a consequent risk of proliferation of such technology through IAEA inspectors; and (B) the exclusion area should permit sufficient access to IAEA inspectors to carry out effective safeguards; e.g., it should avoid placing IAEA in a position of being accused of not … being able to verify independently whether or not diversion has occurred.'[2182]

Rometsch thought that the verification of all feed, tails and product going in and out of the plant would be required to meet that goal. He thought that a model of limited access by inspectors could be effective and credible, and proposed 'the exclusion area be defined as the exterior housings of the centrifuges which are located in the cascade area of the plant' (in other words, access to the cascade hall) as 'this would permit IAEA inspectors to check the layout and interconnections between the centrifuges during periodic design verification or re-verification visits, with advance notice' a a frequency of about 4 visits a year.[2183] Troika officials disagreed and thought 'that access would not naturally add to the effectiveness of safeguards' and so Urenco was 'designing [a] safeguards approach to verify all flows at enrichment plant[s], including seals of doors and containment and surveillance monitoring of all movements through 'holes', including equipment and personnel flows.'[2184]

2180 United States officials were Boright, Griffin, Rosenthal and Drump; United Kingdom officials were Alston, Ellingson, Sturman, Gresley; Netherlands officials were Bruyns and Van Galen Last; FRG officials were Hagen and Von Hees, Coded Message, United States Embassy The Hague to Secretary of State Washington D.C., 'Discussion of Enrichment Plant Safeguards', Confidential, 29th of July 1978, 04204 291126Z, https://wikileaks.org/plusd/pdf/?df=58912, website checked 20-8-2018.

2181 Ibid. All delegations agreed on both the relevance of the quadripartite classification discussions in this context and the need to revisit those at a future meeting.

2182 Coded Message, United States Embassy Vienna to Secretary of State Washington D.C., 'IAEA/EURATOM safeguards – Almelo enrichment plant', Confidential, 13th of July 1978, 06337 (1 of 2) 131651Z, https://wikileaks.org/plusd/cables/1978VIENNA06337_d.html, website checked 21-8-2018.

2183 Ibid.

2184 Coded Message, United States Embassy The Hague to Secretary of State Washington D.C., 'Discussion of Enrichment Plant Safeguards', Confidential, 29th of July 1978, 04204 291126Z, https://wikileaks.org/plusd/pdf/?df=58912, website checked 18-8-2018, Coded Message, United States Embassy The Hague to Secretary of State Washington D.C., 'Discussion of Enrichment Plant Safeguards', Confidential, 29th of July 1978, 04204 291126Z,

The first broad meeting between all the main centrifuge technology holders took place in Tokyo in 'late autumn' 1978 at the initiative of the United States.[2185] Participants were the United States, the Troika countries, Japan and Australia, the latter which while not possessing a mature centrifuge technology, was interested in acquiring it from one of the other technology holders.[2186] The goal of this and subsequent meetings was to work towards developing a dependable safeguards system so that states with GCEPs could fulfill their safeguards obligations under INFCIRC/153. This safeguards system would have to provide the IAEA with an independent capability to achieve its safeguards objectives, prevent the spread of information and technology that could contribute to proliferation and protect commercially sensitive information of the technology holders. The general consensus reached during SAGSI needed to be elaborated upon, as in the late 1970s, in the continued absence of an agreed approach GCEPs were and would remain under *ad hoc* safeguards that excluded cascade hall access, a situation that was, in the words of the HSP Chairman, 'clearly unsatisfactory'.[2187]

Towards this end, the United States was pushing for a more formal collaboration among technology holders in order to make substantial push towards the aforementioned goal. The FRG was hesitant to commit to a technological negotiation that was strongly backed by the United States, wary of ulterior motives in the form of a larger strategy of which this diplomatic initiative could be part, not inconceivable considering its timing; 1978 was the year during which the US NNPA was launched and during which INFCE (another US initiative) was ongoing. The FRG and Japan considered that 'IAEA's verification responsibilities under Article III were adequately met with facility-level nuclear material accountancy' and that INFCIRC/153 did not give the IAEA authority to search for 'possible misuse of the facility through undeclared activities' that would require cascade hall access.[2188] In contrast, others (among which the United States) thought that a key goal of an improved safeguards system would be to allow IAEA to verify 'no misuse' and that this might require access.

These arguments laid bare a more fundamental argument against more intrusive safeguards supported by the United States and IAEA, and the accompanying rationale that 'when

https://wikileaks.org/plusd/pdf/?df=58912, website checked 20-8-2018.

2185 Brown, F., 'The Hexapartite Safeguards Project: a review by the Chairman', IAEA-SM-260/57, in *Nuclear Safeguards Technology 1982: Proceedings of a Symposium, Vienna, 8-12 November 1982, Vol.II* (International Atomic Energy Agency: Vienna 1983) p. 492, Kessler, Christian, J., 'Technical Negotiations in a Political Environment', in *The Nonproliferation Review*, Vol. 20, No. 3 (2013) p. 500, Menzel, Joerg, H., 'Safeguards Approach for Gas Centrifuge Type Enrichment Plants', in *Journal of Nuclear Materials Management*, Vol. 12, No. 4 (Winter 1983) p. 30.

2186 Kessler, Christian, J., 'Technical Negotiations in a Political Environment', in *The Nonproliferation Review*, Vol. 20, No. 3 (2013) p. 500. See also chapter 10, *Uranium Enrichment Research in Australia*, page 371, on Australia's wish to acquire uranium enrichment technology.

2187 Brown, F., 'The Hexapartite Safeguards Project: a review by the Chairman', IAEA-SM-260/57, in *Nuclear Safeguards Technology 1982: Proceedings of a Symposium, Vienna, 8-12 November 1982, Vol.II* (International Atomic Energy Agency: Vienna 1983) p. 492, *Jaarverslag 1982*, Ultra-Centrifuge Nederland N.V. (UCN NV: Almelo) p. 13.

2188 Kessler, Christian, J., 'Technical Negotiations in a Political Environment', in *The Nonproliferation Review*, Vol. 20, No. 3 (2013) pp. 500-501.

applying safeguards, the existence of undeclared materials and activities in NNWS should be assumed.'[2189] This rationale was countered by,

> '… amongst others, … [West-]Germany and Japan with the argument that if the assumption of undeclared material were introduced in the safeguards concept then material accountancy could no longer be maintained as a closed material balance. Its confidence-building function would therefore be lost and in particular those NNWS with large fuel cycles would no longer be able to demonstrate their compliance. What would be the value of being a party to the NPT if parties to the treaty are treated with the same lack of confidence as non-parties?'[2190]

Yet, with the large GCEPs coming online in Almelo and Capenhurst at the start of the 1980s, 'a pragmatic solution had to be found to address the problem of undeclared activities and materials for the commercial enrichment facility of [Urenco]'.[2191]

Japanese officials were shadowing German policy and the UK stuck to its restrictive line, whereas the Netherlands was ready to initiate negotiations to resolve the outstanding issues, wherever those might lead. The Troika, collectively and separately (the FRG) inquired with the US about its intentions regarding safeguards the planned GCEP in Portsmouth and what level of access for the IAEA inspectors US officials found acceptable. FRG's Schmidt-Kuester communicated to the US that his country was particularly concerned with whether access models that included the cascade halls could be allowed under the quadripartite classification guide, and the risk of espionage that IAEA inspectors from countries without centrifuge facilities posed. Additionally, how was the US technically interpreting the 'limited specific access' concept, which had come out of SAGSI? US officials responded that while they hadn't been decided on and were actively studying which access models were acceptable or workable, they clearly signaled that the US Portsmouth GCEP would be included in the US voluntary offer to the IAEA and 'the same safeguards goals would be relevant to a U.S. enrichment plant under safeguards as for any other enrichment plant under safeguards although modes of achieving these goals may be plant specific.'[2192]

2189 Fischer, Wolfgang, Stein, Gotthard, 'On-Site Inspections: Experiences from Nuclear Safeguarding', in *Disarmament Forum*, Vol. 3 (United Nations Institute for Disarmament Research: Vienna, 1999) https://www.peacepalacelibrary.nl/ebooks/files/UNIDIR_pdf-art217.pdf, website checked 12-6-2017, p. 47

2190 Ibid.

2191 Ibid.

2192 Coded Message, United States Embassy Vienna to Secretary of State Washington D.C., '(U) Safeguarding enrichment plants', Confidential, 3rd of May 1979, 04350 040854Z, https://wikileaks.org/plusd/cables/1979VIENNA04350_e.html, Coded Message, United States Embassy Bonn to Secretary of State Washington D.C., '(S) Access of IAEA Inspectors to Uranium Enrichment Facilities', Secret, 29th of September 1979, 17436 302215Z, https://wikileaks.org/plusd/cables/1979BONN17436_e.html, Coded Message, United States Embassy The Hague to Secretary of State Washington D.C., 'Discussion of Enrichment Plant Safeguards', Confidential, 29th of July 1978, 04204 291126Z, https://wikileaks.org/plusd/pdf/?df=58912, Coded Message, Secretary of State, Washington D.C. To United States Embassy, Bonn, 'Access of IAEA inspectors to uranium enrichment facilities', Confidential, 22th of October 1979, 275372, https://wikileaks.org/plusd/cables/1979STATE275372_e.html, websites checked 21-8-2018.

The earlier standoff between the Troika/Euratom and the IAEA on cascade hall access (see above, page 478) had not been resolved and continued into the spring of 1979. US officials had not been forthcoming with a commitment on what level of cascade access they were willing to accept for their Portsmouth GCEP and now, ahead of a May 3rd meeting with the IAEA, Troika negotiators drew a line in the sand; unless the US committed to cascade hall access, they would not even consider it. The Troika and Euratom consequently pushed for 'further, possibly indefinite, postponement of their working group with [the] IAEA to develop safeguards procedures for application at Almelo' until US officials provided clarity.[2193] To US officials, the message was clear: 'if the [US Government] wants effective IAEA safeguards applied at such plants in NNWS's we must demonstrate our willingness to accept equally effective safeguards on our own comparable facilities.'[2194]

IAEA officials were becoming apprehensive about this standoff and feared the long-term consequences if the issue was not resolved. Their specific concern was that,

> '.. in the absence of jointly developing and agreeing on a safeguards approach for Almelo, IAEA will have to apply limited (and probably unsatisfactory) ad hoc safeguards procedures until international agreement on an approach to safeguarding such plants is reached (i.e. until IAEA plans for US Portsmouth plant safeguards are settled) and that (A) these ad hoc procedures will, over time, *become the accepted practice* simply by their precedential nature, and (B) in the annual safeguards implementation report (SIR), top level pressure to have everything "look good" will have the effect of an official acceptance of adequacy of these ad hoc procedures which would be used to oppose any subsequent IAEA staff attempt to make them more rigorous and effective.'[2195]

Troika and Euratom negotiators doubled down by now presenting the IAEA with a paper prepared for the May 3rd meeting, in which they set out a restrictive interpretation of safeguarding goals. As a basic assumption, the paper stated: 'Euratom and [the IAEA] are concerned only with the safeguarding of declared materials as declared to them through the normal reporting procedures and as received and verified on site by safeguards inspectors'.[2196] In other words, undeclared feed was none of the inspector's concern. This confirmed UK and FRG critical positions towards a US paper presented in the April 18-20 multilateral consultants group on enrichment safeguards, which included representatives from the IAEA, FRG, France, Japan, Netherlands, United Kingdom and US. In contrast, the Netherlands representative Harry was very supportive of the US paper, which directly addressed possible misuse of a plant by producing HEU.[2197]

2193 Coded Message, United States Embassy Vienna to Secretary of State Washington D.C., '(U) Safeguarding enrichment plants', Confidential, 3rd of May 1979, 04350 040854Z, https://wikileaks.org/plusd/cables/1979VIENNA04350_e.html, website checked 21-8-2018.

2194 Ibid.

2195 Ibid., italics mine.

2196 Ibid.

2197 Coded Message, United States Embassy Vienna to Secretary of State Washington D.C., '(U) Consultants meeting on enrichment plant safeguards', Confidential, 23rd of April 1979, 03946 01 OF 02 231516Z, https://wikileaks.org/plusd/cables/1979VIENNA03946_e.html, website checked 21-8-2018.

Eventually, after expending considerable diplomatic effort, US officials managed to convince their West-German counterparts to participate in the technical negotiation that would be dubbed the Hexapartite Safeguards Project, so named because it's participants were six (hex) national parties: the FRG, the UK, and the Netherlands (together representing Urenco), the United States, Japan and Australia, as well as delegates from the two safeguards organizations.[2198] The project meant to address all the above mentioned issues and outstanding technical questions. As Kessler pointed out, 'the US willingness to place a highly classified and commercially important technology at the same risks and costs as demanded of others persuaded the NNWS to come to the US initiative, rather than work out on their own, separate agreements.'[2199] However, in light of the above, Kessler's point should be qualified; it was not after considerable arm twisting by the Troika and Euratom that the US saw itself forced to assume this position of equality.

In conceiving the project, the ideas on what form it should take 'ranged from informal discussions to fully integrated development programmes.'[2200] The involved countries settled on giving the project the purpose 'to examine the problems and establish a sound technical basis for the development of effective, efficient and credible safeguards strategies by the Inspectorates.'[2201] There was a consensus among participants that a focus to achieve 'rapid and real progress' on the 'practical application at real plants', instead of 'paper studies on model plants' was vital to the success of the project.[2202]

During the initial, ad hoc and still informal HSP meeting of 5-7 November 1980 at the Urenco Headquarters in Marlow, UK, the participants agreed that,

> '[t]he goal of the project would be to develop, within 2 years, an adequate basis of technical experience and information which could be used by the IAEA, Euratom and the State involved in their evaluation of the various safeguards approaches and the possible development of arrangements for the direct implementation of an effective and efficient safeguards approach to specific plants.'[2203]

As such, '[t]he technical objective of the HSP was to facilitate the application of effective and efficient international safeguards at' GCEPs during the two year project and would be achieved first, 'through the exchange of relevant information, thereby coordinating individual development efforts' and second, 'by the technical consideration of possible safeguards

2198 Kessler, Christian, J., 'Technical Negotiations in a Political Environment', in *The Nonproliferation Review*, Vol. 20, No. 3 (2013) pp. 500-501, Naito, K, 'Hexapartite safeguards project: a retrospective' in *Addressing Verification Challenges: Proceedings of an international safeguards symposium on addressing verification challenges*, Contributed Papers (International Atomic Energy Agency: Vienna 2007) p. 610.
2199 Kessler, Christian, J., 'Technical Negotiations in a Political Environment', in *The Nonproliferation Review*, Vol. 20, No. 3 (2013) p. 503.
2200 Brown, F., 'The Hexapartite Safeguards Project: a review by the Chairman', IAEA-SM-260/57, in *Nuclear Safeguards Technology 1982: Proceedings of a Symposium, Vienna, 8-12 November 1982, Vol.II* (International Atomic Energy Agency: Vienna 1983) p. 492.
2201 Ibid.
2202 Menzel, Joerg, H., 'Safeguards Approach for Gas Centrifuge Type Enrichment Plants', in *Journal of Nuclear Materials Management*, Vol. 12, No. 4 (Winter 1983) p. 30.
2203 Ibid., p. 31.

approaches.'[2204] Concerning the latter, cases of non-access and varying degrees of access to the GCEP cascade halls would be studied in parallel during the second year of the project.[2205] To execute the required project studies, four Working Teams were established, on respectively: (1) 'Facility Characteristics'; (2) 'Containment and Surveillance'; (3) 'Nuclear Materials Accountancy'; and (4) 'Safeguards Strategies Including Different Degrees of Access to Cascade Areas.'[2206]

Following the first plenary meeting, in a JC meeting in December 1980 the Troika partners discussed their participation in the project and decided that they would adopt a common position toward the project using the Technical Safeguards Working Group (TSWG), a working group under authority of the JC. After some initial misunderstanding between the partners, the JC's Subcommittee on Safeguards (SOS) was given new life and tasked with coordinating the Troika's political assessments towards the HSP, with strictly technical assessments delegated to the Technical Safeguards Working Group. TSWG assessments would be cleared by the SOS before being submitted to the HSP.[2207]

The SOS had originally directed the TSWG to, in the context of the HSP, also consider GCEP misuse scenarios, but faced strong FRG resistance to the notion that those should be part of the project's remit, in line with the position the Troika/Euratom had taken in the May 3rd 1979 paper to the IAEA. In a compromise, reached on the margin of the second plenary meeting in Boekelo, the Netherlands, the Troika would,

> '… give "minimum recognition" to undeclared activities at GCEPs in HSP submissions without spelling out the FRG's rationale for why they should be disregarded, effectively glossing over the source of disagreement within the [T]roika. As stated by the T.S.W.G. chair, Blackwell Gresley, the troika's Team 4 paper made "extensive use" of the so-called 'Boekelo understanding,' making no explicit statements on how access strategies might address undeclared materials and equipment.'[2208]

The first HSP Working Team laid the groundwork for the other teams by studying the commonalities and differences between the GCEPs in existence, under construction and in advanced stage of planning, avoiding work on theoretical future designs. Working with the information provided by Team 1, Team 2 then assessed the available containment and surveillance measures that included studying devices such as '[s]eals', '[p]ortal monitors', '[p]ackage monitors', '[o]ptical surveillance systems' and '[p]ipe monitors' that were currently

2204 Ibid.

2205 Ibid., p. 31, Brown, F., 'The Hexapartite Safeguards Project: a review by the Chairman', IAEA-SM-260/57, in *Nuclear Safeguards Technology 1982: Proceedings of a Symposium, Vienna, 8-12 November 1982, Vol.II* (International Atomic Energy Agency: Vienna 1983) p. 493.

2206 Brown, F., 'The Hexapartite Safeguards Project: a review by the Chairman', IAEA-SM-260/57, in *Nuclear Safeguards Technology 1982: Proceedings of a Symposium, Vienna, 8-12 November 1982, Vol.II* (International Atomic Energy Agency: Vienna 1983) p. 496.

2207 Walker, Mark, E., 'The Hexapartite Safeguards Project or: How I Learned to Stop Worrying and Love Multinational Enrichment', Paper submitted to Institute of Material Management Annual Meeting, July 16-20 2017, Indian Wells (CA), pp. 4-6.

2208 Ibid., p. 6.

and in the near-future available for implementation of safeguards.[2209] Team 2 concluded that 'it saw no reason why [containment and surveillance, or C/S] should not be a viable safeguards measure for ensuring that all nuclear material passed through the key measurement points.'[2210] The conclusion drawn by Team 2 confirmed the assumption Team 3 operated on; that C/S could provide assurance that all nuclear materials would pass through and be recorded at KMPs.

Team 3 concluded that considering the bulk of nuclear material in a GCEP was located in storage outside the cascade hall and the amount of material inside the cascade hall was small and could not reasonably be verified, *cascade hall access was not strictly needed* for nuclear material accountancy purposes. Operator experience shared with the project confirmed the aforementioned INFCE assessment (see page 476) that determination of the book inventory for material accountancy at GCEPs could be extremely accurate. Verification of the book inventory could use the existing 'Attributes and Variables approach' using weighing and analysis devices that were in 'an advanced stage of testing.'[2211] Thus, Team 3 concluded the two inspectorates had 'appropriate means' to verify the operator's accounts with confidence. Its work also led to further investigation on how anomalies in operator accounts could indicate HEU production.

Attempting to navigate the most sensitive subject of the project; safeguards inspections inside the facilities that included various degrees of access to the cascade hall, Team 4 collected the views of the participants 'on the acceptability and safeguards value of particular access modes' which provided 'the basis of evaluation the safeguards value of the various alternatives.'[2212]

Agreeing to a common Troika position to be submitted for Team 4's evaluation again proved highly contentious for much the same reasons. The TSWG's prepared draft for submission to the HSP was criticized by the FRG, invoking the 'Boekelo understanding', because it still contained too many direct references to the politically charged terms associated with misuse. The UK, in conformity with their previously voiced concerns over technology proliferation, took issue with a section on security implications associated with cascade access. After Troika consultations a watered down-version of the paper that deferred a Troika position on the revelation of classified information to inspectors was submitted to Team 4, even though the earlier draft found its way into the Japanese HSP delegation's hands.[2213]

2209 Brown, F., 'The Hexapartite Safeguards Project: a review by the Chairman', IAEA-SM-260/57, in *Nuclear Safeguards Technology 1982: Proceedings of a Symposium, Vienna, 8-12 November 1982, Vol.II* (International Atomic Energy Agency: Vienna 1983) pp. 496-497. A package monitor is a surveillance tool that, using gamma-rays, can be used to inspect hand-held packages leaving or entering a containment area for traces of HEU, Fehlau, P.,E., Ortiz, J.,M., Allander, K., S., 'Monitoring Packages and Containers – Passive SNM Package Monitor for Uranium', in, Smith, Darryl, B. (ed.), Jaramillo, Ganara, R. (ed.), *Safeguards and Security Progress Report, January-December 1989*, LA-11914-PR, Los Alamos National Laboratory, https://www.osti.gov/scitech/servlets/purl/6328343-wnu1rg/, website checked 25-5-2017, pp. 7-8.
2210 Brown, F., 'The Hexapartite Safeguards Project: a review by the Chairman', IAEA-SM-260/57, in *Nuclear Safeguards Technology 1982: Proceedings of a Symposium, Vienna, 8-12 November 1982, Vol.II* (International Atomic Energy Agency: Vienna 1983) p. 497.
2211 Ibid., pp. 497-498.
2212 Ibid., p. 498.

Team 4 subsequently reported:

> 'Possible strategies ranging from "access unrestricted in scope and frequency" to "single visit for defined purposes" were examined in detail with respect to their safeguards value and intrusiveness. It was concluded that *the limited-frequency unannounced-access model*, defined as "routine access to each cascade hall with an agreed average frequency and where access is permitted within one to two hours of notification by the Inspectorates" offered the greater advantage.'[2214]

This conclusion applied equally (though with some variations) to different technologies, and an 'Assessment Sub-Group" was established to develop suitable safeguards approaches and further evaluate available technologies to support those approaches.[2215] However, the Sub-Group still evaluated both non-access and limited-access approaches.[2216] The differentiation between technologies was between plants with 'greater "transparency" characteristics' which have a high 'ease of detection by visual observation of a rearrangement of cascade piping' and those with 'lesser "transparency" characteristics'.[2217] Additionally, plants that employed small reliable centrifuges needing no maintenance contrasted with those that employed small or large centrifuges needing routine maintenance. Such maintenance would involve the regular transportation of failed and new centrifuges respectively out and in of the cascade halls, presenting increased and more various verification challenges, such as intensive portal monitoring.[2218]

2213 Walker, Mark, E., 'The Hexapartite Safeguards Project or: How I Learned to Stop Worrying and Love Multinational Enrichment', Paper submitted to Institute of Material Management Annual Meeting, July 16-20 2017, Indian Wells (CA), pp. 6-7. One can speculate on how and why the earlier draft found its way to the Japanese delegation; perhaps someone from the Troika was signaling that internal consensus on its technical conclusions was different from what was communicated to Team 4.

2214 Brown, F., 'The Hexapartite Safeguards Project: a review by the Chairman', IAEA-SM-260/57, in *Nuclear Safeguards Technology 1982: Proceedings of a Symposium, Vienna, 8-12 November 1982, Vol.II* (International Atomic Energy Agency: Vienna 1983) p. 498, italics mine.

2215 Ibid., pp. 498-499, Menzel, Joerg, H., 'Safeguards Approach for Gas Centrifuge Type Enrichment Plants', in *Journal of Nuclear Materials Management*, Vol. 12, No. 4 (Winter 1983) p. 31.

2216 ARC 123-14, p. 1, Menzel, Joerg, H., 'Safeguards Approach for Gas Centrifuge Type Enrichment Plants', in *Journal of Nuclear Materials Management*, Vol. 12, No. 4 (Winter 1983) p. 31.

2217 This includes the '[e]xistence of sampling points, isolation valves or valves for the rearrangement of existing piping.', Naito, K, 'Hexapartite safeguards project: a retrospective' in *Addressing Verification Challenges: Proceedings of an international safeguards symposium on addressing verification challenges*, Contributed Papers (International Atomic Energy Agency: Vienna 2007) p. 612, Menzel, Joerg, H., 'Safeguards Approach for Gas Centrifuge Type Enrichment Plants', in *Journal of Nuclear Materials Management*, Vol. 12, No. 4 (Winter 1983) pp. 36-37.

2218 The large centrifuges were only employed by the United States, where they turned out not to be commercially competitive enough to warrant the continuation of the program after 1985. An attempt to privatize the program from 2001-2002 on was attempted but stalled despite sizable investments of public money. The project was eventually taken over by DOE in 2014 and discontinued in 2015, 'USEC Portsmouth "American Centrifuge Plant" project, USA', World Information Service on Energy: Uranium Project, http://www.wise-uranium.org/index.html, website checked 7-9-2018., http://www.wise-uranium.org/epusecc.html, website checked 25-5-2017, Naito, K, 'Hexapartite safeguards project: a retrospective' in *Addressing Verification Challenges: Proceedings of an international safeguards symposium on addressing verification challenges*, Contributed Papers (International Atomic Energy Agency: Vienna 2007) p. 611, Brown, F., 'The Hexapartite Safeguards Project: a review by the Chairman', IAEA-SM-260/57, in *Nuclear Safeguards Technology 1982:*

Consensus did not immediately emerge in the Sub-Group. Some participants pointed to the ability of a non-access model to provide a credible assurance of non-diversion. In February 1982, leading up to the fifth plenary HSP meeting and the presentation of the Sub-Group's results, the question of what Troika policy with regard to cascade hall access should be pursued came up again. According to a missive from the Urenco management, technical progress in the Troika's Technical Safeguards Working Group had stalled and exposed 'an urgent need' to agree to a Troika political standpoint on cascade hall access. Specifically, what was needed was a re-definition of the agreed position 'which in turn can be used to provide a political signpost for the [HSP].'[2219] Urenco wrote to Troika officials that a meeting of the JC's SOS was required to create political clarity on the issue.[2220]

The Assessment Sub-group reached a consensus that was in line with Team 4's conclusion, that the LFUA (Limited Frequency Unannounced Access) model was the most advantageous model and provided the most benefit to offset its major drawback, which was that it could expose sensitive technology to the inspectorates. The Sub-Group's main conclusion was made conditional by the participants on: the equal application of the model to all participants; clarity on scope, description and definition of the safeguards approach; and adequate security measures to protect the sensitive information in the cascade area and the guarantee that 'extended containment and surveillance (C/S) measures at the periphery of the cascade area [would] not be used.'[2221] The Sub-Group concluded that the advantages of the LFUA model were, as opposed to intensive portal monitoring at KMPs on the cascade hall periphery (a proposal made during the INFCE and again during the HSP), that it was less intrusive and less resource intensive, easier to 'implement in facilities already in operation or under construction', and that the safeguards tools (equipment and measuring technologies) 'could be more credibly demonstrated within the remaining timescale of the [HSP].'[2222] During the HSP's fifth plenary meeting in March 1982, the participants 'endorsed the conclusions and recommendations of the [A]ssessment [S]ub-[G]roup.'[2223] The Assessment Sub-Group gave the limited consensus reached on the LFUA model during Team 4's work a more solid footing and as such, the Sub-Group's work seems to have been, to a degree, predetermined.

Proceedings of a Symposium, Vienna, 8-12 November 1982, Vol.II (International Atomic Energy Agency: Vienna 1983) pp. 499, 502.

2219 ARC 123-14, p. 1. English in original.

2220 Ibid.

2221 Brown, F., 'The Hexapartite Safeguards Project: a review by the Chairman', IAEA-SM-260/57, in *Nuclear Safeguards Technology 1982: Proceedings of a Symposium, Vienna, 8-12 November 1982, Vol.II* (International Atomic Energy Agency: Vienna 1983) p. 499, Menzel, Joerg, H., 'Safeguards Approach for Gas Centrifuge Type Enrichment Plants', in *Journal of Nuclear Materials Management*, Vol. 12, No. 4 (Winter 1983) pp. 31-32.

2222 For the INFCE proposal, see page 477. Brown, F., 'The Hexapartite Safeguards Project: a review by the Chairman', IAEA-SM-260/57, in *Nuclear Safeguards Technology 1982: Proceedings of a Symposium, Vienna, 8-12 November 1982, Vol.II* (International Atomic Energy Agency: Vienna 1983) p. 499, Menzel, Joerg, H., 'Safeguards Approach for Gas Centrifuge Type Enrichment Plants', in *Journal of Nuclear Materials Management*, Vol. 12, No. 4 (Winter 1983) pp. 31-32, Naito, K, 'Hexapartite safeguards project: a retrospective' in *Addressing Verification Challenges: Proceedings of an international safeguards symposium on addressing verification challenges*, Contributed Papers (International Atomic Energy Agency: Vienna 2007) p. 612.

2223 Menzel, Joerg, H., 'Safeguards Approach for Gas Centrifuge Type Enrichment Plants', in *Journal of Nuclear Materials Management*, Vol. 12, No. 4 (Winter 1983) p. 31.

In April 1982, a '"limited access" model' (in reference to the LFUA model) was almost agreed for the Almelo plant.[2224] The German partner was one of the countries that had set some conditions under which IAEA inspectors would be granted access to the cascade halls, and that still needed to be met, but the DRW reported with confidence that there was good reason to believe the HSP would be successfully concluded soon. To the Troika, the Dutch delegation offered to start preparing the Facility Attachment (FA) for EURATOM so that as soon as HSP concluded it could be finalized as well, which led to no objections from the Troika partners and suggests that the earlier impasse within the Troika and in the HSP Assessment Sub-Group had been overcome.[2225]

The LFUA model of the HSP

The model for LFUA that the participants of HSP agreed on was based on INFCIRC/153's safeguards objectives. The consensus that eventually grew in the HSP and that can be counted as one of its successes, was that the two general objectives of INFCIRC/153 in GCEPs were to detect diversion of nuclear material and enrichment of material above reported levels, while avoiding politically charged language that conveyed possible intent, such as 'facility misuse', 'undeclared nuclear material' or 'undeclared activities'.[2226] Official reference to 'undeclared' was not acceptable to all participants of HSP, with some participants suggesting that it implied a lack of good faith on the part of them. Inspired by the 'Boekelo understanding', the UK's Brown, HSP Chairman, had managed to '[facilitate] an agreement among all HSP delegations, … to remove direct references to undeclared material and capacity in team reports'.[2227] Nevertheless, the consensus adoption of the LFUA approach was a strong signal that all the participating parties implicitly accepted that 'no misuse' was one of the conclusions that the IAEA had to draw for the safeguards approach to have credibility.

The project's participants concluded that particularly for the detection of enrichment above reported levels and to confirm the absence of HEU production of which detection was made possible by 'changes in declared UF6 piping arrangement; [the] existence of additional storage, feed and withdrawal stations/facilities; [and] a radiation field indicating HEU', cascade hall access was necessary.[2228] Safeguards activities inside the cascade hall could 'be broadly classified into direct visual observation by inspectors, technical measures, i.e., radiation monitoring and [Non Destructive Assay or NDA] measurements, sampling, and application and verification of seals.'[2229] While there necessarily would be variation in how

2224 ARC 123-18, p. 4. English in original.

2225 Ibid.

2226 Menzel, Joerg, H., 'Safeguards Approach for Gas Centrifuge Type Enrichment Plants', in *Journal of Nuclear Materials Management*, Vol. 12, No. 4 (Winter 1983) p. 32.

2227 Walker, Mark, E., 'The Hexapartite Safeguards Project or: How I Learned to Stop Worrying and Love Multinational Enrichment', Paper submitted to Institute of Material Management Annual Meeting, July 16-20 2017, Indian Wells (CA), p. 9.

2228 Menzel, Joerg, H., 'Safeguards Approach for Gas Centrifuge Type Enrichment Plants', in *Journal of Nuclear Materials Management*, Vol. 12, No. 4 (Winter 1983) p. 32.

2229 Ibid., p. 33, Swindle, D., W., 'Realities of verifying the absence of highly enriched uranium (HEU) in gas centrifuge enrichment plants', Paper presented at the meeting of the American Physical Society, March 12-16,

these activities and measures would be applied to different GCEPs, particularly in light of the different technologies, as much uniformity as possible in safeguards assumptions and approach, derived benefits from the meeting of safeguards objectives, and frequency and duration of inspections would be striven for.

For facilities with a capacity of up to 1.000.000 SW/a, 'average frequency of routine inspections' was 'expected to be in the range of 12-15 times per year.' with the expected number of IAEA inspectors to be at least two.[2230] This number excluded separate visits to service safeguards equipment and verify shipment details, both incoming and outgoing. Indications of duration for routine visits would be three days and the physical inventory taking to be two weeks. For the same plant-size range, inspections inside the cascade hall would have an average frequency of 4 to 12 times per year, but would be subject to a number of factors relating to the frequency of inspections outside the cascade hall, the technology employed at the plant (large or small centrifuges and associated maintenance regimes), and the design and size of the plant.

Inspections inside the cascade halls were expected to last between one and eight hours, with access granted to the hall by the operator within two hours of the inspectorate's official request, in line with Team 4's conclusion.[2231] The time limits in the LFUA model served 'to give the operator sufficient time to take steps to ensure that no sensitive information could inadvertently be obtained by the inspectorate when inside the cascade hall' as well as to,

> '… not give an operator sufficient time to disconnect any process equipment that may be in use for HEU production or to remove evidence of his illegal activity. The conditions agreed to in the HSP were that within 24 h of arriving in the host country, an inspector must be able to exercise the option of conducting an LFUA measurement. These 24 hours are important since any residual evidence of HEU production remaining in the plant decays to undetectable limits in about 24 hours. The issue here can be summarized as follows: as soon as an inspector arrives at an immigration point in a country, the practicality of traveling to the plant site and obtaining access within in the 24-h limit is difficult, if not impossible to achieve on an unannounced basis.'[2232]

Thus, border station agents or airport officials could be monitoring for the inspector's arrival and immediately alert other officials that then would direct the nuclear plant to cease HEU production.[2233]

1990, Anaheim, California, K/ITP-327 DE91 006691, p. 6.

2230 Menzel, Joerg, H., 'Safeguards Approach for Gas Centrifuge Type Enrichment Plants', in *Journal of Nuclear Materials Management*, Vol. 12, No. 4 (Winter 1983) p. 33.

2231 Ibid., pp. 33-34, Swindle, D., W., 'Realities of verifying the absence of highly enriched uranium (HEU) in gas centrifuge enrichment plants', Paper presented at the meeting of the American Physical Society, March 12-16, 1990, Anaheim, California, K/ITP-327 DE91 006691, p. 5.

2232 Swindle, D., W., 'Realities of verifying the absence of highly enriched uranium (HEU) in gas centrifuge enrichment plants', Paper presented at the meeting of the American Physical Society, March 12-16, 1990, Anaheim, California, K/ITP-327 DE91 006691, pp. 5, 9-10.

2233 Ibid., p. 10.

A number of suggestions to restrict access approaches in the cascade hall were also formulated. These suggestions included: restriction of the duration of inspector access, limits to the amount of inspectors, restriction of inspector movement to 'pre-determined and agreed paths' inside the hall, the escorting of inspectors inside the hall, restriction of 'instruments and equipment' used by inspectors to those previously agreed upon; restriction of equipment used by inspectors to those owned by the operator (although inspectors, when asked to use the operator's equipment, would be allowed to verify whether that equipment was properly calibrated) and limiting the taking of photographic evidence to the operator (though at request and direction of the inspectors, and the inspectors would have the right to be present during photo development).[2234]

Demonstration programs were run under auspices (but were not formally part) of the HSP at several of the participants' facilities to test and demonstrate particular safeguards aspect in a practical environment and to make sure assumptions about reliability of equipment and processes were dependable. As the only operational GCEPs, the Troika plants in both Capenhurst and Almelo were made available for testing programs by all the HSP participants except Japan.[2235] An 'Integral Exercise' was planned and executed at the Capenhurst facility after results from earlier project demonstrations came in.[2236]

Kaoru Naito pointed out that the collaboration between the IAEA and EURATOM during the HSP 'nurtured the relationship of mutual cooperation and trust between the two organizations', removing some of the strain that had marked their relationship in the 1970s.[2237] '[I]t appeared that the two safeguards inspectorates rather valued having a colleague in the room, and they tended to approach issues from much the same perspective, in spite of the struggles between them taking place in other fora', Christian Kessler adds.[2238] EURATOM presence in the HSP had been 'necessary from the perspective of the URENCO partners' and during the

2234 Menzel, Joerg, H., 'Safeguards Approach for Gas Centrifuge Type Enrichment Plants', in *Journal of Nuclear Materials Management*, Vol. 12, No. 4 (Winter 1983) p. 34, Naito, K, 'Hexapartite safeguards project: a retrospective' in *Addressing Verification Challenges: Proceedings of an international safeguards symposium on addressing verification challenges*, Contributed Papers (International Atomic Energy Agency: Vienna 2007) pp. 613-614.

2235 Brown, F., 'The Hexapartite Safeguards Project: a review by the Chairman', IAEA-SM-260/57, in *Nuclear Safeguards Technology 1982: Proceedings of a Symposium, Vienna, 8-12 November 1982, Vol.II* (International Atomic Energy Agency: Vienna 1983) pp. 500-501. Simultaneous to testing at GCEP, relevant equipment was also tested at other plants, such as the Oak Ridge Gaseous Diffusion Plant, Smith, Darryl, E., (ed.) *Safeguards and Security Progress Report: January-December 1983*, LA -10170-PR D85 004488, Los Alamos National Laboratory, http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/16/055/16055105.pdf?r=1, website checked 28-5-2017, p. 52.

2236 Brown, F., 'The Hexapartite Safeguards Project: a review by the Chairman', IAEA-SM-260/57, in *Nuclear Safeguards Technology 1982: Proceedings of a Symposium, Vienna, 8-12 November 1982, Vol.II* (International Atomic Energy Agency: Vienna 1983) pp. 501, 503, Naito, K, 'Hexapartite safeguards project: a retrospective' in *Addressing Verification Challenges: Proceedings of an international safeguards symposium on addressing verification challenges*, Contributed Papers (International Atomic Energy Agency: Vienna 2007) p. 612.

2237 Naito, K, 'Hexapartite safeguards project: a retrospective' in *Addressing Verification Challenges: Proceedings of an international safeguards symposium on addressing verification challenges*, Contributed Papers (International Atomic Energy Agency: Vienna 2007) p. 615.

2238 Kessler, Christian, J., 'Technical Negotiations in a Political Environment', in *The Nonproliferation Review*, Vol. 20, No. 3 (2013) p. 504.

deliberations the ESD officials deferred to either the Troika's position, or the IAEA's when it came to technical safeguards issues, which allowed a useful '"technology holder" versus safeguards inspectorate dynamic to emerge in the negotiations, according to Kessler.[2239] He further isolated a number of factors that contributed to HSP's success: the absence of a pre-conceived package pushed by the US; the aforementioned willingness of the US to, as the only NWS involved, commit to the HSP in equal terms; a measure of negotiation-exhaustion following a decade of non-proliferation negotiations that 'permitted the HSP to proceed quietly in the hands of mid-level officials as a technical process', benefiting from the shared set of normative and principled beliefs, shared causal beliefs and notions of validity as part of a common policy enterprise that epistemic communities enjoy.[2240] In the absence of previous agreements on this subjects, as none existed, participants could start 'from a common sense of the issue' and appreciate 'the value of a multilateral discussion, if not approach.'[2241]

The Facility Attachment for Almelo

Negotiations over the Facility Attachment for Almelo were part of the larger process of IAEA-EURATOM negotiations on FAs (see above, page 470).

Design Information (DI) had been sent to the IAEA by EURATOM at several occasions, in 1977, 1978, 1980 and 1981. As early as October 1978, the negotiations on EURATOM GCEPs 'nearly collapsed over [the] issue of possible IAEA access within the walls of [the] cascade area.'[2242] Contrary to what the Troika delegations had told a US delegation earlier that year (see page 478), this was because the 'tripartite/US classification agreement entered into in [the] early 70's prohibits granting access to IAEA inspectors within the walls of the cascade area.'[2243] The IAEA's Almelo Facility officers replied that they 'could not imagine an adequate safeguards approach at Almelo, even granted extensive manpower and money resources, which does not allow access within the cascade area walls' as 'the instrumentation and techniques required to implement such an approach have not yet been developed.'[2244] Briefing US officials on the matter, the IAEA negotiator thought that 'much of the opposition to IAEA access came from some of the UK participants at the meeting who appeared to be concerned about eventual inspector access to their Capenhurst plant.'[2245] This was confirmed by Dutch

2239 Ibid.
2240 Ibid., pp. 503-504.
2241 Ibid. Fischer and Stein note that '[o]f political significance [was] the equal treatment of NWS and NNWS realized for the first time in the safeguards domain by the HSP. In this way, a model was created for later verification agreements that go beyond the narrower safeguards domain.', Fischer, Wolfgang, Stein, Gotthard, 'On-Site Inspections: Experiences from Nuclear Safeguarding', in *Disarmament Forum*, Vol. 3 (United Nations Institute for Disarmament Research: Vienna, 1999) https://www.peacepalacelibrary.nl/ebooks/files/UNIDIR_pdf-art217.pdf, website checked 12-6-2017, p. 48.
2242 Coded Message, 'IAEA safeguards at centrifuge isotope enrichment plants', United States Embassy Vienna to Secretary of State, Washington D.C., Confidential, 24th of October 1978, 09627 241032Z, https://wikileaks.org/plusd/cables/1978VIENNA09627_d.html, website checked 20-8-2018.
2243 Ibid.
2244 Ibid.
2245 Ibid.

MFA official Bruyns, who told US official Boright so in confidence.[2246] Subsequently, US and IAEA officials discussed the possibility of alleviating access concerns through 'the selective designation of inspectors' for these plants.[2247]

The HSP process and its conclusions resolved much of this dispute. As such, the project can be seen as both a part, a dispute resolution mechanism, of the Almelo Facility Attachment negotiation, and the larger process of IAEA-EURATOM Facility Attachment negotiations.

The Almelo draft FA was sent from EURATOM to the IAEA in October 1983, and after the EURATOM-IAEA negotiation team visited the Almelo facility in December negotiations on the Almelo FA and DI ensued in January 1984.[2248] The negotiations involved six plenary meetings and concluded only in January 1985. Both sides agreed that the 'basis for the negotiation' would be the HSP results.[2249] At the start of negotiations in January 1984, the IAEA voiced the intention to conclude the negotiations for the WURX FA (WURX is the facility code for the Almelo plant) as soon as possible, as did EURATOM.[2250]

In the first session, a number of general discrepancies and instances of missing information in the DI and FA were discussed. The IAEA had compared the older DI information with the recent draft FA and asked EURATOM about the absence of mention of pilot plant SP1 in the draft FA; it most probably had been excluded because by 1984 the oldest Almelo cascade hall and its inventory was already decommissioned and being dismantled.[2251] The older DIs had also mentioned the 'possibility of enrichment to a level higher than 5%' although by the conclusion of HSP it had been established that this could not be done without an overhaul of (physical) logistics in a plant and thus should be excluded from an updated DI.[2252] The IAEA also wanted more information on the cascade hall; besides a missing number for the amount of MUF (in the case of centrifuge cascade halls: 'UF6 in the non-gas phase' present in the cascade area) it told EURATOM it 'would like all information which is not of particular sensitivity to be transmitted, and information which is of particular sensitivity to be made available in sufficient detail.'[2253] Freezing the IAEA out of any such cascade-related information did not seem to be a viable policy down the road.

On the draft FA, IAEA reported it found 'some deviations from the HSP findings' in the documents, for example 'the FA identifies as DI re-verification activities which the HSP document denotes as routine inspection activities.'[2254] The IAEA found the number of IAEA

2246 Coded Message, United States Embassy Vienna to Secretary of State Washington D.C., 'IAEA safeguards at enrichment plants, Confidential, 22nd of September 1978, 08581 231927Z, https://wikileaks.org/plusd/cables/1978VIENNA08581_d.html, website checked 21-8-2018.
2247 Coded Message, 'IAEA safeguards at centrifuge isotope enrichment plants', United States Embassy Vienna to Secretary of State, Washington D.C., Confidential, 24th of October 1978, 09627 241032Z, https://wikileaks.org/plusd/cables/1978VIENNA09627_d.html, website checked 20-8-2018.
2248 ARC 124-13, p. 2.
2249 ARC 124-9, p. 2.
2250 Ibid.
2251 *Verslag over het Jaar 1983,* Ultra-Centrifuge Nederland N.V. (UCN NV: Almelo) p. 12.
2252 ARC 124-9, p. 2. English in original.
2253 Ibid. English in original.
2254 Ibid., p. 3. English in original.

inspectors allowed at one time into the cascade to perform inspection overly and 'unnecessarily restrictive.'[2255] Furthermore, the documents were missing a procedure for unannounced access by IAEA inspectors (to make possible the HSP's LFUAs); the agency asked EURATOM to propose procedures for these. EURATOM promised to respond to the IAEA's 'general observations' but at the same time 'considered that … substantial progress should be made, in parallel, with the systemic considerations of the FA.'[2256] Overall, the IAEA wanted EURATOM to bring the FA in line with IAEA 'standard texts and structure' because the current FA had 'deviations', such as mentions of '[j]oint Teams, finance, location of DI, and the inclusions of an annex.'[2257]

The subsidiary arrangement for Almelo (of which the Facility Attachment is a part) had remained under negotiation for many years following the IAEA-EURATOM agreement, only reported by the IAEA as being in place in its 1985 Annual Report.[2258] It was the same year that Japan implemented its renegotiated Facility Attachment (based on the LFUA model) for the Ningyo Enrichment Pilot Plant, with the Ningyo Enrichment Demonstration Plant following soon after.[2259]

After HSP: A GCEP Safeguards Epilogue

Some of the development and testing continued after the HSP ended, such as neutron-area monitoring system's testing and gamma-ray measurement testing at Urenco in Almelo, both collaborations between Los Alamos National Laboratory (US) and the Netherlands Energy Research Foundation (Energie Centrum Nederland: ECN).[2260] By 1987, 'safeguards groups' at UKAEA Harwell, ECN Petten and the West-German Kernforschungsanlage Jülich continued to collaboratively test US-UK-developed gamma spectroscopic enrichment measurement equipment for use in Almelo and Gronau.[2261] The demonstration programs associated with HSP successfully encouraged facility operators 'to offer their facilities as test beds for demonstrating new safeguards methods and technologies through respective Member States'

2255 Ibid. English in original.
2256 Ibid. English in original.
2257 Ibid., p. 2. English in original.
2258 *The Annual Report for 1985*, GC(XXX)/775, International Atomic Energy Agency (IAEA: Vienna 1986) p. 91, Goldblat, Jozef (ed.), Fischer, David, Szasz, Paul, *Safeguarding the Atom: A Critical Appraisal,* Stockholm International Peace Research Institute (Taylor & Francis, London 1985) p. 27.
2259 Naito, K, 'Hexapartite safeguards project: a retrospective' in *Addressing Verification Challenges: Proceedings of an international safeguards symposium on addressing verification challenges*, Contributed Papers (International Atomic Energy Agency: Vienna 2007) p. 614.
2260 Smith, Darryl, E., (ed.) *Safeguards and Security Progress Report: January-December 1983*, LA -10170-PR D85 004488, Los Alamos National Laboratory, http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/16/055/16055105.pdf?r=1, website checked 28-5-2017, p. 56-57.
2261 Packer, T., W., Lees, E., W., Aaldijk, J., K., Harry, R.,J.,S., 'Measurement of the Enrichment of Uranium-Hexafluoride Gas in Product Pipes in the Centrifuge Enrichment Plant at Almelo', Netherlands Energy Research Foundation (ECN: September 1987) http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/19/005/19005404.pdf?r=1, website checked 7-9-2018, p. 1.

Support Programmes.'[2262] HSP also contributed to normalizing the use of unannounced inspections under INFCIRC/153, by 'universal application of the LFUA model to relevant gas-centrifuge facilities.'[2263]

> 'In March 1983, soon after the conclusion of the HSP, an exchange of letters was made between the IAEA and the technology holders, and among technology holders themselves, confirming that the safeguards model contained in the final HSP report shall be applied uniformly to specific plants, either existing or planned, in both NWSs and NNWSs. Negotiation of facility attachments (FAs) or legal instruments for assuring uniform application of the HSP model, was left to the parties concerned.'[2264]

Nevertheless, D.W. Swindle reported in 1990 that some of the technical verification techniques agreed upon in the HSP were only then starting to be used. Part of the delay was because of 'concerns by operators and [technology holders] over the loss of sensitive technology to the inspectorate' and 'operator reluctance to allow foreign inspectors in their operating facilities'.[2265] On a critical note on what 'have become known as LFUA strategy cascade header pipe measurements because the NDA measurements are conducted on the main header pipes that supply UF6 feed and withdraw product and tails from the cascades',[2266] Swindle noted that,

> '[i]n the United Kingdom, for example, only recently in January 1990 has the equipment been adapted to the Capenhurst facility. Inspector training occurred in February and the first true in-plant inspector use is scheduled for March 1990. Likewise, 7 years after the HSP concluded, the Japanese are only now adapting and accepting the technology for use in their plant at Ningyo Toge, with calibration occurring in January 1990 and the first inspector use [occurring] in February 1990. Unfortunately, the Dutch and German gas centrifuge facility operators and governments are "still investigating the technique." although it was proven feasible over 7 years ago.'[2267]

Urenco reported that from 1991 for the Continuous Enrichment Monitor (CEMO) technology, a permanent cascade header monitoring technology that can provide an 'immediate go/no go confirmation' on the presence of HEU, trials were held at the Almelo and Capenhurst facilities.[2268] CEMO is designed to 'give a rapid alarm signal direct to Vienna or Luxembourg',

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2262 Naito, K, 'Hexapartite safeguards project: a retrospective' in *Addressing Verification Challenges: Proceedings of an international safeguards symposium on addressing verification challenges*, Contributed Papers (International Atomic Energy Agency: Vienna 2007) p. 615.

2263 Ibid.

2264 Ibid., p. 614.

2265 Swindle, D., W., 'Realities of verifying the absence of highly enriched uranium (HEU) in gas centrifuge enrichment plants', Paper presented at the meeting of the American Physical Society, March 12-16, 1990, Anaheim, California, K/ITP-327 DE91 006691, p. 12.

2266 Ibid., p. 6.

2267 Ibid., pp. 11.

2268 Veldhof reported that the Almelo trial only lasted a year due to problems with the CEMO equipment, Veldhof, Roy, 'Overview of conducted field trials at URENCO: an operator perspective', Presentation at the IAEA Symposium on International Safeguards: Linking Strategy, Implementation and People, 20-24 October

the IAEA and ESD headquarters respectively, 'if either HEU is detected or if the equipment is not working properly.'[2269] In 2008 Urenco's Peter Friend reported in a paper presentation that 'CEMO has in the main operated reliably, but it has falsely indicated HEU on two occasions, to the consternation of Urenco and the inspectorates.'[2270] Roy Veldhof told an IAEA symposium in 2014 that following the field trials, CEMO was implemented 'by IAEA and Euratom from 1995 to 2011 at URENCO UK and 1995 to 1996 at URENCO Netherlands' in Almelo.[2271] Another monitor tested at Urenco is the Advanced Enrichment Monitor (AEM). After initial discussions, US DOE's National Nuclear Security Administration, the UK Department of Energy and Climate Change and Urenco agreed in January 2011 on a project by Los Alamos National Laboratory for a field trial of the AEM at Urenco's GCEP at Capenhurst. In August 2011 and January 2012 equipment was installed and by mid-2012 the project reported (positive) results.[2272]

Environmental sampling was added to the IAEA toolkit following the failure of IAEA safeguards in Iraq (see page 193) and the DPRK in the early 1990s. Environmental sampling consists of taking swipe samples at or around a nuclear facility and analyzing these at a specialized laboratory such as the IAEA's Seibersdorf laboratory. Environmental sampling was part of a package of expanded capabilities for the IAEA and increased obligations of the member states, developed in the 'IAEA's safeguards strengthening program known as Program 93-Plus-2' (93+2), that made safeguards more robust under the Comprehensive Safeguards Agreement (INFCIRC/153), but also led to the approval of the Model Additional Protocol (INFCIRC/540).[2273] The environmental sampling tool was also applied in GCEPs.

2014, https://www.iaea.org/safeguards/symposium/2014/home/eproceedings/sg2014-papers/000109.pdf, website checked 1-6-2017, pp. 6, 10.

2269 Friend, Peter, 'Urenco's on international safeguards inspection', Presented at 8th International Conference on Facility Operations – Safeguards Interface, 30th of March – 4th of April 2008, http://web.mit.edu/stgs/pdfs/Friend%20-%20Urenco%27s%20Views%20on%20International%20Safeguards%20Inspection.pdf, website checked 1-6-2017, p. 4.

2270 Ibid.

2271 Veldhof, Roy, 'Overview of conducted field trials at URENCO: an operator perspective', Presentation at the IAEA Symposium on International Safeguards: Linking Strategy, Implementation and People, 20-24 October 2014, https://www.iaea.org/safeguards/symposium/2014/home/eproceedings/sg2014-papers/000109.pdf, website checked 1-6-2017, p. 5

2272 Ianakiev, K., D., et al, 'On-Line Enrichment Monitor for UF6 Gas Centrifuge Enrichment Plant', in *Esarda Bulletin*, No. 47 (June 2012) https://esarda.jrc.ec.europa.eu/images/Bulletin/Files/B_2012_047.pdf, website checked 7-9-2018, pp. 41-42, Ianakiev, Kiril, D., et al, 'Field Trial of LANL On-Line Advanced Enrichment Monitor for UF6 GCEP', Presentation for Institute of Nuclear Materials Management annual meeting, 15th of July 2015 to 19th of July 2015, Orlando (Fl), Los Alamos National Laboratory, LA-UR-12-22998, https://permalink.lanl.gov/object/tr?what=info:lanl-repo/lareport/LA-UR-12-22998, website checked 24-8-2018, Veldhof, Roy, 'Overview of conducted field trials at URENCO: an operator perspective', Presentation at the IAEA Symposium on International Safeguards: Linking Strategy, Implementation and People, 20-24 October 2014, https://www.iaea.org/safeguards/symposium/2014/home/eproceedings/sg2014-papers/000109.pdf, website checked 1-6-2017, p. 6.

2273 Press release by Marvin R. Peterson Senior Science Attache U.S. Mission to the IAEA, 'Strengthened IAEA Safeguards System Approved', 6th of April 1997, https://archive.li/QL3eQ, website checked 17-8-2018, 'Additional Protocol', International Atomic Energy Agency website, https://www.iaea.org/topics/additional-protocol, website checked 17-8-2018. Environmental sampling, the use of satellite imagery and the provision of early design information to the agency fell under the legal authority of the Comprehensive Safeguards

Trials with environmental sampling started at Urenco facilities around 1998 and the technique and analysis technology proved highly effective.[2274]

GCEP Safeguards in China

As part of China's Voluntary Offer Agreement with the IAEA, it offered up the Russian-built enrichment plants at Shaanxi and Lanzhou for safeguards. This offer was taken up for the Shaanxi Enrichment Plant by the IAEA in 1997. However, the plant was not suited for the safeguards package as agreed under HSP, because of two important reasons: the plant, using Russian centrifuges, was 'pretty tightly packed' with centrifuges and 'designed for a much greater degree of operational flexibility than other plants' which would for example allow an operator to bypass continuous measurement tools as they would be applied in Urenco plants, and the Shaanxi plant's location is too remote to be reached within the determined acceptable time-frame (2 hours) allotted to LFUA inspections.[2275]

Therefore, IAEA officials worked with Russian and Chinese experts to come up with an appropriate safeguards model for this plant in the Tripartite Enrichment Project. CEMO and CHEM (another type of enrichment monitor) proved to be unusable because the plant uses steel piping, which impedes the signals that these machines rely on. A combination of proven and unproven techniques were tested in the project. A standard set of material accountancy measures, augmented with 'the introduction of SWU (separative work) monitoring as a means to confirm the actual production of the plant, and thereby provide a means to assure that the entire production capacity is used to produce declared product', were applied.[2276] Additionally, 'a novel combination of VACOSS electronic seals and surveillance was introduced for testing at the Chinese enrichment plant, providing a means to track and verify all declared feed, product and tails cylinders.'[2277]

Agreements (CSA), 'while others – such as State provision of information about, and access to, all parts of a State's nuclear fuel cycle, from mines to nuclear waste – required complementary legal authority for them to be implemented' and this was covered in the Additional Protocol (AP). The more robust CSA and AP subsequently allows the IAEA to verify that there no undeclared nuclear activities in the state, 'Additional Protocol', International Atomic Energy Agency website, https://www.iaea.org/topics/additional-protocol, website checked 17-8-2018.

2274 Friend, Peter, 'Urenco's on international safeguards inspection', Presented at 8th International Conference on Facility Operations – Safeguards Interface, 30th of March – 4th of April 2008, http://web.mit.edu/stgs/pdfs/Friend%20-%20Urenco%27s%20Views%20on%20International%20Safeguards%20Inspection.pdf, website checked 1-6-2017, p. 5.

2275 Panasyuk, A., et al, 'Tripartite Enrichment Project: Safeguards at Enrichment Plants Equipped with Russian Centrifuges', IAEA-SM-367/8/02, *http://fissilematerials.org/library/pan01.pdf*, website checked 7-9-2018, p. 1, 4, Lewis, Jeffrey, 'China's New Centrifuge Plants', Arms Control Wonk, *https://www.armscontrolwonk.com/archive/206826/chinas-new-centrifuge-plants/*, website checked 8-8-2018. The fact that the centrifuges in the Russian-built plant were stacked and 'pretty tightly packed' is shared by Olli Heinonen, former IAEA Deputy Director-General for Safeguards, in commentary to Lewis' blog.

2276 Panasyuk, A., et al, 'Tripartite Enrichment Project: Safeguards at Enrichment Plants Equipped with Russian Centrifuges', IAEA-SM-367/8/02, *http://fissilematerials.org/library/pan01.pdf*, website checked 7-9-2018, pp. 3-6.

2277 Ibid., p. 4.

Environmental swiping was applied, as well as a technique of special particulate sampling using installed sample filters (so-called "Koshelev Filters"), which the project reported would be developed further before becoming part of the routine inspection effort. The same went for the UF6 product flow monitors and continuous enrichment monitors. Because of the intention to integrate flow and enrichment monitors in the routine inspection process and the need to service these machines (as well as the Koshelev Filters), cascade hall access would not be restricted to LFUA moments, but be part of every inspection (quite a step from the original HSP agreement!). As part of the project, an exercise to train inspectors in verifying design information in the plant was held in 1998.[2278]

IAEA Further Strengthens Safeguards at GCEPs

Shortly after the discovery of Iraq's nuclear weapons program in 1991, the IAEA's Board of Governors started redefining the authority of the agency. The safeguards regime focus on only declared nuclear material was broadened:

> 'In 1992, the IAEA Board of Governors affirmed that the scope of CSAs was not limited to nuclear material actually declared by a state, but included any material that is required to be declared. Expressed differently, the board confirmed that the IAEA has the right and obligation, under such agreements, not only to verify that state declarations of nuclear material subject to safeguards are correct (i.e., they accurately describe the types and quantities of the state's declared nuclear material holdings) *but that they are also complete* (i.e., that they include everything that should have been declared).'[2279]

Measures to strengthen the IAEA's ability to verify this '[involved] acquisition of a broader range of safeguards-relevant information, more emphasis on information analysis, broader IAEA inspector access to locations in states beyond declared facilities, use of advanced technical verification measures and a more investigative approach in implementing safeguards.'[2280] No longer would the IAEA only verify state declarations at individual facilities, but it would look at 'the state "as a whole"', understand all its nuclear activities taken together, verify the consistency of a states' declaration and 'whether the picture of the state's present and planned nuclear program is complete'.[2281] This is known as the State Evaluation Process, which informs the State Level Approach (based on the State Level Concept); a non-discriminatory yet tailored approach to adequately safeguard an individual state's its particular nuclear infrastructure and nuclear materials inventory.

As part of the trend set by the 93+2 program and the approval of the Model Additional Protocol, the IAEA in 1999 set the task to develop and implement the concept of 'integrated safeguards', defined as 'The optimum combination of all safeguards measures available to the

2278 Ibid., pp. 5-6.
2279 Cooley, Jill, N., 'The State-level Approach to International Safeguards', in *Journal of Nuclear Materials Management*, Vol. 37, No. 4 (Summer 2009) p. 11. Italics mine.
2280 Ibid.
2281 Ibid., pp. 11-12.

IAEA under comprehensive safeguards agreements and additional protocols (see No. 3.6) to achieve maximum effectiveness and efficiency in meeting the IAEA's safeguards obligations within available resources' after the IAEA has confirmed 'the absence of undeclared nuclear materials and activities' in a state.[2282] Integrated safeguards is a trade-off package with the member states; in return for signing the Additional Protocol and allowing its intrusive measures on their territories, the higher level of confidence the agency can have in drawing its safeguards conclusions can result in a lower safeguard burden for the state (and consequently lower resource expenditure of the agency).

Following two SAGSI meetings in 2005, the IAEA updated its model safeguards approach for GCEPs in 2006, the first update since HSP ended. It was updated because GCEP technology had advanced, GCEPs had grown in capacity, operational procedures in plants had evolved, as had safeguards technologies. Moreover, a greater number of plants than originally involved in HSP had acquired centrifuge technology and built plants. As its safeguards objectives, in line with its more robust safeguards system and verification authority, the IAEA by now clearly articulated the timely detection and deterrence of plant misuse 'to produce undeclared product … from undeclared feed' and 'to produce UF6 at enrichments higher than the declared maximum, in particular HEU'.[2283]

In this update, stated measures for the agency to reach its safeguards goals at GCEPs now included 'interim announced or short notice random inspections (SNRIs); [electronic] mailbox declarations by the operator; remote monitoring authentication and monitoring of operator load cells; and additional destructive and non-destructive enrichment measurements' as well as LFUAs and environmental sampling.[2284] As a concept, SNRI was first developed in the early 1990s. Combined with the electronic mailbox system of operator declarations, which are 'secure and unalterable daily reports of operating data to an IAEA computer on-site', it provides high deterrence because at short notice (2 hours, like LFUAs) any declared item in the operator's inventory can be verified, while requiring only a reasonable amount of

2282 *IAEA Safeguards Glossary 2001 Edition*, International Verification Series No. 3 (International Atomic Energy Agency: Vienna 2002) http://www-pub.iaea.org/MTCD/publications/PDF/nvs-3-cd/PDF/NVS3_prn.pdf, website checked 12-7-2017., pp. Foreword, 16-17.

2283 Report, 'Safeguards Statement for 2005', International Atomic Energy Agency, https://www.iaea.org/sites/default/files/es2005.pdf, website checked 21-8-2018, p. 10, Bush, W., et al, 'Model safeguards approach for gas centrifuge enrichment plants', in Book of Extended Synopses, Symposium on International Safeguards 'Addressing verification challenges', Vienna, Austria, 16–20 October 2006, https://inis.iaea.org/collection/NCLCollectionStore/_Public/38/071/38071452.pdf, website checked 21-8-2018, pp. 174-175.

2284 Charlier, C., Cooley, J, Moran, B., Naekaerts, H., Whiting, N., 'Conceptual Approach for applying Safeguards at a Large Gas Centrifuge Enrichment Plant', Paper for 2nd JAPAN-IAEA Workshop on Advanced Safeguards Technology for the Future Nuclear Fuel Cycle, 10-13 November 2009, Japan Atomic Energy Agency, Tokai-mura, Ibaraki Japan, https://www-pub.iaea.org/mtcd/meetings/Announcements.asp?ConfID=39029, website checked 21-8-2018. p. 1, Bush, W., Langlands, D., Tuley, N., Cooley, J., 'Model safeguards approach for gas centrifuge enrichment plants', in Book of Extended Synopses, Symposium on International Safeguards 'Addressing verification challenges', Vienna, Austria, 16–20 October 2006, https://inis.iaea.org/collection/NCLCollectionStore/_Public/38/071/38071452.pdf, website checked 21-8-2018, p. 175.

resources.[2285] By October 2008, SNRI and electronic mailbox trials had been completed at Urenco's Gronau plant.[2286]

New Urenco Plants in France and the United States

In 2008, Urenco had calculated that 'between 80[%] and 90% of all the enrichment production in the world which [had] been subject to IAEA verification [had] been Urenco production' and that none of the plants of its main competitors 'Areva, USDOE/USEC, and Minatom/Rosatom' (formerly Tenex) have been burdened by IAEA safeguards inspections, except for a short period of time 'in the early 1980s … the fledgling centrifuge enrichment plant in [the] USA'.[2287] The Chinese Shaanxi plant was under safeguards, but none of China's plants not built by the Russians were. Gaseous diffusion plants, all located in NWS, although safeguards modalities for them were discussed in the late 1970s, have never been subject to IAEA safeguards.

The Treaty of Almelo remains in place but has been complemented by the Treaty of Washington (1992) and the Treaty of Cardiff (2005). The Treaty of Washington was concluded to allow Urenco to introduce its classified technology into the United States through Louisiana Energy Services (LES, licensed by Urenco USA) which eventually built a 4,8 million SWU GCEP in Eunice, New Mexico (National Enrichment Facility - NEF) using Urenco centrifuge technology. That plant started operations in 2010 and brought the total Urenco capacity (over its UK, Netherlands, Germany and US plants) to 18.8 million SWU in December 2017. The Treaty of Cardiff was concluded to allow Areva (now Orano), France's major nuclear power company, to in 2006 take a 50% share in Enrichment Technology

2285 Fishbone, L., G., et al. 'The mailbox for randomised safeguards inspections', Paper contributed to 13th ESARDA Symposium on Safeguards and Nuclear Material Management, Avignon, France, May 1991, http://aei.pitt.edu/49128/1/B0002.pdf, website checked 22-8-2018, Terada, Hiromi, Osabe, Takeshi, Kakumi, Shizuko, Koyama, Kinji, Kurihara, Hiroyoshi, 'Development of Integrated Safeguards Proposals for Each Type of Nuclear Facilities in Japan', Paper contributed to session 3: Integrated Safeguards, Symposium on international safeguards: Verification and nuclear material security, Vienna, 29th of October to 2nd of November 2001, IAEA-SM-367/3/03, http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/33/045/33045095.pdf?r=1, website checked 7-9-2018, p. 2., Coded Message, United States Mission United Nations Vienna to Department of Energy, National Security Council, RUEANFA RC, Secretary of States, embassies in China, France, Germany, Japan, Netherlands, Russia, United Kingdom, 'IAEA/Safeguards: Year-end round-up of discussions on potential safeguards measures for U.S.Urenco centrifuge plant', Sensitive, 16th of December 2009, 000568, https://wikileaks.org/plusd/cables/09UNVIEVIENNA568_a.html, website checked 22-8-2018.

2286 Boyer, Brian, D., 'The Challenge of Safeguarding Gas Centrifuge Enrichment Plants', Presentation at MIT Workshop on Internationalizing Uranium Enrichment Facilities, October 20-21, 2008, LA-UR-08-06677, in Goodby, James, Forden, Geoffrey, *Proceedings of MIT's Workshop on Multinational Enrichment Facilities* (October 2008), http://web.mit.edu/stgs/pdfs/Proceedings_of_the_MIT_Workship_on_Multinational_Enrichment.pdf, website checked 23-8-2018, pp. 7, 11.

2287 Friend, Peter, 'Urenco's on international safeguards inspection', Paper presented at 8th International Conference on Facility Operations – Safeguards Interface, 30th of March – 4th of April 2008, http://web.mit.edu/stgs/pdfs/Friend%20-%20Urenco%27s%20Views%20on%20International%20Safeguards%20Inspection.pdf, website checked 1-6-2017, p. 3.

Company (ETC). ETC was created in 2003 as the technology holding company of Urenco (that included its centrifuge construction operation) and the joint-venture between Areva and Urenco in ETC allowed Areva/Orano to construct a GCEP in Tricastin, France (Georges Besse II) and operate it using ETC-constructed centrifuges.[2288] Full production of its 7.5 million SWU capacity was achieved at Georges Besse II in January 2016, after the two parts of the plant had been commissioned in 2011 and 2013 respectively.[2289]

The two treaties obligated the United States and France to adhere to the conditions as set down in the Treaty of Almelo. Like the Almelo treaty,

> 'For each treaty, control bodies have been formed with representatives of the governments of the signatory countries. These committees exercise the role of effective supervision of the technology and operations with respect to non-proliferation issues. They also consider all questions concerning the safeguards system (as established by IAEA/EURATOM), classification arrangements and security procedures, exports of the technology and enriched uranium, as well as other non-proliferation issues.'[2290]

To coordinate safeguards policy, a 'sub group for safeguards, the Pentapartite Safeguards Working Group (PSWG)' was established 'to pursue the safeguards goals of the three treaties on a practical level' besides treaty-based safeguards committees that include Troika representatives and representatives from the US and France respectively.[2291] The PSWG, which 'controls the efficient implementation of safeguards processes' has representatives from all the treaty countries (the Troika, US and France) and the involved companies (Urenco, ETC and Areva) and discusses and resolves all safeguards questions and issues.[2292]

In March 2009, the IAEA's Department of Safeguards Director for Operations Herman Naekaerts told US officials that the IAEA its 'preliminary thinking' on applying safeguards at the LES NEF plant in New Mexico was that it wanted to 'explore ways to use LES for

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2288 Korbmacher, Tim, Mann, Melissa, Meyering, Andreas, 'URENCO – A Multinational Contribution to Non-Proliferation', Paper presented at Symposium on International Safeguards: Linking Strategy, Implementation and People, IAEA CN-220, 20-24 October 2014, M Building, International Atomic Energy Agency Vienna International Centre, https://www.iaea.org/safeguards/symposium/2014/home/eproceedings/.../000108.pdf (cached) pp. 2-3, 'Urenco USA', Urenco company website, https://urenco.com/about-us/company-structure/urenco-usa/, 'Business Activity', Urenco company website, https://urenco.com/about-us/business-activity/, 'International expert in uranium processing', Orano company website, http://www.orano.group/en/expertise/from-exploration-to-recycling/an-international-expert-in-uranium-processing, 'About Us: Where we are located', Enrichment Technology Company website, https://www.enritec.com/en/about-us/where-we-are-located/, websites checked 14-8-2018.

2289 Kozak, Dariusz, 'Quarterly Uranium Market Report, 1st Quarter 2017', Euratom Supply Agency, European Commission, http://ec.europa.eu/euratom/docs/2017_1st_QR.pdf, website checked 7-9-2018, p. 7.

2290 Korbmacher, Tim, Mann, Melissa, Meyering, Andreas, 'URENCO – A Multinational Contribution to Non-Proliferation', Paper presented at Symposium on International Safeguards: Linking Strategy, Implementation and People, IAEA CN-220, 20-24 October 2014, M Building, International Atomic Energy Agency Vienna International Centre, https://www.iaea.org/safeguards/symposium/2014/home/eproceedings/.../000108.pdf (cached) p. 1.

2291 Ibid., p. 2.

2292 Ibid., p. 3.

developing novel/alternative safeguards approaches as alternatives to traditional safeguards approaches, for possible eventual use in NNWS.'[2293] This would depend on 'the constraints the U.S. might seek to impose at the facility', and Naekaerts reminded those present that the IAEA had no 'legal obligation under the Hexapartite Safeguards Project to apply safeguards on this facility.'[2294] US officials observed the IAEA seemed much more interested in safeguarding 'LES over the Lead Cascade at Portsmouth, based on the fact that LES employed URENCO technology, which was utilized around the world, whereas the Lead Cascade employed U.S. Technology, which had not been proliferated.'[2295] In a June 12th meeting, IAEA Deputy Director General for Safeguards Heinonen told a US official 'that his primary interest was not to apply safeguards in the United States but to develop methods that could be used in other countries, particularly to detect undeclared nuclear activities.'[2296] In a later meeting (November that year) 'IAEA officials said … they were interested in applying safeguards only if the United States funded the service and if the IAEA were permitted to try out approaches that would be useful elsewhere, e.g. in Iran.'[2297] For more on Iran safeguards, see below.

In subsequent meetings between US and IAEA officials, in April, May, June and November of 2009, the innovative way in which the agency wanted to safeguard LES became more articulated. IAEA principle objectives were '(1) to improve efficiency in verifying non-diversion of declared material, (2) to improve effectiveness at detecting undeclared LEU production, and (3) to improve timeliness in detecting undeclared HEU production.'[2298] Measures such as the use of data from the operator's weighting systems by the agency, NDA methods for header pipe flow and enrichment measurements at feed, product and tails stations as well as cylinder tracking systems were discussed. By more intensively using operator data from mailbox declarations, from weighing stations and from online mass spectrometers combined with random and if needed short notice inspections, effectiveness of safeguards would increase while decreasing the inspection effort.[2299]

US and IAEA officials recognized that Urenco buy-in was essential, so Urenco officials were invited to join the talks on the 15th of June 2009. Urenco's Director of Safeguards and Security Peter Friend had a number of concerns relating to the IAEA's '"long shopping list."'[2300] During the discussion, he attempted to steer the IAEA away from focusing on LES for the testing of new safeguards measures, instead suggesting the use of the Almelo plant. When asked for

2293 Coded Message, United States Mission United Nations Vienna to Department of Commerce, Department of Defense, Department of Energy, RUEANFA NRC, Secretary of State, 'IAEA: Discussion with IAEA on implementation of U.S. additional protocol', Sensitive, 24th of March 2009, 000121, https://wikileaks.org/plusd/cables/09UNVIEVIENNA121_a.html, website checked 21-8-2009.
2294 Ibid.
2295 Ibid.
2296 Coded Message, United States Mission United Nations Vienna to Department of Energy, National Security Council, RUEANFA RC, Secretary of States, embassies in China, France, Germany, Japan, Netherlands, Russia, United Kingdom, 'IAEA/Safeguards: Year-end round-up of discussions on potential safeguards measures for U.S.Urenco centrifuge plant', Sensitive, 16th of December 2009, 000568, https://wikileaks.org/plusd/cables/09UNVIEVIENNA568_a.html, website checked 22-8-2018.
2297 Ibid.
2298 Ibid.
2299 Ibid.
2300 Ibid.

design information of LES, he offered that of the newest plant in Almelo. Friend reiterated Urenco's concern (already voiced in his 2008 paper) that even though other centrifuge plants were being built in the US (the USEC Portsmouth Lead Cascade plant and Areva's proposed plant in Eagle Rock, Idaho) and even though Urenco was only one of 'four companies providing enrichment services internationally', only Urenco was subject to IAEA safeguards and so 'it seemed a little unfair' that now LES looked to be selected for safeguards by the IAEA as well.[2301] Regarding the proposed technical safeguards measures, Friend had concerns that very sensitive enrichment measurements could compromise centrifuge performance data that was classified. Urenco also didn't want detailed mailbox declarations to be transferred off-site to the agency in Vienna and Friend was unsure if the company was willing to share its mass spectrometry data. Another concern related to the intensive use of operator data was if those data system's failed. Moreover, Friend did not want the IAEA to learn about operational problems at Urenco before the company did. In all, Urenco did not principally object to the content of what was proposed and offered some constructive feedback: because online enrichment monitors were inaccurate and expensive, Urenco might allow 'direct gas measurements instead.'[2302] Friend also suggested improvement of cylinder identification systems so that C/S measures would be more effective.[2303]

Even though Urenco's representatives did not voice principal objections to the IAEA's plans during the informal consultation in June, when the IAEA officials involved produced an IAEA paper that specifically addressed the future safeguards at the New Mexico NEF and that was due to be presented at the 2nd Japan-IAEA Workshop on Advanced Safeguards Technology for the Future Nuclear Fuel Cycle' in November 2009 in Japan, the company took action. Urenco officials protested with the US Nuclear Regulatory Commission because the paper suggested the implementation of more intrusive safeguarding measures that had not been cleared for routine use in any of the European GCEPs. These included a 'cylinder tagging system using electronic identification tags (e.g. radio-frequency transmitters)' to 'monitor the movement of cylinders between the UF6 store, the accountability scale(s) the feed, product and tails stations and the blending area' as well as header pipe monitors to measure enrichment levels.[2304] The authors of the paper voiced the hope that this 'maximum use of the new techniques' at LES would lead to their 'universal acceptance' at other GCEPs under safeguards.[2305] Following Urenco's protest with the NRC, the IAEA altered the paper and the connected presentation at the IAEA symposium on advanced safeguards so that there wasn't

2301 Ibid.
2302 Ibid.
2303 Ibid.
2304 Letter, Chief Operating Officer and Chief Nuclear Officer Smith, Gregory, O., D., Louisiana Energy Services LLC to Director Office of Nuclear Material Safety and Safeguards, US Nuclear Regulatory Commission, Washington D.C., 'IAEA's Upcoming Presentation of NEF-Related Safeguards at Japan-IAEA Workshop', 29th of October 2009, NEF-09-00207-NRC, includes abstract of Charlier, C., Cooley, J, Moran, B., Naekaerts, H., Whiting, N., 'Conceptual approach for applying safeguards at the Louisiana Energy Services (LES) National Enrichment Facility, New Mexico, USA', Concept paper for the 2nd Japan-IAEA Workshop on Advanced Safeguards Technology for the Future Nuclear Fuel Cycle', 10-13 November 2009, Tokai-mura, Ibaraki, Japan, https://www.nrc.gov/docs/ML0930/ML093070414.pdf, website checked 21-8-2018, pp. 1-2.
2305 Ibid., abstract, p. 2.

any direct reference to NEF. However, the removal of a small footer 'LES Safeguards Concept' in the paper seems to have been overlooked.[2306]

Most of what was in the paper had already been run by Urenco's representatives in the June meeting. The inclusion of the 'cylinder tagging system' even seems to have been added following the suggestion by Friend himself. However, Urenco had not formally agreed to many of the measures proposed in the paper, and its publication could suggest the content was already cleared for implementation in LES, and so its publication under the IAEA name was premature. Moreover, the IAEA had promised to '1) issue (by the end of July 2009) its proposal for the application of safeguards at the NEF, and 2) hold a follow-up meeting to discuss the proposal in September 2009.'[2307] At the time of Urenco's protest to the NRC, its representative wrote, it had received neither the paper nor had the follow-up meeting been scheduled. By having the IAEA remove the direct linkage to LES, Urenco's officials could stop the paper becoming part of an official record tied to their facility and in its discussion at the conference and reproduction elsewhere to gain a life of its own, which would 'likely have an adverse impact on the agreement negotiations' that still had to commence between the IAEA, the NRC and LES.[2308]

Though not much is publicly known about the safeguards modalities at the new GCEPs in New Mexico and Tricastin, the IAEA has activities in both these plants. In France, it is fair to assume that these are the same as for the Urenco plants in the Netherlands, Germany and the UK.[2309] The US NRC reported that LES, 'while not under an IAEA inspection regime, [is] providing nuclear material accounting data under the Reporting Protocol of the U.S. – IAEA Safeguards Agreement.'[2310]

The agency's wish to use LES as a test-bed for at least one new safeguards measures was granted though. After initial testing and a field trial at Almelo in 2014, the IAEA, in collaboration with Los Alamos National Laboratory, Oak Ridge National Laboratory, the US

2306 Charlier, C., Cooley, J, Moran, B., Naekaerts, H., Whiting, N., 'Conceptual Approach for applying Safeguards at a Large Gas Centrifuge Enrichment Plant', Paper for 2nd JAPAN-IAEA Workshop on Advanced Safeguards Technology for the Future Nuclear Fuel Cycle, 10-13 November 2009, Japan Atomic Energy Agency, Tokai-mura, Ibaraki Japan, Whiting, Neville, 'Conceptual Approach for applying Safeguards at a large Gaseous Centrifuge Enrichment Plant', Presentation at 2nd JAPAN-IAEA Workshop on Advanced Safeguards Technology for the Future Nuclear Fuel Cycle, 10-13 November 2009, Japan Atomic Energy Agency, Tokai-mura, Ibaraki Japan, https://www-pub.iaea.org/mtcd/meetings/Announcements.asp?ConfID=39029, website checked 21-8-2018.

2307 Letter, Smith, Gregory, O., D., Chief Operating Officer and Chief Nuclear Officer, Louisiana Energy Services LLC to Director Office of Nuclear Material Safety and Safeguards, US Nuclear Regulatory Commission, Washington D.C., 'IAEA's Upcoming Presentation of NEF-Related Safeguards at Japan-IAEA Workshop', 29th of October 2009, NEF-09-00207-NRC, https://www.nrc.gov/docs/ML0930/ML093070414.pdf, website checked 21-8-2018, p. 1.

2308 Ibid., pp. 2-3.

2309 Jalouneix, Jean, *Elements of Security and Non-proliferation*, IRSN Science and Technology Series (Institut de Radioprotection et de Sûreté Nucléaire 2017) https://www.irsn.fr/EN/Research/publications-documentation/Scientific-books/Documents/SNP_english_BW_Chapter3.pdf, website checked 7-9-2018, p. 71.

2310 'IAEA Safeguards: Frequently Asked Questions', United States Nuclear Regulatory Committee website, https://www.nrc.gov/materials/fuel-cycle-fac/intl-safeguards/iaea-safeguards-faq.html#Inspected_facilities, website checked 24-8-2018.

International Safeguards Program Office, the US National Nuclear Security Administration and Urenco tested the Online Enrichment Monitor (OLEM) system at the LES plant in New Mexico. From October 2015 until March 2017 (planned) the demonstration featured '[c]ollection nodes … installed on the product, feed, and tails streams of disparate GCEP operating units' allowing the project to gain 'invaluable information regarding the operation of the OLEM systems under real GCEP operating behaviors and conditions.'[2311] In early 2016,

> '[i]t culminated in the deployment of several OLEM collection nodes in Iran as an unattended monitoring system component of the Joint Comprehensive Plan of Action, allowing the IAEA to verify Iran's compliance with the enrichment production aspects of the agreement.'[2312]

GCEP Safeguards in Iran

In August 2002 Iran was exposed to have been developing a full front-end of the nuclear fuel cycle without telling the IAEA, failing its obligations under its comprehensive safeguards agreement, as concluded by the IAEA DG El Baradei in June 2003. At that time, among other activities such as the construction of a heavy water plant in Arak, it was constructing a GCEP in Natanz. A second enrichment plant's construction at Fordow that had been going on from at least 2006 was revealed in 2009. In September 2005, the IAEA Board of Governors concluded that Iran was in non-compliance with its safeguards agreement with the IAEA, because of the country had concealed enrichment and reprocessing activities that involved nuclear material (which it had been obligated to report). In the process of verification of Iran's declarations, the IAEA could not achieve confidence about the peaceful nature of its activities and, following Iran's resumption of enrichment activities at its Natanz GCEP that it had ceased before as a sign of good faith, the agency told the UN Security Council that Iran was required to accept far-going measures (beyond the requirements of a CSA and AP, the latter which Iran had signed in December of 2003 and provisionally implemented until March 2006).[2313]

2311 Younkin, James, R., Garner, James, R., *On-line Enrichment Monitor Phase II Final Report: Techniques and Equipment for Safeguards at Gas Centrifuge Enrichment Plants*, ORNL/LTR-2017/108 (Oak Ridge National Laboratory: February 2017), https://info.ornl.gov/sites/publications/Files/Pub73301.pdf, website checked 24-9-2018, pp. Ix, 3, 10, 12, Veldhof, Roy, 'Overview of conducted field trials at URENCO: an operator perspective', Presentation at the IAEA Symposium on International Safeguards: Linking Strategy, Implementation and People, 20-24 October 2014, https://www.iaea.org/safeguards/symposium/2014/home/eproceedings/sg2014-papers/000109.pdf, website checked 1-6-2017, p. 6.

2312 Ibid., pp. Ix, 3, 12.

2313 Rauf, Tariq, Kelley Robert, 'Nuclear Verification in Iran', *Arms Control Today*, 28th of August 2014, Arms Control Association website, https://www.armscontrol.org/print/6411, 'Iran', Nuclear Threat Initiative website, http://www.nti.org/learn/countries/iran/nuclear/, Brannan, Paul, 'New Satellite Image Further Narrows Fordow Construction Start Date', 18th of November 2009, Institute for Science and International Security website, http://isis-online.org/isis-reports/detail/new-satellite-image-further-narrows-fordow-construction-start-date/8#images, Albright, David, Kelleher-Vergantini, Serena, 'Update on Fordow Centrifuge Site: Future Uncertain', 13th of January 2014, Institute for Science and International Security website, http://isis-online.org/isis-reports/detail/update-on-fordow-centrifuge-site-future-uncertain/8#images, websites checked 24-8-2018,

More revelations about Iran's activities, changes in Iran's declarations about its activities, national and international sanctions, Iranian defiance of UNSC resolutions and more negotiations followed in subsequent years. In 2013, negotiations between Iran and the P5+1 (the UNSC plus Germany, sometimes referred to as the E3+3) resulted in the interim Joint Plan of Action (JPOA) that would eventually result in negotiation of the Joint Comprehensive Plan of Action (JCPOA) in July 2015. In this agreement, Iran accepted far-going restrictions on its nuclear program that included a substantial downsizing of its enrichment activities as well as a very comprehensive verification program for those facilities.[2314]

At the Natanz and Fordow GCEPs, the IAEA applies design information verification (DIV), nuclear material accountancy, environmental sampling, C/S measures such as cameras and seals, physical inventory verification, routine inspections, LFUAs, SNRIs, 'portable radiation detectors and gamma spectrometers' and new technologies such as OLEM (see above). In the regime under the JCPOA, the IAEA has continuous (daily) access to the cascade halls of these GCEPs.[2315]

> 'A [US] Department of Energy official says that a key component of the JCPOA is the ability for the IAEA to use more modern, efficient, and timely safeguards technologies. Many of the new technologies have been developed in the US at Oak Ridge, Pacific Northwest, Sandia, and Los Alamos National Laboratories. A senior administration official said that Iran has agreed to implement "systems that don't exist anywhere else in the world."'[2316]

So although the IAEA did not apply a comprehensive system of safeguards that included the newest available technologies to LES, it could implement one in Iran. The IAEA officials' ambition, that '[t]he implementation of these measures would allow the Agency to demonstrate their effectiveness and efficiency at marginal cost and could promote their

2314 'Iran', Nuclear Threat Initiative website, http://www.nti.org/learn/countries/iran/nuclear/, Albright, David, Stricker, Andrea, Walrond, Christina, 'Déjà vu at Fordow? What are Iran's enrichment plans?', 4th of June 2012, Institute for Science and International Security website, http://isis-online.org/isis-reports/detail/deja-vu-at-fordow-what-are-irans-enrichment-plans/8, website checked 24-8-2018.

2315 Rauf, Tariq, Kelley Robert, 'Nuclear Verification in Iran', *Arms Control Today*, 28th of August 2014, Arms Control Association website, https://www.armscontrol.org/print/6411, Younkin, James, R., Garner, James, R., *On-line Enrichment Monitor Phase II Final Report: Techniques and Equipment for Safeguards at Gas Centrifuge Enrichment Plants*, ORNL/LTR-2017/108 (Oak Ridge National Laboratory: February 2017) https://info.ornl.gov/sites/publications/Files/Pub73301.pdf, pp. Ix, 3, 12, Fournier, Vincent, Gaspar, Miklos, 'New IAEA Uranium Enrichment Monitor to Verify Iran's Commitment under JCPOA', 16th of January, 2016, International Atomic Energy Agency website, https://www.iaea.org/newscenter/news/new-iaea-uranium-enrichment-monitor-verify-iran%E2%80%99s-commitments-under-jcpoa, websites checked 24-8-2018, Report, 'Iran Nuclear Agreement: The International Atomic Energy Agency's Authorities, Resources and Challenges', Report to Congressional Requesters, United States Government Accountability Office, GAO-16-565 (June 2016) pp. 27-29.

2316 Kramer, David, 'Experts say Iran Nuclear Agreement Sufficiently Verifiable', in *Physics Today*, Vol. 26, No. 12 (December 2015) p. 27.

universal acceptance at gas centrifuge facilities' was helped along.[2317] However, the JPCOA included language to undercut any such precedent-setting:

> 'xi. All provisions and measures contained in this JCPOA are only for the purpose of its implementation between E3/EU+3 and Iran and *should not be considered as setting precedents* for any other state or for fundamental principles of international law and the rights and obligations under the NPT and other relevant instruments, as well as for internationally recognised principles and practices.'[2318]

2317 Charlier, C., Cooley, J, Moran, B., Naekaerts, H., Whiting, N., 'Conceptual Approach for applying Safeguards at a Large Gas Centrifuge Enrichment Plant', Paper for 2nd JAPAN-IAEA Workshop on Advanced Safeguards Technology for the Future Nuclear Fuel Cycle, 10-13 November 2009, Japan Atomic Energy Agency, Tokai-mura, Ibaraki Japan, p. 2.

2318 'Joint Comprehensive Plan of Action', Vienna, 14th of July 2015, https://www.state.gov/documents/organization/245317.pdf, website checked 24-8-2018, p. 4.

Chapter 12:

Summary, Analysis and Conclusions

Theory of International Society and Regimes

Evolving insights from the study of international relations and about how states perceive their interests lead to the assertion that critical theoretical approaches that posit states as social entities with complex internal constitutions are useful in understanding the normative behaviors that they exhibit in global interaction. States act as though aware that long term domestic and international benefits from exhibiting normative (ethical) behavior can trump material gains. The purely realist theoretical view on how states perceive their interests that explains outcomes as resulting from instrumental and strategic interaction should therefore be rejected, as it cannot explain states engaging in communicative action. Yet, Realism as a perspective should be included in any interpretation of international politics because of its continued influence on and relevance to ongoing practice. Power-centric perceptions of self-interest that lead to choices for short- and medium-term gains often win out over those that recognize the medium- and long-term gains that ethical choices produce and policy choices that give up short-term material gains in favor of uncertain future collective (security) benefits. Yet the latter do occur, and traditional theory is not equipped to adequately explain and predict such choices.

International institutions create opportunity for states to coordinate their communal ethical behavior. For the period of the case study of this research project, the NPR and its associated institutions and forums fulfilled this function. It allowed states to navigate and negotiate the tensions that result from an expanding and technologically evolving nuclear research and power industry in a community that increasingly viewed the proliferation of nuclear weapon capabilities as reducing their overall medium- and long-term national and collective security and therefore unwelcome, and as their collective responsibility.

States are participants in the international practice and as such acquire identities and exhibit (strategic and communicative) behavior that expresses their competence in navigating the practice and produces their ethical standing in it. Frost recognized two intertwined international practices that together make up international society; the Society of Sovereign States (SOSS) and Global Civil Society (GCS). The communal dynamics in international society are not aggregates of individual countries' behavior but are of an inter-subjective nature and must be understood in terms of their reflexivity (Giddens, Habermas); a relationship of structure and agency that is mutually constitutive and continuously evolving. Regime membership of a state must be understood in the same way. Participants in a practice and members of regimes constantly appraise their own and their fellow participant's actions and are appraised in turn. States, but also a wide range of other actors (such as officials in international organizations, national politicians and policymakers, experts working for NGOs or in academia) are constantly appraising the actions of states. The background against which these appraisals are made are (in the regime context) the rules of the regime and the internalized rules of the practice, which have constitutive effects.

The active engagement with arguments on what proper behavior ought to be, expressed in discourse and behavior, connects to the norms of a practice, which are non-internalized and contestable. Norms can emerge through ethical appraisal and are more successful when they reflect universal principles and values. When successful norm entrepreneurship triggers a norm cascade (Finnemore and Sikkink) and a particular norm becomes accepted by a significant amount of participants of the practice, and it clashes with an internalized rule, the latter becomes contested and can be challenged to the point it loses its relevance in the practice. This is how the rules of the practice evolve over time.

The Theory of International Society (Frost) offers important theoretical and practical benefits and a useful lens to interpret the narrative provided in the case study of this thesis. Below follow five important theoretical insights and their application to the case, after which follows a more in depth concluding discussion of all the major elements of the thesis. Two central questions are answered in the affirmative by this thesis and summarized below:

1. Do the thesis and its case study offer a convincing narrative that is commensurate with the existence of practices as constituting international society and underlying the behavior of states through rules and norms?

2. Do the thesis and its case study offer a convincing narrative of the nuclear non-proliferation regime as an institutionalized area of unsettled practice, in accordance with the adapted definition proposed?

First, the theory provides a convincing framework to explain behavior and discourse in international society and assigns them meaningful roles in its constitution and evolution. To theoretically conceive of international society as a practice allows for the development of its normative structure to be reflected by the rules that participants observe and the norms they argue over. It allows for philosophical insights (Searle) and structuralist theory (Giddens) to inform the constitutive nature of rules and norms, to define the difference between them and to conceive how norm entrepreneurship, norm cascading and internalization can eventually lead to a change in the rules of a practice. The theory furthermore makes understandable that state behavior consists of both strategic and communicative action (Habermas) and why, and in doing so opens up a space to incorporate realist and idealist perspectives in a more inclusive theoretical framework than traditional IR theories can offer, although this framework does not share their positivist epistemology and instead employs a post-positivist one.

The thesis shows that states can act strategically and communicative at the same time, as policy circles inside states succeeded (although not always intentionally) in incorporating both self-interested material interests and normative interests that simultaneously served a greater good in long-term national policies (and that dovetailed the interests of international society's collective security interests). The example of the US efforts to prevent a European enrichment plant is case in point: the State Department's support came from its officials' perception that this served non-proliferation goals, whereas the AEC was clearly pursuing self-interested economic goals. Atoms for Peace, as seen in the context of Operation Candor, was a gift of American technology to the world that simultaneously served to repair some of the goodwill

lost through its nuclear weapons build-up and testing, while also serving its strategic interests through the economic benefits and leverage it offered to the US and by forcing the USSR to follow suit. Dutch participation in the Troika similarly served both economic goals and a 'greater' non-proliferation interest by acquiring a vote in German nuclear exports and preventing an enrichment plant on German territory.

Second, the relationship between rules and norms and their function in a practice can be applied to come to a better understanding of what international regimes are and how they work. While also taking insights from earlier regime theory, connecting international practice theory to post-positivist regime theory allows us to take our post-positivist commitments in epistemology and ontology seriously and as a result can convincingly posit international regimes in their constitutive relationship to the international society practice as the institutionalized vehicle of norm entrepreneurship in a particular issue area. International regimes reflect ongoing ethical projects to integrate and internalize norms into rules of international society practice.

As such, a regime acts as a bounded locus of unsettled practice that can serve as a conduit through which rules can be institutionalized into the practice. Consequently, this makes a regime an area of contestation, in which rival accounts offer discursive appraisals of reality that promote new and existing norms, and in which a space is created in which the rules of the wider settled practice can be drawn out from the background into the conscious foreground, resume the status of norms, and become contested. In this thesis, the thick narrative of the internal Troika discussions offer a clear view of the rise of non-proliferation norms and the contestation of a narrow interpretation of regime rules as set against the more permissive free trade norm of the wider practice. Whereas Dutch officials and political leadership initially had to exert great pressure and take (perceived) risks in their dealings with mainly the German partner that took a very narrow view of its regime obligations while strongly emphasizing its prerogative to freely conduct trade, eventually the norm of and perceptions on acceptable export behavior shifted, bringing about a much higher level of consensus on this subject in the collaboration. Against the background of this 'thick Troika narrative', the account of the wider regime shows the same trend.

Third, unaddressed, unresolved or insufficiently mitigated contradictions in the rules of a regime (not to be confused with the background rules of a practice) and between those rules and the settled norms of the wider practice of international society can serve to protract the regime's existence as a area of contestation and delay its settlement into that wider practice. Such contradictions are expressed through the rival appraisals that regime members and commentators offer in support of or opposition to particular norms and rules and these can be clearly seen in the NPR, as claims and counterclaims are made between NWS and NNWS, 'haves' and have-nots' and first and second generation nuclear exporters, based on a number of possible interpretations of the rights and obligations that regime members have.

Fourth, following Frost and Lechner, a choice for Wittgenstein-inspired (internal) practice theory allows for discourse to take its proper formative role in shaping international practice and international regimes as it acts as the locus and means of the intersubjective evaluation of

actors' actions and standings. A state whose officials consistently exhibits a high level of responsible behavior through their formulation of policies and offer appraisals that can be seen as consistent with those policies and their behavior enjoys positive appraisals in return and enjoys a high standing in international society. This translates to ithat state and its officials enjoying the trust of other states and their officials and their willingness to associate and collaborate. A prime example from the case study are the Troika's attitude and actions towards Australia (see below).

Actors that act manipulative by obscuring their strategic motives while pressuring others to make sacrifices for ethical causes, as at times so clearly seen in the duality of US non-proliferation policy and monopolistic export practices, face real consequences. A lowering of that actor's standing, even a political and economic superpower, was reflected in *mistrust* (the eventual Dutch perception of the US Classification request, efforts to keep US safeguards personnel from enjoying long term access to European nuclear facilities, European reactions to the US Multilateralization Initiative in 1971 and the similar offer in 1974), *disregard* (the FRG's refusal to reconsider sensitive exports, France, Japan's and initially FRG's refusal to abandon the closed fuel cycle at US insistence) and the *necessity to expend political capital* to navigate combative attitudes (EURATOM's refusal to go along with NNPA requirements, FRG's refusal to join HSP until the US committed itself in equal measure, and the US having to commit to some of INFCE's conclusions that were directly opposite to its political goals).

Fifth, taking a constitutive practice-based approach allows for a move away from a state-centric approach and the recognition of constitutive practices underlying the state's behavior in international society. A wide range of actors, both domestic and international, are influential in shaping the perceptions of national policymakers. National political practice was certainly influential in shaping the Dutch approach to its Troika participation in general and Dutch officials' roles in the JC particularly. Participation of Dutch ministers in the national political practice carried real consequences for the collaboration in the Troika; a good series of examples are the commitments several ministers made during debates with the Second Chamber of the Dutch Parliament, promising to involve Parliament in future decisions on expansion and extension of the collaboration that forced their direct successors and successive governments to negate on those, producing considerable political fallout. In turn the partners were affected by and their decision-making was linked to this domestic practice as well, as they attempted to avoid further controversy by making deliveries to Brazil from Capenhurst and by leaving the Troika export policy open-ended.

The Nuclear Non-proliferation Regime, US leadership and Western Europe

With a few marked exceptions, the United States has been the most active norm-entrepreneur to create institutional curbs to the proliferation of sensitive nuclear technologies. Certainly during the first decades of the nuclear age, the US has also been the most successful exporter of nuclear technology. The Atoms for Peace program allowed it to initiate a series of bilateral nuclear deals that made basic nuclear technology and infrastructure available to many countries that didn't have the means to develop their own. This set up its nuclear industry to

capture a majority share of the global nuclear reactor and fuel market. The contrast between the domestic economic interest thus created, and its international policies that sough to create institutional curbs that also would preserve those interests had a negative impact on its status as legitimate non-proliferation norm entrepreneur later on.

US-dominated leadership in international non-proliferation efforts have since the dawn of the nuclear age gone through several phases in which a particular strategy was dominant. Its policies oscillated between two main strategies (denial and cooperation) yet research has shown that US policy more often was based on an amalgamation of the different perceptions of interests and on what strategy was suitable at a given time. Of the greatest relevance to the Troika's commercial and non-proliferation policies as discussed in this study were the US AEC's and US State Department's influence upon the endeavors of several US administrations to project long-term policy coherence in the enrichment market. These endeavors largely failed because US economic and non-proliferation interests were often not commensurable in the short term, and US administrations more often than not failed to sacrifice economic interests for the benefit of the long term ethical good of a credible non-compromised international non-proliferation policy.

Renewed assertiveness of the European allies of the US at the end of the 1950s into the 1960s, most importantly France and the FRG, caused those countries and others to review their strategic interests and to adopt a position of energy independence and direct industrial competition with the US. Western European countries were individually and collectively forced to acknowledge the energy challenges that continued economic growth would produce in the following decades. For the Netherlands, this awareness was reflected in the Nuclear Energy Brief of 1957, which promoted nuclear energy as an important element in an energy security strategy based on diversified sources and technologies.

Part of European renewed assertiveness expressed itself through its European Community project. EURATOM and its integrative function was an important part of that project. EURATOM's standing was novel in that it had a legal foundation; access by the ESD to the member states' territories was legally mandated and enforceable through the EURATOM Treaty, a distinct compromise of the norm of sovereignty ('legalized espionage') that EURATOM members accepted from this regional institution as it was part of a larger political integration project. The IAEA in contrast never acquired such a mandate. This in part explains the interesting norm dynamics that occurred in the negotiation of IAEA safeguards with EURATOM as described in this study. As part of the negotiation of the regime's institutionalization in the NPT, EURATOM members pressured the US into accepting EURATOM safeguards to replace the bilateral arrangements that were in place at the time, a move that further set the IAEA up to be forced to take the back seat to EURATOM during the decades that followed.

Classification

Gas centrifuge enrichment technology started to maturate at the end of the 1950s and soon started to exemplify the tension between civil nuclear technology and its military application. Its proliferation risks were recognized by US officials early on, inspiring a successful push for classification with the US allies that were developing the technology and that were not previously bound by classification agreements; the FRG and the Netherlands. Quadripartite classification between the US, the UK, the FRG and the Netherlands did not only, in the words of William Burr, 'keep the genie bottled up', but its severely restrictive nature also stymied fledgling centrifuge cooperation contacts between the Dutch and Germans.[2319]

The 1960 US push to classify centrifuge technology should partly be understood in light of its wider policy of discouraging European enrichment projects that would make European countries independent of the US in their acquisition of nuclear fuel. Several motivations were behind the US policy; non-proliferation considerations were served through both the non-spread of technology to more countries as well as through US market control and its continued ability to dictate export terms to customers seeking nuclear technology and services. Purely commercial considerations when enrichment proved to be 'good business' for the US were present but not articulated in appraisals by US officials, but nevertheless clearly recognized by its European allies such as reflected in the Dutch officials' appraisals of the US classification request. They furthermore considered the Americans were trying to stop centrifuge proliferation spreading into Europe to Italy and France (both EURATOM members) but disqualified the Americans argument about the risk of proliferation to the USSR. The impression of US duality, expressed in its failure to disclose its economic interest in classification when offering its appraisal of the need for it, was not helped by its almost simultaneous declassification of a number of centrifuge patents for US industry, the same year.

During the following years, the AEC faced domestic pressure to give US industry more freedom in pursuing centrifuge research and development at the same time that US officials pressured its classification partners for more formalized and stringent controls. The FRG, UK and Netherlands resisted this pressure, afraid to lose all future prospect of European centrifuge collaboration. This fear proved well founded as from 1964 the US AEC, supported by ACDA and the Defense Secretary, pursued a policy of 'Maximum Delay' towards foreign countries' drive to nuclear fuel self-sufficiency that was clearly aimed at sabotaging European ambitions toward that end in order to maintain US nuclear fuel market leadership for as long as possible.

This explains that while during the 1960-1961 classification talks the future classification partners received some assurances that classification would not stand in the way of commercial exploitation of the centrifuge, the moment the AEC caught wind of Dutch-West-German collaboration talks in 1965 it attempted to dissuade the two governments from going further. During the same period, from 1964 to 1967, US officials were duplicitous in

2319 Burr, William, 'To “Keep the Genie Bottled Up”: U.S. Diplomacy, Nuclear Proliferation, and Gas Centrifuge Technology, 1962, 1972', in *Journal of Cold War Studies*, Vol. 19, No. 2 (Spring 2017).

repeatedly claiming the US had made no significant centrifuge technology advances, yet they in 1965 canceled the technology sharing arrangement with the UK on the grounds the US centrifuge project now had reached production-level technology.

The treatment the UK received when its officials wanted to share classified centrifuge technology with the FRG and Netherlands in the late 1960s confirms that from the mid-1960s the quadripartite gentlemen's agreement on classification of 1961 was used as a tool to support the AEC's Maximum Delay policy and its commercial position. Only when the Americans gained access to the British centrifuge model and considered it not to be a commercial threat to their own program did they permit the British to share it with its future Troika partners.

By 1967 the general distrust of US good intentions among its allies was more pervasive than ever before and the need to create nuclear fuel independence from the US was now becoming clear, both among the Troika partners as well as other Western European countries and Japan. Soon, nuclear fuel independence showed itself to be important not just on political and commercial grounds, but also as a matter of vital energy security, when close after the 1973 oil crisis the US proved itself to be an unreliable supplier when it first extended nuclear fuel contract lead times in 1973 and then confronted its customers with a full order stop in 1974.

The period from 1967 into the 1970s also marks a period of new-found assertiveness of Western European countries vis-à-vis the US, particularly the second generation nuclear suppliers France and the FRG. This assertiveness expressed itself in an unwillingness to unreservedly go along with US non-proliferation and export-control policies during the NPT negotiations and after. These uncompromising attitudes lasted deep into the 1970s.

The Nuclear Non-proliferation Regime and its Contradictions

With the conclusion of negotiations on and the signing of the NPT, an artificial distinction in status was created between states that possessed nuclear weapons and states that before 1967 did not. An important qualification of this distinction was introduced when it was agreed that NWS did not have to accept international nuclear safeguards on their facilities, while NNWS did.

In the NPR, contradictions are located in its institutions, rules and decision making procedures. When the IAEA was founded in 1957, its decision-making structure institutionalized industrial inequality between 'haves' and 'have-nots'; countries with sizable nuclear infrastructures were and still are heavily represented in the highest political decision-making organ of the agency, the Board of Governors. The NPT discriminates between NWS and NNWS and separates privileges and responsibilities in a way that allowed for long-term contradictions in the strategic security between the two groups and was more intrusive of the latter's sovereignty in the application of the safeguards system as administered by the IAEA. Connected to this was the fact that the safeguards system created another contradiction by demanding the NNWS incur economic costs (through disruption of economic activity) that

NWS did not face, making the latter's civil nuclear industries more competitive. States were asked to accept violations of the norm of state sovereignty and norm of equality in free market competition when other states were not, arguably on the basis of a technological head-start and their ability to project regional and global power. Eventual (minor) adjustments to these contradictions in the regime came when NWS compromised on their sovereignty and competitive advantage by accepting voluntary safeguards on their civil nuclear activities.

US efforts to strengthen the non-proliferation system before and after the signing of the NPT were viewed with suspicion by the Troika partners and a wider group of nuclear industrial countries. They doubted the sincerity of the American efforts and instead had started viewing them as efforts to keep competitors out of 'their' market by restricting their business opportunities and by imposing additional costs on their facilities that the US did not have (such as safeguards), rendering them less competitive. The US Government’s repeated failures to privatize its enrichment industry (in 1971 and 1974) could be argued to have fomented this perception.

The Nuclear Suppliers Group was an early locus in which contradictions in the NPR were contested. Since its inception the NSG suffered a serious legitimacy deficit due to its membership and its agenda of export control. Only countries that already had a sizable nuclear industry were invited for membership and therefore decision-making that negatively affects newcomers was construed as cartelizing behavior. This legitimacy gap in part resembled the IAEA BoG's and undercut the NSG’s standing as a legitimate international institution which primary goal is to curb clandestine proliferation. Additionally, its agenda of strengthening export controls was perceived by developing countries as seeking to maintain and protect the advantages the developing world had on them in the nuclear field, violating the spirit if not the letter of the NPT treaty's Article IV that guaranteed NNWS that forewent nuclear weapons to receive assistance in building up their nuclear infrastructure and to have (unrestricted, in some interpretations) access to nuclear energy technology.

Nevertheless, as a tool to curb the irresponsible spread of sensitive technologies, such as enrichment technology, several of the forum's participants exhibited clear norm entrepreneurship. As a forum to exchange and debate ideas, it helped participants to gain greater understanding of each others' interests and views. Yet, US ability to project norm leadership in the NSG was undercut by the damage its reputation had suffered in the 1960s and early 1970s, as it had used normative non-proliferation arguments in strategic instead of communicative action. By having used non-proliferation arguments to forward its commercial interests, its appraisals were now more intensely scrutinized and more easily rejected by other participants in the non-proliferation practice. Additionally, in the years leading up to the NSG's establishment, the FRG had become convinced the US during 1973-1975 had been actively sabotaging West-German reactor supplier KWU's ability to enter the export market by stealing orders through double-dealing, spreading false rumors and threats of US nuclear fuel denials. The resulting disastrous start of KWU as a nuclear reactor exporter consequently made the Brazil nuclear deal of great (even existential where KWU was concerned) importance to the West-Germans.

Thus it was in the initial period following the establishment of the NSG (1975-1976) that distrust of the US showed itself in open economic conflict that saw second generation nuclear suppliers France and the FRG for a time ignore US calls for restraint in the export of sensitive technologies and in the following period (1977-1980) saw EURATOM countries collectively refuse to renegotiate conditions of Canadian and American nuclear supplies (demanded by those two as part of their new non-proliferation policies), choosing to risk embargo over compromise. For these countries, the autonomy to make independent decisions on what technologies to export and whether and when to reprocess spent nuclear fuel, the former tied to economic security and the latter to energy security considerations, was not something they were willing to concede to first generation nuclear suppliers that had previously failed to show the proper self-sacrificing qualities of true non-proliferation norm-entrepreneurs when their head-start allowed them to spread their nuclear technology across the world under lenient security requirements. The US was seen to use non-proliferation arguments in a self-serving way and Canada, possibly overcompensating after its export debacle that had allowed for the Indian nuclear explosion of 1974, was not in a position to threaten the much more powerful European block. Only when the US Carter Administration started expending large amount of political capital to first apply pressure to get other nuclear exporters to behave responsibly, to then follow up on its own non-proliferation rhetoric by restricting its own export freedom in the NNPA of 1978 and around the same time create a technical non-proliferation forum (INFCE) that allowed for a measure of communicative action to define international non-proliferation priorities, did the US regain some of its international standing on non-proliferation and manage to create positive momentum in the strengthening of international norms on non-proliferation.

The failure of the US and Canada to impose their stricter export policies on the Europeans was brought on by their willingness to use the power of their strategic position as suppliers (of enriched and natural uranium respectively) to achieve their newly formulated non-proliferation objectives. Communicative arguments by particularly the US on the proliferation risks of the closed fuel cycle mostly fell on deaf ears as this was the area in which the Europeans and Japanese were ahead in development and had substantial ambitions, while the US had made little investments itself. Acting unilaterally, attempting to impose a new norm, instead of attempting to first build consensus around it, created a backlash that strengthened the opposing norm of sovereign authority over energy security matters and fueled perceptions that Canada and the US were assaulting the right to reprocess spent fuel. Thus, the resort to strategic action by threat that seemed to reflect distrust, instead of using the institution of non-proliferation practice to (slowly) build consensus through communicative action, betrayed a disregard for the good standing of the other participants in the practice and as a result, lowered the standing of the offenders. As a consequence, the rallying of resistance against these policies was quick and effective.

The open-ended nature of NSG policy, in part caused by distrust of US non-proliferation norm-entrepreneurship in this forum and during this period as well as participants' unwillingness to take the imposition of export rules by the 'haves' on 'have-nots' very far led progress on export controls to stagnate. The strategic instead of communicative nature of US and Canadian efforts to strengthen export controls failed to convert the last of the remaining

political will created by the Indian explosion (if there was any left) into substantive change. Furthermore, the short-lived nature of the US Carter Administration's norm-entrepreneurial leadership in this area compounded on the eventual diffusion of political will in international society to create consensus on more restrictive international export controls. This resulted in the evolution of a system of bilateral export controls to its full integration into the NPR to stall in the 1970s and 1980s. That integration only again gained momentum after additional major proliferation events in the 1990s showed the weakness of the status quo and the need for substantially improvements.

Urenco partners the UK and FRG were involved from the onset of the NSG. When the Netherlands joined the forum when it expanded its membership, it's normative policies and tendency to politically follow the US lead largely prevailed over any inclination to support Troika partner FRG in its appraisals that its nuclear export freedom should not be curtailed. This internal Troika contradiction of norms, on the Dutch side institutionally anchored in the 1975 Disarmament Note, would find expression in the many political discussions held in the Joint Committee.

The Troika

It was clear as early as the late 1960s that centrifuge technology represented one of the greatest proliferation risks for the future due to the modest size and energy signature of the required facilities. Besides the multinational agreement to classify the technology, the warnings the UK sent the US delegation during the NPT negotiations testify of this awareness. The early, pre-NPT strategic practices of the United States in the field of nuclear export had resulted in US-dominated market dominance for nuclear power plants and fuel services in the non-Communist world. This market dominance was one of the motivations for the UK, the FRG and the Netherlands to, right as the NPT was being negotiated and signed, to combine their technological efforts in the field of uranium enrichment by gas centrifuge, for the purpose of securing national energy supplies as well as exporting enrichment services in competition with those offered by the US (and from 1971 on, by the USSR as well).

The FRG sought centrifuge collaboration mostly for the benefit of its standing in international society. This expressed itself in the act of engaging in the collaboration itself, despite having the means and maturity of technology to go at it alone. It's goal was to find reliable partners to which it could make its greatest concession; that the location of a West-German centrifuge plant would be on a partner's territory. This concession was intended to signal the FRG's benevolent intentions for its centrifuge program and its continued commitment to not develop nuclear weapons with it. As such, initiation of the Troika itself was a compromise of the norm of sovereignty. The choice of the FRG to join the collaboration shows that it rather would be constricted by its partners in an ethically defensible and promotable multinational structure than face the political fallout of an 'Alleingang'.

The Dutch, confident about their technology but lacking sufficient resources and potential domestic market, perceived alternative potential partners but gave clear priority to the FRG,

as they appreciated, among other things, the constraints this would put on the West-German freedom of movement. Therefore, for the Netherlands, an important reason to seek a sustained partnership in exploiting the centrifuge process commercially (besides its economic rationale) were its non-proliferation benefits; multinational exploitation of the technology would create more opportunity to positively influence the nuclear policies of particularly the FRG. Dutch officials attempted to achieve non-proliferation successes as early as the Treaty of Almelo's negotiation, using currency in the negotiation not to extract economic concessions but focusing on political goals instead. The Dutch delegation nearly overplayed its hand when it attempted to push the FRG delegation to concede its Government's refusal to sign the NPT. Such 'moralizing' by the smaller partner was not acceptable to the other two partners. It is an early occasion in which the UK, partly motivated to be a part of the collaboration to support its strategic goal of moving closer to continental Europe, acts as the balancing partner. It was a role the UK regularly chose or found itself in going forward.

The Dutch success in the negotiations was reflected in the clear reference to non-proliferation goals when the Troika publicly announced it had come to agreement on collaboration. In their common statement the Troika partners pointed to the multinational nature of their enterprise, their willingness to implement IAEA safeguards on future plants and their intention to use the enterprise to promote non-proliferation goals, signaling norm entrepreneurship. At the same time, the resulting Treaty of Almelo of 1970 included important binding stipulations that served to ensure the collaboration's primary purpose of providing energy security to the partners.

The subsequent parliamentary debate on the treaty in the Netherlands saw both the Government and parliamentarians underline the primacy of non-proliferation goals in the rationale for engaging in the collaboration. Parliament pressured the Government to take its norm-enterpreneurial role seriously by stressing the need for early safeguards on Troika GCEPs and adopting motions that required safeguards on Troika exports in recipient countries and parliamentary approval before expansion of Troika capacity beyond 350 tonnes SWU (the 'initial program' capacity). Foreign Affairs Minister Luns on behalf of the Government furthermore opened the door to future parliamentary involvement in export decisions relating to the Troika collaboration, a move that would add to the considerable challenges for Dutch ministers responsible for the project later on.

International reactions focused mostly concerned the fact that the FRG was going to industrially exploit the sensitive centrifuge enrichment process. The USSR cast the FRG's participation in the collaboration as a violation of its WEU commitment to not acquire nuclear weapons, but as the announcement came at a time when the Soviets were just entering the European enrichment market, alternative motivations for their displeasure could have existed. France was distraught, the announcement being read as evidence of the emergence of a new UK-FRG axis in Europe, torpedoing French efforts to keep the UK out of Europe, marginalizing French interests on the continent and challenging France's own multinational enrichment initiative. The US would not entertain French complaints because the Troika collaboration ensured, at least for a time, that the FRG would not have an autonomous enrichment capability and a breakout capability to a nuclear weapon. Nevertheless, the US

State Department and AEC felt the Troika collectively had violated the spirit of the 1961 classification agreement, at a time when the Nixon Administration was shopping its older less-competitive enrichment technology under unattractive conditions to a distrustful Western Europe.

Urenco and the Clash of Economics and Non-proliferation

Throughout the collaboration, the Troika tried to manage the clashing interest of trying to expand their multinational company Urenco's market share of enrichment services and technology transfers with their shared responsibility to nuclear non-proliferation. The multilateral structure of the partnership itself had non-proliferation benefits and produced additional costs through its bureaucracy. The Troika's willingness to incur those costs itself signals norm entrepreneurship as did its pioneering function as the first collaboration of its kind with the intention of eventually fully integrating what were separate centrifuge development programs and commercial interests.

The Joint Committee is the forum through which the Troika expresses its multilateralism politically; after the individual partners offer appraisals of a potential customer's standing in non-proliferation practice and wider international society practice and thus its political suitability for business, the JC comes to a consensus and offers a collective appraisal. During these internal discussions, strategic interests play a role in the offering of appraisals. The case studies show that during the first years of Urenco's commercial operation, the perceived economic viability of the Troika project depended on attracting fourth country customers and that there was not much room to be overly critical of customer's non-proliferation credentials and overall ethical standing in the NPR. Non-proliferation norm entrepreneurship by the Netherlands was not allowed to overly compromise the economic viability of the project.

Additionally, JC discussions saw individual partners express associated strategic interests such as when, for the West-Germans, KWU's commercial strength was partially dependent on that company's ability to offer Urenco's enrichment services alongside its reactor tenders, as French and American competitors were able to do the same. These discussions did not always take place in an environment conducive of communicative action; threats and political pressure were part of the process of consensus building, particularly during the initial commercial period when a common export policy had not been settled on.

Overall though, in the 1970s and 1980s, Dutch MFA documents from that period show that non-proliferation considerations took a front seat in managing Urenco’s expansion efforts. These considerations were largely championed by Dutch officials in the JC. Important reasons for the primacy of non-proliferation objectives were the constraining effects of national commitments to non-proliferation policy by successive Dutch governments and set down in official policy, the active role the Dutch Parliament initially was allowed and seized in defining Dutch nuclear export policy, as well as Dutch deference to US non-proliferation policies. Through the years, coordinating between the responsible departments and ministries, most importantly the Ministry of Foreign Affairs (responsible for non-proliferation policy)

and the Ministry of Economic Affairs (responsible for nuclear energy development and commercial exports) exposed officials to different perceptions on the project and created an evolving consensus that would reflect the Dutch position in the JC.

These Dutch policies on non-proliferation and nuclear exports often put it at loggerheads with one or both of its Troika partners. Particularly in the 1970s, the FRG's narrow perception of its non-proliferation responsibilities as it attempts to gain a solid foothold for its industry in the closely related reactor export and nuclear fuel services markets clashed with the Dutch Government's perception of its international responsibilities and domestic political risks if it failed to live up to those. The episode documents the clashing of norms, between Dutch view of its ethical responsibility (supporting the norm of non-proliferation) and the West-German perception that the US monopoly in the non-Communist world went against its economic and energy security interests (connected to the norm of sovereignty) and it too had a right to a fair share of the nuclear export market (the norm of free and equal market access) by aggressively pursuing clients for its nuclear industry. In a saturated market dominated by a monopolist, lenient supply conditions were a way to compete for orders. These clashes confronted the three Troika partners with a dose of reality; the Dutch partner was forced to acknowledge that without business there was no non-proliferation promotion or even Dutch influence of Troika policy, while the other partners had to acknowledge that the normative landscape was shifting towards stricter non-proliferation norms and failing to evolve Troika policies in this direction would draw domestic and international criticism, particularly from the US.

Brazil

When in 1975 the FRG hauled in the mega-order to supply reactors, associated fuel and other nuclear technologies to Brazil, the FRG's acknowledgment of the above-mentioned shift was already detectable as its officials felt compelled to boost the transfer's legitimacy by negotiating a trilateral agreement with the IAEA that prohibited the use of the supplies for any nuclear explosive, including a peaceful one. The move was an attempt to pre-empt comparisons to the Indian 'peaceful' nuclear explosion of 1974, showing that even the most aggressive supplier needed to acknowledge the lesson the Canadian experience with the Indians had taught the international community; that suppliers inside the NPT system had a responsibility in strengthening the international safeguards practice and that continuing to do business as before would risk condemnation.

In going along with Urenco's involvement in the overall Brazil-FRG deal, Dutch officials showed deference to the normative authority of the NSG (in the Troika represented by the FRG and UK) as the legitimate forum to set export control norms. But to Dutch officials the trilateral agreement, though considered strict, was the minimum requirement of responsible conduct and to them additional non-proliferation objectives ought to be pursued. The Troika, under Dutch diplomatic leadership, could exercise norm entrepreneurship if additional non-proliferation concessions could be extracted from Brazil, particularly on how the plutonium in Brazil's irradiated fuel would be safeguarded from diversion and military use.

The Dutch diplomatic push to get Brazil to accept additional conditions on the delivery of enriched uranium coincided with a number of Troika governmental and Dutch domestic issues and in the process of resolving all of these they became conditionally linked. Skittish about the prospect of having to make political appraisals of potential customers, Dutch industry exited the centrifuge project and forced the Government to accept a role that now involved not just stewardship over but also full ownership of the project, if it chose to move forward with the partners. A failure to move forward would see the partners refuse to compromise their energy security interest and continue with the project and a centrifuge plant on FRG soil would follow soon after. A failure to approve the Brazil supply would so severely undercut the economic viability of the project that it would also imply a Dutch exit from the collaboration and the consequences attached to it.

As Minister Van der Stoel's Brazil diplomacy became more forceful, emboldened by the resurgence of US non-proliferation policy under the Carter Administration, the partners became impatient. When in March 1977 the Dutch Government fell and deferred a decision on all outstanding issues, the mood in the JC turned sour as Urenco's supply commitments came under threat and its marketing efforts were stunted by the enduring uncertainty. Dutch officials and ministers had to expend considerable political capital to avoid being forced into an early exit from the collaboration, symbolically signaling Dutch commitment to continuation by releasing funds towards the construction of a new plant in Almelo while unable to make a solid commitment to it. Diplomatic brinkmanship by Minister Van Der Stoel was rewarded when Brazil agreed to terms on a plutonium storage regime at the end of 1977, with discussions on an overall Troika deal on capacity expansion, treaty extension and Troika commitment to formulate a common export policy starting soon after. Agreement on the future of the Troika collaboration followed at the start of 1979. Part of the package deal was agreement on the establishment of a West-German centrifuge plant on its own territory (at Gronau), a point Dutch officials in the JC had already conditionally conceded years before in 1974. However, the Dutch Parliament was furious to only be informed of the agreement that much later.

Besides illustrating the difficulty of establishing a multilateral enterprise and an associated responsible commercial export policy among partners whose perceptions of their national interests and policy priorities diverged, when viewed from the Dutch perspective, the initial period of Urenco's commercial operation also shows the complications that the involvement of domestic politics can produce in a multilateral enterprise. When Brazil agreed to the plutonium storage regime, Dutch parliamentarians did not hesitate to attempt to institutionalize it in Dutch non-proliferation policy as a requirement to all future non-NPT customers of Urenco. The Parliament furthermore pushed the Dutch Government to active norm entrepreneurship when it demanded the Government, as it was negotiating the package deal with the partners, to actively promote Full Scope Safeguards (FSS) in international forums. Yet, the role Parliament tried to carve out for yourself was unsustainable. It overreached when it tried to set non-proliferation conditions to exports that were unrealistic (such as NPT ratification as a condition of supply) and going along with its demands would have forced the Netherlands out of the Troika, negating all influence it had over future export decisions and policies and consequently severely damaging the Netherlands' credibility as

both a dependable partner in international technical cooperation as well as a constructive partner in furthering the normative goal of strengthening the NPR. Relatively isolated from the reality of international practice, the norm-entrepreneurial role the Dutch Parliament envisioned for the Netherlands would have made its policies irrelevant. The power struggle that had ensued between Parliament and the Government over the Brazil order's export conditions and the Troika's future export policy was partially resolved in the June 1978 debates on the matter, with PM Van Agt defied Parliament's demands and started to shut the door that Minister Luns had opened years before. Subsequent Dutch governments learned the lesson from the Brazil episode and as much as possible isolated Urenco export decisions and policies from Parliamentary involvement.

The Brazil case shows that the norm of responsible non-proliferation practice was shifting and suppliers needed to adjust to it. The recognition of this normative evolution was experienced by Dutch officials in the JC when it noted that FRG and UK officials started to adopt new attitudes on non-proliferation around 1977. The Troika-Brazil episode also shows that norm entrepreneurship in the non-proliferation practice of the NPR, in that it is aimed at creating a new situation in which involved practice participants agree to observe stricter norms than others, leads to clashes with existing norms under the principle of equality. Brazil officials initially resisted any agreement on a plutonium regime because they felt such a regime, when only their country would be subjected to it, was discriminatory. Eventually, they accepted the discriminatory plutonium regime because the benefits of going along with it, both economically and in normative terms (as Brazil was now co-opted into norm entrepreneurship with the Troika in this area), were greater than the cost of aborting the negotiations at the late stage they were in. Whether the episode of negotiating these commitments itself shifted perceptions that Brazilian officials held of their national non-proliferation responsibilities remains to be investigated.

The Interim Export Policy

Over time, the internal Troika arguments softened in tone as reciprocal understanding of the partners' political and economic positions increased, helped by and reflected in increased West-German and British awareness of their non-proliferation responsibilities as nuclear exporters and increased Dutch realization that sensitive export decision-making benefited from a strong Government prerogative and thus isolation from the domestic political sphere. The agreed-upon interim-export policy for Urenco helped isolate JC appraisals from considerations of individual national interests further. It clarified that future technology exports would always involve continued Troika involvement, it adopted the 'Brazil norm' on the storage of plutonium, would give priority to customers that ratified the NPT and would continue to promote the acceptance of FSS by all states.

The Troika interim export policy never became official, in part because of the role the Dutch Parliament had reserved for itself in evaluating any move to formalize it. Agreement to maintain its interim status, requested by the British, was partly motivated by the British and West-German shared wish to avoid another episode that involved Dutch domestic politics and

exposure to the media, and partly by Dutch anticipation of future opportunities to strengthen the policy further, particularly in light of the possible integrative cooperation with Australia that had now presented itself. This is strategic norm entrepreneurship, with the Netherlands recognizing an opportunity for normative gains in the future at the potential cost of contemporaneously not institutionalizing the concessions extracted from its partners up to that point. Keeping each partner's commitment to the interim export policy pending would allow potential future shifts towards more strict non-proliferation norms in the regime practice to support Dutch arguments for a more restrictive export policy. Moreover, if Australia became part of the partnership, that country was expected prove a valuable ally to the Dutch when it came to adopt stricter Urenco export conditions.

Australia

As a potential customer or partner, Australia was appraised as having excellent standing in non-proliferation practice as it had set some of the strictest conditions on the export of its natural uranium. As such it was a non-proliferation norm entrepreneur, using its position in international forums to advocate stricter international export controls. The exploration with Australia was as close as Urenco would come to exporting its centrifuge technology until the 1990s, when it exported its technology to the US.

The passive approach that marked the Troika governments' involvement in the marketing efforts for their multinational project during the 1970s evolved to a more active role in promoting of Urenco's commercial services with foreign governments during the 1980s. This attentive political facilitation saw Troika officials of the highest political level take an active role to promote Urenco as a reliable and commercially attractive supplier of enrichment services to potential customers, considered necessary in the face of state-owned or -backed competitors that enjoyed similar high-level (political) marketing assistance.

Pro-active involvement of the Troika governments in the promotion of Urenco first became more pronounced during the Australia episode, with that country's strategic value as major uranium producer and potential link to the Japanese market providing a powerful incentive to involve high level officials and political leaders. This involvement was partly made necessary by the need to avert the threat of Urenco's French or American competitors using an Australian partnership to dominate the international enrichment market. Additionally, the active involvement of Troika officials and politicians reflected the need to signal political acceptance of Urenco's proposals to transfer technology to Australia, as well as the Troika's non-proliferation policy's similarity to that of Australia, allowing the Troika to apply its ethical standing as currency to enhance its attractiveness as a partner.

Though proliferation of enrichment technology was not considered desirable by the Dutch, and developments in both the NSG and INFCE had bolstered a norm that discouraged the transfer of sensitive technologies, Australia's excellent ethical standing and the recognition that it had the sovereign right to add value to its natural uranium resources made it a suitable partner for collaboration to the Dutch, on the condition of supplier involvement in a

multilateral structure (in line with NSG guidelines and INFCE conclusions). Because of Australia's excellent non-proliferation credentials, the Troika did not require access limits to its technology, another example of how the appraisal of Australia's standing affected export conditions. Additionally, the envisioned Australia-Troika partnership was open to equity participation to clients that also enjoyed good standing in the non-proliferation practice, such as Japan. Troika officials showed awareness that the conditions under which this sensitive technology transfer by the Troika would take place would set a precedent for all such future transfers and therefore would signal an important caveat to the norm bolstered by the NSG and INFCE conclusions. Its rehearsal in Troika discussions of the appraisal of why Australia should be exempt is indicative of this awareness.

Japan

In light of Japan's good non-proliferation credentials, as it had ratified the NPT, was a member of the NSG and had a nuclear weapons ban encoded in its laws, Urenco was given permission by the JC to explore its market in 1976. The Japan case shows the importance of high level political involvement when dealing with high profile potential customers and also shows how these customers can use eager new suppliers to extract concessions from existing suppliers. Urenco's Japanese experience in the 1980s can be summarized by these two lessons.

Getting Japanese utilities to contract enrichment services with Urenco proved extremely difficult, as they were committed to long term contracts with the AEC. Business relations in Japan generally take long to establish but even after extended efforts, it was not until Dutch ministers started to involve themselves personally, promoting Urenco as a good reliable option to diversify away from American services, that Urenco's profile was raised sufficiently to be taken seriously as a potential supplier of enrichment services to the Japanese utilities. At a later stage, a possible technology transfer was explored. Yet in the end, the French competition landed the Japanese diversification contracts and the exploration of Urenco enrichment contacts and linked technology transfer, criticized by the US, was abandoned by the Japanese. Possibly it was used as leverage to compensate for the 'influence effect' (Hirschman's concept, see Chapter 4, page 125) that the US had over Japan, in order for Japan to extract more lenient reprocessing conditions from the US when the Japanese utilities re-contracted most of their long-term enrichment needs with the AEC.

Other Potential Customers

Though the Troika export policy became more restrictive as it became more defined, the case studies show that early JC appraisals of potential customers resulted in rejections based on countries' ethical standing with regards to its general or non-proliferation credentials. In 1976, Urenco was denied permission to explore business relations in South Africa, because of its appalling human rights record and as a sanctioned approach by Urenco could result in a domestic public relations disasters, for both the company and the Troika governments,

particularly in the UK and the Netherlands. The Netherlands Government minority partner PPR's anti-nuclear and anti-South African activism, that already had a successful record of political opposition to nuclear export to South Africa (the Koeberg affair), also informed the Dutch appraisal.

The JC blocked Urenco explorations in Israel, Iraq and Libya and made them contingent on ministerial approve because of their shaky non-proliferation credentials, among strong suspicions that these countries were seeking nuclear weapons capabilities. Possibly, their location in a geographic region full of tension informed the decision, as this came up when Egypt was appraised in the early 1980s. Yet although Egypt had ratified the NPT and the US was already providing it with nuclear supplies, the domestic political climate in the Netherlands caused the responsible Dutch Foreign Affairs minister to take pause. Egypt's historical adversity to long time ally Israel seemed to play into the decision, even though at the same time it was acknowledged that on paper the JC could not in good faith reject Urenco's services to Egypt.

Approaches by Indonesia were entertained as it seemed to have departed from the earlier claims of nuclear weapons ambition by its former leader, and had since ratified the NPT. Interestingly, though a potential deal appeared uneconomic because it would require alterations to an Urenco plant alongside additional licenses to produce uranium at higher enrichment levels, Dutch officials nevertheless wanted to pursue the deal because of its non-proliferation benefits, choosing normative gains at the risk of material losses.

Yugoslavia

Yugoslavia presents an interesting case study, because that country's officials early on in their discussions with Urenco communicated that their country wanted to acquire an enrichment plant based on Urenco centrifuge technology. While Urenco initially rejected the notion of technology transfer out of hand in 1979 (a fact the Dutch Government told Parliament the next year), when it was faced with heavy French and Canadian competition in light of Yugoslavian ambitions to expand its nuclear power program in 1981 and the opportunity to capture US nuclear fuel contracts to Yugoslavia's Westinghouse reactor, the company asked local Troika officials to intervene in favor of such a transfer. With the French offering chemical exchange enrichment technology and the Canadians offering heavy water technology (setting Yugoslavia up to construct natural uranium reactors), Urenco's management appeared to have concluded that it too was required to add sweeteners to any fuel contract offers in order to compete. Efforts to sway the JC apparently failed and contacts with Yugoslavia produced nu further results until in 1982 Urenco was allowed to proceed with a one-time spot sale of fuel services. The JC decided in favor because of Yugoslavia's good non-proliferation standing; it had ratified the NPT and its nuclear activities were under IAEA safeguards. Efforts by Yugoslavian officials to extract Urenco commitments on technology transfers in 1984 were also rebuffed on the grounds that the economics made no sense, both for the Yugoslavian domestic market and the effect of a possible Yugoslavian enrichment plant in the international enrichment market.

What neither Urenco officials knew nor Troika officials appeared to know was that during the same period it had contacts with Urenco, Yugoslavia pursued a covert nuclear weapons program. The Troika could have been aware of Yugoslavian considerations toward such a program in the late 1970s, and may have entertained notions of how India's 1974 explosion could have convinced fellow NAM member Yugoslavia, competing for leadership of that group of states, that it needed to assert its technological prowess and bolster its prestige by exploding a weapon of its own. Dutch internal discussions at the Ministry of Foreign Affairs do not betray any such awareness however. Possibly the request for enrichment technology in 1979 could have been inspired by Yugoslavian nuclear weapon ambitions, but it seems certain the request in 1984 was, as the nuclear weapon program had seen an ambitious restart in 1982 following the death of Tito. The superior proliferation potential of centrifuge enrichment technology vis-à-vis the French chemical exchange process and the plutonium route that the offered Canadian heavy water technology would have made possible (yet extremely challenging considering the country already had all its reactors under safeguards) can explain Yugoslavian officials' insistence on technology transfer from Urenco and their rejection of the alternative technologies offered to them. The Yugoslavia case thus shows how real the danger of transferring Urenco technology to the wrong country was and how important a role the JC had in mitigating the risk that Urenco officials' commercial impulses proved.

Taiwan

The possibility of supplying enrichment services to Taiwan near the end of 1981 came on the heels of the Chinese diplomatic and economic sanctions on the Netherlands for agreeing to supply Taiwan with submarines. With the FRG's KWU asking for the services and the British not objecting, Dutch officials were put in an awkward position; the potential for intensifying conflict with the Chinese and the shaky sovereignty status of Taiwan and its consequences for the application of safeguards on nuclear supplies could to expose the Dutch Government to intense domestic criticism (which it was already facing over the Submarine Affair) and risked re-opening the discussion on the Dutch participation in the Troika as a whole. An additional complicating factor was the fact that the Dutch were in active high-stakes negotiations with the West-Germans over two other industrial collaborations, showing that Troika decision-making was not isolated from the wider bilateral relationship between the partners. Attempting to carefully manage the Troika relationships, while also making clear that the Dutch would veto a sale to Taiwan in the JC if put on the spot, Dutch officials chose a strategy of non-confrontation, explaining to their partners that clarity over a China's position on the Urenco supplies to Taiwan was important and required. In the end, the West-Germans accepted an option to attract French enrichment services if KWU's bid won the tender (which it did not).

Several years later, knowledge about persistent Taiwanese intransigence in the face of American pressure to forego a nuclear weapons program had emerged sufficiently for Dutch officials to out of hand reject another request for enrichment services to Taiwan in 1988. Taiwan's ethical standing and particularly its non-proliferation credentials had at this time

been considerably eroded because of what had become known of its past behavior and failure to live up to its international promises. Despite the US declaration that now Taiwan was living up to its non-proliferation obligations, Dutch Foreign Affairs officials did not see how their minister could positively appraise a supply to Taiwan in Parliament.

Additional Insights from the Country Cases

The nuclear export landscape underwent another shift during the start of the 1980s. With new leaders in key countries (Reagan in the US, Mitterand in France) we see Urenco's competitors taking more leeway in the conditions of nuclear supplies and the technologies on offer. The norm of responsible nuclear export had become more permissible.

Case studies of Mexico and China show that the active management of 'Urenco's behavior' by the JC during this period was prudent and required. In the case of Mexico, after contacts were sanctioned by the JC Urenco shared information about other potential clients (Australia to Mexico, and Mexico to Australia) too freely and also was to eager in suggesting that technology transfer might be part of a deal. The JC wanted to stay within the new norm that the INFCE had set (reservedness in technology transfers) and Urenco was promptly made to correct its mistake. The fact that its competitors were not strictly observing this norm and were sweetening deals with sensitive technologies did not prompt the JC to compromise its policy, as it hadn't in the face of Yugoslavian requests.

For China, Urenco received a mandate to explore enrichment supplies to that country in 1984 but returned with a more or less tangible technology transfer offer to China. The JC was forced into setting up a China subgroup to explore possible consequences of such a transfer, such as military use. While the Troika wasn't eager to pursue the opportunity of technology transfer to China, none of the individual partners wanted to face the political consequences to their relationship with China that using their veto might imply. The episode shows that faced with a politically influential potential customer that represented substantive economic interests in the future, multilateral institutions that have a function to safeguard normative principles may be faced with pressure that compromises their decision-making. In the end, no such transfer took place and China instead imported Russian centrifuge technology in the 1990s.

Normative considerations once again took a role when the possible supply of enrichment services to India was under the JC's consideration. A principled stance by the Dutch, basing themselves on India's poor ethical standing when it came to non-proliferation, reflected in its refusal to sign the NPT and accept safeguards on its nuclear activities, as well as the possible involvement of 'ethically tainted' South African uranium in the potential deal was offset by a pragmatic West-German position that argued for engagement with NPT hold-outs. In the end, the deal went to the French, who had dropped their demands for strengthened safeguards at Tarapur when its new leadership saw opportunity for economic gains in its relationship with India. They were rewarded with sizable arms sales.

GCEP Safeguards

As circumstances in the world changed, so did global perceptions on the necessity of more comprehensive safeguards on all nuclear facilities, including GCEPs. The 'Safeguards Era' shows a clear division between an initial period that focused on material accountancy (measuring, recording and reporting what entered and exited a facility) and a period that followed it in which environmental information was included in non-proliferation analysis of states and their nuclear activities.

The challenges of safeguarding industrial GCEPs exposed some of the weaknesses of a international safeguard system that at the time was purely based on material accountancy and triggered technical and political discussions on far-going access to plants based on sensitive technology by inspectors. Urenco countries were active participants in discussing and deciding upon early safeguards solutions, export restrictions and classification. Participation by individual or all partners in forums intended to strengthen safeguards, such as in SAGSI, the INFCE discussions and more importantly the HSP reflected that involvement.

The initial Urenco position on IAEA safeguards at its GCEPs was that in the interest of protecting sensitive technology (and thus, serving both commercial and non-proliferation objectives), inspector access to its plants should be restricted. Documents on internal Troika discussions reveal that the Dutch partner advocated far-going access by invoking transparency norms seen in disarmament verification and the importance of setting a good example, particularly since EURATOM inspectors already enjoyed limited restrictions on cascade hall access. This persistent Dutch drive towards transparency dovetails with the general attitude in the early part of the Netherlands nuclear development history, from the Committee Kramers setting declassification of nuclear technology as a policy goal, to Kistemaker 'blowing open' classification of calutrons at Oak Ridge.

The British partner argued that quadripartite classification commitments prevented full access and that well-explained access restrictions would be acceptable considering the risk of exposure of sensitive centrifuge technology to inspectors. What emerged was the 'Urenco principle' or *black box* principle that relied on material accountancy and restricted GCEP cascade hall access. SAGSI's wider audience concluded that this was an acceptable position and endowed the principle with additional legitimacy. Dutch officials continued their opposition but eventually were forced to tone down their rhetoric in the JC because the Brazil case and delays in Dutch decision-making on the Almelo expansion were straining the Dutch relationship with its partners, resulting in the acceptance of the British restrictive position as Troika policy. The acceptance established the norm of access restriction that would serve as the starting point of discussions in the HSP.

Discussions and conclusions drawn in INFCE's Working Group 2 on enrichment plants helped build consensus about safeguards requirements at enrichment plants and, because they were the first type of enrichment plants to be safeguarded, was highly referential of GCEPs. The forum confirmed the norm of restricted access to the cascade halls and upheld the *black box* principle. Nuclear material accountancy was deemed sufficient for the IAEA to meet its safeguards obligations but improvements in containment and surveillance measures were

needed; NMA verification would be supported through surveillance of KMPs. MBAs would have to be set up around a *black box* area for optimal accountancy.

The INFCE (1978-1980) was highly successful as a norm-setting forum because it's initiator (the US) had not used its influence to preconceive any of its conclusions. As a technical forum that was open to all IAEA members and in which participants could participate freely, it facilitated communicative action, and so its conclusions attained broad legitimacy. Additional signs that the forum's conclusions were going to be consequential and it was expected to set the new norm was when states, faced with export decision while the forum was convened (for example, the Troika, but also Canada and the US), made sure not to preempt its conclusions and linked future decisions and policy to it. The acts of doing so can be seen as norm entrepreneurship. After INFCE ended, its conclusions were referenced and appealed to by the Troika and others on numerous occasions, signaling the clear role it had as a norm-setting event.

In the HSP (1980-1983), the US and IAEA pushed for a more intrusive GCEP safeguards norm based on what could be assumed about the ability of big plants to be misused. This clashed with the perspectives of the FRG and Japan, whom did not want to compromise the economic competitiveness of their nuclear infrastructure at this crucial time and who argued that the material accountancy system was adequate. Their perceptions were playing catch-up to reality, still in a 'mode' of distrust with regards to the US intentions. The IAEA's US-supported calls to the FRG and the Netherlands to accept international safeguards at Urenco facilities, at a time when American and Soviet enrichment plants were exempt from these under the NPT, seemed unfair considering the considerable head-start the first generation nuclear suppliers had had in saturating the market with their enrichment services. But that was not all there was to FRG resistance; one of the most important elements in the West-German officials' refusal to accept the notion that misuse of facilities should be assumed as a baseline in safeguards application was the element of trust. Actors in good ethical standing, choosing to be a part of the non-proliferation system instead of enjoying the luxury of staying outside it should be assumed to be trustworthy, instead of being *de facto* mistrusted. An additional argument used non-proliferation as an argument against more intrusive inspections; exposure of (commercially) sensitive information could also contribute to proliferation. A balancing role was thrust upon the Netherlands, as Dutch officials perceived a need for stronger non-proliferation measures and were willing to risk compromise on its commercial position (and possibly inspector espionage) to further a more intrusive norm. Inside the Troika discussions, the Dutch appraised the more intrusive policy agenda as superior to the status quo.

Meanwhile, the IAEA and EURATOM negotiations on the Facility Attachment for Almelo has completely stalled. As part of the wider negotiation process on FAs between EURATOM and the IAEA, the latter's appraisal of what safeguards burden and commercial and proliferation risks were acceptable was out of touch with (the political) reality. The Europeans could point to the supranational safeguards system already in place, which they were not going to give up and which primacy they would not allow to be disputed. European industry would be put at a distinct disadvantage if IAEA was to implement a completely parallel inspection effort. A compromise was reached on most facilities in Europe, but a compromise on GCEP safeguards

could not be reached in that negotiation. IAEA pressure to resolve the question of inspector access at GCEPs sooner rather than later was partly inspired by a fear that non-resolution of this issue would result in the status quo becoming the norm. The IAEA had been from 1978 applying a form of ad hoc safeguards at Almelo that it found entirely insufficient to draw safeguards conclusions from.

A breakthrough was made possible when the US declared its willingness to forgo its exempt NWS status and accept GCEP safeguards, similar to the concession to accept voluntary safeguards that some NWS had made to the FRG during the NPT negotiations. While in practice during the following decade the US only had to accept a relatively small safeguards burden in both cost and intrusiveness because of the nature of developments in its domestic enrichment industry, it's fair to assess this US concession as facilitating communicative action because at the time its officials did not know the future of its Portsmouth GCEP, to which the HSP results would be applied.

At its conclusion the HSP participants compromised by accepting the principle of 'no misuse' verification without using its language (that language was only adopted when the IAEA expanded its authorities in the 1990s, following the discovery of Iraq's nuclear weapon program). The resulting LFUA approach that the HSP produced can be seen as a product of political and economic constraints on access but also of the limited means available to and scope of the HSP process, as some technical options were preferred over others because of the limited time-frame of the project limited the proper evaluation of all options.

The HSP itself, as a forum that facilitated thinking about technical challenges outside the direct realm of politics, benefited from the already high level of consensual technical knowledge that can be seen in epistemic communities. Consequently, it created opportunity for officials to learn more about each others' perspectives and concerns in a collaborative setting. This offered a window for communicative action that facilitated for the solutions that the forum's participants came up with to be quickly accepted as a new norm. The means to present a common position before and during the HSP deliberations, combined with the fact that the participating EURATOM ESD's officials at times deferred to the Troika position, resulted in the Troika being able to exert considerable influence on the outcome of the project. Likewise, participation by both IAEA and EURATOM officials and their shared objectives in the project led to greater understanding and appreciation of each other's roles and contributed to a better relationship between the officials of the two agencies going forward.

In a norm-focused view, the HSP was an exercise in national sovereignty norm compromise for the benefit of non-proliferation norm building. It shows how participants in practice were willing to sacrifice one coveted established norm in favor of the uncertainty of building another, as long as this new norm could be perceived to promise clear benefits over the present situation and certain conditions, such as the equal and fair application of agreed measures, were met. As most participants in the regime practice of safeguarding GCEPs were represented in the HSP and accepted its results, the HSP can be conceived as a norm cascade.

Yet the HSP and its results also show that when a norm is firmly established among participants, universalization across the regime over time is not an inevitable consequence.

Strong norm entrepreneurship of a leading actor (the US) and a norm cascade among a small group of parties in the HSP did not prompt the USSR/Russian Federation and China to include their civilian GCEPs in Voluntary Offer Agreements as the US had done (even though China offered up its Russian-built plants in the 1990s). Even so, considering the IAEA's limited resources and given the low priority it assigned to safeguarding civilian facilities in NWS (exemplified by its attitude towards safeguarding LES), it can be doubted whether Russian and Chinese domestically-built GCEPs would have ever come under safeguards even if they had offered them up. Therefore, the level playing field that most of the HSP participants had hoped for remained and remains absent, validating Urenco's complaint at the commercial unfairness of having been subject to 80-90% of the IAEA's historical inspection efforts at GCEPs in 2008. Further institutionalization did occur, when in 2006 the IAEA updated the model safeguards approach for GCEPs that included a number of safeguards measures applicable to GCEPs that had been added to the agency's toolkit since HSP concluded.

Though strictly not a focus of the case study but rather an epilogue, the ultimate vindication of GCEP safeguards norm-setting that resulted from the HSP came when Iran secretly built up a nuclear infrastructure in the 2000s that was subsequently exposed to the IAEA and the world. The Iran episode supports the normative practice-based approach to regime theory in two important ways. First, it shows how when a state cheats the international community and its fellow regime members by flouting the rules of a regime while offering appraisals that it is abiding by them and when found out offering an account of its behavior that rests on a misinterpretation of the rules of the regime, its standing can be so adversely affected that it can then be forced to accept far-going intrusive measures in order not to become an international pariah or even face military intervention. Second, the intrusive measures that Iran negotiated with the P5+1 included measures that had been agreed with in the HSP as well as those that had since been developed in line with the HSP's conclusions. Had the HSP not moved the norm of verification intrusiveness at GCEPs along, and had the spirit of the HSP not resulted in the Troika and Urenco allowing several generations of verification tools (including unattended monitoring systems such as OLEM) to be thoroughly tested at Urenco's facilities and had the IAEA not further institutionalized its package of measures in the model approach of 2006, it seems unlikely that the P5+1 could have negotiated the most comprehensive inspection regime for GCEPs to date at Iran's plants. In turn, the implementation of this safeguards system in Iran and the experience it will gain the IAEA might also result in another important shift in that norm.

Overall Conclusion

The experiences of the Netherlands' participation in the Troika, as set in the wider historical context of a global market into which second-generation nuclear exporters had to compete to gain a share, largely confirms the theoretical framework of this study. The theoretical framework required the observation that participants in international practices and institutionalized areas of practice such as the NPR appraise each others' actions and act upon

the ethical reputations of other states and international organizations. The case study shows many of these appraisals, as they were acted out in the context of JC discussions but also in the domestic politics of the Troika partners and in other states. It shows the Troika, albeit sometimes after intense internal debate but eventually institutionalized in its interim export policy, was willing to forgo economic gains in order to uphold a normative standard that not all its competitors held themselves to, and in doing so incurred cost for the sake of setting a good example and strengthening the NPR. In turn, this shored up Urenco's reputation as a responsible supplier as well as the partners' standing in international society. The benefit of this approach became apparent in the Australia episode, when high-level démarches could draw attention to the Troika's non-proliferation credibility as a responsible supplier. The avoidance of proliferating centrifuge technology to a nuclear weapons program in the case of Yugoslavia seems to also illustrate the foresight of this approach, yet more data on Yugoslavian decision-making is needed to confirm that assertion.

The role of the Netherlands in the Troika was clearly that of a norm entrepreneur, consistently pushing the status quo towards a more responsible balance between economic and non-proliferation interests. Helped by an (sometimes overly) involved Parliament that prioritized non-proliferation over economics and constrained by the non-proliferation policies of previous governments, Dutch officials took substantial risks with its participation in attempts to shape Troika non-proliferation policy to their design and requirements. Towards the late 1970s, with the strengthening of the international non-proliferation norm following political pressure by and norm entrepreneurship of the US Carter Administration, the Troika partners recognized the changes to the normative landscape and discussions on potential exports became less contentious. When that norm weakened at the start of the 1980s, partly because the US Reagan Administration reneged on keeping to a strict interpretation of the NNPA in the face of declining exports, the Troika's export policy had taken shape and the partners resisted economic pressures to compromise on it in the face of competition that once again offered sensitive technologies to gain the upper hand. Following what could be considered hegemonic leadership in the formation of the NPT by the US and USSR at the end of the 1970s and the US regime leadership in the mid to late 1970s, the start of the 1980s thus see the effects of regime persistence when US hegemony in the Western Alliance had declined and combined leadership by the superpowers was absent.

Disagreements on a common Troika position on safeguards at GCEPs played out during the same period. Here also, Dutch officials were willing to incur material costs and risk exposure of commercially sensitive information to strengthen non-proliferation norms. The highly technical and specialized nature of discussions as they progressed in SAGSI, INFCE and HSP as well as in internal Troika discussions helped eventually create a more intrusive norm that allowed limited safeguards inspections of the cascade halls.

The case study shows that the competing appraisals in the JC were normative, in that they argued in reference to existing or emerging (and evolving) norms, particularly between the norm of sovereignty (and all the national prerogatives such as energy security and more generally the national economic interest) and the norm of nuclear non-proliferation and its collective security benefits. Gaining normative strength as it evolved, the norm of non-

proliferation was particularly visible in the contestation that occurred and the resolution that followed as new standards of proper conduct in export and safeguards became institutionalized in the nuclear non-proliferation regime. The historical narrative of this study offers a view, reflective of that institutionalization, of how in the appraisal of potential customers for enrichment services, the perceptions and awareness of Dutch and other Troika officials evolved and was reflected in their decision-making.

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Annex I:

The Toirkens-Voûte Protocol, for Supervised Use of the Classified Archives of the Ministry of Foreign Affairs (in Dutch, as accorded by the Ministry of Foreign Affairs of the Netherlands; English translation below)

Afspraken omtrend het 'Toirkens-Voûte Protocol'

Dit is het protocol dat bepaalt hoe we terzake van het proefschrift van Frederik Voûte omgaan met het gebruik van confidentieel en geheim materiaal uit het Buitenlandse Zaken-archief. Het basisprincipe hiervan lenen wij van het 'Toirkens Protocol', in het level geroepen i.v.m. het gebruik van archiefstukken en niet-individueel-traceerbare bronnen door José Toirkens, tientallen jaren geleden.

De strekking van dit protocol is dat bronnen die mogelijkerwijs ongeschikt zijn voor openbaarmaking in een commentaar op basis van die stukken gebruikt kunnen worden in anonieme vorm. De bronvermeldingen in het openbare artikel/boek zijn gecodeerd, en een wegwijzer van die codering is alleen beschikbaar voor een beperkt aantal daartoe gemachtigde personen (in dit geval, de Kleine Commissie). Mochten derden op een later tijdstip garanties willen ontvangen over de inhoud van deze bronnen, dan kunnen zij hiervoor de Kleine Commissie benaderen.

Omdat er in het geval van het Voûte proefschrift ook belangen van verdragspartners spelen (aangezien het hoofdonderwerp een samenwerking van Nederland, Groot Brittannië en West-Duitsland betreft) is de Toirkens-constructie uitgebreid met de mogelijkheid van een 'check' met de verdragspartners bij twijfel over de gevoeligheid bij hen van gebruikt materiaal.

Schematisch werkt het proces dan als volgt:

- Promovendus maakt een inventarisatie van de gebruikte archiefstukken: welke archiefbronnen zijn kandidaat-verwijzingen in zijn manuscript, en verwerkt dit in een overzicht. Promovendus verdiept zich in benodigde beveiliging van zijn dissertatie en doet een voorstel opdat deze bronnen vervolgens verantwoord gedeeld kunnen worden.

- Controleurs BuZa ontvangen dit overzicht/voorstel en het betrokken hoofdstuk van de dissertatie (waarin BuZa archiefbronnen zijn gebruikt) via beveiligd medium. Zij controleren het hoofdstuk en de bronnen op politieke gevoeligheid m.b.t. Nederlands beleid en de Troika-samenwerking. Bij twijfel over hoge gevoeligheid kunnen zij verdragspartners om feedback vragen. Zij beslissen, wenselijk na overleg met de promotor, welke bronnen openbaar mogen worden, welke informatie openbaar dan wel via gecodeerde bronnen semi-openbaar mag worden, en welke bronnen en inhoud niet openbaar mag worden.

- Promovendus krijgt een kans feedback op deze beslissing te geven, bijvoorbeeld als hij openbare stukken kan laten zien die dezelfde inhoud aantonen. In overleg kan er dan

mogelijk een meer conservatieve benadering gevonden worden waardoor een deel van de bron wel gebruikt kan worden. Echter, de controleurs van BuZa houden hierin het laatste woord.

- Promotor en twee leden van de Kleine Commissie tekenen geheimhouding, waarna zij het volledige proefschrift ontvangen via een beveiligd medium. Er wordt vervolgens een 'lees-middag' te BuZa georganiseerd voor deze drie lieden, om te controleren of het door promovendus onder gecodeerde condities opgeschrevene overeenkomt met wat er in de archiefstukken staat.

  (Deze stap waarborgt de academische onafhankelijkheid).

- Controleurs BuZa ontvangen de eindversie van het betrokken hoofdstuk voor een laatste controle.

- Nadat het Protocol doorlopen is kan de Grote Commissie/de Promotiecommissie, mits Kleine Commissie akkoord is, de dissertatie beoordelen.

Het resultaat is dat het Ministerie zeggenschap houdt over welke informatie naar buiten gebracht wordt en welke archiefbronnen openbaar gemaakt kunnen worden. Tegelijk waarborgt het Protocol dat de Kleine Commissie de toegang heeft tot het integrale manuscript en wordt een bronnengarantie richting de Promotiecommissie gecreëerd.

English Version:

Agreement regarding the 'Toirkens-Voûte Protocol'

This is the protocol that establishes how we, in the matter of the Ph.D. dissertation of Frederik Voûte, ought to handle the confidential and secret documentary material from the Foreign Affairs archives. The basic principles will be taken from the 'Toirkens Protocol', which was created in the context of the use of archival documents and non-individually-traceable sources by José Toirkens, several decades ago.

The intention of this protocol is to create the opportunity to use sources that may be unsuitable for declassification in a commentary based on those sources, which remain anonymous. The source references in the open access article/book are coded, and a legend of that coding is restricted, only available to a specifically authorized group of persons (in this case, the Small Committee [the Committee of three Professors tasked with examination of the dissertation]). If at a later date others wish to obtain guarantees regarding the content of the used classified source material, they can put in a request with the Small Committee.

Because the content of the Voûte dissertation touches upon the interest of treaty-partners (seeing that the main subject is a cooperation of the Netherlands, United Kingdom and West-Germany), the Toirkens Protocol has been expanded with the possibility of performing a 'check' with the treaty [of Almelo] partners, in the case there is any doubt regarding the sensitivity of the used material.

Schematically, the process works as follows:

- Ph.D.-student makes an inventory of the used archival records: which archival records are candidates for referencing in his text, and creates and index of these. Ph.D-student makes sure he is aware of required security procedures for his dissertation and makes a proposal so that the indexed records can be used in a responsible manner.

- Controllers of the Ministry of Foreign Affairs [MFA] receive this index/proposal and the relevant chapter of the dissertation (in which MFA archival records are used) by secured medium. They examine the the chapter and the archival records for political sensitivity regarding Dutch policy and the Troika-cooperation. When any doubts arise over the sensitivity, they can ask the treaty partners for feedback. They decide, preferably after consultation with the principal Professor, which archival records may be declassified, which information may become public, or semi-public using coded sourcing, and which archival records and information may not be public.

- Ph.D.-student is granted opportunity to provide feedback on this decision, for example when he can show public documents containing the same information. In consultation, an attempt can be made to pursue a more measured approach, resulting in the partial use of the source material. Regardless, the controllers of the MFA maintain the last say in these matters.

- The principal Professor and the two other members of the Small Committee sign secrecy clauses, after which they receive the complete dissertation by secure medium. Subsequently, a 'reading afternoon' will be organized at the MFA for these three persons, in order to verify whether what is written by the Ph.D.-student under the coded references corresponds with what can be found in the archival sources.

(This step guarantees academic independence)

- Controllers MFA receive the final version of the relevant chapter for a last examination.

- After the Protocol has been completed, the Large Committee/the Examination Committee can, pending permission from the Small Committee, examine the dissertation.

This results in the Ministry maintaining control of which information is made public and which archival sources are declassified. Coincidentally, the Protocol safeguards the access of the Small Committee to the complete text of the dissertation and a guarantee regarding the use of sources is created for the benefit of the Examination Committee.

Annex II: Sources from the National Archives of the Netherlands

(Sources are ordered per archive section ('Archiefblok') and date)

Archive section 1:
Archiefblok Ministeries voor Algemeene Oorlogvoering van het Koninkrijk (AOK) en van Algemene Zaken (AZ): Kabinet van de Minister-President (KMP), 620: Opwekking en gebruik van energie, 10849-10861, Stukken betreffende de opwekking, het gebruik en de bescherming van mens en milieu tegen de gevolgen van de aanwending van kernenergie.1970-1979, 10859 Urenco 1976-1979 (2.03.01/10859)

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(See separate file)