Addressing the E-Waste Crisis: The Need for Comprehensive Federal E-Waste Regulation within the United States

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INTRODUCTION

In 2007, studies found that children in the village of Guiyu, an electronic waste recycling center in Southern China, had blood lead levels fifty percent higher than the Center for Disease Control and Prevention (CDC) sets for maximum safe exposure in the United States.[1] Sadly and ironically, while the United States has established health, safety, and environmental regulations to prevent this kind of toxic exposure domestically, the regulations, practices, and policies of the United States and other developed countries have caused significant toxic exposure overseas in towns like Guiyu.[2]

The United States and other industrialized countries are flooding the global waste stream with discarded televisions, computers, cell phones, and other electronics[3] that contain lead,

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1 The journal *Environmental Health Perspectives* conducted the study that found children in Guiyu suffered from lead poisoning. U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-08-1044, ELECTRONIC WASTE: EPA NEEDS TO BETTER CONTROL HARMFUL U.S. EXPORTS THROUGH STRONGER ENFORCEMENT AND MORE COMPREHENSIVE REGULATION 18 (2008) [hereinafter GAO REPORT], *available at* http://www.gao.gov/new.items/d081044.pdf. *See also 'E-cycling' Puts New Life in Electronic Junk: Toxic Trash Turned into Everyday Objects by Growing Industry*, MSNBC.COM (Jan. 2, 2006, 9:23 AM), http://www.msnbc.msn.com/id/10642954/ [hereinafter *E-cycling*] (reporting that water samples from Guiyu showed the village's drinking water had lead levels 2,400 times higher than the limit set by the World Health Organization).

2 *See The e-Waste Crisis*, E-STEWARDS, http://www.e-stewards.org/ewaste_crisis.html (last visited Aug. 17, 2010) [hereinafter *The e-Waste Crisis*] (stating that the U.S. and Canada's e-waste policies are inadequate and have resulted in a social injustice against developing nations).

3 *See, e.g.*, *e-Waste Items*, OMNI TECHNICS INC., http://www.ca-recycle.com/recycle.cfm (last visited Aug. 17, 2010) [hereinafter *e-Waste Items*] (listing "CRT Monitors, LCD Monitors, Plasma Monitors, TVs, Laptop Computers, Desktop Computers, Printers, Scanners, Computer Components & Parts, Circuit Boards, Cables & Wire, Copy

mercury, and other toxic materials.[4] While the majority of these electronic goods are produced for and used by consumers in wealthy developed countries, at the end of their lifecycles many of these products are shipped to developing nations for recycling and disposal.[5] All across Asia and Africa, communities like Guiyu suffer the toxic effects.[6]

The United States contributes approximately four million products to the electronic waste (e-waste) stream each year and is a leading contributor to what has become known as the "e-waste crisis."[7] However, the United States has not yet implemented federal e-waste regulations governing the domestic disposal and recycling of e-waste, and it has failed to create comprehensive policies regulating the export of toxic electronics to developing countries.[8]

The United States has the capital, market influence, regulatory ability, and ethical duty to take responsibility for its contribution to the e-waste crisis.[9] This Comment argues that to address the e-waste issue and its own significant contribution to the e-waste stream, the United States must implement uniform federal e-waste regulations that reduce the volume and toxicity of discarded e-waste and prevent the export of e-waste to developing countries.[10] Legislators seeking to develop effective e-waste policy should first evaluate the extended producer responsibility, advance recovery fee take-back systems, and substance restriction policies implemented by the European

Machines, Fax Machines, PDAs, Cell Phones, Calculators, Telephones, DVDs VCRs, Stereos, Radios, UPSs, Rechargeable Batteries, [and] Most Electronic Products . . . [w]orking or [n]on-[w]orking" as e-waste).

4 Electronic goods contain dangerous levels of highly toxic substances including lead, mercury, cadmium, arsenic, beryllium, and brominated flame retardants. *See* ELECTRONICS TAKEBACK COALITION, E-WASTE: THE EXPLODING GLOBAL ELECTRONIC WASTE CRISIS, AN ISSUE BRIEFING BOOK 2 (2009), http://www.computertakeback.com/Tools/Ewaste%20Briefing%20Book.pdf [hereinafter ETBC BRIEFING BOOK]; Nicola J. Templeton, *The Dark Side of Recycling and Reusing Electronics: Is Washington's E-Cycle Program Adequate?*, 7 SEATTLE J. SOC. JUST. 763, 766–68 (2009); *The e-Waste Crisis*, *supra* note 2.

5 *The e-Waste Problem*, GREENPEACE INT'L, http://www.greenpeace.org/international/campaigns/toxics/electronics/the-e-waste-problem (last visited Aug. 17, 2010) [hereinafter *The e-Waste Problem*]; ETBC BRIEFING BOOK, *supra* note 4, at 4; *The e-Waste Crisis*, *supra* note 2.

6 *See The e-Waste Problem*, *supra* note 5; *The e-Waste Crisis*, *supra* note 2.

7 *See 60 Minutes: Following the Trail of Toxic E-Waste* (CBS television broadcast Aug. 30, 2009) [hereinafter *60 Minutes*], *available at* http://www.cbsnews.com/stories/2008/11/06/60minutes/main4579229.shtml?tag=contentMain;contentBody (reporting that Americans discard 130,000 computers each day and 100 million cell phones each year). *See also The e-Waste Crisis*, *supra* note 2 (stating that Americans threw away four billion pounds of e-waste in 2005).

8 *See E-Cycling*, *supra* note 1.

9 *See* GAO REPORT, *supra* note 1, at 15; Templeton, *supra* note 4 at 763, 771–72.

10 *See* ETBC BRIEFING BOOK, *supra* note 4, at 9.

Union[11] and Japan.[12] Second, legislators should ensure that the United States ratifies existing international treaties regulating the transboundary movement of hazardous waste.[13]

Part I of this Comment provides an introduction to the e-waste crisis. It outlines the health and environmental dangers that discarded electronics pose given the scope and toxicity of the e-waste stream and it documents the United States' exploitative practice of exporting these toxic devices to developing nations for disposal. Part II discusses the United States' failure to implement effective e-waste policy. Part III explores existing e-waste policy developed by the international community. Finally, Part IV outlines a proposal for enacting a comprehensive e-waste policy that: 1) prohibits the use of certain toxic substances, 2) distributes end-of-life responsibility between multiple stakeholders, and 3) utilizes the positive feedback signals that extended producer responsibility and advance recovery fee take-back systems provide. In conclusion, this Comment emphasizes that federal policy must be implemented to stop the export of e-waste to developing countries and must be framed with enough breadth to manage existing and future types of e-waste to effectively address all of the issues presented by e-waste, both domestically and abroad.

I. AN OVERVIEW OF THE E-WASTE CRISIS

E-waste poses a significant environmental threat that requires an immediate national response. Three factors contribute

11 The European Union has taken steps to address the e-waste crisis by implementing the Waste Electrical and Electronic Equipment (WEEE) Directive which requires producers to take back used electronics from consumers, and the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) initiative which prohibits the use of certain toxic substances in the production of new electronic devices. *See* discussion *infra* Part III.B. *See also* Directive 2002/96/EC, of the European Parliament and of the Council of 27 January 2003 on Waste Electrical and Electronic Equipment (WEEE), 2003 O.J. (L 37) 24–25 [hereinafter WEEE Directive], *available at* http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:037:0024:0038:EN:PDF; Directive 2002/95/EC, of the European Parliament and of the Council of 27 January on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment, 2003 O.J. (L 37) 19–20 [hereinafter RoHS Directive], *available at* http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:037:0019:0023:en:PDF; Templeton, *supra* note 4, at 782, 784–85.

12 Japan has implemented a national e-waste policy. *See* discussion *infra* Part III.C. *See also* INFORM, INC., ELECTRIC APPLIANCE RECYCLING IN JAPAN 1 (2003) [hereinafter INFORM, APPLIANCE], *available at* http://informinc.org/japanepr.pdf (explaining that Japan has enacted responsibility requirements for the disposal of, among other things, electronic appliances); INFORM INC., PC RECYCLING IN JAPAN 1 (2004) [hereinafter INFORM, PC], *available at* http://informinc.org/japanpc.pdf (providing an overview of Japan's Recycling Promotion Law, amended in 2001 to govern the responsible disposal of personal computers).

13 *See* GAO REPORT, *supra* note 1, at 34–36.

to the urgency of the e-waste crisis: 1) e-waste is the fastest growing element in today's waste stream,[14] 2) electronic goods are ubiquitous in today's increasingly technological society and contain dangerous levels of highly toxic substances,[15] and 3) e-waste is commonly exported to foreign countries that lack the capacity to safely manage the lingering toxic effects of discarded devices.[16]

A. The Scope of the E-Waste Stream

When the National Safety Council Study estimated in 1998 that twenty million computers were becoming obsolete each year, the number seemed unbelievably high; however, according to the Environmental Protection Agency's (EPA) recent estimates, that number has more than doubled in the past ten years.[17] In 2007, more than 372.7 million units of e-waste, including an estimated 205.5 million units of computer products, 140.3 million cell phones, and 26.9 million televisions, were disposed of in the United States alone.[18]

The U.S. Geological Survey warns that these estimates should be viewed as conservative approximations because seventy-five percent of e-waste is currently in storage and has yet to contribute to the flooded waters of the e-waste stream.[19] The EPA estimates that at the end of 2007, Americans had nearly 235 million electronic devices in storage.[20]

14 *The e-Waste Problem*, *supra* note 5.

15 *See, e.g.*, ETBC BRIEFING BOOK, *supra* note 4, at 2.

16 *See The Problem of Global Electronic Waste Dumping*, ELECTRONICS TAKEBACK COALITION, http://www.computertakeback.com/problem/export_problem.htm (last visited Aug. 17, 2010) [hereinafter ETBC, *Problem: Waste Dumping*].

17 *Statistics on the Management of Used and End-of-Life Electronics*, UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, http://www.epa.gov/epawaste/conserve/materials/ecycling/manage.htm (last visited Aug. 17, 2010). As the lifespan of electronics decrease, consumers purchase and discard electronics more often. *See The e-Waste Problem*, *supra* note 5 (reporting that while the average lifespan of a computer was six years in 1997, in 2005 the average computer's lifespan was only two years).

18 "Computer products" include CPUs, monitors, laptops, keyboards, mice, printers, copiers, and faxes. ELECTRONICS TAKEBACK COALITION, FACTS AND FIGURES ON E-WASTE AND RECYCLING 2 (2009), http://www.computertakeback.com/Tools/Facts_and_Figures.pdf [hereinafter ETBC, FACTS AND FIGURES].

19 DONALD BLEIWAS & THOMAS KELLY, OBSOLETE COMPUTERS, "GOLD MINE," OR HIGH-TECH TRASH? RESOURCE RECOVERY FROM RECYCLING, U.S. GEOLOGICAL SURVEY FACT SHEET FS-060-01 (2001), http://pubs.usgs.gov/fs/fs060-01/fs060-01.pdf.

20 In 2007, the EPA estimated there were 65.7 million desktop PCs, 42.4 million PC monitors, 2.1 million portable PCs, 25.2 million peripherals, and 99.1 million televisions in storage. U.S. ENVTL. PROT. AGENCY, ELECTRONICS WASTE MANAGEMENT IN THE UNITED STATES: APPROACH 25 tbl.3.4 (2008), http://www.epa.gov/osw/conserve/materials/ecycling/docs/app-1.pdf.

E-waste is the fastest growing municipal waste stream in the United States and other industrialized nations,[21] and it is expected to increase as consumers transition to digital televisions and discard old analog devices.[22] The Electronics TakeBack Coalition (ETBC)[23] forecasted that the 2009 conversion to digital television would cause an "e-waste tsunami"[24] as Americans discarded their old televisions and took stockpiled analog sets out of storage because they could no longer be reused or donated.[25] Based on estimates provided by the U.S. Government Accountability Office (GAO),[26] the ETBC calculated that forty million televisions that relied on over-the-air television signals would be rendered obsolete by the digital conversion.[27]

21 The United States and the United Kingdom are the leading culprits in the e-waste crisis; however, the e-waste issue is a global one. Greenpeace reports that twenty to fifty million tonnes (metric tons) of e-waste are generated each year worldwide. *The e-Waste Problem*, *supra* note 5 (reporting that e-waste currently comprises five percent of the worldwide municipal waste stream and is the waste stream's fastest growing component). *See also* Noah Sachs, *Planning the Funeral at the Birth: Extended Producer Responsibility in the European Union and the United States*, 30 HARV. ENVTL. L. REV. 51, 59–60 (2006) (reporting that the European Commission estimates that the European Union will generate twelve million tons of e-waste in 2010 and that the growth rate of e-waste in the European Union is three-times higher than that of the municipal solid waste stream); *id.* at 60 (stating that in 2006 more than 3,500 tons of e-waste became obsolete each day in the United States); *Our e-Waste Comes Back to Haunt Us*, AMERICAN PUBLIC MEDIA (Nov. 14, 2007), http://marketplace.publicradio.org/display/web/2007/11/14/consumed5_pm_1/ (reporting that Greenpeace estimates that four thousand tons of e-waste are discarded every hour worldwide).

22 *See* Nathanial Gronewold & Greenwire, *Electronics: Some See E-Waste Crisis Trailing Switch to Digital TV*, N.Y. TIMES (June 15, 2009), http://www.nytimes.com/gwire/2009/06/15/15greenwire-some-see-e-waste-crisis-trailing-switch-to-dig-81110.html.

23 The Electronics TakeBack Coalition (ETBC) is an organization that promotes responsible recycling and environmentally friendly designs within the electronics industry. *See generally About Us*, ELECTRONICS TAKEBACK COALITION, http://www.computertakeback.com/about/about_coalition.htm (last visited Aug. 17, 2010).

24 Television broadcasters stopped sending out analog television signals on June 12, 2009, rendering televisions that could not receive digital signals obsolete. *Take Back My TV Campaign*, ELECTRONICS TAKEBACK COALITION, http://www.computertakeback.com/corporate/take_back_my_TV.htm (last visited Aug. 17, 2010).

25 Sixty-eight percent of consumers keep their old computer equipment. In 2007, there were 235 million units of used electronics in storage including 99 million televisions. ETBC, FACTS AND FIGURES, *supra* note 18, at 3. *See also* Gronewold & Greenwire, *supra* note 22 (noting that millions of unused televisions are stockpiled in storage and have not yet been disposed of because people often keep old electronics with the hope they will be able to give them to someone else to use; realistically, these televisions will ultimately be discarded since the 2009 digital conversion rendered them obsolete).

26 Referred to as the "congressional watchdog," the GAO is a nonpartisan agency employed by Congress to determine how the federal government uses taxpayer money. *See generally About GAO*, U.S. GOV'T ACCOUNTABILITY OFF., http://www.gao.gov/about/index.html (last visited Aug. 17, 2010).

27 ETBC, FACTS AND Figures, supra note 18, at 6. *See also* Gronewold & Greenwire, *supra* note 22 (reporting that the Basel Action Network (BAN) projected that one-in-four households would discard an obsolete television in 2009, following the digital conversion).

B. E-Waste Described and the Dangers of E-Waste Toxicity

While computers, televisions, and cell phones are at the heart of the e-waste debate, e-waste consists of a wide range of everyday "electronic appliances that are discarded because of malfunction, exhaustion, or obsolescence."[28] Thus, e-waste also includes PDAs, light bulbs, batteries, radios, copiers, fax machines, and other electronic devices.[29] The torrent of electronic goods flooding the waste stream poses a unique danger because of its high volume and toxicity.[30]

Producers' marketing strategies and consumers' purchasing habits promote high obsolescence rates in electronic goods, making e-waste the fastest growing element in the modern waste stream and a significant global issue.[31] The faster electronics become outdated, the sooner consumers purchase more.[32] Therefore, in today's electronics market producers have a disincentive to design durable, repairable, and upgradable appliances and are instead encouraged to design and sell electronic devices with short life spans.[33] The problems presented by this accelerated rate of obsolescence are further compounded by the fact that the e-waste flooding the waste stream is designed in a way that it is difficult and costly to disassemble and recycle.[34]

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28 Jennifer Kutz, Comment, *You've Got Waste: The Exponentially Escalating Problem of Hazardous e-Waste*, 17 VILL. ENVTL. L.J. 307, 307 (2006); *About e-Waste*, OMNI TECHNICS INC., http://www.ca-recycle.com/resources.cfm (last visited Aug. 17, 2010) [hereinafter OMNI: *About e-Waste*].

29 Kutz, *supra* note 28, at 307; *e-Waste Items*, *supra* note 3.

30 *See* Kutz, *supra* note 28, at 307.

31 *See Problem: Electronics Become Obsolete Quickly*, ELECTRONICS TAKEBACK COALITION, http://www.computertakeback.com/problem/made_to_break.htm (last visited Aug. 20, 2010) [hereinafter ETBC, *Problem: Obsolete*].

32 Betsy M. Billinghurst, Note, *E-Waste: A Comparative Analysis of Current and Contemplated Management Efforts by the European Union and the United States*, 16 COLO. J. INT'L ENVTL. L. & POL'Y 399, 404 (2005).

33 The electronics industry actively spurs the obsolescence rate of electronics for their financial gain. Cell phone companies, for example, offer free cell phone upgrades every two years, although most mobile phones are still fully functional at the time of the upgrade. Likewise, software companies, like Microsoft, release new operating systems that are incompatible with older computer models so consumers will buy new hardware. Apple, the producer of the iPod, exemplifies this kind of manufactured obsolescence marketing. It encourages consumers to regularly replace their MP3 devices by continually releasing slightly different models of the iPod and by designing the iPod with batteries that are extremely difficult and costly to replace. *See* ETBC, *Problem: Obsolete*, *supra* note 31.

34 Manufacturers do not consider the end-of-life cycle when designing most electronics. Therefore, a majority of devices are built with materials that are hard to recycle and are constructed in a way that it is difficult to take them apart. *See The Problem with Electronics: Not Designed for Recycling*, ELECTRONICS TAKEBACK COALITION, http://www.computertakeback.com/problem/not_designed_for_recycling.htm (last visited Aug. 17, 2010) [hereinafter ETBC, *Problem: Recycling*]. *See also The e-Waste Crisis*, *supra* note 2 (noting that electronics are often designed with multiple components

Electronic goods contain dangerous levels of highly toxic substances, including lead, mercury, cadmium, beryllium, and brominated flame retardants, which can cause serious health conditions such as cancer and other neurological, circulatory, and reproductive diseases.[35] Furthermore, electronics contain other components that can form hazardous dioxins and polycyclic aromatic hydrocarbons when burned.[36]

Lead is a particularly toxic element of e-waste and is a common component in most electronic appliances, including television and computer cathode ray tubes (CRTs) and computer circuit boards.[37] Lead exposure can damage the nervous, circulatory, and reproductive systems.[38] It is well-documented that developing brains of children are especially vulnerable to lead toxicity.[39]

Like lead, mercury is used in electronic devices including cell phones, flat panel monitors, and batteries, and is particularly dangerous to children and fetuses, causing damage to the brain and kidneys.[40] Cadmium, a carcinogenic heavy metal that causes respiratory, liver, and kidney problems when ingested or inhaled, is found in cathode ray tubes, batteries, circuit boards, and semiconductor chips.[41] Beryllium and beryllium alloys are also commonly found in electronic devices.[42] Once used to make fluorescent lights, beryllium has since been identified as a potential carcinogen, and inhalation of beryllium particles is

and are bolted, glued, and screwed together with little regard for the cost of disassembling or recycling the devices at the end of their lifecycles).

35 Roughly forty percent of the heavy metals in landfills originate from e-waste. *See, e.g.*, ETBC, BRIEFING BOOK, *supra* note 4, at 2 (reporting that electronics manufacturers use more than one thousand materials, including many heavy metals, plastics, and toxins, to produce electronic goods); *The e-Waste Crisis*, *supra* note 2.

36 *See, e.g.*, Templeton, *supra* note 4, at 768; *The e-Waste Crisis*, *supra* note 2.

37 Computer and television CRTs contain between four and eight pounds of lead. *See, e.g.*, *What's in Electronic Devices?*, GREENPEACE INTERNATIONAL, http://www.greenpeace.org/international/campaigns/toxics/electronics/what-s-in-electronic-devices (last visited Aug. 27, 2010) [hereinafter *What's in Electronic Devices?*] (reporting that in 2002, approximately ten thousand tonnes of lead were sold in the form of CRT monitors); Sachs, *supra* note 21, at 59; Templeton, *supra* note 4, at 766–67.

38 Manasvini Krishna & Pratiksha Kulshrestha, *The Toxic Belt: Perspectives on E-Waste Dumping in Developing Nations*, 15 U.C. DAVIS J. INT'L L. & POL'Y 71, 72–73 (2008).

39 *See, e.g.*, Krishna & Kulshrestha, *supra* note 38, at 72–73; *What's in Electronic Devices?*, *supra* note 37.

40 Krishna & Kulshrestha, *supra* note 38, at 73; Templeton, *supra* note 4, at 767. *See also* Sachs, *supra* note 21, at 59 (reporting that twenty-two percent of the mercury the world consumes annually is used to make electronic equipment); *id.* at 60 (stating the National Safety Council estimates that the 500 million computers discarded in the United States between 1997 and 2007 contained more than 632,000 pounds of mercury).

41 Templeton, *supra* note 4, at 767; *What's in Electronic Devices?*, *supra* note 37.

42 Templeton, *supra* note 4, at 767–68.

associated with scarring of lung tissue.[43] Additionally, circuit boards and plastic casings often contain brominated flame retardants which can cause brain impairment and can interfere with hormone functions.[44]

While the toxic components in electronic devices do not generally threaten the health of those who use them in developed countries, these hazardous substances have adverse health and environmental effects when electronics are incinerated,[45] dismantled, or dumped in landfills.[46] Ironically, although they do not generally benefit from electronic devices during the products' useful life, developing nations bear the majority of e-waste's toxic effects.[47]

C. The Export of E-Waste to Developing Countries

Recycling electronic products, which include intricate meshes of plastics, hazardous materials, and precious metals,[48] is a laborious and costly undertaking.[49] This is in part because manufacturers of electronic goods have traditionally designed products without considering the costs associated with disassembling and recycling discarded devices.[50] The high cost of recycling electronic goods, combined with the negligible value of devices that are obsolete in the American market,[51] means that

43 *See* OMNI: *About e-Waste*, *supra* note 28 (describing chronic berylliosis, a lung condition caused by exposure to beryllium fumes and dust).

44 *See, e.g.*, *What's in Electronic Devices?*, *supra* note 37 (reporting that electronic manufacturers used 1,000 tonnes of TBBPA, a brominated flame retardant to produce almost 700 million cellular phones in 2004).

45 Lead, mercury, cadmium and other heavy metals are released into the air when electronics are incinerated. *See Where Does e-Waste End Up?*, GREENPEACE INTERNATIONAL, http://www.greenpeace.org/international/campaigns/toxics/electronics/where-does-e-waste-end-up (last visited Aug. 17, 2010) [hereinafter *Where Does e-Waste End Up?*].

46 Toxic elements can ooze out of discarded electronics that are left in landfills, and eventually can contaminate the groundwater. *See 'E-Cycling', supra* note 1.

47 *See* Jennifer L. Fordyce, *Review of Selected Legislation: Health and Safety Chapter 526: Out with the Old, In with the New—California Addresses the Growing Problem of E-Waste*, 35 MCGEORGE L. REV. 529, 531 (2004).

48 In addition to containing numerous toxic elements, electronic equipment also contains varying amounts of precious metals which make e-waste a commodity in developing nations. These precious metals include platinum, gold, and silver. Krishna & Kulshrestha, *supra* note 38, at 72.

49 *See* GAO REPORT, *supra* note 1, at 9.

50 *See* ETBC, *Problem: Recycling*, *supra* note 34.

51 Flat screen LCD TVs, for example, are designed in a way that makes it extremely difficult and costly to disassemble and recycle their components. LCD TVs typically contain twenty-plus mercury lamps that run the length of the display screen. These lamps are extremely fragile and release toxins when they are broken. Therefore, these lamps need to be removed before the device is shredded or otherwise processed for recycling. The entire TV, however, must be fully disassembled in order to remove the lamps. Because it is time consuming and costly to dissemble the entire device, recyclers instead put these devices in the shredder whole, exposing their workers to mercury, or

obsolete devices are commonly exported to foreign countries where low-wage labor and weak environmental regulations make it cost effective to reuse the devices or reclaim their precious metals.[52] Poverty and lenient environmental regulations in developing countries[53] make China, Nigeria, and India recipients of a majority of the developed world's e-waste.[54]

Exporters have another incentive to export e-waste. Waste management agencies that export used electronics abroad stand to make a profit by selling used televisions, computers, cell phones, and other electronics to purchasers who either resell the electronics or harvest their precious metals and recyclable materials.[55] These practices present problems for the countries receiving vast quantities of e-waste.

Developing countries do not have the infrastructure, technology, or regulatory incentives to safely dispose of e-waste.[56] In its 2008 report on the harmful effects the e-waste trade, the GAO found that e-waste that is exported from the United States is "often recycled in developing countries by crude and inefficient means and with virtually no human health or environmental protection."[57] Low wage workers, including many child laborers, disassemble and extract precious metals from electronic devices by hand in unsafe conditions.[58] Unaware of or with disregard for the extreme toxicity, these laborers burn the plastic coating off of

they dump these TVs in landfills instead of properly disposing of them. ETBC, *Problem: Recycling*, *supra* note 34; *The e-Waste Crisis*, *supra* note 2.

52 *See* ETBC, *Problem: Waste Dumping*, *supra* note 16. S*ee also The Problem with Electronics: Discarded Electronics are Badly Managed in the U.S.*, ELECTRONICS TAKEBACK COALITION, http://www.computertakeback.com/problem/discards_badly_managed.htm (last visited Sept. 1, 2010) [hereinafter ETBC, *Problem: Badly Managed*] (reporting that fifty to eighty percent of the e-waste collected in the United States under the guise of recycling is exported to developing countries for processing and disposal). It is ten times less expensive to recycle computer monitors in China than it is to do so in the United States. *Where Does e-Waste End Up?*, *supra* note 45 (noting that e-waste from the United States, Japan, and the European Union is likely to be exported to China because it is cheaper to dump e-waste in China than to properly dispose of it in developed nations).

53 For the purposes of this article, "developing countries" refers to foreign nations whose infrastructure, technology, and regulatory framework are less developed than those of wealthy industrialized countries like the United States and the United Kingdom.

54 *See* Krishna & Kulshrestha, *supra* note 38, at 73–74. While it may cost twenty dollars to recycle a computer in the United States, it only costs two dollars in India. Krishna & Kulshrestha, *supra* note 38, at 74; *accord Where Does e-Waste End Up?*, *supra* note 45.

55 GAO REPORT, *supra* note 1, at 21 (stating that computers that have little to no value in the United States are commonly exported and sold for one hundred dollars in West African countries); ETBC, *Problem: Waste Dumping*, *supra* note 16.

56 *See* GAO REPORT, *supra* note 1, at 5; *60 Minutes*, *supra* note 7.

57 GAO REPORT, *supra* note 1, at 1.

58 *The e-Waste Problem*, *supra* note 5.

wires to recover copper and submerge circuit boards in open acid baths to separate other precious metals.[59]

1. Recycling in China and Other Asian Countries

The environmental impact of exporting e-waste to developing countries is best documented in the town of Guiyu in southern China.[60] Dubbed the "Chernobyl of electronic waste," Guiyu holds what has been called the "dirty little secret of the electronic age."[61] Guiyu, once a rural rice-growing community, was devastated by the effects of the e-waste trade within five years of becoming an e-waste processing center.[62] With over three hundred disposal sites in the village using open burning and acid baths to recover electronics' precious metals, Guiyu residents suffer from some of the highest incidents of dioxin and lead poisoning in the world.[63] In 2007, the journal *Environmental Health Perspectives* found that lead levels in the blood of children in Guiyu were fifty percent higher than the CDC sets for exposure in the United States, and were fifty percent higher than those of children in neighboring towns where used electronics were not dismantled.[64] Guiyu is just one of many global locations for e-waste recycling.[65] Towns and cities throughout China, Indonesia, Cambodia, and India are home to "'rudimentary' recycling" operations where impoverished workers, including children, toil in scrap yards dismantling the toxic throwaways of developed nations for as little as one dollar per day.[66]

59 *See* ETBC, *Problem: Waste Dumping*, *supra* note 16 (stating that low wage workers in e-waste recycling centers break CRT tubes with hammers, heat circuit boards over open flames, burn wires and plastic casings in the open air, and dump acids and heavy metals into nearby rivers, regularly exposing themselves and their communities to dangerous toxins and health hazards); *Where Does e-Waste End Up?*, *supra* note 45 (reporting that children often dismantle and recycle e-waste in developing countries by hand with no safeguards despite the fact that lead, mercury, cadmium, and other toxins are released into the environment when electronics are incarcerated and dismantled).

60 *60 Minutes*, *supra* note 7.

61 *Id.*

62 Templeton, *supra* note 4, at 773–74. *See also 60 Minutes*, *supra* note 7 (reporting that all of the village's drinking water has to be trucked in because of the pollution).

63 Gronewold & Greenwire, *supra* note 22; *accord 60 Minutes*, *supra* note 7 (reporting that "pregnancies are six times more likely to end in miscarriage [in Guiyu], and that seven out of ten kids have too much lead in their blood").

64 GAO REPORT, *supra* note 1, at 18.

65 *See id.* at 17.

66 *See* GAO REPORT, *supra* note 1, at 19 (reporting that e-waste recycling centers can be found in many of Indonesia's hundreds of sea ports including east Java and Batam Island). Greenpeace has documented e-waste operations in Delhi, Meerut, Ferozabad, Chennai, Bangalore and Mumbai, India. Delhi's scrap yards employ 25,000 laborers and process ten to twenty tonnes of e-waste each year. *Where Does e-Waste End Up?*, *supra* note 45.

2. The Ruse of "Reuse" in Africa

While the trade of electronics for recycling and disposal has its focal point in China and other Asian countries, the environmental impact of e-waste is not limited to Asia.[67] Western Africa also receives large quantities of the developed world's discarded electronics.[68] Recycling operations are less common in West Africa than in Asia because it costs more to ship used electronic goods to Africa[69] and because Africa lacks a market for salvaged materials.[70] Therefore, discarded electronics are shipped to Africa under the guise of being reusable and re-sellable goods.[71] Reuse can extend the product life of some electronic appliances that would otherwise be dumped and can help bridge the "digital divide," making technology available to African countries that would otherwise not have access.[72] However, because it is costly and time-consuming to test each electronic device before shipping it abroad, it is common practice to ship broken and unusable units along with those that have potential for reuse.[73] Every month, 400,000 computers arrive in Nigeria, a hub for the import of reusable electronic goods in Western Africa.[74] Approximately seventy-five percent of this imported equipment is broken "junk" that is dumped or burned with little to no environmental safeguards.[75]

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67 *See* ETBC, *Problem: Waste Dumping*, *supra* note 16.

68 GAO REPORT, *supra* note 1, at 21; BASEL ACTION NETWORK, BRIEFING PAPER 10, PREVENTING THE DIGITAL DUMP: ENDING "RE-USE ABUSE" (2007), http://www.ban.org/Library/BP10_09_07.pdf [hereinafter THE DIGITAL DUMP].

69 GAO REPORT, *supra* note 1, at 21 (noting it costs $750 to ship a forty-foot container from the United States to Hong Kong but it costs between $4,000 to $7,000 to ship a twenty-foot container from the United States to West Africa).

70 Salvageable metals, plastics, and glass taken from e-waste in Asian recycle operations are melted down and reused in manufacturing. *Where Does e-Waste End Up?*, *supra* note 45 (reporting that the demand for e-waste in Asia grew when waste managers discovered they could extract copper, gold, iron, nickel, and silicon from recycled e-waste).

71 *See The e-Waste Crisis*, *supra* note 2 (noting electronic scrap can easily be relabeled as "refurbishable").

72 Templeton, *supra* note 4, at 770–71 (describing the "digital divide" as a disparity in access to technology which hinders economic and infrastructure development in countries that lack access to computers, phones, and other electronic equipment).

73 GAO REPORT, *supr*a note 1, at 21; *Where Does e-Waste End Up?*, *supra* note 45 (noting that although there are benefits associated with reusing electronics in developing countries, exporting electronics for reuse is problematic because the devices will likely have short life spans and the recipient country is unlikely to have adequate waste treatment facilities).

74 Templeton, *supra* note 4, at 775 (reporting five hundred containers containing eight hundred computers arrive in Nigeria each month); *E-Cycling*, *supra* note 1 (reporting thirteen thousand discarded computers are smuggled from America to Nigeria each day).

75 GAO REPORT, *supra* note 1, at 21; Templeton, *supra* note 4, at 775; ETBC BRIEFING BOOK, *supra* note 4, at 5 (reporting that the scrap that Nigeria receives under the banner of reuse often ends up being tossed in unregulated landfills where it exposes impoverished communities to toxins).

Fifty to eighty percent of the e-waste collected in the United States under the guise of recycling is exported to developing countries for processing and disposal.[76] Countries in Asia and Africa receive the majority of the industrialized world's e-waste and suffer from its toxic effects.[77] As the next section will discuss, the United States, a leading culprit in the e-waste crisis, has done little to moderate or remedy this unethical poisoning.[78]

II. THE FAILURE OF THE UNITED STATES TO IMPLEMENT EFFECTIVE E-WASTE REGULATIONS

The United States has failed to adequately address the e-waste issue. First, at a federal level, the primary environmental regulation governing hazardous waste is outdated and spotted with loopholes, and the EPA has failed to aggressively pursue regulatory controls.[79] Second, while states have attempted to independently address the e-waste issue by experimenting with varying waste regulation schemes,[80] these localized attempts have produced a "patchwork" of inconsistent and sometimes counterproductive policies.[81]

A. Federal Regulations Within the United States that Pertain to E-Waste are Inadequate

Despite its contributory role in the e-waste crisis, the United States has not yet adopted a federal e-waste policy, and there are no federal regulations specifically dealing with the domestic management or export of used electronic products.[82] Existing environmental regulations focus on limiting the pollution created during the manufacturing process and ignore the externalities presented by the products and their end-of-life cycle.[83] In the

76 ETBC, *Problem: Badly Managed*, *supra* note 52.

77 *Id.*

78 *See* GAO REPORT, *supr*a note 1, at 21.

79 *See* Heather L. Drayton, Note, *Economics of Electronic Waste Disposal Regulations*, 36 HOFSTRA L. REV. 149, 162–63 (2007); *The e-Waste Crisis*, *supra* note 2.

80 *See generally State by State E-Waste Law Summary: E-Waste Laws Passed and Legislation Being Considered In 2010*, ELECTRONICS TAKEBACK COALITION, http://www.computertakeback.com/legislation/States_Summary_2010.pdf (last updated Feb. 17, 2010) [hereinafter ETBC, *State by State E-Waste Law Summary*]; *State Legislation*, ELECTRONICS TAKEBACK COALITION, http://www.computertakeback.com/legislation/state_legislation.htm (last visited Aug. 19, 2010) [hereinafter ETBC, *State Legislation*].

81 Drayton, *supra* note 79, at 166.

82 *See Regulations/Standards*, U.S. ENVTL. PROTECTION AGENCY, http://www.epa.gov/waste/conserve/materials/ecycling/rules.htm (last visited Aug. 17, 2010); GAO REPORT, *supra* note 1, at 21–23 (noting "U.S. Exports of Potentially Harmful Used Electronics Flow Virtually Unrestricted"); Drayton, *supra* note 79, at 162–63.

83 *See* Sachs, *supra* note 21, at 53, 57–58 (noting that U.S. regulations strictly monitor the release of Volatile Organic Compounds (VOCs) during the manufacturing

absence of federal regulation dealing with used electronic products, the Resource Conservation Recovery Act (RCRA)[84] and the EPA's voluntary product stewardship program[85] currently act as inadequate substitutes.[86] Both the RCRA and the EPA are generally unable to address the e-waste crisis because they are intended to serve a wider purpose and do not have the ability to focus on narrower issues, like e-waste.[87]

The RCRA governs the generation and disposal of hazardous waste within the United States.[88] However, the RCRA was originally enacted in 1976—long before today's overwhelming e-waste stream could be envisioned—and is thus ill-equipped to deal with the issue of discarded electronic goods.[89] To be governed by the RCRA, a material must be deemed a hazardous waste.[90] Because the RCRA provides that equipment that has the "potential for reuse" is not waste, many electronic products at the end of their life cycle are not classified as "waste" and are therefore excluded from the RCRA regulation.[91] The field of used electronic products governed by the RCRA is further limited by the EPA's narrow definition of what is "hazardous."[92] Under the RCRA, a solid material is considered hazardous only if it leaches chemicals in dangerous concentrations during their functional lives.[93] Electronics do not generally do so.[94] So while they contain brews of toxins that pose serious health and environmental risks when they are disassembled or burned—as they often are after being exported to developing countries—most

process, but fail to regulate finished products that contain VOCs, thus allowing the eventual release of the VOC toxins during use or upon disposal).

84 42 U.S.C. §§ 6901–6992k (2006).

85 *See generally Product Stewardship: Basic Information*, U.S. ENVTL. PROTECTION AGENCY, http://www.epa.gov/waste/partnerships/stewardship/basic.htm (last visited Aug. 17, 2010) [hereinafter EPA, *Product Stewardship*].

86 *See, e.g.*, *The e-Waste Crisis*, *supra* note 2; Drayton, *supra* note 79, at 162–63.

87 *See* Drayton, *supra* note 79, at 162–64.

88 *See* §§ 6901–6992k.

89 *See* 42 U.S.C. §§ 6901–6992k; OFFICE OF TECH. POL'Y, U.S. DEPT. COMMERCE, RECYCLING TECHNOLOGY PRODUCTS: AN OVERVIEW OF E-WASTE POLICY ISSUES 4 (2006) [hereinafter RECYCLING TECHNOLOGY], *available at* http://www.bvsde.paho.org/bvsacd/cd57/recycling/intro.pdf; Templeton, *supra* note 4, at 786–87.

90 ROBERT TONETTI, EPA OFFICE OF SOLID WASTE: EPA'S REGULATORY PROGRAM FOR "E-WASTE" (2007), http://www.epa.gov/waste/conserve/materials/ecycling/docs/e-wasteregs.pdf [hereinafter EPA'S REGULATORY PROGRAM FOR "E-WASTE"].

91 *See id.*

92 *See* GAO REPORT, *supra* note 1, at 6.

93 Rob Courtney, Note, *Evolving Hazardous Waste Policy for the Digital Era*, 25 STAN. ENVTL. L. J. 199, 205–06 (2006) (describing limitations of the Toxicity Characteristic Leachate Procedure (TCLP) test and noting that, although the EPA now considers them to be hazardous, for several years CRT computer monitors failed to register on TCLP lead toxicity tests).

94 *Id.* at 205–07.

kinds of e-waste are not considered hazardous and are exempt from the RCRA.[95]

Additionally, even if waste is deemed hazardous and should properly fall under the Act's governance, the RCRA contains a number of loopholes that decrease the regulation's effectiveness against e-waste.[96] The RCRA narrowly focuses on waste generated by large businesses, and it provides exclusions for households and small quantity generators while overlooking the significant contribution of e-waste from the aggregation of sources such as households and small companies.[97]

By providing exemptions for donated equipment, the RCRA encourages "disguised dumping" in which owners of used electronics pass their obsolete appliances on to others, such as non-profit organizations, who ultimately bear the responsibility of managing the product's disposal.[98] A substantial portion of electronic goods that are donated under the guise of "reuse" either have obsolete technology or short life expectancies, or are broken and unusable.[99] Within the United States, many charities and non-profit organizations have started to refuse donations of used electronics because the cost of disposal often outweighs the short life expectancy of these goods.[100] Because the majority of donated electronics are nearing the end of their life, donating shifts the externalities associated with those goods away from the parties who are best able to manage and internalize the cost of disposal and removes the feedback loop that might otherwise encourage the consumer to seek more environmentally conscious electronics in the future.[101]

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95 GAO REPORT, *supra* note 1, at 6 (noting that CRT computer monitors are unique in that they are recognized as hazardous and are governed by RCRA).

96 *See* 40 C.F.R § 261.4(b)(1) (2007) (exclusion for household waste, such as garbage and trash); 40 C.F.R. § 261.5(f)(3) (2007) (conditional exemption for companies that generate less than 220 pounds of hazardous waste per month); JAMES E. MCCARTHY, CONG. RESEARCH SERV., RL31505, RECYCLING COMPUTERS AND ELECTRONIC EQUIPMENT: LEGISLATIVE AND REGULATORY APPROACHES FOR "E-WASTE" 2 (2005), *available at* http://wikileaks.org/leak/crs/RL31505.pdf.

97 Courtney, *supra* note 93, at 208–09. *See also* Sachs, *supra* note 21, at 58 (reporting that American households generate 1.6 million tons of hazardous waste each year).

98 *See* Krishna & Kulshrestha, *supra* note 38, at 88.

99 Drayton, *supra* note 79, at 159 (reporting that donated units are often so old they are not compatible with current technology and have no value to potential users). *See also* THE DIGITAL DUMP, *supra* note 68 (stating that reuse "is a less preferable waste management option for a technology that undergoes rapid obsolescence").

100 Drayton, *supra* note 79, at 159 (noting that organizations that take public donations such as Goodwill and the Salvation Army no longer accept old computers or televisions because the cost to dispose of these items is so high).

101 *See* BASEL ACTION NETWORK & SILICON VALLEY TOXICS COALITION, EXPORTING HARM: THE HIGH-TECH TRASHING OF ASIA 7 (2002), http://www.ban.org/E-waste/

By providing an exemption for recyclable material, the RCRA widens the e-waste loophole in which any party can easily evade the RCRA's disposal requirements by simply claiming their waste is "destined for recycling."[102] This presents a significant environmental danger because the EPA loses its authority to determine whether the goods will actually be recycled once the exemption has been claimed.[103] Accordingly, electronic goods are shipped to other countries, who ultimately suffer from eventual toxic releases when the goods are dismantled or dumped.[104]

B. The EPA Has Failed to Pursue Adequate E-Waste Policies

While the majority of domestic e-waste slips through the RCRA's regulatory loopholes, the small portion of e-waste that is subject to EPA control—cathode-ray tubes (CRTs)—is still widely exported.[105] In 2006, the EPA introduced the CRT rule, which recognized CRTs as hazardous waste and placed regulations on their export.[106] Operating under a notice-and-consent requirement, the CRT rule requires exporters to notify the EPA of their intent to export CRTs for reuse or repair and to obtain the consent of importing countries if CRTs are intended to be recycled abroad.[107] However, because the majority of electronic products are not considered hazardous—despite their dangerous toxicity levels—the CRT rule's scope is too narrow because it only applies to CRTs.[108]

The effectiveness of the CRT rule is further limited both because the CRT regulations are easily circumvented by exporters who ship without submitting the proper paperwork or who intentionally mislabel their shipments of CRTs in order to avoid the regulation, and because the EPA's enforcement of the CRT rule has been inconsistent.[109] Although e-waste operators have reported that the EPA stepped up its enforcement of the

technotrashfinalcomp.pdf [hereinafter EXPORTING HARM]; MCCARTHY, *supra* note 96, at 2; Templeton, *supra* note 4, at 785–87.

102 EXPORTING HARM, *supra* note 101, at 28.

103 *Id.*

104 *See* Templeton, *supra* note 4, at 787; EXPORTING HARM, *supra* note 101, at 1.

105 GAO REPORT, *supra* note 1, at 6–7.

106 *Final Rules on Cathode Ray Tubes and Discarded Mercury-Containing Equipment*, U.S. ENVTL. PROTECTION AGENCY, http://www.epa.gov/osw/hazard/recycling/electron/index.htm (last visited Aug. 19, 2010); *Export Requirements for Cathode Ray Tubes*, U.S. ENVTL. PROTECTION AGENCY, http://www.epa.gov/osw/hazard/international/crts/index.htm (last visited Aug. 19, 2010) [hereinafter EPA, *Export Requirements for CRTs*].

107 EPA, *Export Requirements for CRTs*, *supra* note 106.

108 *See* GAO REPORT, *supra* note 1, at 6.

109 *See id* at 6–7, 23–31; *The e-Waste Crisis*, *supra* note 2.

CRT rule in 2009,[110] in its August 2008 evaluation of the EPA's management of harmful U.S. exports, the GAO found that violations of the CRT rule were "widespread" following the regulation's adoption.[111] Despite numerous documented violations, the EPA failed to issue its first administrative penalty for illegal CRT shipments until July 2008, a year and a half after the rule took effect.[112] Criticizing the EPA for its failure to enforce the CRT rule, the GAO reported that the EPA had neglected to investigate noncompliance with the CRT rule and had not developed the basic elements of an enforcement strategy.[113] The EPA had instead decided to focus on public awareness programs that have also been unable to prevent the export of e-waste.[114]

In place of federal legislation regulating the end-of-life of electronic goods, the EPA endorses a voluntary producer-centered approach based on extended producer responsibility (EPR) known as product stewardship.[115] A diluted version of the pure EPR initiatives,[116] product stewardship encourages manufacturers, retailers, consumers, waste operators, and state and local governments to voluntarily share the responsibility for e-waste management.[117] In an attempt to use its purchasing power as the nation's single largest consumer as leverage to encourage producers to join the product stewardship program and voluntarily design clean electronics, the federal government

110 Email from Mike Easterbrook, Certifications Consultant, Cyclelution, to author (Jan. 5, 2010, 08:32 MST) (on file with author) (reporting that the EPA began "rigorously enforcing the CRT rule" following the GAO's scathing 2008 report).

111 GAO REPORT, *supra* note 1, at 6–7 (noting that forty-three American-based electronic recyclers, including many firms that actively cultivated environmentally friendly public images, failed to comply with the CRT rule when negotiating with undercover GAO agents posing as fictitious buyers from Asia).

112 *Id.* at 7 (noting that although the EPA can seek criminal penalties of up to $50,000 per day of violation and up to two years imprisonment against parties who knowingly violate the CRT rule, the EPA failed to issue a single penalty against an illegal exporter until July 2008).

113 *Id.* (reporting that the EPA does not have a plan or timetable to begin monitoring, investigating, or prosecuting exporters who violate the CRT rule, and noting numerous instances where the EPA failed to detain containers destined for export although the containers had already been denied entry by foreign countries and the EPA knew the containers contained broken CRTs in direct violation of the CRT rule).

114 *Id.* at 8.

115 EPR is a product take-back methodology, which holds the producer responsible as the primary polluter in the e-waste chain. *See infra* Part II.C.1 & Part IV.A. *See also generally* EPA, *Product Stewardship*, *supra* note 85.

116 Pure EPR places the full burden of end-of-life recycling and disposal on electronic producers. Product stewardship is viewed as a diluted version of EPR because it divides the responsibilities between manufacturers, retailers, consumers, waste operators, and the government. *See infra* Part II.C.1 & Part IV.A; Courtney, *supra* note 93, at 216 & n.72.

117 *See generally* EPA, *Product Stewardship*, *supra* note 85. *See also* Courtney, *supra* note 93, at 216.

has begun to incorporate e-waste management provisions into its procurement contracts and has taken steps to identify and purchase environmentally friendly products.[118] Hoping to stimulate similar market-based initiatives in the private sector, the EPA has also launched the Electronic Product Environment Assessment Tool (EPEAT) to help private consumers identify environmentally friendly products.[119]

Some progressive producers including Sony, Apple, Dell, and IBM, and retailers such as Best Buy have voluntarily initiated programs to "take back" electronic waste for recycling.[120] However, some of these companies charge a fee to take back used electronic units,[121] and current industry take-back programs remain an anomaly rather than the norm.[122] Because these programs are limited in scope and are often under-publicized, they are not sufficient to curb the U.S. e-waste stream.[123]

In 2006, the EPA introduced a voluntary program targeted at recyclers known as the Responsible Recycling (R2) Practices for Use in Accredited Certification Programs.[124] R2 sets guidelines for assessing e-waste recyclers' environmental, health,

118 *See* EPA, *Product Stewardship*, *supra* note 85. *See also* Courtney, *supra* note 93, at 216–17 (stating that the federal government spent sixty billion dollars on information technology in 2005 and has since implemented product stewardship into its purchasing practices).

119 The EPEAT provides information on electronic product's environmental attributes so that consumers can make informed purchases. *See generally* ELECTRONIC PRODUCT ENVIRONMENT ASSESSMENT TOOL, http://www.epeat.net (last visited Aug. 19, 2010). *See also The Ultimate Solution: Green Design*, COMPUTER TAKEBACK COALITION, http://www.computertakeback.com/green_design/green_design.htm (last visited Aug. 19, 2010) (describing the TV Company Recycling Report Card and Greenpeace's Electronics Scoreboard, programs similar to the EPEAT which direct consumers to clean electronics).

120 *See Which Manufacturers Take Back Their Products?*, ELECTRONICS TAKEBACK COALITION, http://www.computertakeback.com/corporate/who_takes_back.htm (last visited Jan. 10, 2010); Sachs, *supra* note 21, at 90. *See also How the Companies Line Up*, GREENPEACE INT'L, http://www.greenpeace.org/international/campaigns/toxics/electronics/how-the-companies-line-up (last visited Aug. 19, 2010) (providing a "Guide to Greener Electronics" which ranks the top eighteen producers of personal electronic goods based on their environmental policies).

121 Best Buy only allows households in most states to recycle three items per day and charges ten dollars for televisions up to twenty inches, CRTs, monitors, and laptops. *Frequently Asked Questions for Electronics Recycling Program*, BESTBUY.COM, http://www.bestbuy.com/site/null/Recycling-Electronics/pcmcat149900050025.c?id=pcmcat149900050025&DCMP=rdr0001422 (last visited Aug. 19, 2010).

122 *See* Sachs, *supra* note 21, at 90–91.

123 *Id.* (noting that a similar voluntary recycling campaign launched by the Rechargeable Battery Recycling Corporation in the late 1990's failed because most consumers were largely unaware of the need to recycle used batteries, and those that knew of the requirement did not know where to bring their used batteries and therefore regularly discarded them in the trash because it was more convenient).

124 *See Responsible Recycling Practices*, U.S. ENVTL. PROTECTION AGENCY, http://www.epa.gov/waste/conserve/materials/ecycling/r2practices.htm (last visited Aug. 19, 2010) [hereinafter *Responsible Recycling Practices*].

and safety practices.[125] The EPA's guidelines, however, are largely ineffective because they do not impart any legal obligations on R2 certified e-waste recyclers and contain numerous loopholes that allow recyclers to export, incinerate, and dump e-waste.[126]

While the EPA hopes that rallying federal and private purchasing power around the product stewardship initiative and the EPEAT, as well as motivating recyclers to obtain voluntary e-waste recycling certificates under R2, will solve the e-waste problem, these voluntary programs ultimately are ineffective and inadequate solutions.[127] The initiatives lack enforcement mechanisms, and the American public remains unaware of the e-waste issue.[128]

C. State E-Waste Regulations: An Inconsistent Patchwork of E-Waste Policy

Many states, and a few municipalities, have begun to experiment with varying e-waste schemes based on advance recovery fee and extended producer responsibility methodology.[129] While these local initiatives should be applauded for their attempts to address the e-waste issue, they have failed to address the underlying dangers of e-waste and have instead created an inconsistent "patchwork" of e-waste policies, thus perpetuating the continued export of e-waste to vulnerable countries.[130]

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125 *Id.*

126 The two environmental groups that participated in R2 discussions, the Basel Action Network and Electronics Takeback Coalition, were so disappointed with R2's standards and found the guidelines so "weak" that they both withdrew from the R2 discussion in its final stages. BASEL ACTION NETWORK & ELECTRONICS TAKEBACK COALITION, WHAT'S WRONG WITH THE EPA'S NEW R2 ELECTRONICS RECYCLING STANDARD? 1–4 (2008), http://www.ban.org/Library/Whats_Wrong_With_R2.pdf [hereinafter WHAT'S WRONG WITH R2] (reporting that R2 "fails to adequately address the four biggest problems in the electronics recycling industry": export, incineration/ landfilling, prison recycling and worker health and safety).

127 *See* Drayton, *supra* note 79, at 164; Courtney, *supra* note 93, at 218; WHAT'S WRONG WITH R2, *supra* note 126, at 1–4.

128 *See* TACHI KIUCHI ET AL., GLOBAL FUTURES FOUNDATION, COMPUTERS, E-WASTE, AND PRODUCT STEWARDSHIP: IS CALIFORNIA READY FOR THE CHALLENGE? (2001) [hereinafter GLOBAL FUTURES FOUNDATION, COMPUTERS], *available at* http://future500.org/documents/e-waste.pdf (reporting that the EPA has concluded that "the awareness among most computer and electronic buyers as to the scope of the e-waste problem is low to none"). *See also* Courtney, *supra* note 93, at 218 (pointing out that, because product stewardship lacks enforcement mechanisms, "manufacturers, distributors, and waste generators who simply elect to ignore product stewardship remain free to do so").

129 ETBC, *State Legislation*, *supra* note 80.

130 Drayton, *supra* note 79, at 166.

1. A Brief Overview of E-Waste Methodology: Advance Recovery Fee Systems and Extended Producer Responsibility Policies

Two primary methodologies dominate the governance of e-waste.[131] The first is the advance recovery fee (ARF) system. The second is extended producer responsibility (EPR) approach.[132]

ARF systems place the financial burden of e-waste disposal on consumers and put the physical burden of disposing of and recycling used electronic goods on the government.[133] Under ARF systems, consumers pay an advance collection deposit fee between eight and twenty-five dollars when they purchase electronic products.[134] Retailers collect these fees for the government, and the government then redistributes the funds to public and private entities that manage disposal and recycling.[135]

In contrast to the ARF approach, EPR[136] assigns environmental responsibility[137] to the manufacturers that produce electronic goods and requires that, at the end of the appliance's lifecycle, producers take back the products they made.[138] Known as "cradle to cradle" management, EPR places the burden of safely disposing of and recycling electronic products on the

131 Kutz, *supra* note 28, at 323.

132 *Id.* at 323–24; *Extended Producer Responsibility*, ELECTRONIC TAKEBACK COALITION, http://www.computertakeback.com/legislation/about_epr.htm (last visited Aug. 19, 2010) [hereinafter ETBC, *Extended Producer Responsibility*].

133 See *infra* Part II.C.2 for a discussion of ARF's introduction and role in U.S. e-waste policy; see *infra* Part IV.A for an evaluation of ARF's ability to control the e-waste crisis. *See also* Kutz, *supra* note 28, at 323 (weighing the benefits and problems of ARF systems).

134 As of January 1, 2009, consumers pay eight dollars when purchasing a four to fifteen inch screen, sixteen dollars when purchasing a fifteen to thirty-five inch screen, and twenty-five dollars when purchasing a thirty-five inch or larger screen in California. *See Electronic Product Management: Electronic Waste Recycling Fee*, CALRECYCLE, http://www.calrecycle.ca.gov/electronics/act2003/retailer/fee/ (last visited Aug. 19, 2010) [hereinafter CALRECYCLE]; Sachs, *supra* note 21, at 62.

135 *See* Kutz, *supra* note 28, at 323–24 (noting that bottle recycling deposits are the most common example of the ARF system).

136 EPR is also known as "producer takeback," "product liability," and the "polluters pay principle." Kutz, *supra* note 28, at 324; ETBC, *Extended Producer Responsibility*, *supra* note 132.

137 The EPR places physical responsibility (burden of physically collecting and managing the disposal of used electronic goods), economic responsibility (the cost of managing the end-of-life cycle), informational responsibility (the duty to label products and notify the public of the need and availability of take-back programs), and financial responsibility (financial liability for environmental damage that products cause) on manufacturers. Sachs, *supra* note 21, at 62–63. *See also* Kutz, *supra* note 28, at 334.

138 *Producer Responsibility for Electronic Waste*, ELECTRONIC TAKEBACK COALITION, http://www.computertakeback.com/corporate/corporate_main.htm (last visited Aug. 19, 2010) [hereinafter ETBC, *Producer Responsibility for Electronic Waste*].

companies that produce these goods and relieves the public and the government of this responsibility.[139]

2. States Across the Country Have Implemented an Array of Different E-Waste Policies

Many states have begun to address e-waste issues individually by enacting their own regulations.[140] At the time of this writing,[141] twenty-three states had passed statewide e-waste recycling legislation.[142] In 2003, California became the first state to implement e-waste regulations, and it is the only state thus far to have passed regulations based on the ARF system.[143] In

139 ETBC, *Producer Responsibility for Electronic Waste*, *supra* note 138. See *infra* Part II.C.2 for a discussion of EPR's introduction and role in American e-waste policy; see *infra* Part IV.A for an evaluation of EPR's ability to control the e-waste crisis. *See also* ETBC, *Extended Producer Responsibility*, *supra* note 132.

140 *See generally* ETBC, *State Legislation*, *supra* note 80.

141 The writing of this Comment was finalized in August–September 2010.

142 California, Connecticut, Hawaii, Illinois, Indiana, Maine, Maryland, Michigan, Minnesota, Missouri, New Jersey, New York, North Carolina, Oklahoma, Oregon, Rhode Island, South Carolina, Texas, Vermont, Virginia, Washington State, West Virginia and Wisconsin have passed e-waste regulations. CAL. PUB. RES. CODE § 42460 (West 2007); CONN. GEN. STAT. ANN. § 22a-630 (West 2009); HAW. REV. STAT. ANN. § 339D1–27 (LexisNexis 2009); 415 ILL. COMP. STAT. ANN. 150/1 (West 2009); IND. CODE ANN. § 13-20.5-1-1 (West 2009); ME. REV. STAT. ANN. tit. 38, § 1610 (2008); MD. CODE ANN., ENVIR. § 9-1727 (LexisNexis 2009); MICH. COMP. LAWS ANN. § 324.17301 (West 2009); MINN. STAT. ANN. § 115A.1310 (West 2008); MO. ANN. STAT. § 260.1050 (West 2009); N.J. STAT. ANN. § 13:1E-99.94 (West 2009); 2010 N.Y. Sess. Laws 163 (McKinney); N.C. GEN. STAT. § 130A-309.90 (2009); OKLA. STAT. ANN. tit. 27A § 2-11-601 (West 2008); OR. REV. STAT. ANN. § 459A.300 (West 2010); R.I. GEN. LAWS § 23-24.10-1 (2008); S.C. CODE. ANN. § 48-60-05 (2010); TEX. HEALTH & SAFETY CODE ANN. § 361.951 (West 2010); VT. STAT. ANN. tit. 10, § 7551 (2010); VA. CODE ANN. § 10.1-1425.27 (2010); WASH. REV. CODE ANN. § 70.95N.010 (West 2010); W. VA. CODE ANN. § 22-15A-2 (LexisNexis 2009); WIS. STAT. ANN. § 287.17 (West 2010). *See generally* ETBC, *State Legislation*, *supra* note 80 (providing information on which states have passed e-waste legislation, the date the regulations were signed into law, the start date for recycling, links to the law or bill, and the state program websites).

143 California operates under an ARF based system implemented under the Electronic Waste Recycling Act of 2003: Covered Electronic Waste Payment System (SB 20/SB 50). CAL. PUB. RES. CODE § 42460 (2007); *Electronic Waste Recycling Act of 2003: Covered Electronic Waste Payment System (SB 20/SB 50)*, CALRECYCLE, http://www.ciwmb.ca.gov/electronics/act2003/ (last visited Aug. 27, 2010). Connecticut, Hawaii, Illinois, Indiana, Maine, Maryland, Michigan, Minnesota, Missouri, New Jersey, New York, North Carolina, Oklahoma, Oregon, Rhode Island, South Carolina, Texas, Vermont, Virginia, Washington State, West Virginia and Wisconsin have passed EPR laws. CONN. GEN. STAT. ANN. § 22a-630; HAW. REV. STAT. ANN. § 339D1–27; 415 ILL. COMP. STAT. ANN.150/1; IND. CODE ANN. § 13-20.5-1-1; ME. REV. STAT. ANN. tit. 38, § 1610; MD. CODE ANN., ENVIR. § 9-1727; MICH. COMP. LAWS ANN. § 324.173; MINN. STAT. ANN. § 115A.1310; MO. ANN. STAT. § 260.1050; N.J. STAT. ANN. § 13:1E-99.94; 2010 N.Y. Sess. Laws 163; N.C. GEN. STAT. § 130A-309.90; OKLA. ST. ANN. tit. 27A, § 2-11-601; OR. REV. STAT. ANN. § 459A.300; R.I. GEN. LAWS § 23-24.10-1; S.C. CODE ANN. § 48-60-05; TEX. HEALTH & SAFETY CODE ANN. § 361.951; VT. STAT. ANN. tit. 10, § 7551; VA. CODE ANN. § 10.1-1425.27; WASH. REV. CODE ANN. § 70.95N.010; W. VA. CODE ANN. § 22-15A-2; WIS. STAT. ANN. § 287.17. *See generally E-waste Laws in Other States*, CALIFORNIANS AGAINST WASTE, http://www.cawrecycles.org/issues/ca_e-waste/other_states (last visited Aug. 1, 2010).

addition to promoting an advance consumer fee, California's E-waste Recycling Act (EWRA)[144] also requires manufacturers to report on their efforts to design more environmentally friendly products and reduce the use of hazardous substances in electronic goods sold within the state.[145] These requirements compel manufacturers who sell electronic goods within the state of California to conform to the European Union's Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) Directive,[146] which requires manufacturers to discontinue the use of certain toxic materials including lead, mercury, and cadmium, in the production of electronic goods.[147]

While California pioneered statewide e-waste regulations using the ARF model, each of the twenty-three states that subsequently enacted legislation have implemented EPR systems.[148] In fact, four years after California's consumer fee based EWRA was implemented, California itself adopted a resolution advocating for an EPR approach for future policy.[149]

In the absence of federal e-waste policy, the United States is now covered by varied and inconsistent state e-waste regulations.[150] EPR laws vary from state to state and lack uniformity, often distributing costs in different ways[151] and

144 The EWRA requires consumers purchasing new electronics after January 1, 2005 to pay an advance recycling fee. The retailers collect and transfer these fees to the E-waste Recovery and Recycling Account, which is administered by the California Waste Management Board under the EPA. *See* CAL. PUB. RES. CODE §§ 42460–42486. Today, the EWRA fee ranges from eight to twenty-five dollars. *See supra* note 134. *See generally Electronic Waste: More Information*, CAL. DEP'T TOXIC SUBSTANCE CONTROL, http://www.dtsc.ca.gov/HazardousWaste/EWaste/MoreInfo.cfm (last visited Jan. 11, 2010).

145 *See Electronic Waste Recycling Act of 2003: Covered Electronic Waste Payment System (SB 20/SB 50),* CALRECYCLE, http://www.ciwmb.ca.gov/electronics/act2003/ (last visited Aug. 27, 2010); *Product Manufacturer Information*, CALRECYCLE, http://www.calrecycle.ca.gov/Electronics/Act2003/Manufacturer/ (last visited Aug. 27, 2010).

146 *See* RoHS Directive, *supra* note 11. See *infra* Part III.B. for a discussion of the European Union's e-waste policy and the RoHS Directive.

147 *See* CAL. HEALTH & SAFETY CODE § 25214.10 (West 2006) (banning the sale of electronic goods that the European Union RoHS Directive prohibits). *See also* Phoenix Pak, Note, *Haste Makes E-Waste: A Comparative Analysis of How the United States Should Approach the Growing E-Waste Threat*, 16 CARDOZO J. INT'L & COMP. L. 241, 271 (2008); Fordyce, *supra* note 47, at 531–32.

148 ETBC, *State Legislation*, *supra* note 80.

149 *Id.* (noting that while California is the only state with consumer fee regulations, in 2007 the State Agency adopted a resolution advocating for an EPR approach in future state policy).

150 *See* Drayton, *supra* note 79, at 166. *See generally* ETBC, *State by State E-Waste Law Summary*, *supra* note 80.

151 For example, Maine and Maryland require producers and local governments to share the financial cost of recycling e-waste, while Washington State mandates that the entire financial burden is born by the producer alone. *Compare* ME. REV. STAT. ANN. tit. 38, § 1610 (2008) *and* MD. CODE ANN., ENVIR. § 9-1727 (2009) *with* WASH. REV. CODE

placing varying responsibilities and requirements on manufacturers.[152] Regulatory variations place an arduous and costly burden on producers and consumers as they attempt to decipher which products are regulated in each state.[153] The lack of uniformity among state e-waste policies is further complicated by emerging county and municipal e-waste regulations.[154]

Many manufacturers and states have begun to recognize the high transaction costs of operating within the "patchwork" of state regulations and have begun to advocate for the implementation of a national e-waste policy.[155] Even states with existing e-waste regulations such as Maine and California have joined the call for federal e-waste regulation.[156]

E-waste legislation must be implemented at a federal level for yet another critical reason—states lack the ability to regulate international trade and are thus unable to address the export of e-waste to developing countries, one of the e-waste crisis' largest issues.[157] Under the Commerce Clause, states do not have

ANN. § 70.95N.010 (West 2010). *See also* Pak, *supra* note 147, at 270 (explaining the differences between the Maine, Maryland, and Washington State approaches).

152 For example, while Virginia, Washington State, and Minnesota all operate under EPR, each state places different requirements on producers. Virginia's EPR e-waste law covers desktops, laptops, monitors, and CRTs but does not include televisions. VA. CODE ANN. § 10.1-1425.27 (2010). Washington State's EPR regulations govern the same devices as Virginia (desktops, laptops, monitors, and CRTs), but Washington State's regulation includes televisions. WASH. REV. CODE ANN. § 70.95N.010 (West 2010). Minnesota, which also has EPR e-waste regulations, specifically regulates the disposal of a wide range of devices including computers, peripherals, fax machines, scanners, DVD players, VCRs, and video display devices. MINN. STAT. ANN. § 115A.1310 (West 2009). *See also generally Scope of Products in E-Waste Laws*, COMPUTER TAKEBACK COALITION, (last updated June 23, 2010) http://www.computertakeback.com/legislation/Scope_of_Product_in_Ewaste_Laws.pdf; ETBC, *State by State E-Waste Law Summary, supra* note 80 (providing a breakdown of which products each state regulates and showing that even the states that use EPR place different requirements on manufacturers).

153 Drayton, *supra* note 79, at 166. Arizona, Kentucky, Massachusetts, Nebraska, Pennsylvania and Utah are all scheduled to review proposals regarding e-waste regulation in 2010. ETBC, *State by State E-Waste Law Summary, supra* note 80. With California operating under the ARF system, twenty-three states with different variations of EPR, and six states considering e-waste legislation in 2010, manufacturers and consumers must navigate a web of inconsistent policies. *Id.*

154 In 2008 New York City passed an e-waste recycle bill which banned e-waste from the municipal solid waste stream and required manufactures to implement take-back programs. N.Y.C., N.Y. ADMIN. CODE § 16-420 (2008). *See also* ETBC, *State by State E-Waste Law Summary*, *supra* note 80 (describing the EPR e-waste regulation New York City passed in 2008).

155 *See* Drayton, *supra* note 79, at 166, 168. *See also E-Cycling, supra* note 1 (reporting that "manufacturers and environmentalists complain about a lack of federal regulations addressing the proper disposal and recycling of high-tech components").

156 *See* Drayton, *supra* note 79, at 168 (quoting representatives from Maine and California, two states with e-waste regulations, saying "they could benefit from national leadership" in the area of e-waste regulation).

157 *The e-Waste Crisis*, *supra* note 2.

jurisdiction over trade and cannot regulate foreign commerce.[158] Given this constitutional limitation, federal e-waste legislation is necessary in order to prevent the export of hazardous e-waste abroad.[159] In order to implement effective national policy, the United States should first review international e-waste strategies.

III. LESSONS FROM THE INTERNATIONAL COMMUNITY

A comprehensive evaluation of potential e-waste strategies in the United States must include an analysis of existing policies within the international community. Three prominent sets of initiatives merit individual attention: 1) the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (Basel Convention)[160] and its Ban Amendment,[161] 2) the European Union's Waste Electrical and Electronic Equipment (WEEE)[162] and Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment directives (RoHS),[163] and 3) Japan's Home Appliance Recycling Law (SHAR)[164] and Revised Law for Promotion of Effective Utilization of Resources (Recycling Promotion Law).[165]

A. International Collaboration Against the E-Waste Issue: The Basel Convention and Ban Amendment

While the United States has failed to address the issue of hazardous waste exports, the international community has been

158 *See* U.S. CONST. art. I, § 8, cl. 3; Templeton, *supra* note 4, at 792 (noting that by banning the export of goods to countries whose laws prohibit the import of those goods, California's e-waste regulations do limit the export of e-waste). *See also* Lisa Stiffler, *State's Recycling Plan Could be Poisonous*, SEATTLE POST INTELLIGENCER, Sept. 13, 2007, at B1, *available at* http://www.seattlepi.com/local/331364_computer12.html (noting that Washington State Governor Chris Gregoire vetoed part of Washington State's e-waste bill that prohibited the export of e-waste to certain countries because the state did not have the authority to restrict exports).

159 *See* Templeton, *supra* note 4, at 792. *See generally* Metalclad Corp. v. United Mexican States, ICSID Case No. ARB/97/1 (Aug. 30, 2000), *available at* http://icsid.worldbank.org/ICSID/FrontServlet?requestType=CasesRH&reqFrom=Main&actionVal=OnlineAward (setting aside an award from a NAFTA Tribunal because the tribunal exceeded the scope of its jurisdiction when it adjudicated a dispute regarding the operation of a hazardous waste landfill located abroad).

160 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, art. 4(2), Mar. 22, 1989, 1673 U.N.T.S. 126 [hereinafter Basel Convention].

161 *See The Basel Convention Ban Amendment*, BASEL CONVENTION, http://www.basel.int/pub/baselban.html (last visited Aug. 24, 2010) [hereinafter *The Basel Convention Ban Amendment*].

162 WEEE Directive, *supra* note 11.

163 RoHS Directive, *supra* note 11.

164 INFORM, APPLIANCE, *supra* note 12.

165 INFORM, PC, *supra* note 12.

navigating this problem for over two decades.[166] In 1989, 118 nations created the Basel Convention on the Transboundary Movement of Hazardous Wastes and their Disposal (Basel Convention)[167] after discovering that the development of stricter environmental regulations in industrialized nations encouraged "toxic traders" to ship hazardous waste to developing countries.[168] Designed in part to prevent wealthy industrialized countries from exploiting developing nations, the Basel Convention promotes "environmentally sound management" (ESM)[169] of hazardous waste within the borders of the country that generated it.[170] The treaty has three primary objectives: 1) to reduce the generation of hazardous waste, 2) to dispose of hazardous waste as close to its source of origin as possible, and 3) to reduce the transboundary movement and transportation of hazardous wastes.[171] The Basel Convention requires prior written consent from both the exporting and importing countries before hazardous waste can be moved internationally by Convention parties, and it completely prohibits the export of hazardous wastes to member states that have banned the import of hazardous wastes under their domestic laws.[172]

As of July 2010, 174 nations had adopted the Basel Convention.[173] The United States is the only developed country in the world that has not done so.[174] Furthermore, the United States is one of three nations worldwide to have signed but not

166 *See* Kutz, *supra* note 28, at 315.

167 While it was implemented to deal with larger hazardous waste issues, the Convention regulates waste containing lead, mercury, cadmium, and beryllium, and therefore applies to e-waste, specifically classifying CRTs as hazardous. *See* Basel Convention, *supra* note 160, art. I, Annex I; BASEL ACTION NETWORK, BRIEFING PAPER 1, THE BASEL BAN: A TRIUMPH FOR GLOBAL ENVIRONMENTAL JUSTICE (2007), http://www.ban.org/Library/BP1_09_07.pdf [hereinafter BAN, BRIEFING PAPER 1].

168 *About the Convention*, BASEL CONVENTION, http://www.basel.int/convention/basics.html (last visited Aug. 24, 2010) [hereinafter *Basel Convention Basics*].

169 *Id.* ("ESM means addressing the issue through an 'integrated life-cycle approach,' which involves strong controls from the generation of a hazardous waste to its storage, transport, treatment, reuse, recycling, recovery and final disposal.").

170 Templeton, *supra* note 4, at 793–94.

171 *Basel Convention Basics*, *supra* note 168 (stating the goal to reduce the generation of hazardous wastes includes decreasing both the quantity of existing hazardous waste and the degree of such waste's hazardousness).

172 In order to ensure hazardous waste is dealt with in an environmentally sound manner, the Convention strictly prohibits the export of hazardous wastes to certain countries. It does however allow the transboundary movement of hazardous waste if the state of origin does not have the ability to safely dispose of or manage it. *Basel Convention Basics*, *supra* note 168.

173 *Parties to the Basel Convention*, BASEL CONVENTION, http://www.basel.int/ratif/convention.htm (last visited Aug. 24, 2010).

174 EXPORTING HARM, *supra* note 101, at 3; *The e-Waste Crisis*, *supra* note 2.

ratified the Convention.[175] This is a particular point of contention because although a majority of participating nations wanted the Convention to implement stricter controls, the United States used its leverage as a signing member to weaken the treaty and prevent an outright ban on all hazardous waste exports to developing nations.[176] Many countries were disappointed with the resulting treaty and some refused to endorse it.[177] As a result, less than a decade later, the international community increased the Convention's regulatory control on hazardous waste by adopting the 1995 Ban Amendment, which places a complete prohibition on the export of hazardous wastes from wealthy "Organisation for Economic Co-operation and Development" (OECD) countries[178] to poor non-OECD countries.[179] Questions remain over how many countries need to ratify the Ban Amendment in order for it to take effect.[180] The treaty's status has been further undermined by the fact the United States has failed to ratify it and has even taken steps to reverse it.[181] Despite the United States' resistance, however, many Convention members have adopted the amendment, including many European countries that have simultaneously

175 Templeton, *supra* note 4, at 795 (pointing out that the United States is not only one of three countries worldwide (the remaining two countries are Haiti and Afghanistan) that signed but never ratified the Convention, but that the United States is currently the world's most wasteful country and therefore potentially the Convention's largest violator).

176 *See* Templeton, *supra* note 4, at 794–95; BAN, BRIEFING PAPER 1, *supra* note 167.

177 Greenpeace denounced the treaty, claiming it sanctioned what should be considered criminal activity. BAN, BRIEFING PAPER 1, *supra* note 167 (noting that a group of African nations refused to sign the watered down treaty preferring to create their own treaty banning the import of hazardous waste to Africa).

178 *See The Basel Convention Ban Amendment*, *supra* note 161. The OECD is an international partnership of thirty-two countries committed to democracy and the free market. OECD members include Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, and the United States. *See generally* ORG. FOR ECON. CO-OPERATION & DEV., http://www.oecd.org/home/ (last visited Aug. 25, 2010).

179 Unlike the Basel Convention, which makes exceptions in certain circumstances, the Ban Amendment strictly forbids the transboundary movement of hazardous waste without exception. *See What is the Basel Ban?*, BASEL ACTION NETWORK, http://www.ban.org/about_basel_ban/what_is_basel_ban.html (last visited Aug. 21, 2010); Kutz, *supra* note 28, at 315.

180 *See* Templeton, *supra* note 4, at 795 (reporting that the Ban Amendment has not yet become part of the Basel Convention and that it is unclear when this will officially happen because there are multiple perspectives on how many countries must ratify the amendment before it becomes part of the convention).

181 Templeton, *supra* note 4, at 796. *See also* BASEL ACTION NETWORK, BRIEFING PAPER 4, THE BASEL BAN AMENDMENT: ENTRY INTO FORCE = NOW! (2008), *available at* http://www.ban.org/Library/BP04_June_2008.pdf (discussing how many countries need to ratify the Ban Amendment for it to take effect); *The e-Waste Crisis*, *supra* note 2 (reporting that the United States and Canada actively oppose the Ban Amendment).

united under independent European Union initiatives aimed at addressing hazardous waste exports and e-waste issues.[182]

B. The European Union's Attempt to Control E-Waste: The WEEE Directive and RoHS Initiative

In 2003, the European Union enacted groundbreaking EPR legislation requiring its Member States to implement producer take-back programs.[183] The European Union's Waste Electrical and Electronic Equipment (WEEE) Directive requires producers to finance and coordinate collection facilities where consumers can bring their used electronic goods to be properly disposed of or recycled at no charge to the consumer.[184] Recognized as an example of "wholesale EPR," today the WEEE Directive is one of the most progressive EPR programs in effect.[185] It covers all e-waste[186] and requires producers to take back e-waste regardless of the device's source or quantity.[187]

Advocates of the WEEE Directive argue that it successfully closes the "cradle to cradle" loop of polluter responsibility and captures most of the benefits of the EPR approach to e-waste.[188] However, because the WEEE Directive allows Member States to

182 Templeton, *supra* note 4, at 795 (noting that France, Germany, and the United Kingdom have adopted the Ban Amendment).

183 Prior to 2003, Europe mirrored the United States' present e-waste "patchwork." While some European countries had enacted product take-back laws, Europe lacked a comprehensive e-waste policy. Belgium, Denmark, Germany, Italy, the Netherlands, Norway, and Sweden implemented product take-back policies prior to the introduction of the WEEE Directive. Sachs, *supra* note 21, at 53, 68–70 (describing Germany's 1991 Packaging Ordinance as the "first practical application of EPR in Europe").

184 The WEEE also sets minimum requirements for the quantity of e-waste recovered by each Member State and specifies that Member States erect environmentally-sound treatment facilities. *See* WEEE Directive *supra*, note 11, at art. 6–7; Kutz, *supra* note 28, at 321; Pak, *supra* note 147, at 258.

185 The WEEE is based on full cost internalization EPR methodology. Courtney, *supra* note 93, at 212, 221 (describing the WEEE "'responsibility transfer'" as an example of "full cost internalization" EPR policy and the "most aggressive approach toward helping producers internalize the cost of e-waste"); *cf.* Sachs, *supra* note 21, at 71 (arguing that while the EU's WEEE initiative places primary end-of-life responsibility on producers, municipalities and consumers are required to sort and collect products and are therefore active and necessary participants). See *supra* note 116 for a description of pure EPR.

186 *See* Sachs, *supra* note 21, at 77 (noting that WEEE requires producers to take back small and large household appliances, telecommunications equipment, medical devices, electric tools, toys, and sports equipment).

187 Courtney, *supra* note 93, at 212.

188 First, WEEE supporters maintain that by forcing producers to internalize the costs associated with electronic products' end-of-life, the directive provides an economic incentive for manufacturers to design products with less hazardous materials and appliances which can be more easily recycled. Second, supporters claim it relieves the government and the taxpayers of the financial burden of dealing with e-waste disposal. Pak, *supra* note 147, at 258–59 (noting that while producers could ultimately pass the costs associated with end-of-life management on to consumers by raising the price at which they sell their products, manufacturers will have an incentive to minimize these costs so that they can retain competitive prices in the market).

assign "collective responsibility" rather than "individual responsibility," manufacturers are not forced to manage the end-of-life costs of their own products and the WEEE Directive does not achieve true EPR.[189] As an alternative to assigning individual responsibility for every good each manufacturer produces, Article Eight of the WEEE Directive allows producers to pool financial resources and create collective e-waste management systems.[190] Generally, under these collective systems, participating manufacturers contribute to a common fund that is used to pay a third-party to manage the disposal and recycling of used electronics turned in by the public.[191] Producers who cooperate in collective recycling generally pay a flat fee per the number of units they place on the market, rather than paying for the number of their goods that are actually recycled.[192] This collective approach is favored by some because the costs associated with sorting returned electronics by type and estimating the exact costs of recycling each electronic good are expensive and complex.[193] However, this system is ultimately ineffective because it allows producers to pay a flat fee to recycle, regardless of the life span or toxicity of their products.[194] Under collective systems, manufacturers lose all incentives to redesign their products to contain fewer toxins, to last longer, or to be more easily disposed of.[195]

Furthermore, because the WEEE Directive merely sets minimum requirements[196] and grants all twenty-five Member

189 Pak, *supra* note 147, at 260; WEEE Directive, *supra* note 11, at art. 8. "Individual responsibility" means that firms are held responsible for products they actually produce, and "collective responsibility" indicates that all producers within the industry are collectively held responsible and are required to take back electronic goods, regardless of whether they manufactured that item or not. Pak, *supra* note 147, at 260.

190 *See id.*; WEEE Directive, *supra* note 11, at art. 8. Several European Union Member States, such as France and Germany, have implemented forms of collective-responsibility systems. Sachs, *supra* note 21, at 78–79.

191 *See* Pak, *supra* note 147, at 260 (noting that it is far more efficient to delegate recycling to designated third-parties rather than to have each manufacture develop their own recycling plant and program).

192 *Id.* at 261–62.

193 *Id.* at 261 (arguing that because estimating the cost of recycling individual devices and tracking how many of each manufacturer's goods are returned is nearly impossible, tracking issues are the WEEE's primary weakness). *See also* Sachs, *supra* note 21, at 76–77 (describing the high transaction costs of the EPR system by noting producer fees would have to be tailored to product types and to each firm's individual product model).

194 *See* Pak, *supra* note 147, at 261–62.

195 *Id.* at 262; Sachs, *supra* note 21, at 76.

196 *See* Consolidated Version of the Treaty Establishing the European Community art. 176, Dec. 24, 2002, 2002 O.J. (C 325) 33. *See also* Sachs, *supra* note 21, at 84–85 (noting that because the EU's EPR Directives were established pursuant to the Treaty Establishing the European Community, which states that European Union Directives establish minimum requirements that Member States are able to exceed, Member States

States leeway in implementing additional mandates, the initiative has resulted in "complete chaos" that mirrors the United States' current regulatory patchwork.[197] Inconsistencies between Member State regulations add additional transactional costs and may encourage producers to join a collective recycling initiative rather than manage their own e-waste.[198] Even worse, it may encourage producers and recyclers to export e-waste abroad in order to escape the EU's spider web of environmental responsibility.[199]

While the European Union designed the WEEE Directive to provide incentives to develop cleaner electronics, it also took aggressive steps to ensure that hazardous materials were removed from electronic devices by enacting the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) Directive.[200] The RoHS Directive required that producers discontinue the use of six substances in electronic goods sold within the European Union by 2006: lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBBs), and polybrominated diphenyl ethers (PBDEs).[201]

The RoHS Directive provides exemptions for the use of banned substances when it is "technically or scientifically impracticable" to use a substitute or when use of a substitute will result in "negative environmental, health and/or consumer safety impacts" likely to outweigh any benefits derived from the ban.[202]

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have the ability to establish "higher recycling targets, stricter timetables, or more reporting requirements").

197 Despite the overarching guidelines provided by the WEEE Directive, the European Union retains some inconsistent e-waste policies. JACO HUISMAN ET AL., WHERE DID WEEE GO WRONG IN EUROPE?, *in* PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON ELECTRONICS AND THE ENVIRONMENT 83 (2006), *available at* http://ewasteguide.info/system/files/Huisman_2006_IEEE.pdf (stating that the WEEE Directive has failed to coordinate all twenty-five Member States and has resulted in "complete chaos . . . with having 25 completely different transpositions . . . [and] inaccessible rules and agreements due to language problems").

198 *See* Pak, *supra* note 147, at 262.

199 Critics contend Article Six of the WEEE creates another loophole in the Directive's effectiveness. It allows parties to export e-waste outside of the European Union as long the exporter can show the receiving facility will process the goods in accordance with the environmental standards set by the directive. *See* Pak, *supra* note 147, at 262 (noting the inconsistencies between Member States' implementation of the WEEE Directive incentivizes exporting e-waste either through the WEEE's legal channels under Article Six or through illegal channels).

200 *See* RoHS Directive, *supra* note 11, at art. 1; Kutz, *supra* note 28, at 320; Pak, *supra* note 147, at 263–64.

201 RoHS Directive, *supra* note 11, at art. 4. RoHS prohibited the use of these substances both by manufacturers within the European Union, and also producers who imported electronic goods into the EU. *See* RoHS Directive, *supra* note 11, at art. 3, 4; Kutz, *supra* note 28, at 321; Templeton, *supra* note 4, at 784–85.

202 RoHS Directive, *supra* note 11, at art. 5. For example, the RoHS allows producers to use lead in the glass of CRTs because there is no suitable alternative. RoHS Directive,

Given the ubiquity of the substances that the RoHS Directive bans, electronic producers argue that RoHS-type restrictions impede technological progress and force the industry to produce inferior products.[203] Critics argue that the RoHS Directive poses a threat to the public by forcing manufacturers to rely on unproven technologies and materials, which may be unreliable or may have a more deleterious impact on the environment and public health than the substances that were used before the ban.[204] Generally, however, electronics manufacturers have been able to modify their products to meet the regulation and the RoHS Directive has been successful overall.[205] In addition to cleaning up electronics sold in the European Union, the regulation has forced producers to invest time, research, and money in new, cleaner designs and manufacturing techniques, and has encouraged international manufacturers to clean up the devices they sell throughout the world.[206]

C. Shared E-Waste Responsibility Legislation in Japan

Like the EU, Japan has also enacted legislation based on EPR principals.[207] However, rather than placing full end-of-life management responsibility on producers as the WEEE Directive does, Japan's system distributes e-waste recycling responsibility between four different stakeholders: producers, consumers,

supra note 11, at art. 4, Annex. *See also* RoHS Directive, *supra* note 11, at art. 2 (outlining the scope of products affected by the directive, which does not include devices with medical or military applications). *See also* Pak, *supra* note 147, at 265–66 & n.149 (stating that the directive "excludes from its scope most high-reliability applications, such as medical and military devices").

203 *See* Pak, *supra* note 147, at 264–65 (arguing the banned substances originally used by manufacturers were initially chosen because they were optimally suited for that particular purpose, and that substitute materials may not have provided the same characteristics).

204 S*ee* Commission Decision 2005 O.J. (L 214) 65, para. (1), *available at* http://www.rohs.eu/english/legislation/docs/launchers/launch-2005-618-EC.html (amending Directive 2002/95/EC to tolerate "certain concentration values" of banned substances). The electronics industry, which faced significant challenges and costs when redesigning their products and reconfiguring their factories and supply chains to accommodated substance bans, has been critical of the RoHS Initiative. Pak, *supra* note 147, at 264–66 (stating restrictions placed on the use of lead, a common component in soldering applications, caused the formation of "tin whiskers," a phenomenon which led to the shutdown of a nuclear power plant in 2005). *See generally* HENNING LEIDECKER ET AL., NASA, TIN WHISKERS: A HISTORY OF DOCUMENTED ELECTRICAL SYSTEM FAILURES (2006), *available at* http://nepp.nasa.gov/WHISKER/reference/tech_papers/2006-Leidecker-Tin-Whisker-Failures.pdf; *cf.* Pak, *supra* note 147, at 266 (reporting that although some opponents argue RoHS places too narrow a restriction on the electronics industry, RoHS also faces criticism from those who feel both the exceptions for banned substances without substitutes and high-reliability applications and the RoHS compliance standards are too broad).

205 *See* Kutz, *supra* note 28, at 328.

206 *See* Sachs, *supra* note 21, at 93–94.

207 *See* ETBC, *Extended Producer Responsibility*, *supra* note 132.

retailers, and the government.[208] In 2001, Japan implemented the Home Appliance Recycling Act (SHAR), legislation mandating that consumers discard bulky electronic items at specified collection locations maintained by large appliance retailers and local government agencies.[209] Producers are responsible for the end-of-life processing after collection and are charged with developing the infrastructure and facilities needed to transport and recycle discarded electronic products in an environmentally-sound manner.[210] Japanese consumers fund SHAR collection and recycling by paying disposal fees when they drop their used electronic goods off at the collection centers.[211]

While SHAR initially applied only to large appliances, in 2001, the Revised Law for Promotion of Effective Utilization of Resources (Recycling Promotion Law) extended recycling requirements to used PCs and other electronic accessories such as mice and keyboards.[212] Like SHAR, the Recycling Promotion Law divides end-of-life responsibility between consumers, retailers, the government, and manufacturers.[213] However, while consumers still finance the recycling system under the Recycling Promotion Law, they do so primarily though ARF fees at the time of purchase and are only charged end-of-life disposal fees if they purchased the electronic device before the law's effective date.[214]

By requiring consumers to both physically deliver their used electronic goods to specified collection centers and to pay end-of-life fees, Japan's e-waste policies may encourage some to illegally

208 Pak, *supra* note 147, at 271–72.

209 *See* Catherine K. Lin et al., *Globalization, Extended Producer Responsibility and the Problem of Discarded Computers in China: An Exploratory Proposal for Environmental Protection*, 14 GEO. INT'L ENVTL. L. REV. 525, 541–42 (2002). The Home Appliance Recycling Act is known as SHAR because it was originally named the "Specified Home Appliance Recycling Law." Bulkier electrical and electronic products covered by SHAR include televisions, refrigerators, washing machines, and air conditioners. INFORM, APPLIANCE, *supra* note 12. *See also* ETBC, *Extended Producer Responsibility*, *supra* note 132 (stating that large appliance retail stores, local post offices, and municipalities serve as collection points in Japan).

210 Under SHAR, the largest electronics manufacturers bear the weight of the responsibility for building the infrastructure and facilities needed to appropriately process e-waste. In turn, smaller producers are required to negotiate agreements to access these networks. *See* INFORM, APPLIANCE, *supra* note 12.

211 Pak, *supra* note 147, at 272 & n.196 (noting that manufacturers determine the recycling fees for their own products and these fees typically range from 2,400 to 4,600 yen—or $21 to $41). Japanese consumers pay two fees when they discard e-waste at collection centers: a collection fee which covers the cost of collection, and a recycling fee based on the cost of recycling that particular item. INFORM, APPLIANCE, *supra* note 12.

212 Copy machines are also regulated under the disposal guidelines. *See* Kutz, *supra* note 28, at 322; INFORM, PC, *supra* note 12.

213 ETBC, *Extended Producer Responsibility*, *supra* note 132.

214 Pak, *supra* note 147, at 272–73; INFORM, APPLIANCE, *supra* note 12.

dump unwanted electronics rather than following the policy.[215] However, by offering a hybrid of EPR and ARF policies, Japan's e-waste initiatives offer an innovative approach to the e-waste issue.[216]

Japan's allocation of responsibility between producers, consumers, retailers, and the government ensures that the parties who contribute to the e-waste stream and those with the means to resolve the e-waste issue have an incentive to do so.[217] Consumers are large contributors to the e-waste stream.[218] By making consumers responsible for delivery and the cost of safely disposing of obsolete electronics, Japan's policies educate and alert the public to the e-waste issue, a problem that goes widely unnoticed in most other developed nations.[219] Because the amounts of disposal fees vary depending on the cost of recycling individual brands and items, Japan's system not only encourages consumers to modify their purchasing habits and buy less often, but it also provides incentives to buy environmentally sound products.[220]

By allocating collection responsibilities between retailers and the government, Japan's policies efficiently utilize existing networks that have the ability to coordinate collection centers, and, by assigning the cost to consumers, these policies ensure taxpayers do not bear the financial burden of the system.[221] By holding manufacturers individually responsible for their goods, SHAR and the Recycling Promotion Law create economic incentives for producers to design environmentally sound electronics with longer product lives.[222] Although it allows producers to work within a collaborative network, Japan's policy enforces individual EPR by requiring manufacturers to take physical responsibility for the disposal and recycling of their waste and allowing them to determine disposal costs for their

215 One month after SHAR came into effect, illegal e-waste dumping in Japan increased by twenty-five percent. Lin et al., *supra* note 209, at 542.

216 *Producer Takeback: Japan—Electronics*, CLEAN PRODUCTION ACTION, http://www.cleanproduction.org/Producer.International.Japan.Electronics.php (last visited Aug, 21, 2010) (reporting that Japan's take-back system has "stronger feedback between upstream and downstream actors" than the WEEE).

217 *See* Pak, *supra* note 147, at 275–78.

218 Pak, *supra* note 147, at 278. *See also* Fordyce, *supra* note 47, at 539 (noting the California legislature intended that consumers bear some of the financial responsibility for e-waste recycling when designing Health and Safety: Chapter 526).

219 Pak, *supra* note 147, at 275–78. The EPA has stated that most computer users are unaware of the e-waste problem. GLOBAL FUTURES FOUNDATION, COMPUTERS, *supra* note 128.

220 *See* Pak, *supra* note 147, at 275–78.

221 INFORM, PC, *supra* note 12, at 1–2 (arguing that Japan's postal service offers "widespread and easily recognizable collection infrastructure").

222 *See* Pak, *supra* note 147, at 272–73.

own products.[223] These provisions retain the cost-based feedback loop that some critics argue is lost under the WEEE Directive's collective responsibility opt-out.[224]

The successes and failures of international e-waste schemes provide valuable guidance for the United States. As the following section will discuss, the United States should look to international approaches for direction and implement comprehensive e-waste policy at a national level.

IV. SOLUTIONS TO THE E-WASTE CRISIS

While each system has inherent flaws when implemented independently, taken together, EPR and ARF methodologies offer a possible solution to the e-waste crisis. Therefore, this section proposes that the United States decrease the detrimental impact of e-waste by pursuing a hybrid e-waste policy founded upon EPR methodology that 1) reduces e-waste's volume and toxicity through EPR and ARF incentive-based regulations, and 2) prevents the continued export of hazardous waste abroad through the ratification of the Basel Convention and Ban Amendment.

A. The Potential of EPR and ARF as E-Waste Solutions

As discussed above, ARF systems require the government to coordinate the disposal and recycling of used appliances while consumers cover the cost by paying an advance fee when they purchase new electronics.[225] Supporters of the ARF method[226] claim it is preferable because it places the burden on the parties who use and benefit from the electronic goods,[227] and because fees collected from consumers pool to provide funding for the disposal and recycling of all waste, whether it is orphan waste,[228] the producer of which cannot be readily identified, or historic

223 *Pak, supra* note 147, at 273.

224 *See id.*

225 *See supra* Part II.C.1.

226 Although future policies may change, California has been a leading advocate of the ARF system and has implemented an advance disposal fee system under the E-waste Recycling Act of 2003 (EWRA). See *supra* Part II.C.2 for a discussion of California's e-waste regulation. *See also* Courtney, *supra* note 93, at 218–19.

227 Consumers who purchase electronic goods are partially responsible for the e-waste cycle, and therefore "should bear some of the burden of the environmental consequences of these decisions." Pak, *supra* note 147, at 278.

228 "Orphan e-waste" is waste for which the manufacturer cannot be identified or where the manufacturer is no longer in business and has no successor-in-interest. *NYC's Electronic Equipment Recycling and Reuse Act*, NYC.GOV, http://www.nyc.gov/html/nycwasteless/html/in_business/electronicslaw_reqs.shtml (last visited Aug. 19, 2010).

waste[229] that was manufactured prior to the regulation's effective date.[230]

However, because ARF recycling funds are limited to the fees collected from consumer purchases, funds available for recycling may be insufficient to cover the cost of managing orphan and historic waste, which means the costs will ultimately be passed on to taxpayers.[231] Critics also claim that the ARF system will place a visible tax on electronic goods that will encourage consumers to purchase electronics in states without ARFs in order to avoid the fee.[232] This could potentially lead to decreased revenue generation within the ARF jurisdiction and a depletion of available ARF funds.[233] Additionally, because ARF systems place the financial and physical burden of end-of-life management on consumers and the government, rather than on the manufacturers, pure ARF systems weaken producers' incentives to minimize the environmental impact and costs associated with their goods.[234]

Taken independently, EPR is a superior system because it not only lifts the burden off of consumers and taxpayers,[235] but it encourages manufacturers to evaluate and internalize the end-of-life costs of their products.[236] Accordingly, manufacturers who know they will ultimately be responsible for disassembling and recycling the electronic goods they produce are more likely to use

229 The term "historic e-waste" applies to electronic goods produced prior to the implementation of applicable e-waste regulations. Courtney, *supra* note 93, at 221.

230 Electronic manufacturers generally prefer ARF systems because they do not personally bear physical or economic responsibility for old electronic goods. Kutz, *supra* note 28, at 323–24. *See also* Sachs, *supra* note 21, at 95–96 (noting that producers generally favor ARF systems because they leave the manufacturer free from collection and recycling responsibilities but that some producers, such as Dell and Hewlett-Packard, favor EPR take-back regulations because they want to profit from their own efforts to go green and produce more recyclable products).

231 *See* Kutz, *supra* note 28, at 324.

232 *See* NATURAL RESOURCES DEFENSE COUNCIL, STATEMENT OF THE NATURAL RESOURCES DEFENSE COUNCIL BEFORE THE NEW YORK CITY COUNCIL'S COMMITTEE ON SANITATION AND SOLID WASTE MANAGEMENT REGARDING INTRO. 643 THE ELECTRONIC EQUIPMENT RECYCLING AND REUSE ACT OF 2005 5 (Oct. 24, 2005), http://www.computertakeback.com/legislation/lawsuit_vs_nyc/NRDC_filings/B.1--Testimony%20on%20Intro%20643.pdf.

233 *See id.* at 5.

234 Under ARF programs, producers do not have financial incentives to design their equipment with less toxic materials or in a way that the products could be more easily recycled and dismantled. *See id.*

235 *See* Kutz, *supra* note 28, at 324–35 (noting that in the absence of comprehensive federal regulation dealing with e-waste, local government entities bear the physical and financial burden of managing e-waste).

236 *Id.* at 325. *See also Key Elements of EPR Plan*, CLEAN PRODUCTION ACTION, http://www.cleanproduction.org/Producer.Key.Examples.php (last visited Jan. 10, 2010) [hereinafter CPA, *Key Elements of an EPR Plan*]; ETBC, *Extended Producer Responsibility*, *supra* note 132.

less toxic materials in the production process and design products with longer life spans that are easier to disassemble and recycle.[237] Some producers, such as Dell and Hewlett-Packard, favor individual EPR take-back regulations because they enable them to capitalize on their current efforts to produce environmentally sound products.[238]

B. Proposed E-Waste Policy for the United States

Although it has not yet garnered the full attention of Congress, e-waste is the fastest growing waste stream within the United States.[239] With Americans discarding 133,000 electronic units each day[240] and shipping 5,126 containers worth of e-waste to developing countries each year, e-waste presents a formidable challenge.[241] In order to adequately address this crisis, the United States should implement EPR based federal e-waste policy that: 1) minimizes the extent and toxicity of the e-waste stream, and 2) stops the export of hazardous waste abroad.[242]

1. The United States Should Decrease the Impact of the E-Waste Stream by Decreasing its Volume and Toxicity

Successful e-waste policy must decrease the flow and impact of discarded electronics.[243] The first step in this process is slowing the rate at which electronic goods become obsolete. While manufacturers have long capitalized on continual revenue streams generated by short-lived electronic appliances, e-waste policy must incentivize producers to design products that are durable and can be repaired and upgraded.[244] The second step is to implement regulatory controls and economic-based incentives that persuade producers to design electronic goods that can be easily disassembled and recycled.[245]

As the third and final step, the United States should phase out hazardous materials by adopting legislation that mirrors the

237 *See* ETBC, *Extended Producer Responsibility*, *supra* note 132.

238 *See* Sachs, *supra* note 21, at 95–96.

239 *The e-Waste Problem*, *supra* note 5.

240 *See* Drayton, *supra* note 79, at 149.

241 *See* ETBC, *Problem: Waste Dumping*, *supra* note 16 (reporting that if all the e-waste America exports each year were placed in shipping containers and stacked on top of one another, they would reach eight miles high).

242 *See Federal Legislation on E-Waste*, ELECTRONICS TAKEBACK COALITION, http://www.computertakeback.com/legislation/federal_legislation.htm (last visited Aug. 19, 2010); ETBC, BRIEFING BOOK, *supra* note 4, at 7, 9.

243 Kutz, *supra* note 28, at 317.

244 *Id.* at 320.

245 Manufacturers should be encouraged to use common designs, interchangeable parts, and materials which can be easily recycled and are non-toxic. Kutz, *supra* note 28, at 318–19.

EU's RoHS Directive.[246] While prescriptive systems like the EPR and ARF have the potential to encourage green design changes, the ubiquity of toxic substances in electronic products and the deleterious environmental impact of these materials require that the United States pursue a prohibitory approach that specifies a date for the discontinuance of certain hazardous materials.[247] Decisive prohibitory regulations should ban the same six substances that RoHS Directive has targeted.[248] These substances have already been identified as harmful toxins, and the success of the RoHS Directive and California's EWRA demonstrate that, contrary to critics' claims, it is possible to replace these substances with non-toxic substitutes without crippling the electronics industry or seriously undermining the technological advances upon which today's society depends.[249] The campaigns of the European Union and California have been so successful that some international electronic producers that sell within the United States, China, and Japan have already begun to take steps to remove these substances from their factory lines.[250] Like the EU's initiative, U.S. regulations should provide

246 *See* Pak, *supra* note 147, at 276; Sachs, *supra* note 21, at 93.

247 Krishna & Kulshrestha, *supra* note 38, at 79 (distinguishing prohibitory approaches which specify the outer limits of restrictions, like the RoHS initiative, from prescriptive approaches, like the WEEE, which outline minimum standards that must be followed). *See also* Sachs, *supra* note 21, at 68 (arguing that existing "command-and-control chemical ban[s]" have been more influential in bringing about product design changes).

248 RoHS required the following materials be discontinued by 2006: lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBBs) and polybrominated diphenyl ethers (PBDEs). RoHS Directive, *supra* note 11. *See also* Pak, *supra* note 147, at 276 (advocating that regulations banning the use of hazardous materials in electronic goods in the United States should be consistent with existing restrictions in the international community).

249 Innovative manufacturers have already started designing environmentally sound appliances and have begun using biodegradable "bioplastics" in the production of electronics. *See e.g.*, Kutz, *supra* note 28, at 318–19, 328 (reporting that Motorola has begun experimenting with a biodegradable cell phone cover that decomposes into a sunflower seed and Swedx has created timber-encased computer screens, and accessories; and also noting that toxin reduction regulations have been successful in Europe and Japan).

250 Joel Boon, Note: *Stemming the Tide of Patchwork Policies: The Case of E-Waste*, 15 TRANSNAT'L L. & CONTEMP. PROBS. 731, 753–54 (2006) (noting that many countries and producers were influenced by the EU's RoHS initiative and describing the substance ban's impact on China, Japan and the United States as an intentional and designed "contagion"). While any substance ban should provide a transition period to allow producers to modify their production systems, given the success and global market pressure the RoHS and California's EWRA have already exerted on the electronics' industry, I disagree with other scholars' assertions that the U.S. hazardous substances bans should be implemented in phases in contrast to the EU's RoHS Directive, which went into full force in 2006. *Compare* Sachs, *supra* note 21, at 93 (noting that given the size of California's market, California's adoption of the RoHS Directive has the potential to "elevate the RoHS into a kind of global electronics standard" with the strength to indirectly modify electronic components worldwide), *with* Pak, *supra* note 147, at 276

exceptions that allow producers to use banned substances when it is necessary to do so for technical, scientific, or environmental reasons.[251]

2. EPR Should Form the Foundation of a Hybrid E-Waste Policy in the United States

United States e-waste policy should be founded on a hybrid EPR take-back system.[252] EPR provides the framework to manage existing and future e-waste, and it appropriately places responsibility on the producer—which is both the primary polluter[253] and also the party most able to address the design issues that form the root of the e-waste problem.[254] However, while having a system founded on EPR take-back methodology is central to creating a policy that provides influential feedback incentives for manufacturers to design more environmentally sound electronics, EPR alone will not address all facets of the e-waste crisis.[255]

The United States, therefore, should pursue a hybrid approach, similar to Japan's, that distributes financial, physical, economic, and informational responsibility between multiple parties and incorporates ARF policies into a primarily EPR framework. Federal e-waste policy should distribute end-of-life responsibilities and costs between producers, consumers, retailers, and the government. Producers should assume primary physical and economic responsibility for recycling and disposal.[256] In order to maintain the effectiveness of the EPR feedback loop, U.S. policy should promote individualized EPR systems and encourage manufacturers to take back and recycle

("[U]nlike the EU RoHS Directive, the U.S. RoHS should be gradually phased in to give manufacturers time to adapt.").

251 *See* Pak, *supra* note 147, at 276 (recommending that an immediate exception be granted where the use of banned substances is needed for technical or scientific advancement, but that in order to maintain the integrity of the system, these exceptions should be determined on an individual basis).

252 *See* Kutz, *supra* note 28, at 326–28. *See also* Pak, *supra* note 147, at 275 (advocating for a "moderate" EPR system with equitable distribution between the industry, manufacturers, consumers and the public); Boon, *supra* note 250, at 756 (arguing the United States should implement a take-back system but not specifying it should be EPR).

253 By designing, creating, and distributing toxic electronic goods, manufacturers are easily identifiable as a primary polluter. *See* Krishna & Kulshrestha, *supra* note 38, at 91.

254 With the dual technical and financial ability to address the e-waste issue both during the upstream design process and the downstream disposal stage, manufacturers have an unparalleled opportunity to mitigate the e-waste crisis' contributing factors. *See* Kutz, *supra* note 28, at 325.

255 *See* Courtney, *supra* note 93, at 227 (describing EPR as "the most robust and flexible of the options currently on the table").

256 *See* CPA, *Key Elements of an EPR Plan*, *supra* note 236.

their own products.[257] Given the significant physical and financial burden of developing environmentally sound disposal and recycling systems, however, federal regulations should allow collective EPR schemes.

Producers should be allowed to collectively create and manage shared disposal and recycling facilities or coordinate the development of such infrastructure through third party recyclers.[258] By ensuring that producers that choose to work within a collective disposal infrastructure pay the costs directly associated with their products, the U.S. system would avoid the disconnect in the feedback loop that the WEEE Directive has experienced with its collective opt-out provision.[259] In addition to paying disposal and recycling fees based on the actual end-of-life processing of their products, manufacturers should also pay charges based on whether their devices are durable, repairable, upgradable, and can be easily disassembled.[260]

While some critics maintain that the expense of coordinating collective systems and determining individual producers' costs is overly burdensome, Japan's success demonstrates that a collective EPR option that assigns individual costs is possible. If the collective system proves too arduous for certain manufacturers, these groups have the option to implement their own individual take-back programs. Furthermore, funding for the transactional expenses associated with determining and assigning individual product costs can be provided by consumers.

Although EPR policies are the primary vehicle with which to influence producers' design behavior, consumer fees should also be incorporated into federal policy.[261] Buyer fees provide a

257 *See* Sachs, *supra* note 21, at 77–80 (criticizing the WEEE's collective responsibility provisions and arguing individual responsibility is necessary to incentivize clean design changes). *See also* CPA, *Key Elements of an EPR Plan*, *supra* note 236 (advocating for individual responsibility).

258 Japan has achieved success by allowing smaller manufacturers to contract their recycling out to larger recyclers. *See generally* INFORM, APPLIANCE, *supra* note 12; ETBC, *Extended Producer Responsibility*, *supra* note 132.

259 *See* Pak, *supra* note 147, at 276–77.

260 Fees that provide producers incentives to design durable goods that can be repaired and upgraded will decrease the volume of obsolete electronics entering the waste stream. Likewise, charges that encourage manufacturers to design electronics that can be easily disassembled or recycled decrease the likelihood these devices will be shipped abroad in order to avoid the costs domestic disposal. *See* Kutz, *supra* note 28, at 320 (suggesting that producers can slow how quickly their electronics become obsolete by specifically designing products for "durability, upgradability and disassembly" and which can be "easily repairable and upgradable").

261 I disagree with scholars who suggest that consumer based fees should be used as a temporary remedy that should be phased out after EPR systems gain strength or as an alternative which manufacturers can opt out of. Consumers' purchasing habits spur the e-waste cycle. It is important therefore that e-waste polices continually utilize consumer

continual source of revenue to aid the management of orphan and historic waste, the transactional costs associated with collecting and transporting e-waste to recycling facilities, and the costs of maintaining a system capable of determining and assigning individual disposal costs to producers operating within collective EPR systems.[262]

Consumers perpetuate the continual growth of the e-waste stream and should shoulder partial responsibility for the negative externalities associated with their purchasing habits.[263] Publicized consumer fee-based systems present an ideal platform from which to alert the public to the e-waste crisis and to encourage better buying decisions.[264] The United States should implement ARFs rather than end-of-life disposal charges because drop-off fees may encourage illegal "midnight" dumping, as evidenced by Japan's SHAR regulation.[265]

Opponents of California's ARF system argue that ARF regulations will merely encourage consumers to purchase their electronics outside of ARF jurisdictions, but a federal system would eliminate this concern.[266] If EPR were to form the foundation of the federal e-waste policy, consumer fees could be smaller than those currently imposed in California, where ARFs fund the entire take-back system, and consumers would have little incentive to purchase from abroad because they would have to pay high international shipping costs.[267] Even if a consumer were to purchase electronics from international retailers, those goods would still be subject to EPR at the end of their life cycles, thus minimizing the impact of the lost ARF revenue.

based fees in order to ensure consumers are aware of the e-waste issue and have ongoing financial incentives to modify their purchasing habits. *Compare* Sachs, *supra* note 21, at 73–75 (advocating a consumer based fee and noting that "[fo]cusing attention on producer responsibility . . . may constitute a license for consumers to continue their unsustainable, high consumption lifestyles"), *and* Pak, *supra* note 147, at 277–78 (suggesting consumer based fees raise "consumer awareness . . . [and create] market demand for ecological design"), *with* Sachs, *supra* note 21, at 96 (proposing an ARF "opt-out" that would allow manufacturers to impose or eliminate ARF fees on their products).

262 *See* Kutz, *supra* note 28, at 323–24; Sachs, *supra* note 21, at 96.

263 *See* Pak, *supra* note 147, at 277–78; Sachs, *supra* note 21, at 65, 73–74, 95–96.

264 *See* Sachs, *supra* note 21, at 96.

265 Following SHAR's implementation, 9,692 units of e-waste were illegally dumped between April and June 2000 in Japan. *See* Lin et al., *supra* note 209, at 542.

266 *See* Courtney, *supra* note 93, at 219–20 (reporting that ARF critics claim consumers will purchase their electronics out of state to avoid paying fees).

267 *See* Pak *supra* note 147, at 278. *See also* Courtney, *supra* note 93, at 219–20 (noting it is unlikely consumers would purchase electronics that usually cost one thousand dollars or more out of state in order to avoid paying ten dollar ARF fees). As of January 1, 2009, California's fees ranged from eight to twenty-five dollars. CALRECYCLE, *supra* note 134. Because California's ARF fees have been implemented without notable consumer backlash and have by enlarge proven to be sustainable, I propose a federal fee between five to fifteen dollars, only slightly less than that of California's.

Finally, government and electronics retailers should take primary responsibility for the physical collection of used electronics, as has been required in Japan. Both entities have visible and familiar collection locations that are easily accessible to the public, and they have existing infrastructures with which to efficiently coordinate large-scale collection initiatives.[268] Because producers and consumers will share the economic burden of the national take-back system, taxpayers and retailers will remain free of the financial costs of the system.

3. U.S. Policy Should Stop the Export of E-Waste

To fully address the e-waste issue, U.S. e-waste policy must regulate the export of toxic electronics to developing countries.[269] By influencing producers' objectives and consumers' buying habits, EPR and ARF systems have the potential to clean up electronics and reduce the volume of the e-waste stream in the future.[270] However, these policies cannot fully address the dangers that existing and historic e-waste pose to developing countries.[271] The United States, therefore, should ratify both the Basel Convention and the Ban Amendment.[272] By doing so, the United States would assume responsibility for its contribution to the e-waste stream, take affirmative steps to discontinue its toxic exploitation of developing nations, and spur the momentum necessary to make the Ban Amendment officially part of the Basel Convention.[273]

Opponents to the Ban Amendment claim that the treaty will harm the fragile economies of developing countries that currently trade in e-waste and will widen the digital divide by diminishing

268 The United States should follow Japan's example and utilize post offices as collection centers. *See* Pak, *supra* note 147, at 275 ("Local municipalities would be in the best position to handle the e-waste collection responsibilities because the [municipal solid waste] collection infrastructure already exists."). *See also* INFORM, PC, *supra* note 12 (describing the collection process at Japan post offices).

269 *See* Kutz, *supra* note 28, at 319, 328. *See also* Sachs, *supra* note 21, at 92–93 (arguing that when the United States creates e-waste policy it should be founded on the theory that e-waste should be managed within its own borders); Templeton, *supra* note 4, at 796.

270 *See* Courtney, *supra* note 93, at 225; Sachs, *supra* note 21, at 96.

271 *See* BLEIWAS & KELLY, *supra* note 19 (reporting that seventy-five percent of e-waste is stored by its owners); GAO REPORT, *supra* note 1, at. 40–41 (recommending the EPA submit a legislative package ratifying the Basel Convention to Congress).

272 Templeton, *supra* note 4, at 796. *See also* GAO REPORT, *supra* note 1, at 34–37 (revealing that ratifying the Basel Convention would help fill some of RCRA's gaps because the Convention has a broader definition of what constitutes hazardous waste that ought to be controlled than RCRA).

273 *See* Templeton, *supra* note 4, at 796 (noting that by ratifying the Basel Convention and the Ban Amendment the United States could encourage countries such as Canada and Australia to follow suit).

these countries' access to affordable electronics.[274] The Ban Amendment, however, only prohibits the export of hazardous waste to non-OECD countries and does not prevent the export of clean electronics.[275] Therefore, by implementing the Ban Amendment while simultaneously introducing EPR, ARF, and substance ban initiatives—policies designed to clean up the e-waste stream—the United States will prevent the export of electronics containing hazardous materials and will create a source of clean electronics that can be shipped abroad.[276]

4. Proposed Legislation

In order to successfully decrease the toxicity and volume of the e-waste stream and stop the flow of toxic discarded electronics to developing countries, Congress must implement uniform, nationwide regulations with effective enforcement mechanisms and sufficient breadth to govern all harmful electronics.[277] As has been discussed, many of the United States' current environmental regulations fail to govern e-waste because they focus the environmental effects of the manufacturing process.[278] Future legislation must take a more holistic approach and address the environmental impact of electronics at every stage of their lifecycle.[279]

Existing environmental regulations, such as the RCRA, are also ineffective because many electronics fall outside their governance.[280] Lawmakers should modify the RCRA so that it governs existing e-waste and future generations of electronics.[281] The RCRA's narrow definition of "hazardous" should be expanded to include potentially hazardous items, taking into account that, while items may not release toxins in their natural state, they

274 *See id.*

275 *See Basel Convention Basics*, *supra* note 168; BAN BRIEFING PAPER 1, *supra* note 167.

276 *See* Templeton, *supra* note 4, at 796 (arguing that critics who claim the Ban Amendment would be harmful to the economies of developing nations who capitalize on the e-waste trade undervalue the significant health and environmental dangers this trade presents). *See also 60 Minutes*, *supra* note 7 (reporting Basel Action Network's argument that impoverished workers should never have to choose between "poverty and poison").

277 *See* Kutz, *supra* note 28, at 329.

278 *See* Sachs, *supra* note 21, at 53, 57–58.

279 *See id.* at 53, 98.

280 Implemented long before today's current e-waste crisis could be foreseen, these regulations categorize the substances they govern too narrowly and provide too many exemptions to be effective. *See* GAO REPORT, *supra* note 1, at 31–32 (stating that even when fully enforced, the EPA's current e-waste regulation, the CRT rule, only reaches a small percentage of e-waste).

281 *See* Kutz, *supra* note 28, at 328 (arguing that, given how quickly technology changes the items available in the electronics market, legislation must define and govern current and future electronic equipment in order to be effective); Templeton, *supra* note 4, at 787 (reporting that RCRA is currently inadequate).

may do so when disassembled or incinerated.[282] In order to better govern potentially hazardous goods, the EPA should remove the provision in the RCRA that exempts CRTs labeled for reuse or repair from the notice and consent requirements to which other hazardous substances are held.[283]

Finally, federal e-waste policy must set a uniform national standard and include adequate enforcement mechanisms.[284] To avoid the inconsistent "patchwork" the European Union has experienced, Congress should establish firm, nationwide requirements and give the EPA the authority to enforce e-waste regulations and prosecute violators.[285] When creating e-waste legislation, Congress should simultaneously implement a fine-based system to encourage compliance from producers, retailers, and consumers.[286] Additionally, producers and retailers that fail to meet the requirements imposed by the hybrid EPR and ARF system should be forbidden from selling within the United States.[287] Lawmakers could minimize the burden that enforcement imposes upon the government and the EPA by requiring stakeholders to regularly issue public reports on their compliance with e-waste regulations.[288]

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282 The GAO has recommended that the EPA revise RCRA's definition of "hazardous" to include "products that can pose risks upon disassembly or reclamation." GAO REPORT, *supra* note 1, at 32, 40 (noting that RCRA's narrow definition of "hazardous" stands in "stark contrast" to the ideology of Basel Convention members who seek to regulate *potentially* hazardous items).

283 *See* GAO REPORT, *supra* note 1, at 22 (stating that parties seeking to export CRTs for recycling are required to contact the EPA and obtain the consent of the importing country but that parties seeking to export CRTs for reuse are only required to notify the EPA of their intention).

284 *See* Krishna & Kulshrestha, *supra* note 38, at 90; Kutz, *supra* note 28, at 329.

285 *See* HUISMAN ET AL., *supra* note 197 (arguing that the WEEE has resulted in regulatory chaos because European Member States are allowed to independently implement the Directive). The GAO reports that the EPA currently lacks the legal authority and enforcement power to take back waste after it has been shipped abroad. Between 1998 and 2001, a chemical company called Pyramid Chemicals illegally shipped twenty-nine containers of hazardous waste abroad. GAO REPORT, *supra* note 1, at 35. However, when officials in the Netherlands found leakage coming from the containers and discovered the illegal substances, the EPA lacked the legal ability to have the shipment returned to the United States for proper processing. *Id.* (reporting that should the United States ratify the Basel Convention, Congress would need to give the EPA or another appropriate agency legal authority before the convention's could be enforced domestically).

286 *See* Krishna & Kulshrestha, *supra* note 38, at 90 (advocating for a fine-based system, but also arguing for criminal prosecution of those who violate environmental laws).

287 *See* Kutz, *supra* note 28, at 329.

288 *Id.* (suggesting e-waste legislation requires that producers publish periodic public reports in order to ensure compliance).

CONCLUSION

Technological advances in the last quarter-century have accelerated the standard of living in most industrialized nations and introduced electronics that the world had never before imagined. This technology continues to bound forward as producers introduce new gadgets and improved models every few months. The benefits associated with these new electronics, however, do not outweigh the detrimental impact these toxic devices have on human health and the environment as they flood the waste stream.

By not implementing regulations that adequately address the e-waste issue domestically or abroad, the United States has failed to successfully manage this crisis. Instead, it has been content to reap the benefits of technology and shift the harmful effects of the electronics industry onto impoverished developing nations that lack the infrastructure and ability to manage e-waste with adequate health and environmental protections.

The United States is a leading contributor to the e-waste stream. It has the wealth, regulatory ability, market power, and moral responsibility to address the e-waste crisis by decreasing the volume and toxicity of the e-waste stream and to ensure that poor nations are not saddled with the burden of disposing the industrialized world's toxic throwaways.

In order to address the e-waste issue, regulations must be broadly implemented at a federal level, and should include both prescriptive initiatives that encourage producer and consumer support and prohibitory regulations that ban the use of specified toxic substances and prevent the export of hazardous wastes to developing nations. The United States should implement EPR and ARF take-back systems that assign end-of-life responsibility to multiple stakeholders in a way that encourages the development of more environmentally friendly electronics and decreases the toxicity and volume of the waste stream. For the children of Guiyu and the other low-wage laborers who toil over open acid baths in impoverished communities around the world, it is imperative that the United States take decisive action to address the e-waste crisis and its own contribution to the toxic waste stream.