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CHINA

Confronting a Toxic Blowback From the Electronics Trade

BEIJING—For Anna Leung, conducting research in Guiyu, a village in southern China where discarded computers and other electronics are stripped for their precious metals, was an assault on the senses. The acrid smell of circuit boards baking over coal fires and the stench of runoff from acid leaching were overpowering. More disturbing was the sight of children often helping their impoverished parents with the work. “We really feared for their health,” says Leung, an environmental scientist at Hong Kong Baptist University whose team found sky-high levels of toxicants in the air and soil.

Lately China has lurched from one toxic crisis to the next: Last year’s major scandal was melamine in milk, whereas the latest is the revelation that hundreds of children were sickened by lead pollution from smelters in two cities. But e-waste processing, a burgeoning cabin industry in coastal parts of China, may end up dwarfing those incidents in severity and number of victims, scientists argued at a symposium on flame-retardants here on 22 August. “The problem is just monumental,” says marine toxicologist Susan Shaw, director of the Marine Environmental Research Institute in Blue Hill, Maine. “There is extraordinary contamination of people, especially children, living in e-waste areas,” she says.

E-waste is not a new phenomenon: China has been accepting vast quantities of discarded televisions, computers, printers, and other equipment from abroad since the early 1990s. Since 2000, the central government has prohibited importation of e-waste, and a law passed last year requires e-waste processors to register with local governments and take steps to control pollution. In Guiyu, one of the biggest and most notorious processing sites in the world, banners declare that “Dealing in imported used electronics is an act of smuggling,” says Eddy Zeng, an organic geochemist at the Guangzhou Institute of Geochemistry. But because existing regulations are poorly enforced, he says, “Tremendous amounts of e-waste have been imported illegally,” such that China now processes 70% of the world’s e-waste. Much of the broken or obsolete electronics pile up in coastal villages where residents—often migrants from poorer inland provinces—use

crude methods to recover minute amounts of gold and other precious metals. One site, Longtang, is a surreal scene, says Zeng, where runoff from leaching turns streams a “very, very beautiful blue.”

The roster of substances liberated during e-waste processing is a toxicological nightmare: known carcinogens like dioxins and polycyclic aromatic hydrocarbons; neurotoxic elements like lead; and brominated fire retardants, including polybrominated diphenyl ethers (PBDEs), which have been shown to disrupt endocrine hormones in lab animals and wildlife. Zeng calculates that some 76,000 metric tons of PBDEs alone are released into the environment each year at e-waste sites in China. “This is a chemical time bomb,” he says.

The Hong Kong team, led by Ming Wong, has undertaken pioneering work to track the fate of e-waste toxicants. Along a riverbank in Guiyu, for example, they found levels of PBDE that were thousands of times higher than those found in soil from a control site in the province. “More and more of these toxic chemicals are getting into the food supply,” says Arlene Blum, a biophysical chemist at the University of California, Berkeley.

Already there is evidence that they are ending up in people. Researchers have reported that PBDE blood levels in Guiyu residents are, on average, nearly 600 parts per billion. “These are the highest PBDE levels ever reported to date in people anywhere in the world,” says Shaw. The Guiyu levels are 10 times higher than average levels in the United States and more than 100 times higher than in Europe. At Guiyu, says Leung, “villagers don’t take health precautions” such as wearing facemasks. The bottom line, says Tom Webster, an environmental scientist at the Boston University School of Public Health, is that e-waste sites “are extremely



Digital detritus. Electronic waste accumulates along a riverbank in Guiyu, a world-class site of toxic residues.

good opportunities for epidemiology.”

In the meantime, scientists have proposed several broad strategies for reducing e-waste here. One approach would be to incorporate fewer toxicants into electronics. Another would be to choke off e-waste imports. China receives up to 80% of the United States’s obsolete computers, Zeng notes. “The U.S. is so generous in its contribution to China’s environmental contamination,” Linda Birnbaum, director of the U.S. National Institute of Environmental Health Sciences, says sarcastically. “This is something we should be working on.”

But China shouldn’t wait for other countries to act. One urgent priority is stricter enforcement of existing laws, Zeng and colleague Hong-Gang Ni argue in a 1 June viewpoint in *Environmental Science & Technology*. But “the problem is a lot of local agencies don’t have the resources,” Zeng says. A more promising tack, he says, might be to convince municipalities that future cleanup costs will be much greater than income from processing. And when health costs are factored in, the damage will be enormous. —RICHARD STONE

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