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Supplement Analysis of the Mark-18A Target Material Recovery Program at the Savannah River Site

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Prepared by the Department of Energy
Savannah River Operations Office

Acronyms and Initialisms

Am	Americium
Cf	Californium
Cm	Curium
CRM	Certified Reference Material
DOE	Department of Energy
DSA	Documented Safety Analysis
EIS	Environmental Impact Statement
FRR	Foreign Research Reactor
FY	Fiscal Year
HAD	High Activity Drain
IAEA	International Atomic Energy Agency
IMNM	Interim Management of Nuclear Materials
kg	kilogram
LCF	Latent Cancer Fatality
LLNL	Lawrence Livermore National Laboratory
mrem	millirem
MTHM	Metric Ton of Heavy Metal
NBL	New Brunswick Laboratory
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NNSA	National Nuclear Security Administration
ORNL	Oak Ridge National Laboratory
OSA	Onsite Safety Assessment
Pu	Plutonium
R&D	Research and Development
RBOF	Receiving Basin for Offsite Fuel
ROD	Record of Decision
SCF	Shielded Cells Facility
SNF	Spent Nuclear Fuel
SRNL	Savannah River National Laboratory
SRS	Savannah River Site
TRU	Transuranic
U.S.C.	United States Code
WIPP	Waste Isolation Pilot Plant

1.0 Introduction

1.1 Background

The Department of Energy (DOE) manages materials containing long-lived radioisotopes[1] produced from the 1960s through the 1970s by irradiating targets in production reactors at the Savannah River Site (SRS). The SRS K Reactor operated in a high-flux mode[2] to produce heavy isotopes for defense purposes, DOE programmatic use, scientific research, and other applications (Robinson 2014). Eighty-six Mark-18A targets were irradiated to produce californium-252 (^{252}Cf) and other valued isotopes including plutonium-244 (^{244}Pu) and heavy curium (i.e., curium rich in the isotopes ^{246}Cm through ^{248}Cm). Twenty-one of these targets were processed at Oak Ridge National Laboratory (ORNL) in 1971-1973 (Patton 2016). In addition to recovery of ^{252}Cf, ORNL electromagnetically enriched recovered plutonium to produce gram quantities of ^{244}Pu which were portioned to scientists for basic research and for safeguards programs. The heavy curium was processed for continued production of ^{252}Cf and other isotopes at ORNL from then until the present day.[3] The remaining 65 targets were retained in storage at SRS and now constitute the major potential supply for ^{244}Pu and heavy curium.

In October 1995, DOE issued the *Final Environmental Impact Statement: Interim Management of Nuclear Materials at the Savannah River Site* (*IMNM EIS*) (DOE/EIS-0220) (DOE 1995a), which evaluated the environmental consequences of alternatives for disposition of a large number and variety of nuclear materials. A series of Records of Decision (RODs) identified final decisions for groups of materials for which the *IMNM EIS* had identified interim activities. Most of these supplemental, amended, and original RODs dealt with materials that are unrelated to the Mark-18A targets, and are not reviewed in this *Supplement Analysis*. DOE decided to process many of the evaluated materials in the SRS separations facilities, but selected a Preferred Alternative of continued storage of the Mark-18A targets at SRS pending decisions about their future use (DOE 1995b). In 2000 DOE issued the *Savannah River Site Spent Nuclear Fuel Management Environmental Impact Statement (SRS SNF EIS)* (DOE/EIS-0279) (DOE 2000a), which did not re-evaluate previous alternatives; considered an option to process the targets through H Canyon for disposal; and confirmed the decision to continue storage pending decisions about future use of the isotopes contained in the targets (DOE 2000b).

Now, because the key isotopes contained in the targets have been determined to have significant value for programmatic use and have come into increasingly short supply, DOE proposes to process the Mark-18A targets at SRS to recover the ^{244}Pu and heavy curium by methods that are

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1 A radioisotope is an element with a specific atomic weight, governed by how many neutrons are part of the atom's nucleus. (For instance, "plutonium-244" is a form of plutonium with an atomic weight of 244.) An atom with a specific atomic weight can capture a neutron, for example during irradiation in a nuclear reactor, and become a different isotope of the same element. The resulting isotope can be stable or radioactive. The radioactive isotopes can later undergo radioactive decay or, if they are unstable, split into two smaller atoms known as "fission products."

2 The reactor was configured to produce a high concentration of neutrons, which could be captured by other elements to produce artificial isotopes.

3 When DOE seeks to produce heavy isotopes, the task is less difficult if the starting material contains relatively heavy isotopes. The most common isotope of curium is ^{244}Cm, but ^{246}Cm through ^{248}Cm require fewer neutron captures and are more efficient as "target" material for isotopes with higher weights. During earlier reactor cycles, the curium isotopes are also accompanied by americium-243 (^{243}Am), which is chemically similar to curium and is retained in target materials, and which itself can produce heavy curium during the irradiation cycle.

comparable to those discussed in the previous NEPA analyses but by using current capabilities at SRS in different facilities.

One partially relevant analysis in the *IMNM EIS* dealt with the processing of solutions of americium and curium, previously stored in the SRS F Canyon. The *IMNM EIS* evaluated a No Action option (Continued Storage) for the Mark-18A targets. It also analyzed the processing of targets, together with the much larger inventory of americium-curium in solutions; impacts from that strategy can be inferred from the analysis of the entire americium-curium program. When DOE decided to abandon the processing of the solutions in F Canyon (DOE 2001), the previous processing option described for the Mark-18A targets was no longer viable, and thus this *Supplement Analysis* evaluates an alternative processing location.

DOE has prepared this Supplement Analysis (SA) in accordance with the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. § 4321 et seq.) and DOE's NEPA implementing regulations (10 CFR 1021.314(c)) to evaluate whether the proposed action requires supplementing the existing *IMNM EIS* and *SRS SNF EIS*, conducting a new EIS, or determining no further NEPA analysis is required. This SA analyzes whether there are substantial changes in the proposed action as described in the *IMNM EIS* that are relevant to environmental concerns, or there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts (40 CFR § 1502.9(c)). DOE will also determine whether or not to amend an existing Record of Decision (ROD).

1.2 Purpose and Need

The underlying purpose and need for the proposed project is to ensure the availability of ^{244}Pu and heavy curium. ^{244}Pu is a critical component of certified standards for high-precision laboratory analyses supporting nuclear forensics and nuclear nonproliferation. Heavy curium is needed as feedstock for production of high-demand isotopes such as ^{252}Cf, which is used in many industrial and medical research and health care applications, such as cancer treatment.

The 21 Mark-18A targets irradiated at SRS and processed at ORNL from 1971-1973 have since provided the world's supplies of ^{244}Pu and heavy curium. Current international supplies of both ^{244}Pu and heavy curium are nearly depleted (NNSA 2015). The international inventory of separated ^{244}Pu is located as shown in Table 1 (Patton 2015). Approximately 3 grams remains available worldwide, outside current Defense Programs inventory at Lawrence Livermore National Laboratory (LLNL), compared to the 21 grams contained in the irradiated Mark-18A targets currently located at SRS. These 3 grams are managed by the Certified Reference Material (CRM) program at DOE's New Brunswick Laboratory (NBL) and by isotope support programs at ORNL. Because the current inventory of separated ^{244}Pu has become severely limited, a number of standards organizations have stopped or have severely limited distributing ^{244}Pu standards in order to conserve their remaining small quantities for high priority needs. Lacking ^{244}Pu, the United States, the International Atomic Energy Agency (IAEA), and other entities risk losing measurement capabilities essential for maintaining an active nuclear forensics and safeguards posture.

For nuclear forensics, the only available sources of ^{244}Pu are associated with the CRM program and the material in the remaining 65 Mark-18A targets at SRS. No current reactor or facility is capable of replacing the isotopes that were produced in the unique high-flux reactor campaign, and therefore the 65 remaining targets are the only practical source of additional supply.[4]

Table 1. 2015 Inventories of Plutonium-244

Item Identification Number	Total Pu (grams)	Percent ^{244}Pu	Total ^{244}Pu (grams)	Location
		Separated		
PU244FP33	12.13	17.8%	2.16	ORNL
PU244FP33B	0.68	8.7%	0.06	ORNL
PU244297BR	0.25	98.4%	0.25	ORNL
PU244328A	2.28	2.6%	0.06	ORNL
FP33	0.44	17.8%	0.08	IAEA
CRM 144	0.94	17.8%	0.17	NBL
CRM 144R	0.06	17.8%	0.01	NBL
CRM 131	0.30	97.9%	0.29	NBL
LLNL1 (PU244297BR)	1.52	98.7%	1.50	LLNL (Defense Programs Use)
Total Separated	***18.59***		***4.57***	
		Unseparated		
Mark-18A	436.2	5.0%	21.4	SRS
Total Unseparated	***436.2***		***21.4***	
Grand Total	***454.8***		***25.9***	

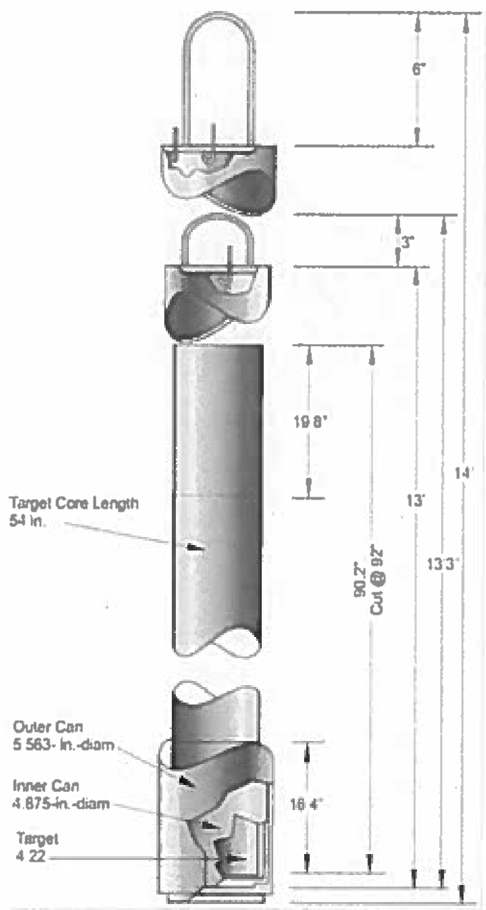
1.3 Proposed Action

The Mark-18A targets are currently stored in L Basin in "J-can" overpack containers, as shown in Figure 1. The J-cans and target cladding are aluminum, while the nuclear materials contained in the active region of the targets are a dispersion of oxides in an aluminum matrix.

DOE proposes to retrieve the 65 Mark-18A targets from their current storage location in L Basin at SRS and transport them to the Savannah River National Laboratory (SRNL) Shielded Cells Facility (SCF) in the SRS A Area, to be processed to recover nuclear material to be then shipped offsite to ORNL.

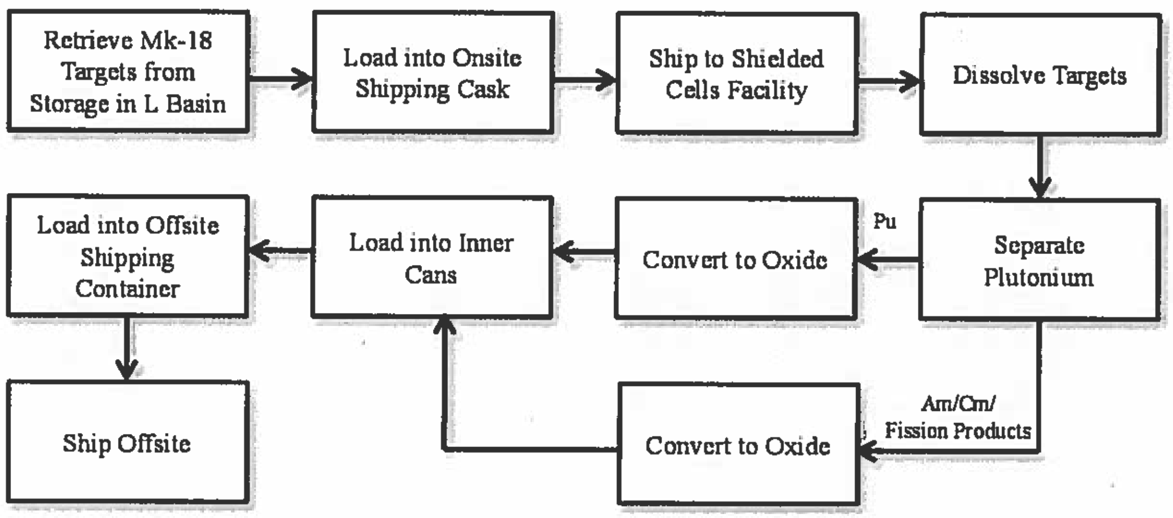
[4] ^{244}Pu is unique for use as a "tracer" or "standard" in laboratory analyses, where even a very small quantity can calibrate plutonium measurements because the tracer quantity is known and cannot have been present in the sample that is being analyzed. (The very-high-flux operations that allowed it to be produced in the Mark-18A targets cannot be duplicated elsewhere.) Heavy curium can be produced by irradiating lighter curium and ^{243}Am, but this would require an additional cycle of target fabrication, recovery, and irradiation to achieve the same result as using the Mark-18A composition. The Mark-18A isotopes would provide preferred feed for heavy and superheavy isotope production in the Oak Ridge High Flux Isotope Reactor (HFIR) for decades.

Figure 1. Mark-18A Target Assembly



The target recovery flowsheet is shown in Figure 2.

Figure 2. Mark-18A Target Recovery Program Flowsheet



The containers would be removed from L-Basin and transported to SRNL in a modified version of an existing shipping cask; the cask would be modified to accommodate the radiation spectrum of the targets (Loftin 2016). The cask currently used for transfer of irradiated fuel from L-Basin to H-Canyon has a gross weight of 70 tons due to the lead shielding included to protect against gamma radiation. Although the Mark-18A targets would not require the same level of shielding against gamma radiation as spent fuel, shielding using lighter elements would be needed to protect against the higher level of neutron radiation from the targets compared to that from spent fuel. A modified cask would be constructed with a different shielding configuration than that for the current cask, but with similar connections for external, remote handling equipment. The modified cask would also be easier to accommodate at SRNL. Each cask would contain one Mark-18A target, and would be shipped to SRNL one at a time due to physical and documented safety analysis (DSA) constraints and to minimize the material at risk during processing. This cask would be certified for onsite use at SRS under an Onsite Safety Assessment (OSA) for Transportation, much like the 70-ton cask that is used to transport spent fuel from L Basin to the SRS H Area.

No modifications would be needed at the L-Basin complex to retrieve the targets.

At SRNL SCF (Allender 2015), the Mark-18A targets would be taken into the shielded cells where they would be removed from their J-can overpack containers. The targets' aluminum cladding would be removed using caustic (sodium hydroxide solution). The remaining undissolved solids containing the actinides and fission products would be dissolved using either mineral acid and/or peroxide fusion followed by dissolution in nitric acid. The resulting solution would be passed through ion-exchange resins to separate the plutonium fraction from the curium, americium, and fission products. Once recovered from the ion-exchange resin, the plutonium solution would be calcined to convert it to an oxide. Similarly, the recovered curium, americium, and fission products would be calcined to create an oxide. The oxides would be packaged for shipment to ORNL using U.S. Department of Transportation (DOT)-certified shipping containers.

These operations are similar to processes used at this scale and in full-scale production. Heavy actinides were processed in the SCF in a Curium Campaign in the 1960s and heavy-actinide targets were processed at SRNL in the 1970s and 1980s in a series of Californium Facility shielded cells (Harbour 2000). Those operations add confidence that the safety basis of the proposed action is understood, although detailed flowsheets will be verified for the specific target materials and current DSAs.

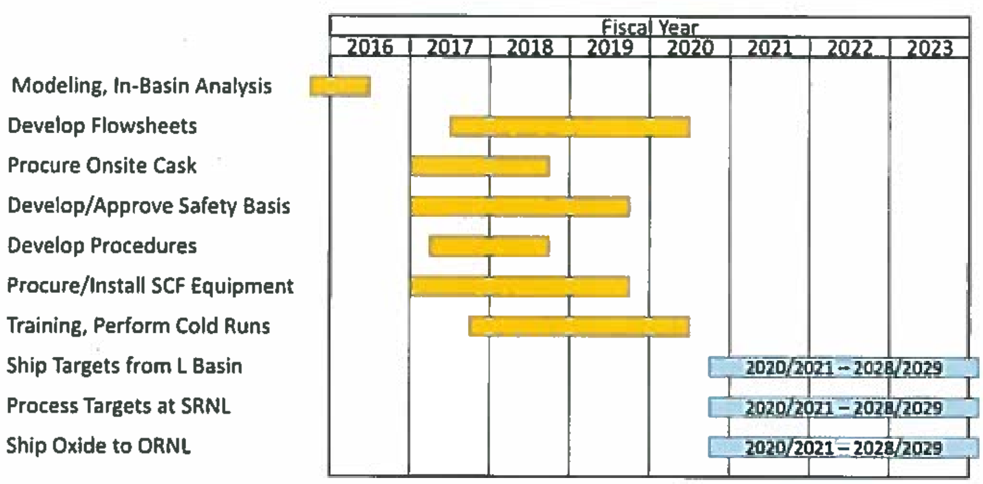
Minor modifications would be made at the SRNL SCF to reconfigure the cells with process equipment specific to this program, including a pass-through port that will allow horizontal entry of targets into the cells instead of overhead cell-loading; and to remove the equipment when the program is completed. Specific handling tools and temporary shielding would be designed and installed, if necessary, to facilitate receipt of the modified shipping cask and removal of the targets from the cask without requiring direct contact of operating personnel with the radioactive targets.

Oxide from sixty-five targets would be packaged and shipped from SRS to ORNL, where isotopes would become part of the continuing Research and Development (R&D) mission. The ^{244}Pu will be added to the supply of existing oxide to support CRM and research programs. The heavy curium and americium will be used primarily for the fabrication of new targets for irradiation in HFIR.

Incidental liquid and transuranic waste and laboratory samples will be managed using existing Laboratory systems (see Section 2.3).

Figure 3 shows a tentative proposed schedule, where shipment and recovery would proceed from FY (Fiscal Year) 2021 through FY 2028, with an early start feasible in FY 2020 and recovery lasting through FY 2029, depending on how many targets (from 7 through 9) can be processed per year. Priorities for flowsheet planning, equipment procurement, and facility readiness will depend on authorization and budgets.

Figure 3. Mark-18A Conceptual Schedule



1.4 Principal NEPA Analyses

The Mark-18A targets have been evaluated for several options that would retain the materials as-is, process them to recover isotopes for programmatic use, or dispose them as waste. Each NEPA activity included these targets as a small subset of large groups of materials that were evaluated for management or ultimate disposition. Key NEPA analyses include:

- In 1995, the *Interim Management of Nuclear Materials at SRS* Environmental Impact Statement evaluated continuing to store the targets "as-is" or to transport them to F-Canyon for dissolving, after which the materials would be purified and converted to oxide for storage pending programmatic use. The ROD for this EIS chose continued storage as the Preferred Alternative (DOE 1995b).
- In 2001, an Amended Record of Decision for this EIS did not specifically address the Mark-18A targets, but eliminated a plan that would have converted similar americium-curium materials (from existing solutions) into oxide pending programmatic use. This decision removed the capability that was considered earlier for conversion to oxide of the isotopes in the targets.
- In 2000, DOE published the *Savannah River Site Spent Nuclear Fuel Management* EIS, which described the full management options for irradiated materials including spent fuel and targets. Considerable detail was given on the impacts of routine operations, onsite and offsite transportation, accident analysis, and impacts on other resources. It provided updates on the current SRS configuration, including the relocation of the Mark-18A targets to L Basin storage. This EIS evaluated the impacts of a different processing alternative (to dissolve the Mark-18A targets in H Canyon before transferring the contents to high-level waste tanks, ultimately to the Defense Waste Processing Facility for storage pending transfer to a geologic repository); however, DOE decided to continue to store these targets (DOE 2000b).
- In 2013 and 2015, DOE issued Supplement Analyses to the *SRS SNF EIS* (DOE 2013) and for the *Foreign Research Reactor Spent Fuel Program* (DOE 2015b). Each analysis gave updated evaluations of the operations that had been studied more than a decade previously and confirmed several conclusions from earlier NEPA studies.

1.4.1 IMNM Final EIS

In 1995, DOE issued the *IMNM EIS* (DOE 1995a) to assess the potential impacts of a suite of alternatives for management of a variety of nuclear materials stored at SRS until decisions could be made regarding their ultimate disposition. The major categories of nuclear material considered in the *IMNM EIS* were Stable Materials, Programmatic Materials, and Candidate Materials for Stabilization. A detailed listing of the material groups in each category are shown in Table A-1 of the *IMNM EIS*.

- *Stable Materials*. Materials that were unlikely to present a safety concern over the next 10 years and were stable and suitable for Continued Storage. These materials included 65 Mark-18A targets containing about 1.1 kilograms of nuclear material, located in the Receiving Basin for Offsite Fuels (RBOF), as well as about 380,000 other discrete items including other types of targets and spent nuclear fuel, research and development material, and reactor materials such as control rods, plus about 700,000 liters (78,000 gallons) of depleted uranium solutions.

- *Programmatic Materials*. Materials that DOE needed to meet current or future program missions, but were almost entirely in a liquid form. These materials included 33,100 liters (8,900 gallons) of ^{242}Pu, ^{244}Cm, americium-243, and neptunium-237 solutions, and 248 discrete solid items such as fuel assemblies, targets, and slugs. The Mark-18A targets were also evaluated in this category. The Record of Decision for the *IMNM EIS* (DOE 1995b) stated that the targets, if a decision were made to process them, would be expected to be managed together with the americium-curium solutions.
- *Candidate Materials for Stabilization*. Materials determined to be in a physical form or storage configuration that could present a safety concern within the next 10 years. These materials included a variety of targets, irradiated nuclear fuels, and other materials including 16,000 Mark-31 targets containing 147 metric tons (160 tons) of nuclear material (primarily uranium-238 and ^{239}Pu) and 3,450 Mark-16 and Mark-22 irradiated nuclear fuels, and americium-curium targets (other than the Mark-18A targets) that were stored in P-Reactor Basin. The total included about 22,600 discrete solid items as well as 34,000 liters (9,000 gallons) of ^{239}Pu solutions and 228,000 liters (60,000 gallons) of enriched uranium solutions.

The evaluated alternatives differed depending on the category of nuclear material.

The original Record of Decision for the *INMM EIS* states (DOE 1995b): [5]

> *DOE has decided that stable materials can be safely managed in their existing physical and chemical forms over the next several years. Programs and projects to consolidate storage of stable materials in order to reduce surveillance and maintenance costs will continue. These materials will remain stored at SRS until DOE makes decisions relative to their future use or disposition.*

Although the Mark-18A targets were assigned a Preferred Alternative of Continued Storage, their potential as Programmatic Materials was recognized as candidates for "decisions relative to their future use or disposition." The ROD notes that the same process approach could be used for the "targets and slugs containing americium and curium isotopes," including the Mark-18A targets:

> *DOE would convert the americium and curium solutions in F-Canyon to an oxide. DOE would modify an existing portion of F-Canyon to provide the necessary equipment. After conversion, the americium and curium oxide would be packaged and stored in an existing vault or the new Actinide Packaging and Storage Facility. DOE could also transport the obsolete targets and slugs containing americium and curium isotopes to F-Canyon, dissolve them and convert the resulting solutions in a similar manner.*

Because the F-Canyon approach for the americium-curium solutions was analyzed quantitatively, the impacts tabulated in the *IMNM EIS* for the Processing to Oxide option can be adjusted

[5] A material in the Stable Materials grouping could also be addressed under the Programmatic Materials or Candidate Materials for Stabilization groupings, with a wider suite of alternatives including stabilization by processing in SRS separations facilities, if it is determined that the material could present health and safety vulnerabilities.

to provide estimates for the incremental impacts of processing the Mark-18A targets (with similar radioactive constituents but holding only a fraction of the quantity) in the same location. However, the locations of storage and processing are no longer viable.

1.4.2 Americium-Curium Solutions Amended Decision

DOE decided to abandon the plan to stabilize americium-curium solutions in F Canyon, deciding instead to dispose of the solutions to high-level waste tanks, in a January 2001 Amended Record of Decision (DOE 2001). The processing option discussed for the Mark-18A targets was no longer viable because the F-Canyon facilities would not be maintained and available.

1.4.3 SRS SNF EIS

In the *SRS SNF EIS* (DOE 2000), DOE evaluated alternatives (including processing in H-Area at SRS) for the management of about 68 metric tons heavy metal (MTHM) of aluminum-clad spent nuclear fuel, about 20 MTHM of stainless-steel or zirconium-clad spent nuclear fuel, and additional irradiated material stored in water basins. The *SRS SNF EIS* evaluated the continued storage of the Mark-18A targets at SRS pending a future programmatic decision, but the storage location was changed from the P-Reactor Basin and the Receiving Basin for Offsite Fuels (RBOF) as evaluated in the *IMNM EIS* to the L-Reactor Basin. This location change was judged to have no significant environmental impact.

This EIS did not re-address the *IMNM EIS* "Processing to Oxide" alternative for the Mark-18A targets but confirmed a decision to continue storage in L Basin pending future determinations of the programmatic need for the isotopes.

Because the *SRS SNF EIS* and subsequent analyses evaluated options for handling the irradiated materials including preparation for disposal or processing for material recovery, as part of broad SRS missions, the impacts from onsite management of similar materials is most relevant to the discussion of Mark-18A targets in their current storage and proposed processing location. The *SRS SNF EIS* evaluated materials management, storage, processing, and transfer options for 68 MTHM, of which the 1.1 kilogram of actinides contained in the Mark-18A targets is a subset that represents only 0.001 per cent of the material discussed there, and their handling constitutes an insignificant fraction of the total nuclear materials managed under routine and continuing SRS operations. For example, the EIS evaluated the potential impacts from removing the targets from L Basin, transporting them to H Canyon, processing the contents for disposal to high-level waste tanks, and vitrification in the DWPF, and concluded that the impact of this processing would be minimal (DOE 2000a):

> *Processing the Mark-18 targets (about 1 kilogram of heavy metal) was previously analyzed in the Final Environmental Impact Statement on Interim Management of Nuclear Materials and, therefore, was not analyzed in this EIS. The impacts of processing this small amount of material are minor and would not significantly affect the impacts analyzed for the Maximum Impact Alternative in this EIS. For example, total radiological dose from the Preferred Alternative to the maximally exposed individual for the entire period of analysis would be 0.67 millirem. Processing the Mark-18 targets would result in a dose of 0.0035 millirem.*

1.4.4 Later Supplement Analyses

Several recent Supplement Analyses did not address Mark-18A targets specifically, but evaluated the handling, management, and impacts of similar irradiated materials. These analyses are relevant because they deal with materials that are similar in characteristics and with most management options as the Mark-18A targets. The potential impacts of the 0.0011 MTHM in the targets can be compared directly to, and are bounded by, the potential impacts of the much larger inventories (multiple MTHM) of combined spent fuel and irradiated material.

The options studies for the Mark-18A Target Recovery Program (Robinson 2014) did not perform complete environmental analyses, but described the physical and operational structure of the management options that remain valid today, including the No Action option of continued storage; full and partial processing in H Canyon with additional processing at ORNL; processing at SRS for either recovery or disposal to waste; and the use of the SRNL SCF versus the use of H Canyon. These comparisons concluded that the limited available supply, the efficiency of the SCF recovery (versus using the large H-Canyon facilities which would be susceptible to material losses), and the SRNL experience in recovering curium and other heavy isotopes make the Proposed Action a viable option with comparatively low operational, exposure, and financial impacts and risks.

1.5 Scope of This SA

This SA updates the evaluation from the *IMNM EIS* to reflect changes in SRS facility: (1) Targets are now stored in L Basin, instead of RBOF, and thus retrieval would proceed from a different location; (2) F-Canyon process support is no longer available, and processing would proceed at a different location in the SRNL SCF; and (3) Onsite transportation would occur from a revised location (L Basin) to a revised location (SRNL SCF).

Under the Proposed Action evaluated in this SA, DOE would discontinue storage of the Mark-18A targets at SRS and instead implement the "Processing to Oxide Alternative" discussed in the *IMNM EIS* for the other americium-curium materials. In addition, DOE would not implement the Processing to Oxide Alternative by transferring the targets from storage to F-Area at SRS, with subsequent processing of the nuclear material within the targets to oxide. Instead, DOE would transfer the targets from storage at L Basin to the SRNL SCF, where an initial processing step would occur to remove the nuclear material and fission products from the targets for separation into plutonium and americium/curium/fission product streams that would be subsequently shipped offsite to ORNL.

This SA evaluates whether the proposed actions constitute substantial changes to the proposed actions described in previous NEPA documents that are relevant to environmental concerns, or whether there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts (40 CFR § 1502.9(c)).

The activities at ORNL occur as part of their continuing Research & Development mission and fall under routine ongoing operations in existing facilities. ORNL activities are covered under the existing NEPA Categorical Exclusion 3059X (ORNL 2005).

2.0 Analysis of Environmental Consequences

In the *IMNM EIS* (DOE 1995a), DOE determined that any of the alternatives involving the large separations facilities at SRS (e.g., F Canyon or H Canyon) would have larger environmental impacts during processing operations than alternatives involving continued interim storage, but that the potential health effects from these alternatives would be low and well within regulatory limits. DOE addressed the radiological impacts on members of the public and workers by summing the highest impacts from each of the alternatives for every evaluated group of materials (Comparative Alternatives Scenario). For the broad range of activities and alternatives discussed, no Latent Cancer Fatalities (LCFs) were expected for members of the public and 1 LCF was projected for workers. It was determined that the potential for accidents involving the materials would be reduced following stabilization activities with some potential accidents eliminated.

The *IMNM EIS* also evaluated the risks to members of the public and workers from onsite transportation of nuclear material between SRS facilities. No radiation exposures were projected to members of the public from incident-free transport of nuclear material, and no LCFs from radiation exposure were projected to workers (either involved or noninvolved). No LCFs to members of the public (either onsite or offsite populations or an offsite maximally exposed individual) were projected from potential transportation accidents considering a range of accidents from very minor to very severe accidents (DOE 1995a).

DOE also determined that implementing any of the alternatives would result in little or no impacts on geologic resources, ecological resources, cultural resources, aesthetic and scenic resources, noise, and land use. Furthermore, there are no significant changes to the environment, policies, or procedures protecting the environment that would either require new analyses or change the significant thresholds or needs of mitigation. Emissions of hazardous air pollutants and releases of hazardous effluents from any of the alternatives would be well within applicable federal standards and existing regulatory permits for the SRS facilities. None of the alternatives would result in emissions of radioactive or nonradioactive constituents that would result in a disproportionate impact on minority or low-income communities in the SRS vicinity. Management of high-level liquid waste, transuranic (TRU) waste, hazardous waste, low-level radioactive waste, and mixed low-level radioactive waste would be within the capacity of existing SRS waste management facilities for storage, treatment, or disposal (DOE 1995b).

The Proposed Action would revise previously evaluated operations for a tiny fraction of the materials evaluated in the *IMNM EIS*. It would entail processing operations similar to those evaluated for tens of thousands of gallons of liquid nuclear solutions and a few tens of thousands of discrete solid items including thousands of targets. As one example, the actinide mass within the Mark-18A targets (including plutonium, americium, curium, and californium), about 1.1 kilograms (Robinson 2014), represents about 7×10^{-4} percent of the mass of nuclear material that was contained in irradiated Mark-31 plutonium production targets, which were also evaluated in the *IMNM EIS* and subsequently processed in F Canyon. Any byproducts from the process would be similarly small relative to SRS activities with similar irradiated materials. Therefore, DOE believes that the Proposed Action would represent a negligible change to the environmental consequences evaluated in the *IMNM EIS*. The analysis in the *SRS SNF EIS* (see Section 1.4.3) reinforces this conclusion by estimating that processing the targets in H Canyon, a much larger facility than the SCF, was projected to result in a Maximum Evaluated Impact dose of 0.0035 mrem for the entire processing campaign.

Considering the operational changes at SRS that would be required for implementing the "Processing to Oxide Alternative" for the Mark-18A targets, this SA re-evaluates the principal environmental impacts that could result from the Proposed Action. The following subsections address: (2.1) radioactive species contained in the targets, upon which shielding and emissions estimates were based, (2.2) potential human health impacts from normal operations and potential human health impacts from accidents, (2.3) potential impacts involving other resource areas, and (2.4) cumulative impacts.

2.1 Radioactive Species

SRNL performed reactor modeling to estimate radionuclide compositions, conservatively with respect to potential dose potential, in the 65 Mark-18A targets remaining in inventory. These calculations were used to estimate potential exposure to workers and the public. Although Tables 2 through 4 give considerable detail for the concentrations of radioactive isotopes, most species would provide only a small fraction of the potential exposure compared to the most radioactive isotopes (e.g., ^{244}Cm for actinides, and ^{90}Sr or ^{137}Cs for fission products). The differences are most relevant for protection of workers and for assuring that the operations fall within existing DSAs and proper shielding is provided; curium can produce neutron radiation, strontium decays by beta emissions, and cesium provides a gamma radiation hazard. The different types of radiation can require different types of shielding or containment.

Table 2 shows actinide concentrations (in grams per average or maximum assembly) projected to January 1, 2016. Tables 3 and 4 tabulate key actinides and fission product isotopes, respectively. Only the actinide radioisotopes present at more than 1 milligram in an average target are shown; isotopes with lesser mass do not contribute significantly to the potential exposure to workers or the public. The total actinide mass of 1.1 kilograms is 0.0011 MTHM, a small fraction of the 68 MTHM discussed in the *SRS SNF EIS.* Almost all of the activity from fission products retained in the targets results from cesium-137 and strontium-90, similar to other irradiated materials stored at SRS.

Table 2. Actinide Composition of Mark-18A Assemblies (grams)

Isotope	Half-Life, years	Average	Maximum
Plutonium-238	87.7	0.010	0.014
Plutonium-239	24,100	0.006	0.009
Plutonium-240	6,560	5.569	9.024
Plutonium-241	14.4	0.020	0.031
Plutonium-242	37,500	0.833	1.369
Plutonium-244	80,800,000	0.249	0.418
Americium-241	432.7	0.098	0.149
Americium-243	7,370	0.635	1.074
Curium-244	18.1	1.810	2.933
Curium-245	8,500	0.425	0.644
Curium-246	4,730	6.792	10.080
Curium-247	15,600,000	0.375	0.582
Curium-248	340,000	0.540	0.872
Californium-249	351	0.009	0.015
Californium-250	13.08	0.001	0.001
Californium-251	898	0.002	0.003
Total Actinide Mass		17.3	27.2
Mass for 65 Targets		1,129	

Table 3. Actinide Composition of Mark-18A Assemblies (Curies)[6]

Isotope	Average	Maximum
Plutonium-238	1.780 E-01	2.463 E-01
Plutonium-239	3.602E-04	5.391E-04
Plutonium-240	1.264E 00	2.046 E 00
Plutonium-241	2.129 E 00	3.221 E 00
Plutonium-242	3.292 E-03	5.407 E-03
Plutonium-244	4.491E-06	7.560E-06
Americium-241	3.384 E-01	5.103 E-01
Americium-243	1.266 E-01	2.139 E-01
Curium-243	3.985 E-03	5.531 E-03
Curium-244	1.464 E+02	2.373 E+02
Curium-245	7.305 E-02	1.105 E-01
Curium-246	2.068 E 00	3.074 E 00
Curium-247	3.482E-05	5.400E-05
Curium-248	2.242 E-03	3.628 E-03
Californium-249	3.665 E-02	6.092 E-02
Californium-250	7.618 E-02	1.277 E-01
Californium-251	3.037 E-03	5.123 E-03

[6] Tables 3 and 4 use Modified Scientific Notation, where "E" followed by a value indicates a power of 10. For instance, "1.780 E-01" is equivalent to 1.780×10^{-1}.

Table 4. Fission Product Composition of Mark-18A Assemblies (Curies)
(showing only isotopes with Average > 1 milliCurie)

Isotope	Average	Maximum
Cesium-137	7.168 E+01	1.094 E+02
Strontium-90	1.281 E+01	1.944 E+01
Europium-154	6.079 E-01	8.713 E-01
Krypton-85	3.389 E-01	5.040 E-01
Hydrogen-3	1.815 E-01	2.797 E-01
Samarium-151	6.632 E-02	9.569 E-02
Europium-155	2.547 E-02	3.594 E-02
Tin-121m	1.620 E-02	2.273 E-02
Technetium-99	1.853 E-03	1.011 E-02
Promethium-147	1.806 E-03	2.661 E-03
Zirconium-93	1.079 E-03	1.631 E-03

2.2 Human Health Environmental Consequences

Potential human health impacts from normal operations at SRS would result from retrieval of targets from L-Basin, onsite transportation to SRNL, processing for actinide recovery, and separation and packaging for offsite shipment.

2.2.1 L-Basin Retrieval

The proposed modified cask (see Section 1.3) would be geometrically similar to the current 70-ton cask that is used routinely for transfer of spent nuclear fuel between L Basin and H Area. Target retrieval and cask handling operations would be the same as other routine L-Area operations. The proposed action would add approximately 1.1 kg of new irradiated material to the 3.3 metric tons (MT) evaluated in *Supplement Analysis: Savannah River Site Spent Nuclear Fuel* Management (DOE 2013), or less than 0.0001 percent, and also represent an insignificant fraction of the activities evaluated in the *Proposed Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel Environmental Impact Statement (FRR SNF EIS)* (DOE 1996a) involving irradiated materials and a subsequent *Supplement Analysis for the Foreign Research Reactor Spent Nuclear Fuel Acceptance Program* (DOE 2015b). As described in these EISs, "incident-free" target retrieval activities at L-Basin would not be expected to result in radiation doses and risks to members of the public or workers in addition to those currently experienced.

Potential impacts to members of the public and noninvolved workers from potential accidents at L Basin were also evaluated in the *FRR SNF EIS*, which is tiered to the *SRS SNF EIS*. Evaluated accident scenarios included a mishandled fuel assembly, a criticality incident, and a change in the basin water level. Each of these accidents could breach the target cladding and release radioactive material to the environment. It is not expected that the Proposed Action would introduce additional accident risks: A criticality accident is not credible for the Mark-18A targets; a change in basin water level would no longer apply for these targets if they are removed for processing. The *SRS SNF EIS* assessed "mishandled fuel assembly" as an "accident expected to result in low consequences and risks to the onsite worker population and the offsite population." This accident was assigned radiological impacts to a Maximum Exposed Individual and offsite population, and Latent Cancer Fatalities, as zero for the entire basin inventory. A series of tests in L-Basin in 2015 verified that three selected J-can overpacks containing the Mark-18A targets in basin storage were intact without leaks. Together with non-destructive assay data of selected targets, DOE concluded the targets were intact within the J-can overpacks (Branney 2016). DOE expects that the aluminum-clad targets would be removed eventually, for processing or disposal or for repackaging for dry storage, and thus the potential for cladding breach due to mishandling applies to all evaluated alternatives.

2.2.2 Onsite Transportation

Design and construction of the modified cask would be conducted in accordance with criteria required by the Savannah River Site Transportation Safety Document (Watkins 2015) and applicable facility DSAs. Onsite transportation at SRS would be conducted under the provisions of DOE Order 460.1, *Packaging and Transportation Safety* (DOE 2010). Potential impacts will also be analyzed and documented in an Onsite Safety Assessment (OSA) for Transportation, and any issues will be resolved when an operating plan is established.

Based on the analyses provided in the series of SNF-related EISs, incident-free transfer of the Mark-18A targets within SRS would not result in radiation exposures of members of the offsite public because of the contained nature of the target J-tube containers and the shipping cask. Potential radiation exposures to transport workers would comply with DOE regulations, and be maintained at levels as low as reasonably achievable. Workers would be protected from industrial risks in compliance with DOE regulations and guidance. Risks to workers from accidents during transfers of the targets are expected to be comparable to or smaller than those from current routine transfers of spent nuclear fuel at SRS (e.g., from L Area to H Area) as evaluated in the *SRS SNF EIS* (DOE 2000). In that document, the total estimated LCF for a maximum of 1400 onsite shipments, with an accident frequency of 1.28×10^{-4}, was estimated to be 1.25×10^{-5}, with a greater hazard to truck operators of 0.16 fatalities from physical impacts of accidents (e.g., driver fatalities) over the same 1400 onsite SNF shipments. For the 65 shipments of Mark-18A targets, the corresponding bounding estimates are 5.80×10^{-7} LCF from radiological exposure and 0.07 fatalities from physical impacts of transportation accidents.

2.2.3 SRNL Processing

The SRNL SCF has been used for a variety of R&D programs involving activities similar to those under the Proposed Action, including a previous processing campaign involving ^{244}Cm. The flowsheet for operations at SRNL under the Proposed Action is similar to the flowsheet used at a past operation at ORNL involving Mark-18A targets. In this 1971 operation, SRS retrieved Mark-18A targets from basin storage and transferred them to ORNL for processing to recover ^{252}Cf, plutonium (including ^{244}Pu), and heavy curium/americium/fission product oxides (Patton 2016). Although the process and location have changed, SRNL plans to incorporate updates based on operating experience at ORNL.

Operations at SRNL SCF would release nonradioactive and radioactive gases from the laboratory off-gas system. Volatile gases (nitrogen oxides, nitric acid, hydrogen from aluminum dissolution) and volatile fission products (krypton, xenon, iodine) would be released and vented through SRNL's E-Wing ventilation system. Air releases are expected to be less than 100 liters of volatile compounds per target, well below levels of potential regulatory or procedural impact.

An atmospheric release analysis conforming to 40 CFR Part 61, Appendix D, *National Emission Standards for Hazardous Air Pollutants* (NESHAP), was performed for the SRNL process plan for the Mark-18A targets. Volatile gasses from the caustic dissolution of aluminum cladding (e.g., NO_x, NH_3, and H_2) and volatile fission products (e.g., Kr, Xe, I_2) will be released and vented through SRNL's E-wing ventilation system and the 791-A Sandfilter Stack. Releases are projected at up to 100 liters (at standard temperature and pressure) per target. The quantity is within the range of the current laboratory operating basis and procedures and the initial, conservative evaluation showed that up to seven "worst-case" targets (i.e., targets approaching the "maximum" radiation levels summarized in Tables 3 and 4 above) could be processed per year while remaining within the facility basis of less than 0.1 millirem per year for release at the laboratory building stack. (This release level is used as a procedural guideline to monitor SRNL activities.) The Stack would remain as a Potential Impact Category (PIC) Level 3 emission source as long as no more than seven maximum targets (modeled conservatively) are processed per year. This rate is well within the range of the current laboratory operating basis and procedures for SRNL, and no additional sampling or approval from the South Carolina Department of Health and Environmental Control will be required.

Therefore, the Mark-18A activities at SRNL fall within the boundary of routine operations supporting the Research and Development mission, and minimal impacts on members of the public or to non-involved workers would be expected from the Proposed Action. More than seven targets at less than "maximum" content could be processed per year with minimal impact on the public or workers. If experience proves that the calculated release rates are conservative (as intended) or overstated, up to nine "maximum" targets may be processed per year.

Operations would comply with DOE regulations, directives, and relevant best management practices to minimize radiation exposures to workers and risks from industrial accidents or hazardous materials.

Caustic dissolution of cladding will also dissolve a portion of the fission products, which will follow the caustic waste stream. The estimated Potential Effective Dose Equivalent (PEDE) is 0.109 millirem per year for seven "bounding" targets. However, it is the air emissions that come closest to putting constraints upon the operating rate based on permit limits.

The SRNL evaluation of processing in the SCF was made to assure compliance with facility safety and environmental basis, using conservative (bounding) characteristics of the target assemblies in the absence of measured data. (Target processing at ORNL in the 1970s focused on the presence of heavy actinides, particularly californium, and did not report fission products and minor isotopes. Therefore, new projections were made from reactor modeling and confirmed to be conservative by selected non-destructive analysis of stored targets (Branney 2016).) The targets were included in the impact analysis for the americium-curium solutions' Processing to Oxide alternative in F Canyon, and by ratioing the impacts shown in Table 2-4 of the *IMNM EIS* to the radionuclide content of the Mark-18A targets, an increment of approximately 2.2×10^{-5} LCF to the population and 0.002 LCF to workers from normal operations, or 0.5 LCF from facility accidents, is estimated. Impacts on water resources are discussed in Section 2.3.

NEPA evaluations of new SRNL activities are typically evaluated against the Laboratory's ongoing Research & Development mission. Previous evaluations, including EISs, Environmental

Assessments, SAs, and Categorical Exclusion Determinations, are maintained at the SRS NEPA Information and Resources website, http://www.srs.gov/general/pubs/envbul/nepa1.htm.

2.2.4 Offsite Transportation

The oxides recovered in SRNL processing would be prepared at SRNL for offsite transportation using packaging approved for these materials and quantities by DOT. All activities would be compliant with applicable Federal regulations and DOE directives, including DOE Order 460.1 (DOE 2010). SRNL anticipates using licensed Type A packaging that is under current license at the time of transport (e.g., the Type S300 special form configuration) for the americium/curium/fission product oxides and Type B packaging (e.g., the Type 9975 or Type 9977) for infrequent transfers of the plutonium product oxides.

A previous SA for the *IMNM EIS* (DOE 2009) evaluated a similar set of activities, the transport of SRS-origin Low-Assay Plutonium from the Hanford site to SRS for processing in H Canyon and disposal of radionuclides to high-level waste tanks. That mission involved 5 kilograms of high-Pu-238 material, of greater estimated hazard than the 1.1 kilograms of actinides in the Mark-18A targets and transportation over a greater distance (2727 miles versus 417 miles) in containers that were suitable for the materials. No specific analysis was performed in that SA for offsite transportation, which was covered by an existing Hanford Categorical Exclusion (Klein 2005). Because the Mark-18A targets were not discussed likewise in a separate Categorical Exclusion, the transportation impacts are discussed here to assure that combined impacts from the onsite operations do not pose a combined significant impact when considered together with offsite transportation.

The DOT regulates the transportation of hazardous materials (including nuclear materials and SNF) in interstate and intrastate commerce by land, air, and on navigable water. The DOE, through its management directives, orders, and contractual agreements, assures the protection of public health and safety by imposing on its transportation activities standards equivalent to those of the DOT and U.S. Nuclear Regulatory Commission. The Type A and Type B packages proposed for the Mark-18A program are approved for much larger quantities of hazardous materials.

The *SRS SNF EIS* estimated the potential impacts from up to 1400 offsite shipments of unprocessed fuel stored in L Basin to a geologic repository as part of its analysis of direct-disposal options for SNF. The methodology also applies to other licensed shipments and is based on risk factors for radiation and hazard release in rural, suburban, and urban locations per kilometer traveled. The current program plan is to ship one container of americium-curium oxide per target (i.e., make 65 shipments) and to ship fewer containers of plutonium oxide (approximately one per year, or eight packages). Based on the unit risk factors for the 417-mile route from SRS to ORNL, the incident-free radiological impacts for shipping the 65-target quantity in the Mark-18A campaign are 0.0015 LCF for occupational exposure and 0.004 LCF for the general population. If impacts are conservatively estimated to be proportional to the number of shipments, radiological impacts to the general population from potential transportation accidents are 6×10^{-7} LCF and the nonradiological impacts of traffic accidents are 0.007 fatalities.

These estimates are based on ratios from analyzed offsite transportation that predominantly involved spent nuclear fuel, for which transportation impacts are dominated by the presence of fission products. Therefore the estimates are judged to be bounding for the potential impacts from the transportation of oxide in DOT-licensed shipping packages. However, under some accident conditions, oxide in cans within shipping packages may be more dispersible than clad spent nuclear fuel in different shipping packages.

A separate analysis based on transportation of actinide oxide showed comparable, but lower, estimated impacts than those discussed above. In the Final Surplus Plutonium Disposition Supplemental Environmental Impact Statement, (*SPD SEIS*) (DOE 2015a), DOE analyzed the transportation impacts for up to 4900 shipments of plutonium oxide from Los Alamos to Savannah River, involving 10 million kilometers of one-way travel. Incident-free radiological impacts included 250 person-rem and 0.2 LCF to the shipping crew and 160 person-rem and 0.1 LCF to the population, with accident risk of 0.00009 LCF from radiological impacts and 0.5 LCF from non-radiological impacts.

The offsite transportation of americium/curium and plutonium oxide from Mark-18A targets from SRNL to ORNL involves a fraction of 0.000035 of the mass compared to the mass of the plutonium oxide discussed in the *SPD SEIS*, transported over 35,000 kilometers in approximately 73 shipments, a fraction of 0.0035. The incident-free risk for shielded shipping drums and the non-radiological accident risk are related to the transportation duration and distance, leading to an estimate of 1.6 person-rem and 0.0009 LCF to crew and 0.8 person-rem and 0.0005 LCF to population from incident-free transportation and 0.002 LCF from non-radiological accident risk. Accident radiological impacts are more related to the mass ratio of the material transported, recognizing that the activity for a kilogram of these oxides (see Tables 3 and 4) is higher by a factor of 84 than the activity of a kilogram of the material discussed in the *SPD SEIS.* With those factors, the impacts from accidents is 2.6×10^{-7} LCF from radiological effects.

2.3 Environmental Consequences Involving Other Resource Areas

The *IMNM EIS* indicated that there would be minimal environmental impacts from the implementation of any alternative (including either Continued Storage or Processing to Oxide for Mark-18A targets) in the areas of geologic, ecological, cultural, aesthetic, and scenic resources; noise; and land use. Impacts in these areas under the proposed action would continue to be limited because no construction of new facilities is necessary and only minor facility modifications would occur within existing buildings in industrialized portions of the SRS. The minor modifications to the SCF at SRNL will not require significant construction or involve activities outside the internal boundaries of the facility. The largest change will be the reconfiguration of the back of one cell to allow the horizontal transfer of assemblies into the cell, reducing potential exposure from the more common method of loading material into the cell from the top.

The existing SRS workforce would support any activities required to implement either continued storage or processing, and thus negligible socioeconomic impacts would be expected from implementing the current baseline of storage or the proposed action. This conclusion is also reconfirmed in more recent NEPA studies of L-Basin operations and transfers of materials to other facilities (DOE 2013, DOE 2015b).

Implementing the Proposed Action would entail activities at existing SRS facilities that are the same as or comparable to existing operations at these facilities. There would be no change in land use at SRS and no need for additional construction that could result in impacts on soil and geology or cultural resources. There would be no need for additional personnel at the two primary SRS facilities affected under the proposed action: L Basin and SRNL SCF. There would be no additional impacts on infrastructure (including utilities), surface and groundwater resources, or ecological resources from operation of these facilities.

Waste generation under the Proposed Action would primarily result from processing operations at the SRNL SCF. Wastes would include sample returns that were sent for destructive analysis under existing procedures, as well as scrap or contaminated equipment including pipettes or hot plates, gloves, wipes, etc. These wastes are expected to be classified either as low-level waste or as transuranic waste requiring disposal at the Waste Isolation Pilot Plant (WIPP). Residual liquids that are acceptable to the SRNL High Activity Drain (HAD) system will be discharged for further processing with other routine laboratory HAD liquids. Major other sources of treated effluent include process cooling water from separation operations. It would be anticipated that the impacts to surface water quality attributed to R&D operations such as the SRNL SCF would be orders-of-magnitude lower than those attributed to separations facilities. If any residual liquid is not suitable for discharge to the HAD, it will either be absorbed for disposal as low-level waste or managed as mixed low-level waste. Quantities of waste generated would be within the capacity of existing SRS waste management facilities for storage, treatment, or disposal. (Even if the entire contents of the Mark-18A targets were disposed to waste, the radioactivity would annually add less than one-millionth of the amount currently stored as liquid waste at SRS (SRNS 2016.) If WIPP is not fully operational at the time transuranic waste is generated, waste packages would be stored in the SRS E-Area Solid Waste Facility pending shipment to WIPP. Solid low-level radioactive waste would be disposed of onsite in E-Area; mixed low-level radioactive waste would be transferred offsite for treatment and disposal.

In summary, even if the entire contents of the Mark-18A targets were disposed to SRNL waste systems, they would constitute a small fraction of the radioactive and chemical hazards evaluated in the referenced NEPA activities for irradiated materials. These hazards would have negligible impacts on waste management systems; would comply with all regulatory permits; and fall within the bounds of SCF Documented Safety Analyses.

2.4 Cumulative Impacts

The *IMNM EIS* evaluated cumulative impacts for public and worker health, water and air resources, waste generation, and utilities for the evaluated alternatives. DOE determined that the potential cumulative impacts on land use, surface water, groundwater, and ecological resources were too small to characterize or were not expected. Implementing the Proposed Action would entail activities at existing SRS facilities that are the same as or comparable to existing operations at these facilities. Therefore, the Proposed Action is not expected to result in increases to the range of cumulative impacts evaluated in the *IMNM EIS*, the *SRS SNF EIS*, or subsequent NEPA studies for irradiated materials.

3.0 Conclusion

DOE proposes to amend its previous decision to store Mark-18A targets at SRS and to instead implement the Processing to Oxide Alternative. DOE would implement the alternative by transferring the targets from storage at L Basin to the SRNL SCF, where an initial processing step would separate the nuclear material and fission products in the targets into ^{244}Pu and americium/curium/fission product streams to be shipped offsite in oxide.

Because the Proposed Action would revise operations for only a tiny fraction of the materials evaluated in the *IMNM EIS* and *SRS SNF EIS*, and these revisions would themselves have only negligible impacts, the Proposed Action would represent a negligible change to the environmental consequences evaluated in the *IMNM EIS* and *SRS SNF EIS*. Considering the operational changes at SRS that would be required for implementing the Processing to Oxide Alternative for the Mark-18A targets, this SA re-evaluated the principal environmental impacts that could result from the Proposed Action. These impacts were determined to be small, and would not result in releases to the environment or radiation doses or risks to members of the public or workers that would be significantly larger than those evaluated in the *IMNM EIS* and *SRS SNF EIS*. DOE will issue amended RODs for the *IMNM EIS* and *SRS SNF EIS* reflecting this decision with respect to management of the Mark-18A targets.

4.0 Determination

In compliance with DOE NEPA regulations, 10 CFR Part 1021, Section 1021.314(c), DOE has examined the circumstances relevant to the Proposed Action to retrieve 65 Mark-18A targets from their current storage location at SRS, transport them to the SRNL SCF, and process them to recover nuclear material that would be then transported offsite. This analysis was performed to determine whether the Proposed Action in this SA would result in a substantial change to the environmental consequences reported in the *IMNM EIS and SRS SNF EIS* or if there were significant new circumstances or information relevant to environmental concerns related to the Proposed Action. Implementing the Proposed Action would result in very small environmental consequences that would not be expected to change the environmental consequences evaluated in the *IMNM EIS.* The Proposed Action would therefore not constitute a substantial change relevant to environmental concerns reported in the *IMNM EIS* and *SRS SNF EIS.* There are no significant new circumstances or information relevant to environmental concerns related to the Proposed Action or its impacts within the meaning of 40 CFR 1502.9(c) and 10 CFR 1021.314. Therefore, neither a supplement to the *IMNM EIS*, a supplement to the *SRS SNF* EIS, nor a new EIS is required. DOE will amend the RODs for the *IMNM EIS* and *SRS SNF EIS* to reflect the decision with respect to management of the Mark-18A targets.

Jack R. Craig
Savannah River Site Manager
Savannah River Operations Office
U.S. Department of Energy

12/9/16
Date

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