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CURRENTS

Toxic Technology

Electronics and the Silicon Valley

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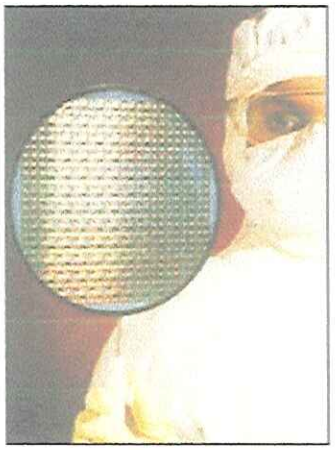

Production of this silicon wafer--a technological marvel--creates a staggering amount of toxic waste.

California's Santa Clara Valley, stretching from the southern reaches of San Francisco to San Jose, was once an agricultural paradise known as the "Valley of the Heart's Delight." Over the past 25 years, however, the region has been transformed from a grower's haven to a toxic wasteland. The culprit? High-tech--the electronics and semi-conductor industry. Better known today as the Silicon Valley, Santa Clara County is home to 29 heavily contaminated Superfund sites, slated for federal cleanup efforts by the Environmental Protection Agency (EPA). Twenty-four of these sites are contaminated by leaks and spills from the electronics industry, especially from companies that manufacture semiconductor devices.

Over 100 different contaminants have been detected in Valley groundwater; the most common include trichloroethylene (TCE), a carcinogen, and 1,1,1-trichloroethane (TCA), which impairs the immune system and causes central nervous system depression. But while Silicon Valley claims the country's highest concentration of Superfund sites, it's not the only part of the world facing the consequences of high-tech pollution. As computer-component production increases to meet the demands of electronics-hungry consumers, the global expansion of the industry--and an increase in its toxicity--are inevitable.

The electronics industry revolves around one minuscule yet important component: the semi-conductor chip. If you were to dissect a computer and lay out all the organs, the brain would be an eight-inch long, fingernail-width silicon wafer intricately etched with millions of transistors. The most complex and expensive part of the computer, this chip also requires the most chemicals for production. Consider the junk-food diet chip manufacturing entails: On average, the production of one eight-inch wafer

(containing hundreds of chips) requires 4,267 cubic feet of bulk gases, 3,787 gallons of waste water, 27 pounds of chemicals, 29 cubic feet of hazardous gases, nine pounds of hazardous waste, and 3,023 gallons of de-ionized water. These chemicals and gases include glycol ethers, which have been identified as "serious reproductive toxins" by the EPA; and arsine, one cylinder of which if leaked could be lethal to an entire semi-conductor production staff. When 220 billion chips per year are taken into account, along with such toxic byproducts as cyanide, phosphine, and sulphuric and nitric acids, the electronic frontier looks like a dangerous place indeed.

The Valley's high-tech headache began in 1982 when a neighborhood action group in Santa Clara County discovered that the Fairchild Semi-conductor Corporation had contaminated San Jose drinking water with a slew of toxic chemicals. Further investigation found birth defect rates in the region to be three times higher than normal, leading outraged community members to combine forces with the Santa Clara Center for Occupational Safety and Health (SCCOSH) to form the Silicon Valley Toxics Coalition (SVTC). Seeking to keep communities and workplaces free from toxic contamination, by 1984 the Coalition convinced the EPA to add 19 Valley sites to its Superfund list. The massive cleanup which followed continues to this day.

Semi-conductor companies now have financial incentives to watch where they dump their sludge. As Ted Smith, executive director of SVTC, puts it, "If you screw up the groundwater it's going to cost you a lot of money." Most companies have detoxified their operations enough to comply with government regulations, substituting environmentally friendly soap and water and citrus juices for some of the nastiest chemical solvents, and eliminating most ozone-depleting chloroflourocarbons (CFCs) from the production process. But many are still involved in an expensive cleanup of their mess from the early '80s. IBM, for instance, pumps and cleans nearly 500 million gallons of water a year in San Jose at a cost of $24 million.

Industrial-sized efforts such as IBM's have done little to reduce the overall amount of hazardous waste generated. According to Smith, pollution has been reduced per unit of production, but the units are on the rise. "It's worse in the sense that there's a lot more high-tech manufacturing. That creates more stress on the environment as it requires more raw materials and generates more waste products."

In all likelihood the stress will continue to build--electronics is the world's largest and most rapidly expanding industry (nearly 140 new semi-conductor manufacturing plants will be built worldwide before the turn of the century). And, says Smith, it's not realistic to think high-tech's growth can be quelled. Nor is that SVTC's goal. "We don't go out there shouting, 'No nukes.' It's more important to get inside the industry to establish strong environmental ethics within each company. Industry is learning that that's good business--that it's expensive to pollute. It's expensive for industry--and for the environment," says Smith.

The most complex and most expensive part of the computer, the semiconductor chip, also requires the most chemicals for production.

Expense may be the only thing industry and the environment have in common in the brutally competitive semiconductor business. In November, 1996, the EPA and the Clinton Administration granted Arizona-based Intel, the world's largest semiconductor manufacturer, the right to change production processes without continually applying to the government for new permits designed to control toxic emissions. This gave Intel a

competitive advantage over the rest of the semi-conductor industry, where the latest, fastest technology is constantly evolving and the winner breaks the market first. "Intel and Microsoft try to get consumers to buy new gadgets every 14 months," says Smith. "I don't see how that can continue. You just can't sustain that type of development considering what it does to the environment."

Although environmentalists are critical of such giant steps toward deregulation, many of those in the semi-conductor business are making an effort to move in the right direction. SEMATECH, a non-profit consortium of 11 semi-conductor manufacturers (including IBM and Motorola) based in Austin, Texas, has a $200 million annual budget, half of which is paid for by taxpayers through the U.S. Department of Defense. Ten percent of that ($10 million) has been earmarked for research on environmentally friendly technology. Miller Bonner, a spokesperson for SEMATECH, says that member companies are working to address environmental issues in the semi-conductor industry. "Whenever we can," says Bonner, "finding the means of reducing the use of hazardous or dangerous chemicals is in our best interest."

And as those in the Silicon Valley can certainly attest, the elimination of hazardous chemicals is not only in the best interest of the electronics industry, but in the best interest of those who work, live, and play anywhere in an electronic world.

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