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

Resources, Community, and
Economic Development Division

B-272431

August 2, 1996

The Honorable Joe Barton
Chairman, Subcommittee on Oversight
and Investigations
Committee on Commerce
House of Representatives

Dear Mr. Chairman:

The Department of Energy (DOE) has about 56 million gallons of highly radioactive waste currently stored in 177 underground tanks at its Hanford Site in the state of Washington. Some of these tanks have leaked, while others contain potentially flammable waste. DOE's tank waste remediation program that deals with this waste promises to be one of the Department's most expensive undertakings. The program's estimated life-cycle cost is $36 billion.[1] DOE has spent about $2.5 billion on this program since 1989. Over the last several years, we have conducted numerous reviews of DOE's management of the program.[2] Our work has found repeated instances of management problems, underestimation of the technical complexity associated with dealing with Hanford's waste, and uncertainty about the program's eventual cost.

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Released 9-3-96

[1]Life-cycle cost estimates include the costs of planning and building facilities, operating the program over its lifetime, and closing or termination costs upon completion.

[2]See Nuclear Waste: Management and Technical Problems Continue to Delay Characterizing Hanford's Tank Waste (GAO/RCED-96-56, Jan. 26, 1996); Nuclear Waste: Hanford Tank Waste Program Needs Cost, Schedule, and Management Changes (GAO/RCED-93-99, Mar. 8, 1993); and Nuclear Waste: Pretreatment Modifications at DOE Hanford's B Plant Should Be Stopped (GAO/RCED-91-165, June 12, 1991).

In April 1996, DOE issued its draft environmental impact statement for the program. The statement proposed a phased approach that involves separating the task of cleaning up the tank waste into two parts, referred to as phase I and phase II. Phase I would primarily demonstrate the technologies needed to treat and immobilize less radioactive (or low-activity) waste and start processing it. Phase II would include finishing the processing of low-activity waste and processing waste with greater levels of radioactivity (high-level waste).[3] If the phased approach is adopted, DOE has decided to use fixed-price contracts that would be awarded to one or more competitively selected contractors for phase I. DOE refers to this as its privatization strategy. If this strategy is successful, DOE plans to use the same contracting method for phase II.

DOE's privatization strategy represents a break with its traditional efforts to clean up tank waste at Hanford. In the past, DOE used a cost-plus-award-fee contract and directed the contractors how to clean up the waste and paid the contractors regardless of what was accomplished. However, under DOE's privatization approach, DOE would use a fixed-price, competitive contract; the contractors would finance, design, build, and operate waste processing facilities; and DOE would pay the contractors only for successfully immobilizing waste. In addition, although DOE would remain responsible for any environmental problems caused before the contractors began operations, the contractors would be liable for any environmental problems they cause. DOE believes that this fixed-price, competitive strategy will reduce the overall cost of remediating Hanford's tank waste.

Because of the uniqueness of DOE's proposed new approach, you asked us to provide responses to five questions concerning the Department's tank waste clean-up effort:

1. What types of problems has DOE experienced in its past efforts to clean up Hanford's tank waste, and what is DOE's current strategy for this cleanup?

2. Has DOE identified lower-cost or quicker alternatives to its phased approach, and, if so, why does it believe the phased approach is the best alternative?

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[3]Some limited processing of high-level waste may occur in phase I, according to DOE privatization officials.

3. How does DOE support its statement that privatization will result in an estimated 30-percent cost savings?

4. What actions will DOE need to take to support privatization, and are there any uncertainties related to these actions that could affect DOE's privatization strategy?

5. How does DOE plan to respond to the Washington State Department of Ecology's concern that DOE should have a fallback plan if privatization is not successful, and how does the fallback plan compare with privatization with respect to time frames and cost?

In summary, we found the following:

1. DOE has experienced numerous problems since it began to address Hanford's tank waste, including (1) technical difficulties that forced the delay or cancellation of key program components; (2) general delays in its schedule; and (3) uncertainties about program costs. DOE believes that its phased approach and privatization strategy will help overcome these problems. The agency expects this approach to enhance progress by focusing initial efforts on waste that is well defined, and it expects privatization to help control costs through fixed-price contracts and competition between at least two private contractors in processing the waste.

2. DOE's recent environmental impact statement for remediating tank waste identifies 10 alternatives in addition to the phased approach DOE prefers--all of which could be completed more quickly than the phased approach and several at less cost. However, DOE believes that the phased approach provides the best balance among compliance with laws and regulations, health and environmental risk, and technological uncertainties.

3. DOE's 30-percent cost-savings estimate is based on a feasibility study performed in 1994 that compares two different contracting approaches for a portion of the $36 billion program. Under DOE's traditional management and operations approach, retrieving, pretreating, and immobilizing tank waste would cost an estimated $13.3 billion. By privatizing those portions of the program, DOE estimated that the cost would be $9.6 billion, or about 28 percent less. However, DOE acknowledges that both estimates are subject to a wide margin of error

and that actual savings will be affected by such factors as the extent to which competition is achieved.

4. To support privatization, DOE must conduct certain tank waste operations, such as identifying (characterizing) the components of the waste to be treated; overseeing contractors in such areas as nuclear health and safety; and providing basic site support services, including waste storage and transfer. Uncertainties associated with these actions include whether (1) DOE can meet requirements for characterizing the waste, (2) contractors and Washington State Department of Ecology staff can meet DOE's proposed 2-year schedule for obtaining facility permits, (3) DOE can effectively deal with an expanded role in overseeing contractors' activities, and (4) phase I activities are sufficient to develop and demonstrate the technologies needed for full-scale operations in phase II, which is expected to be more complex than phase I. These uncertainties may test DOE's privatization strategy. A 1995 Pacific Northwest National Laboratory study noted that privatization works best when the technology is mature and the service is well defined. In contrast, the remediation of the tank waste could be the most complex engineering task DOE has ever undertaken.

5. DOE is developing a fallback strategy, called the alternate path, in response to the Washington State Department of Ecology's concerns that privatization may fail, further delaying the remediation program. The alternate path has two main aspects. The first is to retain, during the early years of privatization, staff with the core technical expertise needed to treat the tank waste if privatization is not successful. The second aspect involves contracting for a report on alternative management approaches that could be used if DOE does not pursue privatization. This report is due in late September 1996. DOE expects that the alternate path, if used, would still meet its overall milestone for completion of the tank waste clean-up effort by 2028 but would cost more than the privatization approach.

Enclosure I provides our detailed responses to each of the five questions.

## AGENCY COMMENTS

We provided DOE with a draft of this report for its review and comment. We received comments from the Deputy Assistant Secretary for Waste Management, the Manager for the Tank Waste Remediation System, the Program Managers

and Team Leader for Privatization of the Tank Waste Remediation System, and other officials from DOE headquarters and its Richland operations. The DOE officials agreed that our draft report was accurate and fairly presented the information. However, the officials believed that our discussion of the technological uncertainties involved in processing Hanford waste was too general and might lead the reader to conclude that technology does not currently exist for processing low-activity and high-level radioactive waste. The officials said that this technology does currently exist, and DOE has challenged competitively selected fixed-price contractors to adapt this technology (or develop new technological approaches) for efficiently remediating Hanford's tank waste. We have made modifications to our report, where we believed appropriate, to recognize this point. (See enc. II for DOE's comments.)

## SCOPE AND METHODOLOGY

We conducted our review at DOE's Richland Operations Office in Richland, Washington, and at its headquarters in Washington, D.C., and Germantown, Maryland. To respond to your questions, we reviewed relevant documents, including the draft environmental impact statement, privatization feasibility studies, privatization cost analyses, and contractor-prepared data. To provide perspective on the material that we reviewed, we interviewed DOE, contractor, and Washington State Department of Ecology officials responsible for the activities discussed in this report. Our work was performed from April through July 1996 in accordance with generally accepted government auditing standards.

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As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days after the date of this letter. At that time, we will send a copy to the Secretary of Energy. We will also make copies available to others upon request.

If you have any questions concerning this report, please contact me at (202) 512-3841. Major contributors to this report include Chris Abraham, John Cass,

James Noël, Jack Paul, Thomas Perry, Bernice Steinhardt, Stanley Stenersen, William Swick, and Charles Sylvis.

Sincerely yours,

Victor S. Rezendes
Director, Energy, Resources,
and Science Issues

Enclosures - 2

## RESPONSES TO QUESTIONS ABOUT DOE'S HANDLING OF HANFORD'S TANK WASTES

**Question 1: What types of problems has DOE experienced in its past efforts to clean up Hanford's tank waste, and what is DOE's current strategy for this cleanup?**

The Department of Energy (DOE) has been attempting to deal with Hanford's tank waste since 1987. DOE's efforts have been characterized by (1) technical problems that have forced the cancellation or delay of key components of the program; (2) schedule delays that have resulted in renegotiation of key milestones in the consent decree between the Washington State Department of Ecology, the U.S. Environmental Protection Agency, and DOE governing Hanford's cleanup, commonly known as the Tri-Party Agreement; and (3) uncertainties about the program's eventual costs.

To address these problems, DOE's current strategy involves separating the task of remediating Hanford's tank waste into two parts, referred to as phase I and phase II. In addition, DOE plans to use fixed-price contracts with one or more competitively selected contractors for each phase. During phase I, which is scheduled to start in late 1996, the private contractor(s) would demonstrate the ability to process and immobilize the low-activity portion of the waste. At DOE's option, the contractor(s) may also process and immobilize some high-level waste. During full-scale operations of phase II, scheduled to start in 2004, the contractor(s) would be required to finish immobilizing the low-activity waste and immobilize the high-level portion. Under the Tri-Party Agreement all processing of the tank waste must be finished by 2028.

### Technical Problems, Schedule Delays, and Cost Uncertainties of the Past

DOE's original clean-up plan for Hanford's tank waste was to (1) proceed with activities for immobilizing waste in the 28 double-shell tanks and (2) defer a decision on disposal of the waste in the 149 single-shell tanks until 2003, when additional development and evaluation of waste retrieval and immobilization methods could be completed. DOE planned to retrieve the double-shell tank waste, pretreat the waste in a former defense processing facility known as B Plant, convert the low-activity portion into a cement-like product known as grout, dispose of the low-activity waste permanently in near-surface vaults on-site, and vitrify[4] the high-level portion for

[4]Vitrification, DOE's preferred method of immobilizing both the high-level and low-activity radioactive waste, involves converting the waste into a glass-like product that

eventual disposal in a geologic repository.

However, DOE experienced technical problems with key steps in this approach. We reported in June 1991 that DOE's plan to modify B Plant would not work because (1) the plant could not meet current environmental standards and (2) the technology being considered for treating the waste could eat through the piping in the facility, rendering it useless. We recommended that DOE cancel further work on B Plant and shift its effort to developing an acceptable alternative. (See our report (GAO/RCED-91-165, Jun. 12, 1991)). In December 1991, after reevaluating its approach, DOE decided not to proceed with B Plant. This project was expected to cost over $600 million, of which DOE spent about $23 million before the project was canceled.

In concert with its decision regarding B Plant, DOE adopted a new strategy--the Tank Waste Remediation System Program--for dealing with the tank wastes. The program was intended to cover all programs, projects, and activities for characterizing, retrieving, pretreating, treating, and disposing of all single-shell and double-shell tank wastes. The resolution of tank safety issues, such as the possibility of explosions, was included in the program and given the highest priority. Despite this change in strategy, technical problems persisted.

In March 1993, we reported that DOE was planning to build a vitrification plant, originally intended for the double-shell tank waste, that could end up being far too small, could require extensive modifications, and could sit idle while other aspects of the program, such as retrieval, were being developed. We recommended that DOE postpone construction of the vitrification plant until these issues were resolved. (See our report (GAO/RCED-93-99, Mar. 8, 1993)). In April 1993, after evaluating the matter, DOE decided to delay the plant's construction. DOE spent about $418 million on preconstruction work for the plant, primarily on facility design.

In that same report, we also noted problems with DOE's plans for grouting the low-activity waste. DOE proposed to pump the grout into large underground vaults for final disposal at Hanford. Because the waste DOE intended to grout contained some long-lived, high-level radioactive waste components that would eventually leak into the environment, we reported that Washington, Oregon, and the Yakima Indian Nation were concerned that grout vaults might not be an acceptable approach for the final disposal of the waste. In response to these concerns, in September 1993, DOE abandoned the grouting approach after building a processing facility and five vaults. In total, DOE spent about $197 million.

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can be poured into steel canisters where it will cool, harden, and remain in place until its radioactive components deteriorate.

In January 1996, we reported that DOE continued to experience delays in its efforts to characterize the waste in the tanks. We found that DOE and its contractor, Westinghouse, were still having difficulty answering fundamental methodological questions, such as how to take reliable samples, and what types and how much sampling data to gather. (See our report (GAO/RCED-96-56, Jan. 26, 1996)).

DOE's efforts to address Hanford's tank wastes have experienced several changes in schedule. The original Tri-Party Agreement was signed in May 1989 and was structured as a series of milestones covering tank waste remediation and other clean-up activities at the Hanford site. Among other things, the agreement called for starting waste treatment operations at the vitrification plant by December 1999.

As a result of problems discussed earlier, in January 1994, DOE renegotiated its agreement with the Washington State Department of Ecology and the U.S. Environmental Protection Agency. This revised agreement resulted in several interim milestone delays, which pushed the overall completion date to December 2028. In this regard, we reported in January 1996 that DOE did not expect to meet its waste characterization milestone until September 2004, more than 4 years late. Currently, DOE is renegotiating the Tri-Party Agreement to accommodate its phased approach and privatization proposal.

Finally, because of the uncertainties involved with the tank waste program, the estimated cost of the program has undergone several revisions. In 1988, DOE estimated the disposal cost of the double-shell and single-shell tank wastes at between $4 billion and $14 billion. This estimate included about $2.8 billion for immobilizing double-shell tank waste and between $1 billion and $11 billion for disposing of single-shell tank waste. In part, the wide range of the estimate for single-shell tanks reflected uncertainty at the time about how much of the waste DOE would remove from the single-shell tanks.

In December 1991, DOE announced that it was adopting the tank waste remediation system program. At that time, an internal DOE briefing placed the estimated life-cycle cost of the program at between $25 billion and $45 billion. DOE officials cautioned that this estimate was still highly uncertain. More recently, DOE estimated the cost of the program at $36 billion. In recent estimates prepared for the environmental impact statement, the cost for the phased implementation was estimated at about $32 billion with a possible range of $30 billion to $38 billion. The estimates differ because of minor differences between the programs.

DOE's Current Strategy for Cleaning Up Its Tank Wastes

Under DOE's current strategy, the three major processing steps–retrieval (in phase II only), pretreatment,[5] and immobilization–will be privatized. To complete these steps, the contractor(s) must design, obtain permits, finance, construct, and operate the necessary facilities to process tank waste in accordance with DOE's performance specifications. The contractor(s) must also deactivate its facilities after the waste is immobilized. DOE will pay the contractor(s) mainly for the waste remediation services based on the volume of waste processed.

DOE's privatization strategy represents a fundamental change in how DOE contracts for services. Instead of telling a contractor how to immobilize the waste and paying for the work regardless of what is accomplished, DOE's privatization approach is designed to pay contractor(s) only for successfully immobilizing waste in a form that meets DOE specifications. Contractors will compete with each other in determining how to treat the wastes, investing in the necessary facilities, and striving for the most cost effective operation. In addition, although DOE would remain responsible for any environmental problems caused before the contractor(s) begins operations, the contractor(s) would be liable for any environmental problems it causes. DOE hopes that this fixed-price, competitive strategy will reduce the overall cost of remediating the tank wastes.

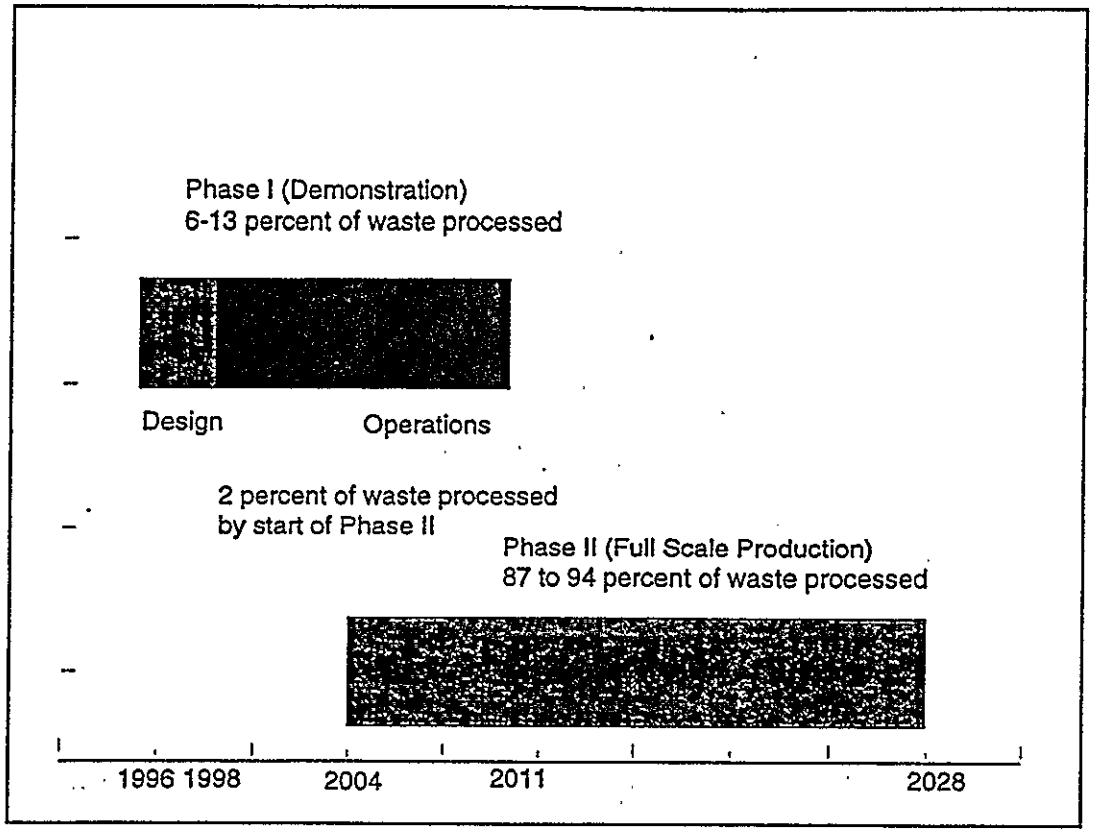
DOE's current strategy calls for a two-phased approach. During phase I–the demonstration phase–which is scheduled to start in late 1996, the selected contractor(s) will demonstrate its capability to immobilize the low-activity portion of the waste that DOE retrieves, primarily, from well-characterized double-shell tanks. The contractor(s) may also attempt to immobilize a portion of the high-level waste if DOE chooses that option. DOE privatization officials said that they expect that about 2 percent of Hanford's tank waste will be processed prior to the start of phase II in 2004 and between 6 and 13 percent of the waste by the end of phase I in 2011. DOE and its management and operations contractor will continue to operate the tank farms, develop waste characterization and retrieval technology, and characterize and retrieve waste during phase I.

Phase II–the production phase–is contingent on the success of phase I and is expected to start in 2004. Under the current plans for phase II, two competitively selected contractors working under fixed-price contracts will retrieve the remaining 87 to 94

[5]Pretreatment involves separating the tank waste into high-level and low-activity portions.

percent of the waste and finance, design, build, operate, and deactivate facilities to process the waste, including finishing the immobilization of the remaining low-activity and the high-level waste portions. Under the existing Tri-Party Agreement, all single-shell tanks are to be emptied by 2018, the double-shell tanks emptied by 2028, and all Hanford waste immobilized by 2028. Figure I.1 summarizes the relationship between the two phases DOE has proposed.

Figure I.1: DOE's Privatization Schedule




Source: Prepared by GAO using DOE data.

**Question 2: Has DOE identified lower-cost or quicker alternatives to its phased approach, and, if so, why does it believe the phased approach is the best alternative?**

Since the late 1980s, DOE has considered--and in some cases rejected--various alternatives for addressing Hanford's tank waste. As explained in question 1, DOE originally intended to grout the low-activity waste but abandoned this approach in 1993. A variety of analyses on technical, cost, and schedule issues have been conducted in concert with some of these changes. For example, in January 1992, DOE began a 15-month evaluation of the Tank Waste Remediation System that culminated in the postponement of construction of the vitrification plant discussed under question 1. During this evaluation, DOE's contractor, Westinghouse, performed a series of studies that examined different options for addressing the tank waste.

The draft environmental impact statement developed jointly by DOE and Washington State for the Tank Waste Remediation System identifies 11 alternatives, including the two-phased approach that DOE prefers. In a recent estimate, DOE projects that the two-phased approach will cost about $32 billion (with a range of $30 billion to $38 billion) and not be completed until 2028. DOE projected that all of the other alternatives would be completed faster than the phased approach. Other alternatives for treating the tank waste range in cost from about $8 billion to fill the tanks with gravel and cover them with a protective cap to about $63 billion to remove the waste, vitrify it, and send it to the repository without separating it into high-level and low-activity portions. The various alternatives and the estimated costs, time frames, and environmental effects identified with the alternatives in the draft environmental impact statement are summarized in table I.1.

According to the draft environmental impact statement and DOE officials, DOE prefers the phased approach because it believes that this approach provides the best balance among key factors--short- and long-term impacts to human health and the environment; uncertainties associated with waste characteristics and treatment technologies; compliance with laws, regulations, and policies such as the Clean Air Act and the Resource Conservation and Recovery Act of 1976, as amended; and cost and time to remediate the waste. In particular, of the 11 alternatives evaluated, only 4 remove the waste from the tanks and vitrify it, thus complying with all regulatory requirements and with the Tri-Party Agreement. The state of Washington, co-preparer of the environmental impact statement, insisted that the preferred approach comply with the Tri-Party Agreement.

The four alternatives that comply with the agreement differ primarily in the degree of separation of the material into high-level and low-activity tank waste. According to the draft environmental impact statement, the no-separations alternative would

produce far too many canisters for the proposed high-level waste repository while the extensive-separations alternative has uncertainties related to the numerous and complex processes used to separate the waste. DOE's preferred approach is similar to the intermediate-separations alternative. However, by using a two-phased approach to facility construction and operation, DOE believes it will have a lower technical and financial risk than the intermediate separations alternative, which calls for earlier construction of large facilities to vitrify the waste.

Table I.1. Comparison of Alternatives (as of July 23, 1996)

| Alternative | Description | Estimated total cost (in billions) | Year operations completed | Meets legal requirements? | Technical risk | Safety risk (fatalities expected)[a] | Environmental impact (ground water) | Health risk to onsite farmer (deaths in 10,000 years) |
|---|---|---|---|---|---|---|---|---|
| No action | Leave tanks and waste in place. Finish pumping liquid from single-shell tanks, maintain spare capacity through evaporator operations, and continue monitoring and maintenance. Control would be maintained for 100 years. | 14.3 | N/A | No | Low | 3 | High | 600 |
| Long-term management | Similar to "no action" alternative above. In addition, replace double-shell tanks twice and transfer waste from existing double-shell tanks to new tanks in 50-year intervals. Administrative control would be released in 2097. | 20.8 | N/A | No | Low | 5 | High | 600 |
| In situ fill & cap | Dispose of waste in place. Evaporate water from double-shell tanks, fill tanks with gravel to prevent subsidence, and cover tanks to limit waste migration. Fill ancillary equipment with grout. | 7.9 | 2009 | No | Low | 1 | Moderate | 300 |
| In situ vitrified & cap | Vitrify waste in place. Remove water from double-shell tanks, build a facility over each tank farm, isolate tanks electrically and fill with sand, melt waste and treat exhaust gases, decommission the facilities, grout ancillary equipment, and cover tank farms. Process would melt waste, tank and soil; vitrification on this scale has never been done. | 16.5 | 2016 | No | High | 4 | Low | <1 |

| Alternative | Description | Estimated total cost (in billions) | Year operations completed | Meets legal requirements? | Technical risk | Safety risk (fatalities expected)[a] | Environmental impact (ground water) | Health risk to onsite farmer (deaths in 10,000 years) |
|---|---|---|---|---|---|---|---|---|
| Ex situ/in situ combination (70 tanks) | Use low-activity and high-level vitrification plants to remediate 60 single-shell tanks and 10 double-shell tanks (about 50 percent of waste). This would recover 90 percent of long-lived radionuclides (such as uranium-238 and iodine-129) and substantial percentages of cesium and strontium. Fill all tanks with gravel and cover them. | 19.7 (23.4 with fee)[b] | 2024 | No | Moderate | 9 | Moderate | 60 |
| Ex situ/in situ combination (25 tanks) | Similar to previous alternative but limited to 25 tanks. This would recover about 85 percent of the long-lived high health risk radionuclides and lesser percentages of cesium and strontium than previous alternative. (Late addition--will be developed fully in final environmental impact statement.) | 15.4 (17.6 with fee)[b] | 2024 | No | Moderate | TBD[c] | Moderate | TBD[c] |
| Ex situ no separation vitrified | Retrieve about 99 percent of waste, vitrify it, and put it in canisters for shipment to repository. | 23.6 (62.5 with fee)[b] | 2019 | Yes | Moderate | 14 | Low | 10 |
| Ex situ no separation calcined | Retrieve about 99 percent of waste and calcine it. Calcined waste would be produced by heating it with sugar to break down the chemicals to produce a dry powder which would be placed in canisters for shipment to the repository. | 21.7 (36.3 with fee)[b] | 2019 | No | Moderate | 10 | Low | 10 |
| Ex situ intermediate separation | Retrieve about 99 percent of waste, separate it into high-level and low-activity components with sludge washing and enhanced sludge washing, and vitrify it in separate facilities. Put high-level waste in canisters for shipment to repository; remove cesium from low-activity waste; and dispose of the low-activity waste in retrievable near-surface facilities. | 24.8 (30.1 with fee)[b] | 2024 | Yes | Moderate | 15 | Low | 10 |
| Ex situ extensive separation | Similar to previous alternative, except use more extensive separation efforts to (1) reduce the amount of high-level waste and (2) remove strontium and technetium from low-activity waste to make it less active. | 27.7 (28.0 with fee)[b] | 2024 | Yes | Moderate | 13 | Low | 10 |

| Alternative | Description | Estimated total cost (in billions) | Year operations completed | Meets legal requirements? | Technical risk | Safety risk (fatalities expected)[a] | Environmental impact (ground water) | Health risk to onsite farmer (deaths in 10,000 years) |
|---|---|---|---|---|---|---|---|---|
| Phased approach | Retrieve about 99 percent of waste, separate it into high-level and low-activity components with sludge washing and enhanced sludge washing, and vitrify it in separate facilities. Put high-level waste in canisters for shipment to repository; remove cesium, technetium, and transuranic wastes from low-activity waste; and dispose of the low-activity waste in retrievable near-surface facilities. Conduct the remediation in two phases: Phase I (lasting about 10 years) to demonstrate the technology and phase II for the large-scale processing. | 27.2 (32.5 with fee)[b] | 2028 | Yes | Low | 14 | Low | 10 |

Note: For all but the first two alternatives, final remediation includes remediation of tank wastes, disposition of tanks and associated equipment, and decontamination and decommissioning of any new remediation facilities. For those alternatives in which waste is removed from the tanks, the Tri-Party Agreement calls for retrieval of 99 percent of the waste. The remaining waste will be treated during tank farm closure. All alternatives also include current operations, such as maintaining tank safety and operating existing facilities and equipment. Cost and duration of these current operations vary with the alternative.

[a]Fatalities expected is the total fatalities expected from accidents and radiation exposure during remediation.

[b]Amounts shown in parentheses include the estimated fee for the high-level waste repository under current projections and canister specifications.

[c]To be developed before the release of the final environmental impact statement.

## Question 3: How does DOE support its statement that privatization will result in an estimated 30-percent cost savings?

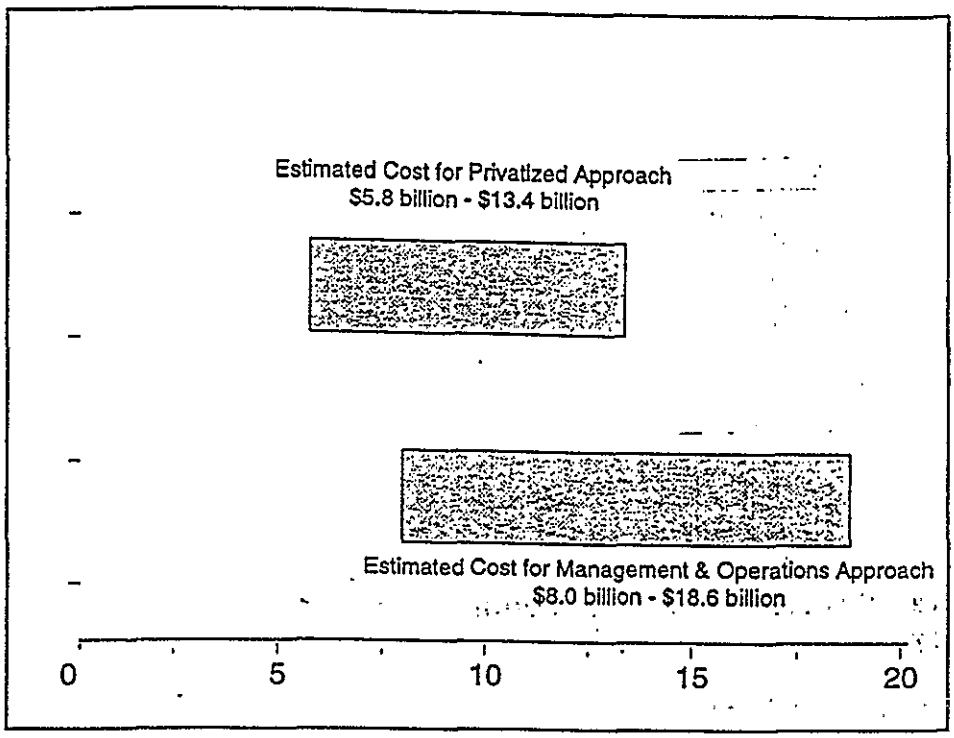
The 30-percent cost savings estimate was based on a feasibility study performed in 1994 that compared the costs of two different contracting approaches for performing several specific clean-up activities included in the $36 billion tank waste remediation system program. The activities included retrieving, pretreating, and immobilizing tank wastes. DOE estimated that these activities would cost about $13.3 billion if it used its traditional management and operations approach. In contrast, DOE expects a competitive, privatized approach to cost about $9.6 billion, or about 28 percent less than the traditional approach. DOE acknowledges that these estimates are subject to a wide margin of error and that the actual savings from privatization will not be known until the program is completed. Savings may also be affected by the limited degree of competition that has occurred to date. However, DOE officials believe that the privatized approach should be tried because the traditional approach to contracting for cleanup of Hanford tank wastes has not been effective.

DOE's cost-savings estimates reflect a comparison of competitive and noncompetitive contracting approaches to doing the work. The management and operations contractor approach (and the baseline for comparison) involves one contractor performing the work in one phase under a cost-plus-award-fee contract in which payment is made as work is performed, regardless of the volume of waste actually processed. In contrast, the privatized approach presumed that at least two contractors would compete during each of several phases of the program and be reimbursed on a fixed-price-per-unit only for successfully processed waste. DOE's Assistant Secretary for Environmental Management believes that the competitive, phased approach should achieve cost savings because of the efficiencies that result from continued competition during the program's life. DOE officials believe that these efficiencies will reduce such costs as labor, materials, and utilities. In addition, according to DOE, fixed-price contracts offer substantial cost savings advantages over cost-plus contracts, which provide little incentive for cost control and have a history of large cost overruns.

DOE officials also pointed out that its privatization initiatives at other DOE sites support its statement that cost savings of up to 30 percent are attainable. DOE has privatized, or is in the process of privatizing, five activities at three of its field locations. These include a laundry for contaminated worker clothing, advanced mixed-waste treatment, and Pit 9 remediation projects at the Idaho National Engineering Laboratory; a laundry for contaminated worker clothing at the Hanford Site; and the M-Area mixed-waste tank remediation project at the Savannah River facility. DOE estimates that under a privatized approach, these projects will have life-cycle costs totaling $424 million--about 54 percent less than the estimate of $928 million under the traditional approach. Because these projects are either in the planning stage or are only recently under way, actual savings have yet to be determined.

DOE's Tank Waste Remediation System savings estimates need to be viewed with some caution. DOE's cost estimates for treating tank wastes are actually a range of values with a margin of error of plus or minus 40 percent. That is, as figure I.2 shows, the $9.6 billion estimate for a privatized approach is the mid-point of a range estimate between $5.8 billion and $13.4 billion. Similarly, the $13.3 billion estimate for a management and operations contractor approach is the mid-point of a range estimate between $8 billion and $18.6 billion. Estimates with such a wide margin of error occur because little is known about the technical process to be used, and little data are available from feasibility or engineering studies.

Figure I.2: Comparison of Cost Estimates for Privatization and Management and Operations Approaches




Source: Prepared by GAO using DOE data.

A second reason for caution is that interest to date from potential contractors may not create the degree of competition DOE expected. In contrast to the three or more bids DOE expected, two contractor teams[6] bid for the phase I work. Washington State's Department of Ecology and other stakeholders have raised concerns that this low number of bidders places DOE at a disadvantage in achieving the lowest possible cost and, therefore, the underlying reason for trying this approach may no longer exist. DOE's Privatization Program Manager said fewer proposals were received than anticipated, but he and other DOE officials believe that competition is still strong because of the excellent technical qualifications of the two contractor teams that submitted bids. In addition, DOE officials believe that their flexibility to award different combinations of contracts for treating the low-activity and high-level waste

[6]The two teams are composed of several companies each. We refer to the teams as the contractors.

will preserve competition between the two contractor teams. For example, DOE could award one or two contracts for processing only low-activity waste, award one or two contracts for processing both low-activity and high-level waste, or award a combination of these contracts to the competing bidders. DOE officials believe that this flexibility, which includes the option of awarding no contracts if DOE considers the cost of the proposals too high, will lead to competition between the two contractor teams.

DOE officials emphasized, however, that although there are uncertainties associated with the privatized approach, the initial phase should be pursued if the contractor bids are acceptable. The officials indicate that DOE's phased privatization approach allows DOE to reassess its cost estimates and to reduce various technical and regulatory uncertainties before it commits itself to various subsequent stages of the privatization effort. DOE chose the privatized contracting approach for tank waste remediation after determining that the progress to date and the projected additional costs of remediating tank wastes under the management and operations contractor approach were unacceptable.

**Question 4: What actions will DOE need to take to support privatization, and are there any uncertainties related to these actions that could affect DOE's privatization strategy?**

DOE is responsible for, among other things, informing contractors about what kinds of waste are in the tanks, removing waste from the tanks and delivering it to the contractors in phase I, and ensuring that contractors comply with environmental and safety requirements. DOE faces several key uncertainties in fulfilling these roles. In the short run, these uncertainties include meeting compressed schedules for providing characterized tank waste samples to privatization contractors, obtaining expedited regulatory approval, and preparing to assume expanded oversight responsibilities. In the longer term, the success of privatization also hinges on the effectiveness of treatment strategies that remain largely untested on Hanford tank wastes.

DOE's Responsibilities in Support of Privatization are Extensive

Under the proposed arrangement with competing contractors, DOE has many operational, oversight, financial, and support responsibilities. Table I.2 lists a number of the key ones. DOE's and the contractors' responsibilities for phase I are subject to change until the privatization contracts are awarded on August 30, 1996. Likewise, responsibilities for phase II will not be established until 2004.

Table: I.2: Key DOE Responsibilities to Support Privatization

| Responsibilities | Actions |
|---|---|
| Tank waste operations | -- Characterize waste in 13 double-shell tanks and 1 single-shell tank for remediation in phase I and continue to characterize waste for phase II.<br>-- Provide characterized sample material to contractors consistent with DOE's waste specifications.<br>-- Retrieve the tank waste and place it in tanks provided to the contractors. (In phase II, retrieval will be conducted by contractors.) |
| Management oversight | -- Provide oversight of contractors.<br>-- Ensure competition.<br>-- Evaluate suitability of final waste products.<br>-- Implement regulatory program to ensure compliance with environmental, health, and safety requirements. |
| Financial | -- Set aside budget authority to ensure that the government can reimburse contractors if the contracts are terminated.<br>-- Make payments to contractors for deliverables. |
| Site support services | -- Provide basic support services, such as electricity, water, fire protection, waste transfer, and waste disposal services.<br>-- Provide facilities for interim storage and disposal of low-activity waste and interim storage of high-level waste products. |

## Uncertainties are Both Immediate and Long Term

DOE faces a variety of key immediate and long-term uncertainties in remediating its tank waste. Key short-term uncertainties relate to whether (1) DOE will be able to provide characterized tank waste sample material so that contractors can proceed with developing their facility designs, (2) DOE's schedule will allow enough time for regulatory review and approval, and (3) DOE will be adequately prepared to oversee contractor activities. DOE also faces both immediate and long-term uncertainties associated with attempting to develop new or modify existing technologies to process Hanford's tank wastes. These latter uncertainties affect whether phase I operations will be sufficient to develop and demonstrate the technologies needed for full-scale operations in phase II.

### Meeting Commitments to Characterize Tank Wastes

The privatized approach to cleanup does not change DOE's basic responsibility for waste characterization; DOE still has to identify what is in the tanks so that (1) it can provide waste samples to the contractors that meet waste specifications and (2) competing contractors can develop processes and design plants for treating the waste.

DOE has had difficulty in the past in being able to keep to a characterization schedule. To provide greater assurance that it can deliver acceptable waste in phase I, DOE has focused its characterization efforts on 13 double-shell tanks and 1 single-shell tank.

Even though DOE has focused phase I on tanks with relatively well-known waste, it faces uncertainty in being able to meet its characterization obligations. Originally, DOE planned to characterize the waste and supply sample material (and associated characterization information) to the contractors by the end of fiscal year 1997. However, DOE's Privatization Program Manager told us that potential contractors indicated that they would need the waste material much sooner, leading DOE to decide in late May 1996 that it would need to complete enough waste samples to provide 64 small containers of waste material to the contractors by September 14, 1996. Although DOE expects to meet this deadline and is deferring other characterization work to concentrate on doing so, the number of samples to be provided and the compressed schedule could make it difficult to meet the deadline. For example, according to Westinghouse's Low-level Waste Manager, up to 150 samples may need to be characterized to ensure that the 64 containers have waste material that meets specifications. If contractors do not receive adequate information about the tank contents on a timely basis, their ability to conduct the necessary design and remediation work could be impaired.

Obtaining Regulatory Approval From Washington State

Under the terms of the Tri-Party Agreement and other state and federal requirements, such as the Washington State Dangerous Waste Regulations and the Resource Conservation and Recovery Act of 1976, as amended, DOE or its contractor must obtain a permit from Washington State's Department of Ecology for operating any facility associated with treating hazardous waste, including tank wastes. Permitting is a complicated process involving such actions as ensuring that the facility conforms to requirements for emissions and protection of human health and the environment. Past experience shows that permitting of complex treatment facilities normally takes about 5 to 7 years to complete, according to Ecology's Tank Waste Project Manager. However, the aggressive schedule DOE has adopted for privatization calls for the privatization contractors to obtain approval for two such facilities (one for each of the competing contractors) within 2 years.

The Department of Ecology said that it will do everything possible to expedite the permitting process. However, the volume of work to be done makes it uncertain as to whether permitting of two such facilities can be completed within the time DOE has set. Department of Ecology officials have also raised concerns about whether the timetable will give contractors sufficient time to prepare plans that are sufficiently detailed to pass the department's permitting process. Ecology officials said that they

plan to grant interim permits to allow construction to begin if the contractors prepare facility designs that meet the department's requirements. Slippage of the approved schedule could affect when construction and operation of contractor facilities can begin.

Overseeing Contractor Activities

Under the privatization program, DOE has both a management oversight role and a regulatory role. In its overall management role, DOE is responsible for overseeing the privatization contractor. DOE has acknowledged that even under its traditional contracting approach, it has had difficulty overseeing contractors. Under privatization, oversight could become more complex and demanding. For example, DOE must ensure that private contractors are selected in a competitive environment. In addition, DOE must ensure that the final waste product meets waste content specifications and final acceptance requirements. In regard to its regulatory role, DOE is required to ensure that the private contractors comply with radiological, nuclear, and process safety laws and regulations that apply to the Hanford site. Because the Nuclear Regulatory Commission regulates private nuclear facilities to ensure compliance with radiological and nuclear safety laws and regulations, DOE requested that the Commission provide this kind of oversight at Hanford. However, the Commission declined to provide regulatory oversight during phase I of DOE's privatization program because it regulates primarily nuclear reactor facilities, and the schedule was too short to develop the procedures needed for overseeing private chemical processing plant operations like those to be conducted at Hanford.

DOE officials emphasized that they are taking steps to assume this regulatory role but acknowledged that DOE is not fully prepared. For example, the agency is formulating a radiological, nuclear, and process safety plan consistent with the Nuclear Regulatory Commission's approach. However, in the past, DOE has not regulated nuclear waste processing facilities that are owned and operated by private companies and currently does not have the procedures or the staff in place to carry out this role.

Dealing With Technical Uncertainties

The viability of developing new or modifying existing technological methods to remediate Hanford tank wastes is a concern, both in the near term and well into the future. The feasibility and efficiency of technical processes expected to be used by private contractors to remediate tank wastes have not yet been demonstrated on Hanford's wastes. For example, during phase I, the contractors will attempt to vitrify the low-activity portion of well-characterized waste, which DOE will retrieve primarily from Hanford's double-shell tanks. However, privatization officials acknowledged that the feasibility of vitrifying Hanford's low-activity waste has not been demonstrated.

These uncertainties escalate as DOE moves into phase II, in which the agency plans to immobilize 87 to 94 percent of the tank waste. DOE privatization officials estimate that only about 2 percent of Hanford's 56 million gallons of waste will be treated by the time phase II is scheduled to begin. Although DOE officials said that they expect waste treated during phase I to be representative of the types of tank wastes that will be treated during phase II, the waste to be processed in phase II differs greatly from the liquid waste to be remediated in phase I. Less is known about the constituents of this waste, and the waste varies in consistency from liquid to hard cement-like material, requiring substantially varying approaches even to remove it from the tanks. Retrieval of the cement-like material and waste sludge has not been achieved in full-scale operations, and the feasibility of full-scale separations technologies for Hanford's tank waste has not been demonstrated. DOE privatization officials acknowledged the existence of these uncertainties but emphasized that one of the primary purposes of the phased approach is to learn more about the waste and therefore resolve uncertainties for phase II.

While the need to demonstrate technologies to remediate Hanford's wastes would exist regardless of the contracting methods used, the risks involved may particularly test the viability of DOE's privatization strategy. A 1995 study by the Pacific Northwest National Laboratory concluded that privatization works best when the technology is mature and the service is well defined. Remediation of the Hanford tank wastes could well be the most complex engineering task DOE has ever attempted, comparable in its uncertainties to building the original atom bomb, according to DOE's January 1995 Tank Waste Remediation System Privatization Study.

**Question 5: How does DOE plan to respond to the Washington State Department of Ecology's concern that DOE should have a fallback plan if privatization is not successful, and how does the fallback plan compare with privatization with respect to timeframes and cost?**

In late 1995, DOE and the Department of Ecology, with concurrence from the U.S. Environmental Protection Agency, agreed to modify the Tri-Party Agreement to add a fallback strategy called the alternate path in case the privatized approach to processing Hanford tank wastes was unsuccessful. The alternate path is a management strategy to reduce significant delays in processing tank wastes if DOE decides not to pursue privatization. Officials from the state Department of Ecology encouraged DOE to develop an alternate approach to managing waste remediation, because the Department of Ecology was concerned that privatization was risky and its failure could jeopardize DOE's ability to meet the Tri-Party Agreement's milestones and further delay the remediation program. DOE expects that the alternate path, if followed, would meet its Tri-Party Agreement milestones but cost more than a

privatized approach. The alternate path is scheduled to be deleted from the agreement in July 1998, when DOE expects to select privatization contractor(s) to proceed with the construction and operation of pilot plants in phase I.

DOE's alternate path has two main features–(1) preserving core technical competencies during the early years of privatization, and (2) developing funding, acquisition, and contracting alternatives to privatization. A DOE official told us that DOE identified 15 core technical competencies that it determined would be critical to minimizing delays during a change from privatization to an alternate approach. The core competencies include, for example, (1) providing data on the behavior of radioactive tank wastes, (2) developing data to improve sludge dissolution and process capability, and (3) determining the additive components and the time and temperature conditions needed to produce acceptable glass. To ensure that these core competencies are available, DOE plans to spend about $5.5 million per year in fiscal year 1997 and again in 1998 to help support about 66 technicians employed by DOE contractors.[9] DOE believes that it needs these competencies until at least July 1998, when the alternate path is scheduled to be deleted from the Tri-Party Agreement, but DOE has not decided if it will need the competencies beyond July 1998, according to the Privatization Project Manager.

To develop the second aspect (funding, acquisition, and contracting alternatives) of the alternate path, DOE plans to contract for a report on alternatives for tank waste processing, facility ownership, contractor incentives, and risk sharing. The report is due by late September 1996. If DOE does not pursue privatization, it intends to preserve some privatization features that encourage contractor efficiencies and hold them more accountable for results, according to the Director of Hanford's Tank Waste Retrieval, Treatment, and Immobilization Division. These factors may include incorporating lessons learned from the phase I privatization effort into an alternative contracting agreement.

DOE has not developed revised cost estimates for an alternate path, although DOE expects the alternate to cost more but be completed in the same general timeframe as privatization. Hanford's Division Director said that it would not be cost effective at this time to develop a cost estimate for an alternate path that may never be used. Furthermore, the cost would depend on the specific acquisition and contracting strategy selected, which has not been determined. However, the Director said that the alternate path should cost more than a privatized approach to retrieval, pretreatment, and treatment of the tank wastes but less than a management and operations

[9]DOE is planning to fund the core competencies primarily by using funds provided by DOE's Office of Technology Development and Office of Waste Management.

contractor approach. On the basis of the Tri-Party Agreement's milestones, the alternate path for starting low-activity waste processing would begin a year later than privatization (2003 versus 2002) and take 4 years longer to complete (2028 versus 2024). However, under both approaches, immobilization of all tank wastes is scheduled to be completed by 2028, as required by the Tri-Party Agreement.

## COMMENTS FROM THE DEPARTMENT OF ENERGY

Department of Energy
Washington, DC 20585

July 26, 1996

Mr. Victor S. Rezendes
Director, Energy and Science Issues
Resources, Community, and
Economic Development Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Rezendes:

Thank you for the opportunity to comment on your draft report of July 17, 1996, concerning "Hanford Waste Privatization." This comprehensive report reflects the General Accounting Office's (GAO) extensive work in summarizing the progress the Department of Energy (Department) has made in moving forward with high-level waste treatment at the Hanford Site. We appreciate your recognition that the Department's privatization strategy represents a fundamental change in how the Department contracts for services.

However, we do not believe that the discussion of "untested technologies" throughout the report accurately represents the status of our privatization effort. Uncertainty of technology is discussed in a context which leads the reader to believe that the Phase I privatization has a high technological risk. This is not the case. Careful study led the Department to identify those portions of the Tank Waste Remediation System which could be privatized. Our analysis indicated that treatment and immobilization were areas which could be sufficiently defined to privatize. A phased approach was selected because an initial demonstration phase could be sufficiently defined so as to involve mature technology and acceptable financial risk. Plans to privatize the retrieval function in a follow-on phase are based on the anticipation that necessary technology will be available by the time the follow-on phase is conducted.

The United States, as well as the international community, is using commercial treatment technology of similar complexity and scale to that required for Phase I of the Hanford privatization. Radioactive waste is being immobilized in similar facilities at the Department's Savannah River Site, the West Valley Demonstration Project, and at various locations throughout the world (including production facilities in France and Great Britain). In addition, immobilization of low-level waste is occurring at production scales at various locations in the world as described in a recent study by the Department (prepared by the Office of Science and Technology).

ENCLOSURE I



Separations technologies also have been extensively used within, as well as outside, the Department for many years. Separations campaigns on Hanford tank wastes have been accomplished successfully in the past at full scale.

The key technological risks seen for the Hanford tank waste privatization initiative are associated with retrieval of the high-level wastes from the tanks. For this reason, retrieval is not included in Phase I of the Hanford tank waste privatization initiative. The Department believes that private vendors would not likely accept these risks at this time and that continued development work by the Government is necessary. The results of the development of retrieval technologies and methods will determine whether the Department can successfully transition the retrieval function to the private sector in the future.

The technical challenge for the privatization vendors will be to commercially demonstrate, using Hanford wastes, that they can integrate the necessary existing technology and efficiently process the waste into the specified product under a fixed-price contract. The Department's challenge is to reduce the known risks through continued characterization and retrieval technology development to move to a well-defined Phase II.

Finally we would like to express our gratitude for the professional way in which this study was conducted and with the open communication which was established and maintained between our organizations.

If you have any questions, please contact me at (202) 586-0370, or Denny Wynne, of my staff, at (301) 903-4967.

Sincerely,

Stephen P. Cowan
Deputy Assistant Secretary
for Waste Management
Environmental Management

(302196)

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