

## COMMENT

E-RESPONSIBILITY: E-WASTE, INTERNATIONAL LAW AND AFRICA'S  
GROWING DIGITAL WASTELAND

*Zelalem Tesfaye Bogale*\*

## ABSTRACT

*“E-waste,” a term for discarded electronic products near the end or at the end of their useful life, contains hazardous materials like mercury, arsenic, and cadmium among other toxic substances. Although e-waste is the largest growing segment of the municipal waste stream in industrialized countries, international and domestic laws – and the enforcement of those laws – have not caught up. Due to weak domestic laws, weakly enforced international laws, and the high cost of properly handling, disposing of, or recycling e-waste, e-waste continues to be exported internationally to developing countries.*

*The West African countries of Nigeria and Ghana have recently become the leading recipients of the developing world's e-waste. Most of the e-waste that is shipped to the metropolitan port cities of Lagos and Accra, however, is unsalvageable, and those who often dismantle this e-waste come from poorer and younger segments of the Nigerian and Ghanaian population.*

---

\* B.A., University of Nevada, Reno, 2004; J.D., California Western School of Law, 2011. I give my thanks and deep appreciation to the staff and editorial board of the U.C. Davis Journal of International Law and Policy (“JILP”) for their diligent work in preparing this Comment for print. In particular, I thank JILP’s Editor-in-Chief, Joanna Cuevas Ingram, for her invaluable editorial advice and her belief in the quality of this Comment. In addition, I thank Professor Sumi Cho of DePaul University College of Law and Professor Francisco Valdes of the University of Miami School of Law for the opportunities they have provided me and their unconditional encouragement of my scholarship. I also thank Professor Richard Finkmoore of California Western School of Law for marshaling his passion for environmental law into a course offering that surveyed international environmental law – a course that provided the intellectual space for this Comment. Penultimately, I must thank Professor Andrea Freeman of California Western School of Law for making this Comment possible and for her mentorship, friendship and firm encouragement of my goals. Finally, I thank my mother and brother for their endless love and I thank my fiancée for supporting me throughout this process with loving patience. All errors in this Comment are my own. This Comment is dedicated to the memory of my father, Tesfaye Gebremedhin Bogale.

*Often, low-income children in Ghana and Nigeria end up burning the e-waste in highly unsafe conditions in order to salvage what few precious metals remain. These dangerous dismantling practices present immense environmental and human health implications. However, with international cooperation and the right economic incentives, the tide of this toxic trade can be stemmed and the international community can more effectively address the lasting negative effects this trade has on global health and the environment.*

## TABLE OF CONTENTS

INTRODUCTION .....	227
I. BACKGROUND .....	229
A. Identifying E-Waste.....	230
B. The Toxicity of E-Waste .....	231
C. The Amount of E-Waste.....	236
D. The Sources of E-Waste .....	238
E. The Destinations of E-Waste .....	238
II. INTERNATIONAL AND DOMESTIC E-WASTE MANAGEMENT EFFORTS ...	239
A. The Basel Convention .....	239
B. The European Union.....	241
1. WEEE Directive .....	242
2. RoHS Directive .....	243
C. The United States and the RCRA .....	244
D. The Bamako Convention, Nigeria and Ghana .....	246
1. The Bamako Convention .....	246
2. Lagos, Nigeria .....	249
3. Accra, Ghana .....	250
III. TOXIC COLONIALISM: HOW AND WHY E-WASTE ENDS UP IN AFRICAN COUNTRIES.....	251
A. The How .....	251
B. The Why .....	252
1. The (Costly) Economics of Recycling in the United States .....	253
2. Bridging the Digital Divide .....	255
IV. E-RESPONSIBILITY: SOLUTIONS.....	256
A. Economic Incentives.....	256
B. Elimination of Hazardous Substances .....	258
C. Leading by Example.....	258
D. International Fund for Technologically-Driven Development.....	259
V. CONCLUSION.....	259

## INTRODUCTION

Did you purchase that ultra-thin laptop with endless hard-drive space and a battery that never dies? How about that stylish and sleek new mobile phone that browses the web, shoots video and plays all your favorite music? Congratulations, you have the latest electronics. However, have you ever wondered where your old laptop, iPod or mobile phone ended up after disposal? There is a good chance it ended up burned and dismantled by young boys in Agbogbloshie, Ghana,<sup>1</sup> a slum located outside Accra, Ghana's capital and largest city.

Today, a smoldering wasteland of electronic debris from discarded electronic products, or "e-waste," exists in place of what was once an unspoiled wetland in Agbogbloshie.<sup>2</sup> Young boys are busy working the dump, burning away plastic on old computers and dismantling the remains. Their work yields precious metals like copper, iron, and gold, which they collect to sell at the nearby market, but not before the combustion releases toxic heavy metals like lead, mercury, and cadmium, among other substances, into the environment. Agbogbloshie children who work to dismantle e-waste wear no protective clothing,<sup>3</sup> exposing themselves to lethal doses of these hazardous chemicals through inhalation of contaminated air. In fact, the toxic areas where the children work or attend school contain threatening pollutants over fifty times higher than risk-free levels.<sup>4</sup> These toxic environments have immense health implications,<sup>5</sup> yet direct exposure to the contaminants in these environments is the price these young boys pay to earn a living.<sup>6</sup>

Agbogbloshie, however, is not the only digital wasteland in Africa.<sup>7</sup> Lagos, Nigeria, and a number of townships in South Africa, Kenya,

---

<sup>1</sup> See *Ghana: Digital Dumping Ground* (PBS Frontline/World television broadcast June 16, 2009) (revealing one computer monitor taken from the heap of trash still bearing the City of Philadelphia School District imprimatur on a red and white sticker) [hereinafter *PBS Ghana*].

<sup>2</sup> *Id.*

<sup>3</sup> Ron Claiborne, *E-Waste in Africa, U.S. Trash is Ghana's Problem*, ABC NEWS, Aug. 2, 2009, <http://abcnews.go.com/GMA/Weekend/story?id=8215714&page=1>.

<sup>4</sup> Stephen Leahy, *Ghana: Toxic Electronic Waste Contaminates Surrounding Area*, ALLAFRICA.COM (Nov. 1, 2011), <http://allafrica.com/stories/201111020037.html>.

<sup>5</sup> See Claiborne, *supra* note 3 (noting that exposure to lead, mercury, and cadmium can negatively affect IQ scores and harm the nervous system).

<sup>6</sup> See *PBS Ghana*, *supra* note 1.

<sup>7</sup> At a conference in Johannesburg in 2008, representatives of the E-Waste Association of South Africa (e-WASA) cautioned that Africa, particularly South Africa, is becoming a "dumping ground for America and Europe" and that "[e]-waste volumes are expected to increase significantly in South Africa in the near future." *E-Waste in South Africa*, SANGONET, (Nov. 12, 2008), <http://www.ngopulse.org/article/e-waste-south-africa>.

Zimbabwe, Zambia and Botswana have become increasingly attractive locations for developed countries to dump their old electronics. According to the head of the United Nations' Environment Programme ("UNEP"), African countries are rapidly becoming the final destination of the world's electronic waste,<sup>8</sup> largely for two reasons: (1) shadow markets emerging from international and domestic recycling loopholes and (2) Asian countries like China and India imposing tighter regulations on the import and methods of recycling e-waste in those countries.<sup>9</sup> The ethical implications of these dynamics are clear: rather than managing their waste, developed countries with consumption-based economies are burdening poor, underdeveloped countries that lack proper waste management apparatuses with unsalvageable junk. Moreover, developed countries often dispose of e-waste under false pretenses.<sup>10</sup> The legal implications of these practices, however, are not so clear despite existing international and domestic legal regimes designed to prevent such practices.

This Comment finds the international community – particularly the leading e-waste exporting and importing countries such as the United States and China, respectively – has not dealt adequately with the consequences of e-waste in African countries through international and domestic law-making. Further, this Comment posits the United States and China, as leading producers and facilitators of e-waste, must lead by example. In particular, the United States must ratify relevant international agreements.<sup>11</sup> In addition, the United States and China must encourage developing African nations to ratify and enforce both existing environmental regulations and, if necessary, enact more stringent environmental regulations based on the precautionary principle<sup>12</sup> and extended-producer responsibility theory ("EPR").<sup>13</sup>

---

<sup>8</sup> See James Simpson, *Toxics Alert: Africa Emerging as E-Waste Dumping Ground*, TOXICS ALERT (Dec. 2006), <http://enews.toxicslink.org/news-view.php?id=3> ("According to a study by the Basel Action Network, a minimum of 100,000 used and obsolete computers a month are entering the Nigerian port of Lagos alone.").

<sup>9</sup> *Id.*

<sup>10</sup> See discussion *infra* Part III.A.2.

<sup>11</sup> See generally Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, 28 I.L.M. 657 (1989), Mar. 22, 1989, 1673 U.N.T.S. 125 [hereinafter Basel Convention]. The United States is a mere signatory and remains the only developed country not to have ratified it. Thus, the treaty lacks the force of law within the United States. The United States' ratification of the Basel Convention clearly is necessary to this effort. This topic is addressed in greater detail later in this Comment.

<sup>12</sup> See *infra* note 156 (discussing in detail the "precautionary principle").

<sup>13</sup> See *infra* notes 122-27 and accompanying text (discussing in detail the theory of Extended Producer Responsibility).

Part I provides background for the article and explains the nature of e-waste: what it is, where it comes from, how much e-waste there is, and where in the African continent it ends up. Part II focuses on international e-waste management efforts, placing emphasis on sub-Saharan Africa and the Bamako Convention. Part III describes and analyzes the ways in which, exporters, importers and e-waste traders exploit loopholes in existing international (and domestic) laws resulting in environmental and human health degradation in Africa.

Part IV presents a practical way to tackle the growing e-waste threat in Africa by taking the best ideas from the disparate patchwork of international and domestic attempts to curb the e-waste trade and combining them into an international regulatory framework. This framework consists of four major elements: (1) economic incentives for e-waste producers, recyclers, and consumers of electronic products designed to increase recyclability rates within developed countries and reduce the export of e-waste from developed countries to developing African countries; (2) permanently phasing out hazardous substances contained in electronic products; (3) encouraging African countries both to recognize existing international laws relating to e-waste and to enact their own strict environmental and occupational regulations concerning proper e-waste management and disposal; and (4) developing and implementing programs designed to help African countries meet their own local and regional information technology needs thereby reducing the ever-growing import market for used electronics. Finally, Part V concludes the article and briefly identifies pertinent issues outside the scope of this paper that must be considered if the e-waste problem is to be addressed comprehensively.

## I. BACKGROUND

For most consumers in developed countries, the electronic device is a fundamental and indispensable fixture in day-to-day life. Each one of us would be hard pressed to envision our lives without electronic devices, even relatively simple devices such as alarm clocks and microwaves, for example. It comes as no surprise, then, that the electronics industry is the world's largest and fastest growing manufacturing industry.<sup>14</sup> As a consequence of such rapid growth, innovation, and the related problem of rapid product

---

<sup>14</sup> See BASEL ACTION NETWORK, THE DIGITAL DUMP: EXPORTING RE-USE AND ABUSE TO AFRICA 7 (2005), <http://www.ban.org/library/TheDigitalDump.pdf> [hereinafter DIGITAL DUMP].

obsolescence,<sup>15</sup> e-waste is one of the fastest growing segments of the municipal waste stream in the industrialized world.<sup>16</sup>

Today, when faced with simple obsolescence or frustrating under-performance of an electronic device, consumers choose one of two options: (a) purchase the newest model and store the older device in a basement, closet or drawer, or (b) throw it away into the trash or a landfill.<sup>17</sup> The few consumers who choose to recycle or refurbish often face long trips to a recycling center and the high costs of recycling or refurbishment.<sup>18</sup> The relative scarcity of affordable and accessible disposal options for consumers are the consequences of strict environmental regulations coupled with the existence of largely inaccessible niche markets that dismantle and/or refurbish outdated electronics.<sup>19</sup>

#### A. Identifying E-Waste

“E-waste” refers to any electronic device, component or accessory nearing the end or at the end of its useful life.<sup>20</sup> E-waste includes cellular phones, computers, televisions, printers, batteries, light bulbs, and consumer electronics,<sup>21</sup> as well as components of these products, such as cathode ray tubes (“CRTs”),<sup>22</sup> circuit boards and ink cartridges.<sup>23</sup> E-waste contains common recyclable materials that most of us are familiar with, such as

---

<sup>15</sup> See *Electronic Waste: Investing in Research and Innovation to Reuse, Reduce, and Recycle: Hearing Before the H. Comm. on Science and Technology*, 111th Cong. 76 (2009) (statement of Rep. Mike Thompson), available at <http://www.gpo.gov/fdsys/pkg/CHRG-111hhrg47543/pdf/CHRG-111hhrg47543.pdf> [hereinafter *House Committee Hearing*].

<sup>16</sup> See DIGITAL DUMP, *supra* note 14, at 1.

<sup>17</sup> See Betsy M. Billingham, *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, 400 (2005).

<sup>18</sup> *Id.*

<sup>19</sup> *Id.*

<sup>20</sup> See *What is E-Waste?*, CAL. DEP'T OF RESOURCES RECYCLING AND RECOVERY, <http://www.calrecycle.ca.gov/Electronics/WhatisEwaste/> [hereinafter CAL RECYCLING].

<sup>21</sup> *Id.* There is no clear definition, however, for “e-waste.” For instance, California has yet to determine whether or not certain items like microwave ovens and other similar “appliances” like toaster ovens or blenders should be considered e-waste. See *id.*

<sup>22</sup> CRTs (cathode ray tubes) are the video display components of older non-flat-screen televisions and computer monitors, consisting of glass tubes containing hazardous levels of lead and barium. See *Fact Sheet: Easier Recycling of Cathode Ray Tubes*, U.S. ENVTL. PROTECTION AGENCY, <http://www.epa.gov/osw/hazard/recycling/electron/crt-fs06.htm>; see also Jennifer Kutz, *You've Got Waste: The Exponentially Escalating Problem of Hazardous E-waste*, 17 VILL. ENVTL. L.J. 307, 308 (2006). In addition, older CRTs contain arsenic while flat-screen monitors and televisions contain significant levels of mercury. *Id.*

<sup>23</sup> See Nicola J. Templeton, *The Dark Side of Recycling and Reusing Electronics: Is Washington's E-Cycle Program Adequate?*, 7 SEATTLE J. SOC. JUST. 763, 765 (2009).

plastics and aluminum.<sup>24</sup> E-waste also contains, *inter alia*, small pieces of valuable metals such as gold, silver, platinum, and copper.<sup>25</sup> The extraction and subsequent sale of these metals is likely the primary motivation for those in developing countries who sort through e-waste in extremely unsafe conditions.<sup>26</sup>

### B. The Toxicity of E-Waste

Although e-waste contains some relatively benign materials, electronic devices contain hundreds of highly toxic substances.<sup>27</sup> Consequently, the escalation of e-waste dumping in Africa<sup>28</sup> poses significant environmental and human health problems. Children are uniquely at risk because (1) children comprise the majority of those who burn or dismantle discarded e-waste, and (2) children are more vulnerable to e-waste's toxicity because of their rapidly developing organs.<sup>29</sup> Through dermal contact and inhalation, as well as indirectly through contaminated food and water, Ghanaian children exposed to e-waste's neurotoxins and carcinogens may suffer from "brain and kidney damage, respiratory illness, developmental and behavioral disorders, and eventually cancer."<sup>30</sup>

Electronic products contain a variety of hazardous halogenated compounds, including toxic heavy metals such as lead, mercury, and cadmium.<sup>31</sup> In fact, many of the substances found in common electronic products are ranked very high on the Comprehensive Environmental

---

<sup>24</sup> JOHN GALLAUGHER, INFORMATION SYSTEMS: A MANAGER'S GUIDE TO HARNESSING TECHNOLOGY § 5.8 (2010), available at <http://www.flatworldknowledge.com/pub/information-systems-managers-g/2374/73228> (last visited Mar. 18, 2012).

<sup>25</sup> *Id.*

<sup>26</sup> See PBS *Ghana*, *supra* note 1.

<sup>27</sup> Karimeh Moukaddem, *Children on the frontlines: the waste epidemic in Africa*, MONGABAY.COM (Sept. 9, 2011), [http://news.mongabay.com/2011/0909-moukaddem\\_ewaste.html](http://news.mongabay.com/2011/0909-moukaddem_ewaste.html) (according to Deborah McGrath, a Biology professor at Sewanee: University of the South, lead, arsenic, cadmium, hexavalent chromium, and mercury are common e-waste components and dangerous neurotoxins).

<sup>28</sup> See *infra* note 182 and accompanying text (detailing the amount of e-waste arriving in Lagos, Nigeria).

<sup>29</sup> Moukaddem, *supra* note 27 (quoting Dr. Kwei Quartey, a Ghanaian author and physician, as stating: "Children anywhere in the world are more vulnerable to any poison, contaminant or toxin because of their rapidly developing organs. Pound for pound, they drink more fluid and breathe more air than adults. Children have about eight times the risk of adults when exposed to metal-laden dust, and blood measurements in children living around e-waste sites have shown high levels of cadmium and lead.").

<sup>30</sup> *Id.*

<sup>31</sup> See 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, 248 (2008).

Response, Compensation, and Liability Act (“CERCLA”) Priority List of Hazardous Substances compiled by the Center for Disease Control in 2011;<sup>32</sup> lead is ranked at number two on the CERCLA Priority List, followed by mercury at number three, and cadmium at number seven.<sup>33</sup> Those working the scrap-yards are exposed to large amounts of these toxins every day while employing crude methods such as open air burning, acid baths and other dangerous forms of dismantling used electronics.<sup>34</sup>

The long-term health impacts on African populations are unknown – not because crude methods of processing e-waste are safe or because e-waste contains innocuous materials – but largely because no specific studies exist concerning such health impacts in African countries.<sup>35</sup> In fact, Atiemo Sampson, Ghanaian researcher and Ph.D. student at the University of Ghana, has said, “We don’t know what the immediate health impacts are. We are hoping to test the children’s blood for contaminants but we have not secured the necessary funding.”<sup>36</sup>

Other researchers, however, have conducted studies involving other groups engaged in similarly crude e-waste dismantling processes.<sup>37</sup> A study conducted in Taizhou in Zhejiang province, one of the major e-waste dismantling areas in China, found that manual recycling techniques release toxic particulate matter into the air, which is then inhaled by the dismantling workers and local residents.<sup>38</sup> The study found that inhaling this polluted air likely caused severe pulmonary inflammatory responses and oxidative stress, scientific jargon for severe lung damage.<sup>39</sup> In addition, this study cites other studies, including an unpublished survey revealing that diseases such as cardiovascular diseases and various cancers have become more common in

---

<sup>32</sup> Lead, mercury and cadmium along with polyvinyl chloride (PVC), polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs) are all within the top eight out of 275 hazardous substances. See Agency for Toxic Substances & Disease Registry, *ATSDR Priority List of Hazardous Substances*, available at <http://www.atsdr.cdc.gov/SPL/index.html> (last visited Mar. 18, 2012).

<sup>33</sup> *Id.*

<sup>34</sup> See DIGITAL DUMP, *supra* note 14, at 2.

<sup>35</sup> See Leahy, *supra* note 4.

<sup>36</sup> *Id.*

<sup>37</sup> See *E-waste linked to adverse health effects*, CONSUMERREPORTS.ORG (June 1, 2011), <http://news.consumerreports.org/health/2011/06/researchers-link-e-waste-to-adverse-effects-on-human-health.html> (reporting on a recent study in the journal of the Institute of Physics, Environmental Research Letter finding Chinese women who dismantle e-waste expose themselves to “contaminants that damage the lungs and possibly contribute to cardiovascular disease and cancer”).

<sup>38</sup> Fangxing Yang et al., *Comparisons of IL-8, ROS and p53 responses in human lung epithelial cells exposed to two extracts of PM2.5 collected from an e-waste recycling area, China*, 2011 ENVIRON. RES. LETTERS 6, [http://iopscience.iop.org/1748-9326/6/2/024013/pdf/1748-9326\\_6\\_2\\_024013.pdf](http://iopscience.iop.org/1748-9326/6/2/024013/pdf/1748-9326_6_2_024013.pdf).

<sup>39</sup> *Id.*



Zhejiang province during the past few decades of e-waste dismantling in that region.<sup>40</sup> Similar health consequences are certain to occur within African populations because Africans in a number of different townships and countries throughout the continent are engaging in similarly dangerous, if not more dangerous, dismantling practices.<sup>41</sup>

Even limited exposure can be dangerous. For example, many of the chemicals present in electronic devices are environmentally persistent, meaning they remain in the environment for long periods of time once released.<sup>42</sup> Thus, even with a short period of exposure, the cumulative effect, over time, may cause significant injury to the environment and human health. The following is a general explanation of e-waste's most common and hazardous components, and the adverse health consequences resulting from even limited exposure to such toxic substances.

Electronic products contain lead primarily in two forms: metallic lead in electrical solder on printed circuit boards, and lead oxide used in CRTs.<sup>43</sup> Comprising about twenty percent of each CRT, approximately four to eight pounds of lead is contained in older CRTs.<sup>44</sup> Not only can lead "leach"<sup>45</sup> from CRTs under landfill conditions, it can also release into the environment during glass crushing or high temperature processing methods often used by Africans processing e-waste.<sup>46</sup>

While lead has no known biological or nutritional function,<sup>47</sup> the adverse health consequences of lead exposure are well documented. Lead exposure may lead to damage to central and peripheral nervous, blood,

---

<sup>40</sup> *Id.*

<sup>41</sup> See generally PBS *Ghana*, *supra* note 1 (depicting Ghanaians processing e-waste under similar conditions as Chinese e-waste dismantling workers).

<sup>42</sup> See GREENPEACE, RECYCLING OF ELECTRONIC WASTES IN CHINA AND INDIA: WORKPLACE & ENVIRONMENTAL CONTAMINATION 4 (2005), [http://www.greenpeace.to/greenpeace/wp-content/uploads/2011/05/electronic\\_waste\\_recycling\\_2005.pdf](http://www.greenpeace.to/greenpeace/wp-content/uploads/2011/05/electronic_waste_recycling_2005.pdf) [hereinafter ENVIRONMENTAL CONTAMINATION].

<sup>43</sup> See GREENPEACE, TOXIC TECH: THE DANGEROUS CHEMICALS IN ELECTRONIC PRODUCTS, <http://www.greenpeace.org/international/PageFiles/24478/toxic-tech-chemicals-in-elec.pdf> (last visited Mar. 18, 2012) [hereinafter GREENPEACE Briefing].

<sup>44</sup> See Pak, *supra* note 31, at 249. Modern flat-screen televisions and laptops with liquid crystal display (LCD) screens are more environmentally safe because they do not contain CRTs. *Id.*

<sup>45</sup> "Leachate" is the product of a process that largely occurs in landfills whereby substances, often toxic heavy metals like lead and cadmium, seep through the moist soil and "leach," as it were, into the groundwater. See *What is Leachate?*, THE LEACHATE EXPERT WEBSITE, <http://leachate.co.uk/main/what-is-leachate> (last visited Mar. 18, 2012). The end product is a liquid that usually contains both dissolved and suspended material. *Id.*

<sup>46</sup> See GREENPEACE Briefing, *supra* note 43, at 4.

<sup>47</sup> *Id.* at 5.

reproductive, circulatory, and endocrine systems,<sup>48</sup> and kidney damage.<sup>49</sup> Children are especially vulnerable to lead exposure where “lead has been found to impede brain development,”<sup>50</sup> causing what one doctor terms “brain drain.”<sup>51</sup> Intense lead exposure in children can cause “vomiting, diarrhea, convulsions, coma, or death.”<sup>52</sup> Furthermore, as mentioned above, lead exposure is cumulative and its effects appear to be irreversible.<sup>53</sup>

Mercury is another highly toxic element of e-waste. Mercury is used in light bulbs, flat screen displays, older types of laptop batteries, switches, relays, and cellular phones.<sup>54</sup> High levels of mercury exposure can lead to brain and kidney damage as well as damage to the central nervous system.<sup>55</sup> When mercury in electronic devices meets water, either through leaching from landfills or simply throwing electronic devices into bodies of water like the Korle Lagoon in Agobogbloshie, it becomes methylated or highly toxic methylmercury.<sup>56</sup> Methylmercury builds up in fish, shellfish and animals that eat fish. As a result, methylmercury becomes more concentrated as it travels up the food chain where, ultimately, humans consume it.<sup>57</sup> Like lead, methylmercury is particularly hazardous to fetuses, infants and children because their bodies are still developing. In fact, exposure to methylmercury causes adverse effects on fine motor skills, thinking, language and visual-spatial skills in children.<sup>58</sup>

---

<sup>48</sup> See 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 (2008); Nisha Thakker, *India's Toxic Landfills: A Dumping Ground for the World's Electronic Waste*, 6 SUSTAINABLE DEV. L. & POL'Y 58, 59 (2006).

<sup>49</sup> See *E-Waste*, SILICON VALLEY TOXICS COALITION, fig. 1, <http://svtc.org/our-work/e-waste/> (last visited Mar. 18, 2012) [hereinafter *Body Burden*].

<sup>50</sup> See Thakker, *supra* note 48, at 59.

<sup>51</sup> *Id.*

<sup>52</sup> See GREENPEACE Briefing, *supra* note 43, at 5. Mike Anane, director of the League of Environmental Journalists in Ghana, has said, “The people [including children] that break open these monitors tell me that they suffer from nausea, headaches and respiratory problems.” Richard Wray, *Breeding Toxins from Dead PCs*, THE GUARDIAN, May 6, 2008, <http://www.guardian.co.uk/environment/2008/may/06/waste/pollution>.

<sup>53</sup> See GREENPEACE Briefing, *supra* note 43, at 5.

<sup>54</sup> See *What's in Electronic Devices?*, GREENPEACE (June 27, 2005), <http://www.greenpeace.org/international/campaigns/toxics/electronics/what-s-in-electronic-devices>; Templeton, *supra* note 23, at 767.

<sup>55</sup> See *Body Burden*, *supra* note 49.

<sup>56</sup> See Kutz, *supra* note 22, at 312.

<sup>57</sup> See Templeton, *supra* note 23, at 765.

<sup>58</sup> *Basic Information: Mercury*, U.S. ENVIRONMENTAL PROTECTION AGENCY, available at <http://www.epa.gov/mercury/about.htm> (last visited Mar. 18, 2012).

Cadmium is another heavy metal found in computer batteries, older CRTs, semiconductor chips, circuit boards and some plastics.<sup>59</sup> Between 1997 and 2004, 315 million computers became obsolete –representing nearly two million pounds of cadmium content.<sup>60</sup> Like lead, cadmium is extremely toxic even in low concentrations. Along with showing a danger of “cumulative effects in the environment due to its acute and chronic toxicity,”<sup>61</sup> cadmium exposure can cause irreversible damage to human health.<sup>62</sup> Cadmium is primarily absorbed through respiration, but it can also be ingested with food.<sup>63</sup> Cadmium and compounds thereof can accumulate in the human body, particularly in the kidneys, where it can cause pulmonary edema and renal damage,<sup>64</sup> as well as respiratory tract problems.<sup>65</sup> Finally, many cadmium compounds are carcinogenic.<sup>66</sup>

Brominated flame-retardants (“BFRs”) are prevalent in common electronic products. Seventy different BFRs are used to fireproof our electronics, from printed circuit boards and computer casings to power cords and cables.<sup>67</sup> BFRs, particularly polybrominated diphenyl ethers (“PBDEs”), are environmentally persistent neurotoxic chemicals that build up in human bodies through repeat exposures.<sup>68</sup> The incineration of BFRs and polyvinyl chlorides releases toxic and carcinogenic dioxins (“PBDDs”) and furans (“PBDFs”) into the environment.<sup>69</sup> Exposure to BFRs is believed to cause endocrine disruption and neurological and developmental reproductive problems,<sup>70</sup> while the U.S. Environmental Protection Agency (“EPA”) has confirmed dioxin exposure can cause cancer.<sup>71</sup> Furthermore, incinerating e-waste is particularly dangerous because copper, a common substance in many electronic components, catalyzes the formation of dioxins.<sup>72</sup>

---

<sup>59</sup> See Body Burden, *supra* note 49.

<sup>60</sup> See SILICON VALLEY TOXICS COALITION, POISON PCs AND TOXIC TVs: CALIFORNIA’S BIGGEST ENVIRONMENTAL CRISIS THAT YOU’VE NEVER HEARD OF 9 (2004), <http://svtc.org/wp-content/uploads/ppc-ttv1.pdf> [hereinafter POISON PCs].

<sup>61</sup> *Id.* at 12.

<sup>62</sup> *Id.*

<sup>63</sup> *Id.*

<sup>64</sup> See Kutz, *supra* note 22, at 311.

<sup>65</sup> See Templeton, *supra* note 23, at 765.

<sup>66</sup> See CAL RECYCLING, *supra* note 20.

<sup>67</sup> See Templeton, *supra* note 23, at 765.

<sup>68</sup> See ENVIRONMENTAL CONTAMINATION, *supra* note 42, at 4.

<sup>69</sup> See Kutz, *supra* note 22, at 308.

<sup>70</sup> See Templeton, *supra* note 23, at 767.

<sup>71</sup> See Kutz, *supra* note 22, at 311.

<sup>72</sup> See JIM PUCKETT ET AL., EXPORTING HARM: THE HIGH-TECH TRASHING OF ASIA 7 (2002), [www.ban.org/E-waste/technotrashfinalcomp.pdf](http://www.ban.org/E-waste/technotrashfinalcomp.pdf) [hereinafter EXPORTING HARM].

It is clear, therefore, the methods used by African people in Ghana, Nigeria, Kenya and others in developing countries to dismantle e-waste are extremely unsafe and likely to cause severe health and environmental consequences now and in the future.

### C. *The Amount of E-Waste*

Each year, the world disposes of between twenty and fifty million metric tons of e-waste.<sup>73</sup> Consequently, e-waste comprises more than five percent of the entire municipal solid waste stream.<sup>74</sup>

As mentioned in Part I, e-waste is the fastest growing part of the United States' municipal waste stream,<sup>75</sup> with the category of "selected consumer electronics" growing by over twenty percent from 2005 to 2008, from 2.63 million tons to 3.16 million tons.<sup>76</sup> In 2007, the United States alone generated over three million tons of e-waste,<sup>77</sup> recycling only 13.6 percent of the waste.<sup>78</sup> That same year, the EPA estimates Americans disposed of 26.9 million televisions (equivalent to 910,600 tons), either by trashing or recycling them,<sup>79</sup> while approximately 53 million tons of e-waste was generated worldwide last year.<sup>80</sup>

Even with this amount of e-waste being generated and discarded each year, there is still much latent e-waste yet to enter the municipal waste stream. According to Hewlett-Packard, 68 percent of consumers stockpile "used or unwanted computer equipment in their homes."<sup>81</sup> In fact, United

---

<sup>73</sup> See Press Release, United Nations Environment Programme (UNEP), Basel Conference Addresses Electronic Wastes Challenge (Nov. 27, 2006), available at <http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=485&ArticleID=5431&l=en> [hereinafter UNEP].

<sup>74</sup> *Id.*

<sup>75</sup> See ELECTRONICS TAKEBACK COALITION, FACTS AND FIGURES ON E-WASTE AND RECYCLING 3, [http://www.computertakeback.com/Tools/Facts\\_and\\_Figures.pdf](http://www.computertakeback.com/Tools/Facts_and_Figures.pdf) (last visited Mar. 18, 2011) [hereinafter ELECTRONICS TAKEBACK].

<sup>76</sup> See OFFICE OF RESOURCE CONSERVATION AND RECOVERY, U.S. ENVTL. PROTECTION AGENCY, MUNICIPAL SOLID WASTE GENERATION, RECYCLING, AND DISPOSAL IN THE UNITED STATES DETAILED TABLES AND FIGURES FOR 2008, 14 (2009), <http://www.epa.gov/osw/nonhaz/municipal/pubs/msw2008data.pdf>.

<sup>77</sup> See ELECTRONICS TAKEBACK, *supra* note 75, at 3.

<sup>78</sup> *Id.*

<sup>79</sup> See U.S. ENVTL. PROTECTION AGENCY, ELECTRONIC WASTE MANAGEMENT IN THE UNITED STATES, APPROACH 1, 20 tbl. 3.1 (2008), [www.epa.gov/osw/conservation/materials/recycling/docs/app-1.pdf](http://www.epa.gov/osw/conservation/materials/recycling/docs/app-1.pdf) [hereinafter EPA APPROACH 1].

<sup>80</sup> See Tom Zeller, Jr., *A Program to Certify Electronic Waste Recycling Rivals an Industry-U.S. Plan*, N.Y. TIMES, Apr. 15, 2010, at B3, available at <http://www.nytimes.com/2010/04/15/business/energy-environment/15ewaste.html>.

<sup>81</sup> See HEWLETT-PACKARD, FACT SHEET, EARTH DAY 2005 (2003), [http://www.hp.com/hpinfo/newsroom/press\\_kits/environment/earthday-fs.pdf](http://www.hp.com/hpinfo/newsroom/press_kits/environment/earthday-fs.pdf).

States government research estimates three out of every four computers *ever sold* remain stockpiled awaiting disposal.<sup>82</sup> According to the EPA, by the end of 2007 there were an estimated 99 million televisions stockpiled or stored in the United States.<sup>83</sup> In addition, with the congressionally-mandated switch from analog to digital televisions, an entire generation of televisions in the United States has been rendered obsolete and will soon begin entering the municipal waste stream. The Government Accountability Office (“GAO”) estimates the switch from an analog to digital signal may affect 40 million televisions.<sup>84</sup>

In 2010, U.S. consumers purchased 3.3 million high-definition (“HD”) televisions for the Super Bowl alone, up from 2.6 million HD televisions for Super Bowl 2009.<sup>85</sup> In 2009, 211 million televisions were sold worldwide, an increase of two percent from 2008,<sup>86</sup> despite expectations that sales would decrease due to economic conditions. In addition, in 2009 U.S. consumers purchased 96 million of the 305.8 million computers sold worldwide.<sup>87</sup> That same year, despite a decrease from 2008 levels, 1.211 billion mobile phones were sold worldwide.<sup>88</sup> Rapid obsolescence of these electronic products leads to the creation of fast-growing mountains of e-waste. In fact, each hour an estimated four thousand tons of e-waste is discarded worldwide.<sup>89</sup>

---

<sup>82</sup> See EXPORTING HARM, *supra* note 72, at 6.

<sup>83</sup> See EPA APPROACH 1, *supra* note 79.

<sup>84</sup> See U.S. GOVERNMENT ACCOUNTABILITY OFFICE (GAO), DIGITAL TELEVISION TRANSITION: BROADCASTERS’ TRANSITION STATUS, LOW-POWER STATION ISSUES, AND INFORMATION ON CONSUMER AWARENESS OF THE DTV TRANSITION 11 (2008), <http://www.gao.gov/news.items/d08881t.pdf> [hereinafter GAO DIGITAL TRANSITION]. This report found fifteen percent of households rely solely on “over-the-air” analog television signals, while an additional twenty-one percent of households have “at least one television” used to watch over-the-air signals. *Id.* With an estimated 110 million households in the United States, this means approximately forty million televisions could be affected by the switch. See *Quick Facts*, U.S. CENSUS BUREAU, <http://quickfacts.census.gov/qfd/states/00000.html> (last visited Mar. 18, 2011) (showing there were 105,480,101 households in the United States in 2000); see also U.S. DEPARTMENT OF COMMERCE, CURRENT POPULATION REPORTS: PROJECTIONS OF THE NUMBER OF HOUSEHOLDS AND FAMILIES IN THE UNITED STATES: 1995 TO 2010, at 5 (1996), [www.census.gov/prod/1/pop/p25-1129.pdf](http://www.census.gov/prod/1/pop/p25-1129.pdf) (projecting almost 115 million households in the United States by 2010).

<sup>85</sup> See ELECTRONICS TAKEBACK, *supra* note 75, at 4.

<sup>86</sup> *Id.*

<sup>87</sup> See *Gartner Says Worldwide PC Shipments in Fourth Quarter of 2009 Posted Strongest Growth Rate in Seven Years*, GARTNER, INC. (Jan. 13, 2010), <https://www.gartner.com/it/page.jsp?id=1279215>.

<sup>88</sup> See *Gartner Says Worldwide Mobile Phone Sales to End Users Grew 8 Per Cent in Fourth Quarter 2009; Market Remained Flat in 2009*, GARTNER, INC. (Feb. 23, 2010), <http://www.gartner.com/it/page.jsp?id=1306513>.

<sup>89</sup> See Templeton, *supra* note 23, at 765.

#### D. *The Sources of E-Waste*

E-waste originates from three general categories: (a) individuals and small businesses; (b) large businesses, institutions and governments; and (c) original equipment manufacturers.<sup>90</sup> North America (particularly the United States), the European Union (particularly France, Germany, the United Kingdom and the Netherlands), China, Japan and India are the major producers of the e-waste that ends up in the African continent.<sup>91</sup> Recognizing these countries as the leading producers of e-waste, however, may be a bit misleading. It is important to note that a typical computer, for example, may contain over 1,000 components, which are manufactured and assembled in different parts of the world.<sup>92</sup> Most U.S.-based companies outsource “production” to contract manufacturers abroad, primarily in Asian countries.<sup>93</sup> Therefore, while it is important to identify the commercial origins of e-waste, it is equally important to recognize that decentralization of electronic equipment manufacturing creates some diffusion of global responsibility for the e-waste problem in African countries.

#### E. *The Destinations of E-Waste*

In developed countries, e-waste has three destinations: landfill, storage, or a recycler’s doorstep. By contrast, developing countries without viable landfills or recycling apparatuses simply dump e-waste out in the open. Asian countries, particularly China and India, are still the primary destinations for e-waste exported from developed countries. African countries like Ghana and Nigeria, however, increasingly are becoming major destinations for the world’s e-waste.<sup>94</sup>

---

<sup>90</sup> See EXPORTING HARM, *supra* note 72, at 6.

<sup>91</sup> See Wray, *supra* note 52. According to Mike Enane, director of the League of Environmental Journalists in Ghana, “Ghana is increasingly becoming a dumping ground for waste from Europe and the U.S.” *Id.*

<sup>92</sup> See *House Committee Hearing*, *supra* note 15, at 23 (“for example, semiconductor chips made in Scotland, a disk drive made in the Philippines, an LCD monitor made in South Korea, circuit boards fabricated in China and assembled in Taiwan, and the final product assembled in Mexico”).

<sup>93</sup> *Id.*

<sup>94</sup> See discussion *infra*, Part III for a more detailed discussion of e-waste destinations in Africa.

II. INTERNATIONAL AND DOMESTIC E-WASTE MANAGEMENT EFFORTS

A. *The Basel Convention*

The international community enacted the most sweeping and comprehensive international environmental agreement on hazardous waste to date in Basel, Switzerland, in 1989.<sup>95</sup> In the mid- to late-1980s, the cost of domestic disposal of hazardous waste rose dramatically in developed countries due to newly-promulgated, strict environmental regulations. As a result, the international hazardous waste trade began to flourish.<sup>96</sup> This rampant “toxic trading” of hazardous waste, often from developed countries to developing countries led 116 nation-states to negotiate and sign the Basel Convention on the Transboundary Movement of Hazardous Wastes and Their Disposal (“Basel Convention”).<sup>97</sup> Today, the Basel Convention has 173 Parties and over 165 ratifications,<sup>98</sup> representing a virtual global consensus on the need to effectively regulate the transboundary movement of hazardous waste.

It is important to note at the outset the Basel Convention regulates, but does not ban, the hazardous waste trade.<sup>99</sup> Instead, the Basel Convention aims at minimizing the generation of hazardous wastes, ensuring disposal as close to the generation source as possible, and reducing the transboundary movement of hazardous waste in order to protect both human health and the environment.<sup>100</sup>

The Convention operates with two main devices: a “notice and consent” procedure<sup>101</sup> and an oversight board (the “Secretariat”).<sup>102</sup> First, the exporting State is required to provide written notification to the importing

---

<sup>95</sup> See Basel Convention *supra* note 11.

<sup>96</sup> See *Origins of the Basel Convention*, BASEL CONVENTION, <http://www.basel.int/convention/basics.html> [hereinafter *Origins of Basel*].

<sup>97</sup> *Id.*; Basel Convention, *supra* note 11, art. 6(1)-(2); see also Muthu S. Sundram, *Basel Convention on Transboundary Movement of Hazardous Wastes: Total Ban Amendment*, 9 PACE INT’L L. REV. 1, 16 (1997).

<sup>98</sup> Although the United States has signed the Convention, it is notably absent from the list of ratifying countries. See Basel Convention, *supra* note 11; see also Zeller, Jr., *supra* note 81 (noting the United States is not one of the over 165 countries that has ratified the Basel Convention).

<sup>99</sup> See Templeton, *supra* note 23, at 794; see also Sundram, *supra* note 97, at 11.

<sup>100</sup> See *Origins of Basel*, *supra* note 96.

<sup>101</sup> See Basel Convention, *supra* note 11, arts. 6(1), (2). The importing State has sixty days to consent to the shipment. However, trading states may agree to a general notification where hazardous wastes having the same physical and chemical characteristics are shipped regularly to the same disposer. *Id.* art. 8(8).

<sup>102</sup> See Billingham, *supra* note 17, at 407.

state of the proposed shipment's hazardous contents.<sup>103</sup> If the importing state consents to the shipment, the oversight board then reviews the notification and may refuse to approve proposed shipments if it determines the shipments contain a prohibited hazardous waste.<sup>104</sup> If the shipment is "clean," the board approves the trade, but requires that a "movement document" accompany the waste.<sup>105</sup> Further, the same notice and consent requirement applies to any transit state through which the shipment passes, regardless of whether the state is a Party to the Convention.<sup>106</sup> Ultimately, many exporters considered the notice and consent procedures to be onerous and costly, while importing countries (often developing countries) believed the regulatory and oversight apparatus would prevent them from receiving the raw materials necessary for development.<sup>107</sup>

Like constitutions, treaties are living and evolving legal instruments.<sup>108</sup> The Basel Convention is no exception.<sup>109</sup> Initially, environmentalists and toxic waste exporters alike rebuked the original text of the Basel Convention – the former believing the Convention legitimized rather than prohibited international toxic waste dumping; the latter, as mentioned above, believing the Convention went too far in restricting hazardous waste trading between developed and developing countries.<sup>110</sup> As a consequence, within ten years of its adoption, Parties to the Basel Convention adopted 103 formal decisions that culminated in the adoption of the Basel Ban Amendment<sup>111</sup> –

---

<sup>103</sup> *Id.*

<sup>104</sup> *Id.*

<sup>105</sup> See Basel Convention, *supra* note 11, art. 4(7)(c).

<sup>106</sup> See Sundram, *supra* note 97, at 15. As a result of this process, every state involved in the movement of the hazardous waste is accorded certain rights pertaining to the transactions. *Id.*

<sup>107</sup> *Id.* at 16.

<sup>108</sup> See generally Mark W. Janis & John E. Noyes, INTERNATIONAL LAW: CASES AND COMMENTARY (discussing the evolving character of treaties, which are often multi-lateral with parties making similar but ultimately different and distinct agreements and arrangements with other parties depending on their particular relationship).

<sup>109</sup> See *Milestones*, BASEL CONVENTION, <http://www.basel.int/TheConvention/Overview/Milestones/tabid/2270/Default.aspx> ("Over the past 20 years, the Basel Convention has had ample occasion to adjust to new global developments and needs with regards to waste management over the years . . .") (last visited Mar. 16, 2012).

<sup>110</sup> See BASEL ACTION NETWORK, BRIEFING PAPER 2 (2011), [http://www.ban.org/wp-content/uploads/2011/10/BP2\\_Oct\\_2011\\_Final\\_A4.pdf](http://www.ban.org/wp-content/uploads/2011/10/BP2_Oct_2011_Final_A4.pdf).

<sup>111</sup> The Basel Ban Amendment prohibits all transboundary movement of hazardous waste from OECD countries to non-OECD countries. See *Ban Amendment*, BASEL CONVENTION, <http://www.basel.int/pub/baselban.html>.



a global ban on the export of hazardous wastes intended for final disposal and recycling from Annex VII countries<sup>112</sup> to non-Annex VII countries.<sup>113</sup>

Under the Ban Amendment, Annex VII countries are either Parties to the Basel Convention, or other states that are members of the Organization for Economic Co-operation and Development (“OECD”).<sup>114</sup> This group includes, *inter alia*, the United States, the United Kingdom, the European Union, Japan, South Korea, Canada and Australia.<sup>115</sup>

Although the Basel Convention was groundbreaking in scope, it has been ineffective at curbing the illegal e-waste trade, largely for three reasons: (1) the United States’ failure to ratify the Convention and the Ban Amendment; (2) exploitation of a loophole permitting export so long as the shipment is designated for reuse; and (3) ratifying Parties’ outright contravention of the Basel Convention’s dictates.<sup>116</sup> Thus, the Basel Convention’s effect was minimal as exporters continued on their way to further export of hazardous waste into African countries.

### B. The European Union

The European Union (“EU”) has recognized the scope and urgency of the e-waste problem. In fact, the EU has been a leader in the international legislative efforts to curb the e-waste trade. In October of 2002, the European Commission introduced two major directives: the Directive on Waste and Electrical and Electronic Equipment (“WEEE Directive”)<sup>117</sup> and the Directive on the Restriction of the use of Certain Hazardous Substances in Electrical and Electronic Equipment (“RoHS Directive”).<sup>118</sup> Ultimately, these directives – which employ two very different methods – aim, in concert, to shift a substantial part of the responsibility of managing and handling e-waste from governments to electronic equipment manufacturers.<sup>119</sup>

---

<sup>112</sup> Annex VII refers to a provision in the Basel Convention that has not yet entered into force as a result of the Parties’ failure to effectively incorporate the Ban Amendment into the Convention through Decision III/1. *See id.*

<sup>113</sup> *See id.*

<sup>114</sup> *See* Basel Convention, *supra* note 11, Annex VII (not yet entered into force).

<sup>115</sup> *See* OECD Country Web sites, Member Countries, Organization for Economic Co-operation and Development, [http://www.oecd.org/countrieslist/0,3351,en\\_33873108\\_33844430\\_1\\_1\\_1\\_1\\_1,100.html](http://www.oecd.org/countrieslist/0,3351,en_33873108_33844430_1_1_1_1_1,100.html).

<sup>116</sup> *See* Thakker, *supra* note 48, at 60.

<sup>117</sup> *See* Council Directive 2002/96, of the European Parliament and of the Council of 27 Jan. 2003 on Waste Electrical and Electronic Equipment, 2003 O.J. (L 37) 24 [hereinafter WEEE Directive].

<sup>118</sup> *See* Council Directive 2002/95, of the European Parliament and of the Council of 27 Jan. 2003 on the Restriction on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment, 2003 O.J. (L 37) 19 [hereinafter RoHS Directive].

<sup>119</sup> *See* Billingham, *supra* note 17, at 408.

### 1. WEEE Directive

The WEEE Directive covers a broad array of products.<sup>120</sup> It includes provisions that address several critical steps in the life cycle of any given electronic device from product design, collection and treatment to recovery, consumer information and penalties.<sup>121</sup> Sourced in Extended Producer Responsibility (“EPR”) theory,<sup>122</sup> the objectives of the WEEE Directive are to “preserve, protect and improve the quality of the environment, protect human health and utilize natural resources prudently and rationally.”<sup>123</sup>

EPR theory serves to establish an initial allocation of responsibility for e-waste management by requiring manufacturers of electronic equipment to take responsibility for the costs associated with the pollution created by their products.<sup>124</sup> This initial allocation of responsibility is critical to catalyzing the entire process of EPR, notwithstanding the likelihood that producers will reallocate the responsibility to other entities, including governments.

The concept of EPR is a species of the “Polluter Pays Principle.”<sup>125</sup> EPR essentially treats electronic equipment manufacturers as polluters who are required to take financial responsibility for the entire life cycle of their hazardous products, especially for the take-back, recycling and proper final disposal of their old and obsolete products.<sup>126</sup> When producers are required to assume ultimate responsibility for the negative environmental and health-

---

<sup>120</sup> Products covered by the WEEE Directive include consumer equipment, large and small household appliances, IT and telecommunications equipment, lighting equipment, most electrical and electronic tools, most medical devices, toys, leisure and sports equipment, monitoring and control instruments, and automatic dispensers. *See* WEEE Directive, *supra* note 117, Annex IA. Among the electrical and electronic devices specifically excluded from the scope of the WEEE Directive are large-scale stationary industrial tools, arms and munitions of war, and all implanted and infected products. *Id.*

<sup>121</sup> *See* WEEE Directive, *supra* note 117, arts. 4-7, 10, 15.

<sup>122</sup> EPR theory was first proposed by Thomas Lindqvist. *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, 536 (2002). The theory is sometimes referred to as regulating from “cradle to cradle.” *Id.*

<sup>123</sup> *See* WEEE Directive, *supra* note 117, pmbl.; *see also* Thakker, *supra* note 48, at 60.

<sup>124</sup> *See* Rob Courtney, *Note: Evolving Hazardous Waste Policy for the Digital Era*, 25 *STAN. ENVTL. L.J.* 199, 226 (2006).

<sup>125</sup> The Polluter Pays Principle (PPP) is an environmental policy principle widely acknowledged as a general principle of International Environmental Law. At its core, the PPP stands for a simple proposition: the costs of pollution should be borne by those who cause it. *See generally* Hans Christian Bugge, *The Principles of Polluter Pays in Economics and Law*, in *LAW AND ECONOMICS OF THE ENVIRONMENT* 53 (Erling Eide & Roger van den Bergh eds., 1996).

<sup>126</sup> *See* Pak, *supra* note 31, at 259.

related externalities of their products, they have greater incentive to design electronics that are both cheaply and easily recycled, as well as toxic-free.<sup>127</sup>

Ultimately, the WEEE Directive seeks to relieve much of the financial burden on governments (particularly municipalities) related to e-waste management by shifting responsibility to producers through a paradigm shift from the traditional “cradle to grave” product cycle to a closed-loop “cradle to cradle” product cycle.<sup>128</sup>

## 2. RoHS Directive

The RoHS Directive takes a hard-line stance on what kinds of materials electronics manufacturers may use to produce electronic products, and there is no ambiguity involved in its mandate. Supplementing the WEEE Directive, RoHS aims at reducing the use of certain hazardous substances in new equipment by setting immediate material content restrictions at the producer level for certain goods entering the European Union market.<sup>129</sup>

As of July 1, 2006, the RoHS Directive prohibits lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls or polybrominated diphenyl ethers from all new electronic equipment put on the market.<sup>130</sup> Containing little to no “fine print,” the clarity of RoHS has left manufacturers little wiggle-room with respect to complying with its requirements. In addition, RoHS facilitates the implementation of WEEE by making e-waste less hazardous to handle.<sup>131</sup>

There are, however, several criticisms of both the WEEE Directive and the RoHS Directive, and the three most pertinent to this article are discussed here in turn. First, it is unclear whether WEEE effectively achieves the closed-loop, virtuous “cradle to cradle” product cycle, largely due to the considerable leeway Member States have in: (a) implementing the e-waste management schemes and (b) enforcing the penalties for breaching the Directive.<sup>132</sup>

---

<sup>127</sup> *Id.*

<sup>128</sup> *Id.*

<sup>129</sup> See RoHS Directive, *supra* note 118, art. 1; see also Pak, *supra* note 31, at 263.

<sup>130</sup> See RoHS Directive, *supra* note 118, art. 4(1). Particular applications of lead, mercury, cadmium, and hexavalent chromium, however, are exempted from the requirements of Article 4, including, *inter alia*: lead in glass of CRTs, electric components and fluorescent tubes; lead in ceramic parts; lead in solders for network infrastructure equipment for switching, signaling, transmission as well as network management for telecommunication; mercury in compact fluorescent lamps not exceeding 5 mg per lamp; mercury in straight fluorescent lamps for special purposes; and hexavalent chromium as an anti-corrosion of the carbon steel cooling system in absorption refrigerators. *Id.* at Annex.

<sup>131</sup> See Pak, *supra* note 31, at 264.

<sup>132</sup> See WEEE Directive, *supra* note 117, arts. 8, 15-17 (although Article 8 creates minimum financial obligations, it also allows producers, in lieu of taking individual

Second, the recycling targets, which began in January 2006, effectively leave ten percent of e-waste to be improperly disposed of (usually by incineration), despite the goals to avoid this outcome.<sup>133</sup> Finally, absent either a tax incentive for producers to use the recycled material amassed through the no cost, mandatory “take back” schemes contained in WEEE,<sup>134</sup> or some kind of legal obligation, producers will have greater incentive to continue illegally exporting e-waste to poor, developing African countries.

### C. *The United States and the RCRA*

Over the years, several e-waste bills have been introduced in Congress but none has passed.<sup>135</sup> Because of congressional failure on this issue, the primary federal law regulating the management and disposal of hazardous waste, including e-waste, is the Resource Conservation and Recovery Act (“RCRA”),<sup>136</sup> passed by Congress in 1976. As will be explained further in this section, the RCRA suffers from two fatal flaws not only leaving it incapable of properly managing e-waste in the United States, but effectively encouraging the export of e-waste to developing countries.

First, the RCRA was enacted based upon a misguided premise – namely, that a limited number of large institutions and governments are the primary generators of e-waste.<sup>137</sup> Accordingly, Subtitle C of the RCRA (which bans the unregulated disposal of hazardous waste by any regulated entity) contains an exemption for “small quantity generators” of hazardous waste,<sup>138</sup> like households and small businesses. In addition, the so-called

---

responsibility for their own products, to participate in collective e-waste management schemes by paying into a common fund that goes to a third-party who in turn assumes the recycling obligations for the participating producers); *see also* Pak, *supra* note 31, at 259. The leeway in implementation granted to Member States by the WEEE Directive has resulted in twenty-five different transpositions of the directive. *Id.* at 262.

<sup>133</sup> *See* Billingham, *supra* note 17, at 410. The recycling targets require manufacturers to take back seventy-five percent of the total amount of e-waste recovered, while only being required to recycle sixty-five percent. *Id.* This leaves out ten percent of e-waste to be incinerated.

<sup>134</sup> *See* WEEE Directive, *supra* note 117, art. 5.

<sup>135</sup> Rick Callahan, *Increasingly, States Push for E-Waste Recycling*, ASSOCIATED PRESS, Oct. 1, 2009, <http://www.newsday.com/news/increasingly-states-push-for-e-waste-recycling-1.1491600>.

<sup>136</sup> 42 U.S.C. §§ 6901-6991 (2005).

<sup>137</sup> *See* Courtney, *supra* note 124, at 208. At least one author has suggested that information technology is slowly but surely decentralizing hazardous waste generation in the United States, just as it has done for so many of our communications and computing infrastructures. As a result, instead of a limited number of large institutions creating the bulk of e-waste, a large number of small entities are responsible for producing most e-waste. *Id.*

<sup>138</sup> 42 U.S.C. §§ 6921-6939(e) (2005). A “conditionally exempt small-quantity generator” is exempt from Subtitle C if it produces less than 100 kg of hazardous waste per month.

“Household Waste Exclusion” under Subtitle C exempts all waste generated by normal households, hotels and motels, campgrounds and other residential facilities based upon their methods of generation, notwithstanding the level of hazardous material contained in the waste.<sup>139</sup> Consequently, the exemptions under Subtitle C effectively place a substantial amount of e-waste outside RCRA’s reach despite the hazardous substances contained in e-waste.<sup>140</sup>

Second, the RCRA contains loopholes that are easy to exploit. Firstly, e-waste from large entities is exempt from regulation under RCRA if the equipment is donated for educational or charitable reuse.<sup>141</sup> Although the intent may be benign, this provision effectively shifts the burden away from manufacturers and large-scale users who are best able to absorb the environmental costs of their products. Secondly, the RCRA does not ban exportation of hazardous e-waste.<sup>142</sup> Instead, like the Basel Convention, the statute simply requires prior notification from the United States and consent from the receiving nation.<sup>143</sup> Furthermore, hazardous e-waste labeled “recyclable” rather than for disposal is totally exempt from this simple notice and consent requirement.<sup>144</sup> Consequently, once an exporter claims the recycling exemption, the export is beyond RCRA’s reach and the exporter (often a recycler) can send the hazardous e-waste wherever it wants. Moreover, little oversight of the export occurs largely because the RCRA does not have storage or treatment requirements for the receiving nations.<sup>145</sup>

It is not surprising, then, that as much as 80 percent, or more, of e-waste *ever generated* in the United States remains unaccounted for.<sup>146</sup> It is also no

---

Special requirements for hazardous waste generated by conditionally exempt small quantity generators, 40 C.F.R. § 261.5(a) (2004).

<sup>139</sup> EPA Solid Hazardous Waste Exclusions, 40 C.F.R. § 261.4(b)(1) (2004).

<sup>140</sup> See STEVE COHEN ET AL., MASTER OF PUBLIC ADMINISTRATION PROGRAM IN ENVIRONMENTAL SCIENCE AND POLICY, COLUMBIA UNIVERSITY, S 510: ELECTRONIC WASTE RECYCLING PROMOTION AND CONSUMER PROTECTION ACT: FINAL REPORT 11 (2006), <http://mpaenvironment.ei.columbia.edu/news/projects/fall2006/E-WasteFinal.pdf>.

<sup>141</sup> See Templeton, *supra* note 23, at 786.

<sup>142</sup> Section 3017 of RCRA, however, establishes a series of requirements governing the export of hazardous waste, including e-waste. See Theodore Waugh, *Where Do We Go from Here: Legal Controls and Future Strategies for Addressing the Transportation of Hazardous Wastes Across International Borders*, 11 FORDHAM ENVTL. L.J. 477, 486 (2000).

<sup>143</sup> 42 U.S.C. § 6938 (2005).

<sup>144</sup> See Waugh, *supra* note 142, at 491.

<sup>145</sup> *Id.*

<sup>146</sup> See Press Release, Greenpeace, *Vast Amounts of Hazardous Electronic Waste Unaccounted For* (Feb. 21 2008), <http://www.greenpeace.org/international/press/releases/vast-amounts-of-hazardous-elec>.

coincidence that up to 80 percent of the United States' e-waste is exported to poor, developing countries, including African countries.<sup>147</sup>

#### D. *The Bamako Convention, Nigeria and Ghana*

There is a long history of developing countries dumping hazardous waste in African countries,<sup>148</sup> and it is useful to contextualize the relatively recent explosion of e-waste dumping in African countries<sup>149</sup> as an extension of that history.

##### 1. The Bamako Convention

In response to the deficiencies of the Basel Convention, members of the Organization of African Unity (“OAU”) sought regional cooperation to tackle the toxic waste trade. This effort culminated in the meeting in Bamako, Mali and the adoption of the Bamako Convention on the Ban of the Import Into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes Within Africa<sup>150</sup> in 1991. As of March 2010, twenty-four African countries have ratified the Bamako Convention and fifty-three African countries have either signed or ratified the Convention.<sup>151</sup>

---

<sup>147</sup> See *Electronic Waste (E-Waste)*, TOXIPEDIA, [http://toxipedia.org/display/toxipedia/Electronic+Waste+\(E-Waste\)](http://toxipedia.org/display/toxipedia/Electronic+Waste+(E-Waste)) (last visited Mar. 18, 2011) [hereinafter TOXIPEDIA].

<sup>148</sup> See UNITED NATIONS ENVIRONMENT PROGRAMME, MINIMIZING HAZARDOUS WASTES: A SIMPLIFIED GUIDE TO THE BASEL CONVENTION 4 (2002), <http://www.basel.int/pub/simp-guide.pdf>; see also Tanya Karina A. Lat, *Testing the Limits of GATT Art. XX(b): Toxic Waste Trade, Japan's Economic Partnership Agreements, and the WTO*, 21 GEO. INT'L ENVTL. L. REV. 367, 369 (2009) (discussing the most recent incident of the *Probo Koala* oil and cargo tanker that had come from Europe – after being denied by several European disposal facilities – only to eventually dump the toxic brew of “dark, glistening mess reeking of sulfur and rotten eggs” in the Ivory Coast).

<sup>149</sup> While e-waste dumping is beginning to affect large swaths of the African population, e-waste dumping, as of today, largely takes place in the ports of West Africa (particularly Accra, Ghana and Lagos, Nigeria) and the ports in South Africa, while the problem escalates in Kenya, Uganda and Zimbabwe among others. See *U.N. Report: Findings on E-Waste Problems in Africa*, JOURNALIST'S RESOURCE, <http://journalistsresource.org/studies/environment/sustainability/un-report-findings-on-e-waste-problems-in-africa> (last visited Mar. 18, 2012).

<sup>150</sup> See Bamako Convention on the Ban of the Import Into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes Within Africa, Jan. 30 1991, 30 I.L.M. 775, available at [ban.org/Library/bamako\\_treaty.html](http://ban.org/Library/bamako_treaty.html) [hereinafter Bamako Convention].

<sup>151</sup> See LIST OF COUNTRIES WHICH HAVE SIGNED, RATIFIED/ACCEDED TO THE BAMAKO CONVENTION, AFRICAN UNION, [www.africa-union.org/root/AU/Documents/Treaties/List/Bamako%20Convention.pdf](http://www.africa-union.org/root/AU/Documents/Treaties/List/Bamako%20Convention.pdf) (Ghana, Nigeria, and Kenya have each signed, but not ratified Bamako, while South Africa has neither signed nor ratified the treaty).

The Preamble to the Bamako Convention asserts the most effective way to avoid the environmental and health-related consequences of hazardous waste, like e-waste, is to minimize its production.<sup>152</sup> Accordingly, the Preamble encourages hazardous waste generators, whether or not they are party to the Bamako Convention, to minimize the production of waste.<sup>153</sup>

The Bamako Convention is very similar to the Basel Convention in language and style,<sup>154</sup> but it differs in three important respects.<sup>155</sup> First, the Bamako Convention subscribes to the precautionary principle.<sup>156</sup> Through the promotion and application of “clean production methods,”<sup>157</sup> as opposed to a “permissible emissions” approach based upon assumptions about assimilative capacities, each Party is required, both individually and in cooperation with other Parties, to implement the precautionary principle in order to prevent e-waste pollution.<sup>158</sup>

Second, the Bamako Convention is broader than the Basel Convention. The Bamako Convention includes radioactive materials within its definition

---

<sup>152</sup> See Bamako Convention, *supra* note 150, pmb1.

<sup>153</sup> *Id.*

<sup>154</sup> The Bamako Convention is similar to the Basel Convention, however, in certain substantive respects. For example, the Bamako Convention employs the identical “notice and consent” requirement established by the Basel Convention. Compare Bamako Convention, *supra* note 150, art. 6(1), (2), with Basel Convention, *supra* note 11, art. 6(1), (2). Also, Bamako establishes a duty to re-import on a party-exporter if the shipment cannot be completed in accordance with the terms of the particular shipment’s contract. Compare Bamako Convention, *supra* note 150, art. 8, with Basel Convention, *supra* note 11, art. 8.

<sup>155</sup> See generally Jason L. Gudofsky, *Transboundary Shipments of Hazardous Waste for Recycling and Recovery Operations*, 34 STAN. J. INT’L L. 219, 245-51, (1998) (discussing in detail both the similarities and the important differences between the Basel Convention and the Bamako Convention).

<sup>156</sup> See Bamako Convention, *supra* note 150, art. 4(3)(f); Krishna & Kulshrestha, *supra* note 48, at 80. The precautionary principle is a theory of prevention demanding that action be taken even in the absence of conclusive scientific proof that inaction would cause harm. See generally David Kriebel et al., *The Precautionary Principle in Environmental Science*, 109(9) ENVTL. HEALTH PERSP. 871, available at <http://ehp03.niehs.nih.gov/article/Article.action?articleURL=info:doi/10.1289/ehp.01109871> (last visited Mar. 18, 2012). When applied to e-waste, the precautionary principle promotes preventive regulatory actions for the purposes of environmental and human health protection even in the absence of conclusive scientific proof that a given substance contained in e-waste harms the environment or human health. See Bernard Kuschnik, *The European Union’s Energy using Products - EuP - Directive 2005/32 EC Taking Transnational Eco - Product Design Regulation One Step Further*, 27 TEMP. J. SCI. TECH. & ENVTL. L. 1, 28 (2008).

<sup>157</sup> “Clean production methods” include: raw material selection, extraction and processing; product conceptualization, design, manufacture and assemblage; materials transport during all phases; industrial and household usage; and reintroduction of the product into industrial streams or nature when it no longer serves a useful function. See Bamako Convention, *supra* note 150, art. 4(3)(g).

<sup>158</sup> See Bamako Convention, *supra* note 150, art. 4(3)(f).

of hazardous waste,<sup>159</sup> something the Basel Convention does not do. In addition, and more importantly, the Bamako Convention regulates not only known hazardous wastes like e-waste, but also wastes that *may* be hazardous.<sup>160</sup> This broad regulatory mandate is a clear example of the Bamako Convention employing the precautionary principle by regulating unknown yet potential hazardous wastes. Third, the Bamako Convention imposes strict, unlimited liability, as well as joint and several liability on hazardous waste generators.<sup>161</sup>

Finally, a basic feature of the Bamako Convention is that it distinguishes between African-generated waste and waste generated outside of Africa.<sup>162</sup> The Bamako Convention tightly limits the movement of hazardous wastes already located within Africa.<sup>163</sup> Intra-African shipments are considered as a last resort,<sup>164</sup> and each Party is required to prevent exportation of hazardous e-waste for disposal, unless the proposed transport and disposal methods would be performed in an “environmentally sound manner”.<sup>165</sup> On the other hand, with respect to outside, non-African waste, the Bamako Convention criminalizes importation of foreign hazardous wastes into Africa.<sup>166</sup> Given the history of the developed world dumping its toxic waste in African countries, coupled with the ineffectiveness of the Basel Convention in clamping down on the illegal, international hazardous waste trade, it is no surprise the Bamako Convention intended to build upon and function more effectively than other international agreements concerning the transboundary shipments of hazardous e-waste.

The results of the Bamako Convention are few primarily because the Convention is financially under-resourced.<sup>167</sup> This has led to organizational underdevelopment, including a dearth of information-gathering bodies, which in turn leads to a lack of reliable data regarding the amount and

---

<sup>159</sup> *Id.* art. 2(1)(d).

<sup>160</sup> *See* Gudofsky, *supra* note 155, at 247.

<sup>161</sup> *See* Bamako Convention, *supra* note 150, art. 4(3)(b); *see also* Waugh, *supra* note 142, at 518.

<sup>162</sup> *See* Gudofsky, *supra* note 155, at 246.

<sup>163</sup> *See* Bamako Convention, *supra* note 150, art. 4(3).

<sup>164</sup> *See* Gudofsky, *supra* note 155, at 246.

<sup>165</sup> *See* Bamako Convention, *supra* note 150, art. 4(3)(h)-(k); *see also* Waugh, *supra* note 142, at 518.

<sup>166</sup> *See* Bamako Convention, *supra* note 150, art. 4(1).

<sup>167</sup> *See* Governing Council of the U.N. Env't Programme, Report of the Global Major Groups and Stakeholders Forum on the work of its 11th sess., Feb. 21-22, 2010, UNEP/GCSF/11/1, 4 (Mar. 12, 2010), *available at* <http://www.unep.org/Civil-Society/LinkClick.aspx?fileticket=hz-wxjA5d6k%3D&tabid=2910&language=en-US> (reporting on Jim Puckett's statement that the Bamako Convention has been “hamstrung by a lack of resources.” Another representative pointed out that the Bamako Convention although previously adopted was “not in operation” and appeared to be “forgotten”).



locations of e-waste importation into African countries.<sup>168</sup> Without such data, Parties to the Bamako Convention, including Nigeria and Ghana, face significant challenges developing e-waste management strategies, policy and regulation aligned with the Convention's goals.<sup>169</sup>

## 2. Lagos, Nigeria

"Lagos" is the name of both a port-city and a state in Nigeria. Lagos-City is the most populous city in Nigeria and home to over 85 percent of the entire population of Lagos-State, which in 2006 stood just above 17.5 million.<sup>170</sup> As the largest port in Nigeria, not only does Lagos serve as the primary entry point for much of Nigeria's goods (including second-hand electronic equipment), it also serves as a trade portal for much of West Africa.<sup>171</sup>

Nigeria's economy is one of the fastest growing in the world, with the International Monetary Fund projecting a growth of 8.3 percent in 2009,<sup>172</sup> largely due to the booming technology sector. In particular, the mobile phone is playing an integral role in the accelerated growth of the Nigerian economy,<sup>173</sup> with over 9.1 million Nigerians having access to mobile phones by the end of 2004.<sup>174</sup> While 9.1 million Nigerians with mobile phone access may not seem like a big number, until it is contrasted with the mere thirty-five thousand Nigerians with mobile phone access in 1999.<sup>175</sup> Similarly, 1.8 million Nigerians were using the Internet in 2004, while less than 108,000 Nigerians had Internet access in 1999<sup>176</sup> – a tenfold increase in only five years.

This explosive growth in computer and cellular phone technology in Lagos, Nigeria is believed to be relatively representative of other port cities

---

<sup>168</sup> See Alice Munyua, *Regional Report: East Africa*, in GLOBAL INFORMATION SOCIETY WATCH 2010: FOCUS ON ICTS AND ENVIRONMENTAL SUSTAINABILITY 64 (Alan Finlay ed., 2010), available at [http://www.giswatch.org/sites/default/files/gisw2010regionaleastafrica\\_en.pdf](http://www.giswatch.org/sites/default/files/gisw2010regionaleastafrica_en.pdf).

<sup>169</sup> *Id.*

<sup>170</sup> See *Population*, THE OFFICIAL WEBSITE OF LAGOS STATE, <http://www.lagosstate.gov.ng/index.php?page=subpage&spid=12&mnu=null> (last visited Mar. 18, 2012). Thus, the population of Lagos-city in 2008 was eighty-five percent of 17.5 million, or roughly 15 million.

<sup>171</sup> See DIGITAL DUMP, *supra* note 14, at 12.

<sup>172</sup> See *Country Information*, THE OFFICIAL WEBSITE OF LAGOS STATE, <http://www.lagosstate.gov.ng/index.php?page=subpage&spid=11&mnu=null> (last visited Mar. 18, 2012).

<sup>173</sup> See DIGITAL DUMP, *supra* note 14, at 11.

<sup>174</sup> *Id.*

<sup>175</sup> *Id.*

<sup>176</sup> *Id.*

in Africa, like Accra, Ghana.<sup>177</sup> One important aspect of this massive growth is the presence of a very large and growing sector of highly educated, well-trained but low-wage workers with a notable ability to repair and refurbish the used electronic equipment for resale at local markets.<sup>178</sup>

As a result of such rapid growth, however, a burgeoning second-hand electronics industry has emerged to provide e-waste exporters an attractive location to dump their “junk”<sup>179</sup> even though such exporting is in direct contravention of international law.<sup>180</sup> Despite Nigeria being a Party to both the Basel Convention and the Bamako Convention – each of which prohibit e-waste’s entry into Nigeria – an estimated five hundred containers of used electronics arrive at the Apapa port in Lagos every month, imported primarily from North America and Europe.<sup>181</sup>

### 3. Accra, Ghana

Much of what is happening in Lagos in terms of e-waste imports is also happening in Accra, Ghana. Although fewer containers are imported into Accra each month than are imported into Lagos, the impact on the Ghanaian people regarding the handling of e-waste may be more acute. In particular, Ghana is less equipped than Nigeria to handle the e-waste entering its ports because many Ghanaians lack the repair and refurbishment skills prevalent in Nigeria, and even Kenya.<sup>182</sup> As a result, Ghanaians routinely resort to dangerous methods like open-air burning to destroy and dismantle the growing mountains of e-waste, often at the expense of their health and the health of the environment.

---

<sup>177</sup> *Id.*

<sup>178</sup> *Id.* at 6.

<sup>179</sup> Although the electronics are exported under the guise of “reuse,” it is estimated that twenty-five to seventy-five percent of all imports into Nigeria are unmarketable due to lack of computing effectiveness, or prohibitive high repair costs. *See* DIGITAL DUMP, *supra* note 14, at 6.

<sup>180</sup> *See* Wray, *supra* note 52. Both the Basel and Bamako Conventions make unlawful the export of hazardous wastes. DIGITAL DUMP, *supra* note 14.

<sup>181</sup> *See* DIGITAL DUMP, *supra* note 14, at 2. “Each container is said to contain about 800 computers or monitors, thus representing about 400,000 arriving each month.” *Id.* According to the Basel Action Network, an estimated ninety-percent of incoming used electronics originated in the United States and Europe, each comprising roughly forty-five percent of the total. *Id.*; *see also* discussion *infra* Part III for an analysis of the mechanics of the rapidly emerging secondhand electronics industry.

<sup>182</sup> *See* Winfred Kagwe, *No More Junk, Pleads Ndemo*, DAILY NATION, Mar. 5, 2010, available at <http://www.nation.co.ke/business/news/No%20more%20junk%20pleads%20Ndemo%20-/1006/873874/-/q2exsz/-/> (quoting the Secretary of the Kenyan Ministry of Information and Communication, Dr. Bitange Edemo, that Kenya has “enough graduates from our local universities and colleges with skills to assemble or even make new computers which would create job opportunities [and] spur further growth”).

As mentioned in the Introduction, *supra*, poor people (often children) do most of the handling of the waste in order to earn a living. In fact, the children working the dumps in Agbobloshie, Ghana may extract, on a very good day, about two dollars worth of copper and other precious metals from the e-waste.<sup>183</sup> Moreover, the Ghanaian government does little to monitor what is in the containers shipped into Ghana,<sup>184</sup> and even less to protect the children and others who end up dismantling junk e-waste.<sup>185</sup> As a result, Ghanaian children often continue the dangerous and difficult task of “handling” e-waste, virtually unaware of the serious health hazards inherent in their work.

### III. TOXIC COLONIALISM: HOW AND WHY E-WASTE ENDS UP IN AFRICAN COUNTRIES

The international and domestic laws designed to facilitate e-waste management and the international e-waste trade are clearly ineffective. As mentioned previously, in the United States the RCRA exempts a significant portion of e-waste from the strict environmental regulations associated with proper recycling and disposal methods.<sup>186</sup> In addition, the Basel Convention’s loophole for reuse permits e-waste generators and would-be recyclers to legally ship toxic e-waste to developing, African countries. And, of course, the United States may simply ignore the loophole and need not devise a way to circumvent it, simply because it is not a party to the Basel Convention. This section contains a more detailed analysis of the consequences of these ineffective international and domestic laws and the mechanics of how these laws are used to essentially facilitate rather than curb the international e-waste trade that is burying many African countries under the weight of toxic waste.

#### A. *The How*

A perfect storm of high demand for used electronics in Africa, high recycling costs in developed countries, and lax international laws effectively permitting the international e-waste trade leaves e-waste exporters with the economically rational option of continuing to send their e-waste abroad. The

---

<sup>183</sup> See Claiborne, *supra* note 3.

<sup>184</sup> See PBS *Ghana*, *supra* note 1 (a man who bought a container from one of the shippers estimates that about fifty percent of goods he sorts through are in good working order, while the rest is dumped at the burn site outside of town).

<sup>185</sup> *Id.* (depicting the absence of any government official monitoring the children as they burn and dismantle the e-waste).

<sup>186</sup> See discussion *supra*, Part II.C (explaining the Household Waste Exclusion under Subtitle C exempts a substantial amount of e-waste from regulation).

logistics of completing these types of transactions are extremely simple and effective, largely because there is almost no effective international oversight over shipping container inventory in these imports.<sup>187</sup>

Presently, the global harmonized tariff codes do not enable identification of used electronics because the codes fail to distinguish between new electronics, used electronics and waste electronics.<sup>188</sup> This is important because certain African countries, short of instituting a total ban<sup>189</sup> on imports of used electronics, have adopted targeted approaches to reduce the amount of e-waste in their countries.<sup>190</sup> These targeted approaches are doomed to fail if these African countries cannot know which products to target and whether the imported goods are reusable. Consequently, containers of toxic e-waste continue to flow unabated from the developed world to poor, developing African countries, with little regard for what happens to the e-waste once it is shipped.

### B. *The Why*

I think the economic logic behind dumping a load of toxic waste in the lowest wage country is impeccable and we should face up to that . . . I've always thought that under-populated countries in Africa are vastly under-polluted; their air quality is probably vastly inefficiently low compared to Los Angeles or Mexico City.

— Lawrence Summers, then Vice President and Chief Economist of the World Bank, in an internal World Bank memo issued in 1991<sup>191</sup>

The Summers memo accurately describes the narrow economic perspective of toxic trading. In fact, the candor of the memo may be more unsettling than the memo's callousness and cruelty.

---

<sup>187</sup> See GAO REPORT, *infra* note 210, at 21 (observing that shippers described used electronics as “mixed plastics” and “scrap metals” to effectively ship CRTs illegally); see also Wray, *supra* note 52 (noting the absence of a European regime that checks computer equipment destined for reuse before it is shipped overseas).

<sup>188</sup> See GAO REPORT, *infra* note 210, at 37; see also DIGITAL DUMP, *supra* note 14, at 12.

<sup>189</sup> See Michael Malakata, *Uganda Reverses PC Recycling Policy as Kenya Imposes Ban*, COMPUTERWORLD, Mar. 22, 2010, <http://news.idg.no/cw/art.cfm?id=87B3471E-1A64-67EA-E4F713476550FB88> (noting the proposed ban of used computers by Kenya and Zambia).

<sup>190</sup> *Id.* (showing Uganda's desire to institute a targeted approach of phasing out imported computers that are harmful to the environment).

<sup>191</sup> See Basil Enwegbara, *Toxic Colonialism: Lawrence Summers and Let Africans Eat Pollution*, THE TECH, Apr. 6, 2001, at 7, available at <http://tech.mit.edu/V121/N16/coll16guest.16c.html>.

### 1. The (Costly) Economics of Recycling in the United States

Like other businesspeople, recyclers in developed countries have bottom lines and overhead costs. As a consequence of stringent environmental regulations related to the management and handling of hazardous waste within developed countries like the United States,<sup>192</sup> recycling is expensive for recyclers and consumers alike.<sup>193</sup> Even though many businesses and consumers in the United States would prefer to recycle their e-waste, recycling systems for e-waste are scarce.<sup>194</sup> Recycling hazardous waste pursuant to appropriate regulations, therefore, becomes an onerous act for both consumers and recyclers. In short, the hazardous character of e-waste adds to the cost of recycling and, as a result, often impedes recyclers from realizing worthwhile profit margins.<sup>195</sup> Consequently, an economic incentive exists for recyclers in developed countries to *export* e-waste, rather than properly dispose of it.

Unfortunately, any environmental benefits reaped from the business of recycling are largely incidental to profit motives, even if profits margins are slim. And while the profit margins of recycling are certainly slim, as demonstrated above, the profit margins of exporting toxic e-waste are extremely lucrative. It should come as no surprise, then, recyclers find it economically rational to ship e-waste to Ghanaian or Nigerian importers who sometimes are willing to pay for the waste.<sup>196</sup>

There are four main drivers of the economic incentives in place for developed countries to export toxic e-waste to African countries: (1) low labor costs;<sup>197</sup> (2) lax environmental and occupational regulations;<sup>198</sup> (3) the

---

<sup>192</sup> See Templeton, *supra* note 23, at 769.

<sup>193</sup> For example, the cost of “glass-to-glass recycling” of computer monitors is ten times higher in the United States than in China. See *Where Does E-Waste End Up?*, GREENPEACE INT’L (Feb. 24, 2009), <http://www.greenpeace.org/international/en/campaigns/toxics/electronics/the-e-waste-problem/where-does-e-waste-end-up/>.

<sup>194</sup> See Billinghamurst, *supra* note 17, at 405.

<sup>195</sup> *Id.* at 401; see also POISON PCs, *supra* note 60, at 21 (noting in California alone the cost of collecting, handling, dismantling and processing the last two decades of computers and televisions, which can range from twenty-five to fifty dollars per unit, could cost well over \$500 million even if recycling rates were to double).

<sup>196</sup> African leaders are aware of this economic disincentive and its effect on their populations. For example, Dr. Bitange Ndemo, the Minister of Information and Communications (PS) in Kenya, recently said, “It is cheaper for companies in the developed world to pay these [local Kenyan] organizations to bring the computers here than destroy them.” Okuttah Mark, *Ministry Proposes Ban on Used Computers*, BUSINESS DAILY, Mar. 8, 2010, available at <http://www.businessdailyafrica.com/Company%20Industry/-/539550/874490/-/t2rl4pz/-/>.

<sup>197</sup> See Templeton, *supra* note 23, at 770.

prohibitively high cost of recycling,<sup>199</sup> and (4) despite international legal regimes prohibiting export of hazardous e-waste, it is legal – at least in the United States – to export e-waste.

The abundance of cheap labor in developing countries acts like a magnet for goods ostensibly imported for refurbishment.<sup>200</sup> Although up to eighty-five percent of e-waste produced in West Africa comes from domestic consumption,<sup>201</sup> many African countries rely heavily on used, secondary materials to support their emerging economies.<sup>202</sup> Second, environmental and occupational health regulations, if any, are not enforced,<sup>203</sup> largely due to the relatively recent explosion of the e-waste problem in Africa and the inability of governments to keep pace with the new risks attendant to the toxic trade.<sup>204</sup> Third, as mentioned above, prohibitively high recycling costs deter recyclers from actually recycling the goods, especially when they are either being paid by developing countries or paying very little<sup>205</sup> to ship the e-waste abroad.<sup>206</sup> Lastly, exporting e-waste is not prohibited, at least in the United States; in fact, it is more accurate to say such exporting is implicitly permitted, if not encouraged.<sup>207</sup>

The combination of the RCRA's flaws coupled with the strict and onerous EPA regulations for wastes disposed within the United States actually appear to encourage handlers and recyclers to export e-waste. Thus, the costly economics of recycling in the developed world leads recyclers to take advantage of low labor costs and the weak capacity to enact and enforce environmental and occupational regulations in developing countries.

---

<sup>198</sup> *Id.* at 771-72 (stating the e-waste trade is not a positive trade based on competitive advantage, but an unjust exploitation of developing countries' weak capacity for environmental and occupational regulation).

<sup>199</sup> See Templeton, *supra* note 23, at 769.

<sup>200</sup> See TOXIPEDIA, *supra* note 147 (borrowed from Basel Action Network).

<sup>201</sup> BASEL CONVENTION, WHERE ARE WEEE IN AFRICA? FINDINGS FROM THE BASEL CONVENTION E-WASTE AFRICA PROGRAMME 10 (2011).

<sup>202</sup> See Bobbie Johnson, *UN Calls for Action on Growing Electronic Waste*, THE GUARDIAN, Feb. 22, 2010, available at <http://www.guardian.co.uk/environment/2010/feb/22/electronic-waste> (noting the rapidly growing demand for materials contained in used electronics in West Africa).

<sup>203</sup> See EXPORTING HARM, *supra* note 72, at 2.

<sup>204</sup> See Barbara Kreissler, *UNIDO and Microsoft Partner to Recycle E-Waste*, THE UN-BUS FOCAL POINT, Apr. 2008, [http://www.enebuilder.net/focalpoint/e\\_article001055964.cfm?x=b11,0,w](http://www.enebuilder.net/focalpoint/e_article001055964.cfm?x=b11,0,w).

<sup>205</sup> According to one industry monitor, at least one U.S. exporter explained all that was needed to get shipments past Chinese customs officials was a crisp \$100 bill taped to the inside of each shipping container. See *Environment: Globalization and E-Junk*, WORLD ASSOCIATION OF INTERNATIONAL STUDIES, <http://cgi.stanford.edu/group/wais/cgi-bin/?p=54243>.

<sup>206</sup> See Templeton, *supra* note 23, at 770 (explaining that economics of e-waste trade leave developing countries with a Hobson's choice between poverty or poison).

<sup>207</sup> See *supra* notes 141-45 and accompanying text.

## 2. Bridging the Digital Divide

Exporting used electronics can bring important benefits, so long as the exported devices are in good working order. Modern, functioning, or repairable devices fill an enormous need in African countries, as the goods move from shipping containers into warehouses and repair shops, and eventually onto the open-air street markets.<sup>208</sup> After all, a healthy electronics export industry extends the life cycle of electronic products and maximizes their utility. Moreover, an incidental benefit, in theory, to extending the life cycle of electronic devices is the prevention of substantial environmental damage by avoiding premature disposal in a landfill.<sup>209</sup>

Clearly, exporting used electronics can lead to productive secondhand use of electronic devices in poor, developing countries, a practice commonly referred to as “bridging the digital divide”.<sup>210</sup> This export practice is so common and so well respected for its benign purpose that each law or agreement related to e-waste management previously discussed in this article – the Basel Convention, the WEEE Directive, the RCRA, and the Bamako Convention – makes export exceptions specifically for reuse.<sup>211</sup> Most importantly, African importers are eager to accept the used electronics<sup>212</sup> despite knowing that most of what they are importing is unusable “junk” waste, likely to be burned and dismantled by poor children outside of town.<sup>213</sup> This growing demand for technology in African countries is fueled by an insatiable hunger to compete on a global level, even at the expense of human health and the environment.<sup>214</sup>

---

<sup>208</sup> See *PBS Ghana*, *supra* note 1.

<sup>209</sup> See Templeton, *supra* note 23, at 769 (explaining because of heightened environmental concern, many states have banned e-waste from landfills, or otherwise adopted strict e-waste regulations).

<sup>210</sup> See U.S. GOVERNMENT ACCOUNTABILITY OFFICE, ELECTRONIC WASTE: EPA NEEDS TO BETTER CONTROL HARMFUL U.S. EXPORTS THROUGH STRONGER ENFORCEMENT AND MORE COMPREHENSIVE REGULATION 10 (2008), [www.gao.gov/new.items/d081044.pdf](http://www.gao.gov/new.items/d081044.pdf) [hereinafter GAO REPORT].

<sup>211</sup> See Bamako Convention, *supra* note 150, art. 1(3) (including “reuse” as part of the encouraged hazardous waste “management” process); Basel Convention, *supra* note 11, Annex IX (List B); see also Daniella Gayapersad-Chan, *Loopholes in Recycling Technology Law Cause Dirty Air in China*, AM. CONST. SOC’Y (Aug. 19, 2008), <http://www.acslaw.org/node/12601> (explaining the reuse and recycling objectives of the RCRA lead exporters to exploit the loopholes meant to achieve those objectives); WEEE Directive, *supra* note 117, art. 6(1), (5).

<sup>212</sup> See GAO REPORT, *supra* note 210, at 16 (showing over a three-month period brokers in developing countries represented over sixty percent of all requests for used electronics on two Internet e-commerce websites, with African countries representing about thirty-percent of that total).

<sup>213</sup> See GAO REPORT, *supra* note 210, at 21 (observing that accepting “junk” is often part of the “arrangement” between U.S. recyclers and African importers).

<sup>214</sup> See Templeton, *supra* note 23, at 770.

Cynically, however, the benign impetus undergirding the theory and practice of bridging the digital divide has become an instrument used by exporters to dump their unusable electronics in poor, developed countries instead of recycling the electronics at home. This is largely a consequence of naked global economic forces, poverty and laxity at the intersection of international and domestic law enforcement.<sup>215</sup> Unfortunately yet predictably, unregulated market forces within the illegal hazardous waste trade ensure that toxic e-waste will follow the economic path of least resistance.<sup>216</sup> For example, the GAO has observed that over seventy-five percent of brokers' requests for used electronic products in developing countries offered ten dollars or less per unit, while almost half offered five dollars or less.<sup>217</sup> When presented with the option of sending e-waste abroad for less than ten dollars, or undertaking the onerous and expensive process of properly disposing<sup>218</sup> or recycling the e-waste, capitalist exporters that do not take into account the carrots or sticks of the Bamako Convention or any other social indicia, may not feel they have much of a choice.

#### IV. E-RESPONSIBILITY: SOLUTIONS

It is clear, although domestic and international legal regimes have an important role to play in stemming the tide of e-waste flowing onto Africa's shores, laws alone cannot stop the growing e-waste trade in Africa. Instead, a comprehensive system of economic incentives, prohibitions on what materials are contained in electronics products, and a renewed sense of environmental justice are required to lay the foundation for an effective international e-waste policy going forward.

##### A. *Economic Incentives*

Without adequate enforcement of existing international agreements, illegal traders will not be deterred from acting in their own economic self-interest. Thus, any proposed comprehensive regulatory framework must address the underlying economic motives of these traders. First, such a

---

<sup>215</sup> See Krishna & Kulshrestha, *supra* note 48, at 73-76.

<sup>216</sup> See EXPORTING HARM, *supra* note 72, at 2.

<sup>217</sup> See GAO REPORT, *supra* note 210, at 16.

<sup>218</sup> See Templeton, *supra* note 23, at 769 (citing JENNIFER CLAPP, TOXIC EXPORTS: THE TRANSFER OF HAZARDOUS WASTES FROM RICH TO POOR COUNTRIES 1 (2001) (noting because landfill capacities have decreased due to tightening regulations landfill costs for dumping hazardous wastes rose from fifteen dollars per ton in 1980 to two hundred and fifty dollars per ton in 1988).



framework must employ EPR concepts<sup>219</sup> in order to incentivize producers to make less hazardous products that are easier to recycle. In particular, take-back programs, which require producers to provide locations for consumers to return their end-of-life products free of charge, are the best way to achieve this incentive.

These programs compel producers to take ultimate responsibility for their products by requiring producers to internalize the costs of proper disposal. In fact, Costa Rica recently enacted a producer take-back program designed to do just that—holding responsible manufacturers, importers and merchants of enumerated electronics for their end-of-life products.<sup>220</sup> This law declares as its stated purpose to “[e]stablish the responsibility for managing these wastes to producers and other actors in the chain, including final consumers”<sup>221</sup> and “[m]inimize the amount of electronic waste generated both in weight and volume as well as in relation to its potential contaminant through the selective collection and recovery, reuse and recycling of waste materials.”<sup>222</sup>

Second, in order to prevent producers from passing on to consumers the cost of proper disposal, the system of economic incentives must include Advanced Recovery Fees (“ARFs”). ARFs were first introduced in California as part of the Electronic Waste Recycling Act of 2003.<sup>223</sup> ARFs are up-front fees paid by consumers at the time of purchasing an electronic product, similar to the bottle deposit approach often applied to beverage containers.<sup>224</sup> In California, these funds are collected by the State Board of Equalization and then distributed in the form of grants to public and private recycling outfits in order to mitigate recycling costs.<sup>225</sup> In addition to assisting recyclers with the costs of recycling e-waste, ARFs are visible to

---

<sup>219</sup> See *supra* notes 122-27 and accompanying text (discussing the mechanics of EPR theory and the benefits associated with EPR models).

<sup>220</sup> See *Tests Detail High Toxic Levels at School, Market Neighbouring Informal E-waste Salvage Site in Africa, STEP* (Oct. 30, 2011), [http://www.step-initiative.org/tl\\_files/step\\_documents/FINAL%20StEP%20release.pdf](http://www.step-initiative.org/tl_files/step_documents/FINAL%20StEP%20release.pdf).

<sup>221</sup> See Reglamento para la Gestión Integral de los Residuos Electrónicos [Regulations for the Comprehensive Management of Electronic Waste], Executive Decree No. 35933-S, Ch. 1, art. 1(b), Diario Oficial, 5 de Mayo de 2010 (Costa Rica), translated at LA GACETA DIGITAL, [http://historico.gaceta.go.cr/pub/2010/05/05/COMP\\_05\\_05\\_2010.html#\\_Toc260740991](http://historico.gaceta.go.cr/pub/2010/05/05/COMP_05_05_2010.html#_Toc260740991) (last visited Mar. 18, 2012).

<sup>222</sup> *Id.* art. 1(d).

<sup>223</sup> See CAL. PUB. RES. CODE §§ 42460-42486 (2003).

<sup>224</sup> See Pak, *supra* note 31, at 270.

<sup>225</sup> See *California Electronic Waste Recycling Act*, CALIFORNIANS AGAINST WASTE, [http://www.cawrecycles.org/issues/ca\\_ewaste/sb20](http://www.cawrecycles.org/issues/ca_ewaste/sb20) (last visited Mar. 18, 2012).

the consumer—thereby heightening consumer awareness of the product's environmental impacts.<sup>226</sup>

### *B. Elimination of Hazardous Substances*

Any serious comprehensive regulatory framework instituted to tackle the e-waste problem must address the hazardous nature of e-waste. Since there is no practical way to completely outlaw the e-waste trade, phasing out and reducing the toxic elements in e-waste will make handling e-waste much safer. The RoHS Directive exemplifies precisely what such a prohibition should look like.

### *C. Leading by Example*

As the leading exporter of e-waste, the United States must ratify the Basel Convention and the Basel Ban Amendment if it is serious about tackling the growing e-waste threat in the developing world. Such a gesture would not only close the recycling loopholes already present in the Basel Convention, it would also allow the U.S. to play an active role in bringing the Ban Amendment into force and resolving the ongoing debate about the number of ratifications required.<sup>227</sup> In addition, the U.S. Congress must pass a strong federal law governing the domestic management and treatment of e-waste directly in order to prohibit e-waste exports, as well as to provide uniformity in how individual states deal with their waste.

Further, as the leading importer of e-waste, China must also play a substantial role in stemming the e-waste tide. By clamping down on imports into Hong Kong and threatening to turn away imports that do not meet strict environmental guidelines, China can make both a substantive and symbolic impact on curbing the e-waste trade. Although refusing to accept waste from the U.S. may lead exporters to find another more welcoming port (possibly in Africa), taking a principled stand against toxic waste may lead developing countries in Africa to take a stand as well.<sup>228</sup>

---

<sup>226</sup> A consumer incentive like the California Beverage Container Recycling and Litter Reduction Act of 1986, CAL PUB. RES. CODE § 14500, *et seq.*, which entitles consumers to a refund upon recycling the beverage container, would probably be a necessary counterpart to any ARF in order to provide consumers with an economic incentive to take their electronic devices to recycling facilities.

<sup>227</sup> See Templeton, *supra* note 23, at 796 (the United States' ratification of the Ban Amendment would likely persuade fellow historically resistant countries, like Canada and Australia, into ratifying the Ban Amendment).

<sup>228</sup> Kenya has already proposed a complete ban on imported computers. See Malakata, *supra* note 189. However, there is power in numbers; if China begins to turn away e-waste, then countries like Kenya may feel empowered to enforce their domestic laws and reject the waste as well.

*D. International Fund for Technologically-Driven Development*

Using the ARFs collected from consumers, the developed world could potentially create an international digital fund to help develop the local information technology (“IT”) industries in African countries. According to Shina Baduru, founder and editor of Nigeria’s Technology Times:

What Africa needs . . . is the ability to evolve its own info tech industry . . . to support its own local system builders, to be able to evolve its own local computers, to be able to write software coded in its own local need . . . a system that should also be priced and made affordable to the local consumer. That is what Africa needs. Africa does not need the used equipment coming in from the North . . .

There’s actually an evolving IT industry in Africa. It’s just been bogged down basically by the fact that the local industry, local players, have huge challenges with access to funding which is the old essence, old point that the digital divide debate is all about. Some kind of digital solidarity fund is needed that will complement or ensure the evolution of the local IT industry . . . .<sup>229</sup>

Such a fund would be a paradigm shift in the concept of “bridging the digital divide.”<sup>230</sup> By focusing on the longterm viability of Africa’s IT industry and the regional and local needs of African electronics consumers, a program of this kind would stop focusing on the short-term stop gap benefits of the current “bridge,” and eventually reduce the amount of electronic junk entering African ports every year.

*V. CONCLUSION*

While the technological advances of the past thirty years have bestowed upon the world previously unimaginable benefits with respect to information access, information sharing, and communication, the growing shadow of this giant leap is beginning to adversely impact global human health and the environment. Although China, India and other Southeast Asian countries continue to be the main targets of e-waste dumping by the developed world, African nations are not far behind. Even where compared with their Asian counterparts, African countries lack the apparatus to properly manage the growing tide of e-waste washing onto their shores.

As primary e-waste producers, traders and leaders in the global economy, the United States and China must do more to set an example for

---

<sup>229</sup> See DIGITAL DUMP, *supra* note 14, at 28.

<sup>230</sup> See discussion *supra* Part III.A.2.

the rest of the world in tackling the growing e-waste threat. Broadly speaking, such leadership requires political courage and recognition of the impact our disposable society has on the rest of the world. Nothing short of a renewed sense of environmental justice is critical to this kind of leadership. One thing is clear: if the United States and China take proper action, children in African countries such as Ghana, Kenya and Nigeria may begin to step out from under the toxic cloud of e-waste and begin thinking about a brighter future.