Department of Energy
Washington, DC 20585

June 2, 1998

The Honorable John T. Conway
Chairman
Defense Nuclear Facilities Safety Board
625 Indiana Avenue, NW
Suite 700
Washington, DC 20004

Dear Mr. Chairman:

Enclosed are the following materials committed by the Department of Energy for the record of the May 7, 1998 Public Meeting on 94-1:

Hanford: Spent Nuclear Fuel

1. Cure notice given to Duke by Fluor Daniel Hanford (FDH) (12/10/97)
2. Copy of FDH basis for lifting the cure notice
3. FDH letter closing the cure notice (5/5/98)
4. DOE-Richland letter to FDH requesting the basis for closure of the cure notice (5/5/98)

Hanford: Plutonium Finishing Plant

1. Statement of dollars needed and reasons for delay for the vertical calciner
2. Report of technical problems with the vertical calciner
3. Statement of number of muffle furnaces required

Savannah River Am/Cm

1. Savannah River technical panel recommendations on the Am/Cm project (The Westinghouse recommendations have not yet been given to DOE but will be provided when available.)

Rocky Flats

1. Notes on the results of the meeting with Defense Programs regarding funding for RFETS materials

If you have any questions, please feel free to contact me or have your staff contact Mr. John Tseng, Acting Director, Nuclear Materials Stabilization Task Group, at (202) 586-0383.

Sincerely,

James M. Owendoff
Acting Assistant Secretary
for Environmental Management

Enclosure

cc: M. Whitaker, S-3.1

Hanford: SNF
Attachment 1

FLUOR DANIEL

Fluor Daniel Hanford, Inc.
P.O. Box 1000
Richland, WA 99352

December 10, 1997 FDH-9761522

Mr. T. L. McConnell, President
DE&S Hanford, Inc. H5-30
Post Office Box 350
Richland, Washington 99352-0350

Dear Mr. McConnell:

Subject: [redacted] SUBCONTRACT NO. 80232764-9-K004

Reference: 1) Project Hanford Management Contract FY 1997 Critical Self Assessment, Section 3.3 Spent Nuclear Fuel Project, dated October 31, 1997.

2) Defense Nuclear Facilities Safety Board (DNFSB) Tech-17, "Review of the Hanford Spent Nuclear Fuel Project," dated November 18, 1997

The Project Hanford Management Contract Self Assessment of the Spent Nuclear Fuel Project (SNFP) identified that "...progress toward project completion was not up to management expectations nor did it meet baseline schedule objectives." Subsequently, the SNFP received an overall progress rating of "marginal."

In the second referenced report (enclosed), the Defense Nuclear Facilities Safety Board (DNFSB) concluded that the extensive and unexpected delays in the SNFP were caused by "...a lack of sound project management..." and suggested that the corrective actions taken to date may not be sufficient to ensure the project's success. Fluor Daniel Hanford, Inc. (FDH) concurs with the DNFSB findings. These findings are consistent with and reinforce problem areas identified by FDH relating to the quality of technical work and poor project management practices exercised by Duke Engineering and Services Hanford Inc. (DE&SH) that FDH has communicated to DE&SH throughout calendar year 1997.

Accordingly, pursuant to Part III, General Terms, Article 18, Withdrawal of Work, Section B (3) of the subject contract which reads "for less than satisfactory performance by the Subcontractor," you are hereby notified that Fluor Daniel Hanford, acting on behalf of the U.S. Department of Energy, considers your failure to adequately address the issues outlined in the referenced reports a condition that is endangering performance of the contract. Therefore, unless this condition is cured via a recovery plan that is acceptable, FDH may terminate DE&SH for default under the terms and conditions of the termination clause found at "FAR 52.249-6, Termination (Cost

Reimbursement)" clause of the contract. The due date for a recovery plan, acceptable to FDH to cure this condition, is close of business December 30, 1997.

Any contractual questions regarding this notice should be directed to Mr. R. B. Willard at (509) 376-5340. Any technical questions should be addressed to Ms. N. H. Williams at (509) 373-6307.

Sincerely,

Jim L. Jacobsen, Director
Contract Management

FLUOR DANIEL

Fluor Daniel Hanford, Inc.
P.O. Box 1000
Richland, WA 99352

May 7, 1998 FDH-9853985 R1

Mr. J. D. Wagoner, Manager
U.S. Department of Energy A7-50
Richland Operations Office
Post Office Box 500
Richland, Washington 99352

Dear Mr. Wagoner:

CONTRACT DE-AC06-96RL13200 - DE&S HANFORD, INC., SUBCONTRACT CURE

Reference: Letter, J. D. Wagoner, RL, to H. J. Hatch, FDH, "Contract No. DE-AC06-96RL13200 - FDH Subcontract with DESH," MGR:JDW, dated May 5, 1998.

In response to the reference letter, Fluor Daniel Hanford, Inc., (FDH) issued the Cure Notice because of DE&S Hanford Inc.'s (DESH) continued lack of sound project management practices which were producing poor results on the Spent Nuclear Fuels (SNF) Project. As reported in the Critical Self Assessment performed in September 1997, the SNF Project was rated as marginal with respect to meeting management and baseline objectives. This fact was further confirmed by the Defense Nuclear Facility Safety Board Report TECH-17.

In December 1997, when the Cure Notice was issued to DESH, there was a continued lack of recognition on the part of DESH management that DESH's performance on the project had been less than adequate. The project was continuing to experience delays that were being driven by DESH's inability to systematically and expeditiously identify issues that were affecting the cost and schedule. This was compounded by the fact that DESH management did not impose an effective change management system thereby forcing Fluor Daniel, Inc., to develop the procedure and direct its implementation on the project. In addition, DESH management was not reporting the impacts that technical and programmatic issues were having on the project cost and schedule baselines such that recovery plans could be put in place. On many occasions in the months before the Cure Notice, DESH management exhibited a reluctance to incorporate suggestions and guidance for improvement in the management of the project which were being provided by FDH. Ultimately, FDH's only recourse to remedy these process and programmatic weaknesses was to issue the Cure Notice with the intent of getting DESH to focus in the areas where improvements were necessary.

DE&S HANFORD, INC., CURE NOTICE
EXPECTATIONS ACCOMPLISHED TO DATE

Completed the transfer of the Project Controls function. This included the transfer of staff and budgetary resources to Fluor Daniel Hanford, Inc., (FDH). FDH is now responsible for all activities associated with the control of the baseline level 3 schedule and ensuring that no changes are made to it without going through baseline control. All progress reporting will be provided by DE&S Hanford, Inc., (DESH) and measured against the baseline.

Replaced the Project Director with Mr. Charlie Aycock who has demonstrated project management experience rather than the previous personnel who were line management focus.

Realigned and consolidated the engineering organization under the leadership of Mr. Alden Segrest who is requirements and configuration control oriented. This skill set will ensure that the projects and safety analysis documentation meet a consistent set of requirements.

Moved the engineering functions and safety analysis functions under one manager, Mr. Alden Segrest, which will aid in achieving alignment between the design and safety analysis documentation.

Brought in a new Safety Analysis Manager, Mr. Robert Morgan, who is experienced in commercial nuclear safety analysis preparation.

Created a Technical Operations Director. This position is responsible for obtaining the resources needed to drive outstanding technical issues to resolution.

Redefined responsibilities of the Project Execution Director to adopt a commercial nuclear outage manager approach. Unlike before, this position now has sole accountability for driving the overall project critical path and developing work arounds when delays are eminent.

Developed guidelines for business operations, technical issue communications, and schedule issue communications.

Aggressively adopted the FDH change control procedure.

Hired a technical expediter to facilitate and resolve procurement issues on the work in the United Kingdom on the Multi-Canister Overpack Handling Machine.

Restructured the sub-tier subcontracts to eliminate the salt and pepper organization within DESH and develop full scope responsibility and accountability with the subcontracting entity. This included the novation of several subcontracts to the performing subcontractor.

DE&S HANFORD, INC., CURE ISSUES THAT REMAIN OPEN

DE&S HANFORD, INC., HAS COMMITTED TO DEMONSTRATE APPRECIABLE IMPROVEMENT IN THE FOLLOWING AREAS OVER THE NEXT TWO MONTHS

Improved safety performance reporting and case management.

Safety Analysis Requirements document quality.

DE&S Hanford, Inc., (DESH) must complete the development and institutionalization of the central safety case document which was initiated by Fluor Daniel Hanford, Inc.

Cost reductions in the areas of staffing and subcontracted work scopes.

Improved K-basin operations including strong management implementation to ensure clear lines of accountability, instituting a more disciplined approach to the Conduct of Operations, ensuring up front involvement of the operations, quality assurance (QA) and radcon personnel in the designs, installations and planning.

Demonstrated understanding of the causal factors behind the project performance problems.

Timely identification and resolution of technical issues.

Improvements in the closure of Unreviewed Safety Questions, prompt response to Limiting Conditions for Operation, Price Anderson Amendments Act reporting/ corrective action follow through, and implementing the necessary changes to ensure a functional corrective management system.

Improved subtier subcontractor management including effective change control, consistent flow down of requirements, effective interface control and cost containment.

Strong management implementation of the DESH project organization to ensure effective accountability, flow of information both downward and upward, and integration between the subprojects.

Focus on the startup planning to ensure the procedures, training, spare parts, tooling, maintenance planning operational testing and startup activities are consistent with the cost and schedule baselines.

Demonstrated understanding of the need to/how to drive accountability into the Spent Nuclear Fuels Project.

Define the centralized engineering function which will include clearly established interfaces and responsibilities between the various different engineering groups in the 100 and 200 Areas, address consistency in requirements, and ensure sufficient technical expertise to address open issues and design decisions.

Improved implementation of the QA program and flow down of requirements.

FLUOR DANIEL

Fluor Daniel, Inc.
3353 Michelson Drive, Irvine, CA 92698
(714) 975-2798 Fax: (714) 975-2956
E-mail: ron.peterson@fluordaniel.com

Ron Peterson
Group President
Government, Environmental & Telecom

May 1, 1998

Mr. John F. Norris, Jr.
President & Chief Executive Officer
Duke Engineering & Service
P.O. Box 1004
Charlotte, NC 28201-1004

Dear John:

Ref: Your letter of April 7, 1998

We did have a good and useful meeting on April 3, and I agree with you that we should make the necessary decisions related to the Cure Notice and extend/recompete quickly. We have been working diligently to do so in accordance with our conditional approval of January 30, 1998.

That letter laid out certain expectations and stated that we would monitor progress made over the next 90 days prior to making a decision on the Cure Notice. We have been doing just that and based on the substantial changes you have made in the last few months and the commitments made to us for further progress by Tony McConnell, Charley Aycock, and yourself, we consider the Cure Notice closed as of May 1, 1998, and will focus on going forward with the work of the project.

In terms of the extend/recompete decision, we will continue to monitor the commitments made in the recent discussions, and if activities stay on the path that we believe that they are on, it is my intention to extend your contract. We will formally notify you of our decision in advance of the contractually required date for the unilateral exercising of options to your contract.

Your personal involvement and attention to this project is appreciated. I agree that if we bring all of the Fluor Daniel and Duke energies to bear, we should be able to solve this problem. The team at Hanford has been instructed to work closely with your people and other participants to make this project successful.

Sincerely,

Ron Peterson

Ronald G. Peterson

— +3 hrs = 11:12am EST

Hanford: SNF
Attachment 4

Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

MAY 5 — 1998

Mr. H. J. Hatch
Fluor Daniel Hanford
Richland, Washington 99352

CONTRACT NO. DE-AC06-96RL13200 - FDH SUBCONTRACT WITH DESH

As we discussed last night, I was surprised that FDH has concluded that DESH apparently "cured" the performance issues identified in the Cure Notice and notified Duke Engineering & Services to that effect in a May 1, 1998, letter from Ron Peterson to John Norris. I would appreciate it if you could provide me by Thursday, May 7, 1998, a comparison of the reasons for the Cure Notice and how DESH was able to persuade you that the issues were resolved.

Ron Peterson's letter also discussed the issue of extension or recompetition of the Subcontract. Please provide your recommendation with supporting justification by May 29, 1998, so that a timely decision can be made. Obviously, the significant performance problems which have existed on this subcontract make this a vital decision.

Sincerely,

John D. Wagoner

John D. Wagoner
Manager

MGR:JDW

cc: Ron Peterson, Fluor Daniel, Inc.

RESPONSE TO ISSUES RAISED AT THE MAY 7 DNFSB PUBLIC MEETING REGARDING RECOMMENDATION 94-1 IMPLEMENTATION

The items below are a response to issues the Defense Nuclear Facilities Safety Board raised at the May 7, 1998 Public Meeting regarding Recommendation 94-1 implementation related the Plutonium Finishing Plant (PFP) located near Richland, Washington.

o **Dollars needed and reasons for delay for vertical calciner.**

Estimates to complete and make the vertical calciner ready for operations are preliminary in nature. Approximately $2M is required to make the vertical calciner operational in order to start stabilization of the pure plutonium nitrate solutions. An additional $4 - 5 million for rehire crews, training, clearances, and perform Operational Readiness Review (ORR). Approximate $2 - 3M design and construction and $2M for training, testing, and operational readiness is required for the ion exchange system. Firmer estimates will be available in late summer as part of the PFP FY 1999 PBS.

The original delay was a result of the technical complexity associated with the installation of the vertical calciner. Funding shortfalls in FY 1998 have further delayed the already missed milestone.

o. **Technical problems with the vertical calciner.**

The following items describe the primary problems with operation of the prototype calciner and how these problems were fixed in the installed calciner:

1. Inadequate heating in early tests. This problem has been solved by replacing everything except the temperature controller in the original heating system. The prototype calciner's last few runs proceeded at the design temperature of 1000°C and at the expected flow rate of 4 L/hr while using only about 88% of the available heating power. Product quality was acceptable with only two exceptions, the highest LOI being 0.718 weight percent. The production unit has a larger heating system than the prototype. Note: during the stabilization campaign, items with high LOI will be re-stabilized in the muffle furnaces.

2. Chipped/broken agitator shaft bushings. The damage to the bushing was caused by shifting of the two top plates of the calciner. This problem was solved by redesigning the two top plates on the calciner. These plates are pinned together and clamped together more tightly to prevent shifting. The holes for the agitator shaft and its bushings were then match-drilled to guarantee their alignment. The prototype has had no problems with shaft bushings since this change was made. The production unit includes this new design.

3. Broken heating elements. This problem has been decreased markedly by correcting some of the other problems. Most of the elements

broke while the calciner was being maintained for other problems. The decrease in tear-downs for other problems led to a corresponding decrease in heating element breakage. The prototype's heating system was also redesigned from two long elements to 14 shorter elements to make it easier to bypass a broken element, if necessary. The production unit uses this same general improvement with 10 separate elements, but also uses elements with a thicker diameter to decrease the chances of breakage.

4. <u>Inadequate agitator drive motor.</u> The original motor was replaced with the current 1/3-hp motor and there have been no torque-related problems since that time. The production unit uses the larger motor.

5. <u>Less than adequate vacuum control inside the calciner chamber.</u> The original vacuum controller could not be set to operate with enough vacuum to keep the pressure below atmospheric during feed pulses because of the sudden steam generation. The controller was replaced to allow more vacuum. At the same time, the feed pump has been replaced giving smaller feed pulses with correspondingly smaller bursts of steam. The production unit uses the improved vacuum controller and a fully functional feed pump control system.

6. <u>Scrubber performance.</u> During most of the prototype's runs, acid gases have reached the process vacuum pump. These gases decreased the pump's seal water pH and required compensatory measures at the pump to keep seal water discharges acceptable. Extended operation at the lower pH would also damage the pump via corrosion. The feed rate for the caustic scrub solution was increased and performance improved, but not enough. Continued testing is needed to determine the best flow rate and to determine if lowering the scrubber operating temperature will help with the scrubbing. The production unit uses an automated pH control system rather than the manual system on the prototype.

7. <u>High product LOIs.</u> Two of the nine product batches had LOIs exceeding the limit of 0.5 weight percent. The highest LOI to date has been 0.718 weight percent. The high LOIs are thought to be caused by slightly pressurized steam inside the calciner due to an inoperative pulse volume control on the feed pump. The feed pump has been replaced and the new pump is set to run with pulses only 1/4 the volume of the previous pulses. There was no steam evident during a ½-L test run with dilute acid after this pump was installed. The production unit uses a different feed pump with previously tested pulse frequency and volume controls. Note: if the product has a high LOI, it will be re-stabilized prior to packaging to 3013.

8. <u>Rusting found in one product can.</u> One can was opened in the 2736-ZB Building and found to have a small amount of condensate in the package and some rust on the inside surfaces of the can. This product had an LOI of 0.466 weight percent when canned. This problem, too, is thought to be caused by the feed pump. If steam

was being trapped in the product, then some NOx was probably trapped there, also. While these gases may not have been much, there might have been enough to put the small amount of rust in the can (NOx oxidation) and condensate in the package (trapped steam). While we are not completely convinced that we know the real reasons for the rusting and condensate, we can think of no other calciner-related causes. Continued prototype operation and product inspection are needed to determine if this is a problem inherent to this calciner or just a fluke occurrence. The production unit will incorporate whatever changes are determined necessary by the prototype's results.

The following items describe potential technical problems with the installed calciner:

1. Continue testing with more types of solutions (i.e., different concentrations, uranium vs. Pu, limited amounts of organics, different sources, etc.). Need to confirm that there will be no adverse operation with the different types of feed. These tests do not remove the need for the feed pretreatment system, which will still be necessary for some feeds.

2. Confirm that the new feed pump with its improved feed pulsing control yields the expected improvement in product quality (i.e., no more high LOIs) and ends the problem of steam escaping the pressure relief device during prototype operation (worked well during a ½ -L dilute acid run after a new pump was installed on the prototype).

3. Confirm the suitability of the product powder for storage without additional processing. Show that the lack of steam and slight pressure inside the calcining chamber yield product that will not produce rusting or condensate inside the storage can. The new feed pump with its smaller feed pulses is expected to cure this problem.

4. Test bed mixing with the new agitator. Movement, not mixing, is the purpose of the agitator; however, we would like to know how much mixing goes on in the powder bed to help understand the residence time distribution. This knowledge may help in setting throughput limits to guarantee product quality. Bed mixing could be tested by alternating feed cations (U vs. Pu) or by feeding differing isotopic blends. Multiple runs would be needed after each change.

5. The calciner has not been operated for an exhaustive length of time. It is unknown what detrimental effects would occur after a run of up to 100 hours or multiple runs. Criticality, radiological concerns, and security limits restrict the length of time the prototype may be run with most types of feeds available. Slower feed rates, more dilute feed solutions, and borrowed staffing may allow us to perform a longer run; however, the product from this and at least one subsequent run should have

artificially low product LOIs when compared to runs at a normal throughput rate. This run might also require additional Analytical Laboratory staffing for fast analysis of spent scrub solution samples and/or product samples.

6. Keep testing the scrubber to get the best combination of caustic solution flow rate and scrubber operating temperature for minimizing acid gases reaching the process vacuum pump.

- **Number of muffle furnaces required.**

  Implementation of the current proposed change requires 7 muffle furnaces, i.e., two already installed, three additional muffle furnaces to complete installation in FY 2001 and 2 muffle furnaces that are part the PuSAP system.

May 12, 1998

Mr. Ambrose L. Schwallie, President
Westinghouse Savannah River Company
Aiken, South Carolina

Dear Mr. Schwallie:

SUBJECT: Westinghouse Savannah River Company (WSRC) Preparation of a New Program Execution Plan for Stabilization of Americium/Curium (Am/Cm) Solutions in F-Canyon

In November 1997, the Department of Energy - Savannah River Operations Office (SR) and WSRC determined that the program to vitrify Am/Cm solutions using a continuous-feed bushing melter should be stopped and the stabilization method and final form of the material be reevaluated. It was clear in November that the proposed vitrification system had become too complex and unreliable, and that allowing parallel Research and Development (R&D), design, and construction was not appropriate. Subsequently, WSRC has moved forward with R&D on a batch-fed, cylindrical induction-heated melter (CIM) in parallel with an in-house reevaluation of other stabilization and disposal options for the Am/Cm.

In response to issues surrounding the Am/Cm program, in March 1998, an independent Panel was established for the Am/Cm stabilization program review. The Panel's charter is to review the Am/Cm project and provide recommendations relative to technology decisions, project management, design, construction, and operations. Two reports were requested. The first is an evaluation of the alternatives studies conducted by WSRC. The Panel has completed this report and a copy is enclosed for your consideration. The second report will be an evaluation of the overall Am/Cm technology program and project management. I expect the Panel to complete their second report by September 1998.

As we have discussed, WSRC should consider the Panel's Report while preparing recommendations for how to move forward with the Am/Cm program. Specifically, I agree with the Report's conclusion that work on vitrification, both via a CIM and an in-can process, should continue as planned; that additional work should be done to evaluate the technological hurdles and cost of stabilizing the Am/Cm via an in-can oxidation process; and potentially disposing the material via the Savannah River Site High Level Waste system should be carefully evaluated. I recognize that between now and September 1998 there may not be resources available to evaluate these options to the same level as WSRC has done for vitrification and the CIM. However, it is incumbent upon us to ensure that when a final decision is made on stabilization of the Am/Cm, that we have adequately considered the options and that we are confident the project can be completed in a safe, effective, and timely manner. Further, it is important that work be accomplished on more than one alternative in the event the technology chosen later this year is not ultimately successful. To that end, over the next several months, WSRC should evaluate and perform some level of research and testing on stabilizing Am/Cm as an oxide and provide a best estimate of cost and schedule for each option discussed above.

Please consider the enclosed report in preparing the WSRC recommendation on how the Am/Cm stabilization program should proceed. I request that your recommendation for how to proceed with the Am/Cm program be submitted by June 12, 1998.

Please have your staff contact John Anderson, Acting Assistant Manager for Material and Facility Stabilization at 952-2497, if they have any questions. If your staff wishes to consult with the Independent Review Panel members, please have them contact Margaret Schwenker at 725-0403.

Sincerely,

Original Signed by
Greg Rudy

Greg Rudy
Acting Manager

Enclosure:
Interim Report, Americium/Curium Stabilization
Independent Review Team, May 8, 1998

cc w/encl.:
Joe Buggy, WSRC
Susan Wood, WSRC
Frank Jordan, WSRC
John Oakland, WSRC
Kent Fortenberry, DNFSB Site Representative
Joe Sanders, DNFSB Site Representative
Judy Bostock, AMSBTD
John Anderson, Acting AMMFS
Roy Schepens, Acting AMHLW

bcc w/encl.:
~~Sachiko McAlhany~~, Office of AMMFS
Marggie Schwenker, Office of AMSBTD
Sam Glenn, Office of the Manager

bcc w/o encl.:
AMMFS Reading File
AMSTBD Reading File
Manager's Reading File

Interim Report
Americium/Curium Stabilization
Independent Review Team
May 8, 1998

Independent Review Team

Larry R. Avens - Team Leader

James C. Truelove

David J. Odland

Eric C. Skaar

Jack H. Riley

1. Executive Summary

In March 1998, the Department of Energy Savannah River Operations Office (DOE SR) Manager initiated an independent review of the F-Canyon Americium/Curium (Am/Cm) Stabilization Program. The Independent Review Team was chartered to examine both the technical and project management aspects of the program. The Charter is included as attachment 1. This is the May 1998 interim report of the Independent Review Team.

The primary focus for stabilization to date has been vitrification of the Am/Cm. Initially research and development (R&D), engineering, and construction were performed in parallel. This approach resulted in frequent engineering and construction changes as the R&D portion of the program generated new design requirements. More recently, design, engineering, and construction have been curtailed while awaiting completion of research and development activities. The original cost estimate for the program was $40.5 million and vitrification was to be complete in 1998. Approximately $30 million has been spent to date and the estimated cost is now $60 to 80 million with vitrification scheduled to be complete in 2002. The chronology of events for the program are shown in attachment 2.

The focus of this report is the technology options for stabilization and recommendations for the path forward.

During March and April, the review team studied documentation (see attachment 2), discussed the project with key Westinghouse Savannah River Company (WSRC) and U.S. Department of Energy (DOE) personnel (see attachment 3), visited the research laboratories, and toured F-Canyon. The team developed a list of technical options and criteria against which the technologies were evaluated. The team also began the review of the project's management and observed that the project has suffered from insufficient detailed planning and strong technical oversight.

The team concluded that no single technical option can be recommended at this time. No option can be recommended because the research and development activities are not yet complete and therefore, accurate cost and schedule information is not available. We recommend that three options for stabilization be pursued: vitrification, in can conversion to oxide, and disposal through the Defense Waste Processing Facility (DWPF). We also recommend that technical oversight of the high risk R&D activities, such as the Technical Advisory Panel (TAP), be strengthened and enhanced and that senior management review of the program continue until the high uncertainty activities have been completed. We further recommend that resource loaded schedules be developed for each option by June 17, 1998. Review and revision of these schedules over the summer will result in a solid understanding of the options by August and support a restart decision in September.

2. Introduction

Approximately 15,000 liters of solution containing isotopes of americium and curium are stored in Tank 17-1 in F-Canyon. These isotopes are held over from plutonium-242 production campaigns in the 1970's. Currently, no facilities exist to stabilize this material.

The Defense Nuclear Facilities Safety Board (DNFSB) in Recommendation 94-1 expressed concern about the slow pace of remediation in the DOE complex. The Board felt that delays in stabilization coupled with deterioration of safety systems could lead to increased risks to workers and the public. The Board also considered the stabilization of the F-Canyon solutions to be especially urgent. Subsequently, compensatory measures were put in place to reduce the risk to the workers and the public.

In 1995, a plan was developed to stabilize the Am/Cm solution via vitrification. Today, unanticipated problems in the vitrification research program have seriously delayed the stabilization schedule. While the vitrification research and F-Canyon preparations for Am/Cm stabilization continue, other elements of the program have been curtailed pending review.

In 1998, the National Research Council recommended that all DOE projects with a total estimated cost greater than $20 million be considered for independent review. Early this year, the DOE SR Manager initiated an independent review of the Am/Cm stabilization program. The Am/Cm Independent Review Team was chartered to evaluate stabilization technologies and review the technologies, project management, and execution with respect to cost, schedule, and safety. The schedule for the review requires technology recommendations in May 1998 and an evaluation to support the project restart decision in September 1998.

This document is the May 1998 report from the Independent Review Team. It details the conduct of the technology evaluation and provides the team's recommendations.

3. Technical Evaluation

During the first phase of the review the team contacted approximately 20 people (partial listing in attachment 3), studied over 1000 pages of documentation (partial listing in attachment 4), and toured several processing and experimental facilities. This background information helped the team obtain a clear picture of the Am/Cm stabilization project history and current status. Using this background and information from other sources, the team developed a list of potential technologies to address the stabilization, as well as criteria to evaluate the technologies which are included in attachment 5.

The criteria that the team used to develop the technology ranking are listed below. The ordering of the criteria does not infer the relative importance; in fact the last criteria, environmental health and safety, was weighted most heavily.

- Recoverability of Am/Cm
- Durability
- Experience in Canyon Operations
- Technical Maturity of the Process
- Timely Stabilization (Cost and Schedule Impact)
- Environmental Safety and Health

The team examined the options and ranked each option in accordance with the criteria listed above. This exercise took many hours to complete and helped determine the most viable options. Perhaps the greatest value of the tool was to expose critical issues.

At this time, the path to a successful vitrification stabilization program for the material in Tank 17-1 is not straight forward. All the attempts at using a bushing melter concept with continuous material feed have failed for one reason or another. The present cylindrical induction melter configuration using a batch feeding process would seem to be more robust than the bushing melter, but it is not a mature, proven technology.

Two additional variations of the vitrification approach are in can vitrification and slurry feed. In can vitrification appears to present less technical risk, because it is conceptually a simple process. But, even in this case, a new glass formulation will be required because of the lower melting point glass required for use with the storage can. Because the present melter concept is a batch operation, there is probably no advantage to using a slurry type of feed.

Options that produce oxide as a product are simple, well understood processes that have the added advantage of prior canyon operational experience.

Stabilization of the material in tank 17-1 was judged as unacceptable. Leaving the metals in the tank would make Decontamination and Decommissioning of the canyon extremely difficult.

The Russian silica process shows promise. However, this option would require the development of specialized equipment after a detailed understanding of the process chemistry is known. Both of these requirements add time and complexity to the project schedule.

The molten metal option was judged to pose the most serious hardware development challenges. While this option could be made to work, the time added to the schedule and the costs required to analyze the numerous unknowns make this a poor option.

All the high efficiency ion exchange, ion chromatography, and solvent extraction separation technologies were judged to be too complex for reliable canyon operation. These options also produce contaminated organic wastes.

The team was not able to select a single most suitable technical approach at this time. The reason that a single most suitable option could not be identified is due to the lack of accurate cost and schedule data.

The team agrees with the review conducted late in 1997 by WSRC (Americium Curium Stabilization Disposition and Alternatives Doc. # NMS-97-0173). The most expedient and cost effective options appear to be vitrification, conversion to oxide, and disposal through DWPF.

Vitrification has the advantages of stabilizing the Am/Cm in a form that is suitable for long term storage and shipping. A strong vitrification technical base exists at Savannah River. A good R&D team is already assembled that currently appears to be working well. Some design work has also been done on the full scale system.

Disadvantages to the vitrification route are that the science is not yet completely developed and the process is not yet defined. Because the science and process are not yet defined, design of the equipment is not possible. The net result is schedule delay and additional costs.

Advantages of the oxide route are that the science is well known, the technology is simple, and the equipment is simple. A further advantage is that oxide production has already been done in the canyon. The prior canyon experience can be used to design a second generation system to give more reliable performance.

Disadvantages of the oxide route include storage issues, shipping issues, and problems associated with handling oxide powder in the canyon. Westinghouse feels that handling oxide powder will be difficult, will increase contamination levels in the canyon, and will make D&D more difficult. The team does not see these barriers as compelling reasons to reject this option.

While the review team feels the Am/Cm should be recovered for use as a fall back alternative, disposal of the Am/Cm through DWPF should be re-examined, barriers identified, and costs estimated. Once this information is known, the Department will be in a better position to weigh the various options.

4. Project Management

The team was also chartered to evaluate this project with respect to project management. Most of the review team's effort to date has been focused on the technical aspects of the project. The team will have more information with respect to project management in the August report, however, we do have some observations.

As discussed earlier, the estimated Total Project Cost was 40 million dollars which included a 40% contingency and was scheduled to be complete in early 1998. The present estimate is between 60 and 80 million dollars and scheduled to complete in 2002. To date the project has suffered from insufficient planning and the lack a of strong technical oversight and review process.

Furthermore,, research, design and construction were being carried out simultaneously. This led to delays and increased costs from excessive redesign. Much of this could have been avoided if design and construction had followed a thorough research phase.

The desire to meet the DNSFB commitment as well as the desire to provide a system which would support the vitrification of plutonium contributed to adding complexity to the R&D and design process. Taken together, the probability of failure was great. Therefore, increased levels of review and controls were needed.

5. Recommendations

The team recommends the pursuit of three options for stabilization of the Am/Cm: 1) vitrification, 2) "in can" conversion to oxide and 3) disposal through DWPF. The first two options represent interim stabilization and storage in MPPF. Detailed schedules for these two options should be prepared including work to be done, costs associated with that work, and length of time to perform the work. Significant issues and barriers to each approach should be identified and activities to resolve these issues initiated. The team also recommends that life cycle planning (to identify issues, barriers, estimated cost and schedule) be conducted for all three options through final shipping off Site for ultimate disposition or storage.

Further, the team recommends that WSRC and DOE continue high level management attention to this project (until all the high risk issues have been resolved) and that actions be taken to ensure the effectiveness of the TAP in providing oversight to the R&D process. The WSRC three phase Cylindrical Induction Melter test program appears to be a good path to define the science and process necessary to demonstrate this technology.

6. Path Forward

The Independent Review Team will continue with the goal of supporting a project restart decision in September. In order to support this goal, the team will 1) evaluate the technology development program and 2) evaluate the project management aspects of the overall program. This will be accomplished through review of documentation, review of project status reports, continued discussions and interviews with program personnel, and on-site visits during May, June, July, and August.

The team will evaluate the program in a disciplined manner. The progress of research and development of the integrated vitrification process and for alternative technologies will be monitored. The evaluation of the project management aspects of the Am/Cm project will continue with the examination of the program team organizations, including roles and responsibilities, of both the DOE and contractor teams. The Independent Review Team will continue to interview selected project and management personnel, review applicable documentation, such as the Project Execution Plan, and review the schedule, work breakdown structure, and cost data associated with the program. The team will also evaluate the methods used for tracking progress and the feedback mechanisms used to alert the program team and management personnel of identified problems in cost or schedule.

The schedule for the Independent Review Team:

June 17, 1998
Resource loaded schedules for the three options (including issues and barriers) delivered to the independent review team.

June 23-25, 1998
Team visit to Savannah River Site (SRS) for presentations of the schedules and discussion of issues and interviews with select project and management personnel.

July 15,1998
Revised schedules and a discussion of the issues delivered to the independent review team.

July 21-23, 1998
Team visit to SRS for presentations of the revised schedules and interviews with select project and management personnel.

August 12, 1998
Revised schedules, Project Execution Plan, and current issues delivered to review team.

August 18-20, 1998
Team visit to SRS for discussion of revised schedules, cost estimates, and Project Execution Plan.

August 20, 1998
Team delivers final report which makes recommends for: Am/Cm disposition technology, project path and project management.

After August 1998
Continued review and consultation regarding project management. costs, schedules, and operations as desired by DOE.

7. Attachments

1. Independent Review Team - Charter
2. Am/Cm Development Program Chronology
3. Documents Reviewed
4. Personnel Contacted
5. Technology Evaluation Criteria and Technology Options Considered

Independent Review Team Charter

Primary Focus of Independent Review Team will be the path ahead for the disposition of Am/Cm solution in tank 17-1 in a safe, expeditious, cost effective manner.

Review Am/Cm vitrification project to determine:

- Technology and planned approach is technically satisfactory.
- Review consideration given to alternative technologies as related to cost, schedule, and safety.
- Review technology development program and effective use of project management for execution as related to cost, schedule, and safety.

Date	Event Description
Dec-94	Vitrification Bushing Project Authorized
Sep-95	Melter #1 Testing Begun
Oct-95	Approval of CD1 For AM/CM Project
Nov-95	CDR Complete
Mar-96	Project Authorization
Jun-96	Forecast Schedule Delay-3 Months
Jul-96	Melter #2 Testing
Jul-96	Melter #2 Failure
Oct-96	Forecast Schedule Delay-11 Months
Dec-96	Suspension of Pretreat/221 Mod. Work
Feb-97	Melter 2A Start
Mar-97	Rebaselining Kick-Off
Jun-97	Offgas Evaluation
Jul-97	Rebaselining Complete
Aug-97	BCP to DOE
Oct-97	Failure of Melter 2A
Oct-97	Review Various Design/Process Options
Oct-97	MPPF Design Activities Suspended
Nov-97	Mods to Bushing Melter System/Process Including Batch Process Option
Nov-97	Rev. O of Development Program Plan Issued, Melter 2B Installed and Started-Up to Support Splatter Runs, and Lab. Work Initiated on Oxalate Precipitate Batch Process Option
Dec-97	Drain Tube Test Stand Work Initiated on Oxalate Precipitate Batch Process Option, Devitrification of B2000 Glass in Drain Tube Test Stand and Eval. of SrABS Glass.
Dec-97	Melter 2B Failure
Jan-98	Decision Made to Focus on Batch Process Option
Jan-98	Switching to Cylindrical Induction Melter
Feb-98	Work Initiated with Pacific Northwest National Lab to Evaluate Oxalate Precipitate-Frit Melt Dynamics
Feb-98	Cylindrical Induction Melter (CIM) Construction Initiated
Mar-98	CIM Construction and Start-up Preparations Completed
Mar-98	CIM Initial Heat-up and Melting of 50SrABS Hybrid Glass
Mar-98	DOE Manager Appoints Independent Review Team
Apr-98	Phase I Testing of CIM Initiated
Apr-98	Proof of Concept (POC) Initial Testing of Oxalate Precipitate Flowsheet Completed in Laboratory and Drain Tube Test Stand.
May-98	Independent Review Team Interim Report Completed

Persons Contacted

Name	Title	Organization
Greg Rudy	Site Manager	DOE (MGR)
Frank McCoy	Deputy Manager	DOE (MGR)
Judy Bostock	Assistant Manager	DOE (AMSTBD)
John Anderson	Assistant Manager	DOE (AMMFS)
Terry Spears	Dep. Asst. Manager	DOE (AMSTBD)
Margaret Schwenker	Team Coordinator	DOE (AMSTBD)
Sachiko McAlhany	Program Manager	DOE (NMSD)
Doug Lilly	Project Manager	DOE (TECHD)
Sam Speight	Project Manager	WSRC (BSRI)
Norm Barnett		WSRC (NMSS Engineering)
John Marra		WSRC (SRTC)
Tracy Rudisell		WSRC (SRTC)
David Peeler		WSRC (SRTC)
Tim Jones		WSRC (SRTC)
Mike Stone		WSRC (SRTC)
John Duane		WSRC
Robert (Bob) Williams		WSRC

Primary Documents Reviewed

1. Americium/Curium Stabilization Disposition and Alternatives -NMS-97-0173 - From Mr. J.F. Jordan to Mr. A.L. Watkins - December 19, 1997.
2. Defense Nuclear Facility Safety Board - Recommendation 94-1.
3. National Research Council - Assessing the Need for Independent Project Reviews in the Department of Energy - Lloyd A. Duscha.
4. Roles and Responsibilities for Project Execution - NMS-SPM-97-007-dtd February 11 1997.
5. Project Execution Plan - Americium/Curium Vitrification Demonstration in the Multi-Purpose Processing Facility - Project S-5997 - December 12, 1995 Rev. A.
6. Plutonium Vitrification in MPPF (U) - NMP-PLS-950308.
7. Extraction of Actinides from Lanthanide Glasses - John M. Pareizs & Ned Bidler.
8. Excerpt from Integrated Stabilization Plan - March 9, 1995.
9. Chapter 8 and 9 - Americium and Curium - "The Chemistry of the Actinide Elements" - Seaborg - Katz - Morse.
10. Vitrification of Americium/Curium and Plutonium - NMP-VP-94278 - December 28, 1994.
11. Disposition of F-Canyon AM-CM - Analysis of Disposition Options (U) - NMP-ESE-940020 - July 13, 1994.
12. Resolution of Technical Issues for Disposal of F-Canyon Americium-Curium (U) - NMP-VP-93-072- April 30, 1993.
13. Presentations on the history and status of the technical aspects of the Am/Cm were made to the team on March 30-31, 1998.
14. Program Plan for Independent Review of Am-Cm Vitrification Project, dtd March 26, 1998.
15. Managing to the Baseline - Improving the Management of the Department's Project - Report to the Secretary of Energy - February 12, 1998.
16. AM-CM Vitrification Development Program Plan - SRT-AMC-97-0111TL-Rev 0 - dtd November 24, 1997.

Criteria and Technical Options Considered

Criteria

A) Recoverability of Am/Cm

Application of this criteria is straightforward, "Can the Am/Cm be recovered from the stabilized form?" The answer to this question in almost every case was yes. The notable exception was sending the Am/Cm to DWPF.

B) Durability

The durability criteria was used to judge the stability of the form produced by stabilization with respect to storage and shipping.

C) Experience in High Level Canyon

Has the stabilization process been used in a canyon environment?

D) Technical Maturity of the Process

To use this criteria it was necessary to classify the maturity of the stabilization process. Stabilization processes that had prior use scored better than processes that were judged to be in the research phase.

E) Timely Stabilization (costs and schedule impact)

This criteria weighed the estimated costs and estimated schedule for application of the technology.

F) Environmental Safety and Health

Environmental fate and safety of the public and workers was our most heavily weighted factor. The complete life cycle of the actinides was considered in using this factor.

Technical Options Considered

Brief descriptions of several technical options the committee considered and scored according to the technical criteria above are listed below:

A) Melter vitrification

Melter vitrification of the material in tank 17-1 has historically been the only option pursued during the life of this project. In this option, material from Tank 17-1 is mixed with glass frit, melted and poured into containers.

B) In can vitrification

In this option, the storage can is the melting vessel. Material from Tank 17-1 is mixed with glass frit in a storage can. The can contents are heated to melt and form a glass.

D) Melter vitrification with slurry feed

In this option, frit and liquid from the tank are mixed together to make a slurry which is fed to the melter and vitrified.

E) In can oxidation of oxalate

In this option, solids from a second oxalate strike are placed in a storage vessel and heated until the oxalate decomposes to form actinide oxides. The can may then be sealed.

F) In can evaporation and oxidation

In this approach, liquid from dissolution of the first oxalate strike is placed in a storage can and allowed to evaporate. Further heating of the can will oxidize the residual material to oxides. The can may then be sealed.

G) DWPF disposal

In this option, the liquid from Tank 17-1 is sent to the tank farm for eventual vitrification. The team realizes that several variants of this approach exist.

H) Russian silica gel process

As this technology is understood, metals from the 17-1 tank are chemically and/or physically sorbed onto a silica based material. The silica based material can then be heated to create a long term storage form.

I) Molten metal technology

In this option liquid or solids from tank 17-1 are injected into a molten metal bath. The extreme heat from the bath vaporizes the solvent. Metals are incorporated into the melt or slag depending on the redox potential of the metal.

J) Tank 17-1 in situ options

Several options have been forwarded to stabilize americium and curium in Tank 17-1. These technologies were considered as a set.

K) Recoverable grout

In this option, liquid from dissolution of the first oxalate strike is stabilized by mixing the liquid with a cement or grouting agent.

L) Seaborg salt process

In this option material from the second oxalate strike is stabilized by heating to form an oxide powder. The oxide is then mixed with a low melting point borate or halide salt. Melting the mixture gives a pourable slurry that can be poured into storage containers.

M) Ion exchange

Various cation and anion exchange schemes exist that could be used to separate fractions of the metals from nitric or hydrochloric acid solvents. These schemes were considered as a set.

O) Extraction chromatography

Specialized molecules have been synthesized to extract specific ions from solution. These systems behave much like ion exchange.

P) Solvent Extraction

Various solvent extraction schemes exist that could be applied to this problem. These schemes were considered as a set.

SUMMARY OF DISCUSSION BETWEEN ENVIRONMENTAL MANAGEMENT AND DEFENSE PROGRAMS ON DEINVENTORYING OF ROCKY FLATS MATERIAL

Meetings were held between the Deputy Assistant Secretary for Nuclear Material and Facility Stabilization (EM-60) and the Deputy Assistant Secretary for Military Application and Stockpile Management (DP-20) on May 11, 1998 and May 29, 1998. The purpose of these meetings was to discuss and develop a path forward for the stabilization and shipment of certain Special Nuclear Material (SNM) from the Rocky Flats Site. The following is a summary of the issues and path forward for the specified material.

Plutonium Salt Residues

The preferred alternative for the treatment and disposal of plutonium salts from Rocky Flats is the blending, or dilution, of salts to acceptable limits for direct disposal at the Waste Isolation Pilot Plant (WIPP). These operations will be conducted onsite at Rocky Flats and the material will be packaged into the pipe-and-go component for disposal at WIPP. These salts have been submitted as part of the Safeguards Termination Limit (STL) variance request to Environmental Management and Nuclear Nonproliferation. Environmental Management will continue to work with WIPP to confirm that there are no technical issues associated with the packaging, transportation, and storage of this material at WIPP.

Shipment of Plutonium Pits to Pantex

The original schedule for shipment of pits to Pantex would have completed shipments in September 1998. Shipments were halted in February 1998 due to concerns relating to the safe packaging and transportation of material. Shipments from Rocky Flats did resume in May 1998. As a result of the delay, shipments can not be completed by September unless additional funds were provided to support overtime at the Pantex site to support the receipt of pits. In addition, the packaging and shipping rates at Rocky Flats would have to be accelerated. To ensure the safe and cost effective transportation of this material, the recommended path forward is to continue shipments at a normal rate with all shipments being completed by February 1999. Defense Programs has committed Pantex to support the shipping schedule through February. The delay does not impact the overall closure of the Site.

Shipment of Highly Enriched Uranium to the Oak Ridge Y-12 Plant

The path forward is for Environmental Management to provide FY 1998 funds ($690K) to Y-12 to begin re-certification of shipping containers for the HEU material to support a tentative shipping schedule which initiates shipments from Rocky Flats in August 1998. Defense Programs will then provide funds in FY 1999 (approximately $3.6M) to Y-12 to complete receipt of HEU material from Rocky Flats in FY 1999. Defense Programs is continuing to investigate schedules and priorities at Y-12 to ensure the support of this tentative shipping schedule.