The Secretary of Energy
Washington, DC 20585

October 29, 1997

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 proposed changes to the Defense Nuclear Facilities Safety Board Recommendation 94-1 Implementation Plan regarding the safe storage of potentially critical materials (uranium) at two facilities at the Oak Ridge Reservation: the East Tennessee Technology Park (ETTP, formerly K-25) and the Molten Salt Reactor Experiment (MSRE). The changes are consistent with those discussed in your meeting with the Oak Ridge Operations Office and the Office of Nuclear Material and Facility Stabilization on July 23, 1997.

The specific changes in the Implementation Plan are:

- Milestones to complete mechanical removal of uranium from the K-25 Building in September 1997 and chemical removal in April 1998 are replaced with milestones to place Category 1 and Category 2 deposits in the K-25 and K-29 Buildings in a safe configuration by December 1997 and March 1998 respectively. Category 1 and Category 2 deposits are ones with the highest criticality risk.

- Removal of the uranium deposits from the MSRE will be completed in February 1999, a one year slip from the current commitment of February 1998, and removal of the fuel salts from the facility will be completed in May 2002, a one year slip from the current commitment of May 2001.

The enclosure to this letter further explains changes in the the Oak Ridge Implementation Plan. Enclosure I shows the specific changes to the Implementation Plan text; Enclosure II explains the causes for the schedule slips and the actions to be taken to minimize the slippages.

We anticipate additional changes to the Implementation Plan in the near term that will affect the 94-1 commitments at Hanford, Savannah River, and the Los Alamos National Laboratory. We will continue to closely track the progress toward meeting all Recommendation 94-1 commitments and will keep your staff apprised of progress. If you have any further questions, please contact me or have your staff contact Mr. John Tseng, Acting Director, Nuclear Materials Stabilization Task Group, at 202/586-0383.

Sincerely,

Federico Peña

Enclosure

Oak Ridge Operations
94-1 Implementation Plan Modification
July 15, 1997

Enclosure I shows the specific changes to the Implementation Plan text. Enclosure I. Part A lists the milestone date changes. Enclosure I. Part B identifies the materials requiring stabilization and provides a description of the objectives of the East Tennessee Technology Park (ETTP) Deposit Removal Project and the Molten Salt Reactor Experiment (MSRE) program. Enclosure I. Part C describes the stabilization programs. states the objectives and notes milestones.

Below are milestone date changes with reference by page number and section of where these dates appear in the Implementation Plan. Note that in some cases the milestone dates appear more than once in the Plan so changes may be documented more than once. One milestone is reported as complete.

Part A: Milestone Date Changes

Uranium Residues

3.5.1 Acceptance and Objectives

p. 87 Replace the third bullet with:

- The objective of the Deposit Removal Project is to remove deposits not in safe, interim storage by March 31, 1998. Deposits are considered stabilized if subcriticality can be assured via double contingency protection and passive engineered controls.

p. 87 Replace the fourth bullet with:

- Interim Corrective Measures were completed in November 1995 at the Molten Salt Reactor Experiment in Oak Ridge to mitigate potential accidental criticality and explosive hazards caused by formation of volatile U-233 hexafluoride in the stored fuel salt. Uranium hexafluoride gas removal was initiated in November 1996. Uranium deposits will be removed by February 1999. Fuel and flush salts will be removed from the drain tanks by May 2002.

3.5.4 Uranium Residues Needing Stabilization at Oak Ridge

p. 91 Molten Salt Reactor Experiment (MSRE)
and
p. 92 Deposit Removal Project at the East Tennessee Technology Park (ETTP) (formerly the K-25 Site).

Replace section 3.5.4 with Part C to reflect the expansion and changes in project scope.

3.5.5 Key Milestones

p. 93

Oak Ridge

Molten Salt Reactor Experiment	Original	Proposed
• Complete corrective interim measures	11/95	Completed
• Complete uranium deposit removal	02/98	02/99
• Complete fuel salt removal*	05/01	05/02

** Although not listed in Section 3.5.5, this milestone has been tracked as a key milestone.*

Deposit Removal Project at the ETTP	Original	Proposed
• Complete mechanical removal of uranium deposits	09/97	Deleted
• Complete chemical removal of uranium deposits	04/99	Deleted

Additional Deposit Removal Project Milestones		
• Place Category 1 deposits in safe configuration		12/97
• Place Category 2 deposits in safe configuration		03/98

Oak Ridge Operations
94-1 Implementation Plan Modification
July 15, 1997

Below are revisions to Section 3.5.1 of the Implementation Plan. The first revision is to Table 3.5-1. Materials Requiring Stabilization on page 85. The second change is to the third and fourth bullets on page 87 of the Acceptance and Objectives. This section describes the objectives of stabilization and notes new milestones.

Part B: Uranium Residue Section Changes

Part I: Stabilization Requirements

3.5.1 General Overview

p. 85 Table 3.5-1: Materials Requiring Stabilization

Change the fourth column - third row, titled **Quantity - Oak Ridge**, to say "approximately 82 kgs U-235.

Site	Material Group	Location	Quantity
Savannah River	HEU Solution	Building 221-H	230,000 liters
Rocky Flats	HEU Solutions	Building 886	569 kgs of U-235 contained in 2,700 liters
Oak Ridge	HEU Solids	Buildings K-25 and K-29[1]	Approximately 82 kgs U-235
Oak Ridge	HEU Solids	Molten Salt Reactor Experiment	Bulk salt inventory of 4,650 kgs (containing 31 kgs U-233, 1 kg U-235, 1 kg Pu)

[1] Additional large deposits of low enriched uranium in Building K-29 have been selected for removal and have been added to the scope of the ETTP Deposit Removal Project.

p. 87 Acceptance and Objectives

- The objective of the Deposit Removal Project is to remove deposits not in safe, interim storage by March 31, 1998. Deposits are considered stabilized if subcriticality can be assured via double contingency protection and passive engineered controls.

- Interim Corrective Measures were completed in November 1995 at the Molten Salt Reactor Experiment in Oak Ridge to mitigate potential accidental criticality and explosive hazards caused by formation of volatile U-233 hexafluoride in the stored fuel salt. Uranium hexafluoride gas removal was initiated in November 1996. Uranium deposits will be removed by February 1999. Fuel and flush salts will be removed from the drain tanks by May 2002.

Oak Ridge Operations
94-1 Implementation Plan Modification
July 15, 1997

Below is the revision of Section 3.5.4, Uranium Residues Needing Stabilization at Oak Ridge, which begins on page 91 of the Implementation Plan. This section describes the MSRE program and the Deposit Removal Project, states the objectives of stabilization, and notes milestones.

Part C: Uranium Residue Section Changes

Part III: Individual Site Activities

3.5.4 Uranium Residues Needing Stabilization at Oak Ridge

p.91 Molten Salt Reactor Experiment (MSRE)

The Molten Salt Reactor Experiment operated from 1965 through 1969 to investigate molten salt reactors for commercial power applications. The reactor fuel, uranium tetrafluoride, was mixed in a molten salt mixture of lithium, beryllium, and zirconium fluorides that circulated through the reactor primary system. Initially the reactor was fueled with U-235, which was replaced with U-233 in 1968. Less than 1 kg of plutonium trifluoride was added in 1969. When the reactor was shut down, the fuel salt was drained into two fuel drain tanks in the drain tank cell, where it cooled and solidified. Following a post-operation examination, the facility was placed under a program of surveillance and maintenance awaiting eventual decommissioning. Radiolysis of the fuel salt was expected to slowly produce fluorine (F_2) gas. A procedure to annually heat the salt without melting was instituted to recombine the F_2 with the salt.

In the late 1980s, radiological surveillance at the facility indicated elevated radiation in piping connected to the drain tanks. A visible release of an unidentified gas was also observed from the off-gas system piping during a maintenance action. Migration of the stored fuel was suspected and an investigation was initiated. Gas samples taken in 1994 indicated significant concentrations of uranium hexafluoride (UF_6) and F_2. A significant solid deposit of uranium was also detected in the inlet section of a charcoal filter in the off-gas system. This filter, the Auxiliary Charcoal Bed (ACB) was located under water in a concrete cell outside of the reactor building. If water were to have entered the ACB and migrated to the deposit, the potential for an accidental criticality could not be eliminated. In addition, the exposure of the activated charcoal in the bed to F_2 and UF_6 was postulated, and later confirmed in laboratory testing, to have created a potentially explosive compound mixed with the uranium deposit.

A comprehensive plan was initiated in 1994 to implement interim corrective measures, remove the reactive gases and uranium deposits, convert these materials to stable oxide for interim storage, and dispose of the fuel salt. The interim corrective measures to mitigate criticality potential, stop continued uranium migration to the charcoal bed, and enhance the containment of the charcoal bed cell to prevent radionuclide releases from a potential explosion were completed in November 1995. During these first remediation actions, additional uranium migration into fuel processing equipment was discovered in additional cells at the facility. In early 1996 during preparations for removal of the UF_6 and F_2, off-gas system pressures near the drain tanks were measured at 10 psig and at least two

internal plugs in the piping system were discovered. A chemical trapping system to depressurize the off-gas system and remove the UF_6 and F_2 started operation in November 1996. Initial operation removed small amounts of UF_6 and F_2, and non-volatile blockages were confirmed.

As a result of the new information on the extent of uranium migration and blockages in the MSRE piping, the original program scope has expanded and a revised plan of remediation has been developed. The charcoal bed uranium deposit will be removed in February 1999, following chemical denaturing of its explosive potential. Since the removal of fuel and flush salts is a Comprehensive Environmental Response Compensation Liabilities Act (CERCLA) Interim Remedial Action, a Feasibility Study for the disposition of the fuel salt will be submitted to the State of Tennessee and Environmental Protection Agency. The fuel and flush salt will be removed by May 2002 contingent on the CERCLA Record of Decision.

p. 92 Deposit Removal Project at the ETTP

During the operating life of the ETTP facilities, isotopically highly enriched uranium accumulated inside gaseous diffusion equipment and piping as a result of wet air in-leakage. Building K-25 was initially shut down in 1964. In 1985 it was determined that the other gaseous diffusion facilities at the site were in excess of uranium enrichment needs, and they were placed on standby. The decision was made to permanently shut them down in 1987. Deposits of enriched uranium remain in the piping and equipment. Based on the nondestructive assay measurements and the openings in the process piping of Building K-25, it was determined that some of the HEU deposits presented an unacceptable criticality risk. In 1989, steps were taken to reduce the likelihood of a criticality event by welding closures over openings in the process piping that could have allowed water in-leakage, and by isolating specific piping and equipment of concern.

The Deposit Removal Project was initiated to remove HEU deposits in piping and equipment in Building K-25. Sixty-five HEU deposits containing U-235 masses above 500 g were identified in target items such as pipes, compressors, cold traps, chemical traps, surge tanks, and converters (Whitehead and Type II). Mechanical removal of four of these deposits located in pipe sections was completed in March 1996. Knowledge gained during the removal activities and additional criticality safety analyses led to a reexamination of the project scope and the need to remove all of the remaining 61 deposits. It has been concluded that many of the 61 deposits are already in stable configurations satisfying the double contingency principle for criticality safety and therefore, do not require removal at this time.

During the reevaluation of deposits at the ETTP, additional deposits of concern were identified in Building K-29. Three of these deposits have now been included in the scope of the Deposit Removal Project.

Oak Ridge Operations
94-1 Implementation Plan Modification
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I. Causes for Implementation Plan Revisions

A. MSRE Program

1. New information on uranium distribution and facility condition

   a) Uranium distribution measurements revealed the presence of migrated U-233 within fuel processing equipment in two additional hot cells at the MSRE facility. The Reactive Gas Removal System (RGRS) will be extended to remove volatile uranium and reactive gases from the processing equipment.

   b) Updated analyses of off-gas system volume led to increased estimates for uranium hexafluoride in the off-gas system and salt drain tanks. This information indicates that an increased fraction of the total U-233 inventory can be removed by extended operation of the RGRS.

   c) Initial operation of the RGRS and new pressure transmitters installed in the off-gas system confirms plugging in at least four locations within the hot cell piping. These plugs will require equipment extensions from the installed RGRS and chemical treatments to dissolve the blockages and to enable removal of the gaseous inventory.

   d) The explosive potential of the carbon-fluorine compounds in the charcoal filter requires a chemical denaturing treatment prior to or during removal of the uranium deposit. This is a new requirement prior to interim shipment or storage of the removed uranium.

2. Delayed Schedules for Implementation Plan Milestones

   a) The uranium deposit removal completion will be delayed one year from February 1998 to February 1999.

   This delay is caused by the addition of a chemical pre-treatment operation to reduce the potential for explosive reactions of fluorine and carbon during the uranium removal process. The pre-treatment process is being bench tested and, if successful, will significantly reduce the hazard and the complexity of the removal operation. The chemical pre-treatment cannot be initiated until reactive gas has been removed from the off-gas piping connected to the charcoal bed. Following this removal, a hot tap for injection of the treatment gas will be installed. Chemical treatment of the charcoal will be conducted at a low rate to minimize temperature increases in the charcoal bed.

I. *Causes for Implementation Plan Revisions*

A. MSRE Program (Continued)

b) The fuel salt removal completion will be delayed one year from May 2001 to May 2002. (*Note: The May 2000 date listed in the February 1995 Implementation Plan is incorrect: the original milestone submitted was dated May 2001.*)

- Reactive gas removal is a precursor to drain tank access for equipment and salt investigations to ensure remelt capability. The blockages in the off-gas system have extended the date at which drain tank access is achievable.

- The technical and waste management approach for fuel salt removal will be selected by the regulatory authorities in the CERCLA Record of Decision. The final schedule for salt removal will be dependent on the selected alternative.

- Key resources are involved in precursor actions on the MSRE project. An extension in the salt removal schedule enables effective utilization of key technical experts.

B. Deposit Removal Project

1. New information

a) Independent evaluation of nuclear criticality issues associated with other uranium deposits at the ETTP indicated that many deposits with mass above 500 grams, the minimum critical mass, are in safe configurations.

b) Initially, the only consideration for inclusion within the scope of the project was mass. All nuclear parameters have now been considered. Four parameters (mass, enrichment, moderation, and geometry) of the nine nuclear parameters are relative to the ETTP deposits.

c) A double contingency analysis was conducted and the determination was made that many of the deposits originally in the scope of the project have passive engineered controls on multiple nuclear parameters.

2. Redefined project scope

a) Based on the new information, the project scope has been redefined. The Deposit Removal Project will take actions to place the deposits in an acceptably safe configuration.

- Delete milestone IP-3.5-003 - Complete mechanical removal of uranium deposits.

- Delete milestone IP-3.5-004 - Complete chemical removal of uranium deposits.

b) Evaluations were used to identify those deposits which can remain in place until future decontamination and decommissioning activities commence.

c) Deposits will be removed based upon criticality risks.

I. *Causes for Implementation Plan Revisions*

B. Deposit Removal Project (Continued)

3. Addition of Implementation Plan milestones

   a) Place Category 1 deposits in safe configuration by December 31, 1997. (Category 1 deposits have one control on a single nuclear parameter.)

   b) Place Category 2 deposits in safe configuration by March 31, 1998. (Category 2 deposits have multiple controls on a single nuclear parameter.)

II. *Actions to Reduce Schedule Slip*

A. MSRE Program

1. The chemical pretreatment operation for the charcoal bed will reuse equipment from the reactive gas removal system to reduce procurement and fabrication schedules.

2. The fuel salt disposition task is evaluating the use of existing MSRE processing equipment and UF_6 trap technology to accelerate the removal of the fuel salt from the fuel drain tanks.

B. Deposit Removal Project

1. Two teams have been established within the project; one to focus on the K-25 Building deposits and one to focus on the K-29 Building deposits.

2. Detailed plans and schedules have been developed and will be executed for the deposit removal activities. Adherence to the schedules will be closely monitored.

3. The revised approach will complete the Deposit Removal Project ahead of the original submittal.