

Discarded Electronics May Be Hazardous Waste

The devices that make possible e-mail, e-news and e-commerce may end their days as e-hazardous waste.

A just-completed study by University of Florida environmental engineers found that electronic-age gadgets ranging from cell phones to computer mice often release enough lead in laboratory tests to be classified as hazardous waste under U.S. Environmental Protection Agency regulations.

The findings, presented in a draft report to the EPA, which funded the study, could prompt the federal government or individual states to change the disposal rules for millions of tons of electronic devices that now routinely make their way into household trash landfills, said UF environmental engineering Associate Professor Tim Townsend, lead investigator on the project.

“The bottom line is that when we tested these devices, in many cases they met the EPA definition for regulated hazardous waste,” said Townsend, who presented his findings at an EPA meeting in Chicago in February.

Rapid changes in technology make the issue of “e-waste” pressing. Experts estimate that more than 20 million personal computers became obsolete in 1998 alone, and project more than 60 million personal computers will be retired in 2005, Townsend said.

Five years ago, Townsend headed research that concluded cathode ray tubes — the “picture tubes” that produce images on standard television and computer screens — release enough lead to be classed as hazardous waste. The finding concerned state and federal officials, prompting the EPA to provide Townsend \$40,000 to test other electronic devices.

In research that began late in 2001,

Townsend and four UF graduate students examined cell phones, printers, flat-panel monitors, keyboards, computer mice, remote controls, VCRs, laptops and central processing units, or CPUs, the components that contain the “guts” of personal computers.

The researchers subjected many of the e-devices to a standard EPA testing procedure for hazardous waste, the Toxicity Characteristic Leaching Procedure. The procedure involves mixing the ground-up devices with an acid solution designed to simulate potential conditions in landfills. Technicians rotate the mixture for 18 hours in a drum container, and then test the results for eight hazardous metals: mercury, arsenic, cadmium, barium, silver, selenium, chromium and lead.

While the UF technicians were able to grind up the smaller devices, such as cell phones, the task proved difficult for the larger devices such as VCRs, Townsend said. As a result, they developed a modified version of the test: a sealed 55-gallon drum suspended on an axle connected to a large electric motor. They placed disassembled printers and other large electronic devices in the drum, added the acid solution, rotated the contents for 18 hours and then tested the leachate.

Every type of electronic device leached lead above the hazardous waste levels in at least some cases, the tests showed. The lead comes from the solder used to connect the circuits. None of seven other hazardous metals showed up as problems in the tests.

For example, 28 of 38 cell phones

tested using the standard procedure produced leachate that exceeded the EPA standards of five milligrams of lead per liter. Seven of eight VCRs tested with the modified test exceeded the standard.

Curiously, the experiments found that computer CPUs frequently exceeded the hazardous waste limit in the modified test, but rarely in the standard test.

Upon closer look at the data, the researchers realized the CPUs and other devices containing a large amount of steel tended to leach less lead when the devices were ground up, which they determined resulted from the electrochemical conditions of the solution.

Townsend said that the laboratory leaching test results provide a good tool, but they may not do a good job of mimicking what happens in actual landfills. To address this question, he has launched a major experiment at the North Central Landfill in Polk County. The experiment will involve burying 16-foot-long, two-foot-wide columns in the landfill, filling the columns with a mixture of municipal solid waste and electronic waste and testing the resulting leachate.

The two-year project is being sponsored by Polk County and the Florida Center for Solid and Hazardous Waste Management, a research center hosted by UF’s College of Engineering and funded by the Florida Department of Environmental Protection.

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