Science & Society

Redressing an environmental injustice

The Environmental Protection Agency has just launched a national pilot project to buy out 358 households in an industrially contaminated neighborhood of Pensacola, Fla. As at Love Canal and Times Beach, the only federal community buyouts bigger than this one, the subdivisions and apartment complex slated for demolition at the Escambria Superfund Site possess unhealthy concentrations of toxic compounds, including dioxin. However, other issues also figured into EPA's decision to relocate these households, notes Kenneth A. Lucas, manager of the pilot project at the agency's Atlanta office.

Certainly, this poor and predominantly black neighborhood "has been thought of as an environmental justice site," meaning that it has been subjected to a disproportionate share of industrial activity and pollution, notes Curt Fehn, also in the Atlanta office. Industrial activity gradually surrounded this neighborhood, causing a dramatic devaluation of residential property and marring the community's attractiveness.

Economics also favored the buyout, Lucas said. Once residents leave, the area will be designated for industrial use only, limiting the government's cleanup responsibilities—and costs. Explains Fehn, "If you've got children playing in the dirt in your yard, it needs to be cleaner than if you paved it over with a parking lot for a factory."

Since Nov. 13, six families have sold their homes to the government. Expected to cost some $24 million, the buyout and cleanup could be completed within 3 years. —*J.R.*

Court orders DOE to take nuclear fuel

By law, the Department of Energy has "an unconditional obligation" to begin disposing of high-level radioactive waste and used fuel from commercial power reactors by Jan. 31, 1998, or so ruled the U.S. Court of Appeals for the District of Columbia Circuit last year. Shortly after that ruling, however, DOE notified utilities and state officials that it could not meet the deadline, largely because it lacked an approved site for long-term waste storage, such as the Yucca Mountain facility (SN: 11/1/97, p. 277). Indeed, the agency argues that this nuclear repository can't accept wastes for at least another 12 years.

Meanwhile, the utilities, which have been anteing up billions of dollars to cover the expected costs of DOE's disposal of their wastes, have been running out of space in which to store used fuel. So earlier this year, the utilities returned to court to challenge the legality of DOE's stalling.

On Nov. 14, the appellate court again found for the utilities, saying that DOE's lack-of-storage argument was insufficient grounds for reneging on its contractual obligations. In fact, the court noted that far from being unable to accept wastes, the agency was already routinely doing that for 41 other countries.

The court also ruled that there are means under the Nuclear Waste Policy Act for utilities to find remedies for any waste-holding costs they incur after Jan. 31. —*J.R.*

Industry's R&D funding up, feds' down

By year's end, spending on U.S. research and development programs is expected to total $205.7 billion, a 6.5 percent increase over last year's expenditures and a 3.8 percent increase after accounting for inflation, according to the National Science Foundation. This marks the third year that R&D investments have outpaced the U.S. economy.

Industry laid out the largest investments this year—some $133.3 billion—of which 98 percent went to industry programs. This represents a 7.3 percent increase above inflation. At $62.7 billion, government-supported R&D will show an inflation-adjusted 2.7 percent decrease from last year. This brings federal support of U.S. R&D to 30.5 percent, the lowest share in NSF's 45-year history of record keeping. —*J.R.*

Technology

Protons as memory aids

One of the nightmares of the computer age is losing an important document when a power outage or some other mishap shuts down the computer before the user could save the file. Researchers have now harnessed protons embedded in a layer of silicon dioxide to develop a prototype microelectronic device that stores digital data and retains that information when the power is turned off.

In conventional memory chips, data are stored as patterns of electric charge, which tends to leak away. Those wayward electrons must be replaced regularly, so if the power goes off, the information disappears.

Developed by scientists at the Sandia National Laboratories in Albuquerque and France Telecom in Meylan, the new memory device consists of a layer of silicon dioxide between layers of silicon. When the silicon sandwich is raised to a high temperature and bathed in hydrogen gas, hydrogen molecules enter the material and break up into individual protons and electrons. The protons migrate to the middle layer and stay there when the device is cooled to room temperature. Essentially, "we create a trap for protons in the oxide layer," says Sandia's Daniel M. Fleetwood.

Applying a negative charge to one of the silicon layers attracts the protons to the boundary between the silicon and silicon dioxide layers, where they congregate. A positive charge forces them to the opposite boundary. When the charge is removed, the protons remain where they are. Recent experiments show that the protons stay put for long periods and are not greatly affected by radiation or temperature changes.

"We've now built transistors based on this effect," Fleetwood says. If developed further, the new device may provide an inexpensive, low-power, radiation-tolerant, easy-to-fabricate alternative to current methods of saving data on special chips.—*I.P.*

Against the wall

When a liquid makes contact with a wall, theory suggests, the atoms or molecules of the liquid organize themselves into distinct layers next to the solid surface. Now, J. Friso van der Veen of the University of Amsterdam and his coworkers have obtained direct experimental evidence of such a formation when the liquid metal gallium makes contact with a diamond wall.

The researchers observed X rays scattered by a millimeter-size drop of gallium sitting on a specially prepared, ultraclean diamond surface. The measurements suggest that gallium atoms adjacent to the wall tend to pair up, with one member of the pair next to the diamond interface and the other at a characteristic distance from the surface. That produces a distinct layer of gallium atoms at the interface and another layer about 0.4 nanometer away from the wall, with relatively few gallium atoms wandering about at intermediate distances. Less distinct layers occur at distances that are small multiples of 0.4 nanometer. The spacing of the layers, which matches that of pairs of gallium atoms in the solid state, suggests that the liquid adopts a solidlike structure near the wall.

"The observed layering of liquid gallium against diamond may have implications for our general understanding of freezing transitions in atomic metals and highlights the possible role of the container wall in triggering the crystallization," the researchers conclude in the Nov. 27 NATURE. —*I.P.*

Record fusion power

Experiments carried out at the Joint European Torus, situated near Oxford, England, have set a new world record for power generated in a nuclear fusion reactor. Using a mixture of deuterium and tritium, the reactor reached a peak power of 13 megawatts (SN: 6/11/94, p. 381; 11/16/91, p. 308). —*I.P.*