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Metal Contamination in an E-Waste Recycling Community in Northeastern Thailand

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Abstract : Electronic waste, 'e-waste', refers generally to discarded electronics and electrical equipment, including products from cell phones and laptops to wires, batteries and appliances. While e-waste represents a transformative source of income in low- and middle-income countries, informal e-waste workers use rudimentary methods to recover materials, simultaneously releasing harmful chemicals into the environment and creating a health hazard for themselves and surrounding communities. Valuable materials such as precious metals, copper, aluminum, ferrous metals, plastic and components are recycled from e-waste. However, persistent organic pollutants such as polychlorinated biphenyls (PCBs) and some polybrominated diphenyl ethers (PBDEs), and heavy metals are toxicants contained within e-waste and are of great concern to human and environmental health. The current study seeks to evaluate the environmental contamination resulting from informal e-waste recycling in a predominantly agricultural community in northeastern Thailand. To accomplish this objective, five types of environmental samples were collected and analyzed for concentrations of eight metals commonly associated with e-waste recycling during the period of July 2016 through July 2017. Rice samples from the community were collected after harvest and analyzed using inductively coupled plasma mass spectrometry (ICP-MS) and gas furnace atomic spectroscopy (GF-AS). Soil samples were collected and analyzed using methods similar to those used in analyzing the rice samples. Surface water samples were collected and analyzed using absorption colorimetry for three heavy metals. Environmental air samples were collected using a sampling pump and matched-weight PVC filters, then analyzed using Inductively Coupled Argon Plasma-Atomic Emission Spectroscopy (ICAP-AES). Finally, surface wipe samples were collected from surfaces in homes where e-waste recycling activities occur and were analyzed using ICAP-AES. Preliminary1 results indicate that some rice samples have concentrations of lead and cadmium significantly higher than limits set by the United States Department of Agriculture (USDA) and the World Health Organization (WHO). Similarly, some soil samples show levels of copper, lead and cadmium more than twice the maximum permissible level set by the USDA and WHO, and significantly higher than other areas of Thailand. Surface water samples indicate that areas near e-waste recycling activities, particularly the burning of e-waste products, result in increased levels of cadmium, lead and copper in surface waters. This is of particular concern given that many of the surface waters tested are used in irrigation of crops. Surface wipe samples measured concentrations of metals commonly associated with e-waste, suggesting a danger of ingestion of metals during cooking and other activities. Of particular concern is the relevance of surface contamination of metals to child health. Finally, air sampling showed that the burning of e-waste presents a serious health hazard to workers and the environment through inhalation and deposition2. Our research suggests a need for improved methods of e-waste recycling that allows workers to continue this valuable revenue stream in a sustainable fashion that protects both human and environmental health. 1Statistical analysis to be finished in October 2017 due to follow-up field studies occurring in July and August 2017. 2Still awaiting complete analytic results.

Keywords : e-waste, environmental contamination, informal recycling, metals
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