

E-CIGARETTES AS WASTE AND THE NEED TO REGULATE “DISPOSABLE” PRODUCTS

by Cameron S. Quackenbush

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SUMMARY

Between January 2020 and March 2023, U.S. electronic cigarette sales grew 43%, from 15.6 million devices per month to 22.4 million devices. During this time frame, the portion of sales comprising disposable devices grew from 4 million to 11.9 million per month. The impact upon the environment has been largely overlooked by policymakers. Containing nicotine, batteries and circuitry containing heavy and precious metals, and plastics, e-cigarettes can qualify as hazardous wastes under the Resource Conservation and Recovery Act, and contain hazardous substances for purposes of the Comprehensive Environmental Response, Compensation, and Liability Act. Due to the diffuse nature of this waste, existing regulations have failed to address this issue. This Article details each phase of the issue, painting a realistic image of current regulations around waste management and cleanup, and provides a pathway to responding to this disaster through both state and federal action.

Electronic cigarettes, or e-cigarettes,¹ are “battery-operated devices that heat a liquid containing nicotine, propylene glycol or glycerol, and flavoring

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Since January 2023, I have served as an intern and Legislative Assistant in the Office of Sen. Lew Frederick (Oregon State Senate District 22). I shared this student capstone Article and its state law proposals with Senator Frederick and his Chief of Staff, Nathan Soltz, whose combined interest in my work led to introduction of a bill embodying the producer responsibility and refundable deposit mandates spelled out in Section IV(B)(2). I anticipate providing testimony for the bill based on the contents of the Article when the bill comes before its respective Oregon Senate and House of Representatives Committees. The Article does not necessarily reflect the views of Senator Frederick, and all views herein are my own.

1. U.S. Food and Drug Administration (FDA), *E-Cigarettes, Vapes, and Other Electronic Nicotine Delivery Systems (ENDS)*, <https://www.fda.gov/tobacco-products/products-ingredients-components/e-cigarettes-vapes-and-other-electronic-nicotine-delivery-systems-ends> (last reviewed May 31, 2024). Although electronic cigarettes are referred to by a broad category of terms, this Article elects to refer to them as “electronic cigarettes” to continually remind the audience that these devices are electronic and hazardous in nature. They are not like other nicotine replacement therapies (NRTs), but are instead

agents into an inhaled aerosol.”² Through the process of superheating a metal coil exposed to an oil-containing nicotine, an electronic cigarette allows its user to smoke without combustion. Electronic cigarettes come in a variety of shapes, sizes, and makes—both reusable and disposable.³ However, due to the hazardous nature of many of their constituent parts, electronic cigarettes present a puzzle with which policymakers continue to struggle.

Since their explosion into U.S. markets in 2007,⁴ electronic cigarettes have been a subject of tumultuous debate, with consumer safety and market availability pitting tobacco corporations against lobbyists, product users, doctors, and regulatory entities.⁵ Despite the discovery of new diseases caused by electronic cigarette usage (e.g., “pop-

chemically addictive electronic devices. Scientific literature generally refers to electronic cigarettes as “electronic nicotine-delivery systems (ENDS).” However, the Article refers to ENDS as electronic cigarettes in order to continually remind the reader of what these devices are—electronic devices.

2. Marc W. Beutel et al., *A Review of Environmental Pollution From the Use and Disposal of Cigarettes and Electronic Cigarettes: Contaminants, Sources, and Impacts*, 13 SUSTAINABILITY 1, 6-7 (2021), <https://www.mdpi.com/2071-1050/13/23/12994>.
3. CENTERS FOR DISEASE CONTROL AND PREVENTION (CDC), E-CIGARETTE, OR VAPING, PRODUCTS VISUAL DICTIONARY 6 (2019), https://www.cdc.gov/tobacco/basic_information/e-cigarettes/pdfs/ecigarette-or-vaping-products-visual-dictionary-508.pdf.
4. Amika K. Sood et al., *Electronic Cigarettes: One Size Does Not Fit All*, 141 J. ALLERGY & CLINICAL IMMUNOLOGY 1973 (2018), <https://doi.org/10.1016/j.jaci.2018.02.029>.
5. Daniel G. Aaron, *Tobacco Reborn: The Rise of E-Cigarettes and Regulatory Approaches*, 25 LEWIS & CLARK L. REV. 827, 830-38 (2021).

corn lung”),⁶ many users and manufacturers cling to the “harm reduction” electronic cigarettes may offer as a path away from traditional smoking.⁷ The regulatory battle over consumer health continues for the U.S. Food and Drug Administration (FDA).⁸

However, between the laundry list of toxic constituent parts of an electronic cigarette⁹ and the sheer scale of the problem due to the number of devices manufactured and sold monthly,¹⁰ electronic cigarette waste is a crisis of toxic and hazardous wastes.¹¹ These devices should not go into the trash,¹² and yet there are no better ideas on how to handle them beyond incineration.¹³ Due to nicotine contamination, electronic cigarettes cannot be readily recycled.¹⁴

So, what happens to electronic cigarettes at the end of their life? According to a 2022 survey by the Truth Initiative, more than half the young electronic cigarette users polled self-reported throwing their “used” nicotine pods or empty disposable devices directly in the trash.¹⁵ Moreover, 17% reported throwing their electronic cigarette waste in a standard recycling bin, which is not designed for electronic

or hazardous waste, and 10% reported “simply throwing them on the ground.”¹⁶

These statistics are underscored by the sheer number of devices manufactured and sold each month. The Centers for Disease Control and Prevention (CDC) notes that nearly 22.4 million devices were sold monthly within the United States as of March 2023, with 11.9 million sold as purely “disposable” units.¹⁷ The CDC reports that sales peaked in March 2022, with 26.1 million electronic cigarettes having sold in that month alone.¹⁸ This issue of mounting electronic cigarette waste is dire, as noted by *Time Magazine*’s reference to the electronic cigarette waste epidemic as an “environmental disaster.”¹⁹

With millions of electronic cigarettes thrown in the trash every year²⁰ in contravention of federal policy,²¹ hazardous waste law has failed to stop the electronic cigarette waste crisis from unfolding. For those electronic cigarettes handled according to federal law, the cost of proper disposal can reach 85 cents per unit in states like New York, with much of this cost falling on the public institutions (notably schools) where the waste coagulates.²² Reports show that this high cost is due to mass incineration of electronic cigarettes as “the only way to keep the nicotine-filled devices out of sewers, waterways and landfills, where their lithium batteries can catch fire.”²³ For example, to comply with the Resource Conservation and Recovery Act (RCRA), Monroe County, New York, has resorted to packaging discarded electronic cigarettes turned in at household hazardous waste receptacles to be sent to Arkansas for industrial incineration.²⁴

Although incinerating massive quantities of hazardous materials is environmentally destructive, there is simply no

6. Perry Dinardo & Ellen S. Rome, *Vaping: The New Wave of Nicotine Addiction*, 86 CLEV. CLINIC J. MED. 789, 794 (2019), <https://www.ccjm.org/content/ccjom/86/12/789.full.pdf>.

7. See Brian King, *Looking Back, Looking Ahead: FDA’s Progress on Tobacco Product Regulation in 2022*, FDA (Jan. 31, 2023), <https://www.fda.gov/tobacco-products/ctp-newsroom/looking-back-looking-ahead-fdas-progress-tobacco-product-regulation-2022>. See also Thomas J. Glynn et al., *E-Cigarettes, Harm Reduction, and Tobacco Control: A Path Forward?*, 96 MAYO CLINIC PROC. 856, 856-58 (2021), [https://www.mayoclinicproceedings.org/article/S0025-6196\(20\)31382-3/fulltext](https://www.mayoclinicproceedings.org/article/S0025-6196(20)31382-3/fulltext) (discussing the clinician’s dilemma between seeking cessation of traditional smoking, but also noting the harms that electronic cigarettes can and do cause); Shue Sing Churk, *E-Cigarette Regulation and Harm Reduction: The Case of Hong Kong*, 71 FOOD & DRUG L.J. 634, 634 (2016), <https://pubmed.ncbi.nlm.nih.gov/29140648/>. See also generally Andrew P. Ray, *Treading Lightly: Why the FDA Should Use Its New Authority to Regulate Electronic Cigarettes Sparingly*, 36 J. LEGAL MED. 215 (2015).

8. See generally Aaron, *supra* note 5.

9. See Section I.B, for a thorough discussion of the various internal parts of an electronic cigarette and the individual challenges they pose.

10. See CDC FOUNDATION, DATA BRIEF, MONITORING U.S. E-CIGARETTE SALES: NATIONAL TRENDS (2023), <https://www.cdcfoundation.org/National-E-CigaretteSales-DataBrief-2023-Mar26?inline> (units recorded monthly). See also TRUTH INITIATIVE, A TOXIC, PLASTIC PROBLEM: E-CIGARETTE WASTE AND THE ENVIRONMENT 1 (2021), <https://truthinitiative.org/sites/default/files/media/files/2021/04/E-Cigarette-Waste-Report-FINAL-042821.pdf>.

11. See generally Max J. Krause & Timothy G. Townsend, *Hazardous Waste Status of Discarded Electronic Cigarettes*, 39 WASTE MGMT. 57, 60 (2015), <https://pubmed.ncbi.nlm.nih.gov/25746178/>.

12. See U.S. Environmental Protection Agency (EPA), *How to Safely Dispose of E-Cigarettes: Information for Individuals*, <https://www.epa.gov/hw/how-safely-dispose-e-cigarettes-information-individuals> (last updated Feb. 26, 2024). See also OREGON HEALTH AUTHORITY, PROPER MANAGEMENT OF E-CIGARETTE WASTE FOR OREGON RETAILERS, https://www.oregon.gov/oha/PH/PREVENTIONWELLNESS/TOBACCOPREVENTION/Documents/Final_TRL_NicotineDisposalGuide-508Compliant_5_5_22.pdf [hereinafter OHA, MANAGEMENT OF E-CIGARETTE WASTE FOR RETAILERS]; OREGON HEALTH AUTHORITY, PROPER MANAGEMENT OF E-CIGARETTE WASTE FOR OREGON SCHOOLS, https://www.oregon.gov/oha/PH/PREVENTIONWELLNESS/TOBACCOPREVENTION/Documents/NicotineDisposalGuide_Schools%20FINAL.pdf [hereinafter OHA, MANAGEMENT OF E-CIGARETTE WASTE FOR SCHOOLS].

13. LUCAS ROCKETT GUTTERMAN, U.S. PIRG EDUCATION FUND, VAPE WASTE: THE ENVIRONMENTAL HARMS OF DISPOSABLE VAPES (2023), <https://publicinterestnetwork.org/wp-content/uploads/2023/07/Vape-Waste-Report-PIRG-Embargoed-7.11-3am-ET-1.pdf> (“Currently, there is no standardized way to recycle e-cigarettes in the U.S.”).

14. *Id.*

15. TRUTH INITIATIVE, *supra* note 10.

16. *Id.*

17. CDC FOUNDATION, *supra* note 10 (units recorded monthly).

18. *Id.*

19. Jamie Ducharme, *The Overlooked Environmental Impact of Vaping*, TIME (July 11, 2023), <https://time.com/6293772/disposable-vapes-plastic-waste/>.

20. See AP, *Communities Can’t Recycle or Trash Disposable E-Cigarettes. So What Happens to Them?*, EL PAÍS (Oct. 19, 2023), <https://english.elpais.com/climate/2023-10-19/communities-cant-recycle-or-trash-disposable-e-cigarettes-so-what-happens-to-them.html>. See also CDC FOUNDATION, *supra* note 10 (units recorded monthly).

21. 42 U.S.C. §6924(c)-(h) (Resource Conservation and Recovery Act’s (RCRA’s) “land ban”).

22. AP, *supra* note 20 (“Monroe County schools pay \$60 to dispose of each one-gallon container of vapes. More than two thirds of the e-cigarettes collected by the county come from schools.”). See also PUBLIC HEALTH LAW CENTER AT MITCHELL HAMLIN SCHOOL OF LAW, DISPOSING OF E-CIGARETTE WASTE: FAQ FOR SCHOOLS AND OTHER INSTITUTIONS 2 (2023), <https://www.publichealthlawcenter.org/sites/default/files/resources/FAQ-e-cig-disposal-schools.pdf>.

23. AP, *supra* note 20:

In late August, sanitation workers in Monroe County, New York, packed more than 5,500 brightly colored e-cigarettes into 55-gallon steel drums for transport. Their destination? A giant, industrial waste incinerator in northern Arkansas, where they would be melted down. Sending 350 pounds of vapes across the country to be burned into ash may not sound environmentally friendly. But local officials say it’s the only way to keep the nicotine-filled devices out of sewers, waterways and landfills, where their lithium batteries can catch fire.

See also PUBLIC HEALTH LAW CENTER AT MITCHELL HAMLIN SCHOOL OF LAW, *supra* note 22.

24. AP, *supra* note 20. See also 42 U.S.C. §§6901 et seq.

better way to dispose of this waste once it exists.²⁵ Considering that millions more electronic cigarettes are sold every month,²⁶ and that the Truth Initiative survey shows just how few of them are likely to wind up managed in the “correct way,”²⁷ it is imperative that there be some stop-gap protecting the public from mass manufacture of these products. Even if incineration of electronic cigarettes were an effective management option, current laws covering the hazardous potential of nuisance products are failing because electronic cigarettes continue to enter the ordinary waste stream.²⁸ Because electronic cigarettes continue to evade hazardous waste regulation in the United States, our inaction has allowed a hazardous waste crisis to flourish.

As a society, we establish hazardous waste laws to catch contaminants before they can threaten human health or the environment.²⁹ But due to gaps within our federal and state hazardous waste and waste management laws, products like electronic cigarettes are mass-manufactured and sold without concern for their final destination, eventually causing real contamination.³⁰ In response to this ongoing catastrophe, the U.S. Congress should introduce federal legislation requiring a full life-cycle analysis for any product labeled or sold in interstate commerce as “disposable.” This legal concept should include the ability to deny manufacture of a product. Further, noting the current difficulty in passing any federal laws,³¹ states must update their current producer responsibility organization statutes and regulations to explicitly apply to electronic cigarettes. States would be wise to similarly extend strict liability to manufacturers of products labeled or sold as disposable, attach-

ing liability to the parties that economically benefit from the product if problems occur.

This Article is broken into five distinct parts. Part I describes what electronic cigarettes actually are from a variety of angles, including how they came to exist, their component parts, how and why they have evolved over time, and how the sum of their parts should render spent electronic cigarettes hazardous waste. Part II discusses the current regulatory structure for electronic cigarettes, centering on how FDA regulations, while attempting to protect children from using nicotine products like electronic cigarettes, have inadvertently shaped this waste epidemic. Part III explains how RCRA and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) operate as applied to electronic cigarettes and the waste they inevitably become. It also explains the limitations of these statutes, which allows nuisance products (i.e., electronic cigarettes) to create contamination when placed in the hands of millions of individual consumers. Part IV proposes both federal- and state-level policies which, if properly enacted, could begin to address the mounting electronic cigarette waste crisis. Part V concludes by placing the entirety of the issue into the context of the finite planet upon which we all live, and calling upon each and every reader to think deeply about how we conceptualize, and normalize, waste.

I. Electronic Cigarettes in Context

In terms of human health impacts, scientific and medical consensus inform us that tobacco products are “inherently dangerous and cause cancer, heart disease, and other serious adverse health effects.”³² However, while this list overlaps in notable ways with the leading causes of death in the United States,³³ these related health impacts are not the central concern with tobacco products. Instead, when Congress passed the Tobacco Control Act (TCA), the central congressional policy findings pertained to the dangers posed by the addictive nature of nicotine.

“Congress found that ‘nicotine is an addictive drug’ and that ‘[v]irtually all new users of tobacco products are under the minimum legal age to purchase such products.’”³⁴ Although Congress prominently notes there are deadly consequences for the continued use of tobacco products—including cancers, heart disease, stroke, and so on³⁵—it is the sheer addictiveness of the substance that makes it so dangerous. As noted by the U.S. Court of Appeals for the District of Columbia (D.C.) Circuit, “[n]icotine is among

25. AP, *supra* note 20.

26. CDC FOUNDATION, *supra* note 10 (units recorded monthly).

27. TRUTH INITIATIVE, *supra* note 10.

28. *Id.*

29. H.R. REP. NO. 76-726, pt. 1, at 11 (1976) (U.S. House of Representatives report on the passage of RCRA, discussing the dangers posed by unregulated dumping of and exposures to waste). See also *Mardan Corp. v. C.G.C. Music, Ltd.*, 804 F.2d 1454, 1455 (9th Cir. 1986) (quoting 126 CONG. REC. 31964 (statement of Rep. Florio)).

30. See Beutel et al., *supra* note 2, at 12 (“[T]here is a significant gap in the literature regarding the costs related to the environmental impact of combustible cigarette and e-cigarette use and disposal.”). See also Press Release, CDC, U.S. E-Cigarette Sales Climbed During 2020-2022 (June 22, 2023), <https://www.cdc.gov/media/releases/2023/p0622-ecigarettes-sales.html>. See also TRUTH INITIATIVE, *supra* note 10 (noting that more than 50% of surveyed youth reported throwing their spent electronic cigarette waste directly into the trash). See also Jeremiah Mock & Yogi H. Hendlin, *Contamination From E-Cigarette, Cigarette, Cigar, and Cannabis Products at 12 High Schools—San Francisco Bay Area, 2018-2019*, 68 CDC MORBIDITY & MORTALITY WKLY. REP. 897 (2019), <https://www.cdc.gov/mmwr/volumes/68/wr/pdfs/mm6840a4-H.pdf> (noting that 19% of the waste items collected from San Francisco high schools were e-cigarette product waste, nearly all of which was from the electronic cigarette company Juul); H.B. 1069 §1(f), 74th Gen. Assemb., Reg. Sess. (Colo. 2024) (“It is estimated that consumers in the United States throw away more than 4 disposable vapes every second.”); Joshua Askew, *Two E-Cigarettes Are Thrown Away Every Second in the UK—What Damage Do They Do?*, EURONEWS (Nov. 26, 2022), <https://www.euronews.com/green/2022/11/26/two-e-cigarettes-are-thrown-away-every-second-in-the-uk-what-damage-do-they-do> (noting that in the United Kingdom (U.K.), 1.3 million single-use electronic cigarettes are thrown away every week, or two per second).

31. Joe LoCascio et al., *118th Congress on Track to Become One of the Least Productive in US History*, ABC NEWS (Jan. 10, 2024), <https://abcnews.go.com/Politics/118th-congress-track-become-productive-us-history/story?id=106254012>.

32. *Nicopure Labs, LLC v. Food & Drug Admin.*, 944 F.3d 267, 272 (D.C. Cir. 2019) (quoting Tobacco Control Act (TCA), Pub. L. No. 111-31, §2(2), 123 Stat. 1777 (2009)).

33. CDC National Center for Health Statistics, *Leading Causes of Death*, <https://www.cdc.gov/nchs/fastats/leading-causes-of-death.htm> (last reviewed Oct. 25, 2024).

34. *Nicopure Labs*, 944 F.3d at 272 (quoting TCA §2(3), (4), 123 Stat. 1777).

35. *Id.* According to the CDC, the leading causes of death for Americans (in relevant part) are (1) heart disease; (2) cancer; (5) stroke; and (6) chronic lower respiratory disease. CDC National Center for Health Statistics, *supra* note 33.

the most addictive substances used by humans.”³⁶ Further, in 2021, Rep. Raja Krishnamoorthi (D-Ill.) introduced a bill to cap the total nicotine available in electronic cigarettes, stating in the bill’s text that “nicotine exposure can harm parts of the brain that control attention, learning, mood, and impulse control.”³⁷ The most dangerous facet of nicotine is its ability to keep users from quitting.

Electronic cigarettes provide highly concentrated nicotine content to a user.³⁸ One study found that, for electronic cigarettes produced by the manufacturer Juul, “[e]stimates of cigarette equivalents for vaping one 5% Juul-pod, based on vaping machine studies, range from 13 to 30 cigarettes.”³⁹ Research suggests that such concentrated nicotine use can inspire increased addiction, pushing users toward nicotine use and thus creating a growing problem.⁴⁰

With such a concentrated nicotine-delivery capability and high corresponding likelihood of addiction, it is easy to see how commonplace use of electronic cigarettes is a problem not only for public health, but also for waste and environmental damage. Electronic cigarettes must not be uncoupled from the ensuing waste the devices themselves become after use. Because there are viable nicotine-delivery alternatives to electronic cigarettes that produce far less total waste, the continued use of electronic cigarettes deserves immediate attention from lawmakers.⁴¹

While health-based regulations on electronic cigarettes generate substantial news coverage,⁴² the environmental debate over electronic cigarette manufacture and waste disposal is relegated to the annals of academic work.⁴³ Despite conversations about health taking place in FDA’s regulatory silo, there has been a notable lack of action to address the associated electronic cigarette waste crisis.⁴⁴

According to the CDC, monthly electronic cigarette sales increased by roughly 43% between February 2020 (15.6 million devices sold) and March 2023 (22.4 million devices sold).⁴⁵ But while the use of electronic cigarettes is

increasing overall, the percentage of disposable electronic cigarettes sold during this same time frame skyrocketed, with four million disposables sold in February 2020, compared to 11.9 million in March 2023.⁴⁶ While the human health impacts from personal use remain highly debated, an environmental catastrophe is unfolding through millions of “waste” electronic cigarettes, many of which were intended for a single usage before disposal.⁴⁷

A. The Evolution of Electronic Cigarettes

According to the CDC, electronic cigarettes are embodied through four generations of designs.⁴⁸ The first-generation electronic cigarettes were single-use and marketed as disposable.⁴⁹ These devices were distinguishable from later iterations by their cigarette-like design—a long, slender tube that contained both the electronic hardware and nicotine solution.⁵⁰

The second generation then built upon the first, separating a rechargeable battery component (commonly called a “pen”) from the cartridge containing either a nicotine or tetrahydrocannabinol (THC) mixture.⁵¹ This second generation introduced a reusable and rechargeable battery component and offered a choice of prefilled or refillable cartridges,⁵² encouraging reuse of the underlying device. Thus, the second generation saw a decrease in the overall waste produced but encouraged users to habitually buy into the product.

This change toward reuse was heavily incorporated into electronic cigarettes of the third generation with the rise of the “tank and mod” system.⁵³ Third-generation devices were rechargeable, refillable, and modifiable, which encouraged reuse of the device itself, not simply the battery.⁵⁴ This third generation also introduced the sale of bulk electronic cigarette “juice” (nicotine solution) through smoke shops, generally in large plastic bottles.⁵⁵

The fourth generation broke away from the trend toward reusability of the electronic cigarette established by the third electronic cigarette iteration. Instead, the fourth generation is a seeming return to the first- and second-generation products—with a rechargeable bat-

36. Aaron, *supra* note 5, at 830 (quoting *Nicopure Labs*, 944 F.3d at 270).

37. H.R. 3051, 117th Cong. §2(1) (2021).

38. *Id.*

39. Judith J. Prochaska et al., *Nicotine Delivery and Cigarette Equivalents From Vaping a JUULpod*, 31 TOBACCO CONTROL e88, e91 (2022), <https://pubmed.ncbi.nlm.nih.gov/33762429/>.

40. Mateusz Jankowski et al., *E-Cigarettes Are More Addictive Than Traditional Cigarettes—A Study in Highly Educated Young People*, 16 INT’L J. ENV’T RSCH. & PUB. HEALTH 1, 102 (2019), <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6651627/>.

41. This can be seen through a later discussion of NRTs. See Section IV.B, for a full discussion of NRTs. See also American Cancer Society, *Nicotine Replacement Therapy to Help You Quit Tobacco*, <https://www.cancer.org/cancer/risk-prevention/tobacco/guide-quit-smoking/nicotine-replacement-therapy.html> (last revised Oct. 28, 2024).

42. See, e.g., Berkeley Lovelace Jr., *The FDA Bans Most Fruit- and Mint-Flavored Nicotine Vaping Products to Curb Teen Use*, CNBC (Jan. 2, 2020), <https://www.cnbc.com/2020/01/02/fda-issues-ban-on-some-flavored-vaping-products.html>; Michael Nedelman, *Partial E-Cigarette “Flavor Ban” Goes Into Effect Today. Here Is What Happens Next*, CNN (Feb. 6, 2020), <https://www.cnn.com/2020/02/06/health/vaping-partial-flavor-ban-fda/index.html>; Abby Goodnough et al., *With Partial Flavor Ban, Trump Splits the Difference on Vaping*, N.Y. TIMES (Feb. 12, 2020), <https://www.nytimes.com/2020/01/02/health/flavor-ban-e-cigarettes.html>.

43. See generally Aaron, *supra* note 5.

44. *Id.* See also CDC FOUNDATION, *supra* note 10 (for the proposition that millions of disposable electronic cigarettes continue to be sold monthly).

45. CDC FOUNDATION, *supra* note 10.

46. *Id.*

47. PUBLIC HEALTH LAW CENTER AT MITCHELL HAMLINE SCHOOL OF LAW, *supra* note 22:

Incineration seems to be the most common disposable method available for such devices at this time, as revealed by methods currently used by waste management companies and facilities. Incinerating lithium batteries is dangerous, time-consuming, and destructive for the environment in terms of carbon emissions. The cartridge containing concentrated nicotine must also be incinerated, as there is no reuse for this hazardous waste.

See also AP, *supra* note 20.

48. CDC, *supra* note 3.

49. *Id.*

50. *Id.* at 8.

51. *Id.* at 9.

52. *Id.*

53. *Id.*

54. *Id.*

55. Jean-François Etter et al., *Analysis of Refill Liquids for Electronic Cigarettes*, 108 ADDICTION 1671, 1671 (2013), <https://onlinelibrary.wiley.com/doi/10.1111/add.12235>.

tery that is designed to work with prefilled or refillable cartridges.⁵⁶ A typical example of these fourth-generation “pod mods” is the electronic cigarette made famous by the manufacturer Juul.⁵⁷

However, with the industry pushed to change by 2020 FDA regulations and enforcement guidance documents on flavored electronic cigarette pods, this fourth generation quickly reverted to a version of the first generation and “disposable” electronic cigarettes.⁵⁸ This reversion was largely due to regulatory intervention, based on the FDA’s 2016 “deeming rule”⁵⁹ and subsequent enforcement guidance decisions, attempting to keep electronic cigarettes out of the hands of children while allowing adult smokers an off-ramp from traditional tobacco use.⁶⁰ Ultimately, we have landed in a reality where electronic cigarettes of all four generations are seemingly being used at once and to varying degrees.⁶¹

The current regulatory approach to electronic cigarettes has centered on individual consumer safety and market availability, with little conversation or concern for what becomes of the millions of discarded devices.⁶² This individualistic debate over product safety for users has ignored the impacts of such practices on the ecosystems in which we live and operate, at the expense of public health and safety.⁶³

B. The Components of Electronic Cigarettes

No matter the iteration of the device being used, electronic cigarettes are properly categorized as “hazardous waste.”⁶⁴ To complete the chain of converting nicotine solution into vapor, every electronic cigarette sold comes equipped with four specific components: (1) the electronic cigarette’s fluid, which commonly contains nicotine; (2) a battery to provide electricity to the device; (3) circuitry to deliver battery power to an internal atomizer (i.e., a heating element or coil); and (4) plastic casings and parts to comprise the shell and water-

tight seal.⁶⁵ This section elucidates that each of these four components poses environmental and health harms.

1. Nicotine Solution (Vape Juice)

Starting with perhaps the “juiciest” constituent part of the electronic cigarette, the nicotine solution (or “e-juice”) is the first hazardous component to these devices.⁶⁶ Facially, the side effects of nicotine are well known and well documented, including impacts on the circulatory, respiratory, reproductive, and urinary systems.⁶⁷ Nicotine has further been shown to have carcinogenic potential in humans, with such toxic potential that “[t]he only other known use of nicotine has been as an insecticide since 17th century.”⁶⁸

Due to this toxicity, nicotine is an enumerated and explicitly listed acute hazardous waste under RCRA.⁶⁹ Under federal regulations, 40 C.F.R. §261.33 exempts from this listing “*patches, gums and lozenges* that are FDA-approved over-the-counter nicotine replacement therapies.”⁷⁰ Notably, “nicotine solution” is absent from this limited list of exemptions from federal RCRA listing. The U.S. Environmental Protection Agency (EPA) has since confirmed that this omission subjects the nicotine solution used in electronic cigarettes to RCRA jurisdiction so long as the “waste” meets RCRA’s baroque definitional structure.⁷¹

Due to RCRA’s central definitional focus on “waste,” under both federal⁷² and state⁷³ law, used and discarded

56. CDC, *supra* note 3, at 12.

57. *Id.*

58. See Enforcement Priorities for Electronic Nicotine Delivery Systems and Other Deemed Products on the Market Without Premarket Authorization; Guidance for Industry; Availability, 85 Fed. Reg. 720 (Jan. 7, 2020). See News Release, FDA, FDA Finalizes Enforcement Policy on Unauthorized Flavored Cartridge-Based E-Cigarettes That Appeal to Children, Including Fruit and Mint (Jan. 2, 2020), <https://www.fda.gov/news-events/press-announcements/fda-finalizes-enforcement-policy-unauthorized-flavored-cartridge-based-e-cigarettes-appeal-children>. See also Matthew Perrone, *FDA Warns Stores to Stop Selling Fruity Disposable E-Cigarettes*, PBS HEALTH (June 22, 2023), <https://www.pbs.org/newshour/health/fda-warns-stores-to-stop-selling-fruity-disposable-e-cigarettes>.

59. Deeming Tobacco Products to Be Subject to the Federal Food, Drug, and Cosmetic Act, as Amended by the Family Smoking Prevention and Tobacco Control Act; Restrictions on the Sale and Distribution of Tobacco Products and Required Warning Statements for Tobacco Products, 81 Fed. Reg. 28974, 28976 (May 10, 2016).

60. See Part II. See also Aaron, *supra* note 5, at 837.

61. CDC FOUNDATION, *supra* note 10.

62. See generally Aaron, *supra* note 5.

63. Beutel et al., *supra* note 2.

64. See *id.* at 7. See also Krause & Townsend, *supra* note 11.

65. *Vaping Devices (Electronic Cigarettes) DrugFacts*, NAT’L INST. HEALTH (Jan. 8, 2020), <https://nida.nih.gov/publications/drugfacts/vaping-devices-electronic-cigarettes>.

66. Lauren H. Greenberg, *The Deeming Rule: The FDA’s Destruction of the Vaping Industry*, 83 BROOK. L. REV. 777, 778 n.8 (2018).

67. Aseem Mishra et al., *Harmful Effects of Nicotine*, 36 INDIAN J. MED. & PAEDIATRIC ONCOLOGY 24, 24 (2015), <https://www.thieme-connect.com/products/ejournals/pdf/10.4103/0971-5851.151771.pdf>.

68. *Id.*

69. 40 C.F.R. §261.33 (listing of hazardous wastes by EPA as P075; nicotine and nicotine salts are considered a hazardous waste—although the regulation “does not include patches, gums and lozenges that are FDA-approved over-the-counter nicotine replacement therapies”). See also Letter from Barnes Johnson, Director, EPA Office of Resource Conservation and Recovery, to AnnMarie Beattie, Harmonized Customs Brokers, Inc., Interfreight Harmonized Logistics (July 19, 2017) (letter regarding hazardous waste status of unused cigarettes and cigars), <https://rcrapublic.epa.gov/files/14894.pdf>.

70. See generally 40 C.F.R. §261.33 (emphasis added). See also Krause & Townsend, *supra* note 11.

71. See Section III.A, for a full discussion of RCRA and its structural purview. See also Hazardous Waste Generator Improvements Rule, the Hazardous Waste Pharmaceuticals Rule, and the Definition of Solid Waste Rule; Technical Corrections, 88 Fed. Reg. 54086 (Aug. 9, 2023). See also Management Standards for Hazardous Waste Pharmaceuticals and Amendment to the P075 Listing for Nicotine, 84 Fed. Reg. 5816 (Feb. 22, 2019). See also PUBLIC HEALTH LAW CENTER AT MITCHELL HAMLINE SCHOOL OF LAW, *supra* note 22.

72. 40 C.F.R. §261.33. See also 42 U.S.C. §6903(5), (27); *American Mining Cong. v. U.S. Env’t Prot. Agency (AMC I)*, 824 F.2d 1177, 1178 (D.C. Cir. 1987).

73. OR. ADMIN. R. 340-102-0011. See also OHA, MANAGEMENT OF E-CIGARETTE WASTE FOR RETAILERS, *supra* note 12; OHA, MANAGEMENT OF E-CIGARETTE WASTE FOR SCHOOLS, *supra* note 12. These sources direct institutions to properly dispose of spent electronic cigarettes through proper channels but say *nothing* about individual consumers. These sources acknowledge that nicotine solution, specifically, is hazardous waste in the state of Oregon. Further, they show that both retailers and schools can be held liable for RCRA violations if they dispose of waste electronic cigarettes above the threshold for small-quantity waste generators.

electronic cigarettes largely evade hazardous waste status. Meanwhile, *unused and discarded* electronic cigarettes would remain a hazardous waste, assuming there is nicotine present.⁷⁴ “Thus, in the U.S., when an unused nicotine product is intended to be discarded[,] it is considered a P075 hazardous waste.”⁷⁵ Another study reports that the residual nicotine in fully used devices can remain in “substantial amounts,” which “further complicates their disposal, because [(1)] e-cigarettes and their cartridges may qualify as both e-waste and biohazard waste,” and (2) neither “policy nor product information currently gives consumers guidelines for disposing of e-cigarettes.”⁷⁶ Thus, electronic cigarettes are properly categorized as hazardous waste due to their nicotine potential alone.

However, on top of nicotine, the solutions found in electronic cigarettes notably contain many other additives, “many of which were known to be toxic or have suspected or unknown toxicities.”⁷⁷ These other ingredients include “aldehydes, TSNAs [tobacco-specific nitrosamines], benzyl alcohol, glycerol-1, 2-diacetate, and dioxolane compounds.”⁷⁸ Benzyl alcohol, alone, is known to cause effects “including respiratory failure, vasodilation, hypertension, convulsions, and paralysis,” according to the CDC.⁷⁹

2. Batteries

Batteries are the second key constituent part of an electronic cigarette.⁸⁰ Batteries contain heavy metals—lead, lithium, nickel, cadmium, and so on—and for a long time have been known to cause heavy contamination.⁸¹ Various iterations of lead are “listed hazardous waste” regulable under RCRA as both acute and non-acute hazardous wastes,⁸² also making them hazardous substances for which

liability may be apportioned under CERCLA.⁸³ Batteries contribute heavily to the hazardous waste calculation for electronic cigarettes, especially as battery plants have historically left Superfund (CERCLA) sites in their wake.⁸⁴

While batteries come in far more versions than electronic cigarettes themselves,⁸⁵ this review will focus on the environmental risks from rechargeable (“secondary”)⁸⁶ batteries, specifically lithium-based batteries, due to their pervasive use in electronic cigarettes.⁸⁷ Lithium-ion (Li-ion) and lithium-polymer (Li-poly) batteries have gained popularity as rechargeable batteries in consumer electronics for their high energy density and a relatively long use-life.⁸⁸ Yet, this resource use creates a Jevons paradox,⁸⁹ such that the increase in battery efficiency has led to their increased use; the result is a growing source of waste and, thus, environmental concern.⁹⁰ We have created a more efficient battery, capable of repeatedly producing a chemical reaction until the internal components wear out.⁹¹ However, in this quest for a “better battery,” we have reintroduced toxic components to these devices, including “copper, nickel, lead, and organic chemicals, such as toxic and flammable electrolytes containing LiClO₄ [lithium perchlorate], LiBF₄ [lithium tetrafluoroborate], and LiPF₆ [lithium hexafluorophosphate].”⁹²

One prominent study found that “all lithium batteries” fall within California’s hazardous waste regulations due to their levels of “cobalt, copper, and . . . nickel.”⁹³ The team

74. Krause & Townsend, *supra* note 11.

75. *Id.*

76. Yogi Hale Hendlin, *Alert: Public Health Implications of Electronic Cigarette Waste*, 108 AM. J. PUB. HEALTH 1489 (2018), <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6187764/>.

77. Beutel et al., *supra* note 2.

78. *Id.*

79. *Neonatal Deaths Associated With Use of Benzyl Alcohol—United States*, 31 CDC MORBIDITY & MORTALITY WKLY. REP. 290 (1982), <https://www.cdc.gov/mmwr/preview/mmwrhtml/00001109.htm>.

80. CDC, *supra* note 3, at 12.

81. Daniel H.P. Kang et al., *Potential Environmental and Human Health Impacts of Rechargeable Lithium Batteries in Electronic Waste*, 47 ENV'T SCI. & TECH. 5495, 5495 (2013):

Our results demonstrate that according to U.S. federal regulations, defunct Li-ion batteries are classified hazardous due to their lead (Pb) content (average 6.29 mg/L; $\sigma = 11.1$; limit 5). However, according to California regulations, all lithium batteries tested are classified hazardous due to excessive levels of cobalt (average 163 544 mg/kg; $\sigma = 62 897$; limit 8000), copper (average 98 694 mg/kg; $\sigma = 28 734$; limit 2500), and nickel (average 9525 mg/kg; $\sigma = 11 438$; limit 2000). In some of the Li-ion batteries, the leached concentrations of chromium, lead, and thallium exceeded the California regulation limits. The environmental impact associated with resource depletion and human toxicity is mainly associated with cobalt, copper, nickel, thallium, and silver, whereas the ecotoxicity potential is primarily associated with cobalt, copper, nickel, thallium, and silver.

82. 40 C.F.R. §261.33 (various hazardous waste listings for lead).

83. 42 U.S.C. §9601(14).

84. *See United States v. General Battery Corp.*, 423 F.3d 294, 296 (3d Cir. 2005) (upholding CERCLA liability for three generations of battery manufacturers and recyclers—Price Battery, General Battery Corp., and Exide Corp.—on the theory of successor liability for continued operations that resulted in heavy lead contamination of the relevant facility and disposal sites).

85. *See* NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES, ENVIRONMENTAL FACT SHEET: ALL ABOUT BATTERIES 1 (2024), <https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/2020-01/hw-23.pdf>.

86. *Id.*

87. Christopher J. Brown & James M. Cheng, *Electronic Cigarettes: Product Characterisation and Design Considerations*, 23 TOBACCO CONTROL ii4, ii8 (2014), https://tobaccocontrol.bmj.com/content/23/suppl_2/ii4.full.pdf. *See also* Matthew Chapman & Fin Johnston, *Lithium Being Trashed by the Tonne as Disposable Vapes Flood the US Market*, BUREAU INVESTIGATIVE JOURNALISM (Dec. 15, 2022), <https://www.thebureauinvestigates.com/stories/2022-12-15/lithium-being-trashed-by-the-tonne-as-disposable-vapes-flood-us-market/>; NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES, *supra* note 85; CDC, *supra* note 3, at 12.

88. Kang et al., *supra* note 81.

89. Mario Giampietro & Kozo Mayumi, *Unraveling the Complexity of the Jevons Paradox: The Link Between Innovation, Efficiency, and Sustainability*, 6 FRONTIERS ENERGY RSCH. art. 26 (2018), <https://www.frontiersin.org/articles/10.3389/fenrg.2018.00026/full> (“The Jevons Paradox states that, in the long term, an increase in efficiency in resource use will generate an increase in resource consumption rather than a decrease.”).

90. Sam Bliss, *Resources for a Better Future: Jevons Paradox*, RESILIENCE (June 17, 2020), <https://www.resilience.org/stories/2020-06-17/jevons-paradox/>:

The Jevons paradox is that efficiency enables growth. New technologies that can produce more goods from a given amount of resources allow the economy as a whole to produce more. More resources get used overall. . . . The paradox is that we tend to assume that the more efficiently we use a resource the less of it we will use.

91. *Guide to Batteries in Product Design*, ENG’G PROD. DESIGN (Oct. 16, 2022), <https://engineeringproductdesign.com/knowledge-base/primary-secondary-batteries-in-product-design-guide/>.

92. Kang et al., *supra* note 81.

93. *Id.*

conducting the study then notes that these same batteries could fail the federal RCRA regulations due to their lead levels, though not all do.⁹⁴ Thus, even under the federal floor regulations, Li-ion batteries can be considered hazardous waste. According to the EPA website, “these batteries should **NOT** go in household garbage or recycling bins. Lithium-ion batteries **SHOULD** be taken to separate recycling or household hazardous waste collection points.”⁹⁵

Yet, as discussed below, when such batteries do wind up in municipal waste, the individual consumer is not liable for this violation,⁹⁶ nor is the corporation that produced the battery.⁹⁷ Instead, it becomes the issue of the waste-receiving plant and potentially the municipality as a whole.⁹⁸ While this division of responsibility is deeply inequitable, another study estimates that approximately “1,200 electric vehicle batteries could be made from the lithium in discarded vapes and electronic cigarettes in one year.”⁹⁹ Waste batteries, therefore, are not only hazardous but also a waste of resources.¹⁰⁰

3. Circuitry

Circuitry is another constituent part of an electronic cigarette.¹⁰¹ Common components of basic circuitry—other than the power source described above—include an “activation button and firing mechanism,” a button connected to several wires that completes the circuit of an electronic cigarette and powers the heating coil.¹⁰² The heating coil, in turn, directly converts the nicotine solution into vapor for inhalation.¹⁰³ “The coil consists of a resistance wire and is made up of two special materials called nichrome and kanthal.”¹⁰⁴

Although the circuitry itself may not merit hazardous waste status for the product, the fact that other hazardous waste components are included within the device renders recycling difficult to impossible, especially when compared to the other beneficial uses for these same metals in other electronics. These considerations should weigh heavily in

favor of regulation regarding the manufacture of electronic cigarettes; otherwise, with each and every single-use/disposable device sold, we waste precious resources.

4. Plastics

Finally, we come to plastics—a primary component of the casing of electronic cigarettes¹⁰⁵ and a notable contaminant of emerging concern.¹⁰⁶ From the beginning, petrochemical companies have touted the alleged benefits associated with plastic over paper, including lower greenhouse gas emissions, lower energy consumption requirements, and lower transport costs and emissions.¹⁰⁷ But with all these professed benefits of plastics, key facts have escaped public discourse: (1) plastic *never* biodegrades,¹⁰⁸ and (2) plastic *is not viably* recyclable on a mass scale.¹⁰⁹

In effect, plastics will remain in the ecosystem long after humans stop producing and disposing of them. Plastics meet the definition of a persistent pollutant.¹¹⁰ This alone should be concern enough to merit serious policy consideration; if not, consider the impacts from delay on regulation of plastics.

“Microplastics contaminate almost every part of the food chain.”¹¹¹ They have been formerly discovered in “human stool, lungs, and placentas,” each of which has or derives from direct pathways from the environment into the body.¹¹² However, research from 2023 shows that microplastics are now being discovered in organs that do not have such clear pathways, specifically in human heart tissues.¹¹³ We must end plastic pollution. This much is clear. And yet, plastic is but one component of an electronic cigarette—a product that can be and is being mass-produced without concern for the resulting waste issue.

94. *Id.* at 5498.

95. U.S. EPA, *Used Lithium-Ion Batteries*, <https://www.epa.gov/recycle/used-lithium-ion-batteries> (last updated Mar. 20, 2024).

96. See 42 U.S.C. §6921(i). See also 40 C.F.R. §261.4(b).

97. See *AMC I*, 824 F.2d 1177, 1179 (D.C. Cir. 1987) (quoting 42 U.S.C. §6902). See also 42 U.S.C. §9601(9); Burlington N. & Santa Fe Ry. Co. v. United States, 556 U.S. 599, 609-10 (2009).

98. See 42 U.S.C. §9607(a).

99. Michael Odei Erdiaw-Kwasie & Matthew Abunyewah, *Stop Tossing Your Spent Vapes and E-Cigs: You're Breeding a New Waste Pandemic*, CONVERSATION (Feb. 16, 2023), <https://theconversation.com/stop-tossing-your-spent-vapes-and-e-cigs-youre-breeding-a-new-waste-pandemic-199956>.

100. See KEVIN BRUNELLI ET AL., CENTER ON GLOBAL ENERGY POLICY AT COLUMBIA, FACT SHEET: LITHIUM SUPPLY IN THE ENERGY TRANSITION (2023), https://www.energypolicy.columbia.edu/wp-content/uploads/2023/12/Lithium-CGEP_FactSheet_121223-2.pdf (for the proposition that a lithium shortage could be upon us by 2030).

101. Eleni Papaefstathiou et al., *Main and Side Stream Effects of Electronic Cigarettes*, 238 J. ENV'T MGMT. 10, 14 (2019), <https://www.sciencedirect.com/science/article/abs/pii/S0301479719300301>.

102. See Brown & Cheng, *supra* note 87. See also Rayming PCB & Assembly, *Exploring the Basics of Vape Circuit Diagram*, <https://www.raypcb.com/vape-circuit-diagram/> (last visited Jan. 12, 2025).

103. Rayming PCB & Assembly, *supra* note 102.

104. *Id.*

105. See Ducharme, *supra* note 19.

106. See generally Michael J. Stapleton & Faisal I. Hai, *Microplastics as an Emerging Contaminant of Concern to Our Environment: A Brief Overview of the Sources and Implications*, 14 BIOENGINEERED 343 (2023), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10413915/pdf/KBIE_14_2244754.pdf.

107. MICHEL ROSCAM ABBING, *PLASTIC SOUP: AN ATLAS OF OCEAN POLLUTION* 8 (2019).

108. William Harris, *How Long Does It Take for Plastic to Decompose?*, HOW-STUFFWORKS (Sept. 8, 2023), <https://science.howstuffworks.com/science-vs-myth/everyday-myths/how-long-does-it-take-for-plastics-to-biodegrade.htm>.

109. DAVIS ALLEN ET AL., CENTER FOR CLIMATE INTEGRITY, *THE FRAUD OF PLASTIC RECYCLING* 7 (2024), <https://climateintegrity.org/uploads/media/Fraud-of-Plastic-Recycling-2024.pdf>. See also ABBING, *supra* note 107, at 34:

Plastic does not break down chemically, but it does in a physical sense, under the influences of sunlight, oxygen, and wave action. . . . This fragmentation does not reduce the overall weight of plastic soup, it only affects the composition. The amount of microplastics and nanoplastics have risen exponentially in a relatively short time.

110. See generally Paromita Chakraborty et al., *Interlinkage Between Persistent Organic Pollutants and Plastic in the Waste Management System of India: An Overview*, 109 BULL. ENV'T CONTAMINATION & TOXICOLOGY 927 (2022), <https://pubmed.ncbi.nlm.nih.gov/35178580/>.

111. Klára Cverenkárová et al., *Microplastics in the Food Chain*, 11 LIFE 1, 13 (2021), <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8704590/pdf/life-11-01349.pdf>.

112. Yunxiao Yang et al., *Detection of Various Microplastics in Patients Undergoing Cardiac Surgery*, 57 ENV'T SCI. & TECH. 10911, 10911 (2023), <https://pubs.acs.org/doi/10.1021/acs.est.2c07179>.

113. *Id.*

C. *The Assembled, Empty Electronic Cigarette as Hazardous Waste*

To contextualize the above discussion, early experiments by Max Krause and Timothy Townsend attempted to discern whether electronic cigarettes, without their nicotine juice,¹¹⁴ could be considered “hazardous waste” under EPA’s tests for characteristic toxicity—the Toxicity Characteristic Leachate Procedure (TCLP).¹¹⁵ The purpose of Krause and Townsend’s study was to determine broadly whether the devices themselves posed “the potential to be hazardous waste in the U.S.”; Krause and Townsend sought to argue for added studies of electronic cigarettes rather than assess the status of any single product in isolation.¹¹⁶ Their study was not designed to show that specific electronic cigarettes were hazardous waste as individual products, but instead whether iterations of electronic cigarettes would fail the TCLP.

In running their experiment, Krause and Townsend “consumed” (emptied) the nicotine from the devices and “milled . . . to pass a 9.5 mm [millimeters] (TCLP) or 2 mm sieve (WET [California Waste Extraction Test]).”¹¹⁷ They then ran the remnants through the TCLP and WET tests, in triplicate and quadruplicate, respectively. While many of the devices they tested did not display hazardous results, a few notably did: “[l]ead was the only element for which regulatory thresholds were exceeded and those exceedances were 1.5-10 times the threshold.”¹¹⁸

Krause and Townsend essentially uncovered a wide variety of potential contaminant concentrations across the devices tested, including among electronic cigarettes of the same variety. For example, the three replicates tested for “e-cigarette B” displayed lead concentrations ranging from 1.1, 7.34, and 20.5 milligrams of lead per liter while the replicates of “e-cigarette D” displayed a range of only .2 to .9 milligrams of lead per liter.¹¹⁹ With a regulatory threshold of five milligrams per liter,¹²⁰ it is clear that while not all empty electronic cigarettes qualify as hazardous waste under the federal regulations, some do by almost four times the regulatory limit.

While Krause and Townsend note that “of the 15 products tested, two exceeded regulatory thresholds,”¹²¹ these TCLP tests were carried out on individual devices

stripped of their nicotine solution.¹²² So, while this study shows that not all empty electronic cigarettes pose regulatory issues, it clarifies that some of them do, to a level that would qualify them as hazardous waste under U.S. hazardous waste regimes.

However, whether the empty device itself qualifies as regulatory hazardous waste is only one part of the problem. When combined with nicotine solution, electronic cigarettes can be classified as hazardous waste from a variety of angles. Thus, the origin of the electronic cigarette pollution problem comes from the way we conceptualize and regulate the products we manufacture, as nuisance products like electronic cigarettes increasingly characterize the “waste” we generate. This problem also stems from the siloing of regulatory purview, specifically, in that regulation for electronic cigarette manufacture and sale is siloed such that it falls on FDA rather than a combination of agencies.¹²³

II. **Current Regulatory Oversight: FDA**

FDA has certain regulatory authority over food,¹²⁴ drugs and devices,¹²⁵ cosmetics,¹²⁶ and tobacco products¹²⁷ under the Federal Food, Drug, and Cosmetic Act (FDCA).¹²⁸ Under its tobacco control authority, FDA is the primary regulatory agency for electronic cigarettes.¹²⁹ This authority empowers FDA to regulate the *purity and labeling* of food, drugs, devices, tobacco products, or cosmetics.¹³⁰ The Act specifically commands FDA to

(1) promote the *public health* by promptly and efficiently reviewing clinical research and taking appropriate action on the marketing of regulated products in a timely manner;

(2) with respect to such products, protect the *public health* by ensuring that—

122. *Id.* at 59.

123. TCA, Pub. L. No. 111-31, 123 Stat. 1776 (2009); 21 U.S.C. §§387 et seq.

124. 21 U.S.C. ch. 9, subch. IV (Food) (§§341-350m).

125. 21 U.S.C. ch. 9, subch. V (Drugs and Devices) (§§351-360ff-8).

126. 21 U.S.C. ch. 9, subch. VI (Cosmetics) (§§361-364j).

127. 21 U.S.C. ch. 9, subch. IX (Tobacco Products) (§§387-387v).

128. *Id.* See also FDA, *Laws Enforced by FDA*, <https://www.fda.gov/regulatory-information/laws-enforced-fda> (last reviewed Apr. 19, 2021):

Today, the FDA regulates \$1 trillion worth of products a year. It regulates all foods and food ingredients introduced into or offered for sale in interstate commerce except for meat, poultry and some egg and catfish (which are regulated by [the U.S. Department of Agriculture]); ensures the safety and effectiveness of all drugs, biological products (including blood, vaccines and cellular and gene therapy products), medical devices, and animal drugs and feed; and makes sure that cosmetics and medical and consumer products that emit radiation do no harm.

129. 81 Fed. Reg. 28974 (May 10, 2016). See also Testimony of Norman E. “Ned” Sharpless, M.D., Acting Commissioner of Food and Drugs, FDA, Before the House Committee on Energy and Commerce, Subcommittee on Oversight and Investigations re: FDA Regulation of Electronic Nicotine Delivery Systems and Investigation of Vaping Illnesses (Sept. 25, 2019), <https://www.fda.gov/news-events/congressional-testimony/fda-regulation-electronic-nicotine-delivery-systems-and-investigation-vaping-illnesses-09252019> [hereinafter Testimony of Ned Sharpless].

130. 21 U.S.C. §331.

114. 40 C.F.R. §261.33 (listing of hazardous wastes by EPA as P075). The presence of nicotine would create a presumption of hazardous waste status, dependent upon the proper listing of the device as waste under 42 U.S.C. §6903(5) and (27). See also *AMCI*, 824 F.2d 1177, 1178 (D.C. Cir. 1987).

115. U.S. EPA, *SW-846 Test Method 1311: Toxicity Characteristic Leaching Procedure*, <https://www.epa.gov/hw-sw846/sw-846-test-method-1311-toxicity-characteristic-leaching-procedure> (last updated Aug. 12, 2024).

116. Krause & Townsend, *supra* note 11, at 58.

117. *Id.*

118. *Id.* at 59.

119. *Id.* (“Identical products (e-cigarette B) leached 20.5, 1.10, and 7.34 mg lead/L. Replicates of e-cigarette D leached 0.22 and 0.97 mg lead/L as well as 4.99 and 5.20 mg nickel/L. Eleven of the 23 e-cigarettes leached undetectable amounts of lead.”)

120. 40 C.F.R. §261.24 (D008).

121. Krause & Townsend, *supra* note 11, at 61.

- (A) foods are safe, wholesome, sanitary, and properly labeled;
- (B) human . . . drugs are safe and effective; [and]
- (C) there is reasonable assurance of the safety and effectiveness of devices intended for human use[.]¹³¹

Though this congressional mandate centers public health in its text, the scope of FDA's purview has focused on the individual health impacts and product safety for individual consumers, seeking to keep individuals safe from adulterated or misbranded products, rather than on holistic, population-wide health protections from the waste these decisions generate.¹³²

The FDCA prohibits the manufacture and sale of only certain products, including “[t]he manufacture within any Territory of any food, drug, device, tobacco product, or cosmetic that is *adulterated or misbranded*.”¹³³ The scope of FDA's regulatory capacity centers upon purity, labeling, and notice of contents or consumer risk that accompanies the product. Therefore, the ultimate review omits reference to or focus upon the societal risk factors from mass manufacture or use of a covered product, including the potential impacts of the waste from FDA-regulated products.¹³⁴ This nuance is critical in the context of electronic cigarettes, and can be readily shown through FDA's current regulatory purview over electronic cigarettes.

Under the TCA, FDA has the authority to regulate “[t]obacco products, including modified risk tobacco products.”¹³⁵ Following a series of setbacks in regulating electronic cigarettes under FDA's “drug and device authorities,”¹³⁶ FDA was able to assert regulatory authority over electronic cigarettes through its “deeming rule.”¹³⁷ The deeming rule brought “all other products meeting the definition of tobacco products, except accessories of newly deemed tobacco products,” within the regulatory purview of the TCA.¹³⁸ However, tying the purview of the TCA and the deeming rule back to the limitations imposed generally by the FDCA, FDA is concerned with assuring the purity and safety of products for their users.¹³⁹

On January 6, 2020, FDA announced preferential enforcement guidance for its implementation of the deem-

ing rule, centering its enforcement discretion upon “the manufacture, distribution and sale of unauthorized flavored *cartridge-based* e-cigarettes (other than tobacco or menthol).”¹⁴⁰ In explaining this policy priority, Alex Azar, the Secretary of Health and Human Services, stated:

By prioritizing enforcement against the products that are most widely used by children, our action today seeks to strike the right public health balance by maintaining e-cigarettes as a potential off-ramp for adults using combustible tobacco while ensuring these products don't provide an on-ramp to nicotine addiction for our youth.¹⁴¹

FDA's express goals in implementing this targeted enforcement policy were concerns for the health of two separate subcategories of electronic cigarette users: adults looking to quit smoking and children who should not be smoking.¹⁴² But this review lacked meaningful consideration of the public health impacts of the waste these products generate.¹⁴³ In an interview with the Associated Press, FDA confirmed that their enforcement guidance document would not apply to “self-contained, disposable products,” and would instead only apply to rechargeable, refillable products.¹⁴⁴ Here, FDA made clear the central thrust of their concern was limiting the availability of the most popular devices among youth electronic cigarette users.¹⁴⁵

FDA otherwise gave no attention to addressing the environmental degradation stemming from an influx of millions of disposable electronic cigarettes into the nation's current waste regimes.¹⁴⁶ According to the CDC, electronic cigarette sales continued to climb following FDA's guidance, growing 46.6% “from 15.5 million units sold in January of 2020 to 22.7 million units in December of 2022.”¹⁴⁷ Further, this same study shows a corresponding increase in disposable electronic cigarette usage, noting

131. *Id.* §393 (emphasis added).

132. See Testimony of Ned Sharpless, *supra* note 129 (for the proposition that FDA's deeming rule had the express intent of controlling youth access to electronic cigarettes). See also Aaron, *supra* note 5, at 836-37 (explaining that the extent FDA considered the “population as a whole, including users and non-users of tobacco products” (quoting U.S.C. §387f(d)(1) (2018)) included consideration of “adults who want to quit cigarettes, and children who do not use tobacco”). See also Ducharme, *supra* note 19 (for the proposition that while FDA attempted to control youth access to electronic cigarettes, they intentionally shifted consumers toward single-use devices, with little concern for the environmental consequences).

133. 21 U.S.C. §331(g) (emphasis added).

134. See *id.* §331. See also FDA, *supra* note 128.

135. 21 U.S.C. §387a(a). See also Aaron, *supra* note 5, at 836.

136. See *Sottera, Inc. v. Food & Drug Admin.*, 627 F.3d 891, 899 (D.C. Cir. 2010). See also Aaron, *supra* note 5, at 836.

137. 81 Fed. Reg. 28974 (May 10, 2016).

138. *Id.* See also Aaron, *supra* note 5, at 836.

139. 21 U.S.C. §393.

140. See News Release, FDA, *supra* note 58 (emphasis added). See also 85 Fed. Reg. 720 (Jan. 7, 2020); Enforcement Priorities for Electronic Nicotine Delivery Systems and Other Deemed Products on the Market Without Premarket Authorization (Revised); Guidance for Industry; Availability, 85 Fed. Reg. 23973 (Apr. 30, 2020); CENTER FOR TOBACCO PRODUCTS, FDA, ENFORCEMENT PRIORITIES FOR ELECTRONIC NICOTINE DELIVERY SYSTEM (ENDS) AND OTHER DEEMED PRODUCTS ON THE MARKET WITHOUT PREMARKET AUTHORIZATION (2020), <https://www.fda.gov/media/133880/download> (Docket No. FDA-2019-D-0661).

141. See News Release, FDA, *supra* note 58.

142. *Id.*

143. Ducharme, *supra* note 19. See also Matthew Perrone, *FDA Crackdown on Vaping Flavors Has Blind Spot: Disposables*, ASSOCIATED PRESS (Feb. 8, 2020), <https://apnews.com/article/health-us-news-ap-top-news-tobacco-industry-regulation-weekend-reads-600c4aa443dde043aad6f70a00251fa0>. See also 85 Fed. Reg. 720 (Jan. 7, 2020); 85 Fed. Reg. 23973 (Apr. 30, 2020); Testimony of Ned Sharpless, *supra* note 129 (for the proposition that FDA's deeming rule had the express intent of controlling youth access to electronic cigarettes); News Release, FDA, *supra* note 58.

144. See CENTER FOR TOBACCO PRODUCTS, *supra* note 140. See also Perrone, *supra* note 143.

145. Perrone, *supra* note 143 (“The agency's rationale: Reusable vaping devices are far and away the most popular with underage users, preferred by more than 60% of high schoolers who vape, according to survey data collected last year.”).

146. Beutel et al., *supra* note 2, at 1-2.

147. Press Release, CDC, *supra* note 30.

that “the share of disposable e-cigarettes increased from 24.7% to 51.8%.”¹⁴⁸

This is an especially brazen environmental oversight given the commands of the FDCA in regard to environmental impact assessments.¹⁴⁹ Although Congress expressly applies the mandates of the National Environmental Policy Act (NEPA)¹⁵⁰ to FDA through the FDCA,¹⁵¹ scholars note that many FDA environmental reviews end in “findings of no significant impact,” and while this is a reviewable determination, “the agency typically wins if it has offered some reasoned elaboration.”¹⁵² Because this change prioritizing enforcement against refillable and rechargeable electronic cigarette systems—but not single-use systems—was carried out through an intra-agency guidance document, this agency action was subject neither to an environmental assessment (EA) nor to public notice and comment.¹⁵³

Overall, FDA’s regulatory purview was insufficient to address the environmental impacts of electronic cigarettes. To address the youth vaping epidemic, FDA made a disastrous decision in promoting single-use electronic cigarettes. While this Article argues that no electronic cigarette is an environmentally friendly device, this argument is most pointed when applied to disposable/single-use devices. Electronic cigarettes comprise multiple hazardous constituent parts, crammed into one device, which are now being mass-manufactured and sold as “disposable.” These devices are better classified as hazardous waste.

III. RCRA, CERCLA, and Hazardous Waste Management and Response

Although the United States has a host of hazardous waste protections, the two central statutes that could apply to nuisance products—RCRA and CERCLA—have both failed to curtail the current waste epidemic posed by electronic cigarettes. The United States’ history regarding waste—specifically hazardous waste—is reactionary in nature. Congress passed RCRA to create specified methods of handling solid waste¹⁵⁴ and passed CERCLA to ensure that abandoned waste sites were cleaned up, and that those responsible for the contamination paid the bill.¹⁵⁵

Thus, the two statutes must be considered side by side because they constitute two sides of the same coin: RCRA regulates how “waste” is managed, while CERCLA provides the response mechanism for imminent or existing

contamination.¹⁵⁶ But because electronic cigarette manufacturers produce a product, which is not yet a waste, they are not regulated prospectively under either regime.¹⁵⁷ Only once the electronic cigarette has gone through its intended life-span and is heading for disposal does either regime attach.

While RCRA and CERCLA apply to prevent and rectify hazardous waste exposures and contamination, respectively, their statutory bases are each flawed, due in large part to the nature of the legislative process. Due to RCRA’s web of statutory and regulatory definitions that all center upon the concept of “waste,” electronic cigarette manufacturers evade liability for or regulation of contamination caused by products sold to consumers.¹⁵⁸ If the waste stream is left unregulated until it becomes a CERCLA problem, the scope of liability and case law interpreting the Act leads to a low likelihood that electronic cigarette manufacturers will be found liable for their products’ latent environmental contamination.¹⁵⁹ Instead, liability will likely fall upon the owner of the contaminated property or, in the case of a municipal landfill, upon the entire municipality and its taxpayers.¹⁶⁰ Because there will be no manufacturer liability for their products once in the hands of consumers, electronic cigarette production presents a massive economic benefit to the manufacturer while posing a societal nightmare for everyone else.

A. Current Hazardous Waste Management and Disposal Regimes: RCRA and Electronic Cigarettes

Passed in 1976, RCRA grew out of what academics colloquially refer to as the “era of midnight dumping.”¹⁶¹ According to the congressional findings prefacing the Act itself:

[A]s a result of the Clean Air Act, the Water Pollution Control Act, and other Federal and State laws respecting public health and the environment, greater amounts of solid waste . . . have been created. Similarly, inadequate and environmentally unsound practices for the disposal or use of solid waste have created greater amounts of air

148. *Id.*

149. See generally 21 U.S.C. §379o.

150. 42 U.S.C. §4332.

151. *Id.*

152. 1 JAMES T. O’REILLY & KATHARINE A. VAN TASSEL, *FOOD AND DRUG ADMINISTRATION* §4:17 (4th ed. 2023).

153. See 85 Fed. Reg. 720 (Jan. 7, 2020). See also 85 Fed. Reg. 23973 (Apr. 30, 2020); Testimony of Ned Sharpless, *supra* note 129 (for the proposition that FDA’s deeming rule had the express intent of controlling youth access to electronic cigarettes); News Release, FDA, *supra* note 58.

154. See 42 U.S.C. §6902(b). See also *id.* §6903(27), (5).

155. *Mardan Corp. v. C.G.C. Music, Ltd.*, 804 F.2d 1454, 1455 (9th Cir. 1986) (quoting 126 CONG. REC. 31964 (statement of Rep. Florio)).

156. U.S. EPA, *Summary of the Toxic Substances Control Act*, <https://www.epa.gov/laws-regulations/summary-toxic-substances-control-act> (last updated Sept. 9, 2024) (Although the Toxic Substances Control Act (TSCA) provides EPA with authority to prohibit the “manufacture or processing” of “chemical substances,” 15 U.S.C. §2604(a)(1), TSCA explicitly exempts “tobacco or any tobacco product” from the definition of a chemical substance. 15 U.S.C. §2602(2)(B)(iii). As such, although TSCA has been applied to chemicals like “polychlorinated biphenyls (PCBs), asbestos, radon and lead-based paint,” it is irrelevant to the discussion of controlling e-cigarette and nicotine contamination.).

157. See 42 U.S.C. §6903(5), (27). See also *AMC I*, 824 F.2d 1177, 1178 (D.C. Cir. 1987); 42 U.S.C. §9607(a)(3); *Burlington N. & Santa Fe Ry. Co. v. United States*, 556 U.S. 599, 609-10 (2009) (internal citations omitted).

158. See generally Section III.A. See also Section III.A.2.

159. See generally Section III.B. See also Section III.B.1.

160. See generally Section III.C.

161. Linda A. Spahr, *Environmental Self-Audit Privilege: The Straw That Breaks the Back of Criminal Prosecutions*, 7 *FORDHAM ENV’T L. REV.* 635, 651 (2011). See also 42 U.S.C. §6901. See also 1 CAROLINE N. BROUN & JAMES T. O’REILLY, *RCRA AND SUPERFUND: A PRACTICE GUIDE* 21 (2022).

and water pollution and other problems for the environment and for health. . . . [O]pen dumping is particularly harmful to health, contaminates drinking water from underground and surface supplies, and pollutes the air and the land[.]¹⁶²

The U.S. House of Representatives report accompanying the Act goes further, stating that the underlying issues of hazardous waste contamination at the time of passage were indeed dire:

Even more threatening are the present disposal practices for hazardous waste. Current estimates indicate that approximately 30-35 million tons of hazardous waste are literally dumped on the ground each year. Many of these substances can blind, cripple or kill. They can defoliate the environment, contaminate drinking water supplies and enter the food chain under preset, largely unregulated disposal practices.¹⁶³

“Congress thus crafted RCRA ‘to promote the protection of health and the environment and to conserve valuable material and energy resources.’”¹⁶⁴ But RCRA’s policy section goals are not fully achievable under the Act’s baroque definitional scheme, since RCRA is only applicable to “wastes” once in existence.¹⁶⁵ Though RCRA narrowly responds to the issue Congress faced in the 1970s, it does not offer an omnibus solution to the crisis of electronic cigarette waste.

Prominent barriers under the RCRA regime include the basic statutory definitions of “solid waste”¹⁶⁶ under a cooperative federalism regime,¹⁶⁷ which severely limits RCRA’s applicability, as well as the household waste exemption and subsequent issues stemming from this exclusion.¹⁶⁸ The combination of these policy choices largely allows products like electronic cigarettes to slip through the cracks and into the environment because an electronic cigarette is not regulated by RCRA when sold,¹⁶⁹ though it meets many of the requirements for “hazardous waste” status.¹⁷⁰

162. 42 U.S.C. §6901(b)(3)-(4).

163. H.R. REP. NO. 76-726, pt. 1, at 11 (1976).

164. *AMC I*, 824 F.2d 1177, 1179 (D.C. Cir. 1987) (quoting 42 U.S.C. §6902).

165. Cadesby B. Cooper, *Toxic Solid Waste Leaching From Telephone Poles? Navigating Ambiguous Definitions in RCRA*, 41 B.C. ENV’T AFFS. L. REV. 14, 19 (2014). See also 42 U.S.C. §6903(5), (27); BROWN & O’REILLY, *supra* note 161, at 22.

166. 42 U.S.C. §6903(27):

The term “solid waste” means any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities, but does not include solid or dissolved material in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges which are point sources subject to permits under section 1342 of Title 33, or source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954, as amended (68 Stat. 923).

167. *Id.* §6926(b).

168. See *id.* §6921(i). See also 40 C.F.R. §261.4(b).

169. See generally 42 U.S.C. §6903(5), (27). See also *AMC I*, 824 F.2d at 1178; Krause & Townsend, *supra* note 11, at 58.

170. See generally Section I.B.

1. RCRA’s Structure and Limitations

While RCRA’s statutory permission to extend state-authorized legislation beyond the scope of the federal RCRA through cooperative federalism is significant, there are two important constraints on power in practice. First, the doctrine of cooperative federalism imposes limitations on how broadly a state may interpret and implement its own authorized program for environmental statutes.¹⁷¹ Second, the Act’s central definition and focus on the term “waste” creates a very narrow regulatory regime that states can work within.¹⁷²

The first constraint, the legal doctrine of cooperative federalism, limits the federal or citizen enforcement of state-authorized programs that extend beyond the scope of the underlying federal act.¹⁷³ RCRA embraces a model of cooperative federalism, such that it creates a federal floor for solid waste and hazardous waste management throughout the United States.¹⁷⁴ RCRA sets the ground rules for how waste is to be handled while allowing states and municipalities to adopt EPA-authorized hazardous waste programs in lieu of the federal program, effectively allowing states and municipalities to preserve their primary role in managing solid wastes.¹⁷⁵ For a state to receive EPA authorization for its own RCRA program, “42 U.S.C. §6929 imposed a duty upon approved states to maintain their RCRA programs at a level at least as stringent as the federal floor.”¹⁷⁶

Thus, RCRA does allow state programs to be more stringent than their federal counterpart and even allows EPA limited enforcement power of state program provisions against private parties within that state.¹⁷⁷ If a state’s authorized program is stricter than the federal floor, the program is federally enforceable per RCRA’s language.¹⁷⁸ However, if the state’s act goes beyond the scope of the federal act, courts will not uphold challenges based on the underlying federal law, as is frequently the case with citizen suits.¹⁷⁹

In *Gwaltney of Smithfield v. Chesapeake Bay Foundation*,¹⁸⁰ the U.S. Supreme Court held that citizens who wish to bring a cause of action under the federal

171. See *Atlantic States Legal Found., Inc. v. Eastman Kodak Co.*, 809 F. Supp. 1040, 1048 (W.D.N.Y. 1992), *aff’d*, 12 F.3d 353 (2d Cir. 1993), *as amended* (Feb. 3, 1994).

172. 42 U.S.C. §6903(5), (27).

173. See *Atlantic States Legal Found., Inc.*, 809 F. Supp. at 1048.

174. See 42 U.S.C. §§6926(b), 6929. See also *AES Puerto Rico, L.P. v. Trujillo-Panisse*, 133 F. Supp. 3d 409, 421 (D.P.R. 2015) (citing *Chico Serv. Station, Inc. v. Sol P.R. Ltd.*, 633 F.3d 20, 27 (1st Cir. 2011)).

175. See *Titan Wheel Corp. of Iowa v. U.S. Env’t Prot. Agency*, 291 F. Supp. 2d 899, 904 (S.D. Iowa 2003), *aff’d sub nom.* *Titan Wheel Corp. of Iowa v. U.S. Env’t Prot. Agency*, 113 F. App’x 734 (8th Cir. 2004). See also BROWN & O’REILLY, *supra* note 161, at 37.

176. *United States v. Marine Shale Processors*, 81 F.3d 1361, 1367 (5th Cir. 1996).

177. 42 U.S.C. §§6928(a), 6829. See also *Marine Shale Processors*, 81 F.3d at 1367.

178. 42 U.S.C. §§6926, 6929.

179. See *Atlantic States Legal Found., Inc. v. Eastman Kodak Co.*, 809 F. Supp. 1040, 1048 (W.D.N.Y. 1992), *aff’d*, 12 F.3d 353 (2d Cir. 1993), *as amended* (Feb. 3, 1994). See also BROWN & O’REILLY, *supra* note 161, at 101-02.

180. 484 U.S. 49, 53 (1987) (citing 33 U.S.C. §1365(a)).

Clean Water Act's (CWA's) citizen suit provision, §505,¹⁸¹ must allege in good faith an ongoing violation of the underlying Act. The Court based this holding upon the language of CWA §505, authorizing citizen suits federally only in situations that plaintiffs are able to “allege[] [a defendant] to be in violation” of an effluent standard or limitation of the Act.¹⁸²

In *Atlantic States Legal Foundation v. Eastman Kodak Co.*, the U.S. District Court for the Western District of New York followed *Gwaltney's* underlying logic, holding that New York's state-authorized National Pollutant Discharge Elimination System (NPDES) permits were unenforceable under the federal citizen suit provision because the state permit extended to prohibit the discharge of “any pollutant not identified and authorized by such permit.”¹⁸³ As this language “would effectively circumvent the permit system and expand the scope of a citizen suit under the Act,” the district court disposed of the case on summary judgment.¹⁸⁴ Although *Gwaltney* and *Eastman Kodak* involve the CWA, they illustrate that state statutes implementing federal regimes are only federally enforceable to the extent that the state action remains within the scope and intention of the underlying federal statute.¹⁸⁵

The second constraint on state authority to implement RCRA stems from this preceding line of cases on cooperative federalism, and comes to a point at RCRA's definitions of “hazardous waste”¹⁸⁶ and “solid waste.”¹⁸⁷ Under RCRA's statutory definitions, “hazardous waste” is defined as “a solid waste . . . which . . . may—(A) cause or contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or (B) pose a substantial present or potential hazard to human health or the environment.”¹⁸⁸ Complimentarily, RCRA defines “solid waste” as “any garbage, refuse, sludge . . . and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities.”¹⁸⁹

To qualify as a “hazardous waste” under RCRA, a substance must first be a “solid waste.”¹⁹⁰ As the following case illustration will show, the nexus of this waste focus, under the doctrine of cooperative federalism, severely limits a state's ability to apply RCRA's jurisdiction over electronic cigarettes, which are unused—and thus not waste—when sold from manufacturer to retailer or from retailer to consumer.¹⁹¹

Thus, RCRA's protections do not apply to electronic cigarettes until they are used and their owners are ready to

discard.¹⁹² This nuance between solid waste and hazardous waste is important, given that states like Oregon follow the federal model generally¹⁹³ and exempt FDA-approved over-the-counter nicotine patches, gums, and lozenges from RCRA listing.¹⁹⁴ Oregon follows the federal model here and does not exempt nicotine solutions like those found in electronic cigarettes, declaring nicotine specifically to be hazardous waste dependent only upon its pathway to the waste stream.¹⁹⁵

In *American Mining Congress v. U.S. Environmental Protection Agency (AMC I)*, AMC challenged an EPA rule updating the Agency's regulatory definition of “solid waste” to include “secondary materials reused within an industry's ongoing production process.”¹⁹⁶ In challenging this rule, AMC argued that EPA's regulatory authority extended only to materials that are discarded or intended to be discarded, and not to materials intended for secondary recycling or reuse within industrial processes, like crude oil fractions or still-refinable ore.¹⁹⁷ The D.C. Circuit held that “Congress clearly and unambiguously expressed its intent that ‘solid waste’ (and therefore EPA's regulatory authority) be limited to materials that are ‘discarded’ by being disposed of, abandoned, or thrown away.”¹⁹⁸ Through this decision, the D.C. Circuit foreclosed the possibility of EPA (or state) regulation under RCRA of products that are not “disposed of, abandoned, or thrown away.”¹⁹⁹ As such, RCRA does not apply to electronic cigarettes until they are “disposed of.”

2. RCRA's Application to “Solid Wastes”: Products Versus Wastes

While manufacturers intend for disposable electronic cigarettes to be thrown away eventually, their sale as a commercial product controls the application of RCRA. As the U.S. Court of Appeals for the Second Circuit found persuasive:

It is not only the waste by-products of the nation's manufacturing processes with which the committee is concerned: but also the products themselves once they have served their intended purposes and are no longer wanted by the consumer. For these reasons the term discarded materials is used to identify collectively those substances

181. 33 U.S.C. §1365(a).

182. *Id.* §1365.

183. 809 F. Supp. at 1047.

184. *Id.* at 1048.

185. *Id.* See also *Gwaltney*, 484 U.S. at 61.

186. 42 U.S.C. §6903(5).

187. *Id.* §6903(27).

188. *Id.* §6903(5) (emphasis added).

189. *Id.* §6903(27).

190. See *id.* §6903(5), (27).

191. *Id.*

192. See *Connecticut Coastal Fishermen's Ass'n v. Remington Arms Co.*, 989 F.2d 1305, 1313 (2d Cir. 1993).

193. OR. ADMIN. R. 340-100-0002.

194. See *id.* R. 340-102-0011. See also 40 C.F.R. §261.33.

195. OHA, MANAGEMENT OF E-CIGARETTE WASTE FOR RETAILERS, *supra* note 12; OHA, MANAGEMENT OF E-CIGARETTE WASTE FOR SCHOOLS, *supra* note 12. These sources direct institutions to dispose of spent electronic cigarettes through proper channels but say *nothing* about individual consumers. Further, these sources acknowledge that nicotine solution is a hazardous waste in the state of Oregon. Combined, these two sources show that while regulatory control over electronic cigarettes and their waste is warranted, there remains an open pathway for these devices to cause rampant contamination via consumer waste.

196. 824 F.2d 1177, 1178 (D.C. Cir. 1987).

197. *Id.* at 1180-81.

198. *Id.* at 1193.

199. *Id.*

often referred to as industrial, municipal or post-consumer waste; refuse, trash, garbage and sludge.²⁰⁰

In *Connecticut Coastal Fishermen's Ass'n v. Remington Arms Co.*, the plaintiffs alleged that (1) the lead shot and clay pigeon remnants scattered throughout defendant Remington Arms' gun range were hazardous wastes under RCRA; (2) Remington failed to attain a treatment, storage, and disposal (TSD) permit under RCRA; and (3) Remington must clean up the wastes scattered across its lands because of the potential for contamination of the Long Island Sound.²⁰¹ In response, Remington Arms argued:

[B]ecause lead shot and clay target debris are not "solid wastes"—and hence cannot be "hazardous wastes" regulated by RCRA—it is not subject to a permit requirement . . . [essentially contending that] RCRA does not apply to [Remington Arms] because any disposal of waste that occurred there was merely incidental to the normal use of a product.²⁰²

Instead of facially addressing Remington's assertion, the Second Circuit artfully noted a central dichotomy within RCRA's *hazardous waste* definitions: "The EPA distinguishes between RCRA's regulatory and remedial purposes and offers a different definition of solid waste depending upon the statutory context in which the term appears."²⁰³ Regarding the lead shot and clay pigeon remnants scattered throughout Remington's property, the court found that the debris did not properly fall within the regulatory definition of "solid waste," and thus could not comprise the basis for a cause of action alleging a permit violation under RCRA.²⁰⁴ This finding rested on the fact that the lead and target remnants were not "stored" within EPA's regulatory definition, thus the wastes did not fall within RCRA's regulatory purview.²⁰⁵

However, the *Remington Arms* court continued, noting that the contamination from Remington's activities fell within the broad statutory definition of *solid waste*, thus allowing a claim to proceed under the Imminent and Substantial Endangerment Clause, 42 U.S.C. §6972(a).²⁰⁶ The court noted that "[t]he statutory definition contains the concept of 'discarded material,' 42 U.S.C. §6903(27), but it does not contain the terms 'abandoned' or 'disposed of' as required by the regulatory definition. 40 C.F.R. §§261.2(a)(2), (b)(1)."²⁰⁷ Because the shot and target fragments contaminating the gun club "have accumulated long enough to be considered solid waste,"²⁰⁸ the court

found that the lead and fragments were discarded and fell within the purview of RCRA's imminent and substantial endangerment requirements. Remington, therefore, had to abate the threat.

The *Remington Arms* decision displays the particular nature of RCRA's various definitions for what constitutes *solid waste* and *hazardous waste*. At the end of the day, lead is lead, but what RCRA finds important is how the substance at issue has been handled. However, the Second Circuit leaves out the most applicable part of what *Remington Arms* stands for, from a policy standpoint. The issue in *Remington Arms* was whether the gun club itself was in violation of RCRA. But the opinion omits any reference to the bullet manufacturer or their decisions in creating the bullets at issue. While the context of a gun club makes sense for this finding—holding the gun club's activities accountable for their decision to scatter lead throughout a single plot of land—it makes less sense as applied to lead shot left upon a hunting ground where there is no obviously liable party for the contamination.²⁰⁹ This policy of applying hazardous waste law to the method and site of disposal makes even less sense as applied to nuisance products like electronic cigarettes.

Thinking about the contaminated gun club in the context of electronic cigarettes, consider as an analogy a school where individual students have "disposed of" their electronic cigarettes. By limiting our primary regulatory statutes for hazardous waste to center upon "disposal," sites like schools and convenience stores can wind up facing contamination problems and liability, which were created by a third-party company that actually benefitted from the sale. This system is even less equitable as applied to latent contamination caused by individual electronic cigarette users disposing of their spent devices improperly—through either throwing them in a trash can or on the ground, creating a diffuse waste issue with no clearly liable party beyond the broader locality or municipality.²¹⁰ Under the *Remington Arms* holding, it becomes clear that the manufacturer of wastes that pass through consumer hands will rarely become liable for their products under RCRA.

3. Hazardous Waste Status Under RCRA Through the TCLP

The regulatory definition of *hazardous waste* in 40 C.F.R. §261.3 states that a hazardous waste is a solid waste if it, first, is not excluded by 40 C.F.R. §261.4, and second,

200. *Connecticut Coastal Fishermen's Ass'n v. Remington Arms Co.*, 989 F.2d 1305, 1314 (2d Cir. 1993) (quoting H.R. REP. NO. 1491, at 4 (1976), reprinted in 1976 U.S.C.C.A.N. 6240).

201. *Id.* at 1309.

202. *Id.* at 1313.

203. *Id.*

204. *Id.* at 1315.

205. *Id.* at 1316 (citing 42 U.S.C. §6903(33)).

206. *Id.*

207. *Id.*

208. *Id.*

209. See *Center for Biological Diversity v. U.S. Forest Serv.*, 80 F.4th 943 (9th Cir. 2023) (conclusion to the case over the endangerment of the California condor, based on lead ammunition left in hunting grounds within the Kaiabab National Forest).

210. See OHA, MANAGEMENT OF E-CIGARETTE WASTE FOR RETAILERS, *supra* note 12; OHA, MANAGEMENT OF E-CIGARETTE WASTE FOR SCHOOLS, *supra* note 12 (for the proposition that only when generators of hazardous waste surpass regulatory thresholds for waste generation do RCRA regulatory mandates attach). See also Mock & Hendlin, *supra* note 30 (examples of high schools contaminated with electronic cigarette waste).

exhibits enumerated characteristics (including ignitability, corrosivity, reactivity, and toxicity).²¹¹ The tests to determine whether a solid waste is a hazardous waste because it exhibits one of these four characteristics are codified in EPA regulations within the SW-846 Compendium.²¹²

The central test for showing toxicity under RCRA is the TCLP.²¹³ Under the TCLP, a “representative sample of the waste”²¹⁴ is subjected to conditions expected of a typical landfill (exposed to crushing weight and leachate)²¹⁵ to assess whether the sample contains toxic constituents.²¹⁶ If the sample yields any of the contaminants listed in Table 1 of 40 C.F.R. §261.24 in concentrations “equal to or greater than the respective value given,” then the solid waste is considered toxic and thus *hazardous waste* under RCRA.²¹⁷

As mentioned previously, individual electronic cigarettes that were emptied of their nicotine solution (nicotine, which is itself a P-listed hazardous waste)²¹⁸ have been documented to fail the TCLP.²¹⁹ On the mass scale of electronic cigarette use, with millions of units being sold and a considerable portion being sold as disposable, the baseline laboratory studies confirm the gravity of this electronic cigarette epidemic. These devices contain hazardous substances that can and do threaten public health. It should be further noted that, unlike Krause and Townsend’s laboratory study,²²⁰ electronic cigarettes disposed of by individual users will not be fully emptied of their additional nicotine solution.²²¹

4. Application of RCRA to Electronic Cigarettes: The Land Ban?

If RCRA does attach to electronic cigarettes, in the case of unused or spilled products at the point of manufacture, sale, or (sometimes) disposal,²²² RCRA provides some strong protections to assure that the hazardous constituent parts of an electronic cigarette remain controlled. If a specified waste is able to meet the statutory definition of a “solid waste,”²²³ only then can the waste be screened under the regulatory definition and regulatory tests for whether the waste is definitionally hazardous for purposes of Subtitle C.²²⁴ One central protection offered by RCRA to Subtitle C hazardous waste, or hazardous waste meeting EPA’s

more stringent regulatory definition, is the “land ban.”²²⁵ Under the land ban, any person is barred from land applying or disposing of hazardous wastes in a landfill, through deep well injection, or otherwise.²²⁶ Because RCRA regulates hazardous wastes from “cradle to grave,”²²⁷ this ban on land applying waste follows for its entire existence on earth, if it applies.

The application of RCRA to nuisance products like electronic cigarettes is complicated by the confusing definitional hierarchy of what is considered a *waste*. To bar a contaminant from land application under RCRA, it must be considered a *solid waste* under the statutory and regulatory definitions²²⁸ as well as a *hazardous waste* under the regulatory definition.²²⁹ Federally, RCRA and EPA regulations exempt household waste from being considered “hazardous waste.”²³⁰ This means that household waste is presumed, from the beginning, to be nonregulatory hazardous waste; neither the land ban nor permitting requirements typically apply and household waste can be handled as Subtitle D solid waste.²³¹ Thus, there is no enforcement pathway in place to assure that hazardous waste is absent from household wastes.²³²

This pattern continues at the state level. In Oregon, for instance, individual households would escape RCRA generator status as a “conditionally exempt small quantity generator”²³³ because they are presumed to generate hazard-

211. 40 C.F.R. §261.3.

212. *Id.* §260.11.

213. *Id.* §261.24. *See also* U.S. EPA, *supra* note 115.

214. 40 C.F.R. §261.24(a).

215. *See* Pace, *TCLP Testing Services*, <https://www.pacelabs.com/analytical-environmental/tclp/> (last visited Jan. 26, 2025).

216. 40 C.F.R. §261.24.

217. *Id.*

218. *Id.* §261.33.

219. Krause & Townsend, *supra* note 11, at 60.

220. *Id.*

221. Hendlin, *supra* note 76.

222. OHA, MANAGEMENT OF E-CIGARETTE WASTE FOR RETAILERS, *supra* note 12; OHA, MANAGEMENT OF E-CIGARETTE WASTE FOR SCHOOLS, *supra* note 12.

223. 42 U.S.C. §6903(28).

224. *Id.* *See also* 40 C.F.R. §261.2. *See also* Connecticut Coastal Fishermen’s Ass’n v. Remington Arms Co., 989 F.2d 1305, 1314 (2d Cir. 1993).

225. 42 U.S.C. §6924(c)-(h) (RCRA’s “land ban”). *See also id.* §6903(15). (“The term ‘person’ means an individual, trust, firm, joint stock company, corporation (including a government corporation), partnership, association, State, municipality, commission, political subdivision of a State, or any interstate body and shall include each department, agency, and instrumentality of the United States.”).

226. 42 U.S.C. §6924(c)-(h).

227. *City of Chi. v. Environmental Def. Fund*, 511 U.S. 328, 331 (1994). *See also* 42 U.S.C. §§6921-6934.

228. 42 U.S.C. §6903(27). *See also* 40 C.F.R. §261.

229. 40 C.F.R. §261.

230. 42 U.S.C. §6921(i). *See also* 40 C.F.R. §261.4(b).

231. 42 U.S.C. §§6941-6949a (RCRA subch. IV or subtit. D—State or Regional Solid Waste Plans).

232. *See* OR. REV. STAT. §459.247:

(1) No person shall dispose of and no disposal site operator shall knowingly accept for disposal the following types of solid waste at a solid waste disposal site: (a) Discarded or abandoned vehicles; (b) Discarded large home or industrial appliances; (c) Used oil; (d) Tires; (e) Lead-acid batteries; or (f) Covered electronic devices. (2) As used in this section: (a) “Covered electronic device” has the meaning given that term in ORS [Oregon Revised Statutes] 459A.305, except that “covered electronic device” does not include a computer peripheral or a printer as those items are defined in ORS 459A.305.

Section 459.247 proceeds to provide:

Each disposal site operator shall establish and implement, in accordance with any permit requirements established by the Department of Environmental Quality, a program reasonably designed to prevent acceptance of covered electronic devices for disposal. If an operator operates the disposal site in conformity with the program, the operator is presumed to have complied with the provisions of this section that prohibit knowingly accepting covered electronic devices for disposal.

Id. §459.247(5)(a). As such, the only “screening” that a waste-receiving plant has to do is for computer products. Because such covered devices exclude e-cigarettes, there is currently no regulatory control over the disposal of e-cigarettes in Oregon.

233. *Id.* §459.412:

Definition for ORS 459.411 to 459.417. As used in ORS 459.411 to 459.417, “conditionally exempt small quantity generator”

ous waste at levels below regulatory thresholds. As such, individual electronic cigarette users whose devices wind up in the trash, the street, or a storm drain are unlikely to be personally responsible for the contamination they create.²³⁴

This division in responsibility has nothing to do with the underlying toxicity of the product. Instead, it reflects a policy decision that remains unfulfilled: “[g]overnment and industry are working to develop consumer products with fewer or no hazardous constituents . . . for some products, such as car batteries and photographic chemicals, no ‘safe’ substitute exists.”²³⁵ This policy allows for the mass distribution of hazardous materials without proper regulation on a societal scale.

This reality is reflected in both federal- and state-level guidance on the proper disposal of electronic cigarettes.²³⁶ In terms of federal guidance, EPA notes that individuals must *not* throw their spent electronic cigarettes in the trash and must instead take them to a household hazardous waste collection site.²³⁷ But because the use and disposal of electronic cigarettes is a diffuse problem spread out throughout the United States, enforcing the “correct” disposal of many products is simply not possible at an individual level.

In comparison to the individual controls advocated for by EPA, the Oregon Health Authority has published two other public-facing guidance documents—one aimed at retailers of electronic cigarettes and the other at Oregon schools.²³⁸ These documents both contain information warning their respective audiences that electronic cigarettes contain both liquid nicotine and Li-ion batteries, which cannot be thrown away in municipal garbage or poured down the drain, and that electronic cigarette waste is definitionally hazardous waste when disposed of, especially if done in quantities that exceed regulatory thresholds.²³⁹ Both guidance documents then provide information on the various regulatory waste generation and accumulation thresholds for RCRA generator status, including *very small*

quantity generators, *small quantity generators*, and *large quantity generators*.²⁴⁰ Finally, the guidance documents end with a section on how to handle electronic cigarette waste itself, including details on spill kits, data sheet requirements, personal protective equipment, and storage methods for Li-ion batteries.²⁴¹

These guidance documents provide clarity that in condensed electronic cigarette locations, like schools and electronic cigarette retail stores, built-up electronic cigarette waste accumulates and can surpass regulatory thresholds and lead to liability for such entities. This means that retail locations and schools alike could be held liable as generators for violating RCRA, but not the individuals who actually used the product nor their manufacturer. It should be noted at this point that there is no similar state-level guidance document (at least in Oregon) for how individuals ought to manage their waste.

This is the message that RCRA leaves us with—at the end of the day, it is the product user or entity in possession of electronic cigarettes at the disposal stage (the generator)²⁴² that must properly handle the waste. The generator is responsible for finding a home for the waste in the form of a RCRA-permitted TSD facility, and that TSD facility must manage the waste in accordance with their permit.²⁴³ However, if that product user is an individual, there is no clear enforcement pathway for either EPA or a state agency to hold a bad actor accountable since they are generally found to be exempt as a small-quantity generator.²⁴⁴ In the case of a diffuse social problem like electronic cigarette use that can spiral out of control in a regulatory void, RCRA does not do much, if anything, to stem the rising tide of the electronic cigarette waste crisis.

In summation, (1) electronic cigarettes *should be* considered toxic, hazardous waste under RCRA, and (2) RCRA does not sufficiently stem the flood of electronic cigarettes into the hands of consumers, and from the hands of consumers into the environment. With the increasing reported sales of electronic cigarettes,²⁴⁵ combined with evidence to show that many young people either throw their used devices straight into the trash, a regular recycling bin, or straight onto the ground,²⁴⁶ RCRA is failing to stem the electronic cigarette waste crisis. “RCRA’s purpose is to minimize the present and future threat to human health and the environment, not effectuate the clean-up of toxic waste sites or allocate those costs.”²⁴⁷

means a person who generates a hazardous waste but is conditionally exempt from certain regulations because the waste is generated in quantities below the threshold adopted by the Environmental Quality Commission pursuant to ORS 466.020. [1993 c.560 §49].

234. See *City of Chi. v. Environmental Def. Fund*, 511 U.S. 328, 328 (1994): Although a pre-§301(i) EPA regulation provided a “waste stream” exemption covering household waste from generation through treatment to final disposal of residues, petitioners’ facility would not have come within that exemption because it burned something in addition to household waste; the facility would have been considered a Subtitle C hazardous waste generator, but not a (more stringently regulated) Subtitle C hazardous waste treatment, storage, and disposal facility, since all the waste it took in was nonhazardous.

235. OFFICE OF SOLID WASTE AND EMERGENCY RESPONSE, U.S. EPA, HOUSEHOLD HAZARDOUS WASTE MANAGEMENT: A MANUAL FOR ONE-DAY COMMUNITY COLLECTION PROGRAMS 1 (1993) (OS-305), <https://nepis.epa.gov/Exe/ZyPDF.cgi/10000RGD.PDF?Dockey=10000RGD.PDF>.

236. See U.S. EPA, *supra* note 12. See also OHA, MANAGEMENT OF E-CIGARETTE WASTE FOR RETAILERS, *supra* note 12; OHA, MANAGEMENT OF E-CIGARETTE WASTE FOR SCHOOLS, *supra* note 12.

237. U.S. EPA, *supra* note 12.

238. See OHA, MANAGEMENT OF E-CIGARETTE WASTE FOR RETAILERS, *supra* note 12; OHA, MANAGEMENT OF E-CIGARETTE WASTE FOR SCHOOLS, *supra* note 12.

239. See OHA, MANAGEMENT OF E-CIGARETTE WASTE FOR RETAILERS, *supra* note 12; OHA, MANAGEMENT OF E-CIGARETTE WASTE FOR SCHOOLS, *supra* note 12.

240. See OHA, MANAGEMENT OF E-CIGARETTE WASTE FOR RETAILERS, *supra* note 12; OHA, MANAGEMENT OF E-CIGARETTE WASTE FOR SCHOOLS, *supra* note 12.

241. See OHA, MANAGEMENT OF E-CIGARETTE WASTE FOR SCHOOLS, *supra* note 12, at 3.

242. 42 U.S.C. §6924(a).

243. *Id.*

244. See OHA, MANAGEMENT OF E-CIGARETTE WASTE FOR RETAILERS, *supra* note 12, at 1; OHA, MANAGEMENT OF E-CIGARETTE WASTE FOR SCHOOLS, *supra* note 12, at 1.

245. CDC FOUNDATION, *supra* note 10.

246. TRUTH INITIATIVE, *supra* note 10 (looking at the demographic of 15-24-year-old electronic cigarette users and their waste management practices).

247. *Stratford Holding, LLC v. Foot Locker Retail Inc.*, 77 Env’t Rep. Cas. (BNA) 2127, 2013 WL 5550461 (W.D. Okla. Oct. 8, 2013). See also BROWN & O’REILLY, *supra* note 161, at 30-31.

B. Cleaning Up: CERCLA and Electronic Cigarettes

Since RCRA has proven incapable of stopping the electronic cigarette waste crisis, and we now know that there is contamination,²⁴⁸ how can we clean it up and who will foot the bill? Both questions are solidly within the realm of CERCLA.²⁴⁹ But as with RCRA, CERCLA's statutory framework does not cleanly apply to electronic cigarette waste. Moreover, it is likely to impose the steep cost of cleanup on entities other than the electronic cigarette manufacturer, the true architect of this waste crisis. Instead, the cost of cleanup would likely fall upon the waste disposal site, and potentially the municipality that sent its waste to that site.

Passed in 1980,²⁵⁰ CERCLA:

was a response by Congress to the threat to public health and the environment posed by the widespread use and disposal of hazardous substances. Its purpose was to ensure the prompt and effective cleanup of waste disposal sites, and to assure that parties responsible for hazardous substances bore the cost of remedying the conditions they created.²⁵¹

CERCLA was specifically enacted to plan the response to existing contamination from infamously contaminated sites, including chemical fires at a Bridgeport, New Jersey, chemical waste facility and the neighborhood of Love Canal, New York, where residents were experiencing a series of rashes, miscarriages, and birth defects due to the development being built atop a hazardous waste graveyard.²⁵² However, like RCRA, CERCLA rests on a foundation cracked by industry interests and political compromise.²⁵³

248. See Beutel et al., *supra* note 2, at 12 (“[T]here is a significant gap in the literature regarding the costs related to the environmental impact of combustible cigarette and e-cigarette use and disposal.”). Press Release, CDC, *supra* note 30. See also TRUTH INITIATIVE, *supra* note 10 (noting that more than 50% of surveyed youth reported throwing their spent electronic cigarette waste directly into the trash); Mock & Hendlin, *supra* note 30 (noting that 19% of the waste items collected from San Francisco high schools were e-cigarette product waste, nearly all of which was from the electronic cigarette company Juul); H.B. 1069 §1(f), 74th Gen. Assemb., Reg. Sess. (Colo. 2024) (“It is estimated that consumers in the United States throw away more than 4 disposable vapes every second.”); Askew, *supra* note 30 (noting that in the U.K., 1.3 million single-use e-cigarettes are thrown away every week, or two per second).

249. 42 U.S.C. §§9601 et seq.

250. See *id.* §9601 (Pub. L. No. 96-510, tit. I, §101, 94 Stat. 2767 (1980)).

251. Mardan Corp. v. C.G.C. Music, Ltd., 804 F.2d 1454, 1455 (9th Cir. 1986) (quoting 126 CONG. REC. 31964 (statement of Rep. Florio)).

252. *Id.* See also U.S. EPA, *Superfund History—Printable Version*, <https://www.epa.gov/superfund/superfund-history-printable-version> (last updated Sept. 25, 2024); BROWN & O'REILLY, *supra* note 161, at 607.

253. See *United States v. Hercules, LLC*, No. 2:18-CV-62, 2019 WL 6403416, at *4 (S.D. Ga. Nov. 27, 2019) (quoting *United States v. Akzo Coatings of Am., Inc.*, 949 F.2d 1409, 1416-18 (6th Cir. 1991)):

CERCLA was a hastily-assembled bill which contained a number of technical flaws due to Congress' limited understanding of the hazardous waste problem and its effects on the environment. See also [Frank P.] Grad, *A Legislative History of the Comprehensive Environmental Response, Compensation and Liability (“Superfund”) Act of 1980*, 8 COLUM. J. ENV'TL. L. 1, 2, 34 (1982).

Although CERCLA has been amended multiple times in response to the Act's various shortcomings,²⁵⁴ some of the Act's central omissions continue to this day.²⁵⁵ Further, none of these changes apply to prospectively regulate environmental contamination, nor should they do so due to CERCLA's intended purpose of remedying hazardous waste sites.²⁵⁶

1. Liability Under CERCLA

“[CERCLA] was designed to promote the ‘timely cleanup of hazardous waste sites’ and to ensure that the costs of such cleanup efforts were borne by those responsible for the contamination.”²⁵⁷ CERCLA's liability scheme is fairly simple: whenever there is (1) a release or threatened release,²⁵⁸

254. See Superfund Amendments and Reauthorization Act (SARA), Pub. L. No. 99-499, 100 Stat. 1617 (1986); Lender Protection Amendments, Pub. L. No. 104-208, div. A, tit. II, §2502(a), 110 Stat. 3009-462 (1996); 1999 Scrap Amendments, Pub. L. No. 106-113, 113 Stat. 1501; Liability Relief Amendments (Brownfield Amendments) and the Build Act, Pub. L. No. 107-118, 115 Stat. 2356 (2002). See also BROWN & O'REILLY, *supra* note 161, at 620-26.

255. See 42 U.S.C. §9601(14):

The term [“hazardous substance”] does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically listed or designated as a hazardous substance under subparagraphs (A) through (F) of this paragraph, and the term does not include natural gas, natural gas liquids, liquefied natural gas, or synthetic gas usable for fuel (or mixtures of natural gas and such synthetic gas).

256. See SARA, Pub. L. No. 99-499, 100 Stat. 1613 (1986). See also Small Business Liability Relief and Brownfields Revitalization Act, Pub. L. No. 107-118, 115 Stat. 2356 (2002); U.S. EPA, *Superfund: CERCLA Overview*, <https://www.epa.gov/superfund/superfund-cercla-overview> (last updated Oct. 8, 2024).

257. *Burlington N. & Santa Fe Ry. Co. v. United States*, 556 U.S. 599, 602 (2009) (quoting *Consolidated Edison Co. of N.Y. v. UGI Utils., Inc.*, 423 F.3d 90, 94 (2d Cir. 2005)). See also *United States v. Olin Corp.*, 107 F.3d 1506, 1511-15 (11th Cir. 1997); *United States v. Monsanto Co.*, 858 F.2d 160, 175 (4th Cir. 1988):

The restitution of cleanup costs was not intended to operate, nor does it operate in fact, as a criminal penalty or a punitive deterrent. *Cf. Tull v. United States*, 481 U.S. 412, 107 S. Ct. 1831, 1838, 95 L. Ed. 2d 365 (1987) (distinguishing civil penalties under Clean Water Act from equitable remedy of restitution). Moreover, as this case demonstrates, Congress did not impose that obligation automatically on a legislatively defined class of persons.

258. 42 U.S.C. §9604(a). See also *id.* §9601. CERCLA defines a “release” as: any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment (including the abandonment or discarding of barrels, containers, and other closed receptacles containing any hazardous substance or pollutant or contaminant), but excludes (A) any release which results in exposure to persons solely within a workplace, with respect to a claim which such persons may assert against the employer of such persons, (B) emissions from the engine exhaust of a motor vehicle, rolling stock, aircraft, vessel, or pipeline pumping station engine, (C) release of source, byproduct, or special nuclear material from a nuclear incident, as those terms are defined in the Atomic Energy Act of 1954, if such release is subject to requirements with respect to financial protection established by the Nuclear Regulatory Commission under section 170 of such Act, or for the purposes of section 9604 of this title or any other response action, any release of source byproduct, or special nuclear material from any processing site designated under section 7912(a)(1) or 7942(a) of this title, and (D) the normal application of fertilizer.

of (2) a hazardous *substance*,²⁵⁹ from (3) a facility,²⁶⁰ CERCLA empowers EPA with certain methods of compelling a cleanup, and provides a narrow cause of action for states, Indigenous tribes, and private citizens to also engage in cleanup.²⁶¹

Where EPA seeks to unilaterally compel a *potentially responsible party* (PRP) to clean up a site, the Agency must also show that there “may be an imminent and substantial endangerment” to the environment or public health or welfare due to “an actual or threatened release of a hazardous substance from a facility.”²⁶² In achieving this goal, CERCLA seeks to “spread the costs of responding to improper waste disposal among all parties that played a role in creating the hazardous conditions” to remedy contaminated areas.²⁶³

Further, CERCLA is a strict liability statute, imposing causation-free liability for the cost of cleanup compliant with the national contingency plan (NCP).²⁶⁴ Keeping

in mind that CERCLA §107(a)(4)(A) extends liability to PRPs for “all costs of removal or remedial action incurred by the U.S. Government or a State or an indigenous tribe not inconsistent with the national contingency plan,” this is a staggering potential for economic liability.²⁶⁵ And CERCLA further embraces the concept of joint and several liability, such that in any mixed waste case, “[r]esponsible parties are jointly and severally liable for the full cost of the cleanup, but may seek contribution from other responsible parties.”²⁶⁶

These damages are only divisible between PRPs if a defendant can show that the harm is divisible.²⁶⁷ Once CERCLA’s web of liability attaches, its primary goal is attaining a “CERCLA Quality Clean-up” under CERCLA §105²⁶⁸ rather than ensuring equity in the division of costs.²⁶⁹ Because CERCLA coverage extends to releases and threatened releases alike, liability for a CERCLA site is not limited by any “quantity” of contamination added²⁷⁰ and CERCLA can apply in a variety of situations.²⁷¹

2. Response Options Under CERCLA

CERCLA provides multiple options in responding to hazardous substance contamination. First, under CERCLA §104, EPA could investigate and clean the site itself at its own expense and then sue to recover those expenses from liable parties under CERCLA §107.²⁷² This option is limited by design, as EPA may only utilize funds from the “Superfund”²⁷³ for removal actions—short-term solutions to stabilize a release or lessen the threat of a release of haz-

259. 42 U.S.C. §9604(a). *See also id.* §§9607(a), 9601(14). CERCLA defines “hazardous waste” in 42 U.S.C. §9601(14) by incorporation to other environmental statutes:

The term “hazardous substance” means (A) any substance designated pursuant to section 311(b)(2)(A) of the Federal Water Pollution Control Act, (B) any element, compound, mixture, solution, or substance designated pursuant to section 9602 of this title, (C) any hazardous waste having the characteristics identified under or listed pursuant to section 3001 of the Solid Waste Disposal Act (but not including any waste the regulation of which under the Solid Waste Disposal Act has been suspended by Act of Congress), (D) any toxic pollutant listed under section 307(a) of the Federal Water Pollution Control Act, (E) any hazardous air pollutant listed under section 112 of the Clean Air Act, and (F) any imminently hazardous chemical substance or mixture with respect to which the Administrator has taken action pursuant to section 7 of the Toxic Substances Control Act. The term does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically listed or designated as a hazardous substance under subparagraphs (A) through (F) of this paragraph, and the term does not include natural gas, natural gas liquids, liquefied natural gas, or synthetic gas usable for fuel (or mixtures of natural gas and such synthetic gas).

260. 42 U.S.C. §9607(a). *See also id.* §9601(9). CERCLA uses a broad definition for “facility,” considering almost any place that hazardous substances are located to be a facility for the purposes of CERCLA. Section 9601(9) states:

The term “facility” means (A) any building, structure, installation, equipment, pipe or pipeline (including any pipe into a sewer or publicly owned treatment works), well, pit, pond, lagoon, impoundment, ditch, landfill, storage container, motor vehicle, rolling stock, or aircraft, or (B) any site or area where a hazardous substance has been deposited, stored, disposed of, or placed, or otherwise come to be located; but does not include any consumer product in consumer use or any vessel.

261. *Id.* §§9604, 9606, 9607, 9622(a).

262. *Id.* §9606(a).

263. *United States v. Monsanto Co.*, 858 F.2d 160, 174 (4th Cir. 1988). *See also* 61C AM. JUR. 2D *Pollution Control* §1133:

The primary purposes of [CERCLA] are to provide for the prompt cleanup of hazardous-waste disposal sites and to impose the costs of such cleanup on those responsible for the contamination. The former, under the statutory scheme, must precede the latter. CERCLA, also known as the Superfund statute, was enacted to address the serious environmental and health risks posed by industrial pollution. However, it does not provide a general cause of action for all harm caused by toxic contaminants.

264. 42 U.S.C. §9601(32). *See also* *Burlington N. & Santa Fe Ry. Co. v. United States*, 556 U.S. 599, 608 (2009) (“CERCLA imposes strict liability for environmental contamination . . .”). *See also* *New York v. Shore Realty Corp.*, 759 F.2d 1032, 1042 (2d Cir. 1985):

Congress intended that responsible parties be held strictly liable, even though an explicit provision for strict liability was not included in the compromise. Section 9601(32) provides that “liability”

under CERCLA “shall be construed to be the standard of liability” under section 311 of the Clean Water Act, 33 U.S.C. §1321, which courts have held to be strict liability, *see, e.g.*, *Steuart Transportation Co. v. Allied Towing Corp.*, 596 F.2d 609, 613 (4th Cir. 1979), and which Congress understood to impose such liability, *see* S. Rep. No. 848, 96th Cong., 2d Sess. 34 (1980) . . .

265. 42 U.S.C. §9607(a)(4)(A).

266. *Atlantic Richfield Co. v. Christian*, 140 S. Ct. 1335, 1346 (2020) (quoting 42 U.S.C. §9613(f)(1)).

267. *O’Neil v. Picillo*, 883 F.2d 176, 178-79 (1st Cir. 1989) (internal citations omitted).

268. 42 U.S.C. §9605.

269. *See id.* §§9607, 9613(h). CERCLA was enacted to respond to orphan waste sites, and as such, places emphasis on making the soluble parties at the table pay out first under CERCLA §107, then provides a right for cost recovery for these paying parties to chase down others who are potentially jointly and severally liable.

270. *New York v. Shore Realty Corp.*, 759 F.2d 1032, 1045 (2d Cir. 1985).

271. *Id.* at 1042:

It is quite clear that if the current owner of a site could avoid liability merely by having purchased the site after chemical dumping had ceased, waste sites certainly would be sold, following the cessation of dumping, to new owners who could avoid the liability otherwise required by CERCLA. Congress had well in mind that persons who dump or store hazardous waste sometimes cannot be located or may be deceased or judgment-proof . . . We will not interpret section 9607(a) in any way that apparently frustrates the statute’s goals, in the absence of a specific congressional intention otherwise. *See* *Capitano v. Secretary of Health and Human Services*, 732 F.2d 1066, 1076 (2d Cir. 1984); *Bartok v. Boosey & Hawkes, Inc.*, 523 F.2d 941, 947 (2d Cir. 1975).

272. *See* 42 U.S.C. §§9604(a), 9607(a)(4)(A).

273. *Id.* §9611.

ardous substances²⁷⁴—unless the relevant facility is listed on the national priorities list (NPL),²⁷⁵ in line with CERCLA §105.²⁷⁶

It is critical to note that the NPL consists of the highest-priority facilities in the nation, “due to their ‘relative risk or danger to public health or welfare or the environment.’”²⁷⁷ Only when a facility makes its way onto the NPL can EPA order remedial actions—or actions aimed at creating a permanent remedy on top of removal actions.²⁷⁸ This is an important limitation, as it prohibits EPA from unilaterally taking the lead on, ordering, or otherwise forcing a cleanup of a site that is not on this priority list.²⁷⁹

Next, EPA’s second and third potential courses of action in a CERCLA matter both stem from CERCLA §106(a).²⁸⁰ The second course of action allows EPA to initiate a judicial abatement action to resolve a contamination issue, stating that EPA may “secure such relief as may be necessary to abate such danger or threat,” and vests jurisdiction to hear this form of challenge in the “district court of the United States in the district in which the threat occurs.”²⁸¹ CERCLA §106(a) then provides that the district court with jurisdiction over a CERCLA matter “shall have jurisdiction to grant such relief as the public interest and the equities of the case may require.”²⁸²

The third pathway provided to EPA states that “[t]he President [or Administrator of EPA] may also, after notice to the affected State, take other action under this section including, but not limited to, issuing such orders as may be necessary to protect public health and welfare and the environment.”²⁸³ This pathway is commonly referred to as a *unilateral administrative order* (UAO), and in a manner

unique to CERCLA, they are extraordinarily powerful.²⁸⁴ The major limitation upon EPA’s authority under CERCLA §106 stems from the language requiring a “determin[ation] that there may be an imminent and substantial endangerment to the public health or welfare or the environment.”²⁸⁵ However, this limitation has been read broadly by courts, embracing the concept that EPA does not have to prove either the “imminent and substantial endangerment,” nor that people are actually at risk.²⁸⁶

EPA’s fourth option is to pursue a settlement with PRPs under CERCLA §122.²⁸⁷ While this avenue is not particularly relevant to the discussion at hand, it is worth noting because settlement is a preferable method of resolving CERCLA matters for EPA for three reasons: (1) the bulk of the costs are absorbed by the PRP group upfront, leaving EPA to pay for little out of its own pocket; (2) the strength and harshness of CERCLA §106 actions serve as a strong incentive to encourage settlement; and (3) cleanups are initiated and completed faster when they are carried out by private parties.²⁸⁸ CERCLA’s statutory language further instructs EPA to enter into a settlement whenever a settlement is both in the public interest and consistent with the NCP.²⁸⁹ Upon agreement between PRPs, EPA, and the U.S. Department of Justice, the final agreement is lodged with the relevant district court as a consent decree,²⁹⁰ subject to an opportunity for community comment.²⁹¹

The bottom line remains the same: CERCLA is a reactive statute. Its central goals under §104 and the liability web spun by §107 each provide a limited application in which there can only be liability for a “release or threatened release” of a hazardous substance.²⁹² This is the first major limitation of CERCLA—that it is powerless to stop a crisis from unfolding beyond simply providing the potential for

274. *Id.* §9601(23):

The terms “remove” or “removal” means the cleanup or removal of released hazardous substances from the environment, such actions as may be necessary taken in the event of the threat of release of hazardous substances into the environment, such actions as may be necessary to monitor, assess, and evaluate the release or threat of release of hazardous substances, the disposal of removed material, or the taking of such other actions as may be necessary to prevent, minimize, or mitigate damage to the public health or welfare or to the environment, which may otherwise result from a release or threat of release. The term includes, in addition, without being limited to, security fencing or other measures to limit access, provision of alternative water supplies, temporary evacuation and housing of threatened individuals not otherwise provided for, action taken under section 9604(b) of this title, and any emergency assistance which may be provided under the Disaster Relief and Emergency Assistance Act.

275. 40 C.F.R. pt. 300 app. B (62 Fed. Reg. 15576 (Apr. 1, 1997)). See also U.S. EPA, *National Priorities List (NPL) Sites—by State*, <https://www.epa.gov/superfund/national-priorities-list-npl-sites-state> (last updated Oct. 7, 2024).

276. 42 U.S.C. §9604(a), 9605.

277. *Genuine Parts Co. v. U.S. Env’t Prot. Agency*, 890 F.3d 304, 341 (D.C. Cir. 2018) (quoting 42 U.S.C. §9605(a)(8)(A)).

278. 42 U.S.C. §9601(24).

279. *Id.* §9607(a)(4)(A). Notably, CERCLA §107 extends this same general cause of action to states and Indian tribes. However, for the purposes of this Article, this parallel cause of action is not fully relevant and thus not considered.

280. *Id.* §9606(a).

281. *Id.*

282. *Id.*

283. *Id.*

284. Under CERCLA §113(h)(2), UAOs are unchallengeable until EPA initiates a subsequent judicial enforcement action of the underlying order. 42 U.S.C. §9613(h). Further, the statute states that “[a]ny person who, *without sufficient cause*, willfully violates, or fails or refuses to comply with, any order” may be fined up to \$25,000 per day of continued violation or lack of action. *Id.* §9606(b)(1) (emphasis added).

285. 42 U.S.C. §9606(a).

286. *United States v. Conservation Chem. Co.*, 619 F. Supp. 162, 192 (W.D. Mo. 1985), *overruled in part on other grounds by United States v. Northeastern Pharm. & Chem. Co., Inc.*, 810 F.2d 726, 741 (8th Cir. 1986):

Examining the language of Section 106, it must be noted that the United States does not have to prove that an “imminent and substantial endangerment” actually exists. The statute clearly authorizes the United States to obtain relief when “there *may* be an imminent and substantial endangerment.” 42 U.S.C. §9606(a) (emphasis added). Secondly, the United States does not have to show that *people* may be endangered. Section 106(a) authorizes relief where there may be an endangerment to “the public health *or* welfare *or* the environment.” 42 U.S.C. §9606(a) (emphasis added).

See also *City of El Paso v. Reynolds*, 597 F. Supp. 694, 700 (D.N.M. 1984).

287. 42 U.S.C. §9622.

288. Memorandum from Lee M. Thomas, Assistant Administrator, EPA Office of Solid Waste and Emergency Response et al., to Regional Administrators, Regions I-X, Interim CERCLA Settlement Policy 3-4 (Dec. 5, 1984), <https://www.epa.gov/sites/default/files/2013-10/documents/cerc-settlmnt-mem.pdf>.

289. 42 U.S.C. §9622(a).

290. *Id.* §9622(d)(1)(A).

291. *Id.* §9622(d)(2)(B).

292. *Id.* §9604, 9607(a)(4).

a costly cleanup, if liability can be assigned at all. All CERCLA can (and should) do is react.

3. The Limitations of CERCLA: Timing and Applicability

The framework of CERCLA largely accomplishes what Congress set out for it to do—clean up contaminated facilities.²⁹³ However, these successes are not without their faults. There have been notable drawbacks with this arrangement, considering that Portland Harbor Superfund Site, for example, has been listed since December 2000 and is still awaiting the initial stages of remedial action as of May 2024.²⁹⁴ Further, of the 1,340 sites listed on the NPL as of 2024, 996 were listed before the year 2000.²⁹⁵ Yes, CERCLA can lead to eventual cleanup. But in the interim, there is continued exposure and relatively little ability for individuals outside EPA and the PRP pool to provide input. Even when there is an opportunity for community comment, it is within EPA discretion to ignore everything.²⁹⁶

While CERCLA is enough to deter some large corporations from environmentally destructive practices, it has not and will not function to halt electronic cigarette manufacturers' actions, largely because they usually escape CERCLA's net of "covered persons."²⁹⁷ CERCLA does little, if anything, to help avert future contamination other than the staggering potential for CERCLA financial liability.²⁹⁸ So, if electronic cigarette manufacturers escape liability, why would they bother changing their business model? CERCLA lays out four categories of "covered persons":

(1) the current owner and operator of a site; (2) the past owner and operator of the site when hazardous substances came to be located there; (3) anyone who "arranged for disposal or treatment" of the substances at that site; and (4) any transporter who selected the site.²⁹⁹

CERCLA §101(21) defines a "person" broadly to include "[a]ny individual, firm, corporation, association, partnership, consortium, joint venture, commercial entity, United States Government, State, Municipality, commission, political subdivision of a State, or any interstate body."³⁰⁰ Under this definition, CERCLA can apply to seemingly any entity that causes or contributes to a threatened release of contamination within a facility.³⁰¹ But CERCLA was designed with a dumpsite such as Love Canal—a true environmental nightmare—in mind, where hazardous substances came to rest in conglomerated and comingled situations.³⁰² Applying CERCLA to the contamination caused by electronic cigarette waste is not so straightforward, as CERCLA's framework of covered persons is not designed to manage the diffuse waste problem electronic cigarettes create while in the hands of millions of consumers.

Under the four categories of covered persons spelled out by CERCLA, the only potentially applicable category to a manufacturer of an electronic cigarette—beyond contamination of its own manufacturing plant—is as an arranger for disposal or treatment.³⁰³ Although electronic cigarettes can be considered hazardous wastes under RCRA, and thus hazardous substances under CERCLA,³⁰⁴ the application of CERCLA is blocked by the nature of the sale of an electronic cigarette and its pathway into the environment. Because electronic cigarette manufacturers are selling a product, and not seeking to dispose of a waste, the nature of the sale vitiates the application of CERCLA to electronic cigarette manufacturers as an arrangement for disposal.³⁰⁵

Unfortunately, this limitation on the application of CERCLA stems from Supreme Court precedent. In *Burlington Northern & Santa Fe Railway Co. v. United States*, the Court wrote:

It is plain from the language of the statute that CERCLA liability would attach under §9607(a)(3) if an entity were to enter into a transaction for the sole pur-

293. See U.S. EPA, *Superfund Success Stories*, <https://www.epa.gov/superfund/superfund-success-stories> (last updated Oct. 8, 2024) (includes external links to cleanups for the Hudson River PCB crisis, the Celotex Corporation, Eureka Mills, Libby Asbestos, the Rocky Mountain Arsenal, and Hanford Nuclear).

294. See National Priorities List for Uncontrolled Hazardous Waste Sites, 65 Fed. Reg. 75179 (Dec. 1, 2000). See also 40 C.F.R. pt. 300. See also U.S. EPA, *Portland Harbor Superfund Site: Connecting to the Willamette River*, <https://storymaps.arcgis.com/stories/ab89faf239624854a5b9c7723f1c43da> (last visited Jan. 12, 2025). See also U.S. EPA, *PORTLAND HARBOR SUPERFUND SITE UPDATES* (2022), <https://semsub.epa.gov/work/10/100427828.pdf> (showing the current status of the cleanup at various project locations—none are past 30% remedial design completion).

295. U.S. EPA, *supra* note 275. See also 40 C.F.R. pt. 300 app. B (62 Fed. Reg. 15576 (Apr. 1, 1997)).

296. U.S. EPA REGION 10, *PORTLAND HARBOR SUPERFUND SITE, PORTLAND, OREGON: EXPLANATION OF SIGNIFICANT DIFFERENCES* §2, at 2-1 (2019), <https://semsub.epa.gov/work/10/100194028.pdf>. See also U.S. EPA, *Portland Harbor Superfund Site: Final Explanation of Significant Differences at 2* (Dec. 2019), <https://semsub.epa.gov/work/10/100193522.pdf> (for the proposition that the public comments received were contrary to the eventual modification of the record of decision for the Portland Harbor Superfund Site).

297. 42 U.S.C. §9607(a)(1)-(4).

298. See Laurel Adams, *EPA Superfund Cleanup Costs Outstrip Funding*, CTR. FOR PUB. INTEGRITY (Feb. 22, 2011), <https://publicintegrity.org/environment/epa-superfund-cleanup-costs-outstrip-funding/>. See also U.S. GOVERNMENT ACCOUNTABILITY OFFICE, *GAO-10-380, SUPERFUND: EPA'S ESTIMATED COSTS TO REMEDIATE EXISTING SITES EXCEED CURRENT FUNDING LEVELS, AND MORE SITES ARE EXPECTED TO BE ADDED TO THE NATIONAL PRIORITIES LIST* (2010), <https://www.gao.gov/assets/gao-10-380.pdf> ("In the past decade, EPA allocated \$243 million per year for Superfund cleanup. It estimates \$335 million to \$681 million per year will be needed for future cleanup.")

299. 42 U.S.C. §9607(a)(1)-(4).

300. *Id.* §9601(a).

301. See Eckardt C. Beck, *The Love Canal Tragedy*, EPA J. (Jan. 1979), <https://www.epa.gov/archive/epa/aboutepa/love-canal-tragedy.html> (This is an archived post by the EPA Region 2 Administrator from 1977-1979. On an observational note, this web of liability is potent. As applied to a context like Love Canal, this formulation fits perfectly. Love Canal was "an industrial dump, [with] 82 different compounds, 11 of them suspected carcinogens, [which] have been percolating upward through the soil, their drum containers rotting and leaching their contents into the backyards and basements of 100 homes and a public school built on the banks of the canal.")

302. *Id.* See also U.S. EPA, *supra* note 252. See also BROWN & O'REILLY, *supra* note 161, at 607.

303. 42 U.S.C. §9607(a)(3).

304. *Id.* §9601(14)(B).

305. See generally *Burlington N. & Santa Fe Ry. Co. v. United States*, 556 U.S. 599 (2009).

pose of discarding a used and no longer useful hazardous substance. It is similarly clear that an entity could not be held liable as an arranger merely for selling a new and useful product if the purchaser of that product later, and unbeknownst to the seller, disposed of the product in a way that led to contamination.³⁰⁶

In *Burlington Northern*, the Court was posed with a factual situation in which defendant Shell Oil sold pesticides and other chemical products to defendant Brown and Bryant (B&B), a lessee of Burlington Northern's property.³⁰⁷ According to the facts presented, Shell Oil was aware that spills of these chemicals were commonplace upon each transfer of these chemicals from its carriers to B&B's storage tanks.³⁰⁸

While the U.S. government argued that Shell Oil should be liable as an "arranger for the disposal of hazardous substances" given its knowledge of spills and leaks with each delivery,³⁰⁹ the Supreme Court found otherwise. Justice John Paul Stevens, writing for the majority, opined that

knowledge alone is insufficient to prove that an entity "planned for" the disposal, particularly when the disposal occurs as a peripheral result of the legitimate sale of an unused, useful product. In order to qualify as an arranger, Shell must have entered into the sale of D-D with the intention that at least a portion of the product be disposed of during the transfer process by one or more of the methods described in §6903(3).³¹⁰

Due to the primary thrust being the sale of a good, and not an "arrangement for disposal," Shell Oil was found not liable for the contamination on Burlington's property.³¹¹

Unfortunately, this case becomes a central (and chilling) lesson for the application of CERCLA to electronic cigarette contamination. Because tobacco companies are selling a product rather than arranging for the disposal of a waste, applying CERCLA's net of liability is unlikely to snare tobacco companies nor electronic cigarette manufacturers. Under the logic of *Burlington Northern*, the purchaser—and not the manufacturer—would be liable for the resulting contamination from electronic cigarette waste. However, as discussed in the next subsection, even the individual electronic cigarette user is unlikely to face liability for their contamination.

4. Liability for Electronic Cigarette Waste Under CERCLA

So, who is liable for electronic cigarette waste contamination, if not the company benefitting from the sale of these

devices? Is it the individual consumer of such a product? According to CERCLA §107(p), the individual consumer will not be held accountable either.³¹² Section 107(p) embodies CERCLA's "municipal solid waste exemption," which provides a carve-out from CERCLA liability for (1) all owners, operators, or lessees of "residential property from which all of the person's municipal solid waste was generated with respect to the facility"; (2) a small business entity having employed no more than 100 people over the preceding three years; and (3) tax-exempt 501(c)(3) nonprofit organizations.³¹³ While this protection is not absolute,³¹⁴ the diffuse nature of electronic cigarette waste contamination means that the individual user will not be held personally liable under CERCLA §107 for the contamination they created.

Given the potential expense of such a cleanup, this exclusion makes sense from a policy standpoint. Individuals are unlikely to have the sort of capital necessary to satisfy even a small CERCLA removal action. While states are insulated from CERCLA liability through their exclusion from the definition of "person" under CERCLA §101(21),³¹⁵ municipalities are not exempt.³¹⁶

For instance, in *New Jersey Department of Environmental Protection & Energy v. Gloucester Environmental Management Services*, a landfill owned by the township of Gloucester, New Jersey, came to be highly contaminated, earning a spot on the NPL.³¹⁷ Gloucester argued that it had contributed only municipal solid waste to the landfill at issue, which it argued contained only "incidental amounts of hazardous substances arising from household products."³¹⁸ Thus, the municipality moved to dismiss the case as a matter of law, due to the municipal waste exemption under CERCLA.³¹⁹ However, the U.S. District Court for the District of New Jersey definitively held against the municipality, stating "a municipality that has generated or arranged for the disposal of municipal solid wastes at a facility may be liable under CERCLA §107(a)(3) for an equitable share of responsibility."³²⁰ Thus, should any action under CERCLA become necessary to abate a release or threatened release from electronic cigarette waste in a facility, the municipality and every taxpayer within it could be liable.

In all, CERCLA covers existing or soon to exist contamination, and creates a liability structure necessary to remediate and remove contaminants. However, CERCLA's remedial thrust does little to abate future or budding contamination issues, especially in the case of diffuse and

306. *Id.* at 609-10 (internal citations omitted).

307. *Id.* at 602-03.

308. *Id.* at 604.

309. *Id.* at 611-12.

310. *Id.* at 612.

311. *Id.* at 613.

312. 42 U.S.C. §9607(p).

313. *Id.* §9607(p)(1)(A)-(C).

314. *See generally id.* §9607(p)(2) (providing exceptions to the municipal waste exemption for, inter alia, municipal waste that "contributed significantly or could contribute significantly . . . to the cost of the response action or natural resource restoration with respect to the facility").

315. *See id.* §9601(21). *See also* BROWN & O'REILLY, *supra* note 161, at 760.

316. *See* 42 U.S.C. §9607(a). *See also* New Jersey Dep't of Env't Prot. & Energy v. Gloucester Env't Mgmt. Servs., Inc., 821 F. Supp. 999, 1004 (D.N.J. 1993).

See also BROWN & O'REILLY, *supra* note 161, §9:56, at 760.

317. 719 F. Supp. 325, 328 (D.N.J. 1989).

318. *Gloucester Env't Mgmt. Servs., Inc.*, 821 F. Supp. at 1004.

319. *Id.*

320. *Id.* at 1008-09.

scattered contamination stemming from consumer products. Because CERCLA's liability scheme centers upon the nexus of contaminant and place of contamination, the overarching liability scheme employed does not cleanly apply to the manufacture or sale of many consumer products. With both RCRA and CERCLA fully fleshed out, it is clear that the problem of electronic cigarette waste has not been addressed by federal statute.

C. *The Gap: Hazardous Waste Statutes and Electronic Cigarettes*

In short, RCRA regulates “waste generation and disposal,” while CERCLA “looks back and tries to clean up waste that was buried or left behind through actions that ceased years ago.”³²¹ While these two statutes are highly tailored to the specific congressional concerns that motivated their passage, they are not tailored to address nuisance products that pass from producer to consumer to “waste.” On the RCRA side, the central importance of the statutory definition of “solid waste” artificially limits the Act's scope to “discarded material[s].”³²² From the line of RCRA cases that hold only materials that have been intended to be waste fall within either the regulatory or statutory purview, RCRA is incapable of addressing spent electronic cigarettes until after they have been generated, used as a product, then discarded.

However, even when RCRA does attach to an e-cigarette, the diffuse nature of the contamination (entering the environment from the hands of millions of consumers rather than from a concentrated point source), compounded on top of the household waste exemption,³²³ creates a pollutant source that is regulatorily difficult to control. Individuals will almost always fall outside the scope of regulation,³²⁴ while only centralized localities (like retailers of electronic cigarettes or schools where these devices are used and discarded) may fall under RCRA's generator status and could then incur liability.³²⁵ But for these centralized localities, there is seemingly no regulatory control over the mass manufacture and distribution of electronic cigarettes under modern hazardous waste laws.

Likewise, CERCLA is incapable of mitigating the budding waste crisis from electronic cigarettes because of its backward-looking scope. CERCLA is toothless until its jurisdictional statement is satisfied, requiring a release or

threatened release,³²⁶ of a hazardous substance,³²⁷ from a facility.³²⁸ Then, even if such a release is to occur, only the four listed categories of “covered persons” under CERCLA §107 will be held liable for their share of the cleanup.³²⁹

While CERCLA liability, under this framework, would attach to an electronic cigarette manufacturing plant contaminated with the constituent components,³³⁰ this liability of the manufacturer would not extend to contamination of a convenience store, which bought electronic cigarettes to then sell to consumers.³³¹ The liability of the convenience store would similarly cease once the electronic cigarette is sold to its final consumer, who is in turn protected from liability by CERCLA §107(p).³³² Theoretically, if the sale of a disposable electronic cigarette could be considered an “arrangement for disposal,” then the manufacturer or convenience store selling the product could be liable.³³³ But as the Supreme Court has clarified, knowledge of disposal is not sufficient to evoke CERCLA jurisdiction when such an outcome is only “peripheral” to the legitimate sale of a good, making this line of liability highly unlikely.³³⁴

As a result, our current regime protects electronic cigarette manufacturers from liability for the toxic products they peddle. Under RCRA, electronic cigarette manufacturers are free to mass-manufacture and sell their products without regard to what will become of them. When a response is finally necessary under CERCLA, the liability web of CERCLA §107 imposes liability on parties other than the manufacturers and those profiting from the sale of electronic cigarettes because the transaction is viewed as a sale of a product, and not an arrangement for disposal.³³⁵ And due to the various exclusions like the municipal solid waste exemption,³³⁶ individual electronic cigarette consumers will not bear the direct brunt of their contamination; instead, that cost will be spread out throughout their entire community of taxpayers.

This liability structure is deeply inequitable, because the corporations profiting off of the sale of the devices will escape liability for electronic cigarette contamination latently in the environment while the users who directly used the products contaminating the facility will have their share of the contamination redistributed across all the individuals who never partook—in contravention of CERCLA's “polluter-pays” motto.³³⁷ In the end, all taxpayers will be collectively on the hook for the price of cleanup.

321. BROWN & O'REILLY, *supra* note 161, §9:1, at 589.

322. 42 U.S.C. §6903(27).

323. *Id.* §6921(j). See also 40 C.F.R. §261.4(b).

324. See 40 C.F.R. §§261, 262.14. See also OR. REV. STAT. §459.412: Definition for ORS 459.411 to 459.417. As used in ORS 459.411 to 459.417, “conditionally exempt small quantity generator” means a person who generates a hazardous waste but is conditionally exempt from certain regulations because the waste is generated in quantities below the threshold adopted by the Environmental Quality Commission pursuant to ORS 466.020. [1993 c.560 §49].

325. See OHA, MANAGEMENT OF E-CIGARETTE WASTE FOR RETAILERS, *supra* note 12; OHA, MANAGEMENT OF E-CIGARETTE WASTE FOR SCHOOLS, *supra* note 12.

326. CERCLA §104(a) (42 U.S.C. §9604(a)).

327. CERCLA §107(a) (42 U.S.C. §9607(a)).

328. *Id.*

329. 42 U.S.C. §9607(a)(1)-(4).

330. *Id.* See also *United States v. Bestfoods*, 524 U.S. 51, 55 (1998).

331. *Burlington N. & Santa Fe Ry. Co. v. United States*, 556 U.S. 599, 611-12 (2009).

332. 42 U.S.C. §9607(p).

333. *Id.* §9607(a)(3).

334. *Burlington N. & Santa Fe Ry.*, 556 U.S. at 611-12.

335. See generally *id.*

336. 42 U.S.C. §9607(p).

337. See Memorandum from John Peter Suarez, Assistant Administrator, EPA Office of Enforcement and Compliance Assurance & Marianne Lamont Horinko, Assistant Administrator, EPA Office of Solid Waste and Emergency Response, to EPA Regional Administrators, Enforcement First for Remedial Action at Superfund Sites (Sept. 20, 2022), <https://semspub.epa>

Society will quite literally pay the price of continued inaction regarding electronic cigarettes.

IV. Proposed Solutions

The solution to the problem caused by mass production of electronic cigarettes comes from catching the issue before it begins: amending our hazardous waste regime, at the federal and state levels, to mitigate and eliminate the use of “disposable” products, especially disposable electronic cigarettes. Because of the way we currently conceptualize waste, and by extension hazardous waste, we have left ourselves open to nuisance products like electronic cigarettes. A good start is extending producer responsibility for the wastes that are generated.³³⁸

While some states, including Oregon, have embraced such a strategy,³³⁹ these regimes assume that there will be a use or method of recycling available for products once they are waste. As we have seen, this is not the case for electronic cigarettes.³⁴⁰ Thus, there must be an incentive to curb production. Moving forward, legal waste regimes must be amended—from back-end “management” of generated hazardous waste (“back-end regulations”)³⁴¹ to forward-looking regulations on products sold in the U.S. market (“front-end regulations”). The clear starting point for this change is adding a regulatory control for products sold as disposable.

Though the background painted here is grim, this does not have to be reality. Both sides of this issue are entirely created by human beings, from the waste we collectively accept to the laws that regulate how this waste is handled and who is liable when response is necessary. While this tidal wave of electronic cigarette waste has its roots in the acceptance of and rabid political support for consumer choice in purchasing,³⁴² there seems to be an equally strong policy argument favoring regulation based on the inevitability of nonconsumers being forced to live within a contaminated and degraded ecosystem.

At the federal level, Congress should implement a NEPA-style review for all products regulated by federal entities and sold as “disposable.”³⁴³ In this way, Congress would place the decisionmaking authority over the sale of potential nuisance products in the hands of agency experts, rather than in the self-interested hands of industry.³⁴⁴ However, noting that congressional action on this matter is

unlikely in the near future,³⁴⁵ state legislatures should enact their own legislation to remedy the issue of electronic cigarette waste as soon as possible.

To do so, states should update or enact *producer responsibility* statutes to include manufacturers of disposable products, beginning with electronic cigarettes.³⁴⁶ Through this, states would be able to force producers of nuisance and disposable products to internalize the cost of disposal. However, because the reclamation of products like electronic cigarettes solves only part of the problem, states should seek to impose strict liability on manufacturers of disposable products, ensuring that any excess damages caused will be placed on the parties responsible for causing them.

At the state level, legislatures can still enact change despite federal silence on electronic cigarette waste. In the sections below, Oregon recycling and waste law and policy is considered exclusively. In my second year of law school, I began interning in the office of State Sen. Lew Frederick—a senior state senator who introduced me to a wide array of Oregon-specific policy areas. Amongst these were Oregon’s strong producer responsibility requirements, enshrined in Oregon Revised Statutes Chapter 459A.

Striving to “think globally and act locally,” the discussion here of Oregon law was originally intended to provide lawmakers and lobbyists with conceptual guidance on how to effectuate immediate protections around electronic cigarette waste in Oregon. But these lessons are readily applicable in any jurisdiction within the United States, simply depending on the strength of the jurisdiction’s existing producer responsibility statutes. As discussed below, a stronger preexisting program will mean easier legislative action.

A. What Has Been Done to Address Nuisance Products in Oregon?

By now, it should be clear that back-end regulation of electronic cigarettes is problematic for various reasons: from the nature of collective acceptance of “waste”; the difficulties in defining “waste”; and even defining who the responsible party ought to be. All in all, it is inequitable to continue in this fashion, as those who benefit the most from the sale of electronic cigarettes will likely not be liable to pay for the damage. An electronic cigarette will have multiple owners throughout its useable life cycle.³⁴⁷ And due to the various limitations of our hazardous waste regimes, this pathway from producer to consumer to environment remains a viable method for corporations to evade liability for their products, as shown through the case study of electronic cigarettes.

gov/work/HQ/101588.pdf (enforcement guidance document explaining the polluter-pays principle for CERCLA).

338. Hendlin, *supra* note 76.

339. See generally OR. REV. STAT. §§459A.300-975 (specific recycling requirements).

340. PUBLIC HEALTH LAW CENTER AT MITCHELL HAMLINE SCHOOL OF LAW, *supra* note 22.

341. See AP, *supra* note 20. “Back-end regulation” here means controlling waste once created and not providing guidance on the process of manufacture. Essentially, back-end regulation assumes that we can properly manage waste once in existence—which is not the case for spent electronic cigarettes.

342. Consumer Choice Center, *From Smoking to Vaping*, <https://consumerchoicecenter.org/from-smoking-to-vaping/> (last visited Jan. 12, 2025).

343. See Section IV.B.1.

344. *Id.*

345. LoCascio et al., *supra* note 31.

346. Juleen Lam et al., *Modeling the Global Economic Costs of Tobacco Product Waste*, 100 BULL. WORLD HEALTH ORG. 620, 621 (2022), <https://pmc.ncbi.nlm.nih.gov/articles/PMC9511662/> (for the proposition that other researchers have suggested utilizing electronic cigarette refundable deposits and producer responsibility as a potential method of addressing electronic cigarette waste).

347. ABBING, *supra* note 107, at 122 (comparing an electronic cigarette to the plastic bottle described by this source).

1. Manufacturing and Recycling Mandates for Covered Electronic Devices

In Oregon, the primary method of controlling nuisance electronic products is the use of specific recycling requirements.³⁴⁸ In deciding to subject the manufacture of certain electronic devices to specific recycling requirements, the Oregon Legislature found that “1) [i]t is necessary to encourage the design of electronic devices that are more resource-efficient, more recyclable and less environmentally toxic . . . and 3) [a] statewide collection, transportation and recycling system should be financed by manufacturers of those electronic devices.”³⁴⁹ As such, the Oregon Legislature subjects manufacturers of “covered electronic devices”³⁵⁰ to specific recycling requirements for manufacturing electronic products.³⁵¹

This mandate, fleshed out by Oregon Revised Statutes §459A.320, states that to sell their products such manufacturers must permanently mark their products with their brand and include the brand name within a report filed to the Oregon Department of Environmental Quality (DEQ) under §459A.320.³⁵² Manufacturers must pay an annual fee to Oregon DEQ, with a maximum fee of \$15,000 imposed on “manufacturers selling more than one percent of the total number of units of covered electronic devices sold in this state the previous calendar year.”³⁵³

Manufacturers must further submit a “manufacturer program plan” in line with §459A.320, which includes (1) a plan for statewide collection of its covered products; (2) “environmentally sound management practices to collect, transport and recycle covered electronic devices”; (3) advertising and promoting these collection opportunities, on a regular basis; and (4) conveniently locating its drop sites, “in every county in this state and at least one collection site for any city with a population of at least 10,000.”³⁵⁴ Further mandates of the manufacturer’s program plan include studies of the number of covered devices it sells and receives (including weight and brand name) and

a requirement to document details of how this plan was carried out in previous years.³⁵⁵

While this program is strong in its application to traditional electronic waste, it is inapplicable to electronic cigarette waste due to the statute’s definition of “covered electronic devices.”³⁵⁶ Under this statute, “covered electronic devices” are computers, monitors, televisions, and computer accessories.³⁵⁷ And while electronic cigarettes do not fit neatly under any of the enumerated categories, they arguably do fit under one of the exemptions to this definition: “[c]overed electronic device’ does not include: . . . (C) [t]elephones or personal digital assistants of any type unless the telephone or personal digital assistant contains a viewable area greater than four inches measured diagonally[.]”³⁵⁸ While some electronic cigarettes (notably, the second- and third-generation tank mods) do contain small digital readouts, none would contain a screen larger than four inches diagonally. But even if they did, as has been discussed, electronic cigarettes cannot be readily recycled due to the latent nicotine contamination they contain.³⁵⁹

The waste has already been created and would either have to be incinerated or land applied.³⁶⁰ Because these recycling mandates constitute another back-end regulatory approach on waste rather than a front-end regulation on manufacturing design or disposability, added recycling requirements will not avert the electronic cigarette waste crisis. Unless this structure is expanded to encompass a bar on the manufacture of disposable electronic cigarettes, and arguably electronic cigarettes generally, mandated recycling will not solve the electronic cigarette waste issue.

2. Producer Responsibility Organizations Generally

Beyond the recycling mandates for electronic devices, Oregon has also codified a more generalized “producer responsibility program” within Oregon Revised Statutes Chapter 459A.³⁶¹ Prefacing this plan, the Oregon Legislature notes several sharp changes in the way Oregonians handle waste:

The way Oregon’s residents use and consume materials and products, and the way residents manage them when no longer wanted, has changed significantly in the 35 years since Oregon’s first recycling programs were established, that the state’s recycling policies were not designed to address such changes, and that these factors have created unintended consequences, such as the deterioration of natural systems regionally and worldwide, as well as increased levels of pollution, greenhouse gas

348. OR. REV. STAT. §§459A.300-.365.

349. *Id.* §459A.300.

350. *Id.* §459A.305(4)(a) (Defines “covered electronic device” as “(A) A computer monitor of any type having a viewable area greater than four inches measured diagonally; (B) A desktop computer or portable computer; (C) A television; (D) A computer peripheral; or (E) A printer.” This section goes on to exclude certain products under §459A.305(4)(b), stating:

“Covered electronic device” does not include: (A) Any part of a motor vehicle; (B) Any part of a larger piece of equipment designed and intended for use in an industrial, commercial or medical setting, such as diagnostic, monitoring or control equipment; (C) Telephones or personal digital assistants of any type unless the telephone or personal digital assistant contains a viewable area greater than four inches measured diagonally; or (D) Any part of a clothes washer, clothes dryer, refrigerator, freezer, microwave oven, conventional oven or range, dishwasher, room air conditioner, dehumidifier or air purifier.

351. *Id.* §459A.310(1), (3).

352. *Id.* §459A.310(3).

353. *Id.* §459A.315(2)(b)(A).

354. *Id.* §459A.320(2).

355. *Id.* §459A.320(3)(e)(A), (C).

356. *Id.* §459A.305(4).

357. *Id.* §459A.305(4)(a).

358. *Id.* §459A.305(4)(b).

359. See PUBLIC HEALTH LAW CENTER AT MITCHELL HAMLINE SCHOOL OF LAW, *supra* note 22. See also AP, *supra* note 20.

360. PUBLIC HEALTH LAW CENTER AT MITCHELL HAMLINE SCHOOL OF LAW, *supra* note 22.

361. OR. REV. STAT. §§459A.860-.975.

emissions that contribute to global climate change and reductions in human well-being, especially for the most vulnerable populations.³⁶²

The Oregon Legislature declared it the policy of the state to “prioritize practices that prevent and reduce the negative environmental, social, economic and health impacts of production, consumption and end-of-use management of products and packaging across their life cycle, and that it is the obligation of producers to share in the responsibility to reduce those impacts.”³⁶³ If a manufacturer’s products fall under this statute, they are to “join a producer responsibility organization that administers a producer responsibility program,”³⁶⁴ pay an annual membership fee calculated in line with Oregon Revised Statutes §459A.884,³⁶⁵ keep records of the products sold, and so on.³⁶⁶ However, the central thrust of the producer responsibility program centers on the producer’s obligations to work with recyclers to ensure recycling “by responsible end markets.”³⁶⁷

Unfortunately, this producer responsibility plan similarly fails to address electronic cigarette waste. Like the electronic device recycling mandates previously discussed, the focus of the producer responsibility organization is to “ensure, to the extent practicable, that covered products covered by a recycling collection service are recycled by responsible end markets.”³⁶⁸ Again, with electronic cigarettes, there is no ability to recycle the waste (or even a virgin product) because it has been contaminated with nicotine.³⁶⁹

And yet, even if this were not the case, the definition of a “covered product” for purposes of a producer responsibility organization extends only to packaging, printing and writing paper, and food service ware.³⁷⁰ Although the unfilled plastic shell of an electronic cigarette alone (without any other constituent part) may fall within the loose definition of “packaging,” the section proceeds to exclude “packaging and paper products sold or supplied in connection with . . . nonprescription drugs as defined in ORS [Oregon Revised Statutes] 689.005.”³⁷¹ Because electronic cigarettes would likely fit within this category of “drugs [that] may be sold without a prescription and that are packaged for use by the consumer and labeled in accordance with the requirements of the statutes and regulations of the state and the federal government,”³⁷² electronic cigarettes seemingly escape this pathway too.

362. *Id.* §459A.860(2).

363. *Id.* §459A.860(4).

364. *Id.* §459A.869(1).

365. *Id.* §459A.869(5)(a).

366. *Id.* §459A.869(5)(b).

367. *Id.* §459A.869(7).

368. *Id.*

369. AP, *supra* note 20.

370. OR. REV. STAT. §459A.863(6)(a).

371. *Id.* §459A.863(6)(b)(M)(ii).

372. *Id.* §689.005(23).

3. Analysis of Current Oregon Regimes

Because neither of the two potentially applicable state-level waste programs effectively controls the issue of electronic cigarette waste, it is clear that new legislation is needed. While specific producer responsibility programs in Oregon have been applied to mattresses,³⁷³ drug take-back programs,³⁷⁴ newsprint and directories,³⁷⁵ glass,³⁷⁶ compost,³⁷⁷ mercury,³⁷⁸ and plastics,³⁷⁹ these organizations seem to only stem the tide of our waste epidemic—not seek to solve it. In the case of plastics, for instance, petrochemical companies have known for decades that “the vast majority of [their] plastics cannot be recycled—meaning that they cannot be [effectively] collected, processed, and remanufactured into new products.”³⁸⁰ Despite this truth, plastics manufacturers and petrochemical companies alike have utilized tactics of persuasion (and fraud) to lull consumers into a false sense of security that plastic recycling remains viable.³⁸¹

And after so many rounds of corporate malfeasance and outright lies in pursuit of economic self-interest from petrochemical companies,³⁸² tobacco companies,³⁸³ automobile manufacturers,³⁸⁴ and pharmaceutical companies,³⁸⁵ why should we expect any different from the future? It is

373. *Id.* §§459A.150–.189.

374. *Id.* §§459A.200–.266. Although e-cigarettes could fit within this section too, the problem that the waste has already been created remains. Nicotine-contaminated devices are unlikely candidates for recycling, let alone reuse. So, with the waste already created, application of this section creates the same outcome as described for the electronic device recycling requirements under Oregon Revised Statutes §459A.300.

While Oregon presently allows for electronic cigarettes to be accepted at drug take-back facilities, in line with national policy provided by the U.S. Drug Enforcement Administration (DEA), “vaping devices and cartridges will be accepted, provided the lithium batteries are removed.” Press Release, DEA, DEA Hosts the 27th National Prescription Drug Take Back Day on Saturday to Remove Unneeded Medications From Homes (Oct. 25, 2024), <https://www.dea.gov/press-releases/2024/10/25/dea-hosts-27th-national-prescription-drug-take-back-day-saturday-remove>. In the present age of single-use electronic cigarettes (vaping devices), the removal of the battery requires breaking the device open, exposing the toxic nicotine juice to the environment. Though this is one pathway to proper disposal under current regulations, we need better front-end regulation to keep these devices from being mass-manufactured to begin with.

375. OR. REV. STAT. §§459A.500–.520.

376. *Id.* §459A.550.

377. *Id.* §§459A.600–.620.

378. *Id.* §459A.630.

379. *Id.* §§459A.650–.665.

380. ALLEN ET AL., *supra* note 109, at 2.

381. *Id.* at 28.

382. *Id.* See also Complaint, City of Chi. v. BP, P.L.C., No. 2024CH01024 (Ill. Cir. Ct. filed Feb. 20, 2024) (for the proposition that major cities are suing Big Oil companies for their promulgation of climate change denial).

383. See Greenberg, *supra* note 66, at 781–83.

384. See Colin Marshall, *Story of Cities #29: Los Angeles and the “Great American Streetcar Scandal,”* GUARDIAN (Apr. 25, 2016), <https://www.theguardian.com/cities/2016/apr/25/story-cities-los-angeles-great-american-streetcar-scandal>.

385. See generally CHADHI NABHAN, TOXIC EXPOSURE: THE TRUE STORY BEHIND THE MONSANTO TRIALS AND THE SEARCH FOR JUSTICE (2023) (for the proposition that Monsanto knew glyphosate (Roundup) was carcinogenic, and fought to cover up this information). See also PATRICK RADDEN KEEFE, EMPIRE OF PAIN: THE SECRET HISTORY OF THE SACKLER DYNASTY (2021) (for the proposition that Purdue Pharma sold OxyContin as an everyday pain killer, while simultaneously covering up the fact that it had immense addictive and overdose potential). See also THE DEVIL WE KNOW (Stonebois Entertainment 2018) (for the proposition that the chemical manufacturer 3M sold its proprietary “C8” as a safe nonstick coating, despite disastrous health impacts, including birth defects and cancer).

time to move away from a reactive take on waste, like that embodied by producer responsibility organizations and recycling mandates,³⁸⁶ and begin to apply a proactive regulatory approach to the waste we generate. Because of their nicotine content and internal contamination, electronic cigarettes cannot be viably recycled.³⁸⁷ As such, applying a recycling mandate or take-back program will do little to solve the waste crisis electronic cigarettes present—beyond reconcentrating the waste for incineration. If we are to solve this crisis, a starting point would be the regulation of consumer products marketed as disposable.

B. Proposed Management of Disposable Consumer Products

Modern American waste management focuses on exactly what it claims: managing waste. Electronic cigarettes are only the latest in a long line of nicotine replacement technologies, each of which generates some waste. According to the American Cancer Society, alternative forms of nicotine replacement therapies (NRTs)—which include patches, gums, nasal sprays, inhalers, and lozenges—all provide methods to substitute a smoker’s nicotine intake from other methods (like traditional cigarettes).³⁸⁸ From a policy standpoint, even though there will be some residual waste contaminated by nicotine in each of the preceding NRT forms, the relatively small quantity remaining post-use, compounded by the limited recommended duration of use, logically lends itself to a more controlled waste problem.

While the American Cancer Society does not provide a recommended timeline for stopping the use of nicotine lozenges, this form of NRT is almost completely unlikely to contribute to nicotine contamination as the NRT dissolves through its use.³⁸⁹ When looking at even the most analogous comparison—between electronic cigarettes and nicotine inhalers—the American Cancer Society states that “[n]icotine inhalers are the FDA-approved nicotine replacement method that’s most like smoking a cigarette, which some people trying to quit find helpful. *They are not the same as electronic cigarettes, which are not approved by the FDA to help people quit smoking.*”³⁹⁰ In shaping policy around electronic cigarettes and NRT devices, both the impact of the devices’ entire life-span to both the individual user as well as the perpetual impact to society at large should be considered and balanced. Not all NRT forms are created equal.

All this to say that, from a policy standpoint, there are alternatives to electronic cigarettes that do not produce the same waste at the end of the product’s usable life-span. This assertion is bolstered by the limited advisable usage time-

line for NRT. According to the American Cancer Society, NRT is only meant as a temporary bridge between smoking and nonsmoking—with maximum recommended usage periods ranging between three to five months for nicotine patches, and six months for nicotine gum, nicotine nasal spray, and nicotine inhalers.³⁹¹

In the case of electronic cigarettes, with a propensity for heightened addiction and continual use, this balancing act would cut against mass manufacture due to the sheer amount of hazardous waste the use of electronic cigarettes presents. Here, electronic cigarettes contrast against other forms of NRT, as NRT products are intended for a limited duration of recommended use (smoking cessation). This short durational use combined with the minimal remaining wastes from NRT products shows a less problematic consumable product. Thus, electronic cigarettes comprise a redundant, and unnecessary, waste stream.

Black’s Law Dictionary defines the term “disposable” as “[i]ntended to be used but once, usu[ally] for a short time, and then discarded.”³⁹² Because of the limitations of the ecosystem in which we live, and the constraints it presents, we must align “disposability” with the confines of hazardous waste law. While some products will necessarily need to be made disposable, such as medical devices, many others do not need to be disposable and so should not be.³⁹³

1. Federal-Level Policy Proposal

At the federal level, RCRA is not designed to control a hazardous waste crisis stemming from consumer waste. Leaving the issue of electronic cigarette waste unaddressed until it becomes a CERCLA matter leads to vastly inequitable results. While both statutes provide guidance for handling waste once produced and how to deal with present or imminent contamination, they have no authority over certain budding waste streams, like electronic cigarettes. Because Congress has the constitutional authority to regulate interstate commerce under the Commerce Clause,³⁹⁴ Congress could craft a comprehensive strategy to control nuisance consumer products, including disposable consumer products.

Other authors, notably Justine Fuga, have suggested Congress accomplish this goal through ideas like “trading public nuisance for product safety,” by reviving the U.S. Office of Technology Assessment within the U.S. Patent and Trademark Office as a new Technology Assessment Division, providing a clear front-end regulation of products sold.³⁹⁵ By utilizing the Office of Technology Assessment to “conduct . . . one-to-two-year technology assessment stud[ies] on potentially hazardous consumer products,”

386. See generally OR. REV. STAT. ch. 459A.

387. See GUTTERMAN, *supra* note 13 (“Currently, there is no standardized way to recycle e-cigarettes in the U.S.”). See also PUBLIC HEALTH LAW CENTER AT MITCHELL HAMLINE SCHOOL OF LAW, *supra* note 22; AP, *supra* note 20.

388. American Cancer Society, *supra* note 41.

389. CDC, *Tips From Former Smokers*, <https://www.cdc.gov/tobacco/campaign/tips/index.html> (last reviewed Feb. 5, 2024).

390. American Cancer Society, *supra* note 41 (emphasis added).

391. *Id.*

392. *Disposable*, BLACK’S LAW DICTIONARY (11th ed. 2019). See also MERRIAM-WEBSTER ONLINE DICTIONARY, *Disposable*, <https://www.merriam-webster.com/dictionary/disposable> (last visited Jan. 12, 2025) (“2: designed to be used once or only a limited number of times and then thrown away”).

393. American Cancer Society, *supra* note 41.

394. U.S. CONST. art. I, §8, cl. 3.

395. Justine Fuga, *Trading Public Nuisance for Product Safety: Reviving the Office of Technology Assessment*, 13 DREXEL L. REV. 489, 489 (2021).

Fuga argues that the United States would be able to screen out potentially hazardous devices and products before they hit the market.³⁹⁶

Fuga further argues that the Technology Assessment Division would be able to prioritize their assessments by filtering the numbers of patent applications submitted within a particular area of manufacture, the ubiquity of the technology in everyday life, and the availability of evidence to confirm or verify the product's safety.³⁹⁷ Ultimately, she theorizes that the implementation of the Technology Assessment Division would “break the epidemic cycle of public nuisance products” through a front-end institutionalized filter, which would be able to avert nuisance products before they hit the market.³⁹⁸

While the idea of reviving a single office to watch over products with the potential to pose a hazardous nuisance should be seriously assessed, we need to break free from the siloing of the regulatory state. This same siloing led to the specific problem of electronic cigarettes, as there was collective reliance on FDA to ensure “product safety” for electronic cigarettes with no environmental analysis nor input from the lead agency in charge of environmental protection—EPA.³⁹⁹ Due to FDA's limited purview, this safety review looked only at the issue of providing a method of quitting smoking for current tobacco users while at the same time keeping the devices away from children.⁴⁰⁰ But in “solving” one issue, FDA made other aspects of the electronic cigarette crisis far worse, specifically by incentivizing the rise of the single-use electronic cigarette over reusable versions.⁴⁰¹ While Fuga's suggestion provides that one office would be in charge of determining whether a product poses hazardous threats if mass-manufactured and distributed, this burden is heavy even in the abstract.

Instead, introducing a governmentwide mandate analogous to NEPA⁴⁰² would create a system in which this regulatory burden is spread across the government. Under NEPA, whenever a federal agency makes any “recommendation or report on . . . major federal actions significantly affecting the quality of the human environment,” the agency must compile a “detailed statement [environmental impact statement (EIS)].”⁴⁰³ This EIS must contain information about all “reasonably foreseeable” impacts of the proposed action, specify adverse impacts from the project that are not avoidable, provide a “reasonable range of alternatives to the proposed agency action,” provide a comparison of the short- and long-term benefits and detriments of the proposed action, and specify “irreversible and irretrievable

commitments of federal resources . . . involved in the proposed agency action.”⁴⁰⁴

If an agency is unsure whether their action rises to the level of a “major federal action significantly affecting the quality of the human environment,”⁴⁰⁵ an agency must prepare an EA.⁴⁰⁶ According to Council on Environmental Quality regulations, an EA must “[b]riefly provide sufficient evidence and analysis for determining whether to prepare an [EIS] or a finding of no significant impact[,]” as well as a description for the need, environmental impacts, and alternatives to the proposed action.⁴⁰⁷ Finally, the current basis (and limitation) of NEPA comes down to the “hard look” mandate.⁴⁰⁸ In essence, an agency sufficiently meets NEPA's “hard look” requirement if the administrative record compiled for the project is “‘founded on a reasoned evaluation of relevant factors.’”⁴⁰⁹

A federal statute applied to the federal regulation and authorization of products could function similarly to the NEPA structure, with the notable change to a substantive mandate as opposed to NEPA's procedural mandate.⁴¹⁰ In passing a product review statute that is more than a simple procedural mandate,⁴¹¹ Congress should require permitting agencies to compare the constituent pieces of any disposable products with current hazardous waste regimes, including CERCLA and RCRA. Such a review would follow the model generally set forward by NEPA regarding the preparation of an EIS, including all “reasonably foreseeable” impacts from the mass manufacture of a proposed device as well as alternatives to the proposal. However, unlike NEPA, should this review result in a potential for nuisance hazardous waste like in the case of electronic cigarettes, the action agency must have veto power over mass manufacture and distribution.⁴¹²

This mandate should apply any time a device is authorized by a federal regulatory board, if the device will be sold as disposable.⁴¹³ By establishing such a federal mandate, agency experts would be in the position to determine what kinds of contaminants are readily available and pushed through the waste stream, rather than a self-interested corporation. This review must ultimately assess whether there is a potential for contamination were the product in the hands of millions of consumers. It must similarly ana-

396. *Id.* at 522.

397. *Id.*

398. *Id.* at 524.

399. See CENTER FOR TOBACCO PRODUCTS, *supra* note 140. See also Perrone, *supra* note 143 (for the proposition that FDA's regulations and enforcement guidance led to a runaway waste problem, with no clear input from EPA).

400. Perrone, *supra* note 143.

401. *Id.*

402. 42 U.S.C. §§4321 et seq.

403. *Id.* §4332(C).

404. *Id.* §4332(C)(i)-(v).

405. *Id.*

406. 40 C.F.R. §1501.3.

407. *Id.* §1501.5(c).

408. See 42 U.S.C. §4332(2)(C). See also Price Rd. Neighborhood Ass'n, Inc. v. U.S. Dep't of Transp., 113 F.3d 1505, 1509 (9th Cir. 1997) (“NEPA requires an agency to take a ‘hard look’ at the potential environmental consequences of proposed projects before taking action.”); Baltimore Gas & Elec. Co. v. Natural Res. Def. Council, 462 U.S. 87, 97 (1983).

409. Marsh v. Oregon Nat. Res. Council, 490 U.S. 360, 378 (1989) (relevant factors are those enumerated by NEPA for consideration in the process of EA or EIS compilation).

410. See Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 351 (1989) (“Other statutes may impose substantive environmental obligations on federal agencies, but NEPA merely prohibits uninformed—rather than unwise—agency action.”).

411. *Id.*

412. *Id.*

413. *Disposable*, BLACK'S LAW DICTIONARY (11th ed. 2019) (“Intended to be used but once, usu[ally] for a short time, and then discarded.”).

lyze pathways to rectify the contamination or methods to impose liability on the manufacturer for any environmental harm their product causes.

2. State-Level Policy Proposal

RCRA scholars note that, due to the process of legislating, RCRA embodies a seemingly irrational system that is “acknowledged to be broken but will not be fixed until warring factions of Washington’s environmental regulation and industrial communities can agree.”⁴¹⁴ And because CERCLA is designed to remedy contamination, rather than stop it from occurring, the regulatory gap between our prominent hazardous waste statutes has allowed electronic cigarette waste to reach a crisis point.⁴¹⁵ Given the recent track record of Congress, states should not assume—nor hope—that Congress will address the gap in hazardous waste law anytime soon.⁴¹⁶

At the state level, Oregon should update both its electronics recycling mandates⁴¹⁷ and its producer responsibility organizations⁴¹⁸ to apply to electronic cigarettes and their waste. Ideally, these would apply to all consumer products that are sold as disposable. In this way, the state of Oregon (and any other state following Oregon’s lead) would begin to place the onus of tracking and dealing with nuisance products like electronic cigarettes on those who are (1) deciding how their products will be built and used, and (2) profiting from their sales. In this way, consumers are protected from fraudulent claims of disposability.

However, as noted, producer responsibility programs and recycling mandates only go so far, especially as applied to products like electronic cigarettes, which need to be incinerated.⁴¹⁹ As such, this mandate for coverage of disposable consumer products should extend strict liability to the manufacturer for any and all disposable consumer products. From a policy standpoint, the application of strict liability to disposable products, like disposable electronic cigarettes, would have the effect of ratcheting down production, while not outright banning it. If a manufacturer truly believed that the best way to proceed would be to mass-manufacture such devices, they would remain liable for *all* externalities wrought by their devices—regardless of how the product finally wound up in the environment causing contamination. For a model of this standard of

liability, a state like Oregon could look to the standard of liability under CERCLA §107.⁴²⁰

V. Conclusion

In terms of economic importance, “e-waste is worth at least \$62.5 billion annually, which is more than the gross domestic product of most countries. . . . In the right hands, however, it could be worth considerably more.”⁴²¹ Comparatively, the value of the waste from small consumer items, like electronic cigarettes, hairdryers, and speakers, is roughly \$9 billion per year.⁴²² Thus, by averting the creation of needless waste, our society can preserve vital resources and limit the impact of waste.

In 2025, the electronic cigarette market is predicted to generate \$27.2 billion worldwide and \$9.395 billion in the United States.⁴²³ Meanwhile, Juleen Lam et al. note that, in 2020, the cost to the United States from tobacco product waste generally (including both electronic and traditional cigarette waste) was \$265 million.⁴²⁴ Without reform, manufacturers of electronic cigarettes have no responsibility to clean up the contamination their products cause, while profiting from further sales. Essentially, from an economic standpoint, controlling electronic cigarette waste is a justice issue.

However, even if the economics of waste did not cut strongly enough against our current single-directional economy, the fact that the concept of waste is a uniquely human invention should.⁴²⁵ “In nature waste equals food. Always. Even ‘waste’ discharged by humans and other animals is food for other organisms. They break this material down into benign, usable nutrients.”⁴²⁶

This ecological lesson forms a background against which we can compare “disposable” electronic cigarettes. Electronic cigarettes are not only waste but contain constituents that are toxic and hazardous according to U.S. hazardous waste laws. And with millions of electronic cigarettes churned out each month and sold to consumers,⁴²⁷ no way to recycle the spent devices,⁴²⁸ and incineration being

414. BROUN & O’REILLY, *supra* note 161, at 22.

415. *Burlington N. & Santa Fe Ry. Co. v. United States*, 556 U.S. 599, 602 (2009) (quoting *Consolidated Edison Co. of N.Y. v. UGI Utils., Inc.*, 423 F.3d 90, 94 (2d Cir. 2005)). See also Ducharme, *supra* note 19.

416. LoCascio et al., *supra* note 31. Compare CTP Newsroom, *FDA Warns Online Retailers to Stop Selling Illegal E-Cigarettes Popular Among Youth*, FDA (Dec. 13, 2023), <https://www.fda.gov/tobacco-products/ctp-newsroom/fda-warns-online-retailers-stop-selling-illegal-e-cigarettes-popular-among-youth>, with CENTER FOR TOBACCO PRODUCTS, *supra* note 140 (for the proposition that FDA is still trying to control illegal sales of electronic cigarettes to children, even after three years of their enforcement priority guidance).

417. OR. REV. STAT. §§459A.300-.365.

418. *Id.* §§459A.860-.975.

419. AB, *supra* note 20.

420. See 42 U.S.C. §9607. See also *id.* §9601(32). See also *Burlington N. & Santa Fe Ry. Co.*, 556 U.S. at 608 (“CERCLA imposes strict liability for environmental contamination[.]”). See also *New York v. Shore Realty Corp.*, 759 F.2d 1032, 1042 (2d Cir. 1985).

421. GARAM BEL ET AL., WORLD ECONOMIC FORUM, A NEW CIRCULAR VISION FOR ELECTRONICS: TIME FOR A GLOBAL REBOOT 6 (2019) (citing CORNELIS P. BALDÉ ET AL., UNITED NATIONS UNIVERSITY ET AL., THE GLOBAL E-WASTE MONITOR 2017 (2017)).

422. Zahra Khan, *Disposable Vapes Contribute to Nearly \$10 Billion of “Invisible” E-Waste Every Year*, CHEMISTRY WORLD (Oct. 13, 2023), <https://www.chemistryworld.com/news/disposable-vapes-contribute-to-nearly-10-billion-of-invisible-e-waste-every-year/4018234.article>.

423. Statista, *E-Cigarettes—Worldwide*, <https://www.statista.com/outlook/cmo/tobacco-products/e-cigarettes/worldwide> (last visited Jan. 26, 2025). According to Statista, “[t]he E-Cigarettes market is projected to generate a revenue of US \$27.2 [billion] in 2025.”

424. Lam et al., *supra* note 346, tbl.1.

425. Mike Kensler, *Director’s Corner: Waste? Humans Invented It. Nature Never Heard of It.*, AUBURN UNIV. OFF. SUSTAINABILITY (Apr. 7, 2016), <https://sustain.auburn.edu/dc-waste/>.

426. *Id.*

427. CDC FOUNDATION, *supra* note 10.

428. GUTTERMAN, *supra* note 13 (“Currently, there is no standardized way to recycle e-cigarettes in the U.S.”).

the most commonly practiced RCRA-compliant method of handling the waste (once it is waste),⁴²⁹ electronic cigarette waste is an unfolding crisis.

While in some contexts waste is an inevitability, as in the medical field due to patient safety and infection control, electronic cigarettes are an unnecessary evil, especially when compared against other forms of NRTs.⁴³⁰ “Material consumption has been increasing faster than increases in population, indicating that it is not driven by population growth but by the current model of economic development based on consumerism and industrial mass production.”⁴³¹ Electronic cigarettes are mass-produced, consumer electronic devices, with hazardous constituent parts that create a near impossibility of reuse or recycling.⁴³²

Because the problem of electronic cigarette waste presents the nexus of the question posed by excessive production and inevitable waste, electronic cigarettes form a case study of a disposable product that should be discontinued due to their disproportionate impacts compared to other products and the lack of accountability by those creating the devices. Not only are electronic cigarettes composed of components individually classifiable as hazardous waste, but they are commonly marketed and sold under the guise of being “disposable.”⁴³³ This is a sham. Labeling an electronic cigarette as disposable does not change its nature. This contamination has occurred in plain view, obscured only by communal acceptance of the phenomenon of “trash.”

In a finite world, with limited resources and immense interconnectivity between all of its inhabitants, the management of “waste” can only do so much. As Garrett Hardin famously postulated, waste is the example of a “reverse tragedy of the commons,” in which rational self-interest drives the degradation of the “commons,” our earth, through the sheer social acceptance of waste.⁴³⁴ Hardin explains:

Here it is not a question of taking something out of the commons, but of putting something in—sewage or chemical, radioactive, and heat wastes into water; noxious and dangerous fumes into the air; and distracting and

unpleasant advertising signs into the line of sight. The calculations of utility are much the same as before. The rational [person] finds that [their] share of the cost of the wastes [they] discharge[] into the commons is less than the cost of purifying [their] wastes before releasing them. Since this is true for everyone, we are locked into a system of “fouling our own nest,” so long as we behave only as independent, rational, free-enterprisers.⁴³⁵

We must introduce a mechanism by which to control the mass manufacture and distribution of disposable consumer products. Through local, state, and federal legal reforms, our current waste management processes can be amended to do just this. Through the application of a NEPA-style review to federally regulated and authorized products, we can escape from the siloed regulatory state that put us in this situation in the first place. And through concerted state action, even in the absence of federal legislation, states can begin to control the issue of nuisance electronic cigarette waste, before allowing it to become a CERCLA problem.

Our planet is as much a part of us as we are of it. The interconnected nature of the food chain is irrefutable proof that humankind cannot be separate from our surroundings any more so than our surroundings’ ability to be free of humans and our incredible impact. In the era of the Anthropocene,⁴³⁶ “a new geological epoch . . . characterized by the reality that human activity—not nature—is the dominant force transforming the physical world,” one species is now capable of shaping planetary ecosystems and their flow.

Business as usual has created a situation in which the life-support systems humans have relied upon throughout our evolutionary process are disappearing. Our food chain is contaminated by products, especially plastic, which we rely on for pure convenience—lulled into a false sense of security through corporate deceit.⁴³⁷ In order to alter this dynamic moving forward, we must collectively change our acceptance of the waste stream. If we do not begin to wake up to this reality, we just may run out of resources or wind up buried in our own refuse.⁴³⁸

429. AP, *supra* note 20. See also PUBLIC HEALTH LAW CENTER AT MITCHELL HAMLINE SCHOOL OF LAW, *supra* note 22.

430. American Cancer Society, *supra* note 41.

431. Nikolaos Voulvoulis, *Transitioning to a Sustainable Circular Economy: The Transformation Required to Decouple Growth From Environmental Degradation*, 3 FRONTIERS SUSTAINABILITY 1, 2 (2022).

432. GUTTERMAN, *supra* note 13.

433. Erdiaw-Kwasie & Abunyewah, *supra* note 99.

434. Garrett Hardin, *The Tragedy of the Commons: The Population Problem Has No Technical Solution; It Requires a Fundamental Extension in Morality*, 162 SCIENCE 1243, 1245 (1968).

435. *Id.* Hardin’s philosophy describes the root of the waste crisis—a collective acceptance of the concept of waste. However, even his own writing implicitly accepts the concept of waste, as he describes a choice between costs of releasing treated and untreated wastes. While Hardin’s writing is a good starting point for a discussion of the drivers of resource degradation, it is critical to balance his point of view with the suggestion that in our world there is no true “waste.”

436. John G. Sprankling, *Property Law for the Anthropocene Era*, 59 ARIZ. L. REV. 737, 737 (2017).

437. See generally ALLEN ET AL., *supra* note 109 (for the proposition that not only do plastics contaminate everything we eat, drink, and breathe, but they have been known to do so for at least the past 30 years; recycling is not a viable method of dealing with plastic waste, and plastic manufacturers knew it and sold it anyway).

438. See WALL-E (Walt Disney Pictures & Pixar Animation Studios 2008).