

GAO

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

June 1990

NUCLEAR HEALTH AND SAFETY

DOE Has Not Demonstrated That Restarting PUREX Is a Sound Decision



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**Resources, Community, and
Economic Development Division**

B-240130

June 29, 1990

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

Dear Mr. Chairman:

This report responds to your August 8, 1989, request that we examine the shutdown and planned restart of the Plutonium-Uranium Extraction (PUREX) plant at the Department of Energy's (DOE) Hanford Site in Washington State. PUREX, whose main function has been to produce plutonium and other special nuclear materials for nuclear defense, research, and development programs by reprocessing used (or "spent") nuclear reactor fuel, was shut down in December 1988 for safety-related reasons. DOE's current plans are to (1) restart PUREX in March 1991 to continue its role of extracting weapons-grade plutonium from spent fuel and (2) convert PUREX to a waste management role by processing, for disposal, the spent fuel that cannot yield weapons-grade plutonium. DOE officials indicate permanent shutdown will probably occur around the year 2000.¹

As agreed with your office, we assessed the adequacy of DOE's plans for restarting PUREX.

Results in Brief

DOE's plans for restarting PUREX are not adequate. More specifically, DOE has not

- demonstrated that restarting PUREX, either as a producer of plutonium or as a processor of radioactive waste, is a sound decision. More specifically, DOE has not demonstrated that a need exists for weapons-grade plutonium from PUREX, and it has not fully compared PUREX with other waste disposal alternatives to determine whether PUREX is the best choice.

¹By permanent shutdown of PUREX, we mean what DOE has formally called "deactivation": removal of special nuclear materials from the plant to reduce the level of radioactivity.

- determined whether a supplemental environmental impact statement² for PUREX is needed. Preparing such a statement would address, among other things, (1) any new circumstances or information relevant to environmental concerns that have occurred since the initial environmental impact statement was prepared in 1983 and (2) the need for and alternatives to DOE's planned/proposed action to convert PUREX to a waste management role.
- required that all identified deficiencies in the final safety analysis report³ for PUREX be corrected before the planned restart date. By not requiring full compliance with current DOE requirements prior to restart, DOE has no assurance that the plant can be operated within safety control limits.
- adequately addressed staff turnover and training problems at the plant. From December 1988 to May 1990, over one-third of the plant's operators have left, and DOE's restart plans do not provide assurance that staff will be fully trained to operate PUREX safely.

In view of the importance of the above concerns and their associated costs, a more important issue is whether PUREX should be restarted at all.

Background

PUREX is a DOE-owned, contractor-operated facility at the Hanford Site in Washington State. The plant began operations in 1956, was idled in 1972, and was restarted in 1983. Its main function has been to reprocess spent uranium fuel rods from Hanford's now-closed nuclear materials production reactor, the N-reactor. Reprocessing involves dissolving the rods in acid and extracting plutonium. If the plutonium is of adequate quality it can then be used in making nuclear weapons.

DOE initially planned to complete reprocessing of the N-reactor fuel rods by fiscal year 1994. By 1986, however, problems were causing frequent

²An environmental impact statement is a detailed written statement prepared by an agency pursuant to the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 et seq.), that identifies significant environmental effects of a proposed major federal action. A supplemental environmental impact statement is required if, subsequent to the environmental impact statement, an agency makes substantial changes in the proposed action that are relevant to environmental concerns or there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impact.

³Safety analysis reports are used by DOE to show that facilities are safely designed and constructed. They identify problem areas so that corrective actions can be taken. For contractor-operated facilities such as PUREX, the contractor is responsible for making the safety analysis review, which is subject to DOE review and approval.

shutdowns at the plant, and in December 1988, because the plant operated outside established safety requirements, it was again shut down and has not been able to resume operations. DOE estimates that costs to keep PUREX in its current status in fiscal year 1990 will be \$87 million because of the need to maintain operating systems and to train staff. For fiscal year 1991, DOE estimates operational costs to be about \$101 million.

DOE Has Not Demonstrated That Restarting PUREX Is a Sound Decision

DOE has not demonstrated that restarting PUREX in either of its intended roles—producing plutonium or processing waste for disposal—is a sound decision. More specifically, DOE has not demonstrated that a need exists for the remaining weapons-grade plutonium that could be extracted, and it has not fully compared PUREX with other waste processing alternatives to determine whether PUREX is the best approach. A comparison of waste processing alternatives would be made if DOE updated PUREX's environmental impact statement by issuing a supplemental environmental impact statement, but DOE has not yet determined whether such an update is needed.

The Need for Weapons-Grade Plutonium Has Not Been Established

Under the National Environmental Policy Act, DOE is required to assess the impact of any proposed major federal action it takes that significantly affects the quality of the human environment by preparing an environmental impact statement. The act's implementing regulations also provide for a supplemental environmental impact statement whenever there are substantial changes in the proposed action that are relevant to environmental concerns or there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts.

The initial environmental impact statement for PUREX was prepared in 1983. In it, DOE stated that operation of PUREX was needed "to meet projected needs for plutonium . . . in the nation's nuclear defense . . . programs" and that the number of years of operation "will depend on the future needs for plutonium." After PUREX was shut down in 1988, DOE planned to restart PUREX in its role of producing plutonium for the nation's defense mission.

A number of circumstances have developed since the initial PUREX environmental impact statement was prepared that affect the purpose and need for operating PUREX in its traditional role. Specifically, according to DOE's fiscal year 1989 Hanford chemical processing plan, the plutonium

needed for new nuclear weapons is to come, not from PUREX, but from retired warheads and from the stockpile of plutonium "scrap" generated during the warhead production process. Furthermore, the specific role PUREX plays in plutonium production has changed. For example, after shutdown in 1988 DOE planned to restart PUREX to recover plutonium from all of the N-reactor spent fuel that was to be reprocessed.

Although the majority of the N-reactor spent fuel was fuel-grade plutonium, DOE planned to upgrade it to weapons-grade plutonium at the proposed Special Isotope Separation Plant to be built at DOE's site at Idaho Falls, Idaho.⁴ These plans were significantly affected in January 1990 when funding to build the plant was not included in DOE's budget. Without the plant, DOE does not have the capability nationwide to upgrade the fuel-grade plutonium at PUREX into weapons-grade material. As a result, the national defense mission for PUREX appears to have been largely eliminated. Only about 360 metric tons of N-reactor spent fuel can be processed at PUREX for weapons-grade plutonium, not the approximately 2100 metric tons originally anticipated.⁵

In light of these events, the need for the weapons-grade plutonium that would result from the estimated 9 months of plutonium production (March-December 1991) may be questionable. Although DOE's Deputy Assistant Secretary for Nuclear Materials told us in April 1990 that the plutonium from PUREX was needed, this conflicts with Hanford's fiscal year 1989 chemical processing plan. The Hanford chemical processing plan, as noted, states that plutonium for nuclear weapons is to come from retired warheads and from the stockpile of plutonium "scrap" generated during the warhead process. In addition, the fiscal year 1989 budget request says that most plutonium for new nuclear weapons systems is to come from retired weapons, but it does not clearly indicate the role of PUREX, if any, in satisfying plutonium requirements. A significant factor in deciding whether to restart is that if the plutonium from PUREX is not needed, there would be no reason to operate PUREX for this purpose.

⁴DOE also planned to process on-site reactor fuel from two other DOE facilities—the Shippingport Pressurized Water Reactor Core II and the Fast Flux Test Facility at Hanford—before deactivating PUREX. As with the N-reactor fuel, plans called for off-site upgrading to weapons-grade plutonium at the proposed Special Isotope Separation Plant.

⁵About 1400 additional metric tons from two other DOE facilities is also planned. By metric tons of spent fuel, we mean metric tons of uranium.

The Need to Restart PUREX as a Waste Processor Has Not Been Established

Equally important is the fact that DOE has not established whether PUREX is the best alternative for processing the spent fuel as waste. As indicated, plans call for converting PUREX to a waste processing role—a fundamental change in its mission. DOE has assumed that processing the spent fuel as waste at PUREX is the best approach, but it has not fully compared PUREX with other waste processing alternatives.

In November 1989 the PUREX contractor advised DOE that PUREX was the best alternative for disposal of N-reactor spent fuel. Of the three alternatives to PUREX that were evaluated, one involved shipping the fuel to DOE's Savannah River Site in South Carolina where it would be processed to recover the plutonium and another involved building a new plutonium processing facility at the Hanford Site. Only the third alternative involved disposal of the fuel as waste to a geologic repository.

Although DOE officials told us that a decision has not been made on what the best choice is for disposal of N-reactor fuel, DOE has continued to plan for a restart of PUREX for this purpose. More importantly, its plan to restart is not supported by any detailed technical, engineering, or cost analyses that fully demonstrate that PUREX is the best option for disposal of spent fuel as waste. Without a thorough analysis of the alternatives evaluated by the PUREX contractor, as well as other potential alternatives, DOE has not clearly established whether PUREX represents the safest, most economical, or most environmentally sound approach to disposal.

DOE Has Not Determined the Need for a Supplemental Environmental Impact Statement

DOE has not made a final determination on whether a supplemental environmental impact statement for PUREX is needed. The preparation of such a statement would address, among other things, any new circumstances or information relevant to environmental concerns that have occurred since 1983 and the need for and alternatives to DOE's planned/proposed action to convert PUREX to a waste management role.

The regulations implementing the National Environmental Policy Act emphasize that the "heart of the environmental impact statement" is a discussion of alternatives (40 C.F.R. section 1502.14). Although DOE indicated in a preliminary draft environmental analysis⁶ prepared in May 1990 that continued operations of PUREX will not affect the environment

⁶An environmental analysis is the first stage of the National Environmental Policy Act process. At this stage an agency review determines whether any further assessment, such as an environmental impact statement, is required.

in any manner significantly different than projected in the initial environmental impact statement, this draft analysis does not address plans to change the mission of PUREX. It only addresses PUREX's plutonium production role.

One of the drawbacks of preparing a supplemental environmental impact statement is that it could take over one year to complete and could be costly. (DOE told us that the cost to prepare such a statement for other DOE facilities has ranged from about \$2 to \$5 million.) However, in light of the changes that have occurred since the initial environmental impact statement was prepared, which affect the purpose and need for operating PUREX in its traditional role, we believe that preparing a supplemental environmental impact statement would address a number of important issues. Specifically,

- The preparation of such a statement would address any new circumstances or information relevant to environmental concerns that have occurred since 1983.
- DOE's approach faces likely legal challenges. In January 1990, three environmental groups announced that they intended to sue to require a supplemental environmental impact statement prior to any restart of PUREX. These groups assert that operating PUREX, even in its traditional role as a plutonium producer, will affect the environment in a manner that differs significantly from that projected in the initial environmental impact statement. While the outcome of such a suit is unknown, a decision in favor of these groups could substantially delay any restart of PUREX. These delays would add additional unplanned expense while waiting for a restart.
- Updating the environmental impact statement would help demonstrate DOE's commitment to operating its nuclear facilities safely and in an environmentally sound manner. One of the Secretary's major initiatives is to ensure that environmental, safety, and health issues take precedence over production. The Secretary has also committed to full disclosure and complete assessment of the environmental impacts of DOE's actions.
- Most importantly, such a statement would address the apparent changed need for PUREX to continue processing spent fuel and whether PUREX represents the best alternative for disposing of spent fuel as waste.

PUREX's Safety Analysis Does Not Meet DOE Requirements to Ensure Safe Plant Operations

PUREX's final safety analysis report⁷ is not in compliance with DOE requirements. Furthermore, DOE has not required correction of all the identified deficiencies in the report to ensure that PUREX is in full compliance before the planned restart date. Therefore, DOE cannot ensure that the plant can be operated within safety control limits.

DOE's Safety Analysis and Review System Order, DOE Order 5841.1B, requires each facility to have a final safety analysis report. Such reports are significant in that they systematically identify hazards, evaluate measures taken to eliminate, control, or mitigate them, and document the overall risks associated with operation of the plant. The safety control limits (safety boundaries) for a facility are required to be included as part of this report and such operational safety limits must be reviewed and approved by DOE. Safety controls can include limits on steam pressure, temperature, and volume of nuclear material. The primary objective of the safety control limits is to provide the controls necessary to help prevent the occurrence of accidents. For example, when PUREX was shut down in December 1988, inadequate steam pressure for a backup system violated an operational safety requirement.

The PUREX final safety analysis report does not meet DOE's requirements. At PUREX, the operational safety requirements containing safety control limits are in the contractor's plant manual, not in the final safety analysis report. The plant manual is not subject to DOE's review or approval. As a result, changes made in safety control limits following the December 1988 shutdown have not been fully reviewed by DOE nor approved as required under DOE orders governing the final safety analysis report. Without the required review and approval, DOE cannot ensure that the plant can be operated within safety control limits at restart.

Moreover, DOE has not required that other identified weaknesses in the PUREX safety analysis report, such as insufficient information about replaced or modified equipment or insufficient analysis of potential accidents involving toxic chemicals, be corrected before restart in March 1991, nor has DOE provided the necessary funding to ensure that such weaknesses can be corrected in accordance with regulations prior to restart. PUREX officials originally planned for a complete revision of the

⁷We discussed the issue of safety analysis reports in an earlier report entitled, *Nuclear Safety: Safety Analysis Reviews for DOE's Defense Facilities Can Be Improved* (GAO/RCED-86-175, June 16, 1986).

final safety analysis report for PUREX by fiscal year 1992 at an estimated cost of \$5 million. Subsequently, however, due to the lengthy time and costs involved, a modified plan was developed. This modified plan provides for the revision of only a portion of the report before the planned March 1991 restart date. However, DOE has not made these revisions a requirement for restart. Under this modified plan, not all identified weaknesses would be corrected before the planned restart. And, as for funding, as of May 1990 only about \$1.25 million in fiscal year 1990 funds had been made available for making revisions; an additional \$2.5 million for revisions was planned for the year but not funded. DOE's restart plans do not address when all identified weaknesses would be corrected.

Training Problems and Plant Turnover Will Not Be Resolved Prior to Restart

DOE has acknowledged that it is heavily dependent on skilled, experienced personnel to operate the PUREX plant safely. Since the plant's shutdown there has been a considerable loss of experienced personnel and serious training deficiencies identified as early as 1988 persist. DOE's plans are insufficient to resolve identified training needs and turnover problems prior to restart. As a result, there is no assurance that plant staff will be adequately trained to operate the plant safely.

Serious training deficiencies were reported in DOE's 1988 technical safety appraisal⁸, including the lack of quality technical support for operations training and the lack of a proficiency program to ensure that operators maintained a minimum level of qualification on certified positions. Again, in 1989, PUREX officials reported that plant personnel lacked familiarity with procedures required to ensure that operations are within safety requirements. Since that time, according to DOE and contractor officials, a number of steps have been taken to correct the identified deficiencies including the development of training manuals and increased operator training on safety requirements.

Training problems at PUREX have been compounded by the high turnover of personnel. The Advisory Committee on Nuclear Facility Safety reported in July 1988 a turnover of one-third to one-half of the PUREX staff. Our review showed that 48 of 104 plant operators at PUREX in December 1988 were no longer at PUREX and that even more turnover in plant operations staff is expected by the planned March 1991 restart

⁸A technical safety appraisal is a documented multi-discipline appraisal of a nuclear facility conducted by DOE to ensure, among other things, the proper department-wide application of particular safety elements.

date. DOE told us that PUREX will likely continue to lose staff due to the uncertainties surrounding the future of PUREX. The plant manager estimated that by March 1991 as many as two-thirds of the operations staff may not have had any actual operational experience in processing spent fuel in the plant. PUREX officials believe that possibly the greatest factor affecting restart will be the loss of experienced technical and operations staff. In addition, they expect a decrease in the performance of existing staff because of the inability to practice skills under plant operating conditions before the planned restart.

In the past there have been plant shutdowns due to errors made by plant staff. With numerous changes in plant procedures since the December 1988 shutdown, PUREX officials believe there will be additional errors due to the time needed to learn new procedures. As long as there is a high turnover this problem will persist.

DOE's current plans are insufficient to resolve these problems. DOE has not required that PUREX officials identify how they plan to maintain technical and operation staff skills intact until March 1991. Furthermore, sufficient time and money are needed for training and retraining on a continuing basis when PUREX is operating. The solution proposed by PUREX officials is to add enough staff to create an additional shift, leaving more time during normal operations for training. The cost for doing this is estimated to be about \$2.1 million annually. Although PUREX officials have told DOE that their plans include implementation of another shift after resumption of normal operations, DOE's current plans do not require that such a shift be implemented. Unless DOE makes the additional shift a requirement, it has no assurance that the PUREX contractor will carry through with its plans.

Conclusions

The Secretary of Energy has committed to ensuring that all DOE nuclear facilities are operated safely and in an environmentally sound manner; one of his major initiatives is to ensure that environmental, safety, and health issues take precedence over production. The Secretary has also committed to full disclosure and complete assessment of the environmental impacts of DOE's actions. DOE's plans for restarting PUREX appear to be inconsistent with the Secretary's stated position.

Preparing a supplemental environmental impact statement for PUREX would help to demonstrate DOE's commitment to environmental, safety, and health issues. Although DOE's plans call for restarting PUREX as soon as March 1991, DOE has not yet decided whether the changes that have

occurred since the initial 1983 environmental impact statement require the department to prepare a supplemental environmental impact statement for PUREX prior to restart.

A more important question is whether PUREX should be restarted at all given the costs to operate PUREX, in combination with the costs to prepare a supplemental environmental impact statement, the time and costs associated with correcting identified safety and training deficiencies, the relatively small amount of remaining weapons-grade plutonium, and the possibility that a better alternative exists to dispose of the fuel-grade plutonium. The Secretary of Energy is in a position to make this determination. If a decision is made to continue with plans to restart PUREX, we believe that a supplemental environmental impact statement should be prepared prior to restart of the plant. Also, if PUREX is to be restarted, DOE needs to ensure that all identified safety and operational deficiencies are corrected.

Recommendations

In light of the various issues that have an impact on the future of PUREX, we recommend that the Secretary, DOE, determine at this time whether PUREX should be restarted at all. If the Secretary decides to continue with plans to restart PUREX, we recommend that a supplemental environmental impact statement be prepared before restart. As part of this process, DOE should demonstrate that PUREX is the best alternative for disposition of spent fuel as waste. Detailed technical, engineering, and cost analyses should accompany DOE's final decisions.

Also, the Secretary should prohibit restart of PUREX until all of the identified safety- and training-related concerns have been corrected or adequately addressed. This would include

- making corrections to PUREX's final safety analysis report so that it is in full compliance with DOE orders,
- requiring the PUREX contractor to demonstrate how it plans to maintain technical and operation staff skills intact until the plant is restarted, and
- making implementation of an additional shift a requirement so that adequate time for needed training can be better ensured.

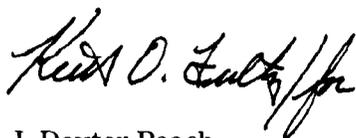
Scope and Methodology

To complete our work, we interviewed officials at DOE headquarters and the Richland Operations Office. We also interviewed DOE contractor personnel, including PUREX plant staff. In addition, we interviewed environmental groups, Environmental Protection Agency Region X officials (encompasses the states of Washington, Oregon, Idaho, and Alaska), and Washington State regulatory agency officials. We reviewed pertinent documents, including congressional testimony, DOE regulations and Secretary of Energy notices, and applicable Richland Operations Office memoranda and PUREX procedures. To develop an overall perspective on the potential implications of restarting PUREX, we also relied on independent studies and correspondence associated with PUREX shutdowns. We conducted our work from October 1989 through June 1990, in accordance with generally accepted government auditing standards.

We discussed the results of our work with DOE officials and incorporated their comments where appropriate. In general, they agreed with the information presented. As requested, we did not obtain official agency comments on this report. Unless you publicly announce its contents earlier, we plan no further distribution of this report for 30 days from the date of this letter. At that time, we will send copies to the appropriate congressional committees; the Secretary of Energy; and the Director, Office of Management and Budget. We will also make copies available to others upon request.

This work was performed under the direction of Victor S. Rezendes, Director, Energy Issues. If you have any questions, please contact him at (202) 275-1441. Major contributors to this report are listed in appendix I.

Sincerely yours,



J. Dexter Peach
Assistant Comptroller General

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