United States General Accounting Office

GAO

Report to the Chairman, Environment, Energy, and Natural Resources Subcommittee, Committee on Government Operations, House of Representatives

June 1991

NUCLEAR WASTE

Pretreatment Modifications at DOE Hanford's B Plant Should Be Stopped

GAO/RCED-91-165

GAO

United States
General Accounting Office
Washington, D.C. 20548

Resources, Community, and
Economic Development Division

B-243848

June 12, 1991

The Honorable Mike Synar
Chairman, Environment, Energy, and
Natural Resources Subcommittee
Committee on Government Operations
House of Representatives

Dear Mr. Chairman:

On October 15, 1990, you asked us to determine the current status of pretreatment technologies and facilities for disposing of the high-level radioactive waste stored in underground double-shell tanks at the Department of Energy's (DOE) Hanford Site near Richland, Washington. You were particularly concerned about DOE's plans to modify the 46-year-old B Plant to pretreat the mixed high-level radioactive waste from the double-shell tanks before vitrification—a process that immobilizes the high-level waste by turning it into glass.[1] Consequently, as the first phase of our effort, we evaluated the status and adequacy of DOE's plans and funding for modifying B Plant.

Results in Brief

B Plant does not meet today's regulatory requirements. Since 1987, DOE has had information available that B Plant did not meet specific federal and DOE regulations. Nonetheless, DOE did not discuss its compliance problems with Washington State until the Secretary of Energy advised the governor of these problems in a January 30, 1991, letter. Previously, DOE had assumed that the state would grant waivers to operate B Plant as a pretreatment facility. In March 1991, state officials recommended to members of the state's congressional delegation that DOE abandon B Plant as a pretreatment facility.

Moreover, the new process that DOE is developing to pretreat about 75 percent of the high-level waste requiring pretreatment is currently incompatible with B Plant's waste pipes. A December 1990 DOE study stated that the chemicals used in the process will cause extensive corrosion to B Plant's embedded pipes. No technology has been developed to resolve this problem.

[1]Mixed waste contains both radioactive and hazardous components, as defined by the Atomic Energy Act of 1954, as amended, and the Resource Conservation and Recovery Act of 1976, as amended, respectively.

Given continuing concerns about the viability of B Plant as a pretreatment facility, the Director of DOE's Office of Environmental Restoration and Waste Management directed the DOE Richland Operations Office (DOE Richland) to assess the risks of the Hanford Site vitrification program in September 1990. Preliminary results of this assessment indicate that B Plant will not meet the requirements imposed by federal environmental law. The principal reason for noncompliance, as reported in several earlier DOE studies, is the absence of double containment for pipes, tanks, and other processing facilities.

Despite serious concerns about using B Plant as the pretreatment facility, DOE continues to modify the plant for that purpose. Even though DOE has placed modification projects totaling more than $400 million on hold, five pretreatment projects totaling about $43 million are still under way.

Background

In the early 1980s, DOE began to develop plans for immobilizing and shipping high-level radioactive waste stored in underground tanks to a geologic repository for permanent disposal. DOE selected vitrification, a process chosen by many nations. In vitrification, high-level waste is blended with glass-forming materials to form a molten, radioactive product. This molten product is then poured into stainless steel canisters to cool and solidify. The glass-filled canisters can be stored at the vitrification site for eventual transfer to a geologic waste repository.

Before the waste is vitrified, it must be removed from the underground storage tanks and separated into high-level and low-level radioactive portions in a step called pretreatment. This step is desirable because it decreases the volume of high-level waste that must be vitrified. The remaining low-level waste can be disposed of less expensively than the high-level waste. At the Hanford Site, DOE plans to convert the low-level waste into a cement-like product at the Hanford Site grout facility and dispose of it permanently in near-surface vaults on site. Of the approximately 24 million gallons of double-shell tank waste at Hanford as of March 1991, only about 7 million gallons are estimated to require pretreatment.

The 7 million gallons of double-shell tank waste that will be pretreated consist of four different waste types, which result from different nuclear fuels or reprocessing techniques. The four waste types are neutralized current acid waste, neutralized cladding removal waste, plutonium finishing plant waste, and complexant concentrate.

Since 1983, DOE's official plan has been to use existing facilities, including B Plant, to pretreat all four waste types. B Plant is a 46-year-old facility that was originally used to recover plutonium for nuclear weapons. In the early 1960s, it was refurbished to remove certain high-level radioactive materials—strontium and cesium—from stored tank waste. In 1983, DOE began upgrading B Plant to pretreat the neutralized current acid waste. Modifications have since been undertaken to comply with current DOE facility design criteria and with federal and state environmental regulations. When this waste has been processed, DOE plans to shut down B Plant and refit it before pretreating the remaining three waste types, using a process being developed called Transuranic Extraction (TRUEX). The TRUEX process is expected to treat about 75 percent of the 7 million gallons requiring pretreatment.

As of March 1991, DOE had spent about $23 million on completed capital modifications to B Plant. DOE estimated that additional projects costing about $609 million would be needed to modify the plant.

B Plant Does Not Meet Regulatory Requirements

B Plant does not comply with federal or Washington State environmental regulations or with DOE's own design criteria. Although B Plant did not comply with these regulations, DOE continued to modify B Plant because it considered modification less costly than construction of a new facility and believed that it would allow earlier startup of pretreatment operations.

As a mixed-waste treatment facility, B Plant is subject to regulation under the provisions of the Resource Conservation and Recovery Act of 1976 (RCRA).[2] The Environmental Protection Agency (EPA) authorized the state of Washington to implement the RCRA hazardous waste program within the state on November 23, 1987. RCRA regulations, in effect since January 1987, and Washington State's dangerous waste regulations, in effect since February 1989, require double containment for waste pipes, tanks, and other processing facilities that handle hazardous waste, including mixed waste. In addition, in a December 1987 draft order, DOE headquarters established design criteria that reflected RCRA requirements. In February 1988, DOE headquarters directed all departmental

[2]On July 3, 1986, EPA published a notice (51 FR 24504) of its determination that radioactive mixed wastes would be subject to regulation under RCRA. This determination was confirmed on May 1, 1987, by a DOE-published final by-product material interpretive rule (52 FR 15937). Consequently, DOE-generated radioactive wastes that qualify as hazardous waste under RCRA are subject to dual regulation under RCRA and the Atomic Energy Act of 1954, as amended.

units to ensure that DOE facilities complied with the new design requirements set forth in the draft order. Formalized in April 1989, this order generally requires that alterations to existing facilities and new construction use double-walled piping, multi-pipe encasement, and double-walled tanks to establish the primary and secondary confinement boundaries for the underground portions of high-level liquid waste systems.

As early as 1987, DOE had information available showing that B Plant's single-walled pipes did not meet the then existing requirements and that some pipes had failed. An August 1987 study, directed by DOE Richland, concluded that the overall condition and integrity of B Plant's single-walled pipes embedded in its concrete structure were unknown. Two pipe lines in B Plant were known to have failed, but, as the study pointed out, no technology was then available to permit inspection of the pipes to verify their condition.

Since the 1987 study, three DOE-funded studies have addressed B Plant's noncompliance with regulatory requirements. Studies completed in March and April 1989 reconfirmed the problems associated with the embedded pipes. The April 1989 study reported that B Plant's embedded pipes did not comply with DOE design criteria and concluded that the pipes would be almost impossible to replace. This study also pointed out that B Plant process tanks did not comply with federal double containment requirements and recommended that DOE request a variance from the regulator to permit the use of these tanks for pretreatment.[3] A January 1990 study, directed by DOE Richland, concluded that the problem with the process tanks remained unresolved.

In April 1989, during a previous assignment, we asked DOE headquarters in writing to what extent B Plant complied with environmental regulations and whether waivers would be needed to operate the plant. In his July 7, 1989, written response to our letter, the DOE Under Secretary told us that DOE had recently performed a detailed comparison of the facility against DOE orders and other standards and codes, including EPA regulations for hazardous wastes and state of Washington dangerous waste regulations. The Under Secretary said that with new upgrades of $14 million, B Plant could be brought into compliance with current codes and standards, and that these upgrades were feasible. The Under Secretary expressly stated that no waiver or deviation from federal regulations or any DOE order was expected to be required for B Plant's

[3]For purposes of this report, variances and waivers are used interchangeably.

operation. In addition, he did not identify any need for waivers or deviations from state dangerous waste regulations.

In January 1991, DOE Richland officials told us that at the time this letter was prepared, they were assuming that a waiver or a variance would be required but could be obtained from the state to allow the use of embedded, single-walled pipes in the pretreatment process. The Director of DOE's Office of Environmental Restoration and Waste Management confirmed this assumption and told us that the Under Secretary's response to GAO's letter was clearly in error. He speculated that the error was made because the DOE officials who had drafted the response were not knowledgeable about B Plant's compliance problems or about federal and state environmental regulations. Although the state regulatory agency—the Washington State Department of Ecology (Ecology)—has granted an interim RCRA permit for B Plant activities, he emphasized that B Plant could only be used for pretreatment if the state granted a variance. He said that Westinghouse Hanford Company—the Hanford Site contractor—was optimistic that a waiver could be granted; however, he believed that the state was unlikely to grant one.

Although Ecology could grant a variance, state officials told us in January 1991 that DOE did not request or discuss with them waivers for using the single-walled pipes in B Plant. Moreover, they said that the state, more than likely, would not issue any waivers or variances to allow B Plant to conduct pretreatment operations.

DOE Richland officials also told us DOE believes it could demonstrate that the concrete in which B Plant's waste pipes are embedded would provide adequate double containment of high-level radioactive waste. However, the Westinghouse B Plant operations manager specifically told us that contamination has migrated through concrete confinement barriers in B Plant. For example, he said that in the early 1980s, when chemicals leaked from tank valves in B Plant's Aqueous Makeup Unit, the hazardous chemicals migrated through 2 feet of concrete to administrative offices below.

Although state and federal regulations do not disqualify the use of concrete encasement as a secondary containment measure, they do require that secondary containment measures include a means of detecting waste leaks. However, according to Westinghouse and state officials, B Plant's pipes, tanks, and processing facilities do not have adequate waste leak detection systems. For example, in July 1990, Westinghouse discovered a leak of low-level radioactive liquid in B Plant's electrical

distribution facility. This leak had gone undetected for about a year. After identifying the leak, the contractor spent nearly a month identifying its source and stopping it. According to B Plant's operations manager, the liquid originated in a process facility, leaked through a disconnected drain pipe, and then migrated along one of B Plant's concrete expansion joints into both the electrical facility and the soil. As of April 1991, Westinghouse had not yet determined the full extent of contamination. However, it estimated that between 85,000 and 230,000 gallons of the low-level radioactive liquid leaked within B Plant and into the soil under B Plant.

Studies we reviewed and the DOE Under Secretary's response to our 1989 letter both indicate that DOE chose to modify B Plant primarily because modification was considered less costly than building a new facility and would allow earlier startup of pretreatment operations. The Director of DOE's Office of Environmental Restoration and Waste Management confirmed for us that economic considerations drove DOE's selection and continued support of B Plant modification. However, he emphasized that in view of B Plant's compliance problems, modification can no longer be considered the most economical pretreatment option.

TRUEX Pretreatment Process May Not Be Compatible With B Plant

The TRUEX process being developed to pretreat about 5.5 million gallons, or about 75 percent, of the high-level waste could permanently damage existing B Plant waste pipes. A report issued by the DOE Hanford Waste Pretreatment Technology Review Panel in December 1990 stated that the chemicals used in the TRUEX process would cause extensive corrosion to B Plant's embedded pipes. The report characterized the pipes as nonreplaceable because they are embedded in the building's concrete structure. In addition to TRUEX chemicals, fluorides contained in double-shell tank wastes could also corrode B Plant's pipes.

According to Westinghouse engineers, technology to reduce the corrosiveness of TRUEX chemicals and fluorides in the high-level radioactive waste is still being developed. Westinghouse engineers told us that recent small-scale tests, which used an aluminum solution to alter these substances, did not adequately decrease their corrosiveness. Moreover, the aluminum solution inhibited the TRUEX waste separation process. Although the Westinghouse engineers emphasized that the problem is solvable, they could not estimate when the technology could be fully developed. They said that even after the technology is developed and demonstrated on a small scale, nothing can ensure that it will be successful on a large scale.

DOE Is Reevaluating B Plant as Well as Other Pretreatment Options

In September 1990, the then recently appointed Director of DOE's Office of Environmental Restoration and Waste Management directed DOE Richland to assess the risks of the Hanford Site vitrification program activities. DOE Richland officials told us that they plan to complete this assessment in September 1991. In conjunction with this assessment, DOE Richland is reevaluating (1) B Plant's viability as a pretreatment facility, (2) alternative pretreatment processing options, and (3) alternative pretreatment facilities, including construction of a new facility. Studies assessing these issues will be released in December 1991, according to DOE Richland's Assistant Manager for Operations.

The Director told us that he had initiated the assessment because significant problems remained unresolved in retrieving, pretreating, and vitrifying double-shell tank wastes under the Hanford vitrification program. He said that after extensive briefings and a tour of the facility, he felt that B Plant was not a viable option for pretreatment because it did not comply with double-containment requirements and because its stainless steel embedded pipes were not compatible with the TRUEX pretreatment process. In his view, it is unlikely that B Plant's shortcomings can be corrected.

In a January 30, 1991, letter, the Secretary of Energy advised the governor of Washington that the preliminary results of the ongoing risk assessment indicate that

> B Plant will not meet the requirements of the Resource Conservation and Recovery Act (RCRA), which requires double containment for piping and liners for cells that handle hazardous waste. The B-Plant has steel pipes embedded in concrete walls and unlined cells that do not meet this requirement. In addition, as you are well aware, concerns about hydrogen generation in the double-shell tanks have led us to conclude that we need a better waste characterization program, and we also need a better understanding of the implications for waste pretreatment. This information was not known in 1989 during formation of the Tri-Party Agreement.[4]

According to a DOE Richland briefing to DOE headquarters officials in January 1991 on the progress of Hanford's vitrification risk assessment, the lack of double-contained pipes, tanks, and processing facilities in B Plant could result in a DOE mandate to build a new pretreatment facility.

[4]In May 1989, DOE, EPA, and Ecology signed the Hanford Federal Facility Agreement and Consent Order, commonly referred to as the Tri-Party Agreement. This agreement represents a comprehensive effort to bring the Hanford Site into compliance with RCRA and the Comprehensive Environmental Response, Compensation, and Liability Act of 1980. The agreement identified B Plant as the facility for pretreating double-shell tank waste.

Because DOE may not be able to use B Plant, it is evaluating new pretreatment approaches. According to DOE and Washington State officials, DOE is evaluating a simpler process for pretreating double-shell tank wastes. This approach, which does not use the TRUEX process, involves washing and filtering all double-shell tank wastes before vitrification. DOE is also considering using either Hanford's Plutonium Uranium Extraction (PUREX) Plant for pretreatment or building a new pretreatment facility.[5] However, according to a DOE official, the PUREX plant has the same double-containment problems as B Plant.

The State Recently Recommended Abandoning B Plant

In a March 13, 1991, letter, Ecology's Director recommended to members of the state congressional delegation that DOE abandon B Plant as a pretreatment facility. She stated:

> While pretreatment must be accomplished, it is our position that B Plant cannot practically support this function. The facility's single-walled piping does not meet the double containment standards of USDOE orders or of federal and state hazardous waste laws. Other problems include the inability of existing piping to resist the corrosive nature of some tank wastes, the inability to meet seismic requirements, the lack of integrity of tanks within B Plant, and the lack of closed loop cooling systems.

Ecology recommended to members of the state congressional delegation that DOE promptly discontinue work to modify B Plant and redirect its efforts and resources to evaluating alternatives for waste pretreatment.

According to the Director of DOE Richland's Waste Management Division, Ecology did not make this recommendation to DOE, and therefore no DOE response is planned. Furthermore, he emphasized that although DOE continues to evaluate B Plant's pretreatment capabilities, DOE has no immediate plans to change its pretreatment program.

DOE Continues to Modify B Plant

Despite serious questions about B Plant's viability as a pretreatment facility, DOE continues to modify B Plant for that purpose. Even though DOE has placed B Plant modification projects totaling more than $400 million on hold, five projects totaling about $43 million are in progress. These five projects were justified on the basis that they were needed for pretreatment. One of these projects is a $25.1-million TRUEX pilot plant

[5]The PUREX facility has been used primarily to reprocess spent uranium fuel rods from Hanford's now-closed nuclear materials production reactor.

project to be located in B Plant, even though the TRUEX process may not be used to pretreat double-shell tank waste as originally planned.

As of March 1991, DOE had spent about $23 million on completed projects to modify B Plant for its pretreatment role and for supporting operations at the adjacent Waste Encapsulation and Storage Facility (WESF). WESF stores highly radioactive cesium and strontium capsules originally produced in B Plant. B Plant provides utilities, such as electricity and water, to WESF. Liquids and wastes generated by WESF are funneled to B Plant for processing and disposal. B Plant may require further modification to improve its support of WESF, according to Westinghouse officials.

DOE planned to complete 33 modification and related B Plant projects through fiscal year 1999 at a total estimated cost of about $609 million. DOE budgeted about $6.9 million from fiscal year 1991 appropriations for B Plant projects. The status of these projects, as of March 1991, is shown in table I.

Table I: Status of Modification and Related B Plant Projects

Dollars in millions

Project status	Number of projects	Project cost
Proposed	12	$160.9[a]
On hold	12	402.9
Ongoing		
B Plant pretreatment	5	43.2
B Plant other	4	2.3
Total	**33**	**$609.3**

[a]Funding information was not available for one project.

As table I shows, DOE has temporarily placed 12 projects totaling more than $400 million on hold until the risks of B Plant's pretreatment capabilities have been assessed. According to DOE officials, each of these projects was designed and justified to support B Plant's pretreatment function.

Five additional projects, however, are still under way. Like the projects on hold, these projects were designed and justified to support the B Plant pretreatment mission. The projects include

- an $875,000 project to upgrade B Plant's Aqueous Makeup tanks to support full-scale operation of the neutralized current acid waste pretreatment process;
- a $3.5-million Hanford environmental compliance project to prevent release of chemically or radiologically hazardous materials from B Plant's chemical storage tank system, chemical makeup ventilation system, and chemical staging/measuring tank system;
- a $12.5-million waste retrieval project, which was justified on the basis that new double-lined waste transfer pipes were needed to connect B Plant and the vitrification plant to double-shell tank farms to support B Plant pretreatment operations;
- a $1.2-million project to provide permanent office space for 100 new staff who would be needed at B Plant to support pretreatment operations; and
- a $25.1-million TRUEX pilot plant project to be conducted at B Plant. DOE has not decided whether or when this process will be used to pretreat double-shell tank waste.

As of March 1991, DOE was procuring construction materials for the first three projects. According to B Plant officials, construction was expected to begin in April 1991. The project for providing permanent office space and the TRUEX pilot plant project were still in the design phase.

Conclusions

It is increasingly clear that B Plant is no longer a viable option for pretreating high-level waste in the double-shell tanks. DOE studies have consistently concluded that B Plant does not meet specific federal and DOE regulations. DOE studies have recommended that if DOE intended to use B Plant for pretreatment, it would have to request waivers from the state. In light of (1) state officials' statements, (2) Ecology's recent letter to members of the state's congressional delegation, and (3) the views of the Director of DOE's Office of Environmental Restoration and Waste Management, such waivers probably will not be granted by the state. Consequently, a new pretreatment facility or process must be found. Consistent with finding a new approach is cancelling all B Plant pretreatment projects and shifting funds for these projects to developing an acceptable alternative.

The failure of DOE officials to discuss the possibility of waivers with state officials, even as they incorporated B Plant into the Tri-Party Agreement and failed to identify to us the need for any waivers, indicates the need for stronger commitment to openness and full compliance with environmental regulations. The need for the Director of DOE's

Office of Environmental Restoration and Waste Management to intervene personally and require a risk assessment further indicates that DOE Richland's management needs to look critically at how it makes decisions about cleanup.

Recommendations

We recommend that the Secretary of Energy direct the Manager of DOE's Richland Operations Office to

- cancel all projects designed primarily to upgrade B Plant as a pretreatment facility and shift the funds for these projects to developing an acceptable alternative and
- ensure that only projects designed to support WESF operations are continued.

In addition, the manager of DOE's Richland Operations Office should be directed to develop an approach for making decisions on environmental projects that (1) takes into account all available information, (2) is premised on full compliance with environmental regulations, and (3) requires open communication with the appropriate regulators.

Agency Comments and Our Response

We discussed the facts presented in the report with DOE program officials and incorporated their comments where appropriate. DOE generally concurred with the facts. However, as requested by your office, we did not obtain official DOE comments on this report.

We performed our review from January 1991 through April 1991 in accordance with generally accepted government auditing standards. To assess the status and adequacy of DOE's plans for modifying B Plant and the cost of these modifications, we interviewed DOE headquarters and Richland Operations Office officials, as well as Westinghouse officials and project managers responsible for B Plant. We also interviewed officials of the Washington State Department of Ecology and EPA Region X, which encompasses the states of Washington, Oregon, Idaho, and Alaska.

We reviewed pertinent laws, federal and state regulations, DOE orders, and applicable DOE Richland Operations Office memoranda. We also reviewed DOE budget and project documents and several B Plant studies performed by the DOE Richland Operations Office, Westinghouse Hanford Company, and independent consultants.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from the date of this letter. At that time, we will provide copies to DOE and other interested parties upon request.

This report was prepared under the direction of Victor S. Rezendes, Director of Energy Issues, (202) 275-1441. Other contributors to this report are listed in appendix I.

Sincerely yours,

J. Dexter Peach
Assistant Comptroller General

Major Contributors to This Report

Resources, Community, and Economic Development Division, Washington, D.C.	Judy A. England-Joseph, Associate Director James Noel, Assistant Director Edward E. Young, Jr., Assignment Manager
Seattle Regional Office	Leonard L. Dowd, Regional Management Representative Thomas C. Perry, Evaluator-in-Charge Dana E. Greenberg, Staff Evaluator

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