What Can We Do With Nuclear Waste?

For about the past 50 years, people have been arguing about what to do with radioactive waste. Since the waste is harmful to humans—as well as to the environment—deciding where to put it is a serious problem.

Protection for 10 000 Years

As radioactive isotopes decay, nuclear waste emits all common forms of radioactivity–α-particles, β-particles, γ-radiation, and X rays. When this radiation penetrates living cells, it knocks electrons away from atoms, causing them to become electrically charged ions. As a result, vital biological molecules break apart or form abnormal chemical bonds with other molecules. Often, a cell can repair this damage, but if too many molecules are disrupted, the cell will die. This ionizing radiation can also damage a cell's genetic material (DNA and RNA), causing the cell to divide again and again, out of control. This condition is called cancer.

Because of these hazards, nuclear waste must be sealed and stored until the radioactive isotopes in the waste decay to the point at which radiation reaches a safe level. Some kinds of radioactive waste will require safe storage for at least 10 000 years.

Questions of Disposal

Low-level waste includes materials from the nuclear medicine departments at hospitals, where radioactive isotopes are used to diagnose and treat diseases. The greatest disposal problem involves high-level waste, or HLW. Nearly all HLW consists of used fuel rods from reactors at nuclear power plants; about a third of these rods are replaced every year or two because their supply of fissionable uranium-235 becomes depleted, or spent.

When nuclear power plants in the United States began operating in 1957, engineers had planned to reprocess spent fuel to reclaim fissionable isotopes of uranium and plutonium to make new fuel rods. But people feared that the plutonium made available by reprocessing might be used to build bombs, so that plan was abandoned. Since that time, HLW has continued to accumulate at power plant sites in "temporary" storage facilities that are now nearly full. When there is no more storage space, plants will have to cease operation. Consequently, states and utility