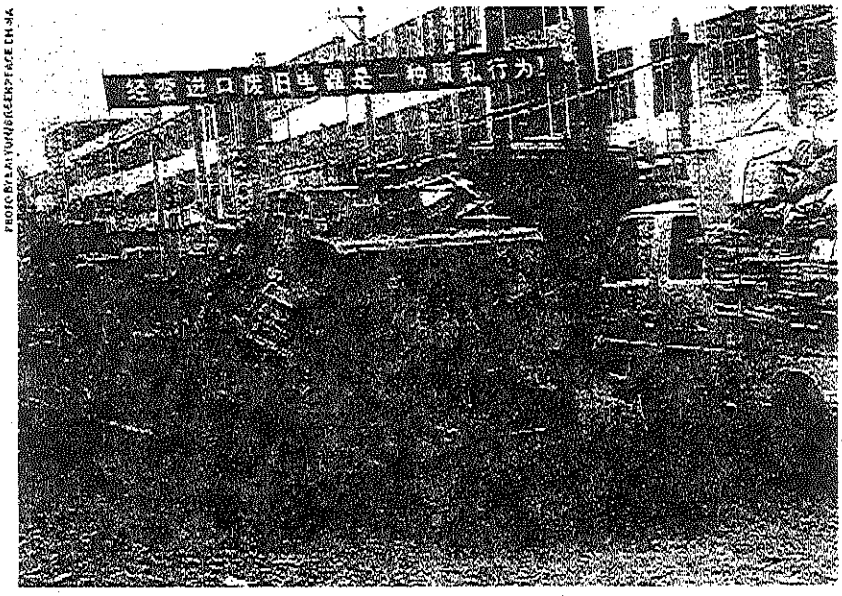

PHOTO BY LIU YUN/GREENPEACE EN-JA

ILLEGAL ENTRY A truck loaded with imported waste computers passes under banner that says, "Imports of electronic waste are considered smuggling." This photo was taken in February 2004 in Guiyu, China, after a law was passed outlawing electronic waste imports.

ELECTRONIC WASTE

States strive to solve burgeoning disposal problem as more waste ends up in developing countries

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THE HIGHLY INNOVATIVE ELECTRONICS industry is one of the world's fastest growing manufacturing sectors. As a consequence of its success, 100 million computers, monitors, and televisions become obsolete each year in the U.S. alone. According to the Environmental Protection Agency, electronic waste comprises 1 to 4% of municipal solid waste but is growing at three times the rate of other household trash. Only about 10% of commercial or consumer equipment is recycled.

Because consumers usually must pay a fee for the recycling of electronic devices and often have to drive a long distance to a drop-off site, there is little financial incentive to recycle. People generally store their discarded equipment in garages, basements, and attics or send it to a landfill.

This wouldn't be a problem except that electronic waste contains a variety of toxic materials. Lead, mercury-containing lamps, beryllium alloys, hexavalent chromium, cadmium, and brominated flame retardants are commonly found in used electronics. The cathode-ray tubes in televisions and old-style computer monitors, for example, are shielded with an average of 4 lb of lead.

Even if the equipment were nontoxic, recycling would be important because it recovers reusable resources, such as gold, silver, platinum, copper, aluminum, and shredded plastic. In 2003, the latest year for which data are available, recycling in the U.S. produced 900 million lb of usable materials out of 1.5 billion lb of waste, according to the International Association of Electronics Recyclers.

In the U.S., however, recycling is not profitable. The recovered materials are worth less than the costs of collecting the devices and the highly intensive labor involved in separating the usable materials. "You end up with commodities with some resale value," says Richard Goss, director of environmental affairs at the Electronic Industries Alliance (EIA). "But the value does not begin to come close to costs of collecting used devices from 150 million households, transporting them to recycling centers, and physically disassembling them."

Over the past few years, the general public has become aware that cast-off electronic equipment is a growing problem that has to be dealt with. Three states have passed laws banning electronic devices from landfills and providing incentives for recycling, and 26 states are considering such legislation.

Consumers in most states can still legally put electronic waste in landfills. Large companies are prohibited by the Resource Conservation & Recovery Act from shipping discarded electronics to landfills, so they generally send them to one of the more than 400 businesses operating in the U.S. that call themselves recyclers.

IN 2005, both the House and Senate held hearings on electronic waste, and the House formed an e-waste working group. Several bills were introduced in Congress to deal with such waste. Members of Congress now are trying to develop compromise legislation that will include an advanced recovery fee collected when electronic products are sold and a tax credit to consumers for recycling televisions and computers.

A coalition of 10 New England and other northeastern states is working on legislation to govern discarded electronic equipment, and six midwestern states are also collaborating on a common approach.

In the meantime, European Union members have started to implement a Waste Electrical & Electronic Equipment directive, enacted by the EU in 2002, that requires retailers and manufacturers to take back electronic products at the end of their useful lives. In 2003, the EU passed a law setting standards for toxic materials in new electronic equipment: The Reduction of the Use of Certain Hazardous Substances (RoHS) directive goes into effect on July 1. It puts strict limits on lead, mercury, cadmium,

Electronic waste contains a variety of toxic materials: lead, mercury, beryllium alloys, hexavalent chromium, cadmium, and brominated flame retardants.

hexavalent chromium, and polybrominated biphenyls and polybrominated diphenyl ethers used as flame retardants. Among the polybrominated dibenzyl ethers, only the decabrominated compound is allowed.

All major electronics manufacturers say they plan to comply with the RoHS directive for all their new electronic devices, even those sold in the U.S., because their markets are global. "Going forward, the major brand-name companies, EIA members, are not going to be making different products for Europe than for the U.S.," Goss says.

While Europe has been developing regulations and U.S. states have been considering various approaches, more and more of the used electronic equipment collected for recycling is being shipped to China, India, Pakistan, and Africa, where most of it is disposed of inappropriately. The Government Accountability Office (GAO) estimates that 50–80% of the devices collected for recycling in the U.S. end up in Asia or Africa. Although a small percentage of the devices are refurbished and reused abroad, most are disassembled and disposed of in a way that poses risks to workers and the environment.

Much of the equipment that is exported to Nigeria, for example, is simply strewn along rivers and roads or burned in large piles without any attempt to recover useful materials. "In Nigeria, they would just routinely set ablaze the plastic carcasses of computers and televisions," says Jim Puckett, coordinator of the Basel Action Network (BAN), which is based in Seattle.

BAN, along with the Silicon Valley Toxics Coalition, and with support from Greenpeace and other organizations, investigated the conditions under which electronic waste is recycled in China, India, Pakistan, and Nigeria. In 2002, BAN published a report on recycling in China. There, the report says, most of the equipment is dismantled and recycled under primitive conditions that are dangerous for workers and the environment. Much of the toxic material in the equipment ends up in water, air, soil, or the workers themselves.

IN A CLUSTER of villages called Guiyu, in Guangdong province, computers were being hammered apart to extract the metals, and the plastic casings were burned in open air. Outside or in small workshops, children and adults wearing no protective clothing were removing wires and dissolving them in acid to extract metals. They were also melting circuit boards over open fires.

In 2000, China banned the importing of electronic waste and asked the U.S., Europe, and other developed countries to stop exporting waste to its shores. But the trade, allowed by local Chinese customs officials, resumed shortly after.

In 2004, BAN and Greenpeace China investigated the recycling of electronic waste in the Taizhou region of China. They found that e-waste was being smuggled by container ships from various ports. It was also arriving from Japan mixed in with loads of scrap steel and copper. In rural areas around Taizhou, women, children, and elderly men were "cooking" computer circuit boards over charcoal burners to remove the chips and other components.

In October 2005, BAN published a report on the recycling of electronic waste in Lagos, Nigeria. Exporters of such waste to Nigeria claimed the shipments were repairable equipment that would help bridge the digital divide between Africa and industrialized countries. Lagos has a workforce with the education and skills to repair electronic equipment. But BAN found that three-quarters of the devices were so old or badly broken they could not be fixed. "People in Lagos told us that two years ago they weren't getting any container loads of computers. Now they are getting 500 a month," Puckett says.

Much of the e-waste arriving in Lagos is from North America, but a lot of it is from Europe, Puckett says. In Europe, it is illegal under the Basel Convention to ship unrepairable electronic products to developing countries. But, he says, the authorities are not testing the products before export to see if they can be refurbished. "What we saw in Africa was in some ways worse than in China because there was so much more open burning of the waste." BAN is also receiving reports that electronic trash is being sent to Senegal, Kenya, and Tanzania, he says.

The only real long-term solution for electronic waste, Puckett says, is to get the toxics out of these products. Developing countries will not have the ability to deal with toxics anytime soon. He believes that computers could be redesigned to contain virtually no toxics by 2010. "That is why the RoHS directive is so important," he says. "That is why extended producer responsibility is so important, because if you can make the manufacturers responsible for the end of life of their products, there is an incentive for them to clean up the front end."

In the U.S., the e-waste problem might be closer to resolution if electronics manufacturers agreed on a standard approach. But there is a strong difference of opinion about how to finance collection and recycling. IBM and the television companies, including Panasonic, want a government-run program in which retailers collect an advanced recovery fee, imposed at the time of sale, and the government sets up a nonprofit group to collect discarded products and send them out for recycling.

In contrast, most computer firms, including Dell and Hewlett-Packard, support an extended producer responsibility approach. In this system, producers would be required to set up programs in which they collect waste

ACID WORKER A laborer heats aqua regia—a mixture of nitric acid and hydrochloric acid—to dissolve tiny amounts of gold from computer chips. The worker inhales acid fumes all day as she swirls computer chips in the mixture. The sludge left over from the process is dumped directly into the Lianjiang River in Guiyu, China.

from certain consolidation points and pay for recycling. Cities and towns would finance the collection and transfer of discarded products. Those who favor this approach believe manufacturers will have a greater incentive to design nontoxic products if they also must pay for recycling the discarded devices, says Barbara Kyle, coordinator of the Computer TakeBack Campaign.

Among the states with consumer recycling laws—California, Maine, and Massachusetts—California has the most far-reaching legislation. In January 2005, it began collecting an advanced recovery fee on all new televisions and computer monitors sold within the state. The fee is $6.00, $8.00, or $10, depending on the size of the device. The state uses the revenues to reimburse nonprofit and for-profit recyclers at a rate of 48 cents per lb. The recyclers reimburse the collectors of used electronics at a rate of 20 cents per lb, giving them an incentive to provide free recovery from households and businesses.

Manufacturers have a role in implementing the California program. They must tell consumers where and how to dispose of the covered electronic devices. Each year, manufacturers must submit to the California Waste Management Board an estimate of the total number of covered electronic devices sold in the state. They must also estimate the total amounts of mercury, cadmium, lead, hexavalent chromium, and polybrominated biphenyls used in covered devices that year and the reduction from the previous year. In addition, they must formulate plans to design products that are easier to recycle.

Recyclers in California are not allowed to export electronic waste to foreign destinations unless they can demonstrate that it will be handled in accordance with standards established by the Organization for Economic Cooperation & Development.

During the first 10 months of implementation, 286 e-waste collectors and 39 e-waste recyclers have begun to provide recycling opportunities at more than 311 locations in California, said Mark Murray, executive director of Californians Against Waste, to the House Subcommittee on Environment & Hazardous Materials. In most areas of the state, there are convenient locations for depositing electronic waste to be recycled, he said.

California expects to collect more than 50 million lb of electronic devices in 2005, Murray said. And the total projected advanced recovery fees of $60 million to $70 million from the program will be more than enough to make the required payments to collectors and recyclers, he noted.

Maine's law takes a producer-responsibility approach. In 2004, the state passed legislation requiring computer and television manufacturers that sell products in Maine to pay for the take-back and recycling of their discarded products. Under this law, consumers transport used electronics to consolidation points, and manufacturers are responsible for collecting and recycling used devices with their brand name as well as a share of the "orphan" devices for which a producer no longer exists.

Last year, Maryland passed a law requiring all computer manufacturers that sell in the state to pay $5,000 into a fund to help finance local recycling programs. The state expects to collect about $400,000 annually with this legislation.

"The NGO [nongovernmental organization] community used to be adamantly in favor of extended producer responsibility, almost to a religious extent," Puckett says. "But lately, some of us have thought that an advanced recovery fee wouldn't be so bad if it were coupled with a RoHS-type of agreement" prohibiting certain toxic materials in electronic devices.

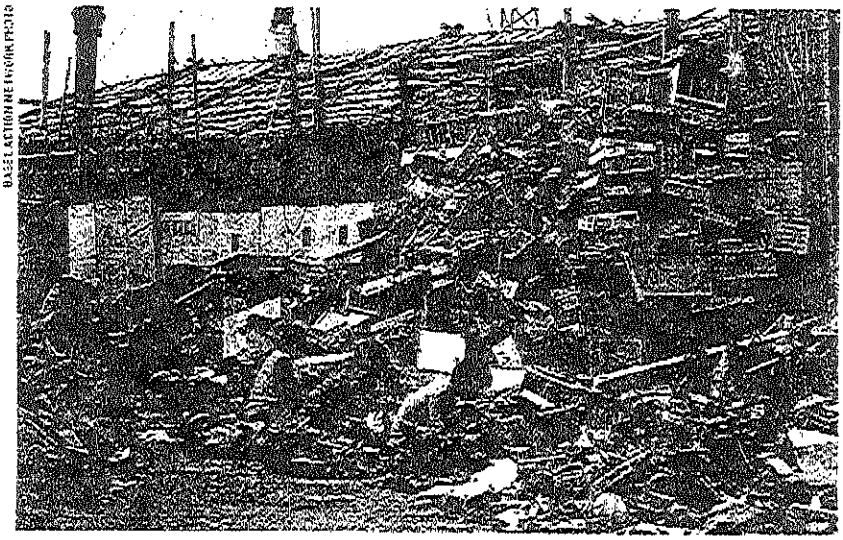
IN A REPORT on electronic waste released on Dec. 12, 2005, GAO says that "a patchwork of potentially conflicting state requirements is emerging that may ultimately place a substantial burden on recyclers, retailers, and manufacturers." It recommends that EPA develop proposed legislation that addresses some of the economic and regulatory issues discouraging recycling of used electronic equipment.

While EPA says it agrees with most of the GAO report, the agency believes that it is inappropriate for EPA to develop legislation because manufacturers are sharply divided over a method of financing for national recycling. Some favor a fee charged at the point of sale, while others favor some kind of internalized fee charged to the manufacturers. Retailers are universally opposed to collecting fees. The agency "is not in the best position to choose between competing financing solutions, given that this decision is one that is fundamentally a business and economic issue, rather than an environmental issue," EPA says.

Kyle concurs that retailers "hate" the California law. "They don't want to be on the hook for collecting all the money. Stores such as Office Depot have to program all their computers to charge a $6.00, $8.00, or $10 fee and get it to the state," she says. "It is very costly for retailers."

In the long run, "it makes sense to have federal legislation" rather than a patchwork of state laws, Kyle says. "But we don't see the current Administration ever approving a serious solution to this problem." As a "diversionary tactic," some manufacturers argue that having a variety of state laws will interfere with interstate commerce and reduce the profitability of the industry, she explains. "But we can't wait another four or five years until there is a law on the federal level. In the meantime, the states should act," she says. A lot of the bills that states are considering "are very, very similar."

EIA's Goss would like to see a streamlined and consistent national framework for recycling used electronic products. "But



ELECTRONICS SCAVENGING About 100,000 migrant workers break down imported computers in hundreds of operations like this one near the Lianjiang River in Guiyu, China.

if we can't get that right away, our second choice is to have regional coordination," he says. EIA is very supportive of the effort by 10 northeastern states and the similar project in six midwestern states to come up with consistent state laws, he says. "No one thinks it makes sense to deal with this state by state or city by city.

"A recycling system should start with a limited number of product types and build over time to incorporate more," Goss continues. "Some states have proposed recycling 47 different products right from day one," he explains. "It's challenging enough on a statewide basis to create a recycling infrastructure for the big products—computer monitors, TVs, and laptops—where there is a lot of industry experience on collection, transportation, and recycling costs."

Goss also stresses that when discarded electronic products are transported to recyclers, they must be handled properly. "We're working with industry, NGOs, EPA, and recyclers on government recycler certification" to make sure products are recycled safely, he says. Kyle's group—the Computer TakeBack Campaign—is also cooperating with recyclers to create a national recyclers certification program. "There are some very good recyclers who are trying to do the very most they can within the technology," Kyle explains.

However, "recyclers tell us off the record that a huge amount of sham recycling is going on in this country," Kyle says. Sixty to 80% of what is collected, presumably for recycling, is exported to developing countries where people can't deal with it, she explains. Another corrupt practice is that recyclers put the equipment in large U.S. warehouses, take out the parts that have the most value for materials recovery, and disappear. Then the warehouses become abandoned dumpsites.

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"There is very little effective recycling going on, other than commercial recycling by companies such as Hewlett-Packard," says David Betts, president of Electronics Product Stewardship Canada, an industry-led nonprofit group that is trying to devise solutions for Canada. "Every couple of weeks, I get a request for a container-sized shipment of e-waste to be sent to the Third World," presumably for recycling. "If someone wants a container-sized shipment, you know what is happening with that stuff. Every time you see someone offering to pay for e-waste, that is bad news," he says. Once products can no longer be used for their intended purpose, there is no way in North America you can make money recycling them, he explains.

Given the deplorable fate of electronic waste in developing countries and multiple state efforts to create laws to deal with this waste, it is likely that at some time in the next decade Congress will pass a law creating a federal response to the problem. Meanwhile, there is an almost universal belief among producers, government officials, consumers, and NGOs that e-waste should not end up in landfills or on ships bound for Asia or Africa. ■