

GREEN PC

BY JOEL MAKOWER

The Toll of a New Machine

The PC Industry Is Tackling Environmental Issues

Next time you sit mindlessly staring at your computer screen, consider this: The PC you're working on was made with more than 700 different compounds including plastics, metals, glass, ceramics, a witch's brew of composites, solvents, and gases — everything from arsenic to zinc.

More than half of these materials are toxic, and nearly all will eventually be released into the air, water, or earth when your PC is finally discarded. So while using a PC may seem environmentally benign (at least compared to clear-cutting a national rain forest), there's more to the PC story than meets the eye. Manufacturing and

disposing of computer equipment is anything but earth-friendly.

This month's 25th annual Earth Day is a good time to take stock of how the computer industry has revamped its toxic-laden manufacturing processes — and how easy the industry is making it to recycle computers as well.

The story is mixed. The good news is the industry has done a pretty good job at cleaning up its manufacturing and using recycled materials where it can. The bad news is the exponential growth of the PC market could reverse these achievements, taxing the earth's resources to the max.

Let's consider the positive side of the ledger. When it comes to the environment, the electronics industry is probably five years ahead of most other industries, according to Robert D. Shelton, director of environmental, health, and safety management at Arthur D. Little in San Francisco, who has been a consultant in the industry for years. "They haven't solved all the problems, but they've got a process in place that, given time, will ensure they won't have problems in the future."

In recent years, some companies have

intractable environmental problems have been solved. One big success was the virtual elimination from the manufacturing process of ozone-depleting chlorofluorocarbons (CFCs), used to clean solder and flux off printed circuit boards. When the world's governments agreed to phase out CFCs, computer makers were among the loudest protesters, arguing that without these cleaners they could not remain in business. But when IBM, Intel, and other companies found safer substances, the rest of the industry quickly changed its tune. "Once the decision was made to go with alternatives, they moved quite rapidly and quite creatively in accomplishing a pretty fundamental production process change," says Ted Smith, executive director of the Silicon

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watchdog group. "One of the advantages of this industry is that making changes rapidly is its bread and butter."

BEYOND STYRO

Packaging is another area where the industry has taken a turn for the better. We're not talking about just switching from bleached, white product boxes to natural brown ones, or eliminating foam packing peanuts. Several companies are totally rethinking packaging from the ground up. For example, last year IBM issued a 105-page set of environmental packaging guidelines that detail everything from the amount of recycled content in packaging to the heavy metals used in the inks on some packages to the reuse of wooden shipping pallets to keep them out of landfills.

Another leader is DEC, which reduced its packaging by 54 percent simply by designing a more durable internal component for one of its computers. The increased durability cost about \$1 more per unit, but the decreased packaging shaved costs by \$10 per unit. DEC's annual savings on materials, labor, and disposal was a whopping \$11 million.

ACCOUNTING FOR THE EARTH

big motivator for going green. "It cost companies enormous amounts of money doing it wrong," says Ted Smith. "Cleaning up groundwater contaminated with your solvents can be a \$100 million proposition. That gets the issue into the boardroom."

Another big challenge for this and other industries is measuring the true environmental costs of their products. "One of the reasons that we are not as environmentally efficient in manufacturing as we might be is a lack of information," says Greg Pitts, director of environmental programs for the Microelectronics and Computer Technology Corp. (MCC), an industry consortium. For example, in the R&D stage, a product engineer can easily describe a material's tensile strength, but there's no environmental engineer in the process saying, "Well, this product's more recyclable or will cost you less in the long run."

Still, money talks, and its voice is loud and clear — at least at some companies. Pitts tells the story of one PC manufacturer that regularly generated 55-gallon drums of mixed hazardous waste, which had to be assayed to determine its contents, then separated, properly handled, and disposed. The cost was about \$1,000 a drum. When company executives told manufacturing

quickly figured out they didn't have to commingle the wastes and could even avoid using some particularly hazardous chemicals. Costs and toxic waste output plummeted.

Similar practices have helped many computer companies significantly reduce emissions, according to data from the Santa Clara County Manufacturing Group, a Silicon Valley trade association. Since 1987, its 22 member companies — including several major PC manufacturers — have decreased their emissions of the most noxious chemicals by more than 88 percent.

PC POPULATION EXPLOSION

But these gains may be threatened by the sheer growth of the industry. "What's very problematic is that the industry is moving so fast, products are obsolete so soon, and there's a demand to build more and more new facilities," says Ted Smith. He estimates that the semiconductor industry will need to build 60 new plants — huge, \$2 billion chip-fabrication factories — between now and the end of the century.

"It's an enormous resource issue," says Smith. "For example, Intel's new chip plant in New Mexico will use 10 million gallons

worldwide demand for chips escalates, we're going to hit a wall in the [environment's ability] to sustain production. I don't think [the industry] has come grips with that yet."

Water is by no means the only significant environmental challenge. The PC industry is awash with other issues. A sampling:

- **Monitors.** Disposing of cathode ray tubes (CRTs) from computer monitors has long been a messy affair. For starters, they contain a mind-boggling number of toxic chemicals, including significant amounts of lead, a toxin that has been banned from gasoline, house paints, and many other products because of its association with brain damage in children and hypertension and heart disease in adults. In CRTs, lead is mixed into the glass to protect users from harmful radiation.

The industry's solution: ramp up production of flat-panel displays, such as plasma, electroluminescent, field emissions, and active-matrix liquid crystal panels. All use fewer toxic materials and pose fewer dangers to both the environment and workers who manufacture them. Within a few years, flat-panel displays could overtake CRTs as the monitor technology of choice.

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• **Printed circuit boards.** Reducing the lead used to solder printed circuit boards is another challenge. Lead solder is cheap, easy to handle, and reliable. But reducing lead is a priority, so a variety of safer alternatives have been developed, though none has yet proven suitable for widespread use. The industry has been fighting an outright ban on lead solder, opting for "the responsible use of lead and responsible recovery," says MCA's Greg Pitts.

Who's Green, Who's Not?

Who are the biggest polluters among PC makers? Unfortunately, there's no single set of data that comprehensively compares companies, says Ted Smith of the Silicon Valley Toxics Coalition, who has tried for years to come up with such ratings. Besides, he says, ranking companies by their raw emissions overlooks those that have instituted pollution prevention programs that have yet to pay off.

One attempt comes from the Council on Economic Priorities (CEP), which tracks the environmental performance of hundreds of companies. In 1993, CEP rated the social responsibility of 12 computer companies, from their environmental records to their workplace practices, and other policies.

Overall, the companies rated pretty well on the environment. Apple, Compaq, Digital, and Fandem were rated "top." The other eight — Advanced Micro Devices, Hewlett-Packard, IBM, Intel, Motorola, National Semiconductor, and Texas Instrument — rated "middle." No companies rated "bottom." Some have criticized the study as overly generous to the industry.

Steve Dyott, CEP's Research Director of Corporate Social Research, says his study looked at more than environmental per-

Equally troublesome are the chemicals used to manufacture the boards themselves. Circuit boards are made using a *substrative* process, in which solvents selectively remove layers of plastic from a board, exposing a copper layer underneath to form circuits. The process involves a myriad of hazardous chemicals and generates a great deal of hazardous waste. The industry is researching ways to use an *additive* process that deposits metal circuits only where they are needed using a new generation of conductive inks. The process promises lower costs and fewer emissions.

• **Energy efficiency.** The industry has made great strides in reducing PC energy use, thanks in large part to the EPA's Energy Star Computers program, which encourages companies to design PCs, monitors, and printers that slip into a low-energy "sleep" mode when idle. But as microprocessors get faster and more powerful — and manufacturers add increasingly more features — curbing energy appetites will be more challenging. "The target 30-watt sleep mode could become more difficult for companies to meet," says Linda Latham, director of Energy Star programs at the EPA.

"The computer market is incredibly competitive and the margins so small, that many companies can stay in business only by keeping their costs down," explains Latham. "If Energy Star-compliance leads to more expensive products, many manufacturers may question the value of [participating in] the Energy Star program."

• **International standards.** European PC manufacturers are increasingly being required to take back their used products for disassembly, reuse, and recycling, which has led to a whole to new approach to product design. While such "takeback" laws don't exist in this country (and likely won't, given the current climate) U.S. hardware manufacturers with hefty international sales are paying close attention. It's often cheaper to design a single product for multiple markets, which means American consumers (and the environment) may benefit from Europe's stricter standards.

The success of redesign efforts will largely depend on how easy it is for users to recycle their dead PCs. At the moment, there's no

bilities to their subcontractors and suppliers; dealing with reproductive hazards confronting employees at electronics manufacturing plants; educating buyers to seek out greener products; and on and on.

It won't be an easy journey, particularly in an industry in which new products are obsolete every 18 months. But the past 5 years have seen the PC industry tackle environmental issues head-on, with encouraging results.

"I'm bullish," says Arthur D. Little's Rob Shelton. "It's not going to work right in every company, or not every environmental issue will be properly addressed. But for the first time ever, companies have processes in place that

The Silicon Principles

The Silicon Valley Toxics Coalition (SVTC), along with a consortium called the Campaign for Responsible Technology, has drafted the "Silicon Principles," a set of environmental guidelines it believes should be endorsed by the PC industry. In coming months, the group will be asking companies to endorse the principles listed here, in part by encouraging shareholders to pressure company management.

- ① Establish a comprehensive toxics-use reduction program.
- ② Develop health and safety education programs and health monitoring.
- ③ Work with local communities to establish "Good Neighbor Agreements."
- ④ Implement a Worker Improvement Program and Economic Impact Statements.
- ⑤ Support a national R&D policy directed by civilian (not military) needs.
- ⑥ Establish corporate policies requiring equal standards for subcontractors and suppliers.
- ⑦ Establish corporate standards