

## Recycling computers and other electronic appliances

The title of the news story told the tale: “Gadgets to garbage, Electronics of Christmas Past are coming back to haunt US landfillers.”<sup>(130)</sup> Continuing in the holiday theme, the article went on to say that buying new cellphones for the holidays also meant throwing away the old ones, and that industry sources predicted that 3 billion units of consumer electronics would be scrapped between now and 2010. The National Safety Council estimates that in California alone there are 2.9 million unused TVs and 3.2 million computer monitors stored away in closets and attics.<sup>(131)</sup> The organization also says that about 3 million tonnes of electronics gear is dumped into American landfills each year.<sup>(131)</sup> The problem can only get worse. Somewhere between 20 and 80 million PCs become obsolete every year, and they have to go somewhere.<sup>(132,133)</sup> Experts expect 130 million cellphones to bite the dust in 2005.<sup>(133,134)</sup>

So-called e-waste is the fastest-growing component of trash.<sup>(135)</sup> As mentioned in **Extension 11.1, *Waste in Germany***, the European Union directive will force electronic appliance takebacks, which will keep European electronics and computers out of landfills there. The Europeans take the Precautionary Principle seriously.<sup>(45-51,135)</sup> Assuming their proposal is ratified and fully in effect in 2008, three-fourths of the electronic equipment that would have gone into landfills will not.<sup>(136)</sup>

As is clear from the mantra—reduce, reuse, recycle—there are other measures one can adopt before turning to recycling. It is not really clear, however, how we could reduce the number of computers. Reuse is possible. For example, Xerox has made great strides in its “Xero waste” program in constructing components so that they are able to be reused as parts in other products.<sup>(137,138)</sup> Xerox factory recycling rates have risen into the 60%

range.<sup>(139)</sup> This will save the company money (\$45 million was saved in 1998 and \$47 million was saved in 1999),<sup>(137,138)</sup> and ultimately save the customer money.

Norway is a leader in recycling computers. As of 1999, Norway levies a “green fee” for all electric appliances. The recycled materials are reused to the extent possible.<sup>(140)</sup> In Germany, Duales System Deutschland recycles about 1.8 Mt/yr of electronic scrap, including computers.<sup>(41)</sup>

Japan enacted a tough law forcing manufacturers of four sorts of appliances (air conditioners, televisions, refrigerators, and washing machines) to recycle those appliances.<sup>(129,141)</sup> The Japanese face the same reality as the Europeans—lack of landfill space. This problem is much more acute than it is for Europe.<sup>(129)</sup> Japanese consumers were totally taken aback to find that they must pay a hefty disposal fee (since the 300 million appliances in the consumers’ hands constituted a big threat).<sup>(129)</sup> In Japan, after recovery of valuable materials, the remainder of the appliances are shredded.<sup>(129,141)</sup> It is expected that computers and cars will also be recycled soon in Japan.<sup>(141)</sup>

At this time, computer recycling is not at breakeven, partly due to the labor-intensive character of parts mining and safe disposal of components.<sup>(142)</sup> However, private companies are getting into the market, and there is the promise of profit whenever such a small enterprise begins. In Massachusetts, net disassembly cost was \$119/t or 12 cents per kilogram.<sup>(143)</sup> In San Jose, the net cost of recycling computers was about 16 cents per kilogram.<sup>(142)</sup> The difficulty with recycling computers begins with the monitors. Each CRT monitor contains 2 to 4 kg of lead placed there to guard against x rays.<sup>(144)</sup> The tubes also contain mercury and cadmium.<sup>(145)</sup> Of course, the same concerns hold for disposal of television sets. The Massachusetts Department of Environmental Protection

has decided that no TVs or monitors can be accepted at any waste facility in the state.<sup>(146)</sup> Oregon and California have also forbade landfilling of old televisions.<sup>(147,148)</sup>

The problem is going to get much worse. An estimated 20 million computers headed to the trashcan in 1997, with 315 million expected by 2004.<sup>(149)</sup>

Compaq, Dell, and Gateway are developing infrastructures for disassembling computers through contracts with third-party electronics remanufacturers. IBM Corp. has some 14 recycling facilities around the world. IBM and Hewlett-Packard recycle computers for a fee. HP charges \$13 to \$34 for each item, while IBM charges \$30.<sup>(147)</sup> Hewlett-Packard's facility is company-owned, but IBM contracts out the computer recycling to the company Envirocycle, a Hallstead, Pennsylvania, recycling firm.<sup>(150)</sup> A&B Recycling of Georgia also accepts computers for recycling.<sup>(149)</sup> The Silicon Valley Toxics Coalition heaped praise on Hewlett-Packard for its approach to recycling computers, but panned Dell for sending its computers to foreign sweatshops.<sup>(151)</sup>

Not all computer companies charge customers for disposal. Gateway gives a rebate of up to \$50 good toward a new Gateway PC to customers who bring in their old computer.<sup>(147)</sup> In 2004, Hewlett-Packard and Office Depot teamed up to test a new computer recycling program. Between 18 July and 6 September, old computers (and, in fact, all electronics equipment including TVs and cellphones) could be dropped off for free at the 850 Office Depot locations nationwide. Hewlett-Packard accepted everything and trucked it to its facilities.<sup>(131,152)</sup> The test appeared to have been successful from its inception.<sup>(153)</sup>

Cascade Asset Management, a Wisconsin company started with state assistance, recycled 305,000 kg of old computers. Typical of these companies, whole computers may be

salvaged, then valuable parts stripped from computers that are not wholly reused, and finally the remainder is chopped up.<sup>(27)</sup> It costs between \$85 and \$136 to recycle a PC.<sup>(152)</sup>

To find a home for your old computer investigate the websites [www.SVTC.org](http://www.SVTC.org), and [www.800Cleanup.org](http://www.800Cleanup.org). If you wish to give your old computer away, consider looking up [www.ShareTechnology.org](http://www.ShareTechnology.org) or [www.UsedComputer.com](http://www.UsedComputer.com).<sup>(154)</sup> You might also want to buy replacement laser cartridges from LaserMonks, a nonprofit firm supplying refilled inkjet and laser printer cartridges, run by actual, well, monks of the Cistercian Abbey of Our Lady of Spring Bank in Sparta, Wisconsin. Whatever money they make goes to doing good deeds.

LaserMonks and other remanufacturing firms must content with “sabotage” by the printer companies trying to protect their very profitable business. The inkjet printer companies follow their own variation of Gillette’s maxim—give away the razor and make huge profits on the blades. So these companies install smart chips to disable the printer if a remanufactured inkjet is installed.<sup>(155)</sup> Europe has outlawed the smart chips.

Sony America accepts televisions for recycling in six states.<sup>(138)</sup> Some states ban disposal of old computers and television sets. Massachusetts banned both as of April, 2000.<sup>(156)</sup> As of June, 2002, Oregon and California no longer allows either to be sent to a landfill, after recognizing CRTs as hazardous waste because of the lead and other metals used.<sup>(147,148)</sup> Florida is also considering such a non-legislative approach to CRT disposal. Relatively new TVs can be reused, and much effort has gone into helping establish exchange programs (usually with charities such as Goodwill Industries, for example).

The monitors may be sent overseas, most to China, causing pollution problems in other places. The lead content is especially hazardous, and the foreign processors seldom protect their workers.<sup>(134,157,158)</sup> Materials found in old TVs and computer monitors include plastics, lead (about 2 kg), aluminum, gallium, nickel, vanadium, beryllium, chromium, cadmium, mercury, arsenic, and silica. Many of these materials can cause health problems; the metals especially are implicated in cancers, disorders of organs, and brain impairment.<sup>(134)</sup> Some experts claim these wastes represent “the largest toxic waste problem of the 21st century.”<sup>(134)</sup>

In addition, cellphones are being bought, and thrown out, in record numbers. Chinese companies, with a poor and bountiful labor force available, are prominent in cellphone recycling, too.<sup>(159)</sup> As in the handling of monitors and TV sets, the workers at cellphone recycling are virtually unprotected. The situation is different in Japan, where labor laws protect workers, but mining cellphones for gold is profitable enough to justify the expense.<sup>(160)</sup>

### European approaches to dealing with electronics

Two recent EU directives deal in whole or in part with electronic wastes. They are the Waste Electrical and Electronic Equipment (WEEE) directive and the Restriction of the use of certain hazardous substances in Electrical and Electronic Equipment (ROHS) directive. ROHS requires elimination of certain toxic materials (including electronic equipment but also, for example, use of flame retardants in textiles), while WEEE deals solely with disposal of electronic wastes.

As discussed above, there are many hazardous components to electronic wastes. ROHS requires member states to substitute other substances for “the use of lead, mercury,

cadmium, hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ether (PBDE) in electrical and electronic equipment” by 1 January 2008. One of the most difficult issues is the use of lead-based solder, with industry arguing that it is essential to continue its use. However, alternatives to lead-based solder are available and have been proven effective.<sup>(124)</sup> Japan has allowed only “exceptional use” of lead-based solders since 1 January 2005.<sup>(124)</sup>

The WEEE holds producers jointly responsible for equipment generated (adjusting for each company’s market share). This relaxes the direct “producer pays” (EPR, see Extensions 11.1 and 11.2) connection that can be so effective.<sup>(124)</sup> In addition, as Lymberidi points out, “collective financial responsibility does not remunerate the innovating producer.” This reduces the effectiveness and flexibility inherent in EPR.

The WEEE directive suggests that “historical wastes” (those generated before the directive became effective) should be covered by a tax on current producers, a provision fought bitterly by manufacturers. It is likely that some EU subsidy will be needed, especially if “deposit” incentives are put into place to induce people to return the equipment for the refunded “deposit” rather than throwing the material away.