Department of Energy
Washington, DC 20585

December 20, 2002

The Honorable John T. Conway, Chairman
Defense Nuclear Facilities Safety Board
625 Indiana Avenue, NW, Suite 700
Washington, D.C. 20004-2901

Dear Mr. Chairman:

My September 30, 2002, letter to you committed to preparing a project plan for the disposition of the Savannah River Site (SRS) depleted uranium (DU). The enclosed plan not only covers the DU but also covers the excess natural and low-enriched uranium at SRS. This plan has been approved for public release.

Significant progress has been made on the disposition of these materials. All of the DU oxide drums in the two buildings that were of concern to the DNFSB have been palletized and shipping of these drums to Envirocare of Utah (EOU) is scheduled to begin in February 2003. This disposition path is also expected to be appropriate for the remainder of the DU oxide inventory. The depleted and natural metal stored in M-Area is also planned to be shipped to EOU beginning in the same timeframe.

If you have any further questions, please call me or Mr. Paul Golan at (202) 586-0738.

Sincerely,

Jessie Hill Roberson
Assistant Secretary for
Environmental Management

Enclosure

cc: Mark Whitaker (S-3.1)
Paul M. Golan (EM-3)
Jeffrey M. Allison, (SR)

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Project Plan for the Disposition of the SRS Depleted, Natural, and Low-Enriched Uranium Materials

WSRC Document No.: WSRC-RP-2002-00459
Revision 2
November 21, 2002

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ADC & Reviewing Official: G. C. Rodrigues
Date: 11/21/02

Disclaimer

Approval Signatures

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Edwin L. Davis **Date**

Manager, Facilities Decontamination and Decommisssioning Program

W. A. Condon for 11/21/02

William J. Johnson **Date**

Vice President, Nuclear Materials Management Division

Revision Summary

Rev. No.	Rev. Date	Affected Sections*	Description of Revision
0		All	Initial Issue
1	10/23/02	Executive Summary	Better align the executive summary with the narrative in Sections 3.3, 3.4, and 3.5
2	11/22/02	Executive Summary	Added phrase to the first sentence of the second paragraph stating the recommendation will complete disposition by FY-06. Combined FDDP materials. Revised narrative as indicated to include latest activities.
		1.2 & 1.3	Combined Sections 1.2 and 1.3
		2.2 & 2.3	Combined Sections 2.2 and 2.3
		3.1	Revised narrative to include latest planning activities.
		3.2 & 3.3	Combined sections 3.2 and 3.3. Revised activities and dates to the latest plans.
		3.5	Deleted execution target of FY-2007 to FY-2010.

* The changes from the previous to the latest revision are noted with a vertical line in the left margin.

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List of Acronyms

AOP	Annual Operating Plan
ASTM	American Society for Testing and Materials
CLAB	Central Analytical Laboratory
DNFSB	Defense Nuclear Facilities Safety Board
DOE	Department of Energy
DOT	Department of Transportation
DU	Depleted Uranium (<0.71% ^{235}U)
DUN	Depleted Uranyl Nitrate
DUO	Depleted Uranium Trioxide
DWPF	Defense Waste Processing Facility
EIS	Environmental Impact Statement
FDDP	WSRC Facilities Decontamination and Decommissioning Program
FY	Fiscal Year (October 01 to September 30)
HEU	Highly Enriched Uranium (>20% ^{235}U)
HLWD	WSRC High Level Waste Division
IMNM	DOE/EIS-0220, Interim Management of Nuclear Materials Environmental Impact Statement
LEU	Low Enriched Uranium (0.71%<^{235}U<20%)
MTU	Metric Tons of Uranium
NEPA	National Environmental Policy Act
NFS	Nuclear Fuel Services, Inc.
NMMD	WSRC Nuclear Materials Management Division
NTS	Nevada Test Site
NU	Natural Uranium (0.71% ^{235}U)
ORNL	Oak Ridge National Laboratory
ROD	Record of Decision
RCRA	Resource Conservation and Recovery Act
SRS	Savannah River Site
SWD	WSRC Solid Waste Division
U	Uranium
WAC	Waste Acceptance Criteria
WSRC	Westinghouse Savannah River Company

Executive Summary

The objective of this plan is to describe the disposition activities for the SRS depleted, low-enriched, and natural uranium materials. The disposition pathways need moderate-to-significant development efforts to resolve the technical, regulatory, and funding issues before the actual disposition activities can be planned and executed. Therefore, the first step will be to develop a recommended disposition pathway for each uranium material covered by this plan.

This initial issue of the plan describes the major activities[1] leading to a disposition recommendation for each uranium material consistent with a disposition goal of FY-06. This plan will be revised as each disposition pathway is accepted for implementation.

The subject materials are the legacy of the SRS nuclear material production programs[2]. The materials managed by the Facility Decontamination and Decommissioning Program (FDDP) were generally the feed materials into the production programs while those managed by the Nuclear Materials Management Division (NMMD) were the byproducts of the nuclear material separation and purification processes.

Disposition pathways for these legacy materials are being developed as the SRS facility missions end and higher states of facility deactivation are being planned. While safely stored in tanks, disposition of the depleted uranyl nitrate solution, which is a key activity in the execution of the F-Canyon Suspension Plan, provides the greatest risk reduction. The other materials are safely stored in relatively low operating cost storage facilities pending disposition.

Recommendations on disposition paths, schedules, and costs will be developed during fiscal years 2003 and 2004.

Material	Preferred Pathway[3]	Quantity (MTU)	Managing Organization	Recommendation Commitment Date
• Depleted uranyl nitrate	Vendor	186	NMMD	12/31/03
• Depleted, low-enriched, and natural uranium metal	Low-level waste	2,735	FDDP	03/01/03[4]
• Low-enriched uranium trioxide	Blendstock	260	NMMD	09/30/03
• Depleted uranium trioxide	Low-level waste	20,000	NMMD	01/31/04

[1] See Attachment 1, Integrated Schedule for Disposition Recommendations
[2] See Reference 3, WSRC Document No. ESH-PEQ-2000-00059.
[3] The disposition pathways are subject to change as further analyses are completed.
[4] For these materials, this date is the start of disposition activities.

1.0 Description of Materials and Storage Facilities

1.1 Depleted Uranyl Nitrate

The depleted uranyl nitrate (a liquid) was produced through the dissolution of depleted uranium (DU) targets and was historically converted to depleted uranium oxide (DUO) in the FA-Line Facility as described in Section 1.5. Approximately 186 metric tons of uranium (MTU) as uranyl nitrate are stored in tanks (F-Area) and transportation containers (H-Area). The depleted uranyl nitrate (DUN) is categorized for accountability purposes as an in-process material. The FA-Line operations were suspended in the early 1990's, and a determination[5] was made to safely store the DUN pending a final disposition. The DUN storage vessels are in good condition with no identified deficiencies.

Historically, the uranium stream was normally processed through the 2nd Uranium Cycle for additional purification prior to conversion to DUO. However, the existing DUN inventory was not processed through this additional purification cycle. Therefore, the DUN contains higher than typical concentrations of fission products, transuranic elements, and other impurities (e.g., mercury and chromium).

1.2 Depleted, Low-Enriched, and Natural Uranium Metal

Approximately 2,735 MTU of DU, LEU, and NU metal are currently stored in two metal frame buildings located in M-Area. These cores were produced at the DOE Fernald, Ohio site. The majority (≈64%) of the DU metal had been introduced into the target fabrication process prior to shutdown. These metal cores have either been cleaned, plated, and/or canned. The remainder of the DU metal inventory is considered "bare" metal cores (as received at the site). The unprocessed metal components are typically stored in the original shipping containers (wooden boxes) while the processed metal components are typically stored in cardboard containers.

A portion of the NU inventory was exposed to an intermittent low-level neutron flux in an SRS test pile. This material will require additional characterization before qualification as blendstock, or the selection of any alternative disposition pathway.

1.3 Low-Enriched Uranium Oxide

The LEU oxide[6] was produced by the Mark 15 program in the early 1980's. SRS produced 380 LEU oxide drums using the same process described in Section 1.5. The LEU oxide contains trace quantities of fission products and transuranic elements.

The LEU oxide was packaged identically to the DUO except galvanized steel drums were used. The drums are approximately a third to half full with an average weight of 800 pounds. The LEU drums are stored separately from the DUO drums in Building 221-21F. The LEU drums are in a single-tier array for criticality control[7] and each is in contact with the adjacent drums.

1.4 Depleted Uranium Trioxide

The depleted uranium trioxide (UO_3, DUO, or oxide) is categorized for material accountability purposes as a byproduct of the nuclear material production programs. DU billets were produced at Fernald, fabricated into targets at SRS, then irradiated in one of the SRS production reactors. The irradiated targets were transported to F-Canyon where the targets were dissolved. After dissolution, the fission products were separated from the plutonium and uranium which were then separated from each other. After additional purification, the uranium stream was transferred to the FA-Line Facility where it was

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5 See Reference 1, DOE/EIS-0220.

6 The subject LEU has average enrichment (^{235}U content) of 0.94%.

7 The eversafe criticality-safe enrichment for uranium trioxide is less than 0.9% ^{235}U.

processed into (tri)oxide[8] for storage in drums. The DUO contains trace quantities of fission products and transuranic elements.

A plastic liner was placed into a carbon steel, 55-gallon drum prior to loading the DUO. After loading, the drum tops were fastened with a standard ring-type seal. An unknown number of the drums in Building 221-22F are manufactured from galvanized steel. The drums are approximately 2/3 full with an average weight of 1,500 pounds. SRS produced approximately 36,000 drums during the production campaigns.

The DUO drums are stored in seven buildings located in F (5), N (1), and R (1) areas. Buildings 221-12F, 221-21F, 221-22F, 714-7N[9], and 105-R are in good condition. The other two F-Area buildings (728-F and 730-F) which were constructed in the 1950's are in poor condition.

The drums in each storage facility are stacked in three-high tiers and are in physical contact with the adjacent drums. This storage configuration allows close visual inspection of only the drums located on the outer perimeter of the storage array. The condition of the drums varies from good to poor with a high percentage of the drums having some degree of outer surface corrosion although no leakage has been observed to date. A significant number of drums in two facilities (221-21F and 221-22F) have been placed into overpacks as a mitigating action for corrosion control and to prevent spills.

As the drums were placed into the buildings, wooden slats were placed between tiers as well as between the floor and the first tier. Some of the wooden slats placed between the tiers have deteriorated from water intrusion, particularly those between the first tier and the floor. Without the slats for support, some drums are leaning, but are not in immediate danger of falling.

2.0 Recent Accomplishments

2.1 Depleted Uranyl Nitrate

SRS recently completed a multi-division study[10] to conceptually assess disposition alternatives for the depleted uranyl nitrate. The preferred alternative was to incorporate the DUN into saltstone via the high level waste (HLW) transfer system. Potential impacts to the HLW program are being further assessed.

2.2 Depleted, Low-Enriched, and Natural Uranium Metal

FDDP subcontracted MHF Logistics, Inc.[11] to determine the regulatory, packaging, and shipping requirements to ship 2,700 metric tons of SRS material to Nuclear Fuel Services[12] or the DOE Portsmouth, OH site for interim storage pending beneficial reuse. Of the various options studied, the most cost-effective shipping package option is to place the containers into larger DOT-compliant packages that satisfy the DOT requirements[13] for a strong, tight package. The selected package should be compatible with both truck and rail transport in order to provide the flexibility to ship by either mode.

2.3 Low-Enriched Uranium Oxide

None

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8 Three chemical forms (UO_2, UO_3, & U_3O_8) are commonly known as uranium oxide. SRS produced the uranium trioxide form (UO_3).

9 This building was refurbished in FY-2000.

10 See Reference 5, WSRC Document No. M-AES-F-0001

11 See Reference 9, Subcontract AC27432T

12 Nuclear Fuel Services is a commercial uranium processor located in Erwin, TN.

13 The DOT transportation requirements are contained Title 49 of the Code of Federal Regulations.

2.4 Depleted Uranium Oxide

2.4.1 Drum Corrosion Study

Savannah River Technology Center (SRTC) personnel studied the outer surface corrosion on 15 drums in Buildings 728-F and 730-F. The SRTC findings are documented in Reference 4. The study results indicated that the corrosion may have caused significant wall thinning in small areas near the bottom rims of a few drums. Their conclusion was that the drums were in generally satisfactory condition for near-term storage and could tolerate handling. However, the data indicates that a few drums may present a handling issue. NMMD will institute handling procedures that minimize drum failure and that would mitigate any spillage from a failed drum.

The study also concluded that the corrosion would progress slowly as long as the drums were not in contact with water. The report recommends that NMMD establish a coupon-monitoring program conducted by SRTC to establish the corrosion rate(s). Carbon steel coupons would be placed in each storage building, then SRTC would regularly analyze the coupons to determine the corrosion rate. Implementation of a coupon-monitoring program will be considered in the DUO disposition recommendation.

2.4.2 DUO Transportation Study

A transportation vendor (MHF Logistics, Inc.) recently completed a study that indicated that NMMD could economically ship the DUO drums to a low-level waste facility in compliance with the applicable DOT radioactive material regulations. The study showed that rail shipments of the DUO drums in DOT-compliant containers (Type 7A) were the most cost-effective shipping method.

2.4.3 DUO Disposition Demonstration Project

NMMD through the Solid Waste Division (SWD) contacted Envirocare of Utah, Inc. and the Nevada Test Site (NTS) regarding acceptance of the DUO as low-level waste. After SRS personnel visited both sites, Envirocare was selected to receive the DUO based on its capability to receive rail shipments. WSRC initiated three key activities to dispose of the DUO in Buildings 728-F and 730-F during FY-03.

First, the DUO is being characterized to determine the impurity concentrations identified in the Envirocare waste acceptance criteria and the DOT transportation requirements. A sample plan compliant with these two needs was completed and the specified analyzes are in progress at the appropriate laboratories.

Second, the procurement of a transportation vendor has been initiated to provide the shipping conveyances and mode of transportation. A statement of work has been prepared and the procurement process is underway.

Third, the DUO disposition as low-level waste was granted a *Categorical Exclusion* under existing NEPA documentation.

3.0 Disposition Recommendation Activities

3.1 Depleted Uranyl Nitrate

SRS is managing the depleted uranyl nitrate under the F-Canyon Suspension Plan that currently plans for removal from F-Canyon by June 2004. This removal could be to an interim storage location while final disposition activities continue. The major activities leading to a DUN disposition recommendation are:

Activity	Commitment Date
• Material characterization	11/05/02
• Planning alternative study	12/15/02
• Grout study	08/30/03
• Additional studies for recommendation	As needed
• Disposition recommendation	12/31/03

The first activity will provide characterization data on the material. The second study will confirm that the DUN can be disposed in the saltstone matrix under the existing waste acceptance criteria and state regulatory permits. The planning alternative study will produce the initial preferred disposition pathway. Additional studies may be required to resolve issues with the disposition pathways prior to the recommendation.

Additional DUN disposition alternatives are discussed in References 5 and 6.

3.2 Depleted, Low-Enriched, and Natural Uranium Metal

The decommissioning of the M-Area facilities that is scheduled to start in FY-04 necessitates that the inventory in Buildings 330-M and 331-M be dispositioned by the end of the 2nd Quarter FY-03. SRS does not anticipate a beneficial reuse for these materials in the timeframe necessary for disposition, therefore the materials are expected to be dispositioned as low-level waste. Disposal can be accomplished at either the Nevada Test Site or Envirocare of Utah. The determination of a final disposition location will be based upon the most cost-effective combination of delivery schedule, packaging requirements, disposal fees, and transportation costs.

The major activities leading to disposition are:

Activity	Commitment Date
• Develop characterization criteria	10/30/02
• Complete characterization package	12/10/02
• Complete alternative disposition study	12/10/02
• Develop final cost and schedule.	02/28/03
• Commence shipping uranium metal to the disposal sites	03/01/03

3.3 Low-Enriched Uranium Oxide

SRS anticipates that a beneficial use[14] will emerge for the LEU oxide, most likely as a blendstock material. Since the LEU oxide is a low risk material in safe, stable storage, funding has not been directed to this effort. Once funded, the major activities leading to a LEU oxide disposition recommendation are:

Activity	Commitment Date
• Material characterization	06/30/03
• Disposition alternatives study	08/15/03
• Disposition recommendation	09/30/03

SRS will perform a disposition alternatives study to identify the preferred disposition alternative plus at least one other disposition pathway as a contingency. Since blendstock is the most likely disposition alternative, SRS will perform the material characterization for the impurities and to the levels of detection specified in the ASTM standards for commercial nuclear fuel and in the DOT regulations for radioactive materials. Technical studies will be performed as necessary to overcome issues introduced from impurities identified in the material characterization, or as necessary to develop the disposition pathway.

3.4 Depleted Uranium Oxide

As described in Section 2.5.3, SRS has initiated a project to dispose of the DUO (3,263 drums) stored in Buildings 728-F and 730-F as low-level waste. This project will demonstrate the feasibility of the low-level waste disposition alternative. Assuming success of the demonstration project, a disposition schedule will be developed for the remaining ≈33,000.

The major activities leading to a DUO disposition recommendation are:

Activity	Commitment Date
• Environmental evaluation	09/30/02
• Material charcterization	11/30/02
• Transportation contract	01/03/03
• Palletize drums	01/17/03
• Envirocare acceptance documentation	01/31/03
• Transport DUO to Envirocare	09/19/03
• Demonstration project evaluation	11/28/03
• Disposition recommendation	01/31/04

The material characterization is necessary to confirm that the DUO is within the Envirocare waste acceptance criteria and the selected DOT radioactive material transportation container requirements. The environmental evaluation granted a *categorical exclusion* to this disposition pathway under existing NEPA documentation. SRS will lease the shipping conveyances and contract the transportation from a commercial vendor through the site procurement process. A study[15] indicated that purchasing the shipping conveyances was economically prohibitive and unnecessary.

[14] The LEU oxide has increased economic value compared to depleted or natural uranium blendstock materials.
[15] See Reference 7, Subcontract AC27440T.

After the DUO shipments are completed, SRS will assess the actual project performance (including costs), then extrapolate the data to the remaining DUO inventory. SRS will base its recommendation on this assessment. SRS anticipates that the only issue with this disposition pathway for the remaining oxide will be the identification of a funding source. The SRS recommendation will contain a funding strategy proposal.

Additional DUO disposition alternatives are discussed in Reference 6.

4.0 Continued Safe Management Activities

SRS will continue to manage these materials in accordance with the Management Plan for Depleted, Natural, and Certain Low-Enriched Uranium Materials[16] until a disposition pathway is executed for each material. The management plan activities include the routine surveillance of the materials and facilities. Based on the surveillances, SRS will perform necessary maintenance to ensure safe storage until disposition of each material is completed. SRS will support studies and planning activities as necessary to advance the disposition of the materials covered by this plan.

[16] See Reference 8, WSRC-RP-2002-00392.

5.0 References

1. DOE/EIS-0220, titled *Final Environmental Impact Statement for the Interim Management of Nuclear Materials*, dated October 1995.
2. DOE/EA-1308, titled *Environmental Assessment for the Offsite Shipment of Certain Low-Level Waste from the Savannah River Site*, Rev. 0
3. WSRC Document No. ESH-PEQ-2000-00059, titled *Historical Generation and Flow of Recycled Uranium at the Savannah River Site* (U), dated June 08, 2000, authored by Louis E. McCarty
4. WSRC Document No. TR-2002-00113, titled *Corrosion Assessment of Storage Drums for Depleted Uranium Oxide Powders* (U), dated March 2002, authored by J. I.Mickalonis and C. F. Jenkins
5. WSRC Document No. M-AES-F-00001, Rev. 0, titled *Depleted Uranyl Nitrate Solution Disposition Alternative Study* (U), dated July 31, 2002
6. Document No. WSRC-TR-2002-00158, titled *Disposal Options for Depleted Uranium Trioxide (DUO_3) Study*, dated May 30, 2002, authored by Timothy Jones and others
7. Subcontract AC27440T, titled *Logistical Study for Removal of 3,200 Drums of Depleted Uranium Oxide Material from Storage Warehouses Building 728-F and Building 730-F at DOE's Savannah River Site* by MHF Logistical Solutions, Inc. dated April 02, 2002
8. Document No. WSRC-RP-2002-00392, titled *WSRC Management Plan for Depleted , Natural, and Certain Low-Enriched Uranium Materials at the Savannah River Site* (U), dated August 06, 2002
9. Subcontract AC27432T, titled *Logistical Study for Removal of 2,700 Metric Tons of Uranium Materials from Storage Warehouses M-330 and M-331 at DOE's Savannah River Site* by MHF Logistical Solutions, Inc. dated November 12, 2001