How are Computers Recycled?

Some products destined for recycling, such as aluminum cans and newspapers, find themselves reborn as like products. But tracing the path of recycled electronic products is considerably more complicated. What follows are some of the steps a typical computer could undergo during recycling:

Circuit Boards. Most circuit boards and some hard drives can be marketed for resale as operational parts. Unusable circuit boards are chopped into a powder and separated into fiberglass, metals and precious metals through a process called *fire assay*.

Computer equipment being collected for recycling at the 2004 Electronic Waste Collection Event.

Plastic Housings. Plastic housings are separated from the electronic equipment, and materials such as labels and foam insulation are removed through air classification. Unfortunately, plastic housings on computers and monitors will not fit on newer equipment. At present, these plastics are difficult to market because they contain mixed or unmarked resins that cannot be readily identified or separated, as well as some additives such as flame retardants that complicate recycling. Some near-term uses of these plastics include use in roadbed fill. Efforts are under way, however, to find higher value applications for these plastics in products such as flooring, computer, and automotive parts. Because of the difficulty recycling plastic housings due to resin combinations, many times the housings are processed at a smelter to separate the metals from the plastics.

Small Plastic Components. The small plastic parts inside computers are typically made from uniform-colored, high density polyethylene (HDPE). This makes them easier to remove, grind, and process. Recyclers must take great care not to mix other materials (e.g., metals) or different resins in with these plastics. Even a small amount of contamination can cause a buyer to reject an entire load. If ground plastic resins appear to have contamination from mixed resins, the recycler can hydroseparate them because of their varying densities.

Screws, Clips, Small Metal Parts. Screws, clips, and small metal components are sorted and separated magnetically into ferrous and nonferrous groups. The metals are sold as scrap.

Monitors. Monitors are handed over to a separate demanufacturing line, where workers remove the plastic housings, metal supports, and circuit boards. The cathode ray tube (CRT) itself is a funnel-shaped, leaded glass tube with a metal frame inside. The worker separates the funnel from the front panel glass. The CRT is then crushed, and the leaded glass and metal are separated. The glass is screened, processed, and inspected for contaminants. Much of it can be sold to CRT manufacturers for use in new CRT glass. The metal is sold for its scrap value.

Adapted from: WasteWise Update-Electronics Reuse and Recycling. U.S. EPA, Solid Waste and Emergency Response. October 2000. EPA530-N-00-007. Www.epa.gov/wastewise.

Refurbishing (reusing): The fixing and reselling or donating of used computers for their original intended purpose. This involves repairing or replacing parts, upgrading memory, and even installing new software.

Recycling: Separating raw materials (metals, plastics, glass, etc.) for further processing and recovery.

Demanufacturing: Manually breaking down computer equipment into its separate components. The components are then either recovered for resale/reuse in other equipment or sorted for future recycling or recovering of raw materials.

Environmental Benefits of Computer Reuse and Recycling...

- **Diverts materials from disposal.** Computer reuse and recycling divert bulky equipment from landfills and incinerators.
- **Protects local water resources.** By keeping computer equipment out of landfills and using proper disposal processes, ground water supplies are protected from potential metal contamination from landfill leachate.
- **Conserves natural resources and reduces pollution.** Products reconfigured or redesigned to reduce materials and use greater recycled content use fewer virgin resources and require less energy to produce. When less virgin material and energy is used, pollution is reduced. These energy savings also translate into reduced greenhouse gas emissions. When reuse is not an option, recycling computers creates a supply of parts and materials that can be used to refurbish older products or manufacture new ones.

Adapted from: WasteWise Update-Electronics Reuse and Recycling. U.S. EPA, Solid Waste and Emergency Response. October 2000. EPA530-N-00-007. Www.epa.gov/wastewise.

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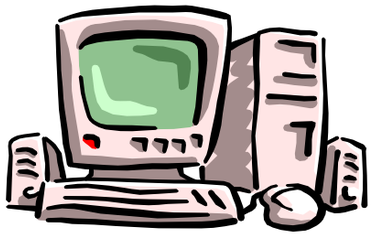
Computers: A Hazardous Waste?



Managing outdated and obsolete equipment to protect our environment and human health

Gallatin Local Water Quality District

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(406) 582-3168

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What you need to know...

Outdated, unwanted and broken computers and other electronic equipment are known as e-waste (electronic waste). E-waste that is not disposed of properly is considered hazardous because it contains metals and other materials that can harm humans and the environment.

Rapid advances in computer technology have resulted in a ballooning volume of outdated and discarded computers. The average life span of a computer is 2-3 years and items that break are usually discarded rather than repaired due to the relatively low price of replacement equipment.

Obsolete and unwanted computers usually end up destined for landfills, incinerators or hazardous waste exports. Millions of computers and computer-related equipment become obsolete or "retired" every year.

Contaminants Found in Computers...

Cadmium - *Found in chip resistors, infrared detectors, and semiconductors.* Cadmium is persistent, bioaccumulative, and toxic.

Lead - *Found in glass panels in computer monitors and in lead soldering of printed circuit boards.* Lead can accumulate in the environment and have a detrimental effect on plants, animals, humans and water resources. **One computer monitor can contain up to 8 pounds of lead. Consumer electronics may be responsible for 40% of the lead found in landfills.** The principal pathway of concern is lead leaching from landfills and contaminating drinking water supplies.

Mercury - Found in position sensors, relays and switches (e.g., on printed circuit boards) and batteries. When mercury makes its way into waterways, it is transformed into methylated mercury in the sediments. Methylated mercury accumulates in living organisms and travels up the food chain.

Hexavalent Chromium or Chromium VI - Used to protect against corrosion of untreated and galvanized steel plates. Major pathways are through landfill leachate or from fly ash generated when materials containing Chromium VI are incinerated.

Brominated Flame Retardants - Found on printed circuit boards, components such as plastic covers and cables. Once released into the environment through landfill leachate and incineration they become concentrated in the food chain.

Additional Environmental Concerns

Manufacturers use many different types of plastic in computers and other electronic equipment. This makes it the most challenging to recycle. These plastics often contain metal screws and inserts, foams, labels, coatings and paints which are considered contaminants in the plastic recycling process. Plastics treated with brominated flame retardants are harder to recycle and can be dangerous for the individuals exposed to them.

Additionally, electronics are made with valuable resources—precious metals, engineered plastics, glass and other materials. This requires energy to manufacture. Additional pollution is generated when new products must be manufactured out of virgin materials.

Recycling computers is not very profitable and a large amount of computer waste is shipped to Asia where labor costs are extremely low and health and environmental regulations are less stringent. This leads to hazardous and unsafe conditions for the workers who dismantling the computers in order to extract the metals. It also impacts the environment—including polluting water supplies.

What Can You Do About Computer Waste?

REDUCE. When the speed of your computer has slowed or memory capacity has reached its limits, consider extending the life of your computer by upgrading features and fixing or replacing parts.

RECYCLE. If your computer has reached its end of life or is unusable there are several of options for proper disposal:

⇒ Contact the computer manufacturer. Many have recycling or lease programs, and may even give discounts on the purchase of your next system if you return your old one.

⇒ Take your computer to a local collection drop-off site.
For more information on drop-off site locations, contact the Gallatin Solid Waste Management District (582-2495/2494).

⇒ Take to one of the local retailers with a recycling collection program for computers such as Staples or Office Depot. Contact them in advance to find out program details and associated costs.

ReCompute Bozeman, Inc.
411 W. Main Street, Bozeman, MT 59715
(406) 552-9049

Public or organizations can arrange drop-off of late model computers (386 and faster). In some cases, they will pay for them. Pick-up possible depending on quantity. Working and non-working accepted. They reuse, resell & recycle parts. They accept CPUs, monitors (15 inch minimum), keyboards, mouse, printers, and cartridges.

Tips for Donating Your Computer

Contact the organization first. Before you drop-off that computer equipment, contact the organization you plan to make the donation to and see if they can actually use it.

Accessories, Accessories, Accessories. Include all the accessories that came with your computer. The individual or organization receiving your equipment will appreciate being able to use a *complete* computer system. Wouldn't you?

Keep the operating system intact. Most operating systems are pre-installed on computers and the license is only valid when used on that original machine. Charitable organizations usually cannot afford to purchase and license new operating systems, a legal transfer (keeping machine and operating system together) is very helpful.

Keep your personal information private. Use disk cleaning software to remove personal information from your computer prior to donation (cookies, internet browser's cache, email contacts and documents, recycle and trash folders, nontransferable software, etc.).

Palletized computers ready for transport and recycling during the 2006 E-Waste Recycling Collection Event.