When a nuclear reactor dies…
$98 million is a cheap funeral.

by Seth Shulman

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The mighty Columbia River carves its way through the Cascade Mountains of the northwestern United States to leave a massive swath of running water dividing Washington and Oregon. Standing on its gorge-ridden banks, one cannot help but feel humbled. Every day the Columbia irrigates seven million acres of land and delivers a steady surge of electricity to the entire region, as well as to parts of Los Angeles, nearly a thousand miles away.

Today, the river's quiet power is especially striking as a tiny dot of a barge called the Paul Bunyan peeks over the hazy horizon. It is hard to believe that the barge, Hanked by tugboats and dwarfed by its surroundings, totes a thousand-ton payload. Over its 30-million-year history, the river has never known the likes of this barge's cargo. On board, like a huge sepulcher, is the spent reactor vessel from the world's first commercial nuclear-power plant.

A milestone for the nuclear industry

Almost silently, the Paul Bunyan navigates the last leg of what must rank as one of the world's longest funereal journeys. Setting off from the outskirts of Pittsburgh, Pennsylvania, the nuclear remains have traveled down the Ohio and Mississippi rivers, into the Gulf of Mexico, through the Panama Canal, up the Pacific coast, and now inland on the Columbia en route to an earthen burial in a trench on the Hanford Military Reservation (pop. 30,000) in southeastern Washington.

Beyond even the impressive 8,100 miles logged, though, the barge voyage represents a significant milestone for the nuclear industry. Shippingport, the nuclear reactor whose spent core now lies atop the barge, was the cornerstone of President Dwight D. Eisenhower's "Atoms for Peace" program. Built in 1957, Shippingport usliered in the age of commercial nuclear-power, generation. Now, fittingly perhaps, the Shippingport reactor vessel's final voyage also halls a new chapter for nuclear power. Its demise is being used by the U.S. Department of Energy as a model project to show the world that nuclear reactors can be shut down and torn apart safely.

Until recently, this was not a pressing issue, given the more urgent (and as yet unsolved) problem of how to dispose of a nuclear reactor's fuel rods, which can power a reactor for only about three years. The spent fuel rods-the most highly radioactive entities known on the planet-are still the major problem on the industry's hands, and it is worth pausing for a moment to contemplate their nature.

The fuel for a nuclear reactor is made up of small pellets of uranium poured into thin metal rods 12 feet long. Each full-size reactor holds roughly

40,000-50,000 of these pencil-thin rods, wrapped in groups called fuel assemblies. Every year, approximately a third of a reactor's extremely radioactive rods need to be disposed of. The rods are said to he "spent" but, actually, during their time in the reactor they have become far more radioactive than when they were inserted.

In the United States, the spent fuel from commercial nuclear-power generation-now totaling some 22,500 tons-is nearly all stored temporarily in water-filled cooling ponds adjacent to the nation's reactors. Many of these ponds are already filled to capacity, but more waste than ever is currently being generated; its volume is expected to double within the decade. And the proposed high-level waste repository deep inside Yucca Mountain in Nevada is still far from ready to receive it.

Everyone knew, of course, that in the long run the reactors themselves, with their roughly 30-year operating life spans, would eventually face the retirement quandary: at least 50 nuclear power plants in the Western world will reach retirement age within the next decade. About a dozen U.S. reactors are ready now for decommissioning, a process that formally terminates a nuclear power plant's operating license and is supposed to clean up residual radioactivity, leaving the site safe for other uses.

Indeed, the problem of disposing of all wastes from nuclear reactors, military as well as commercial, has lately become a matter of nationwide planning and controversy. Currently, federal law calls on states to create regional or individual dumps for "low-level" waste (which can run the gamut from relatively harmless to absolutely lethal) by 1993. The selection process has sparked growing "nimby-ism" ("not in my backyard") as Americans discover, according to one recent report, "that nuclear waste is coming soon to a dump near them. "High-level waste from military sites, except for spent fuel, is destined for burial near Carlsbad, New Mexico, although there is much controversy over the site (see sidebar, page 66). And the spent fuel from both military and civilian reactors awaits a tomb tunneled into Yucca Mountain, a site scientists are also questioning (it lies between two prominent earthquake faults and 12 miles from a still-young volcano).

Today, however, 32 years into the age of commercial nuclear power, Shippingport provides a firsthand glimpse of what is actually entailed in the process of decommissioning a nuclear plant. It signals, too, that many daunting challenges still lie ahead as we face the prospect of eventually dismantling the more than 500 reactors now on-line or under construction worldwide.

In this context, a moment of history is marked by the Paul Bunyan's arrival. On a hot and dry Wednesday last spring at a gravel-strewn dock on the outskirts of Richland, Washington, in the remote southeastern corner of the state, a scattered crowd of about a hundred have meandered by on their lunch hour. Some workers front the nearby Hanford Military Reservation have a small office pool under way, a friendly competition to bet on the precise time the barge will dock. Except for the local television cameras and special federal police, it looks hardly like the history-making scene that project manager john Schreiber will assure you it is.

The Paul Bunyan docks at 1:20 P.M., and almost immediately a team of workers with blowtorches attacks the pedestal of the reactor vessel to unweld it from the barge. Officials from Washington and Oregon climb onto the platform with hand-held Geiger counters to take surface measurements of the low-level radiation that the vessel is emitting. Schreiber hustles down to the guarded dock area to join the action. He has spent the past few days following the barge along the Columbia's shore in his black, rented sedan, hopping out in the heat every few miles on banks and bridges to check the progress. His forehead is red from the miles of sun-beaten surveillance and it adds somehow to his marinelike appearance. For Schreiber, the barge's arrival is a tangible culmination of the Department of Energy's five years of work on the project. From here the vessel has only to be brought some 30 miles overland to its burial on the Hanford Reservation. "Shippingport shows that we can decommission nuclear power plants safely," Schrelber will say later, "with standard tools and with radiation exposure to the workers well below acceptable standards." For now, though, he is consumed with the details accompanying the Paul Bunyan's landing.

Although he is not focusing on it now, Schreiber has taken a good deal of criticism for some of the choices made by the Department of Energy in the Shippingport project. Some critics see the reactor vessel's lengthy voyage to a military dumpsite as an embarrassment, only underscoring the siting obstacles facing Lhe disposal of future commercial reactors. At present no civilian site in the United States is willing to take such nuclear debris, and Hanford was available only because of the government's oversight of this unique pilot project.

Many also question the Energy Department's decision to ship the nuclear reactor vessel in one piece. Shippingport, at 72 megawatts, was a relatively small reactor. Decommissioning a full-size, 1,000-megawatt, modern commercial reactor, according to many experts, will almost certainly require carving the vessel into smaller pieces, a problematic and high-radiationproducing step that the department notably managed to avoid in Shippingport's decommissioning-taking some of the shine off Schreiber's sweeping claims for the project.

But now is a time when Schreiber understandably takes a good deal of pride in his work. Despite everything, the job is on schedule for its 1990 completion and is even slightly under its $100 million budget. The project has managed to avoid any large-scale catastrophes and has weathered countless minor debacles, "We do wear a belt and suspenders," Schreiber says, "although no one gives us credit for it."

Only a few bright streaks against the tarp covering the vessel mar Schreiber's message-markings left by several dozen protesters on nearby bridges who, as the barge passed, pelted it with balloons filled with fluorescent green paint. The streaks of paint reflect tile opposition of many activists and residents in Washington and Oregon to the disposal plan for the Shippingport reactor. They also make it clear how much times have changed since the reactor was horn.

Shippingport's tale is really nothing less than the story of commercial nuclear-power generation. The story began in September 1954, in a much-publicized media event from a Denver television station where President Eisenhower waved a "radioactive wand"-a neutron source-in front of a small detector. This device sent a radio signal that triggered the groundbreaking for the Shippingport Atomic Power Station. These were the heady days of nuclear power. In the year following Shippingport's completion, Lewis Strauss, the second chairman of the Atomic Energy Commission, made his now-famous prediction that nuclear energy would soon be "too cheap to meter."

It is clear now that the Shippingport reactor was more a key component of a public relations campaign than a technical or economic breakthrough. At the time, the Eisenhower Administration was preoccupied with the fact that the Soviet Union had made its own nuclear weapons, and had just brought on-line its first weapons-producing and electricity-generating reactor at Obninsk. Shippingport offered a way to offset the Soviet Union's newfound nuclear limelight-making the United States the world leader in the peaceful use of the atom.

Ironically, the "civilian" Shippingport reactor was actually a military prototype originally planned as a propulsion system to power a ship in Adm. Hyman Rickover's still-youthful nuclear Navy. The reactor was a scaled-up version of a design the Navy had already used successfully in its submarines, a so-called pressurized water reactor. In this type of reactor design, still the most commonly used throughout the world, the nuclear fuel heats water under high pressure in the reactor vessel. The pressurized water is pumped through pipes that get hot enough to boil coolant water into steam, which in turn is captured to drive turbines that generate electricity.

Shippingport actually began generating commercial electricity for a local utility company by the end of 1957. In truth, though, like the feeble man behind the curtain who was operating the visage of the Wizard of Oz, the Shippingport reactor's record shrank beside its own image. Shippingport was acknowledged carly on to be an economic failure, producing electricity more than ten times as expensive as that generated by conventional coal-fired plants of the day. But to early proponents of nuclear energy, it didn't matter. Shippingport was a symbol of a new age. And the utility didn't mind, because Shippingport was a heavily subsidized government project. Part of the arrangement dictated that the government would be responsible for the project from cradle to grave, which explains the Energy Department's involvement today. In decommissioning other large-scale commercial nuclear-power plants in the years ahead, however, the industry will be left on its own.

Shippingport's symbolic mystique continues to overshadow reality even in its demise. The reactor vessel's burial isn't triggered by a "radioactive wand" but it is a media event just the same, a symbol being used to benefit the nuclear industry. Little matter that the Hanford Reservation is already home to six similar reactor vessels removed from decommissioned nuclear submarines and quietly buried by the Navy, or that the government is overseeing the project's every detail, depositing a government-built reactor on a government-built reservation. This, we are told repeatedly, is a prototype of the first commercial disposal effort of its kind, a demonstration that promises many successful efforts from the nuclear power industry in the future.

On Thursday morning at the dock, the task ahead is to haul the mammoth cylinder on its 320-wheel transport trailer to its designated burial site at Hanford. Three huge trucks with names such as "Mary Ann" and "Big Jim" painted above their front fenders spew diesel fumes as they strain to lug the reactor vessel off the barge. But on the twisting gravel grade away from the dock they lose their traction and slip back down. Eventually, two more enormous vehicles must be recruited to aid the cause, underscoring the uncertainties involved in the entire decommissioning process. Finally, the ungainly caravan manages to take the first hill leading away from the dock, but even with all this horsepower, the trucks can only move about three miles per hour, and even that pace seems difficult.

The line of cars following along carrying reporters, amateur photographers and other interested observers makes a very appropriate cortege. If only they all had their headlights turned on, it would seem much like an ordinary funeral procession behind a quite extraordinary hearse. As evening falls, the vessel is parked on a Hanford service road, starkly, incongruously posed against the sunset and just visible from the edge of town.

Meanwhile, in Shippingport, Pennsylvania, 25 miles outside of Pittsburgh, the reactor vessel's former home

is quiet. It still looks like a messy construction site, but not much is left here. It will take almost a year to complete the project's mandate of returning the site to the Duquesne Light Company (the Pittsburgh utility that ran the Shippingport plant) for unrestricted use. But when it is all over, john Schreiber stresses, "the place will be as safe as my backyard."

There is little sign now at the Shippingport site of the years of demolition work that have taken place, but a clue to the project's magnitude are the fragments of several dense cement foundations marking the muddy earth, six feet thick in places.

With this kind of bulky composition, nuclear power plants would be tough to dismantle even if they were not radioactive. The same massive structure touted for its safety by the nuclear industry during the plant's construction and operation has now returned to haunt the industry in the decommissioning process.

About 15 percent of all the materials used in the construction of an average reactor will emit a discernible amount of radiation at decommissioning time. While most of these materials will contain only low levels of radioactivity, they make up a hefty volume: some 160,000 cubic feet, or enough to cover a football field 12 feet deep in debris. Significantly, though, these figures do not include the nuclear fuel rods that drive the fission reaction in a power plant. While comparatively small in size, these fuel rods account for the overwhelming majority of radioactivity at a nuclear power plant.

A nuclear reactor's fuel is not normally considered a part of the decommissioning process because it is assumed that the fuel will be removed prior to decommissioning. In fact, no country in the world has yet settled upon exactly what to do with these extremely radioactive spent fuel rods. For the decommissioning of Shippingport, though, the problem of where to store its used fuel was bypassed. The fuel assemblies were moved, temporarily, to a military facility in Idaho.

Lifting a 1,000-ton reactor vessel

Tearing down a nuclear reactor makes for an odd kind of demolition work, combining large and complex tools with some painstaking hand labor. Pat Coughlin, the principal engineer for the Shippingport decommissioning project, becomes animated when he talks about the operation he helped design and oversee to lift the 1,000-ton reactor vessel from its underground housing. For this key step a huge frame of steel girders was built, replete with four huge hydraulic jacks and more than 30 steel cables. The jacks, something like those used at a garage to lift up your car, were strong enough to lift more than 6,000 tons, or the equivalent of several shopping-center parking lots' worth of cars. When the steel frame was complete, the jacks hoisted the reactor vessel 77 feet into the air, moved it half again as far horizontally along a track and lowered it onto the transport trailer. "It worked like a charm," says Coughlin proudly, "but that baby was heavy."

The Energy Department's decision to remove the reactor vessel whole, which avoided cutting apart the radioactive structure, saved $7 million and dramatically lessened worker exposure to radiation, Schreiber stresses. This is true, but critics like Cynthia Pollock Shea, a senior researcher at the Worldwatch Institute, and Michael Pasqualetti, a decommissioning expert at Arizona State University, warn that such a procedure will not be possible for larger reactors. Because of this, they say, the Department of Energy missed an important opportunity with Shippingport to test the remotecontrol technologies that will be needed to carve up reactor vessels in future efforts, when government resources will not be on tap.

Even at Shippingport, handling the reactor vessel required caution. Dozens of workers in protective suits with radiation detectors began work in 1985, tearing apart the outside emergency cooling-water tanks with picks, shovels and drills. Then, by hand, they scrubbed down the radioactive residue from the walls inside the plant. Later, the job required bulldozers and backhoes, blowtorches and larger plasma torches, explosives and even wrecking balls. During the height of activity in tearing down the main containment building, more than 200 workers attacked various aspects of the project. All this labor generated vast amounts of debris, which workers sorted into piles of radioactive and nonradioactive material. Over the next few years, aside from the barge that would eventually transport Shippingport's reactor vessel, more than a hundred large truckloads of radioactive waste were driven across the country to the dump at Hanford. The sheer quantity of low-level radioactive debris generated by dismantling a reactor presents the final major dilemma of the decommissioning process. Currently none of the three operating disposal facilities for low-level commercial waste will accept the volume of debris a decommissioned reactor produces. The prospect of creating the numerous repositories needed around the country to bury the remains of existing nuclear power plants is so politically volatile that renewed consideration is being given by industry and environmental groups alike to leaving the reactors standing indefinitely. The simplest plan would entail posting guards around the plants, at least until some other solution is found. A more elaborate version would be a kind of mothballing, or "entombment," encasing the reactors in concrete. These plans, though, are unsettling in that many of the reactors that will eventually be retired are in or near populated areas. Because potentially dangerous levels of radiation will be present for tens, or even hundreds, of thousands of years, the prospect of leaving a nuclear reactor, emitting low levels of radioactivity, to decay and possibly even be forgotten centuries into the future is not a comforting one. These concerns would remain even if the spent fuel rods were stored elsewhere, as DOE experts contemplate.

For Shippingport, decommissioning was possible because of the availability of the Hanford Military Reservation. The choice of Hanford as the site for Shippingport's remains is rife with historical and political irony. In many ways, Hanford and Shippingport are like matched halves of the nuclear age. What Shippingport was to civilian nuclear-power generation, Hanford was to weapons production. The Hanford Reservation was established as a top-secret location during World War II to produce weapons material for the Manhattan Project. It was here on this sagebrushdesert reservation half the size of Rhode Island that the nation's first significant quantities of plutonium were made, including the plutonium used for the bomb dropped on Nagasaki, Japan. After the Army Corps of Engineers selected the remote site in 1943, work began here at a furious pace. Almost overnight a city of 30,000 workers was imported-virtually none of whom had an inkling of what they were working to build. "company town" sprang up next to Hanford and, in the intervening 40 years, it has become the sprawling tri-city area of Richland, Pasco and Kenniwick.

Given its history, it is understandable that tri-city residents take a lot of pride in the reservation for which so many of them work. Around here just about everybody or their parents or grandparents was 'involved in the major war effort that the Hanford Reservation initially represented. But driving down Richland's Proton Avenue, or past Pasco's Atomic Foods and nearby Atomic Laundry, it is easy to see why outsiders call the place "nuclear city," and often claim that the area has taken it all too far. The high school football team in Richland confirms the feeling. The Bombers, as they are called, have mushroom clouds emblazoned on their helmets; a mushroom cloud also rises, billboard-size, at the end of their home playing field.

A barren landscape of hidden contamination

It's Friday now, and we are inside the gates of the vast Hanford Reservation, well past the guardhouse at the entrance nearest the town. Bill Klink, my escort, reports that a specially trained police force here is armed with submachine guns and attack helicopters to protect against terrorists, but the place seems fairly quiet nonetheless. The day is hot, and the mood has dimmed a bit. Inside the guarded reservation, the reporters are gone, as are the casual onlookers. But there is still quite a crowd of managers and other personnel on the scene. And there is a good contingent from the site in Pennsylvania. Pat Coughlin came with several other colleagues from Shippingport. They have brought a cooler of soft drinks in the back of their rented car, and they are squinting from a bluff at the vessel being hauled to the western section of the reservation. The bluff is one of only a few elevated vantage points in the entire reservation, and the view is filled with gray-green scrubby flatland-miles and miles of it. From here, the land displays a barren beauty that belies the truth about the hidden contamination it holds. just as Shippingport symbolized the public's hopes about nuclear power, Hanford has come to represent the nuclear age's worst environmental nightmare. During its 40-year history, the Hanford Reservation, with its nine plutonium-producing reactors, has released untold millions of curies of radioactivity into the ground, water and air. In just one example, according to information uncovered by local reporters sifting through some 19,000 pages of government documents, more than a half-million curies of radioactive iodine-131 were released into the atmosphere at Hanford between 1944 and 1957. The accident at Three Mile Island, by comparison, released only 15-24 curies. This spring, Governor Booth Gardner of Washington and officials from the Department of Energy signed a landmark cleaning agreement for Hanford. The agreement is laudable in its intent, but if anything it dramatized for the world the extent of Hanford's environmental woes. The cost of the 30-year cleanup is estimated at a staggering $57 billion, more than four times greater than the Energy Department's entire budget for fiscal year 1989. The enormous cost of the project reflects the amount of waste material involvedan estimated 30 million cubic feet of nuclear waste and perhaps as much as one hundred times that amount of contaminated soil. From my perch surveying the vast, open scene amid the tailgating workers in the desert sun, the facts and figures seem incomprehensible, otherworldly.

It won't be until the next day that the vessel is finally driven into its trench but, impatient with its pace, Klink and I leave the bluff to drive the last seven miles to the final resting place. Here, adjacent to Shippingport's assigned trench, are row upon row of thousands of black drums of "transuranic" waste, long-lived but slightly less radioactive than high-level waste material. And just a hundred yards away lies Hanford's most notorious site, where hundreds of large underground storage tanks have leaked more than 500,000 gallons of high-level liquid waste into the ground. That the majority of the hundreds of single-shell tanks built between the 1950s and the 1970s have breached is a tragedy of immeasurable proportion. And despite the recent cleanup plan, no one has any idea how to clean this facet of the site's contamination. The entire area surrounding the underground tank farm is dangerous. And the tanks themselves are still filled with corroding, highly radioactive sediment.

Of all the travesties that have recently come to light about the handling of radioactive materials at the Energy Department's facilities around the country, Hanford's underground tanks may be the most egregious. But they have much competition. Serious radiation leaks have been found at every one of the Energy Department's 16 major nuclear-weapons-production facilities, leaks that have forced many of these facilities to shut down permanently. Yet a wooden sign at the edge of the Shippingport trench gives the entire area an unnervingly euphemistic label. It reads: "Burial Garden."

Early the next morning the trucks will pull away from the site and leave the dry, gravelly dust to settle around the reactor vessel, perched upon a steel pedestal at the bottom of the trench. At some future date when more waste has been added, the trench will at last be filled.

There, under the earth, the Shippingport reactor vessel will continue to emit a low, but discernible, level of radiation for 100,000 years. For this reactor vessel from the world's first commercial nuclear power plant, the job is through. For the nuclear industry, as it faces the legacy left by our reliance upon nuclear power, the real work has yet to begin.

Delay for a dump Pointing out that the Mexican wolf cannot speak for itself, a young man at tile lectern stared across the ten feet that separated him from two U.S. Department of Energy officials and howled. Twice. If the DOE people were surprised, their faces did not show it.

This was the second of two days last June during which 200 or so people in Albuquerque, New Mexico, expressed their views in public hearings about the first-planned permanent nuclear-waste dump, a $700 million project already 15 years in the making, called the Waste Isolation Pilot Project, or WIPP. The site of WIPP is a 200-million-year-old inland sea long since evaporated into a salt bed that is 3,000 feet thick and lies 1,000 feet below the surface in southeastern New Mexico, not far front Carlsbad. Nearly all the rest of the public commentary-much of it rather more technical and closely reasoned than the wolf howls was against the project.

Meanwhile, DOE was garnering a great deal of damaging publicity about leaks of radioactive waste into the environment and other problems at its nationwide string of nuclear weapons plants, and none of this was lost on WIPP's opponents.

What the government is planning to bury here is highly radioactive "nuclear trash" from military sites, everythingexcept for spent fuel rods -from sludge to rubber boots. A half-mile down, huge rooms are being mined out of the ancient salt. A salt burial was selected as best by the National Academy of Sciences as carly as the 1950s, because of salt's tendency to "creep in" and encase the 55gallon drums in a permanent embrace in a geologically stable formation. But problems plagued the project almost from the outset.

When work began in 1975, drilling uncovered a brine pocket and geological "discontinuities" in the salt, and the site had to be moved. At the current site, pockets of brine have also been found in the salt, but scientists at Sandia National Laboratory determined that they are as old as the inland sea itself, satisfying DOE that water will not seep around much in the salt. Other people, including the Attorney General of Texas, fear seepage into the water that lies above and below the salt bed, specifically the Pecos River.

There are many reasons for concern about seepage. Recently, the underground rooms have developed cracks and, due to surrounding pressure, their walls have been closing in three and a half times faster than expected. DOE's response has been to install roof bolts, in the same way that mines are stabilized, and to begin constructing smaller rooms for the first tests of the facility.

Another source of seepage could be from gas pressure building up in the nuclear waste itself, as organic matter such as rubber and fatrics front contaminated clotlies decomposes in the sealed drums. Earlier research suggests that this gas may reach 25 times the pressure needed to create fracturing in the salt tombs after the drums have corroded. DOE now plans to test this by burying small quantities of waste in the new, smaller rooms when ready although some scientists argue that the tests could be done aboveground as easily, with less risk.

At the Albuquerque hearings, and a few days later in Sante Fe, public concerns about WIPP mirrored those of the scientists. Even the National Academy of Sciences would declare in July that the combined problems of room closure, gas generation and brine require "urgent attention." This was in response to a call from Energy Secretary James Watkins, who asked for a thorough NAS review of the entire project when he visited WIPP in June, announcing that it would not open in September as planned. Watkins' openness and emphasis on safety and the environmental concerns was a surprising whiff of glasnost from the head of DOE, an agency tong known for its secrecy.

Even if doubts about the site are ultimately resolved, there is fear about transportation of the nuclear trash to WIPP-fear that a truck will crash, leading to a devastating radioactive leak into the environment. DOE's Jim Tollison calls the fear a "nonissue."

Tollison put the containers for the lethal material through tests designed by the Nuclear Regulatory Commission and carried out by Sandia. The containers, a type called Trupact II, consist of double layers of stainless steel with ceramic foam in between (each holds 14 drums of waste). The tests involved dropping them, loaded with concrete, 30 feet onto concrete pads and 31/2 feet onto six-inch steel spikes, and burning them in jet fuel at thousands of degrees. The NRC has reviewed the results and approved the containers. In the unlikely event of a breach. Tollison says, the accident would be treated like any other hazardous waste spill. Opponents find this a bit cavalier: representatives of the American Public Health Association, for instance, point out that emergency squads along the routes have not had proper training, Others complain that the routes themselves have not been clearly specified, nor has the money DOE promised for bypass highways been forthcoming.

In short, WIPP has been a great tangle of controversy that has both sides pulling their hair in frustration. Meanwhile, the other proposed site for highlevel wastes (the spent fuel from civilian and military reactors) at Yucca Mountain, Nevada, is tangled in even greater controversy. Its planned opening in 1998 has been postponed until 2003, and no one is betting on that date.