

Alert: Public Health Implications of Electronic Cigarette Waste

Health policy debates about electronic cigarettes (e-cigarettes) have thus far overlooked the potentially serious environmental effects these products pose. From mining to manufacturing, using, and disposing, each stage of the e-cigarette product lifecycle presents novel environmental harms compared with traditional cigarettes. The effect of e-cigarettes on the environmental determinants of health requires urgent study. Tobacco companies already recognize that e-cigarettes pose new environmental burdens, necessitating them to “manage new areas of impact due to the increasing use of electronics and batteries in [their] products.”^{1(p54)} Few independent data currently exist assessing the product lifecycle of e-cigarettes and the accompanying environmental health risks. Focusing on disposal patterns and effects here, precedents from traditional cigarettes and electronic waste (e-waste) indicate that e-cigarette disposal is an emerging problem warranting public health’s attention.

MAGNITUDE OF THE PROBLEM

An estimated two thirds of the world’s 6.25 trillion plastic cellulose acetate cigarette butts are littered annually,² clogging sewer drains, blighting city parks, and costing billions of dollars annually to clean up in the United States alone.³ Disposal of e-cigarettes, however, potentially poses an even graver long-term environmental threat because of their material composition.

In 2015, more than 58 million e-cigarettes and refills were sold in the United States at grocery and convenience stores (excluding vape shops or online), 19.2 million of which were designed for single use.⁴ E-waste in general is already an overwhelming problem, with 99 billion pounds discarded annually according to 2017 global estimates.⁵ Even though most e-waste from Western countries is shipped to developing countries, displacing the hazards and pollution of reprocessing, reclaiming, or incinerating e-waste does not eliminate the problem.

E-WASTE: AN ENVIRONMENTAL HEALTH PROBLEM

No studies have yet tracked disposal patterns of e-cigarettes, but research in progress suggests that like cigarette butts, spent e-cigarette capsules or replaceable nicotine-filled plastic pods are often littered. These pods contain endocrine-disrupting plastics, electronic circuitry, and the residue of concentrated nicotine extracts. Some e-cigarettes contain enough toxic chemicals to qualify as hazardous waste.⁶ Highly concentrated nicotine and e-waste residuals present biohazard risks, and the hard plastics, lithium-ion batteries, and electronic circuit boards require disassembly, sorting, and further recycling and disposal. When littered or improperly discarded, broken devices can leach heavy metals (including mercury, lead, and bromines), battery acid, and nicotine into the

local environment and urban landscape, affecting humans and other organisms.^{2,6} Like cigarette butts, e-cigarette waste poses choking hazards for small children and may be inadvertently eaten by birds and other animals. Unlike cigarette butts, however, e-cigarette waste contains sharp and acidic elements that can puncture, explode, or burn.⁶

Of the various types of e-cigarettes, disposable e-cigarettes pose the highest potential environmental costs, because they contain e-waste elements similar to those of reusable e-cigarettes but are used only for a predetermined time (about 400 puffs or 20–40 cigarettes’ worth of vapor) before becoming spent. The e-waste from disposable and refillable devices is similar in terms of principal components, but refillable ones last much longer, requiring changing out only the nicotine liquid (“juice”) or flavored juice-filled pod. The additional environmental harms from disposable e-cigarettes suggest that phasing out single-use e-cigarettes while instituting strict product standards for reusable e-cigarettes would achieve an environmental good. Just like cigarette butts, the disposal patterns of e-cigarettes and their effects may indicate additional environmental health burdens among already vulnerable populations.

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RECYCLING E-CIGARETTES

Even when e-cigarettes are not littered, they should not be simply disposed of in regular trash bins. Because of their electronic components, discarded e-cigarettes are e-waste, not ordinary trash, and should be disposed of accordingly. The fact that they also contain residual nicotine—in some cases in substantial amounts—further complicates their disposal, because e-cigarettes and their cartridges may qualify as both e-waste and biohazard waste.⁶ Neither policy nor product information currently gives consumers guidelines for disposing of e-cigarettes.

The task of disaggregating and recapturing the components in e-cigarettes is best fulfilled by the companies that produce them, through a well-worn model to close the waste loop known as extended producer responsibility. With extended producer responsibility, electronics manufacturers establish and publicize end-of-life buyback programs to collect their used products, avoiding littered or inappropriately discarded e-waste and other hazardous materials (such as computer monitors or paint). Easy recycling programs with monetary incentives are missing from the e-cigarette recycling ecosystem, even though the material composition of e-cigarettes is more akin to a smartphone than a traditional cigarette.

Although some companies have voluntarily instituted versions of extended producer responsibility, the existing channels are difficult for

most consumers. Altria has instituted two different disposal schemes for its major e-cigarette subsidiaries: Green Smoke allows consumers to mail in exactly 80 used e-cigarette (e-liquid) cartridges of any type or brand, in exchange for Green Smoke e-cigarette reward points redeemable for their specific cartridges; MarkTen e-cigarette batteries can be recycled with the organization Call2Recycle, which has national drop-off locations, albeit concentrated in major metropolitan areas. Other major brands such as current market leader Juul are silent on product disposal, and RJ Reynolds' Vuse e-waste program is defunct.

REGULATORY SIGNIFICANCE

The US Food and Drug Administration (FDA) has the power to require e-cigarette manufacturers to comply with product robustness standards to ensure that these products do not needlessly cause waste and instead are disposed of properly. The National Environmental Policy Act and the Council on Environmental Quality Regulations stipulate that all federal agencies as a rule are required to include

environmental effects in the assessment of any proposed federal law, such as the FDA's laws governing e-cigarettes. Under the Unfunded Mandates Reform Act of 1995, the FDA must issue Environmental Impact Assessments (EIAs) if they estimate that the societal costs imposed by new products such as e-cigarettes will exceed \$100 million nationally.⁷ Based on current quantities, e-cigarettes pose an environmental burden from e-waste likely far exceeding this threshold. An EIA could result in instituting an extended producer responsibility program requiring companies to receive, repurpose, and recycle e-cigarettes.

All products submitted to the FDA's Center for Tobacco Products require either an EIA or a Finding of No Significant Impact, but the deadline for assessing this has been postponed from 2018 to 2022. Currently, e-cigarettes are sold with minimal oversight by regulatory institutions, including environmental agencies, and it is unclear what environmental compliance standards the FDA will require for e-cigarettes. To prevent unnecessary harms to human and environmental health from e-cigarette disposal, the FDA

must act quickly before products and consumer habits become entrenched to designate product robustness standards requiring e-cigarettes to be reusable rather than disposable and standardize closed-loop manufacturing and disposal of e-cigarettes (extended producer responsibility) to minimize their environmental health harms.

REDUCING HARMS

EIAs are necessary but not sufficient mechanisms to reduce the toxicity and amount of litter and trash from e-cigarettes. Mandating extended producer responsibility will incentivize companies to minimize the amount and toxicity of products, favor reusable products easy to repair, extend product robustness and durability, and decrease e-cigarettes' environmental health burden. *AJPH*

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Human Rights: The Violence Against Women Act Reauthorization Is Due

The Violence Against Women Act (VAWA; <https://www.congress.gov/bill/103rd-congress/house-bill/3355>), drafted by former senator Joe Biden and signed into law by former President Bill Clinton in 1994, provides critical support to survivors of violence. This year, 2018, the VAWA reauthorization is due. In our current,

tumultuous political environment, public health professionals must advocate continued funding of this important legislation. Although all women are vulnerable to violence, factors that influence access to power—including poverty, race, and ethnicity—can heighten women's vulnerability. Consequently, violence against women is also

a human rights issue, which demands legislation, activism, and empirical research to support

survivors and prevent further violence. As declared by Hillary Clinton at the United Nations (UN) Fourth World Conference on Women in 1995, “Human rights are women's rights and women's rights are human rights.”¹

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