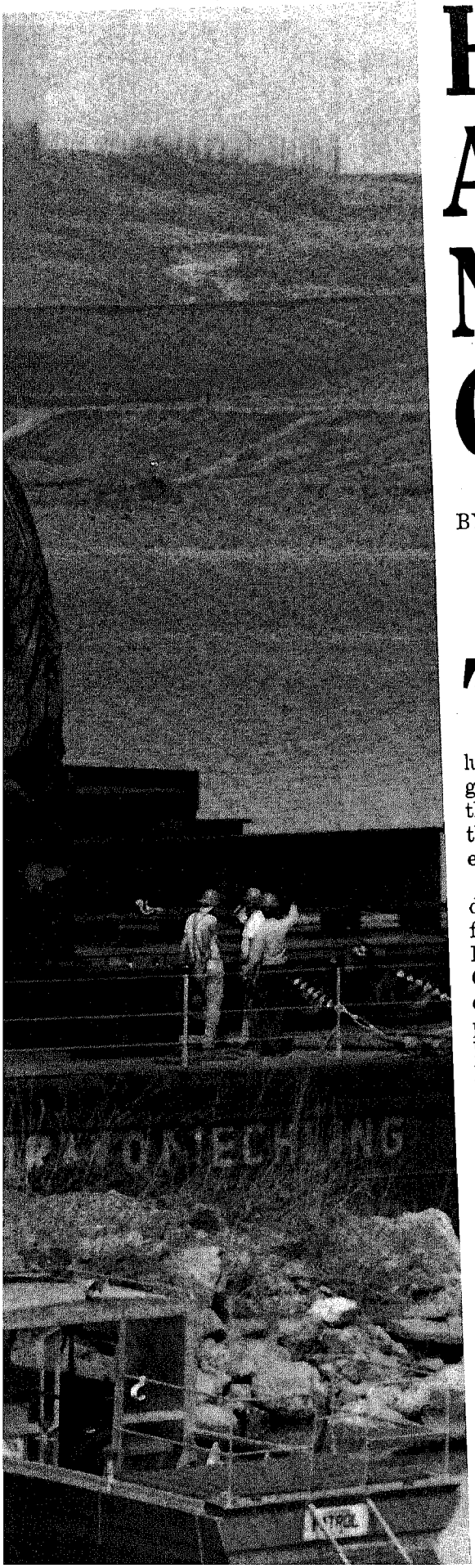
J. BART RAYNIAK, *SPOKESMAN-REVIEW*



HANFORD: AMERICA'S NUCLEAR GRAVEYARD

BY KAREN DORN STEELE

The jackrabbits, burrowing owls, and rattlesnakes that inhabit the arid expanses of the Hanford Nuclear Reservation are radioactive. So is the sagebrush and lupine. So are many of the shoreline and underground springs discharging groundwater into the mighty Columbia River that bends around the northeast perimeter of this desolate, guarded place in eastern Washington.

Just 50 years ago several Indian tribes wandered and foraged this land, and 6,000 farmers from the towns of Hanford, Richland, and White Bluffs grew fruit in orchards irrigated from the Columbia. But after the Manhattan Project expropriated 570 square miles of land in 1943, plutonium and its lasting legacy, nuclear waste, became Hanford's crop, forever altering the land.

Plutonium from Hanford was the stuff of the second atomic bomb, which was dropped on Nagasaki August 9, 1945. During the war and throughout the Cold War and the recent arms buildups of the Carter and Reagan administrations, deadly wastes from the plutonium production and extraction processes were dumped into soil and trenches or poured into million-gallon steel tanks. Some of the tanks cracked and leaked after the liquids were mixed with chem-

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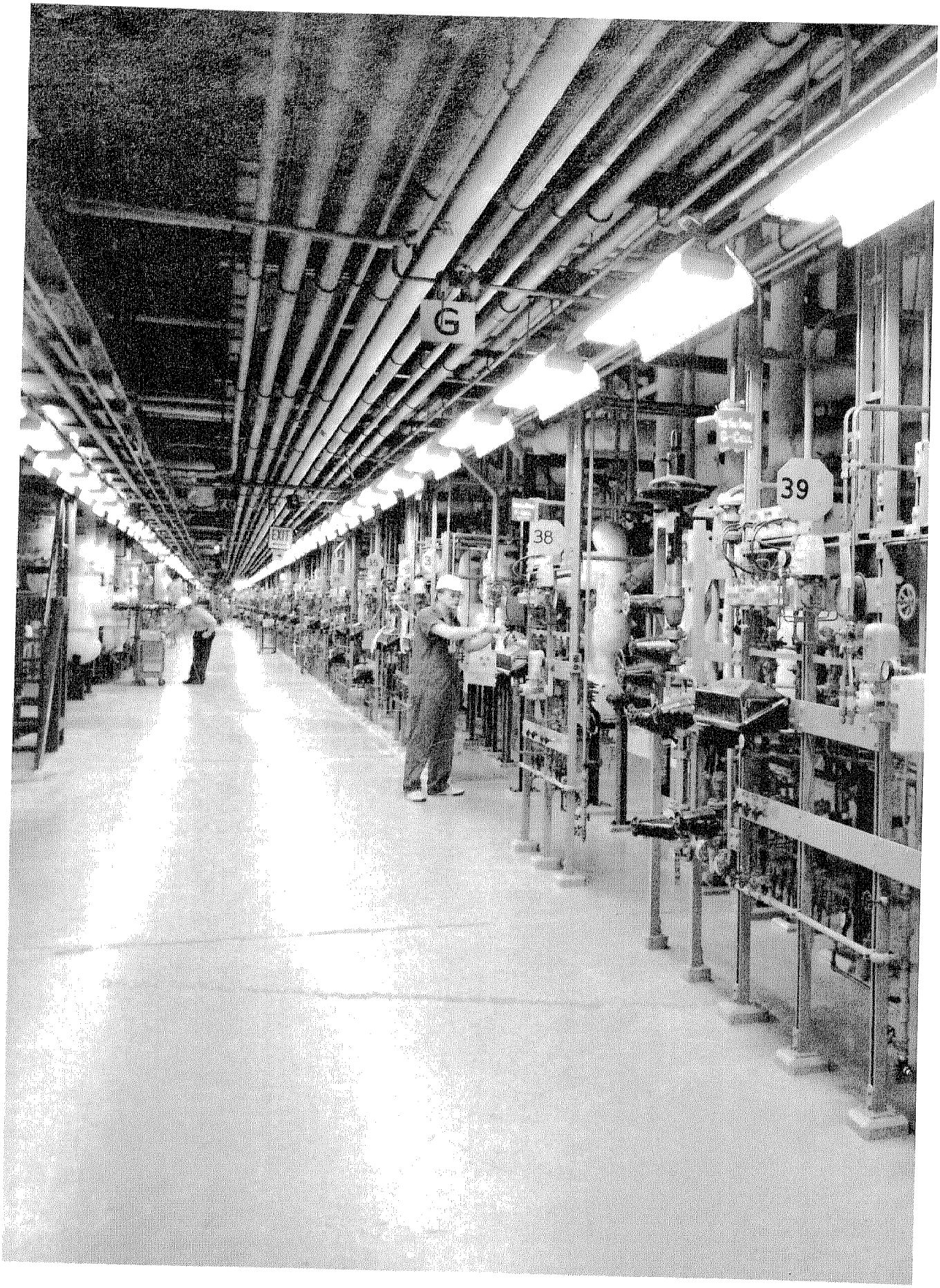
Shippingport reactor vessel arrives for burial, April 1989.



U.S. ENERGY DEPARTMENT

icals in an effort to neutralize the most radioactive materials.

Hanford is also the designated graveyard for reactors from U.S. Navy Polaris submarines. Six are buried there now, and more will follow. And just last spring, the 1,000-ton reactor vessel and 200 truckloads of other debris from the nation's first commercial nuclear reactor, the Shippingport (Pennsylvania) Atomic Power Station, were shipped to Hanford for burial. [See sidebar.]

But although many more commercial power reactors will be decommissioned in coming decades, none of them will be buried at Hanford. Congress halted studies of Hanford as a commercial nuclear waste repository after Washington State filed suit and the Nuclear Regulatory Commission uncovered documents suggesting that water contaminated with iodine 129 from Hanford might have been moving to farm wells on the east side of the Columbia since the 1960s.

Hanford's waste sites, like those at other major weapons complexes, are a dramatic monument to failed "interim" nuclear waste policies initiated during the 1940s. These practices are currently prohibited by environmental laws governing private industry but were allowed at Hanford and other weapons plants under the protective national security umbrellas of the Atomic Energy Acts of 1949 and 1954.

"The Department of Energy and its predecessors have been carrying out their mission to produce nuclear weapons with an attitude of neglect bordering on contempt for environmental protection," said Sen. John Glenn, the Ohio Democrat who has led the fight in Congress to reform the department's practices. "What they've said, in effect, is 'we're going to build bombs and the environment be damned.' "

Enough to flood Manhattan

The government's nuclear undertakers have buried and dumped a complex array of wastes at Hanford. Using data from Energy Department documents, a Spokane group reported: "In early 1985, the cumulative volume of liquid wastes discharged to the environment from Hanford reprocessing plants surpassed 200 billion gallons—enough fluid to cover the isle of Manhattan to a depth of over 40 feet."[1]

More than 60 percent of the nation's high-level radioactive waste from 45 years of weapons production is stored at Hanford, the most contaminated site in the nuclear weapons complex. According to a Hanford contractor's 1985 estimate, inactive waste disposal sites stored about 1.6 billion cubic meters of liquid wastes and

When operating, PUREX generates a million gallons of high-level radioactive waste each year.

Last rites for first commercial reactor

Last April the Shippingport Atomic Power Station was lowered into a 40-foot-deep grave on the Hanford nuclear reservation. It was the end of an 8,100-mile odyssey for the 1,000-ton reactor vessel, which had been barged from Shippingport, Pennsylvania, down the Ohio and Mississippi rivers, through the Panama Canal, up the Pacific coast, and into the Columbia River for the final leg of its journey to Hanford. It also marked the end of a five-year government pilot program to demonstrate how a nuclear reactor could be safely decommissioned.

Local residents unfurled a "welcome to Richland" banner as the huge reactor vessel was nosed to shore by a tugboat on April 13. The reactor was then slowly nudged onto a flatbed trailer and trucked to the Hanford reservation 10 miles away. Shippingport's fuel rods had been removed in 1984 and sent to the Idaho National Engineering Laboratory at Idaho Falls. The reactor produced power from 1957 to 1982.

Edward J. Daum, a retired Richland resident and ex-Hanford worker who used to live near the Shippingport reactor, was excited. "It's great that it's here. It produced so much electricity for 25 years. I don't understand what those people downstream were screaming about," Daum said.

At the mouth of the Columbia near Portland, Oregon, and most of the way up the river, members of the Northwest Radiation Alert Network staged protests. Some splattered the tarp-covered reactor and barge with lime-green paint, saying they don't want the Columbia to become a "nuclear highway." A man in a kayak tried to challenge its passage at Astoria, Oregon.

Energy Department officials said the project has proved that one method of dealing with dead reactors—removal and burial—can succeed. "This sets a model for decommissioning, and it also demonstrates how to ship a reactor pressure vessel," said John Schreiber, manager of the project.

Sixty-seven other reactors will be candidates for decommissioning by 2010, but none of them will be buried at Hanford. "This is a one-time shipment," said Energy spokesman Tom Bauman. "It is a decision that was made a long time ago when there were different environmental rules than there are today." Shippingport was government owned, and commercial utilities are prohibited from using federal land.

Shippingport cost $125 million to build in 1950s dollars, and $98 million to decommission. The Nuclear Regulatory Commission said in a 1988 study that each utility should set aside $100–130 million per reactor for decommissioning, but critics say that's not enough for most commercial reactors. A recent estimate for the Fort St. Vrain nuclear plant in Colorado is $400–500 million.

The Shippingport experiment has been criticized by groups which say that moving a small, government-owned reactor has little relevance to tough decisions faced by private utilities by the end of the 1990s. "No way can we take these large reactors on a barge and ship them out to Hanford," said Ken Bossong, director of Public Citizen's Critical Mass Project in Washington, D.C. "In many ways, the Shippingport project is an opportunity that has been squandered."

—K. D. S.

GLOSSARY

Curie: a measure of radioactivity based on the rate of disintegration of one gram of radium: 37 billion disintegrations per second. A picocurie is one trillionth of a curie.

High-level waste: highly radioactive material, containing fission products, traces of uranium and plutonium, and other transuranic elements, that results from chemical reprocessing of spent fuel.

Reprocessing: the means by which spent fuel from a nuclear reactor is separated into waste material for disposal and material to be reused, such as uranium and plutonium.

Transuranic waste: any waste material containing elements with atomic numbers greater than uranium—neptunium, plutonium, americium, and curium, for example.

140,000 cubic meters of solid waste. The soils of the waste trenches, or "cribs," hold about 75,000 metric tons of chemicals and 90,000 curies of radiation. The wastes include:

- 300 acres containing plutonium- and uranium-contaminated wastes which were routinely dumped directly to soils and cribs. The 20,000 curies of transuranics in these soils include 190 kilograms of plutonium—enough for about 40 Nagasaki-sized bombs if the waste were reprocessed and the plutonium extracted.
- 149 single-shell tanks, each with million-gallon capacity. The tanks now contain 46 million gallons of high-level radioactive liquid wastes. Some 66 have been identified as "leakers" or "possible leakers." These tanks are so weak that more wastes cannot be removed without risking further leaks and radiation exposures.
- 28 newer double-shell tanks containing 11.4 million gallons of liquid high-level waste.
- "specific retention basins" where millions of gallons of "marginal" wastes, some originally stored as high-level wastes in tanks, were dumped to gain more space in the tanks.
- at least 10 "reverse wells" where other wastes, including those containing plutonium, were injected deep into the ground. From 1945 to 1947, over four kilograms of plutonium and 75 curies of strontium 90 were disposed of in this manner.
- transuranic-contaminated solid waste from operations before 1970, including plutonium-contaminated waste in cardboard boxes and 55-gallon drums. Eleven waste sites contain 33,000 curies of transuranics with 350 kilograms of plutonium.
- 59,000 curies of post-1970 transuranic solid wastes in temporary storage.
- reactor sections, weighing about 1,000 tons each, from six Polaris submarines retired after about 25 years of service. Four more are destined to follow soon. The Hanford site could accommodate about 100 reactors, about the number the navy expects to retire over the next 20–30 years.
- the nation's first commercial nuclear reactor [see page17].

These are just the known wastes. Energy officials acknowledge that no records exist for some lost burial sites from the Manhattan Project era.

In addition, eight defunct reactors at Hanford await decommissioning. They contain about 10,000 curies of activation and fission products, primarily carbon 14 and cobalt 60. Several other aging facilities eventually must be decommissioned as well. They include PUREX (plutonium-uranium extraction), the world's largest plutonium reprocessing plant. The trouble-plagued plant, which operated from 1956 to 1972 and was restarted in November 1983, was scheduled to keep producing plutonium until 1995. But it was shut down in mid-run last December after a steam pressure problem, and no date for restart is scheduled.

No brownie points in waste

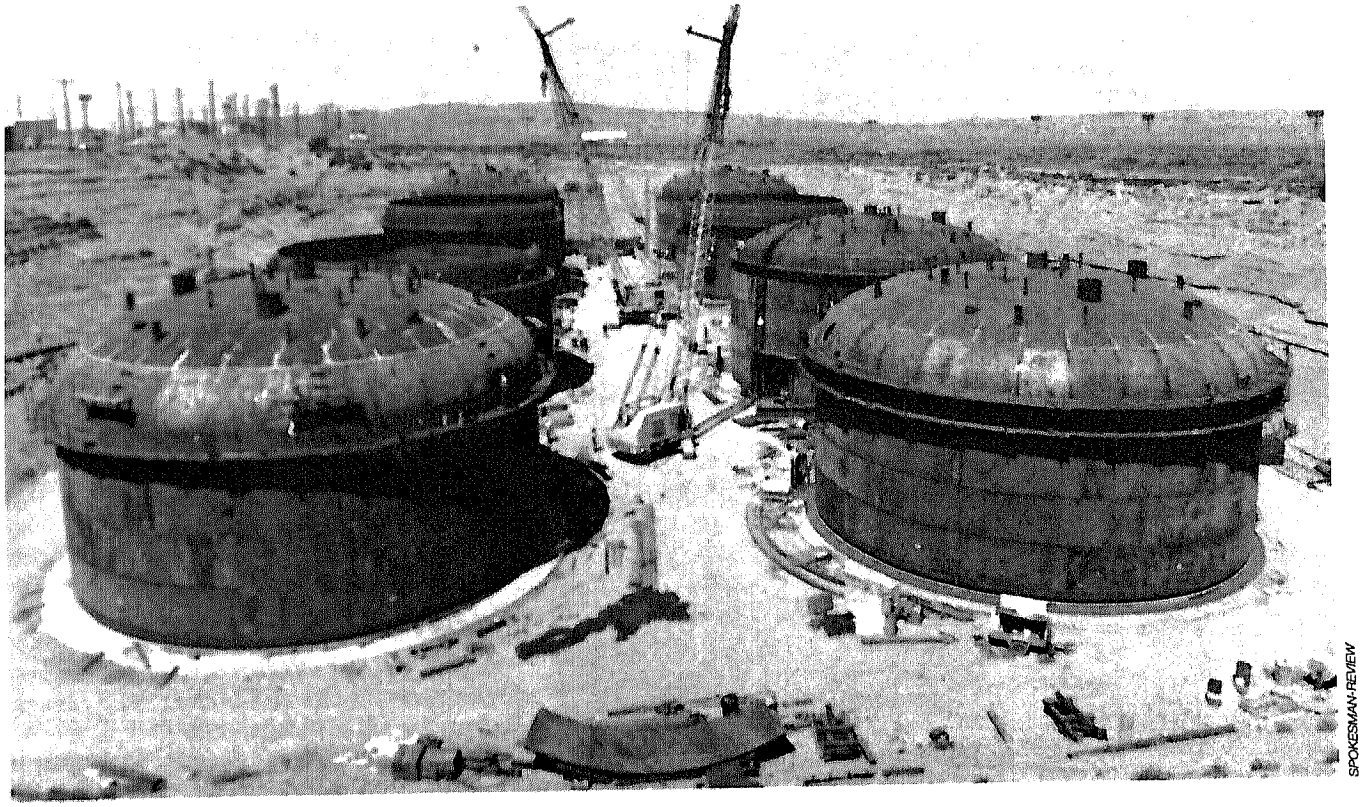
Reprocessing plants like PUREX and its predecessors, which recover plutonium from irradiated uranium, have been responsible for some of the worst environmental contamination at Hanford because they generate huge volumes of toxic chemical and radioactive wastes. The process that produces one kilogram of plutonium at PUREX also produces over 340 gallons of liquid high-level radioactive wastes mixed with hazardous chemicals, more than 55,000 gallons of low- to intermediate-level radioactive wastes discharged to cribs, and over 2.5 million gallons of cooling waters disposed to ponds.[3] Plutonium production generates a million gallons of high-level radioactive waste a year.

Earlier reprocessing plants produced even more wastes because the process was not as efficient. Those wastes remain in 149 fragile single-shell tanks sunk in the desert floor. Constructed during the war, the tanks were made of carbon steel as an interim measure because stainless steel was in short supply. Because reprocessing wastes are acidic, they had to be neutralized so they would not dissolve the tanks. That required adding lye and water. The water increased the volume of the wastes, and the lye created chemical reactions, causing the radioactive elements to precipitate out as sludge. About 90 percent of the sludge concentrated at the bottom of the tanks, where the heat buildup caused cracks.

Hanford managers were worried about the integrity of the tanks as early as the late 1940s. But, as former Atomic Energy Commissioner Carroll L. Wilson wrote in the June 1979 *Bulletin*, waste was "not glamorous, there were no careers, it was messy. Nobody got brownie points for caring about nuclear waste. The Atomic Energy Commission neglected the problem." After the war, the tanks were still thought of as a temporary option—the cheapest alternative when the nation's nuclear arsenal was expanding rapidly. No timetable was established to empty them and devise a more permanent disposal method.

The potential danger of these wastes was dramatically illustrated at Kyshtym in the Soviet Union in 1957, when a chemical explosion occurred in a waste storage tank. Soviet authorities acknowledged last summer for the first time that the blast sent a plume of radioactive isotopes 100 miles downwind.

When the Hanford tanks began to leak in the 1950s, engineers devised a system of "tank farms" with miles of pipe to move the liquids around and allow the radioactivity to decay before moving it back to the original tanks. But



SPOKESMAN-REVIEW

Rust pits have been found in the double-shelled tanks built in the 1970s.

this equipment also leaked, sometimes spilling liquids and contaminating workers. In the 1970s, Hanford's managers built double-shell tanks to hold additional wastes. None of these have leaked, but rust pits have been discovered on the stainless steel liners inside them.

Seeping to the river

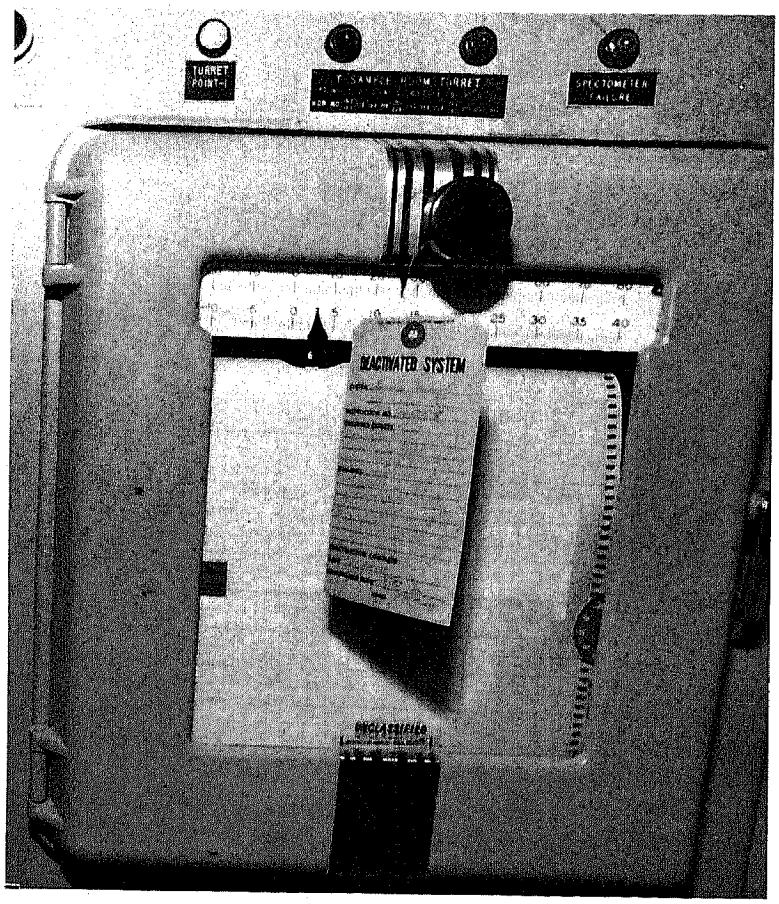
The practice of discharging radioactive wastes directly into the ground, a strategy followed through the 1960s, has caused other problems. Hanford engineers assumed soil particles would trap the most dangerous materials and dilute them to safe levels in a "buffer zone," the large expanse of land between the plants and the site boundary. They believed that Hanford's unique topography, a layer of gravelly soils underlaid by basalt, was an ideal disposal medium. Over the years, 200 billion gallons of low-level radioactive water was dumped into evaporation ponds, seepage basins, and burial pits—enough to raise the entire water table under the nuclear reservation.

Original estimates were that it would take 175–180 years for contaminated groundwater to reach the Columbia. But the first contamination was detected beyond the reservation boundary in 1956, only 11 years after the first plutonium was produced. And when PUREX was built in 1956, it took only seven years for a radioactive tritium plume from reprocessing operations there to reach the river nine miles away. The plume is now adding about 4,000 curies of tritium to the river annually, according to groundwater monitoring reports by Hanford contractor Battelle Pacific Northwest Laboratory.[4] Along one stretch of the Columbia, the tritium is entering the river at average concentrations at or above the Environmental Protection Agency's (EPA) drinking water standard of 20,000 picocuries per liter.

A study funded by Greenpeace has discovered major underwater springs in the Columbia that were discharging nitrates, the major nonradioactive effluent from PUREX, at a rate three times the Battelle estimates. At the most contaminated springs, tritium concentrations measured five times the EPA drinking water standard.

While no Kyshtym-type catastrophe has occurred at U.S. weapons plants, Hanford managers were worried enough about a disposal site called Z-90 Trench that they spent $2 million to dig it up after a cautionary 1972 Atomic Energy Commission report was published. The trench had been filled with wastes containing plutonium, and about 100 kilograms of plutonium had clustered in 1,800 cubic feet of soil. "It is possible to conceive of conditions which could result in a chain reaction," the report warned.

Beginning in September 1983, Robert Cook, the former on-site inspector for the Nuclear Regulatory Commission at Hanford, began studying Hanford's suitability for the nation's first commercial nuclear waste repository. One requirement for issuing a license for a repository was that radioactive water would have to be contained within the site boundaries for at least 1,000 years.



U.S. ENERGY DEPARTMENT

Switch at B Reactor. Some see B as a monument to an exciting physics project, others remember the destruction of Nagasaki.

Cook zeroed in on iodine 129, a byproduct of reprocessing that could be traced and could indicate the off-site migration of radiation from Hanford. Early in 1985, he came across a letter written in June 1973 by L.M. Richards, president of Atlantic Richfield Hanford, site contractor from 1967 to 1976, to the AEC's waste management director. It noted that well tests showed a "strong possibility" that water contaminated with iodine 129 from Hanford was moving through aquifers across the Columbia to farm wells on the east side of the river. Richards suggested that all information on the touchy discovery should be limited to those individuals who have a "need to know."

"It was the thing that really gave me the clue that hey, they really didn't want to put this information out," Cook said in a recent interview. He reported the letter. Cook also discovered unpublished reports and a large Battelle data base on iodine 129 and asked the Energy Department why none of the information had been incorporated into studies of Hanford's suitability as a nuclear waste dump. In 1986, Hanford was eliminated as a potential repository site.

Energy battles Ecology

Within the last year and a half, a series of shutdowns and scandals at weapons plants across the country have riveted public attention on the serious problems within the complex. Now growing pressure from the public, Congress, and other government agencies is forcing the Energy Department to begin to deal with its nuclear waste legacy.

For example, a July 19 report from the General Accounting Office, requested by Northwest congressional representatives, estimated that approximately 743,000 gallons of high-level waste had leaked from the single-shell storage tanks—250,000 more than Energy studies had estimated. Noting that tritium is already reaching the Columbia, and that uranium, strontium 90, and iodine 129 have been detected in groundwater, the study concluded: "Although [the Energy Department] has maintained that the environmental impact of leaks will be extremely low or nonexistent, the studies we reviewed do not provide convincing evidence that this is the case."

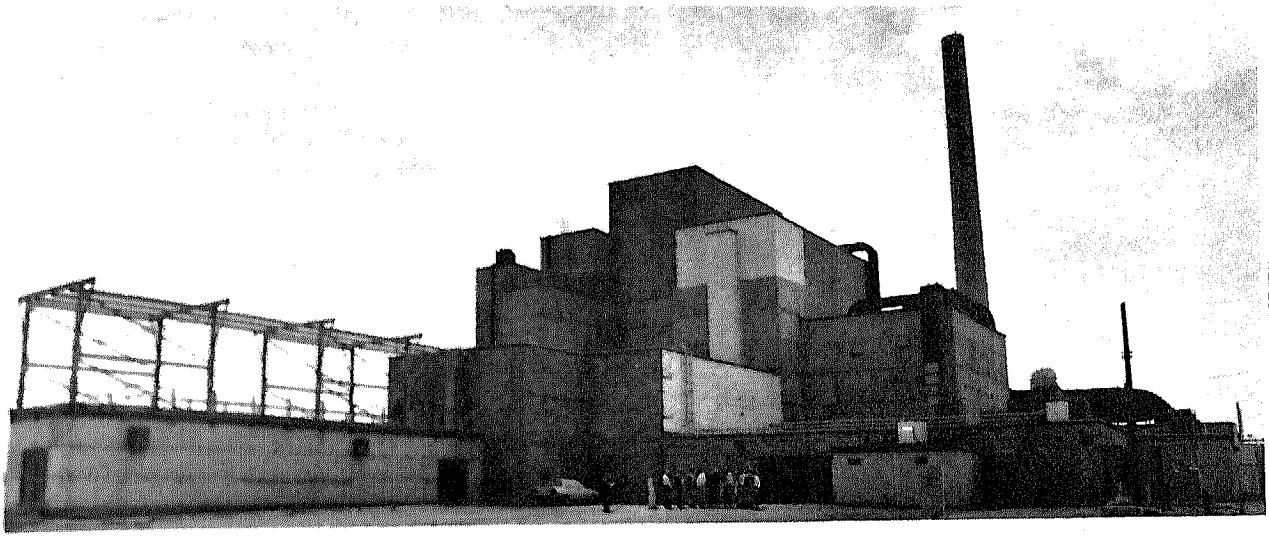
In 1983, Energy submitted a plan to Congress for long-term waste management and cleanup at its major sites. It called for:

- burial of transuranic wastes contaminated with plutonium and other heavy elements in the Waste Isolation Pilot Project (WIPP), a repository in Carlsbad, New Mexico;
- solidifying high-level tank sludge into glass (vitrification) and burying it with wastes from commercial nuclear plants in a deep repository. Yucca Mountain, Nevada, has been designated for this purpose after other states, including Washington, fought the site-selection process.
- mixing cement with low-level radioactive and hazardous liquids that remain in the tanks, in a process called "grouting," and pouring it into concrete-lined pits at Hanford and other sites.

These plans, essential for a thorough Hanford cleanup, are already far off schedule and in trouble. WIPP, which already has cost more than $800 million, was supposed to open last October. But unexpected groundwater seepage and other problems have caused repeated delays at the site deep in the eastern New Mexico desert, where the Energy Department plans to bury as much as six million cubic meters of waste. The delays have led several Western governors to object to continued storage of wastes in their states if there is no permanent disposal solution.

WIPP would not have been large enough to contain all the contaminated soil from Hanford, let alone other sites, if the department had not loosened its standards on dumping plutonium into the soil through the grouting process. The new standard permits 10 times more plutonium to be discarded in the grout, meaning that only 30,000 cubic meters of soil will have to be moved from Hanford to WIPP instead of some 12 million.

The adoption of the 1983 plan marked only a



CHRIS ANDERSON SPOKESMAN-REVIEW

What to do with B Reactor?

The world's first full-scale nuclear reactor, which produced the plutonium for the second atomic bomb dropped on Japan, sits inert near the banks of the Columbia River on the Hanford nuclear reservation—an aging and controversial icon of the nuclear era. B Reactor's fuel assemblies have been removed from its 100,000 machined graphite blocks, and "out of service" tags hang on the old-fashioned rows of gauges and toggle switches in the control room. A simple display describes its role in ending the war.

Aware of its controversial nature, the U.S. Department of Energy is asking the public for help in deciding whether B Reactor should be buried or dismantled and moved with seven other plutonium reactors, or preserved as a museum because of its role in history.

"We are asking for public comment on whether it should be nominated for the National Register of Historic Places," said Roger Freeberg, chief of Energy's restoration branch in Richland.

B Reactor was built in haste, the first engineering feat of the top-secret Manhattan Project. Not until after the atomic bombings of Japan did Hanford workers learn what they had made at B Reactor. "It's Atomic Bombs," read the local newspaper headline.

Opinions are mixed about whether B Reactor deserves designation as a historic landmark. Wallace Howell, a retired Hanford radiation protection worker who worked at B Reactor, remembers the atmosphere of the war years and thinks the reactor should be preserved. "We didn't know exactly what the Germans were doing, but we knew they had advanced nuclear scientists. We were concerned they'd develop a bomb before we did—that was part of the urgency of building it," Howell said. "I think it would be beneficial to keep it. It had a key role in helping to end the war, and it was an amazing piece of engineering work."

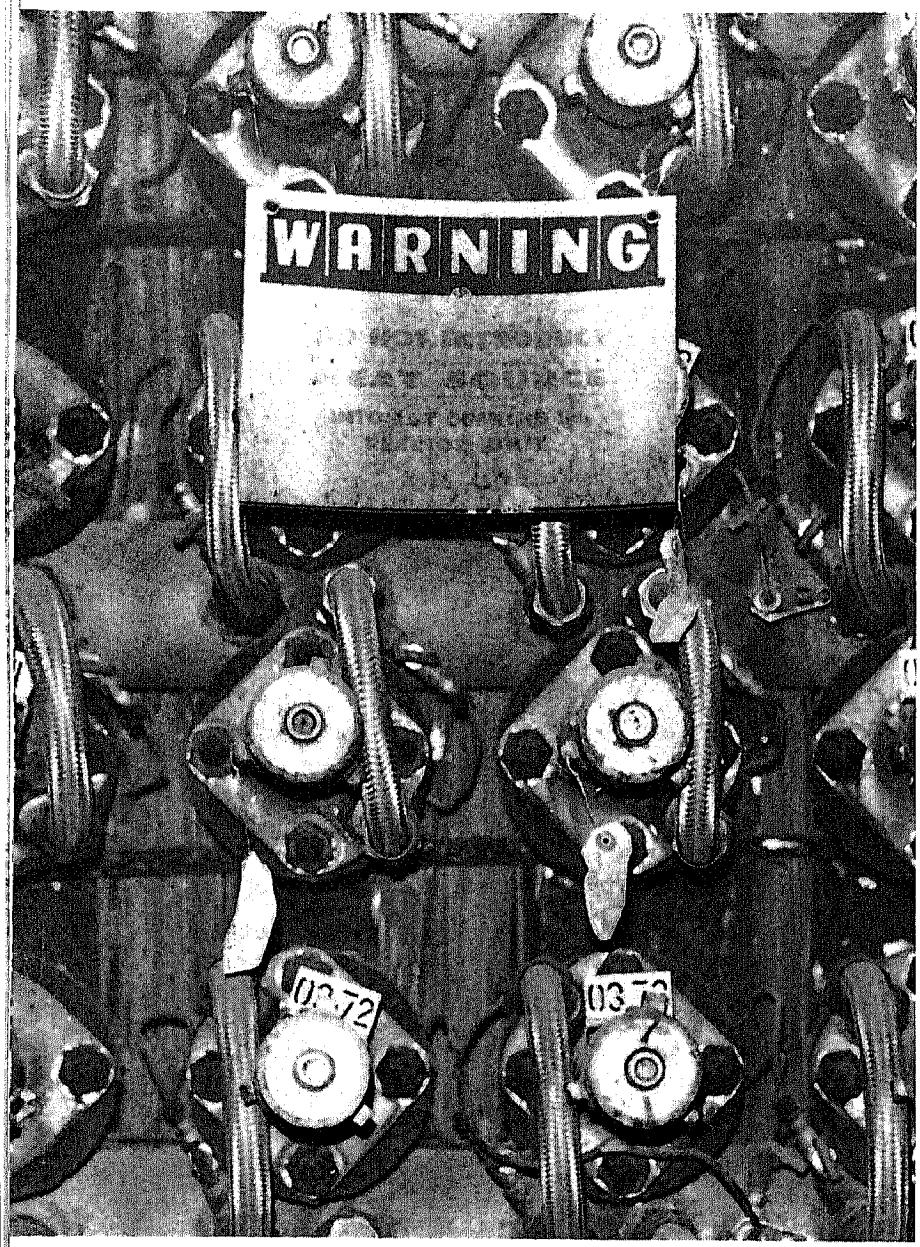
Others are less certain. "There really are two questions: Should it be preserved, and if so, what kind of monument is it going to be?" said Tim Connor, associate director of the Hanford Education Action League (HEAL) of Spokane, a 350-member Hanford watchdog group. "The Hanford community sees it as a very exciting physics project. Our images are of the horror of Nagasaki."

The Energy Department is taking public comment on the fate of seven other defunct plutonium reactors at Hanford as well. The graphite reactors were built between 1943 and 1955 along a 12-mile stretch of the Columbia so they could be cooled by river water. The last one, K East, was shut down in 1971. A sentence in the Energy Department's draft environmental impact statement mentions that the soil column under the K East's storage basin "contains a significant, but not yet fully characterized, radionuclide inventory from a past leak that has been repaired."

Although their highly radioactive fuel has been removed, the reactors contain tens of thousands of curies of radiation that must be shielded from people and from the environment for as long as 4.5 billion years. Decommissioning the ghost-gray nuclear hulks could take 103 years and cost $217 million, depending on the disposal method chosen, according to the draft statement released in spring 1989. Some options would be far less costly.

The reactors either will be left where they are or will be transported to a burial site near the center of the reservation, away from the river. Washington and Oregon state officials are urging the latter option, to protect the public and the environment. Another choice is to act immediately or to wait 75 years, to allow radioactive decay of dangerous cobalt 60. HEAL and other Northwest environmental groups are urging the agency to begin at once.

"By doing the job immediately, citizens have a greater assurance that the reactors will not be forgotten. . . and that the federal government will restore the land to public use," said Jim Thomas, HEAL staff researcher. The department will choose an alternative for dealing with the old reactors by late 1990. —*K. D. S.*



CHRIS ANDERSON, SPOKESMAN-REVIEW

A museum piece? The front face of B Reactor, with plugs filling the channels where fuel rods were once inserted.

temporary truce in a continuing battle between the Energy Department and local, state, and federal custodians of the environment. In Washington State, the conflict was precipitated in the early 1980s, when state officials began insisting that Hanford waste disposal practices should conform to federal and state environmental regulations.

The Resources Conservation and Recovery Act (RCRA), passed in 1976 and reauthorized in 1984, gave states new leverage to deal with soil and groundwater contamination from careless disposal of solid and hazardous liquid wastes. Washington State adopted analogous laws in 1982, and, following the precedent of a successful suit against a weapons site in Tennessee, Washington's Department of Ecology decided to push Hanford for compliance.

In 1984, Roger Stanley, a supervisor in Ecology's industrial section, identified 20 violations of state law at Hanford, including use of unpermitted facilities and failure to install groundwater monitoring systems. Energy responded by changing the rules: it exempted from RCRA coverage all "mixed" wastes, that is, those that contain radioactive as well as hazardous chemical wastes. They cited the Atomic Energy Act, which gives Energy jurisdiction over the radioactive component of the wastes. But according to EPA, RCRA covers mixed wastes. All 24 liquid waste streams from PUREX were declared exempt from RCRA.

The state and the Natural Resources Defense Council, a national environmental group, protested. Senator Glenn proposed giving complete jurisdiction over the mixed wastes to the EPA; after a similar bill was brought to the House, the Energy Department fought back, walking out on subcommittee hearings for the bill in 1986 when critics of department policy were invited to testify. The bills did not pass.

Washington's Ecology Department fined Energy $49,000 for violations in February 1986 and, along with the EPA, demanded compliance on five violations. In July, Energy's Office of General Counsel decreed that the EPA couldn't order it to do anything. Finally, in October 1986, Energy agreed to comply with the order but refused to pay the fine.

Finally, the cleanup?

Negotiations between the state of Washington and the federal government in late 1988 and 1989 marked significant progress in calling a halt to Energy's outmoded waste management practices. On May 15 a landmark cleanup agreement was signed by the state, the EPA, and the Energy Department. It calls for spending $50 billion over the next 30 years on Hanford's worst problems.

Over the next five years, the plan asks Congress for $2.8 billion to: hasten removal of liquids from the single-shell tanks, study how to remove solid wastes from the bottoms of the tanks, install new groundwater monitoring wells, investigate old waste sites, and begin to treat waste from the double-shell tanks in grout and borosilicate glass. Design work will begin on a high-level waste vitrification plant, due to begin operating in 1999.

"The agreement means that, at long last, we can begin a massive effort to clean up the 45 years of accumulated chemical and nuclear wastes at Hanford," Washington Gov. Booth Gardner said in a press conference the day the agreement was signed.

Energy Secretary James Watkins, who has been under pressure from Congress to clean up the defense facilities, agreed: "It is of utmost importance that all of the Department's facilities

be operated in complete compliance with environmental laws and that needed cleanup activities be carried out both promptly and prudently," he said.

The cleanup agreement requires more attention to RCRA. Since 1985, over 130 new monitoring wells have been installed to bring the Hanford site into compliance with state-implemented regulatory requirements of the act. Many of them are at active waste discharge sites, such as PUREX. Fifty of these wells are specially designed to monitor for RCRA-related chemicals, such as volatile organics and trace metals.

The new studies will seek more answers about migration of contaminants from the disposal sites and will characterize in detail Hanford's 33 liquid effluents and how they are affecting area groundwater. A final report is due in August 1990.

But critics have assailed the agreement for two reasons: it cannot require future Congresses to appropriate the funds, and it allows PUREX to continue operating until 1995, generating hundreds of millions of gallons of new wastes. After receiving strong objections to the PUREX exemption from more than 300 people at hearings last March and April, the parties agreed to a separate, 14-month investigation of the liquid waste streams from PUREX and other facilities. When the study is completed next year, the agencies will determine whether some or all of the discharges should be halted or phased out on an accelerated schedule.

With the Tri-Party Agreement, Washington State has joined other states in a move to reform Energy Department practices. At the Western Governors' Conference in July, 17 governors endorsed a resolution calling on Congress to clearly establish that federal agencies must comply with the same laws as other businesses and institutions.

And congressional pressure for cleanup is growing. On July 19, a bill sponsored by Cong. Dennis Eckart, Ohio Democrat, passed the House by a 380–39 margin. It would allow the EPA and state hazardous waste enforcement agencies to penalize the Energy Department with administrative orders and civil penalties if it violates RCRA. The bill would also waive federal sovereign immunity from complying with state and federal environmental regulations, which the department has claimed on the grounds of national security.

In the Senate, Washington's Brock Adams is a cosponsor of the Federal Nuclear Facilities Environmental Response Act, which would establish a dedicated federal trust to finance cleanup, decommissioning, environmental compliance, and long-term monitoring of federal nuclear facilities. The bill would also create a joint Energy-EPA research and development program to develop new compliance and cleanup technologies.

The Bush administration does not support all the provisions of these bills. It prefers only limited state enforcement authority under RCRA, without the right to fine federal agencies. But the Sierra Club's Shira Flax said: "Without the ability to force [the Energy Department] to clean up the very dangerous contamination present at many sites throughout the country, the states are emasculated in their ability to protect public health and the environment."

Some critics of the ambitious Hanford cleanup plans say that the word "cleanup" may be a misnomer. They say it may only be possible to protect groundwater and fence the contaminated areas, creating "national sacrifice zones."

"It's not enough to say, let's clean up the mess we created. We simply don't know how to go about it. It's possible that the cleanup process may be as dangerous as the production of the weapons themselves," said an aide to Senator Glenn.

It will be at least as costly, if not as dangerous. Even now, as the waste continues to pile up, the Energy Department is using about 45 cents of every dollar spent on making bomb materials for waste management. And the staggering sums required for cleanup will be hard to come by in an era of shrinking federal budgets. The sum of $50 billion for Hanford alone "is considered by all involved to be a fairly conservative figure," said Larry Goldstein, an environmental planner with Washington's Department of Ecology.

But groups like Spokane's Hanford Education Action League (HEAL), a citizen group which has lobbied for defense waste cleanup funds, express public sentiment in the Northwest when they insist a thorough effort must be made.

"The Department of Energy has, until now, retained sole authority to determine what are 'acceptable' risks and what are 'environmentally sound' practices," said Tim Connor, HEAL's associate director. "HEAL no longer believes this state of affairs ought to be tolerated by citizens of the Northwest. Fundamental corrections are needed to assure the public that the Hanford wastes will remain safely isolated and insure the protection of the Columbia River." ■

The Energy Department's estimate of $50 billion to clean up Hanford is considered a fairly conservative figure.

1. Tim Connor, "Hot Water: Groundwater Contamination at the Hanford Nuclear Reservation" (Hanford Education Action League, 1986), p. 5.

2. U.S. Department of Energy, "Draft Phase I Installation Assessment of Inactive Waste-Disposal Sites at Hanford" (July 1986), pp. iv and 4.2.

3. U.S. Department of Energy, *Operation of PUREX and Uranium Oxide Plant Facilities*, Draft Environmental Impact Statement 0089D (May 1982), pp. 3.8, 3.12.

4. Pacific Northwest Laboratory, *Environmental Monitoring at Hanford for 1984*, PNL-5407 (May 1985).