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Marisa D. Pescatore

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THE ENVIRONMENTAL IMPACT OF TECHNOLOGICAL INNOVATION: HOW U.S. LEGISLATION FAILS TO HANDLE ELECTRONIC WASTE'S RAPID GROWTH

"The U.S. has always been the elephant in the room that nobody wants to talk about . . . Until it decides to play a part, we can't really solve the problem of e-waste shipments."[1]

I. Sparks Fly: An Introduction to Electronic Waste and the Laws Surrounding its Disposal

Benjamin Franklin took a kite out on a stormy afternoon in 1752, curious to discover more about a mysterious phenomenon known as "electricity."[2] Since then, inventors have used electricity to improve everyday aspects of human life.[3] From Thomas Edison's invention of the light bulb and Alexander Graham Bell's telephone to the modern advent of the cell phone, electricity has been used to advance technology, an unimaginable evolution to those living in 1752.[4]

Devices that use electricity to work are electronic devices, or "electronics."[5] Electronic waste is generated when electronics "have

1. Brook Larmer, *E-Waste Offers an Economic Opportunity as Well as Toxicity*, N.Y. Times Mag. (July 5, 2018), https://www.nytimes.com/2018/07/05/magazine/e-waste-offers-an-economic-opportunity-as-well-as-toxicity.html (quoting Deepali Sinha Khetriwal, United Nations University research associate). The United Nations University is a global think tank established by the United Nations responsible for researching important global problems, including the environment. *United Nations University*, U.N. Global Marketplace, https://www.ungm.org/Shared/KnowledgeCenter/Pages/UNU (last visited Oct. 13, 2020) (describing history and role of United Nations University).

2. *See, e.g.*, Nancy Gupton, *Benjamin Franklin and The Kite Experiment*, Franklin Inst. (June 12, 2017), https://www.fi.edu/benjamin-franklin/kite-key-experiment (discussing story about Benjamin Franklin "discovering" electricity).

3. *See 35 Inventions That Changed The World*, Interesting Eng'g (Nov. 25, 2016), https://interestingengineering.com/35-inventions-that-changed-the-world (noting transistors, refrigerators, televisions, and computers as world-changing inventions).

4. *Id.* (discussing Thomas Edison and Alexander Graham Bell's contribution to technological innovation).

5. *See Electronics*, Merriam-Webster, https://www.merriam-webster.com/dictionary/electronics (last visited Oct. 4, 2020) (defining electronics as "[A] branch of physics that deals with the emission, behavior, and effects of electrons (as in electron tubes and transistors) and with electronic devices").

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exhausted their utility value" and are no longer used.[6] It is important to note that electronic waste is considered hazardous waste because it contains toxic materials that can damage human health and the environment.[7] Electronic waste, however, is unlike other types of hazardous waste because it also contains recoverable, precious resources in addition to its toxic materials.[8]

The combination of toxic materials and valuable resources found in electronic waste complicates its disposal.[9] Recycling and recovering the valuable materials, while disposing of the hazardous ones, must be done in a way that protects humans and the environment.[10] But under the current legal landscape, electronic waste often falls in the hands of parties ill-equipped to manage the recycling and recovery process safely.[11]

This Comment explores the unforeseen consequences of electronic innovation on the environment, especially in developing parts of the world.[12] This Comment also discusses the relevant state and federal policies and laws that address the effects of electronic waste, both nationally and internationally.[13] Finally, this Comment analyzes the flaws and strengths of the state and federal policies addressing electronic waste, as well as other potential alternatives.[14]

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6. *See* Gitanjali Nain Gill, *Electronic waste*, ENCYCLOPEDIA BRITANNICA, https://www.britannica.com/technology/electronic-waste (last visited Oct. 4, 2020) (defining electronic waste and discussing its characteristics and impact).

7. *See Learn the Basics of Hazardous Waste*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/hw/learn-basics-hazardous-waste (last visited Oct. 4, 2020) (defining hazardous waste under Resource Conservation and Recovery Act (RCRA)).

8. For a discussion of the materials found in electronic waste, see *infra* notes 31-40 and accompanying text.

9. For a discussion of the hazards of electronic waste recycling and collection of the valuable materials, see *infra* notes 31-40 and accompanying text.

10. For a discussion of electronic waste recycling's impact on human health and the environment, see *infra* notes 31-95 and accompanying text.

11. For a discussion of current electronic waste legislation, see *infra* notes 42-114 and accompanying text. Furthermore, for a discussion of how current legislation has led to disposal in foreign countries, see *infra* notes 145-95 and accompanying text.

12. For a discussion of the increase in electronic innovation and use, see *infra* notes 15-23 and accompanying text.

13. For a discussion of current policies and laws addressing electronic waste, see *infra* notes 42-137 and accompanying text.

14. For a discussion of the issues with the current laws and policies, see *infra* notes 138-92 and accompanying text.

II. BURIED IN CIRCUITRY: A BACKGROUND ON THE RAPID GROWTH OF ELECTRONIC WASTE

The emergence of technologies such as smartphones and smartwatches — which have replaced other traditionally non-technological items — has been principally responsible for the rise in electronic use.[15] Developing countries have also started to utilize electronics as they have become cheaper and more accessible.[16] Large technology companies, like Amazon and Google, are rushing to develop the best of these cutting-edge devices in their quest to gain market dominance.[17] Smart home products, like doorbells equipped with cameras that stream to the owner's smartphone and speakers that act as an assistant in addition to playing music, are just some of the many emerging technologies becoming increasingly prevalent in households.[18] These products can make people's lives easier and safer, but come at a cost.[19]

New versions of smartphones and other devices are coming out more quickly than ever before.[20] Many consumers discard their

15. *See generally What Is the Growth Rate of the Electronics Sector?*, INVESTOPEDIA (Feb. 5, 2020), https://www.investopedia.com/ask/answers/052515/what-growth-rate-electronics-sector.asp (noting rise in prevalence of consumer electronics globally). "Within the consumer electronics sector, companies that focus on emerging technology are driving significant growth and include manufacturers of smartwatches, smart home products, and smart speakers." *Id.* (attributing growth in electronic device market to development of smart products).

16. *See E-waste Rises 8% by Weight in 2 Years as Incomes Rise, Prices Fall*, U.N. UNIV. (Dec. 14, 2017), https://unu.edu/media-relations/releases/ewaste-rises-8-percent-by-weight-in-2-years.html (noting effect of rising income and lower device prices on rise in electronic waste). "Falling prices now make electronic and electrical devices affordable for most people worldwide while encouraging early equipment replacement or new acquisitions in wealthier countries." *Id.* (noting new affordability of technology previously too expensive for many people to own).

17. Matthew Lane, *How Competitive Is the Tech Industry?*, DISRUPTIVE COMPETITION PROJECT (July 29, 2019), http://www.project-disco.org/competition/072919-how-competitive-is-the-tech-industry/ (noting various technology companies' competition within industry).

18. *See, e.g.*, AJ Dellinger & Denny Arar, *Facebook's Portal video-calling smart display is now available internationally*, DIG. TRENDS (Apr. 30, 2019), https://www.digitaltrends.com/home/facebook-portal/ (discussing Facebook Portal's new international availability and Amazon Alexa smart speakers). *See also* Mike Prospero, *What Is a Smart Refrigerator, and Is It Worth It?*, TOM'S GUIDE (Mar. 26, 2019), https://www.tomsguide.com/us/what-is-a-smart-refrigerator,review-6307.html/ (describing new smart refrigerator technology); Megan Wollerton, *Best video doorbell cameras of 2020*, CNET (Oct. 2, 2020, 4:00 AM), https://www.cnet.com/news/best-video-doorbell-cameras-of-2020/ (ranking best video doorbells).

19. For a discussion on the negative impact electronic waste can have on the environment and human health, see *infra* notes 33-40 and accompanying text.

20. *See* Alana Semuels, *The World Has an E-Waste Problem*, TIME (May 23, 2019, 6:27 AM), https://time.com/5594380/world-electronic-waste-problem/ (discussing modern technologies that make thousands of devices obsolete at once). "5G promises faster speeds and other benefits. But experts say it will also result in a

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old, yet usable, devices for the new, shiny versions whenever given the opportunity.[21] Some consumers discard their old devices in the garbage, meaning the devices reach regular landfills.[22] In contrast, other consumers choose to take their devices directly to recycling centers or return them to their manufacturers through designated trade-in programs.[23] The worldwide rise of electronics use, concurrent with shorter device lives, has subsequently increased electronic waste.[24] Electronic waste, sometimes referred to as e-waste, is defined as "electric and electronic equipment that have ceased to be of value to their users or no longer satisfy their original purpose."[25]

In 2016, "the yearly accumulation [of electronic waste worldwide] reached 49.3 million tons," and experts predict this number will continue to rise.[26] Moreover, only a fraction of global e-waste – barely twenty percent in 2016 – is collected and recycled.[27] The U.S. produced 6.9 million tons of electronic waste in 2016, amounting to forty-two pounds per person, making it the second-largest

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dramatic increase in e-waste, as millions of smartphones, modems and other gadgets incompatible with 5G networks are made obsolete." *Id.* (noting how upgrades in smartphone networks will render incompatible devices unusable).

21. *Id.* (discussing how consumers buy new products before products they own stop working).

> Americans spent $71 billion on telephone and communication equipment in 2017, nearly five times what they spent in 2010 even when adjusted for inflation, according to the Bureau of Economic Analysis. (Apple alone sold 60 million iPhones domestically last year, according to Counterpoint Research.) When we buy something new, we get rid of what's old. That cycle of consumption has made electronics waste the world's fastest-growing solid-waste stream.

Id. (explaining why electronic waste has grown rapidly in recent years).

22. *See id.* (noting consumer role in electronic waste recycling). "Many consumers, paralyzed by the hassle or put off by the expense, simply throw their devices into the trash or stash them in a drawer, hoping they'll just disappear." *See id.* (explaining why many consumers tend to throw electronic devices in trash instead of recycling).

23. *See id.* (describing options when consumers want to dispose of electronic devices).

24. *See E-waste Rises 8% by Weight in 2 Years as Incomes Rise, Prices Fall*, *supra* note 16 (noting effect of rising income and lower device prices on rise in electronic waste).

25. Gill, *supra* note 6 (defining electronic waste).

26. Larmer, *supra* note 1 (citing global think tank tracking problem). 49.3 million tons is "enough to fill more than a million 18-wheel trucks stretching from New York to Bangkok and back." *Id.* (giving visual depiction of 49.3 million tons).

27. *Id.* (noting small portion of electronic waste recycled). "The fate of the rest [of the electronic waste] is largely unknown. Only 41 nations compile e-waste statistics, and their partial data can't keep up with the expansion of electronic devices into so many consumer categories — toys and toilets, watches and refrigerators." *Id.* (recognizing lack of data on electronic waste disposal).

electronic waste producer behind China.[28] In comparison, European countries generated significantly less electronic waste than the U.S. and recycled approximately thirty-five percent of their electronic waste, far higher than the recycling rate in the U.S.[29]

III. A LOOK INTO THE CIRCUIT BOX: WHAT IS INSIDE ELECTRONIC DEVICES?

Because new technology is being released at a rapid pace with a shorter device lifespan, it is necessary to find a way to manage the disposal of old devices safely.[30] Electronic waste's hazardous nature, therefore, is a paramount concern when developing protocols for electronic device disposal.[31] Further, unlike other types of hazardous waste, electronic waste contains highly valuable resources that can be reused if recycled properly.[32]

The hazardous materials found in electronics are both directly and indirectly harmful to humans.[33] Direct long-term exposure to substances found in electronic devices – such as lead, mercury, and flame retardants – can harm the nervous system, kidneys, and other bodily systems.[34] In addition to direct harm to the human body, environmental contamination caused by unsuitable disposal methods may lead to future exposure and related health issues.[35]

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28. *Id.* (detailing amount of electronic waste produced in U.S.). "[E]-waste makes up just 2 percent of the total volume in American landfills — but more than two-thirds of heavy metals." *Id.* (highlighting high volume of hazardous materials found in small amount of electronic waste); Felix Richter, *These Countries Generate the Most Electronic Waste*, STATISTICA (Dec. 14, 2017), https://www.statista.com/chart/2283/electronic-waste/ (noting China and U.S. as biggest electronic waste producers).

29. *See* Larmer, *supra* note 1 (comparing Europe and U.S. electronic waste recycling). *See also* Richter, *supra* note 28 (depicting electronic waste generated in some European countries).

30. *See* Maura Keller, *E-WASTE RECYCLING LEGISLATION RULES 25 STATES*, AM. RECYCLER (Aug. 2019), https://americanrecycler.com/8568759/index.php/news/electronics-recycling/3868-e-waste-recycling-legislation-rules-25-states (discussing state government advancement of legislation regarding electronic waste).

31. *See generally* Santhanam Needhidasan, ET AL., *Electronic waste – an emerging threat to the environment of urban India*, 12 J. ENVTL. HEALTH SCI. & ENG'G (2014) (relaying electronic waste's health risks).

32. *See id.* (recognizing valuable materials found in electronics).

33. *See id.* (laying out data showing effects of electronic waste's hazardous materials on human health).

34. *See id.* (describing hazardous materials' negative health effects on multiple body systems).

35. *Id.* (noting "long lasting effects" of electronic waste on environment).

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Aside from harmful materials, there are valuable resources and materials present in electronics.[36] For example, three of the rarest elements – gold, neodymium, and indium – are used in small quantities in a wide range of electronics including cell phones, LCD screens, and hard drives.[37] The Environmental Protection Agency (EPA) notes that "for every million cell phones . . . recycle[d], 35 thousand pounds of copper, 772 pounds of silver, 75 pounds of gold and 33 pounds of palladium can be recovered."[38] Additionally, repurposing disposed electronic devices can realize savings on energy costs and resources.[39] According to experts, just "the raw materials contained in e-waste were worth roughly $61 billion in 2016 . . . ."[40]

IV. CROSSED WIRES: U.S. FEDERAL ELECTRONIC WASTE LEGISLATION AND POLICIES

While the federal government does not have a specific law addressing electronic waste recycling, the Resource Conservation and Recovery Act (RCRA) does govern certain aspects of hazardous material disposal.[41] RCRA's governance of electronic waste, however, is limited in scope and the current federal scheme is insufficient to address the rapid growth of electronic waste.[42] This section explores current federal legislation and policies that regulate electronic waste, including executive policy, the Resource Conservation and Recovery Act, and the Basel Convention.[43]

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36. *See* Swiss Federal Laboratories for Materials Science and Technology, *Rare metals from e-waste*, PHYS.ORG (Jan. 10, 2019), https://phys.org/news/2019-01-rare-metals-e-waste.html (discussing value of rare metals found in electronics).

37. *Id.* (reciting electronics where valuable materials are found).

38. *See Electronics Donation and Recycling*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/recycle/electronics-donation-and-recycling (last visited Oct. 8, 2020) (listing quantities of valuable metals recovered from recycling cell phones).

39. *Id.* (noting amount of energy saved by recycling electronics).

40. *See* Larmer, *supra* note 1 (quoting global research institute United Nations University). "[T]he raw materials contained in e-waste were worth roughly sixty-one billion dollars in 2016, more than the gross domestic product of even middle-income countries like Croatia or Costa Rica." *Id.* (considering high worth of materials found in electronic waste).

41. *See generally* Resource Conservation and Recovery Act, 42 U.S.C. § 6901 *et seq.* (1976) (introducing federal statute that permits EPA to regulate hazardous solid waste). For a discussion of RCRA in the context of electronic waste, see *infra* notes 54-92 and accompanying text.

42. For a discussion of the dearth of effective federal legislation, see *infra* notes 93-99 and accompanying text.

43. For a discussion of the current laws and policies involving electronic waste, see *infra* notes 44-92 and accompanying text.

A. Executive Policy

In 2011, U.S. President Barack Obama collaborated with sixteen federal departments and agencies, as well as members of the electronics and recycling industries, to address the growing electronic waste issue by launching the National Strategy for Electronics Stewardship (NSES).[44] The NSES aims to:

1. Build incentives for design of environmentally preferable electronics and enhance science, research, and technology development in the United States.
2. Ensure that the federal government leads by example.
3. Increase safe and effective management and handling of used electronics in the United States.
4. Reduce harm from U.S. exports of electronics waste (e-waste) and improve handling of used electronics in developing countries.[45]

In 2015, President Obama signed an Executive Order entitled Planning for Federal Sustainability in the Next Decade.[46] This general instruction to the federal government included an initiative to continue implementation of the NSES.[47] Further, electronics companies were encouraged to partner with the EPA to promote corporate and consumer electronics recycling with recyclers who are certifiably environmentally-friendly.[48] Although it is important to incentivize businesses and promote safe recycling, the Executive Order's initiative was not binding and did not ensure that parties would comply.[49]

B. The Resource Conservation and Recovery Act

Despite no law specifically dealing with regulating and recycling electronic waste, RCRA tasks the EPA's Office of Land and Emergency Management – also known as the Office of Solid Waste

44. *National Strategy for Electronics Stewardship (NSES)*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/smm-electronics/national-strategy-electronics-stewardship-nses (last visited Oct. 8, 2020) (describing how NSES aims to deal with electronic waste).

45. *Id.* (laying out goals to improve electronic waste issue).

46. Exec. Order No. 13693, 80 Fed. Reg. 15869 (Mar. 19, 2015), *revoked by* Exec. Order No. 13834, 83 Fed. Reg. 23771 (May 17, 2018) (promoting electronics sustainability and federal action).

47. *Id.* at 15876 (encouraging federal government to continue practicing electronics stewardship).

48. *Id.* (noting potential benefit of partnering with electronics industry).

49. *National Strategy for Electronics Stewardship (NSES)*, *supra* note 44 (describing policy as recommendation).

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– with regulating hazardous solid waste, which in some cases includes electronics.[50] RCRA seeks to protect human health and the environment by assuring hazardous solid waste is handled properly "from cradle to grave."[51] The EPA specifically works with the "RCRA hazardous waste compliance monitoring program" to oversee parties who handle hazardous waste, including those who produce it, transport it, and recycle it.[52]

RCRA subjects each party to different regulations.[53] Hazardous waste producers, or generators, are responsible for determining whether their waste is hazardous.[54] RCRA explicitly defines hazardous waste as "a waste with properties that make it dangerous or capable of having a harmful effect on human health or the environment."[55] The EPA uses four questions to determine whether waste is hazardous: (1) whether the material is a solid waste, (2) whether RCRA's definitions of solid or hazardous waste exclude the material from regulation, (3) whether RCRA lists the material as a waste that is known to be hazardous or have hazardous characteristics, and (4) whether RCRA delists the material from regulation.[56]

A material must be considered a solid waste to be regulated under RCRA.[57] RCRA defines solid waste as "any garbage or refuse,

50. 40 C.F.R. § 1.47 (2015) (stating Office of Land and Emergency Management is also referred to as Office of Solid Waste); *Electronic Waste: Strengthening the Role of the Federal Government in Encouraging Recycling and Reuse*, U.S. GOV'T ACCOUNTABILITY OFFICE (Nov. 2005), https://www.gao.gov/new.items/d0647.pdf (laying out electronic waste recycling background).

51. *Hazardous Waste Compliance Monitoring*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/compliance/hazardous-waste-compliance-monitoring (last visited Oct. 10, 2020) (noting regulations for hazardous waste under RCRA).

52. *Id.* (stating "main focus areas of compliance" are identification of hazardous waste, hazardous waste generators, hazardous waste transporters, and waste management facilities).

53. For a discussion of the different regulations under RCRA, see *infra* notes 54-92 and accompanying text.

54. *See Learn the Basics of Hazardous Waste*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/hw/learn-basics-hazardous-waste#hwid (last visited Oct. 10, 2020) (instructing generators how to classify whether waste is hazardous).

55. *Id.* (defining hazardous waste).

56. *See Criteria for the Definition of Solid Waste and Solid and Hazardous Waste Exclusions*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/hw/criteria-definition-solid-waste-and-solid-and-hazardous-waste-exclusions (last visited Oct. 10, 2020) (providing flowchart for determining whether solid waste is hazardous). *See also Defining Hazardous Waste: Listed, Characteristic and Mixed Radiological Wastes*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/hw/defining-hazardous-waste-listed-characteristic-and-mixed-radiological-wastes (last visited Oct. 10, 2020) (noting chemicals and properties RCRA considers hazardous).

57. *Criteria for the Definition of Solid Waste and Solid and Hazardous Waste Exclusions, supra* note 56 (explaining what constitutes solid waste).

sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, resulting from industrial, commercial, mining, and agricultural operations, and from community activities."[58] This definition is not limited to physically solid wastes, but also includes liquids, semi-solids, and gases.[59] Put simply, under RCRA, solid waste is any material that was discarded in some way, whether "disposed of, burned, incinerated, or sham recycled."[60] Solid waste also includes materials that are inherently hazardous to human health and the environment.[61]

But even if a material meets the definition of solid waste, RCRA may still exclude it from regulation "for a variety of reasons, including public policy, economic impacts, regulation by other laws, lack of data, or impracticability of regulating the waste."[62] Notably, this is the basis for excluding cathode ray tubes and shredded circuit boards – two hazardous materials commonly found in electronics – from regulation under RCRA.[63] If the material is a solid waste that does not warrant an exception, however, the EPA next considers whether the material is a type of waste that is listed as hazardous waste or has characteristics of hazardous waste.[64] Listed wastes are hazardous wastes that emerge from common manufacturing and industrial processes and are known to be hazardous.[65] Characteristic wastes are hazardous because they contain properties that are ignitable, corrosive, reactive, or toxic.[66] Solid waste, therefore, is considered hazardous waste if (1) it does not fall under a listed exception and (2) is a listed waste or contains characteristics of hazardous waste.[67]

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58. *See id.* (defining solid waste under RCRA).

59. *Id.* (clarifying solid wastes do not have to be physically solid).

60. *Id.* (listing ways materials become solid waste).

61. *Id.* (describing materials that inherently qualify as waste regardless of whether they are disposed). "Some materials pose such a threat to human health and the environment that they are always considered solid wastes; these materials are considered to be inherently waste-like. Examples of inherently waste-like materials include certain dioxin-containing wastes." *Id.* (noting why some materials are inherently waste-like).

62. *See Criteria for the Definition of Solid Waste and Solid and Hazardous Waste Exclusions*, *supra* note 56 (discussing solid waste exclusions under RCRA).

63. *Id.* (listing waste excluded under RCRA).

64. *Defining Hazardous Waste: Listed, Characteristic and Mixed Radiological Wastes*, *supra* note 56 (describing test to decide whether solid waste is hazardous).

65. *See id.* (defining listed materials under RCRA).

66. *Id.* (comparing waste that is hazardous because of its characteristics to waste that is hazardous because it is already known to be hazardous).

67. *See id.* (explaining how to decide whether waste is hazardous).

Further, there are three categories of hazardous waste generators: large quantity generators, small quantity generators, and very small quantity generators.[68] Large quantity generators "generate 1,000 kilograms per month or more of acutely hazardous waste."[69] These types of generators "may only accumulate waste on-site for 90 days," subject to certain exceptions.[70] Large quantity generators do not have a hazardous waste storage limit; however, the waste must be managed in "tanks, containers, drip pads or containment buildings . . . ."[71] Sites with large quantity generators must also comply with certain tracking, procedural, safety, and land disposal restriction requirements in addition to submitting hazardous waste reports.[72]

Small quantity generators are subject to less stringent regulation.[73] These types of generators "generate more than 100 kilograms, but less than 1,000 kilograms of hazardous waste per month."[74] Small quantity generators "may accumulate hazardous waste on-site for 180 days without a permit," provided the waste is kept in approved tanks or containers.[75] Small quantity generators also have to follow tracking and procedural requirements, as well as disposal restriction requirements.[76]

Very small quantity generators are the least regulated producers of hazardous waste.[77] Very small quantity generators "generate 100 kilograms or less per month of hazardous waste or one kilogram or less per month of acutely hazardous waste."[78] Their primary responsibility is to identify the hazardous waste and ensure

68. *See Categories of Hazardous Waste Generators*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/hwgenerators/categories-hazardous-waste-generators (last visited Oct. 10, 2020) (comparing types of hazardous waste generators).

69. *Id.* (describing large quantity generator storage regulations).

70. *Id.* (noting RCRA hazardous waste storage time length for large quantity generators).

71. *Id.* (identifying waste storage requirements for large quantity generators).

72. *Id.* (discussing large quantity generator's responsibilities under RCRA).

73. *See Categories of Hazardous Waste Generators*, *supra* note 68 (describing regulation of small quantity generators under RCRA).

74. *Id.* (noting amount of waste small quantity generators produce).

75. *Id.* (stating how much hazardous waste small quantity generators may keep).

76. *Id.* (listing small quantity generator's compliance requirements).

77. *See id.* (noting minimal regulation of very small quantity generators compared to larger generators).

78. *See Categories of Hazardous Waste Generators*, *supra* note 68 (defining very small quantity generator's generators characteristics).

that it is "delivered to a person or facility who is authorized to manage it."[79]

RCRA also has authority to regulate hazardous waste recycling programs, as waste continues to be hazardous once recycled.[80] The EPA must consider recycling practices to be legitimate before allowing them to be subject to RCRA's less stringent recycling regulations.[81] The EPA defines illegitimate recycling programs as "situations when a secondary material is [i]neffective or only marginally effective for the claimed use; used in excess of the amount necessary; or handled in a manner inconsistent with its use as a raw material or commercial product substitute."[82] A legitimate recycling program is determined by four factors:

1. Legitimate recycling must involve a hazardous secondary material that provides a useful contribution to the recycling process or to a product or intermediate of the recycling process.
2. The recycling process must produce a valuable product or intermediate.
3. The generator and the recycler must manage the hazardous secondary material as a valuable commodity when it is under their control.
4. The product of the recycling process must be comparable to a legitimate product or intermediate.[83]

RCRA provides that recycled hazardous waste may not be subject to hazardous waste regulation or a lesser form of regulation.[84] Batteries and lamps, for example, contain hazardous waste and are excluded from regulation when recycled.[85] Many electronics contain precious metals, and waste used for precious metal recovery is

79. *Id.* (noting principal duty of very small quantity generators regulations under RCRA).

80. *See Regulatory Exclusions and Alternative Standards for the Recycling of Materials, Solid Wastes and Hazardous Wastes*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/hw/regulatory-exclusions-and-alternative-standards-recycling-materials-solid-wastes-and-hazardous (last visited Oct. 10, 2020) (noting RCRA's continued regulation of hazardous waste once recycled).

81. *Id.* (discussing RCRA recycler regulation requirements).

82. *See Legitimate Hazardous Waste Recycling Versus Sham Recycling*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/hw/legitimate-hazardous-waste-recycling-versus-sham-recycling (last visited Oct. 10, 2020) (defining sham recycling program).

83. *Id.* (outlining legitimate recycling program factors).

84. *See Regulatory Exclusions and Alternative Standards for the Recycling of Materials, Solid Wastes and Hazardous Wastes*, *supra* note 80 (noting some waste excluded from regulation).

85. *Id.* (identifying examples of devices excluded from regulation when recycled).

subject to lesser regulation "[b]ecause these materials will be handled protectively as valuable commodities with significant economic value . . . ."[86]

It is important to note that exporters of hazardous waste are subject to RCRA regulation.[87] First, an exporter must apply to the EPA and obtain an EPA identification number.[88] After obtaining the EPA identification number, the exporter and receiver must enter into a contract establishing both parties' intent and willingness to abide by RCRA before exporting hazardous waste.[89] Once both parties sign the contract, the exporter must provide the EPA with a notice of intent to ship the hazardous waste "at least 60 days before the first shipment of hazardous waste is expected to leave the United States."[90] The notice of intent must satisfy certain information requirements, such as the names of the exporter and receiver, the waste's destination, a description of the waste being shipped, and how the receiver uses or disposes of the waste.[91] In addition to the notice of intent, an "international movement document" must accompany the shipment until it reaches its destination.[92]

RCRA fails to address one of the largest sources of electronic waste by exempting households and other residential facilities.[93] Additionally, RCRA excludes very small quantity generators, which means it does not regulate producers who generate "less than 100 kilograms of hazardous waste per month," other than identifying

86. *Id.* (explaining reasoning behind lesser regulation of hazardous waste with valuable materials). For a discussion of the valuable materials found in electronic waste, see *supra* notes 36-38 and accompanying text.

87. *Information for Exporters of Resource Conservation and Recovery Act (RCRA) Hazardous Waste*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/hwgenerators/information-exporters-resource-conservation-and-recovery-act-rcra-hazardous-waste (last visited Oct. 10, 2020) (describing RCRA's regulations regarding electronic waste export).

88. *Id.* (introducing procedure for exporter's compliance with RCRA regulation).

89. *Id.* (explaining contractual commitment between parties transporting and receiving electronic waste to obey RCRA).

90. *Id.* (describing requirement to inform EPA).

91. *Id.* (providing notice of consent requirements).

92. *Information for Exporters of Resource Conservation and Recovery Act (RCRA) Hazardous Waste*, *supra* note 87 (stating movement document requirement).

93. *See* Jeremy Knee, *Guidance for the Awkward: Outgrowing the Adolescence of State Electronic Waste Laws*, 33 ENVIRONS ENVTL. L. & POL'Y J. 157, 162 (2009) (discussing shortcomings of RCRA).

the waste as hazardous and assuring that its generators deliver it to somewhere authorized to manage it.[94]

More importantly, RCRA's current scheme allows an exporter to export hazardous waste as long as the foreign receiver agrees to accept the shipment.[95] This structure is problematic because underdeveloped countries are willing to "recycle" electronic devices for the economic benefits of the valuable waste materials without understanding the consequences associated with the hazardous materials that the recycling process produces.[96] Illegal exportation of electronic waste occurs as well.[97] RCRA regulates electronic waste in some ways but does not adequately encourage consumers and producers to recycle or reuse electronics.[98] State laws, discussed in the next section, promote recycling more comprehensively.[99]

C. The Basel Convention

The Basel Convention, an international treaty to which the U.S. is signatory, aims to reduce the production of hazardous waste, establish its safe disposal, and restrict and regulate its movement globally.[100] The Basel Convention began addressing electronic waste in 2002, focusing on safe management and the prevention of illegal exportation to developing countries.[101] Although the U.S. is one of the world's largest electronic waste producers, it is the only developed country that has not ratified the Convention.[102]

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94. *Id.* (criticizing RCRA exemptions). *See also Categories of Hazardous Waste Generators*, *supra* note 68 (providing RCRA requirements for small quantity generators).

95. For a discussion of RCRA's regulatory structure, see *supra* notes 44-92 and accompanying text.

96. For a discussion of the recycling industry in underdeveloped countries, see *infra* notes 145-92 and accompanying text.

97. For a discussion of the problems regarding electronic waste exportation, see *infra* notes 145-92 and accompanying text.

98. For a discussion of state laws that regulate manufacturers and consumers, see *infra* notes 118-37. For a discussion of RCRA, see *supra* notes 50-92 and accompanying text.

99. For a discussion of state laws that regulate manufacturers and consumers, see *infra* notes 118-37 and accompanying text.

100. *Convention Overview*, BASEL CONVENTION, http://www.basel.int/TheConvention/Overview/tabid/1271/Default.aspx (last visited Oct. 10, 2020) (stating goals of Basel Convention).

101. *Overview*, BASEL CONVENTION, http://www.basel.int/Implementation/Ewaste/Overview/tabid/4063/Default.aspx (last visited Oct. 10, 2020) (noting Basel Convention's acknowledgement of electronic waste).

102. Larmer, *supra* note 1 (highlighting U.S. failure to ratify Basel Convention).

The Basel Convention carries out its goals in numerous ways.[103] Countries that have ratified the Convention are required to follow guidelines that ensure waste is handled in an environmentally-responsible manner.[104] To address movement of hazardous waste, the Convention bans the exportation of hazardous waste "to Antarctica, to a State not party to the Basel Convention, or to a party having banned the import of hazardous wastes."[105] Moreover, parties can only transport hazardous waste internationally if the movement is environmentally safe, non-discriminatory, and "carried out in accordance with the Convention's regulatory system."[106]

The regulatory system is the most important part of the Basel Convention.[107] The system is built around the idea of "prior informed consent."[108] Prior informed consent requires a country exporting hazardous waste to inform countries importing or transiting the waste of the planned movement.[109] The system also provides for hazardous waste training centers in every region.[110]

The U.S. has been a signatory to the Basel Convention since 1990 but has failed to become a party to it.[111] By declining to become a party to the Convention, the U.S. is not bound by its requirements.[112] This means the U.S. can export hazardous waste without violating the Convention even though it appears that the U.S. is working with other countries to stop exporting hazardous and electronic waste to underdeveloped countries.[113] In fact, U.S.

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103. *Convention Overview*, *supra* note 100 (describing regulations helping to promote Basel Convention goals).

104. *Id.* (discussing provision regulating electronic waste management).

105. *Id.* (noting bans on exportation under Basel Convention).

106. *Id.* (allowing certain exportations of electronic waste).

107. *Id.* (acknowledging regulatory system as most important part of Basel Convention).

108. *Convention Overview*, *supra* note 100 (describing regulations helping to promote Basel Convention goals).

109. *Id.* (defining prior informed consent).

110. *Id.* (detailing purpose of Convention's training centers).

111. *See* Larmer, *supra* note 1 (stressing U.S. failure to ratify Basel Convention); *Parties to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal*, BASEL CONVENTION, http://www.basel.int/Countries/StatusofRatifications/PartiesSignatories/tabid/4499/Default.aspx (last visited Oct. 10, 2020) (noting U.S. has been signatory to Basel Convention since 1990).

112. *What is the difference between signing, ratification and accession of UN treaties?*, DAG HAMMARSKJOLD LIBR. (Apr. 26, 2018), https://ask.un.org/faq/14594 (noting different legal obligations for signatories and parties).

113. *See generally* Katie Campbell & Ken Christensen, *Where does America's e-waste end up? GPS tracker tells all*, PBS NEWS HOUR (May 10, 2016, 11:07 AM), https://www.pbs.org/newshour/science/america-e-waste-gps-tracker-tells-all-earthfix (describing electronic waste recycling sting using GPS tracking where U.S. elec-

manufacturers continue to export hazardous waste to other parts of the world for disposal, even countries that ban importation.[114]

V. STATE ELECTRONIC WASTE LAWS IN THE U.S.

In light of the absence of effective federal action, twenty-five states have passed laws establishing electronic waste recycling programs.[115] These laws vary in how they fund recycling programs, require parties to participate, and subject waste to recycling programs.[116] This section uses a sample of state electronic device recycling laws to illustrate the differences among state legislation and offers a brief analysis of each law.[117]

A. Connecticut: Out of State Market Share Extended Producer Responsibility Model

Connecticut – like every state with electronic waste laws other than California – uses the extended producer responsibility model, which requires producers of certain electronic devices to pay an annual fee to fund the state's electronic waste recycling program.[118] The recycling program funds private recycling companies that register and are approved by the state to recycle electronic waste.[119] The program specifically requires electronic device producers conducting business in Connecticut to register with the Department of Energy and Environmental Protection (DEEP), which then determines the producer's annual recycling fee based on the type of

tronic waste ended up in foreign countries). The United Nations estimates that the U.S. exports between ten and forty percent of electronic waste to other countries for recycling. *Id.* (estimating how much electronic waste is exported from U.S. to other countries).

114. *See generally* Elizabeth S. Pope, *The Shadowy World of Hazardous Waste Disposal: Why the Basel Convention's Structure Undermines Its Substance*, 13 S.C. J. INT'L. L. & BUS. 305, 324 (2017) (noting U.S. as one of main exporters of hazardous waste).

115. Jennifer Schultz, *Electronic Waste Recycling*, NAT'L CONFERENCE OF STATE LEGISLATURES (Sept. 17, 2018), https://www.ncsl.org/research/environment-and-natural-resources/e-waste-recycling-legislation.aspx (describing state electronic waste recycling laws).

116. For a discussion of various state electronic recycling laws, *see infra* notes 118-37 and accompanying text.

117. *Id.* (summarizing state electronic recycling laws).

118. *Electronics Manufacturer Requirements for Compliance with Connecticut's Electronics Recycling Law*, CONN. DEP'T OF ENERGY AND ENVTL. PROT. (July 2, 2020), https://www.ct.gov/deep/cwp/view.asp?a=2714&q=397488&deepNav_GID=1645 (discussing CONN. GEN. STAT. § 22a-629 *et seq.*) (noting manufacturers' recycling requirements of electronic waste recycling law); *See* Knee, *supra* note 93, at 163 (defining extended producer responsibility model).

119. *See generally id.* (describing Connecticut electronic waste legislation and how it regulates manufacturers).

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electronic waste recycled.[120] DEEP calculates television recycling fees based on the producer's national market share.[121] Connecticut uses a return share model for devices other than televisions; the model "apportions costs on each manufacturer based on the weight of its own products that are actually returned for recycling in a given period."[122]

Connecticut's law only regulates *covered* electronic devices, which includes "desktop or personal computers, computer monitors, portable computers, CRT-based televisions and non-CRT-based televisions or any other similar or peripheral electronic device . . . sold to consumers . . . ."[123] Most notably, the law excludes electronic components of motor vehicles, clothes washers and dryers, refrigerators and freezers, microwaves, and most telephones.[124]

The volume of hazardous electronic waste generated by devices outside the scope of the statute exposes a large loophole in Connecticut's approach.[125] The extended producer responsibility model encourages producers to work toward building more environmentally-friendly products by assessing weight-based fees, as producers pay less if their devices are discarded less often.[126] The market share approach, however, fails to incentivize similarly television producers who will pay their market share regardless of whether their products are disposed.[127]

B. California: Advanced Recycling Fee Model

California's Electronic Waste Recycling Act of 2003 "[a]ssesses a covered electronic waste recycling fee on retail sales of covered

120. *Id.* (noting requirements of electronic waste recycling law).

121. Vizio v. Klee, No. 3:15-cv-00929, 2016 WL 1305116, at *3 (D. Conn. Mar. 31, 2016) (comparing statute's different fee calculation methods based on type of device).

122. *Id.* (comparing statute's different fee calculation methods based on type of device).

123. CONN. GEN. STAT. § 22a-629 (2011) (defining covered electronic devices). A cathode ray tube ("CRT") television means a vacuum tube or picture tube used to convert an electronic signal into a visual image. *Id.* (defining cathode ray tube under statute).

124. *Id.* (listing electronic devices not covered under law).

125. For a discussion of the large amount of electronic waste coming from consumer electronics, see *supra* notes 15-29 and accompanying text.

126. *See generally* Knee, *supra* note 93, at 164-65 (explaining how weight-based fee calculation incentivizes manufacturers to reduce weight and make less hazardous products).

127. *See id.* (describing why manufacturers have incentive in extended producer responsibility model).

electronic devices" to fund a corresponding recycling program.[128] Consumers pay anywhere between four and six dollars at the time of purchase for covered electronic devices, depending on the size of the device.[129] Unlike the majority of states with electronic waste recycling laws, manufacturers of electronic devices incur no financial responsibility under California's program and only have to label their products with recycling information and report certain data to administrators of the recycling program.[130] This legislation, therefore, does not offer the same incentives as the extended producer responsibility model because the consumers fund the recycling program rather than the manufacturers.[131]

C. Indiana: Disposal Bans

Indiana's electronic waste law bans Indiana households, public schools, and small businesses from disposing of a variety of electronics, including televisions, computers, fax machines, DVD players, and cameras.[132] The Indiana Department of Environmental Management's website also links consumers to a document listing electronic waste collectors.[133] For large and small quantity generators, Indiana law excludes reused or recycled electronic waste from hazardous waste regulation.[134] Generators disposing of cathode ray tubes found in computers and televisions, however, are regulated as hazardous waste.[135] Moreover, Indiana legislation differs from other states by focusing on consumer disposal.[136] Unlike Connecticut and California, Indiana imposes non-monetary requirements on generators instead of prioritizing recycling funding.[137]

128. *Electronic Waste Recycling Act of 2003*, CALRECYCLE (Apr. 3, 2020), https://www.calrecycle.ca.gov/electronics/act2003 (explaining how California electronic waste recycling program works).

129. *Covered Electronic Waste Recycling Program*, CAL RECYCLE (Oct. 7, 2020), https://www.calrecycle.ca.gov/Electronics/CEW/ (describing calculation of recycling fee).

130. *See* Knee, *supra* note 93, at 163 (noting responsibility California legislation places on manufacturers).

131. *See generally id.* (noting benefits of extended producer responsibility model).

132. *Indiana Regulations Affecting Electronic Waste (e-Waste)*, IND. DEP'T OF ENVTL. MGMT., https://www.in.gov/idem/recycle/2384.htm (last visited Oct. 10, 2020) (listing electronic waste regulations under Indiana laws).

133. *Id.* (connecting consumers to places where electronics may be disposed).

134. *Id.* (noting RCRA's federal regulations).

135. *Id.* (describing regulation of hazardous waste generators).

136. For a discussion of Connecticut and California's electronic waste legislation, see *supra* notes 118-31 and accompanying text.

137. For a discussion of the monetary focus of Connecticut and California's electronic waste legislation, see *supra* notes 118-31 and accompanying text.

VI. SHORT CIRCUITING: FAILURE OF CURRENT LAWS AND POLICIES

RCRA is ill-equipped to stop exportation of hazardous electronic waste to countries that do not have the resources or wealth to handle it.[138] State laws also have numerous shortcomings.[139] Current laws and policies, therefore, fail to provide comprehensive solutions for the growing e-waste problem.[140] Recycling devices is only a preliminary solution.[141] There are still dire issues to be addressed even when consumers and producers recycle their products, or when states pay for recycling.[142]

Recycling is the primary method of electronic waste disposal.[143] Although practical, the recycling of electronic devices has led to unforeseen consequences.[144] Specifically, the primary issue is that much of electronic waste recycling takes place in developing countries using unsafe methods.[145] The low labor costs and lack of environmental regulation in developing countries make electronic waste exportation a tempting option for businesses in developed countries, thus lowering the incentive to resolve their disposal issues domestically.[146]

The U.S. government has failed to effectively ban hazardous waste exportation, resulting in recycling companies pushing their disposal problems onto vulnerable countries.[147] Under RCRA, recycling companies are permitted to save money by outsourcing recycling to developing parts of the world as long as the company follows the EPA's procedure and obtains consent from the re-

138. For a discussion of RCRA and its shortcomings, see *supra* notes 50-98 and accompanying text.

139. For a discussion of state laws and their shortcomings, see *supra* notes 118-37 and accompanying text.

140. For a discussion of the current state and federal laws and policies addressing electronic waste, see *supra* notes 44-137 and accompanying text. For a discussion of why the current laws and policies are insufficient, see *infra* notes 144-92 and accompanying text.

141. For a discussion of problems associated with electronic waste recycling, see *infra* notes 144-92 and accompanying text.

142. For a discussion of the problems associated with electronic waste recycling, see *infra* notes 144-92 and accompanying text.

143. For a discussion of the current U.S. laws and policies regarding electronic waste recycling, see *supra* notes 44-137 and accompanying text.

144. Devin N. Perkins ET AL., *E-Waste: A Global Hazard*, 80 ANNALS OF GLOBAL HEALTH 286, 286 (2014) (noting adverse health effects from improper electronic waste recycling).

145. *Id.* at 287-92 (discussing informal recycling's effects on underdeveloped countries).

146. *Id.* at 288 (noting reasons for electronic waste exportation).

147. For a discussion of U.S. electronic waste's effects on underdeveloped countries, *see infra* notes 149-92 and accompanying text.

ceiver.[148] Emerging industrialized countries have subsequently found a niche within the electronics recycling industry for receiving and recycling waste.[149]

Many emerging industrialized countries use unsafe recycling methods, resulting in citizen exposure to hazardous materials.[150] Residents in electronic waste recycling areas, especially children, are at high risk of physical harm from hazardous chemicals.[151] Guiyu, China is one of these emerging industrial areas.[152] In exchange for work and a livelier economy, residents breathe "air [that] leaves a burning sensation in the eyes and nostrils."[153] Guiyu's recycling process involves "burning circuit boards, plastic and copper wires, or washing them with hydrochloric acid to recover valuable metals like copper and steel."[154] This unsafe process releases "toxic heavy metals like lead, beryllium, and cadmium" into the environment.[155] Many children in Guiyu have "higher than average levels of lead in their blood, which can stunt the development of the brain and central nervous system."[156] While China has officially banned the import of electronic waste, it still travels there through illegal channels and also now travels to other countries, such as Thailand.[157]

Unfortunately, the situation in Guiyu is not an abnormal story.[158] The Seattle-based Basel Action Network partnered with

148. For a discussion of RCRA, *see supra* notes 50-94 and accompanying text.

149. Marie Noel-Brune ET AL., *Health effects of exposure to e-waste*, THE LANCET GLOB. HEALTH (June 28, 2013), https://www.thelancet.com/journals/langlo/article/PIIS2214-109X(13)70020-2/fulltext#articleInformation (discussing less developed countries recycling electronic waste).

150. *Id.* (recognizing "unsafe recycling practices")

151. *Id.* (noting women and children's common exposure to electronic waste).

152. Ivan Watson, *China: The electronic wastebasket of the world*, CNN (May 31, 2013), https://edition.cnn.com/2013/05/30/world/asia/china-electronic-waste-e-waste/index.html (describing electronic waste's effect on disposal areas).

153. *Id.* (discussing China's electronic waste disposal issues).

154. *Id.* (explaining actions resulting in negative environmental effects).

155. *Id.* (noting toxic material emission during disposal process). Additionally, devices made by Hewlett-Packard, IBM, Epson, and Dell were found in Guiyu's muddy water buffalo grazing fields. *Id.* (highlighting electronic waste's prevalence in disposal cities).

156. *Id.* (describing toxic materials found in electronic waste's effects on human health).

157. David Meyer, *How Thailand Became the Latest Dumping Ground for the World's Electronic Waste*, FORTUNE (May 30, 2018, 7:23 AM) https://fortune.com/2018/05/30/china-ban-thailand-electronic-waste/ (illustrating China's electronic waste ban's effect on Thailand).

158. *See* Campbell, *supra* note 113 (describing unsafe conditions caused by improper electronics recycling in underdeveloped countries).

the Massachusetts Institute of Technology to put geolocating trackers in old electronics and "dropped them off nationwide at donation centers, recyclers and electronic take back programs."[159] These locations advertised themselves as environmentally-friendly recyclers, but the trackers indicated a third of the electronics went overseas.[160] These devices recycled in the United States were shipped to "Mexico, Taiwan, China, Pakistan, Thailand, Dominican Republic, Canada and Kenya."[161]

The Basel Action Network's founder, Jim Puckett, worked with a Chinese journalist and translator, Dongxia Su, to follow one of the electronics that was tracked to a region of Hong Kong along the border of mainland China called the New Territories.[162] The New Territories were traditionally used for agriculture, but shifted to industrial work in recent years.[163] When Puckett and his partner arrived at the New Territories, they approached a "high metal wall made from old shipping containers."[164] On the other side of the wall were workers, without any protective gear, sifting through the rubble of used electronics to collect printers for resale.[165] This process involved dismantling electronics and wading through broken white tubes that release dangerous "invisible mercury vapor," something the workers were unaware of.[166]

Until recently, the New Territories only helped smuggle whole electronic device waste into mainland China.[167] Workers would unload electronic waste onto small trucks, which would then travel across the border into China.[168] The processing of electronic waste, however, largely moved to the New Territories after the Chinese government implemented a border control initiative called "Green Fence" to stop electronics from moving into mainland China.[169]

159. *Id.* (explaining operation to track electronic waste).

160. *Id.* (explaining devices recycled in United States were shipped to "Mexico, Taiwan, China, Pakistan, Thailand, Dominican Republic, Canada and Kenya.").

161. *Id.* (listing countries electronic waste was tracked to).

162. *Id.* (describing trip to find tracked electronic waste).

163. *See Campbell*, *supra* note 113 (discussing industries of New Territories).

164. *Id.* (describing what was discovered when tracker followed).

165. *Id.* (explaining workers' activity at junkyard).

166. *Id.* (noting mercury's neurotoxicity even in small amounts).

167. *Id.* (noting New Territories' changed role in electronic waste recycling industry).

168. *See Campbell*, *supra* note 113 (discussing New Territories' previous role in electronic waste recycling industry).

169. *See id.* (explaining how New Territories got involved with electronic device recycling).

Puckett's search did not end with the New Territories as he followed another tracker to a different site.[170] This lot, purporting to be farmland, was "the size of a football field piled 15 feet high with printers."[171] The workers at the lot, many of whom were migrants from mainland China, wore clothes covered in toner ink, a dangerous substance linked to respiratory problems.[172]

In response to the deplorable conditions at these recycling centers, Jackson Lau, director of the Hong Kong Recycle Materials and Reproduction Business General Association, noted that "[t]he majority of these workshops tend to operate in a shady manner" and that the workshops are frequently "unlicensed and poorly regulated . . . ."[173] Despite China's ban, whole electronic device waste gets through customs by being labeled as "raw plastics."[174] Hong Kong, however, was able to return illegal shipments of electronic waste to the U.S. twenty-one times between 2013 and 2016, but the damage done from even one shipment is significant.[175]

Both junkyards that were visited contained evidence that the waste came from the U.S.[176] In addition to "labels from a library, a hospital and other organizations in Washington and Oregon[,]" Puckett found boxes bearing a Total Reclaim logo.[177] Ironically, Total Reclaim was one of the first recyclers to join the Basel Action Network and used the certification to gain large contracts.[178] Recyclers certified through Basel Action Network's e-Stewards program can export raw materials from recycled devices but cannot export whole devices containing hazardous materials.[179] Evidently, Total Reclaim disobeyed this requirement.[180]

In April 2019, three years after this investigation, prosecutors charged Total Reclaim's founders in the third-ever illegal electronic waste export case.[181] Although this retroactive punishment may de-

170. *Id.* (stating next step in electronic waste investigation).

171. *Id.* (describing what junkyard looked like).

172. *Id.* (observing unsafe working conditions at junkyard).

173. *Campbell*, *supra* note 113 (explaining problem with electronic waste recycling in Hong Kong).

174. *See id.* (elucidating how illegal waste gets through to junkyards).

175. *Id.* (giving government credit for preventing import of some electronic waste).

176. *Id.* (describing findings from electronics trackers).

177. *Id.* (noting waste found in junkyard).

178. *See Campbell*, *supra* note 113 (noting Total Reclaim was one of first recyclers to be certified).

179. *Id.* (noting requirements for certified e-waste recyclers).

180. *Id.* (revealing Total Reclaim materials found in illegal waste).

181. Mike Rosenberg, *Largest e-recycling fraud in U.S. history sends Kent firm to prison*, THE SEATTLE TIMES (Apr. 24, 2019, 11:39 AM) https://

ter the exportation of electronic waste in the future, it is possible that U.S. businesses will be unphased by the lawsuit.[182] Total Reclaim is still in business, earning $5.1 million in revenue in 2018 and serving 740 customers.[183]

Basel Action Network's investigation also uncovered illegal exports by Dell, a major computer manufacturer.[184] The first in its industry to do so, Dell "ban[ned] the export of non-working electronics to developing countries."[185] The Dell Reconnect Program, established in 2004, partnered with Goodwill to collect old computers for refurbishing and recycling.[186] The Basel Action Network dropped electronics with trackers at participating Goodwill locations to see where the devices would end up.[187] Unsurprisingly, the trackers revealed some of the devices "went abroad . . . to Hong Kong, Taiwan, mainland China, and Thailand."[188]

While Total Reclaim and Dell profited from exporting electronic devices to China, archaic recycling methods and unsafe disposal have led to irreversible consequences in the region.[189] Fires at the junkyards release cancer-causing chemicals from the burning devices.[190] These chemicals "endure for long periods of time in the environment and human body" and emit odors long after the burning is controlled.[191] The growing number of junkyards render water from the area undrinkable.[192]

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www.seattletimes.com/business/largest-e-recycling-fraud-in-u-s-history-sends-owners-of-kent-firm-to-prison/ (noting punishment for Total Reclaim founders because of export).

182. *Id.* (noting effect Total Reclaim export had on environment). "'This is a serious offense,' U.S. District Court Judge Richard Jones told Lorch and Zirkle in a standing-room-only courtroom Tuesday. He noted their actions 'struck a huge blow' to the public trust, 'damage that can't be recovered.'" *Id.* (explaining seriousness of electronic waste export).

183. *Id.* (describing Total Reclaim's business).

184. *See Campbell*, *supra* note 113 (describing Dell's electronic waste export).

185. *Id.* (noting Dell's apparent attempt to combat electronic waste).

186. *Id.* (discussing partnership between Goodwill and Dell).

187. *Id.* (describing operation to see where Dell and Goodwill program devices were disposed of).

188. *Id.* (listing countries where Dell and Goodwill devices ended).

189. *See Campbell*, supra note 113 (discussing effects on areas with electronic waste junkyards).

190. *Id.* (noting presence of unsafe chemicals in disposal areas).

191. *Id.* (explaining lasting effects of electronic waste junkyards).

192. *Id.* (quoting resident of junkyard area). "'When I was young, I used to drink water directly from the river,' he said through an interpreter. 'Now I do not even dare drink water from the well.'" *Id.* (providing testimony from farmer about how illegal recycling has affected his hometown).

VII. REPAIRING THE DAMAGE: SOLUTIONS FOR ELECTRONIC WASTE GOING FORWARD

Electronic waste is different than traditional hazardous waste and requires solutions beyond modifying existing legislation.[193] If electronics are recycled properly, United Nations University estimates over $60 billion worth of secondary raw materials would be collected.[194] It is imperative, therefore, that any legislation ensures the safe acquisition of these valuable materials through recycling while mitigating the hazardous effects.[195]

With only half of the states enacting electronic waste legislation — Washington D.C. most recently in 2014 – "[t]he progress made in electronic waste legislation has been slow . . . ."[196] The states without electronic waste legislation could make a difference by enacting laws to regulate electronic waste.[197] Those states with electronic waste laws could improve their current legislation.[198] For example, California could adopt the extended producer responsibility model and charge electronics manufacturers to recycle their products, thereby incentivizing them to create greener and longer-lasting products.[199] Similarly, states like Connecticut could mitigate loopholes in their statutory schemes that benefit smaller quantity generators and exclude certain electronics.[200]

Even if state laws promote and fund recycling, Congress must ensure that recyclers do not export recycled waste to developing countries.[201] On an individual level, consumers can choose re-

193. For a discussion of how electronic waste contains both hazardous and valuable materials, see *supra* notes 31-39 and accompanying text.

194. C.P. Baldé, ET AL., The Global E-waste Monitor 2017, U.N. UNIV. (2017), https://collections.unu.edu/eserv/UNU:6341/Global-E-waste_Monitor_2017__electronic_single_pages_.pdf (noting value of electronic waste materials in Euros).

195. For a discussion of how unsafe recycling affects human health and the environment, see *supra* notes 154-92 and accompanying text.

196. Maura Keller, *E-Waste Recycling Legislation Rules 25 States*, AM. RECYCLER (Aug. 2019), https://americanrecycler.com/8568759/index.php/news/electronics-recycling/3868-e-waste-recycling-legislation-rules-25-states (observing slow development of electronic waste legislation).

197. For a discussion of the strengths and shortcomings of various state laws, see *supra* notes 115-37 and accompanying text.

198. For a discussion of the strengths and shortcomings of various state laws, see *supra* notes 115-37 and accompanying text.

199. For a discussion of the extended producer responsibility model in Connecticut and California's current electronic waste law, see *supra* notes 118-33 and accompanying text.

200. For a discussion of Connecticut exemptions for small quantity generators and certain devices, see *supra* notes 121-24 and accompanying text.

201. For a discussion of how the export of electronic waste affects developing countries, see *supra* notes 150-96 and accompanying text.

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cyclers who promise not to export their waste and, instead, deal with it in an environmentally-responsible manner.[202] But even if consumers choose to use "responsible recyclers," the Total Reclaim story discussed in the previous section illustrates that some recyclers may not fully abide by their promises.[203] Investigators and consumers, therefore, can hold recyclers accountable by using tracking systems to see where recycled electronic waste goes.[204]

More importantly, Congress can ban the exportation of electronic waste completely, or at least to countries that do not accept imports, as the Basel Convention suggests.[205] In 2019, House Representatives Adriano Espaillat and Paul Cook introduced the Secure E-Waste Export and Recycling Act (SEERA), which would halt the exportation of most electronics.[206] While it was motivated by concerns that goods exported to China return to the United States as "counterfeit goods," the SEERA would still require the U.S. to deal with electronic recycling domestically instead of passing the issue to other countries, further avoiding a sustainable solution.[207]

Even if the U.S. stops exporting electronic waste or finds a way to recycle all products safely, private parties like manufacturers can contribute to reducing electronic waste by designing more environmentally-friendly products and promoting trade-ins to their consumers.[208] It is important for current legislation, therefore, to

202. For a discussion of consumer disposal of electronics, see *supra* notes 21-23 and accompanying text.

203. For a discussion of how alleged green recycler Total Reclaim exported electronic waste, see *supra* notes 177-90 and accompanying text.

204. For a discussion of how trackers put in used electronics found U.S. exported waste, see *supra* notes 159-94 and accompanying text.

205. For a discussion of the Basel Convention's regulations, see *supra* notes 100-14 and accompanying text.

206. Press Release, Rep. Adriano Espaillat, REP. ADRIANO ESPAILLAT INTRODUCES BIPARTISAN BILL TO STOP CHINESE ELEC. COUNTERFEITING (July 1, 2019), https://espaillat.house.gov/media/press-releases/representative-adriano-espaillat-introduces-bipartisan-bill-stop-chinese (noting bipartisan bill aiming to regulate electronic waste).

> I appreciate the bipartisan effort to curb China's baneful economic practices, and I am delighted to work with my colleague, Representative Paul Cook, on our bill to abate e-waste exports to China, which directly threaten our national security and economic interests. Despite the recently enhanced prevention and detection measures imposed on e-waste, the current situation remains untenable and requires a comprehensive strategy to choke off counterfeiters' feedstock: American e-waste exports. . . ."

Id. (describing motivation behind bill proposal).

207. For a discussion of U.S. exportation of electronic waste, see *supra* notes 146-92 and accompanying text.

208. *See generally* Peter Holgate, *The model for recycling our old smartphones is actually causing massive pollution*, VOX (Nov. 8, 2017, 12:30 PM), https://www.vox.com/

incentivize private manufacturers to handle their own electronic waste instead of exporting it abroad.[209] In addition to designing more efficient and environmentally-friendly products, manufacturers and retailers should encourage participation in trade-in programs, which recycle parts for reuse in other products and keeps electronic waste from entering dumps.[210]

VIII. CONCLUSION

The use of electronics continues to rise all over the world.[211] New devices are being introduced at a rapid pace, meaning "old" electronics are becoming obsolete with greater frequency.[212] As a result, electronic waste has become a tremendous issue and will continue to accumulate.[213] Multiple solutions are needed to deal with the disposal of electronic waste effectively.[214] Accordingly, the U.S. government and private parties alike have a role to play going forward.[215]

States can make their laws more effective by closing loopholes and broadening their scope.[216] The federal government could modify the RCRA, become a party to the Basel Convention, and prohibit the exportation of electronic waste to certain countries.[217] Alternatively, the federal government could ban the exportation of electronic waste altogether, which would ensure that exporters cannot move their electronic waste to other developing countries once

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2017/11/8/16621512/where-does-my-smartphone-iphone-8-x-go-recycling-after-life-toxic-waste-environment (discussing manufacturer and consumer roles in dealing with electronic waste).

209. For a discussion of the extended producer responsibility model and how it can incentivize producers and consumers to be more environmentally friendly, see *supra* notes 118-27 and accompanying text.

210. For a discussion of consumer disposal of electronics, see *supra* notes 21-23 and accompanying text.

211. For a discussion of the increase in electronics innovation and use, see *supra* notes 15-23 and accompanying text.

212. For a discussion of the rapid pace of consumer disposal of devices, see *supra* notes 20-23 and accompanying text.

213. For a discussion of the increase in electronics use and waste, see *supra* notes 15-29 and accompanying text.

214. For a discussion of potential solutions to the growing amount of electronic waste, see *supra* notes 194-210 and accompanying text.

215. For a discussion of the roles that different parties play in order to handle electronic waste, see *supra* notes 194-210 and accompanying text.

216. For a discussion of how states can help electronic waste disposal, see *supra* notes 196-200 and accompanying text.

217. For a discussion of how the U.S. federal government can help electronic waste disposal, see *supra* notes 205-07 and accompanying text.

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refused elsewhere.[218] Finally, laws can incentivize manufacturers to design longer-lasting products with safer materials and encourage consumers to trade in their devices so manufacturers can reuse materials.[219]

*Marisa D. Pescatore**

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218. *See* Hannah Beech & Ryn Jirenuwat, *The Price of Recycling Old Laptops: Toxic Fumes in Thailand's Lungs*, N.Y. TIMES (Dec. 8, 2019), https://www.nytimes.com/2019/12/08/world/asia/e-waste-thailand-southeast-asia.html (noting how Chinese ban on electronic waste imports led to Thailand electronic waste imports).

219. For a discussion of how manufacturers and consumers can help electronic waste disposal, see *supra* notes 208-10 and accompanying text.

* J.D. Candidate, May 2021, Villanova University Charles Widger School of Law; B.A., 2018, University of Pittsburgh. I would like to thank my family, friends, and Villanova Law for making my law school experience far better than I could have ever imagined. This Comment is dedicated to my parents, John and Michelle, step-parents, Susan and Lou, and siblings, Johnny, Christian, and Sofia, who have made my academic career (and this Comment) possible with their love and encouragement. I would also like to thank everyone on the Villanova Environmental Law Journal for their help throughout the writing process.