let's LOOK at

Disposal of High-Level Nuclear Wastes

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Garbage. A particular problem of the 20th century society . . . mountains of household garbage, clouds of ash and gases, barrels of chemical wastes and, of course, the high-level radioactive waste discharged from nuclear power plants.

How do we handle it? Where do we put it? How long do we have to look after it?

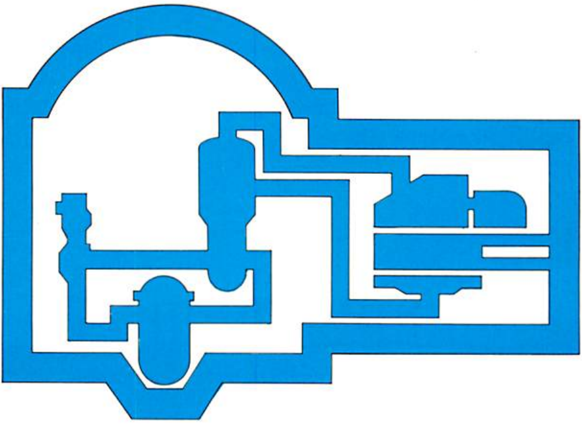
All these questions apply to all kinds of wastes, and in some cases (like chemical herbicides and pesticides), we don't know the answers. Fortunately, we do know the answer in the case of used (spent) nuclear fuel.

A clue to the answer comes from natural history. More than two billion years ago, a natural nuclear fission reaction — the same kind of reaction that makes electricity in nuclear power plants — took place in Africa. Water seeped into a bed of very rich uranium ore and started a natural chain reaction, which created the same kind of waste products as does the chain reaction in a nuclear power plant. And nature stored the waste underground, just as nuclear power plant wastes will be stored.

What happened to it? It's still there, more than two billion years later. Geologists tell us that in all that time, even in the presence of ground water, it has moved less than 30 feet, and it poses no hazard to the people and wildlife in the area. The same is, and will continue to be, true of nuclear power plant wastes.

There are two kinds of nuclear waste — high-level and low-level, differentiated by the amount and kind of radioactivity they contain.

Here we're talking about high-level waste, the kind that comes from the spent power plant fuel (and also from defense activities).

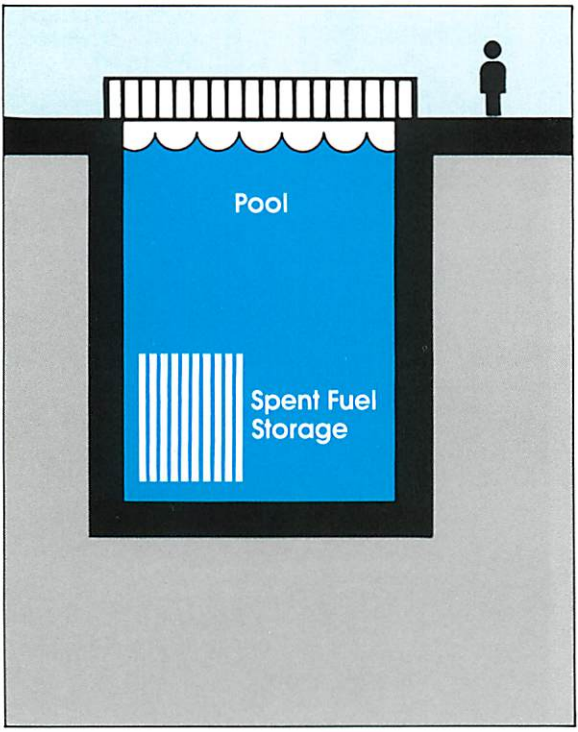


Nuclear power plants are refueled about once a year. At each refueling, some of the old fuel is taken out, because it has "spent" its ability to produce energy efficiently, and replaced with fresh fuel. The fact that this spent fuel, a ceramic substance inside metal tubes, is highly radioactive creates the concerns about disposal . . . how to handle it, where to put it, and how to look after it.

We are all exposed to both natural and man-made radiation every day of our lives. Radiation comes from the earth, from cosmic rays, from medical and dental X-rays; at commonly occurring levels it has no adverse effect on our health. At very high levels, of course, it is dangerous.

But like many of the dangers we face, we know how to deal with it. Even at its peak, the radiation from spent nuclear fuel can be shielded — the dangerous particles and rays stopped

—by 1 foot of lead, 10 feet of dirt, or 20 feet of water. It's water that's now being used to stop the radiation from spent fuel; the discharged fuel rods are stored at the power plant sites in large pools. This kind of waste storage has worked well for the quarter century that commercial nuclear power plants have been in operation, but obviously it's not the answer for the long term.



The long-term answer is underground storage — the same answer that nature provided in Africa eons ago. Clearly a proven answer, proven not only by nature but by well-documented scientific studies. The American Physical Society, for instance, carried out a research program for the National Science Foundation which concluded that safe and reliable management of nuclear waste can be accomplished with existing technologies or straightforward extension of existing capabilities.

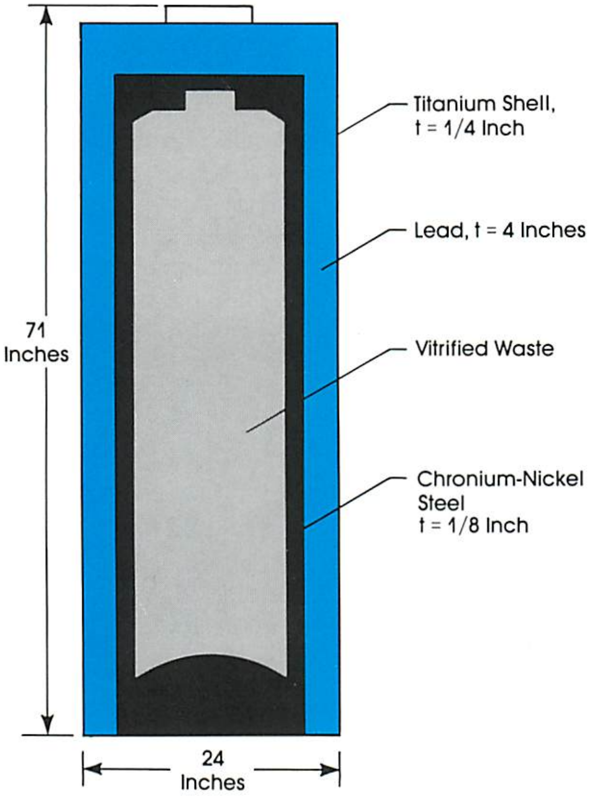
The method most likely to be used consists of burying the waste deep under ground (about a half mile) in carefully selected salt or rock areas, far from any contact with flowing ground water. The waste would be in a water-resistant glass or ceramic form and sealed in corrosion-resistant containers. History again shows how well this kind of storage works, when we look at glass artifacts unearthed from archaeological digs. Samples of glass from excavations in Israel and Egypt, dating back as far as 1500 BC, are in excellent condition.

Egyptian Glass - 3000 Years Old

Roman Glass - 2000 Years Old

From this information, *Archaeology* magazine concludes, "Such remarkable survival rates may bode well for the disposal of nuclear wastes . . . especially when one remembers that the more chemically sophisticated new waste glass cylinders will have less surface area, and thus drastically reduced vulnerability to aging."

Vitrified High Level Waste in Canister of Lead and Titanium



The major potential hazard from underground storage lies in the possibility of contact by ground water. But there has been no flowing water in salt beds, for example, for hundreds of millions of years. (If there had been, the salt would have dissolved!) Even if flowing water should suddenly appear, many thousands of years would pass before the water dissolved the salt and reached the buried waste. And then hundreds of years to dissolve the container and thousands of years to dissolve the glass, and more thousands of years for the waste to reach the surface. By this time, the radioactivity would have long since ceased to be a hazard.

Because radioactivity decreases steadily with time, the danger from nuclear waste (unlike that from chemical waste) gradually disappears. Within 10 years, 90 percent of the radioactivity from spent fuel is gone. Eventually the nuclear waste generated today will be no more dangerous than the naturally occurring uranium ore which was mined to make the fuel.

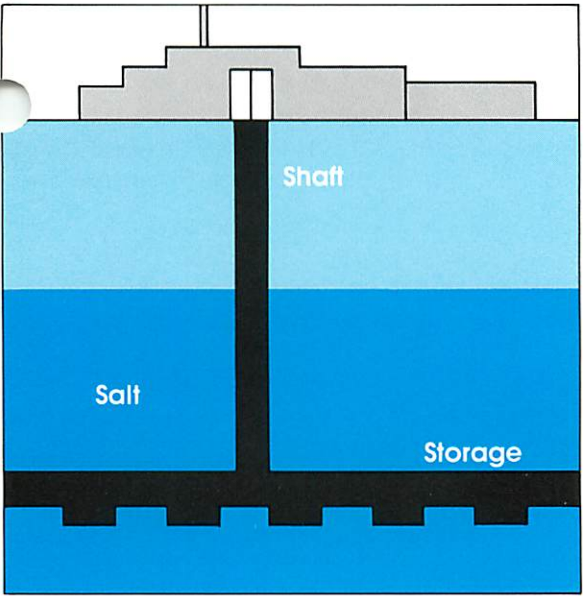
All of this natural and scientific documentation of the safety of high-level waste disposal has led to the Nuclear Waste Policy Act of 1982, which Congress passed to establish a federally mandated system for disposing of nuclear power plant waste. Signed into law on January 7, 1983, the act may be summarized as follows:

- It declares the United States' intention to safely dispose of high-level waste.

- It sets a timetable for site selection and operation of waste repositories.
- It ensures that the costs of disposal are paid by the owners and generators of the spent fuel.
- It provides for involvement of state governments and Indian tribes in deciding on waste disposal sites.

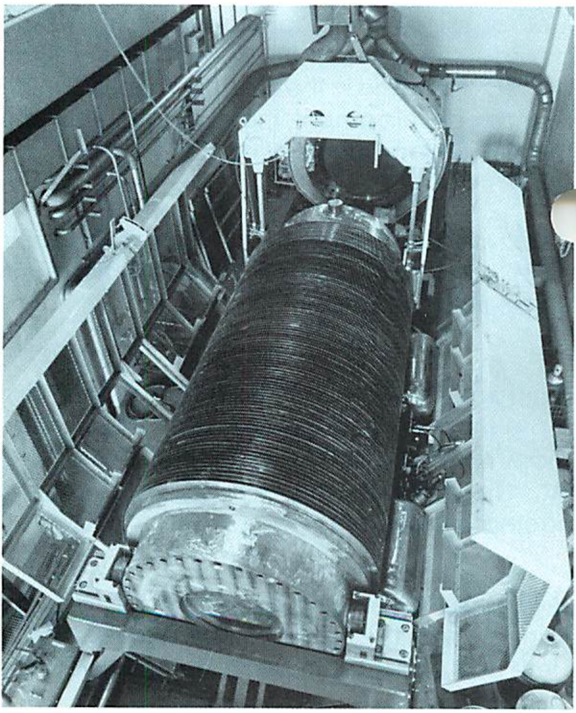
Progress is being made. Nine potential sites have been selected for investigation. The geological stability of these potential sites will be carefully studied, the potential effects to the environment will be determined, and hearings will be held to answer any questions from the public.

Nuclear Waste Facility



The Nuclear Waste Fund is already operational. Utilities with nuclear power plants are being billed a tenth of a cent per kilowatt-hour for nuclear waste disposal; income to the Fund is expected to amount to a half billion dollars annually. Contracts have been signed between the Department of Energy and all the nation's nuclear utilities to allow for eventual disposal of the utilities' nuclear waste, with the utilities paying the cost of the program. (Waste disposal costs will amount to less than 10 cents a month to the average consumer.)

Spent Fuel Handling



These programs will make it possible for spent fuel pools at the nuclear power plant sites to be emptied and the wastes disposed of safely and permanently.

There is potential for even more progress in the future. Although the spent fuel discharged from nuclear power plants has used up its present ability to produce energy efficiently, there's still energy left in it. In fact, 97 percent of the spent fuel consists of uranium and plutonium which can be reprocessed and used as fuel again. This makes it a valuable natural resource in our efforts toward energy independence. Recycling spent fuel to make new fuel for today's nuclear power plants would provide the energy equivalent of 4 billion barrels of oil. And in the breeder reactor, which is under development, the equivalent is more than 30 billion barrels of oil.

This available energy supply is three times the 10-billion-barrel total oil deposit in the north slope fields of Alaska.

Garbage? Not in this context! Dangerous? Not more than we can handle, and less so than many nondecaying wastes. A threat to posterity? No more than the two-billion-year-old nuclear wastes in Africa.

High-level nuclear waste disposal is a question to which the answer exists, here and now. Here and now, the answer is being turned into action.

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