DOE/EA-1574

Environmental Assessment for U-233 Stabilization, and Building 3019 Complex Shutdown at the Oak Ridge National Laboratory Oak Ridge, Tennessee

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ACRONYMS

ACL	Administrative Control Level
ACGIH	American Conference of Governmental Industrial Hygienists
AIHA	American Industrial Hygiene Association
ALARA	As Low As Reasonably Achievable
ANS	American Nuclear Society
ANSI	American National Standards Institute
ARF	Airborne Release Fraction
BJC	Bechtel Jacobs Company LLC
CAS	Chemical Abstract Service
CD	Critical Decision
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response Compensation Liability Act
CEU	Consolidated Edison Uranium
CEUSP	Consolidated Edison Uranium Solidification Program
CFR	Code of Federal Regulations
CH-TRU	Contact Handled Transuranic Waste
CO	Carbon Monoxide
CRK	Clinch River Kilometer
D&D	Decontamination and Decommissioning
DNFSB	Defense Nuclear Facilities Safety Board
DOE	Department of Energy
DOT	U. S. Department of Transportation
DSA	Documented Safety Analysis
DUN	Depleted Uranyl Nitrite
DUO_3	Depleted Uranium Oxide
EA	Environmental Assessment
EDE	Effective Dose Equivalent
EIS	Environmental Impact Statement
EM	Environmental Management
EPA	U. S. Environmental Protection Agency
EPHA	Emergency Planning Hazards Assessment
ERPG	Emergency Response Planning Guide
ETTP	East Tennessee Technology Park
FDDI	Fiber Distributed Data Interface
FONSI	Finding of No Significant Impact
FTE	Full-Time Equivalent
FP	Fire Protection
FY	Fiscal Year
HEPA	High-Efficiency Particulate Air
HEU	Highly Enriched Uranium
HFIR	High Flux Isotope Reactor
HM	Heavy Metal
HQ	Hazard Quotient
HVAC	Heating, Ventilation, and Air-Conditioning
IFDP	Integrated Facility Disposition Project
INL	Idaho National Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
LLLW	Liquid Low-Level Waste

LLW	Low-Level (radioactive) Waste
LSS	Laboratory Shift Superintendent
MEI	Maximally Exposure Individual
MeV	Mega Electronvolt
mrem	Millirem
MSRE	Molten Salt Reactor Experiment
NAAQS	National Ambient Air Quality Standards
NaF	Sodium Fluoride
NaOH	Sodium Hydroxide
NEPA	National Environmental Policy Act
NFS	Nuclear Fuel Services
NNSA	National Nuclear Security Administration
NO_x	Nitrogen Oxide
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NRHP	National Register of Historic Places
NTS	Nevada Test Site
OMB	Office of Management and Budget
ORNL	Oak Ridge National Laboratory
ORO	Oak Ridge Office
ORR	Oak Ridge Reservation
OSHA	Occupational Safety and Health Administration Act
PC	Performance Category
PCB	Polychlorinated Biphenyl
PDSA	Preliminary Documented Safety Analysis
ppm	Parts Per Million
RCRA	Resource Conservation and Recovery Act of 1976
rem	Roentgen Equivalent in Man
RF	Remedial Facility
ROI	Region of Influence
SAR	Safety Analysis Report
SLLW	Solid Low-Level Waste
SNF	Spent Nuclear Fuel
SNS	Spallation Neutron Source
SO	Site Office
SOF	Sum of the Fraction
SR	Savannah River Operations
SRS	Savannah River Site
STEL	Short Term Exposure Limit
TDEC	Tennessee Department of Environment and Conservation
TEDE	Total Effective Dose Equivalent
TEEL	Temporary Emergency Exposure Limits
TQ	Threshold Quantity
TRU	Transuranic
TSCA	Toxic Substances Control Act of 1976
TWA	Time Weighted Average
UO_3	Uranium Oxide
WIPP	Waste Isolation Pilot Plant
Y-12 Complex	Y-12 National Security Complex
^{208}Tl	thallium-208
^{220}Rn	radium-220

^{229}Th	thorium-229
^{232}U	uranium-232
^{233}U	uranium-233
^{235}U	uranium-235
^{238}U	uranium-238
^{3}H	tritium

1.0 INTRODUCTION

1.1 PURPOSE AND NEED

The purpose and need for the proposed action evaluated in this Environmental Assessment (EA) (DOE/EA-1574) is, in regard to Uranium-233 (^{233}U) currently stored in Building 3019 at the Oak Ridge National Laboratory (ORNL), to (1) address safeguards and security requirements, (2) eliminate long-term worker safety and criticality concerns, and (3) place the ^{233}U material in storage in preparation for future decisions regarding disposal. ^{233}U is a special nuclear material which requires strict safeguards and security measures to protect against access. In addition, the Defense Nuclear Facilities Safety Board (DNFSB), in a report to the Department of Energy (DOE) (DNFSB 97-1), has determined that the long-term storage of ^{233}U poses a concern with regard to a potential nuclear criticality accident and worker exposure. In treating the ^{233}U inventory as expeditiously as possible, this action would reduce the substantial annual costs associated with safeguards and security and eliminate the potential for a criticality event as well as the need for future facility upgrades for Building 3019. This action meets the short term needs the Department has to treat and store ^{233}U material until such time as disposal options have been identified and secured. This action has independent utility and is not expected to prejudge any reasonable disposal options which may be available as a result from the downblending of the ^{233}U inventory.

In a letter to DOE dated March 3, 1997, the DNFSB transmitted Recommendation 97-1, *Safe Storage of Uranium-233,* with eight sub-recommendations. Two of these sub-recommendations stated:

- Initiate near-term risk assessments, surveillance activities, and safety assurance actions at each affected site; and,
- Establish a U-233 Safe Storage Program to address problems associated with long-term storage of ^{233}U.

DOE accepted this recommendation on April 25, 1997, and has completed actions to assure safe interim storage until final disposition of the Building 3019 inventory is achieved.

1.2 BACKGROUND/OVERVIEW

1.2.1 Project Status

As a result of the procurement process, the DOE Office of Nuclear Energy announced on October 9, 2003, that it would award the ^{233}U stabilization contract to Isotek Systems, LLC (Isotek) located in Oak Ridge, Tennessee. Isotek is a limited liability corporation formed by Duratek Federal Services, Inc. (now Energy Solutions, Inc.), Nuclear Fuel Services, Inc. (NFS), and Burns and Roe Enterprises, Inc. The base contract award is for Phase I of the project. Phases II and III would take place pursuant to the unilateral exercise of options by the government. Phase I will encompass preliminary planning and design activities. Phase II involves project execution and will be contingent upon successful completion of Phase I. Phase III would be the Building 3019 Complex shutdown phase, in accordance with shutdown/transition plans developed in Phase II. Phase III would also be contingent upon successful completion of Phase II.

In December 2004, DOE issued a Finding of No Significant Impact (FONSI) as a result of an EA (DOE/EA-1488). In this EA DOE had proposed to:

(1) Modify the Building 3019 Complex to accommodate processing equipment and support operations necessary to downblend the ^{233}U inventory;
(2) Process and package the DOE inventory of ^{233}U stored in the Building 3019 Complex (see Section 1.2.4) to eliminate the need for safeguards, security, and nuclear criticality controls, thereby rendering the material suitable for safe, long-term, economical storage;
(3) Extract thorium-229 (^{229}Th) during ^{233}U processing to increase its availability for medical research and treatment;
(4) Operate the Building 3019 Complex during the ^{233}U processing and medical isotope production;
(5) Place the Building 3019 Complex in safe and stable shutdown for transfer to the DOE program for decontamination and decommissioning (D&D); and,
(6) Place downblended inventory in long-term storage awaiting future use.

In the November 2005, Conference Report for the Energy and Water Development and Related Agencies Appropriations Act for Fiscal Year (FY) 2006, the conferees provided no funding for the Medical Isotope Production and Building 3019 Complex Shutdown project. The conferees' action directed DOE to terminate promptly the Medical Isotope Production and Building 3019 Complex Shutdown project. Per DOE's recommendation, the responsibility for disposition of the ^{233}U was transferred to the Environmental Management (EM) program. The conferees provided FY 2006 funds in the Defense EM appropriation for disposition of the material stored in the Building 3019 Complex and directed the Department to provide a report within 60 days detailing a path forward for managing the material. The Department issued its report to Congress in February 2006, *Management of U-233 Stored at Building 3019, Oak Ridge National Laboratory, Oak Ridge, Tennessee, Preliminary Report to Congress,* dated February 8, 2006, to The Honorable Pete V. Domenici, et al.

In response to Congress, DOE has modified the original project scope to the following:

(1) Modify the Building 3019 Complex to accommodate processing equipment and support operations necessary to downblend the ^{233}U inventory;
(2) Process and package the DOE inventory of ^{233}U stored in the Building 3019 Complex to eliminate the need for safeguards, security, and nuclear criticality controls, thereby rendering the material suitable for safe economical storage;
(3) Operate the Building 3019 Complex during the ^{233}U processing;
(4) Place the Building 3019 Complex in safe and stable shutdown for transfer to the DOE program for D&D;
(5) Conduct surveillance and maintenance activities of Building 3019; and,
(6) Place the downblended inventory in safe storage.

The primary objectives of the ^{233}U Stabilization Project are to eliminate concerns relating to long term storage of ^{233}U in Building 3019, reduce the attractiveness level as weapons material, eliminate the possibility of a nuclear criticality event, and to reduce the substantial annual costs associated with safeguards and security. ^{233}U can be made criticality safe by the limiting fissile mass per drum by isotopically diluting ^{233}U with Uranium-238 (<0.66 wt % in ^{238}U). Furthermore, ^{233}U can be converted to non-weapons usable ^{233}U by isotopically diluting the ^{233}U with ^{238}U (<12 wt % ^{233}U in ^{238}U).

Currently, there are no disposal facilities licensed and/or permitted to receive the ^{233}U due to its assay and fissile concentrations; therefore, downblending is the first step toward meeting any disposal facilities waste acceptance criteria. An ancillary benefit of downblending the ^{233}U inventory is broader management options for the material, including additional downblending, if necessary, for future disposal. Disposal is not part of this EA. Also not included in the scope of this EA is the D&D of the Building 3019 Complex.

1.2.2 ^{233}U Inventory Description

The ORNL inventory consists of approximately 450 kg of ^{233}U in approximately 1,000 canisters in various forms, quantities, and matrices. ^{233}U is, by definition, special nuclear material and, as such, requires stringent safeguards, security, and criticality controls. The inventory at the Building 3019 Complex is primarily in the form of uranium oxides, but includes metals and other compounds. Uranium-232 (^{232}U) impurities are present in the ^{233}U inventory at concentrations ranging from 1 to about 220 parts per million (ppm) of total uranium.

The bulk of the material is contained in approximately 1,000 outer packages stored in shielded tube vaults within the building. Figure 1.1 is indicative of some representative container types. Approximately 400 packages [Consolidated Edison Uranium Solidification Program material (CEUSP)] contain relatively large amounts of ^{232}U and its daughter product thallium-208 (^{208}Tl), which represents a substantial radiation hazard. In addition, the CEUSP material contains cadmium and gadolinium, which serve as neutron poisons to reduce the probability of a criticality event. The facility is also receiving ^{233}U from the remediation of the Molten Salt Reactor Experiment (MSRE) at ORNL. The interim remedial action for the material from the MSRE was addressed in the *Record of Decision for Interim Action to Remove Fuel and Flush Salts from the Molten Salt Reactor Experiment Facility at the Oak Ridge National Laboratory, Oak Ridge, Tennessee* (DOE 1998). In addition to the material currently stored within the Building 3019 Complex and planned receipts, the contents of a tank attached to Building 3019A Tank P-24, would also be included in the proposed action.

1.2.3 ^{233}U Inventory Condition

A risk assessment was performed by ORNL to develop a conservative characterization of the expected condition of the ^{233}U material and packages based on available package records and a recently completed inspection of selected inventory packages. This assessment was based on the types of packages, the materials of construction, the number of container layers and method of closure, and on the chemical and physical form of the ^{233}U. The results of this assessment are documented in the *Oak Ridge National Laboratory Site Assessment Report on the Storage of* ^{233}*U* (ORNL 2002a). Preparation of the site assessment was the result of a commitment in the DOE Implementation Plan, *Safe Storage of Uranium-233* (DOE 1997a), in response to DNFSB Recommendation 97-1.

Sampling data from the off-gas system that ventilates the storage tubes, and visual inspections of empty storage tubes, indicates that there has not been a gross failure of the packages. It should be noted that some storage tubes are contaminated, and others are suspected to be contaminated, from packages that were contaminated when originally stored. There is evidence of limited corrosion and pitting of the carbon steel storage tubes due to atmospheric moisture; however, there is no evidence of condensate or accumulated water in the empty storage tubes.

While the containers at the bottom of many storage tubes have not been inspected, occasionally containers have been removed from the tubes to allow uses such as extraction of the ^{229}Th that was being used as source material in ongoing clinical trials. Some containers have also been removed from the bottom of the tube vaults for purposes other than ^{229}Th extraction with no indications of condensation or accumulated water. No evidence of outer container degradation has been found, and there are no indications of other problems for materials remaining in storage.

Over 120 packages have been successfully retrieved from the vaults as part of the inspections. All the outer canisters appeared to be in good physical condition, with only minor indications of some surface rust. No holes or penetrations were observed in any outer canisters, and all were lifted from the vault and handled without incident. Furthermore, no indication of internal pressurization or material leakage was observed. As part of the ongoing surveillance and maintenance program, storage vaults are continuously monitored to detect any radiological emissions which would indicate a breach in the storage containers.

Figure 1.1, Representative Container Types Stored in the Building 3019A Tube Vaults

1.2.4 Building 3019 Complex

For the purpose of this project, the Building 3019 Complex consists of a main building, several support facilities, grounds defined by a perimeter fence, and access driveways located in the north-central area of the Bethel Valley site of ORNL as depicted in Figure 1.2. Building 3019A, the main building, was originally constructed in 1943 as a chemical separations pilot plant for the Manhattan Project. Because of its historical significance Building 3019 is eligible for listing on the National Register of Historic Places (NRHP). Although the majority of the Building 3019 Complex support facilities will not be required to process the ^{233}U inventory, ancillary equipment such as ventilation systems and stacks that support the entire Building 3019 Complex will continue to be shared consistent with their intended purpose.

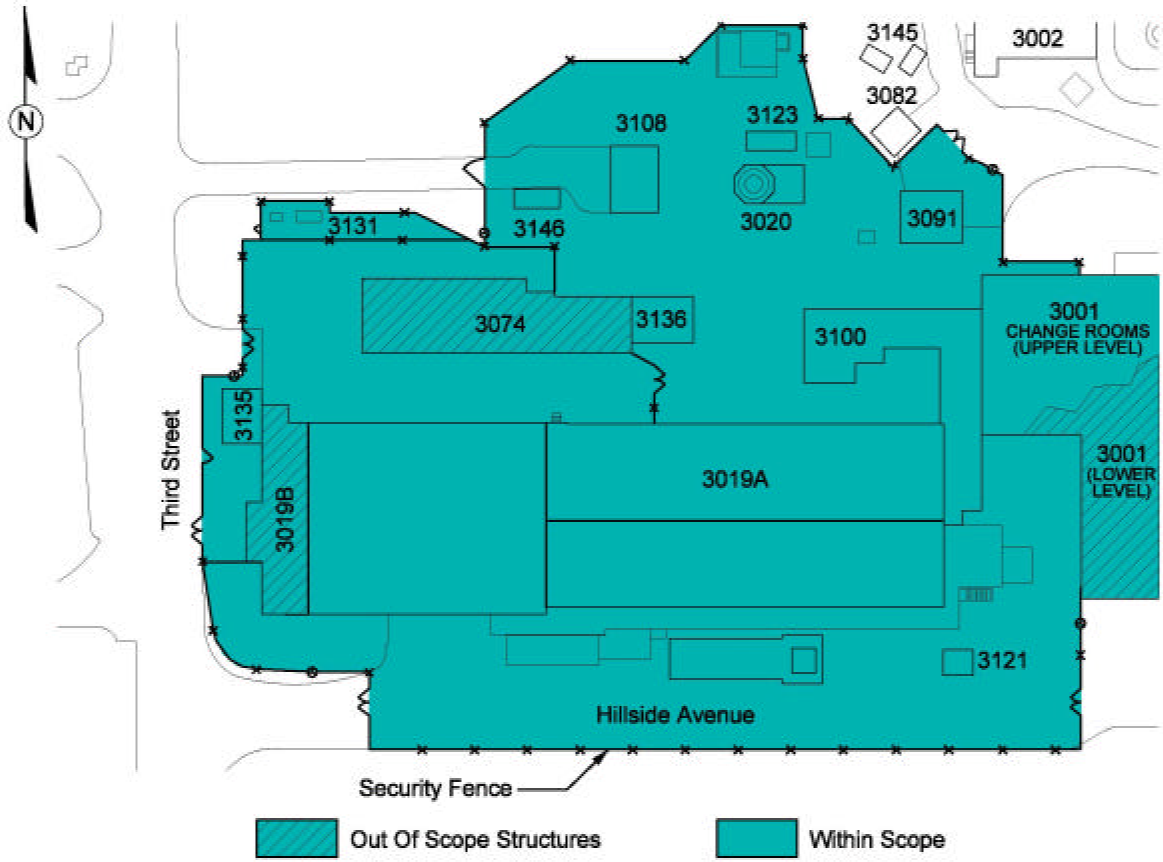

Figure 1.2, Building 3019 Complex

Building 3019A is a Hazard Category 2 nuclear facility. Building 3019B, the former High-Radiation-Level Analytical Facility, is attached to the west end of Building 3019A. A portion of Building 3001, the Graphite Reactor, is the ground floor under the east end of Building 3019A. Doorways between these attached buildings are sealed. Both Building 3019B and Building 3001 are out of service and not part of the scope for this action. However, a shower/change room in Building 3001 is currently being used to support ongoing operations at Building 3019A. This room would continue to be used as part of the proposed action. The support facilities are Building 3100 (storage vault); Buildings 3091 and 3108 (off-gas filter houses); Building 3020 (off-gas stack); Building 3121 (unused, contaminated filter house); Building 3136 (uncontaminated mockup and storage building); and Buildings 3123, 3131, and 3146 (standby power generators).

Building 3019A is a nominal 30,000-square foot, three-story (ground, first, and second floors) structure. The building is situated on a hillside with the grade level on the north side, about three feet below the first floor (or main level). On the south side, the ground level (or basement) is at grade level. At the core of the building are seven shielded processing cells positioned from east to west. Above the processing cell is a high-bay structure (or Penthouse) with a ten-ton-capacity bridge crane.

Building 3019A contains four sets of top-loaded, shielded, storage tube vaults for solid containerized fissile materials. The lower ends of these vaults are sealed, and each vault is ventilated at the upper end. There is also a number of security features associated with the stored nuclear materials. Building 3019A also contains operational laboratories with glove boxes and hoods and several areas with out-of-service glove boxes.

Building 3019A has four ventilation systems to maintain confinement and zoning of the facility. The four systems are the Vessel Off-Gas, Cell-Off Gas, Glove Box Off-Gas, and the Laboratory Off-Gas. The ventilation systems for the main building (a combination of the Laboratory and Cell Off-Gas systems) can exhaust approximately 40,000 cubic feet per minute, with the exhaust passing through roughing and high-efficiency particulate air (HEPA) filters.

The Laboratory and Cell Off-Gas systems also provide ventilation to the out-of-service hot cells in the adjoining 3019B facility. The Vessel Off-Gas, a low-flow, high-negative-pressure system, is provided by the 3039 Stack system, which is the responsibility of the EM Management and Integration Contractor. Utilities available to Building 3019A from ORNL include steam, potable, process and fire water, electricity, plant air, storm sewer, and sanitary sewer.

Because of the extended history of operations, there are a number of legacy issues in the Building 3019 Complex:

- In 1959, a chemical explosion in a Building 3019A cell distributed plutonium contamination throughout the interior and exterior of the building. Although extensive decontamination was performed, most surfaces of the building, interior and exterior, use paint bonding to prevent spread of the residual alpha contamination.
- Most areas of the facility contain out-of-service, contaminated equipment remaining from extensive pilot operations and special campaigns with spent nuclear fuel, plutonium, ^{233}U, thorium, and other radionuclides. An extensive health physics program tracks potential migration of contamination, which is impeded by a combination of physical boundaries (e.g., glove boxes, cells, etc.) and multi-zoned ventilation control.
- In addition to the radioactive hazards, uncoated lead shielding, lead paint, polychlorinated biphenyls (PCBs), asbestos, combustible foam insulation, and perchlorate contamination are present within the facility.
- Tank P-24, which is enclosed in an underground ventilated bunker, contains approximately 4,000 gallons of thorium nitrate solution contaminated with ^{233}U. (Note: The contents of Tank P-24 are included in the scope of this action.)
- The out-of-service sample conveyor, which crosses the roof from Building 3019A to 3019B, has been a recurring source of contamination to areas of the exterior roof.
- The older exterior ventilation ducting requires periodic sealing to prevent leakage of radioactive contaminants.
- The facility produces Liquid Low-Level Radioactive Waste (LLLW), Solid Low-Level Radioactive Waste (SLLW), polychlorinated biphenyl waste, waste governed by the Resource Conservation and Recovery Act of 1976 (RCRA) (RCRA hazardous waste), and wastes with either RCRA hazardous and/or PCB waste mixed with low level radioactive waste (mixed waste) in the course of routine operations and maintenance.
- The extended age of much of the equipment in the facility requires a comprehensive Preventative and Corrective Maintenance Program.

1.3 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT

This EA presents information on the potential impacts associated with activities necessary to process the ^{233}U, store the downblended ^{233}U inventory, and place the Building 3019 Complex in safe shutdown in preparation for transition to the D&D program. DOE has prepared this EA to assess the potential consequences of its activities on the human environment in accordance with the Council on Environmental Quality (CEQ) regulations [40 Code of Federal Regulation (CFR) Parts 1500–1508] implementing the National Environmental Policy Act (NEPA), and with DOE NEPA Implementing Procedures (10 CFR 1021). If the impacts associated with the proposed action are not identified as significant as a result of this EA, DOE shall issue a FONSI and will proceed with the action. If impacts are identified as potentially significant, an environmental impact statement (EIS) will be prepared.

This EA (1) describes the affected environment relevant to potential impacts of the proposed action and alternatives; (2) analyzes potential environmental impacts that could result from the proposed action; (3) identifies and characterizes cumulative impacts that could result from the proposed action in relation to other ongoing or proposed activities within the surrounding area; and, (4) provides DOE with environmental information for use in prescribing restrictions to protect, preserve, and enhance the human environment and natural ecosystems.

2. PROPOSED ACTION AND ALTERNATIVES

2.1 PROPOSED ACTION

DOE proposes to (1) modify the 3019 Complex to accommodate processing equipment and support operations necessary to downblend the ^{233}U inventory; (2) process and package the ^{233}U stored at the Building 3019 Complex; (3) place the downblended ^{233}U inventory in permitted storage at the ORNL; and, (4) place the Building 3019 Complex in stable shutdown and perform surveillance and maintenance activities. These activities would be performed to ensure the immediate safe interim storage of the ^{233}U, achieve closure of DNFSB Recommendation 97-1 at ORNL, and prepare the Building 3019 Complex for future D&D. Downblending of the ^{233}U inventory will meet the primary objectives of the project by reducing the concentration of fissile material. Thorium, a non-fissile isotope produced by normal radioactive decay of ^{233}U, causes the radioactivity of the material to increase to a peak after ten years of storage, then to decrease to a low at 700 years. Since most of the ^{233}U was processed in the 1950s and 1960s, Figure 2.1 indicates that the ^{233}U activity is slightly past its first ten-year peak but well above its 700-year low. The proposed process assumes the presence of thorium throughout downblending operations, including maintenance and equipment change-out considerations. As a result, the process was designed to minimize exposure risks due to thorium. In addition, the calculations for the storage containers have conservatively estimated the shielding required at this peak to protect the workers; therefore, there will be no additional impact above administrative limits for worker exposure due to the presence of thorium or the natural generation of thorium during processing and/or storage operations.

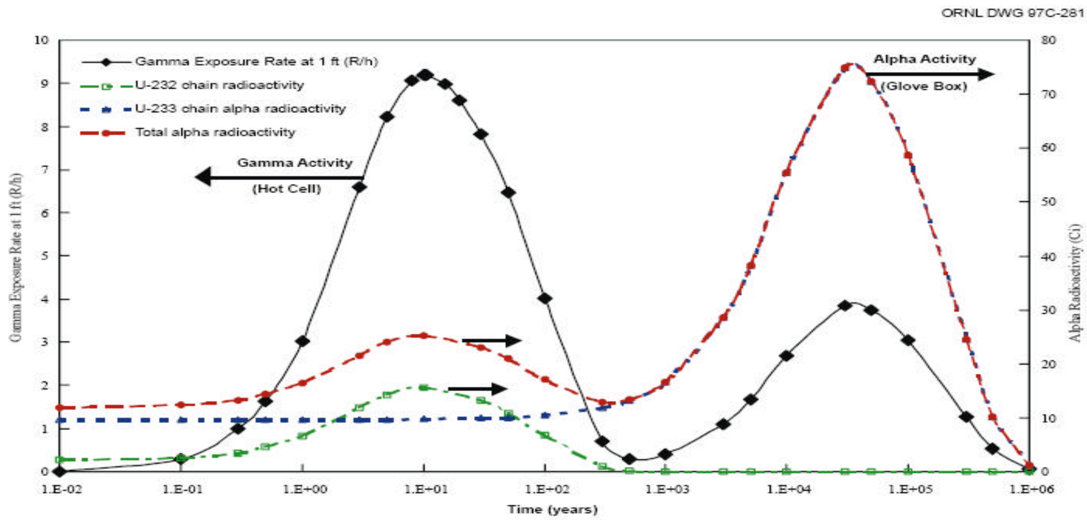

Figure 2.1, Alpha activity and gamma exposure rate at 1 ft as a function of time calculated for 1 kg ^{233}U (with 100 ppm ^{232}U) as a loose-pour powder (1.5 g/cm2) contained in a 3-in. dia. by 6-in. tall can with 20-mil thick steel walls. ORNL/TM-13517

Small quantities of ^{233}U bearing materials are currently stored at Brookhaven National Laboratory, Los Alamos National Laboratory, Materials and Fuels Complex (formerly Argonne West) and other DOE locations. Although there are no current plans to ship these materials to ORNL, if such shipment were to occur, these materials would account for less than a 1% increase in the total amount of material containing ^{233}U at ORNL. If such materials were shipped, materials would be required to meet acceptance criteria for processing in Building 3019A and the shipments would be in full compliance with U. S. Department of Transportation (DOT) and DOE regulations. Shipping from off-site would be subject to appropriate NEPA review.

The proposed action would involve several different activities in order to complete. These activities are graphically represented in Figure 2.1 and include:

- Construction modifications to Building 3019 Complex and a loading/unloading station at Buildings 7572 and 7574;
- retrieval and inspection of ^{233}U containers;
- ^{233}U dissolution;
- shipment of depleted uranium oxide (DUO_3) from Savannah River Site (SRS), conversion to depleted uranyl nitrate at Erwin, Tennessee, and receipt of depleted uranyl nitrate at the 3019 Complex;
- downblending of the ^{233}U inventory using the DUO_3 and conversion to a stable oxide;
- packaging of the downblended inventory with subsequent transportation and placement into storage at the ORNL; and,
- facility shutdown, surveillance and monitoring.

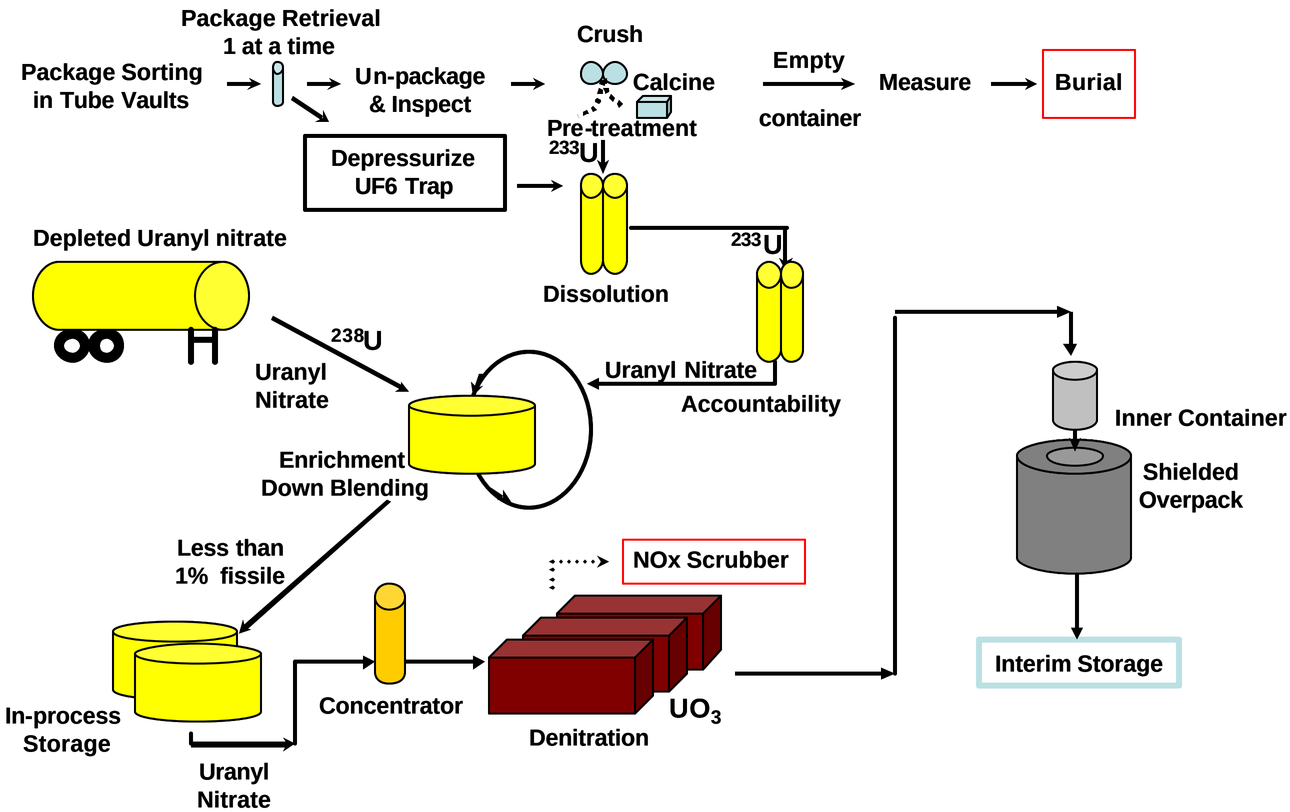

Figure 2.2 Conceptual ^{233}U Downblending

The durations of these proposed activities are summarized in Table 2.1 and brief descriptions of these activities are presented in the following sections.

Table 2.1 Duration of Proposed Action

	Demolition (Section 2.1.1)	Construction/Startup (Section 2.1.1)	Processing (Sections 2.1.2 – 2.1.7)	Shutdown (Section 2.1.8)
Duration	11 months	43 months	30 months	10 months

Note: DOE will address disposal at a later time. There is a 5 month overlap between demolition and construction, making the total schedule from start of demolition to completion of shutdown 89 months.

DOE would manage the design and construction modifications to Building 3019 Complex and associated facilities in order to implement the proposed action. Shielded workstations would be installed to conduct high-radiation work. Criticality safety controls would be in place to prevent an inadvertent nuclear criticality.

Safe storage of the ^{233}U stored in the Building 3019 Complex would be continued while the proposed action is being implemented, through revisions of the existing safeguards and security program, configuration management program, authorization basis, and permits. Secondary waste generated during processing will be removed and disposed of at appropriate permitted facilities.

2.1.1 Demolition, Construction, and Equipment Installation (collectively referred to as building modifications)

DOE would manage the design and construction modifications to the Building 3019 Complex and its associated facilities, and oversee the installation of equipment necessary to perform the proposed action. No modifications would be made beyond those necessary to safely and effectively accomplish the project's objectives. Activities associated with construction and equipment installation are proposed in Sections 2.0 through 2.04 of the Work Breakdown Structure of ISO-PLN-001, Project Execution Plan. The proposed schedule for implementation is included also in the Project Execution Plan. Demolition and construction/startup activities are estimated to continue for 54 months.

2.1.2 Retrieval and Inspection of ^{233}U Containers Within Building 3019 Complex

The ^{233}U containers would be retrieved, opened, and inspected in shielded workstations using remote-handling equipment. Various types of retrieval equipment have been designed into the operating configuration for use depending on the configuration of the container to be retrieved. Inspection equipment would allow visual inspection of the container surface and labels. Retrieval equipment would not need to be changed out except in the case that a repair was necessary. Contingencies for changing out equipment have been incorporated into the design and project schedule.

2.1.3 Dissolution of ^{233}U

After retrieval and inspection of the ^{233}U containers, the uranium would be oxidized, if necessary, in a small furnace and then dissolved in nitric acid. Following dissolution, the total uranium in a batch would be determined using a certified analytical procedure. The materials' former storage containers and packing material would be assayed and characterized prior to being disposed as secondary waste. Size reduction techniques, such as crushing to enhance the dissolution process, may be used. The nitric acid supply tank would be exterior to the Building 3019 Complex, along with a sodium hydroxide (NaOH) storage tank. The furnace, crushing station, and dissolvers would be housed in a shielded workstation.

2.1.4 Shipment of DUO_3 and Conversion to Depleted Uranyl Nitrate at Erwin, Tennessee

In order to accomplish the isotopic downblending of the ^{233}U after processing, approximately 255,000 kilograms of DUO_3 would be needed. Various sources of DUO_3 were evaluated for use in the downblending, based on the materials' physical and chemical composition, contaminants, potential emissions, and availability. A DUO_3 material specification describing necessary attributes of the material was provided to DOE for use in finding sources of suitable oxide material within the DOE Oak Ridge Reservation (ORR). After evaluation, National Nuclear

Security Administration (NNSA) determined the sources of the depleted uranium in storage at Oak Ridge were unsuitable for use.

Uranium oxide, in the form of triuranium octaoxide, from the Depleted Uranium Hexafluoride project was also evaluated by DOE and determined to be unsuitable (ISO-WP-2006-011, *Use of Oxide from the Depleted UF_6 Project*). Currently, the only available source of DUO_3, in sufficient quantities and having the required attributes, is in storage at the DOE SRS. The ^{233}U Stabilization Project would be responsible for the packaging and transportation of this material according to applicable DOE and DOT requirements. Approximately 400 drums of DUO_3 would be shipped from SRS to the NFS uranium processing facility located in Erwin, Tennessee (see Section 4.9.2). Impacts due to these proposed shipments are addressed in Section 4.9.2. Each truck shipment would consist of approximately thirty drums of DUO_3. At the NFS processing facility, the drums of DUO_3 would be stored temporarily until being converted to a depleted uranyl nitrate solution. The depleted uranyl nitrate blend stock produced at NFS would then be shipped to ORNL in a Nuclear Regulatory Commission (NRC) licensed, DOT certified, 3,500-gallon tanker truck at a rate of one to three tank trailer shipments each month, as required to support downblending. Once at ORNL, the solution would be transferred from the tanker truck to Tank P-23, external to the Building 3019 Complex. Tank P-23 is an existing 10,000 gallon stainless steel tank located adjacent to Building 3019A in a concrete bunker. The bunker is partially below ground and partially above ground and is accessible by removing concrete shield hatches. In the event of a leak, the bunker would serve as secondary containment. The bunker is equipped with a sump pump should the need arise to pump the pit. The tank will be equipped with a high level alarm, and the sump shall also be alarmed.

Because the depleted uranyl nitrate blend stock is received in small quantities on a calculated, as-needed basis, no excess, unused DUO_3 is expected to remain after completion of downblending operations.

2.1.5 Downblending and Storage of the ^{233}U Inventory

The purpose of downblending is to reduce the concentration of fissile material. The ^{233}U will be downblended to achieve a fissile content of less than 0.96% ^{235}U effective (one gram of ^{233}U has a fissile equivalent to 1.5 grams of ^{235}U). At that concentration, the safeguards significance and the nuclear criticality controls are no longer concerns.

Thorium is a non-fissile isotope produced by normal radioactive decay of ^{233}U. Thorium causes the radioactivity of the material to increase to a peak after ten years of storage, but then to decrease to a low at 700 years (see Figure 2.1). Since most of the ^{233}U was processed in the 1950s and 1960s, Figure 2.1 indicates that the ^{233}U activity is slightly past its first ten-year peak but well above its 700-year low. DOE's proposed action assumes the presence of thorium throughout downblending operations, including maintenance and equipment change-out considerations. As a result, the process was designed to minimize exposure risks due to thorium. In addition, the calculations for the storage containers have conservatively estimated the shielding required at this peak to protect the workers. Specific details related to system design for thorium-containing material are described in ISO-WP-2006-001, *Summary of Baseline Changes to the U233 Project*, April 2006.

After downblending, the non-fissile uranyl nitrate solution would then be converted to an oxide through direct thermal denitrification for stabilization and to remove moisture and other volatile materials. The steam and nitrogen oxides (NO_x) from the thermal denitrification process would be collected in a scrubber and off-gas collection system. The solid uranium oxide (UO_3) product would be packaged for handling.

In selecting UO_3 as the product form, the Project considered material stability, processing costs, and risk. DOE-STD-3028-2000, *Criteria For Packaging and Storing Uranium-233-Bearing Materials,* lists UO_3 as a stable form of uranium. UO_3 will absorb moisture from humid air, and therefore the radiolysis of water into hydrogen and oxygen was evaluated and determined to be of no significant impact. By stopping the process after UO_3 production, the Project is able to eliminate an oxide conversion furnace, a product cooler, and the associated material conveyors. This reduced the equipment costs and reduced worker exposure by eliminating equipment that would require maintenance during the life of the project. In addition, UO_3 is a form suitable for disposal at Waste Isolation Pilot Plant (WIPP) and Nevada Test Site (NTS).

Packaging for storage of the UO_3 would be doubly contained (i.e., exclusive of any over-pack that may be used for shielding in), robust containers approved by DOE. The containers would be constructed of stainless steel, with an installed vent with HEPA filters and a vent to provide ten minutes of hold-up to allow radon to decay. These containers would be placed into shielded overpacks to allow for the container-overpack arrangement to be contact-handled. The shielded overpacks will have 3 inches of lead on all sides to allow the material to be contact handled. The environmental impact of using this material is expected to be favorable since lead used to fabricate the procured shielded overpacks is anticipated to come primarily from the recycling of lead stored at DOE sites. The use of recyclable lead (contaminated or not) that is currently in storage is expected to reduce the potential for environmental impacts such as contamination of stormwater runoff. The fabrication of shielded overpacks also provides a beneficial use for the lead and will potentially preclude having to spend Federal dollars on the continued storage, management, and ultimate disposal of this material. The overpacked containers would then be transported to an existing Hazard Category 2, currently permitted for RCRA hazardous waste and located in the east end of Melton Valley.

In storage, the downblended material would be non-weapons usable and will not pose criticality concerns. Even though it would continue to generate ^{229}Th through radioactive decay, no further downblending would be required during storage operations since ^{229}Th is not a criticality safety or security concern and shielding provides protection against worker exposure. However, the stability of the UO_3 would allow for future downblending, if necessary, to allow for disposal. Whereas the configuration of the overpacked UO_3 would allow for long term storage, it is believed that, in meeting the project objectives, the material could be dispositioned or disposed in less than ten years.

2.1.6 Dispositioning of Secondary Waste

Secondary waste would be generated during demolition and construction; ^{233}U processing; and facility stabilization, shutdown, surveillance, and maintenance activities. Secondary waste is classified as any waste generated during implementation. Secondary waste does not include downblended material or material that has a future use. Types of secondary wastes include, but are not limited to, used, discarded personal protective equipment, construction and demolition debris, unusable equipment, spent filters, contaminated debris, sample equipment, etc. Secondary wastes are expected to be generated throughout all phases of the project and will be disposed of in accordance with all Federal, state, and local laws and regulations. No secondary wastes will go into long term storage. The categories of secondary waste and disposition pathways are discussed in Section 3.9.

2.1.7 Facility Shutdown, Surveillance, and Maintenance

Plans would be developed to place the Building 3019 Complex in safe and stable shutdown for transition to D&D. These plans would be consistent with applicable functional end points specified by DOE to meet facility stabilization/transition requirements. As part of this transition, all processing systems and equipment used for the ^{233}U downblending operations would be cleaned. All unattached solid waste materials would be removed by flushing of the pipes and tanks. After cleanup, these systems and equipment would be characterized for subsequent disposal. Additionally, remaining process materials or wastes would be removed and disposed of.

Because only a portion of Building 3019A would be utilized for the operations phase of the project, at DOE's direction, shutdown activities could begin during ongoing operations in unused portions of the facility. Activities would include removal of processing residues and radioactive and hazardous materials. Radiological control practices and procedures would be implemented to minimize the potential for airborne contamination and spread of contamination, with particular emphasis on in-use areas. Facility shutdown activities, exclusive of activities started early during operations, would require a total of ten months to complete. After building shutdown is complete, surveillance and monitoring activities would be provided for the Building 3019 Complex and associated facilities until the facility is transferred to D&D.

2.2 NO-ACTION ALTERNATIVE

The no-action alternative provides an environmental baseline from which the impacts of the proposed action and alternatives can be compared and is required by the DOE NEPA regulations. Under the no-action alternative, the ORNL inventory of ^{233}U would remain stored within the Building 3019 Complex. Continued storage in the Building 3019 Complex would require major capital upgrades and retrofits to critical facility systems that have deteriorated due to aging or that may not meet current standards. Significant additional annual operating expenses would also be incurred to meet the material-handling requirements associated with repackaging about 400 packages to meet the DOE storage standard for ^{233}U (STD-3028-2000) and to provide protection against potential nuclear criticality accidents or theft of the material. As of 2006, annual operation and maintenance costs for Building 3019 Complex were about \$5–6 million per year, not including the DNFSB 97-1 Inspection and Repackaging Program at an additional approximate \$8 to \$10 million per year for a five- to six-year period. Extended storage of the ^{233}U in Building 3019 Complex would require additional structural and confinement systems upgrades with a preliminary estimated cost of \$20 million. However, no engineering analysis of the upgrades has been completed. The no-action alternative would also require revising safeguards and security controls to ensure protection as a weapons material under new guidance.

Finally, under the no-action alternative DOE would fail to meet its commitment to Congress. On February 17, 2006, DOE informed Congress of its intent to safely process and stabilize the Building 3019 inventory. Because of its fissile content of the Building 3019 inventory the material must be processed prior to determining final disposition.

2.3 ALTERNATIVES CONSIDERED BUT NOT ANALYZED

In addition to the proposed action and no - action alternatives, the following alternatives were considered but not analyzed. With the exception of a recent expression of interest from NNSA for a small quantity of ^{233}U in support of weapons test programs, there is no programmatic use for the remaining inventory. Therefore, reuse options were eliminated from further evaluation. Four alternatives to the proposed aqueous process were considered but were eliminated based on cost and/or the technological basis as described in Sections 2.3.6, 2.3.7, 2.3.8, and 2.3.9 below.

2.3.1 Continued Storage of the ^{233}U Inventory in Another Facility on the Oak Ridge Reservation

The storage requirements for ^{233}U materials must take into consideration containment, criticality control, security and safeguards, and shielding. ^{233}U has some similar properties to other fissile materials [i.e., highly enriched uranium (HEU) and plutonium]; but it has its own unique properties, which require differences in storage/handling. In addition to the criticality and safeguards requirements, a portion of the ^{233}U inventory stored at Building 3019 Complex contains quantities of the impurity ^{232}U. ^{232}U decays to ^{208}Tl, which, in turn, decays and emits a 2.6-MeV gamma ray. This associated radioactive decay requires heavy radiation shielding and

remote-handling operations to protect workers. Very few facilities within the DOE complex, outside of Building 3019A, are capable of meeting the requirements for storing the ^{233}U inventory. The requirements also substantially increase the costs of preparing and storing the material at a new facility. Costs for this alternative include initial inspection and repackaging, facility preparation, inventory transportation (including heavily armed security escort), and facility recurring costs. Because of the various constraints associated with the storage of ^{233}U, including cost, DOE decided that this alternative was not feasible, and it was eliminated from further evaluation.

2.3.2 Continued Storage of the ^{233}U Inventory at Another DOE Site

The two most likely sites within the DOE complex are the Idaho National Laboratory (INL) and the SRS. INL has the second largest ^{233}U inventory in the complex while SRS has the capability of processing the ^{233}U inventory.

The storage requirements for ^{233}U materials must take into consideration containment, criticality control, security and safeguards, and shielding. ^{233}Uranium has some similar properties to other fissile materials [i.e., HEU and plutonium]; but it has its own unique properties, which require differences in storage/handling. In addition to the criticality and safeguards requirements, a portion of the ^{233}U inventory stored at Building 3019A contains quantities of the impurity ^{232}U. Uranium-232 decays to ^{208}Tl, which, in turn, decays and emits a 2.6-MeV gamma ray.

This associated radioactive decay requires heavy radiation shielding and remote-handling operations to protect workers. Very few facilities within the DOE complex, outside of the Building 3019 Complex, are capable of meeting the requirements for storing the ^{233}U inventory (see Section 2.3.6 below for consideration of the SRS H Canyon). The requirements also substantially increase the costs of preparing and storing the material at a new facility. Currently there are no licensed containers to ship the material in its "as is" condition. Some of the inventory would need to be converted to an oxide, and most would require re-containerization to reduce the quantity per package for safeguards and security, and nuclear criticality concerns prior to shipment. Costs for this alternative include initial inspection, some processing of select populations to an oxide form, repackaging, facility preparation, inventory transportation (including heavily armed security escort), and facility recurring costs.

Because of the constraints identified above, the uncertainties associated with the transportation and the costs to acquire adequate storage, DOE decided that this alternative was not feasible, and it was eliminated from further evaluation.

2.3.3 Tag for Russian Highly Enriched Uranium

This alternative would require the use of a small amount of the ^{233}U inventory as a tag for Russian HEU to reduce the risk of theft or diversion and allow identification of the source of stolen or diverted material. This use would only require about 30 kilograms (< 7%) of the current ^{233}U inventory and could be obtained while preparing the bulk of the ^{233}U for disposition. However, the NNSA Office of Defense Nuclear Nonproliferation has determined that this proposed use of the ^{233}U material is not feasible due to problems such as the difficulty in mixing a ^{233}U tag uniformly into the HEU, and difficulties associated with negotiating arrangements already agreed to by the Russian Federation. Because of these issues, this alternative was eliminated from further consideration.

2.3.4 Thorium Fuel Cycle Development

Under this alternative, the ^{233}U, which is a fissile material, would be used in the development and testing of a more advanced and proliferation-resistant thorium fuel cycle. Researchers in various DOE laboratories have proposed this alternative. This use would probably only use the higher isotopic quality portion of the ^{233}U inventory. The Office of Nuclear Energy currently has no funded projects or immediate plans for the research and development of the thorium fuel cycle. Should, in the future, research on thorium cycle technology be initiated, there exists a significant quantity of legacy materials containing thorium and irradiated thorium fuels inventory at the Idaho National Laboratory, and elsewhere at DOE, that could be used. Therefore, this alternative was eliminated from further consideration.

2.3.5 Analytical Safeguards Procedures

Pure ^{233}U is used as a calibration spike in the determination of uranium concentrations and isotopic compositions in materials containing natural uranium or uranium enriched in ^{235}U. This type of analytical safeguards procedure is used in many safeguards and production operations and other analytical applications. The quantities of material used are very small (typically fractions of a gram for each use) and can be obtained independently from the proposed action or from retained materials designated by DOE. Therefore, this alternative was eliminated from further consideration.

2.3.6 Processing at the Savannah River Site

The SRS has the capability to process material containing ^{233}U through H-Canyon. The technology to be used in H-Canyon is oxide dissolution and simple uranyl nitrate solution blending. There are several obstacles preventing direct shipment to SRS, including: (1) there are no licensed containers to ship the material in its "as is" condition; (2) SRS cannot process some of the material in its current form; (3) SRS cannot receive the material as it is currently packaged due to security issues; and, (4) SRS cannot process the material as currently packaged due to criticality concerns. Because of this, some of the inventory would need to be converted or dissolved and reconverted to an oxide and re-containerized to reduce the quantity per package for nuclear criticality concerns, safeguards and security. The cost of processing at ORNL prior to shipment to SRS is estimated at $328 million. Additionally, SRS has estimated that the cost to process this material through the H-Canyon would exceed $1 billion. Because of these concerns, DOE eliminated this alternative from further consideration.

Melt and Dilutes are another alterative based at the SRS, in conjunction with Argonne National Laboratory, developing the process for dispositioning spent research reactor fuel by melting the fuel assemblies in molten aluminum and diluting with depleted uranium. Proof of principle testing has been performed (reference: WSRC-MS-2004-00782, *A Mobile Melt-Dilute Module for the Treatment of Aluminum Research Reactor Spent Fuel*). The technology has three significant disadvantages:

- It has not been demonstrated under production conditions.
- It will increase the disposal volume by 3 to 20 times due to the aluminum that is added to dissolve the canister and the uranium.
- It could not be used to disposition the fluoride materials due to their volatility when heated; and additional process would have to be established to first convert the material to an oxide or metallic form.

The Department concludes that while the technology may have merit, pilot testing, design, and construction of projection facilities should significantly extend the duration of the U-233 Disposition Project, and therefore was eliminated from further consideration.

2.3.7 Dry Blending

Dry blending would use a proposed dual drive planetary ball mill technology in a five-inch diameter, five-inch high container. The concept has been demonstrated using titanium oxides and uranium oxides. This equipment has shown the ability to grind oxides averaging 40-micron in diameter to submicron size in 75 minutes. The smaller the particle size, the harder it is to reverse the downblending process, which enhances the safeguards and security aspects of the project. However, materials that are ground to less than ten microns pose a substantial health hazard due to potential deep lung exposure. In September 2000, an independent study conducted by the HEU Disposition Program (HEU 2000) concluded that use of grinding media is estimated to generate 50 metric tons of additional secondary waste and take up to an additional 17 years because smaller batch sizes would be required when compared to aqueous processing. In addition, the study stated that the dry blending technology would require extensive research and development in order to prove its viability as a disposition option since it has not been proven on a large scale. Due to the research and development requirements, many of the impacts noted under the no-action alternative would also be relevant here. It has also been determined that at the present time there is no known demonstrated highly-enriched dry blend-down technology, so considerable process testing would be required to demonstrate the blend-down effectiveness in meeting safeguards and security performance objectives. Therefore, this alternative was eliminated from further consideration.

2.3.8 Co-Processing with TRU Waste

Most of the ^{233}U material has plutonium contamination such that the material, after downblending, will meet the 100 nanoCuries per gram threshold for being classified as TRU material. Since such processing would require design and construction (or modification) of facilities on the ORNL reservation to be able to process and downblend the ^{233}U material, there is no advantage to considering this as a viable alternative to processing in Building 3019. It would require the additional operations of retrieval, packaging for transport, and transporting the canisters of material to an alternate processing facility.

In addition, current information indicates that the total volume of TRU at ORO will be significantly less than the original estimate, and most of it will have been dispositioned prior to having capabilities in place on and industrial scale to handle the ^{233}U. Thus there is not enough TRU material to dilute a significant portion of the ^{233}U. This may be a viable disposition path for small quantities of fissile material, but is not considered to be viable for the amount of material stored in Building 23019.

2.3.9 Chemical Dilution

This technology involves adding 200 grams or less of fissile material to a burial package that contains other materials such as concrete, steel, grout, or other materials. The ^{233}U and other fissile material would remain as weapons-usable assay, so policy questions must be addressed relative to safeguarding the material after dispositioning. Most of the canisters contain more than 200 grams of fissile material, so facilities would need to be designed and installed to open the canisters, subdivide the contents into quantities not exceeding 200 grams, then adding the fissile material to the other material matrix. The product packaging must also address the extent of immobilization of the fissile material and treatment of hazardous constituents to meet transportation and waste acceptance criteria. If such material were to be dispositioned at WIPP, the number of waste canisters would increase by about a factor of 10 and would extend the project completion by about 80 years. This may be a viable disposition path for small quantities of fissile material, but is not considered to be viable for the amount of material stored in Building 3019.

3. AFFECTED ENVIRONMENT

This section provides the background information for evaluating the potential environmental impacts of the proposed action and alternatives analyzed in this EA.

3.1 LAND USE

The main ORNL site encompasses facilities in two valleys (Bethel and Melton Valleys) on approximately 1,100 acres of land within the ORR. ORNL facilities are also located on other parts of the more than 21,000 acres for which ORNL is responsible, including some at the nearby Y-12 National Security Complex (Y-12 Complex) and field research areas. Within the main site, the DOE land use designation is "institutional and research." The site supports ORNL research and development mission activities in science and technology, energy resources, environmental quality, and national security. In addition, a number of facilities located within the developed, central areas of ORNL are currently in the EM D&D Program or planned for other non-EM surplus programs. At the eastern end of the main ORNL site is the Spallation Neutron Source (SNS) facility, located near Chestnut Ridge.

The Building 3019 Complex is located within the Central Complex of ORNL. The Central Complex contains over two million square feet of facilities centered around the buildings in the 4500 series. Facilities in the Central Complex range from offices to high-performance computing and wet chemistry laboratories. Primary facilities include the Central Research and Administration Buildings (4500N and S), the High-Temperature Materials Laboratory (Building 4515), and the Metals and Ceramics Laboratory (Building 4508). Other facilities located nearby to the Building 3019 Complex include High-Rad-Level Analytical Facility (Building 2026), Chemical Technical Division Annex (Building 3017), Waste Operations Control Center (Building 3130), and the Surface Sciences Laboratory (Building3137).

Once processing has been completed, the downblended inventory will be packaged and transported to existing storage facilities in Melton Valley at ORNL (Buildings 7572 and 7574) for temporary storage. The existing facilities are currently permitted Hazard Category 2 used to store contact-handled (CH) transuranic (TRU) waste, mixed TRU waste, and fissile material and are located outside the area of Melton Valley that has undergone remediation. Current operations consist of CH waste storage, loading, unloading, and transfer of waste containers; periodic inspections; installation of drum vents and sample ports; and facility surveillance and maintenance. Personnel are present only during these operations.

Buildings 7572 and 7574 were constructed in 1995 to provide indefinite retrievable storage for waste materials stored primarily in 55-gallon drums or 4x4x6-foot boxes. Waste types allowed at the facilities include RCRA hazardous waste, low level waste (LLW), TRU waste, mixed-TRU waste, and fissile waste. Historical operations at Buildings 7572 and 7574 included storage of RCRA hazardous waste, LLW, TRU waste, mixed-TRU waste, and fissile waste; loading, unloading, and transfer of waste containers; periodic inspections; facility surveillance and maintenance; and occasional outside storage adjacent to the building. The waste containers stored at the building were contact-handled. Processing of waste was not performed at the facility, and the containers were generally not opened except to consolidate contents or to overpack a damaged container.

The containers of downblended material will be stored in overpacks that provide additional protection from spills and allows for the overpacks to be contact-handled. An addition will be built between the facilities to allow for unloading of the containers for storage. A follow-on use will be to load containers prior to transporting for disposal.

3.2 AIR QUALITY AND NOISE

The ORR and surrounding area cover portions of Roane, Anderson, and Loudon counties. The area surrounding the 3019 Complex is located in Roane County and is classified as an attainment area for all National Ambient Air Quality Standards (NAAQS). The state of Tennessee has adopted these national standards, and the Tennessee Department of Environment and Conservation (TDEC) has also adopted regulations to specify permissible short and long term concentrations of hazardous and/or toxic air pollutants.

The TDEC Division of Air Pollution Control issues air permits for non-radiological and radiological airborne emissions for ORNL. Nine major sources of air emissions from ORNL operations are covered under a Title V Operating Permit (Permit Number 556850). The primary sources of non-radioactive emissions at ORNL include the steam plant on the main ORNL site and four small package-unit boilers located at the 7600-area complex, and the SNS. These sources account for approximately 75% of ORNL's allowable emissions. During 2005, TDEC inspected all permitted emission sources at ORNL, and all were found to be in compliance.

Radioactive airborne discharges at ORNL consist primarily of ventilation air from radioactively contaminated or potentially contaminated areas, vents from tanks and processes, and ventilation for reactor facilities. These airborne emissions are treated and then filtered with HEPA filters and/or charcoal filters before discharge. Radiological airborne emissions from ORNL consist of solid particulates; absorbable gases (e.g., iodine); tritium (^{3}H); and nonabsorbable gases (i.e., noble gases). The major radiological emission point sources for ORNL consist of the following five stacks located in Bethel and Melton Valleys:

- 2026 High Radiation Level Analytical Laboratory;
- 3020 Radiochemical Processing Plant (i.e., Building 3019 Complex);
- 3039 central off-gas and scrubber system, which includes the Building 3019A vessel off-gas system, and serves the 3500 and 4500 Areas' cell ventilation system, 3525 ventilation system, 3025 and 3026 Areas' cell ventilation system, 3042 ventilation system, and 3092 central off-gas system;
- 7503 (formerly 7512) MSRE remediation; and,
- 7911 Melton Valley complex, which serves the High Flux Isotope Reactor (HFIR) and the Radionuclide Engineering Development Center.

In general, radionuclide emissions from the ORNL have slowly declined over the past five years. The ^{3}H emissions for 2005 totaled approximately 73 curies. Iodine-131 emissions for 2005 were 0.04 curie. Argon-41, emitted as a nonabsorbable gas from the HFIR facility stack (7911), were

210 curies in 2005. Cesium-138, which totaled 1200 curies, was the major contributor to the off-site dose at ORNL (DOE 2003). These are within the levels allowable under TDEC permits.

Noise sources at ORNL can be categorized into two major groups, transportation and stationary. Transportation noise sources are associated with moving vehicles that generally result in fluctuating noise levels above ambient noise levels for a short period of time. Stationary noise sources are those that do not move or that move relatively short distances. Stationary noise sources in the vicinity of the Building 3019 Complex include ventilation systems, air compressors, generators, power transformers, and construction equipment. During peak hours, Bethel Valley Road traffic is a major contributor to traffic noise levels in the area.

Buildings 7572 and 7574 are insulated, pre-engineered, steel-frame buildings located on a concrete pad. Building 7572 measures approximately 50 × 140 ft, and Bldg. 7574 is approximately 50 × 80 ft. Each building is a rigid steel frame structure with steel siding panels and interior insulated metal liner panels. The buildings are equipped with a ventilation system. The ventilation system may be set for automatic operation or manually operated from a control box on the south wall beside each personnel access door. The equipment rooms have an exhaust fan on the north wall and a louver intake vent on the south wall. This ventilation system may also be operated manually or set for automatic operation.

3.3 GEOLOGY AND SOILS

Bedrock beneath the main plant area of ORNL in Bethel Valley is composed of limestone, siltstone, and calcareous shale facies of the Ordovician Chickamauga Group. Bedrock beneath the area surrounding the Building 3019 Complex includes the Fleanor Formation, Rockdell Formation, and the lower portion of the Benbolt Formation. Heterogeneous soils overlying bedrock include a mixture of fill, reworked soils, and native residual soils. During construction of site facilities, soils were extensively modified by excavation and refilling of areas around waste storage tanks, underground piping, and buildings (DOE 1999).

3.4 WATER RESOURCES

3.4.1 Surface Hydrology

The Building 3019 Complex is located in the Bethel Valley Watershed. White Oak Creek is the main receiving surface water body in Bethel Valley. Its watershed comprises approximately 2098 acres of Bethel Valley and includes the following tributaries: Northwest Tributary (runs along the west side of the West Campus); First Creek (divides the west end of ORNL from the central area and receives drainage from both); and Fifth Creek (runs through the middle of central ORNL). Flow from White Oak Creek in Bethel Valley flows downstream to White Oak Lake, and eventually discharges to the Clinch River (DOE 1999). Surface runoff from the impervious surfaces surrounding the Building 3019 Complex is routed to Fifth Creek via storm drains. Fifth Creek discharges into White Oak Creek via National Pollutant Discharge Elimination System (NPDES)-permitted storm water outfalls. No wetlands are present in the immediate vicinity of the Building 3019 Complex, and the area is not located within any floodplain.

Buildings 7572 and 7574 are located in the Melton Valley Watershed. As with Bethel Valley, White Oak Creek is the main receiving surface water body in Melton Valley. However, there are no tributaries feeding White Oak Creek within Melton Valley. Flow from White Oak Creek in Melton Valley flows downstream to White Oak Lake, and eventually discharges to the Clinch River (DOE 1999). No wetlands are present in the immediate vicinity of Buildings 7572 and 7574 and the area is not located within any floodplain.

3.4.2 Groundwater

Groundwater flow in Bethel Valley is generally from the northeast to the southwest (i.e., parallel to the strike direction). Some of the limestone bedrock underlying the area is subject to chemical weathering and dissolution resulting in karst features, including cavities and conduits, which strongly influence groundwater flow and transport of contaminants. In addition, extensive modification of the soils profile has extensively altered the soil hydrology and created numerous preferential seepage pathways, which provides a preferred pathway for groundwater flow and contaminant transport in the shallow groundwater zone (DOE 1999).

Historic processes, programs, and waste management practices associated with laboratory operations have led to areas of groundwater contamination in Bethel Valley. Groundwater quality in Bethel Valley has been characterized during Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) investigations. Common contaminants detected in groundwater include volatile organic compounds [mostly solvents; i.e., trichloroethene, tetrachloroethene, 1, 1-dichloroethene, benzene, and vinyl chloride] near the east end of ORNL; metals (primarily mercury) and an array of radionuclides are common contaminants detected under or near the central and west end of ORNL (DOE 2003).

Wastes in Melton Valley reside at a variety of locations, including trenches, tanks, landfills, pipelines, surface structures, and impoundments. Contamination at some locations has leached into surrounding soil and groundwater, where it migrates to nearby streams. Leaks and spills from some historic sites have also contaminated soil and sediment. Contaminants include metals and radionuclides, primarily strontium-90, cesium-137, and tritium. Cobalt-60 is found in some areas. Between the 1960s and mid-1980s approximately 3.2 million gallons of liquid and sludge waste were injected into artificially induced fractures in a shale formation at depths of 700 to 1,000 feet. All injections wells have now been plugged and capped as part of remediation activities. Hydrologic isolation has been used to mitigate migration of contamination from shallow land burial sites in combination with the capping of the areas. Beginning in 2008, groundwater monitoring will be initiated to evaluate the effectiveness of remediation activities in the western portion of Melton Valley. These activities will have no affect on the storage of the downblended ^{233}U in Buildings 7572 and 7574, which are located in the eastern portion of Melton Valley.

3.5 ECOLOGICAL RESOURCES

Vegetation in the vicinity of the Building 3019 Complex is limited, highly disturbed, and mostly maintained by mowing. Grasses and herbaceous vegetation dominate the vegetation cover except for some Virginia pines located to the north and south of the building.

Since there is very little habitat available for native animals, the majority of the animal species found in the vicinity are species that adapt well to disturbance and the presence of humans, including small rodents, birds such as starlings and pigeons, reptiles and waterfowl, especially Canada geese. There would be no changes to the existing habitat under the proposed action. Furthermore, existing routine disturbances, such as mowing, traffic, fencing, and industrial activities currently preclude the presence of rare, threatened, and endangered plant and animal species.

Buildings 7572 and 7574 were constructed in 1995 to provide indefinite retrievable storage for waste materials stored primarily in 55-gallon drums or 4x4x6-ft boxes. Vegetation in the vicinity of the Buildings 7572 and 7574 is limited due to the fact that the surrounding fenced area is graveled to allow for transport vehicles easy access.

3.6 CULTURAL RESOURCES

The Building 3019 Complex is considered to be a contributing structure to the ORNL Main Facilities Complex historic district and is eligible for listing in the National Register of Historic Places. The facility, which was part of the Manhattan Project, was completed in December 1943. The purpose of the building was to serve as a pilot plant to process and separate plutonium from irradiated slugs produced in the adjacent Graphite Reactor. The design and technology developed for this chemical processing plant were used for the construction of a full-scale plant at Hanford, Washington. Following World War II, Building 3019 served as a pilot plant for the development of other chemical separation processes that have played a major role in the advancement of chemical reprocessing techniques used worldwide (Carver and Slater 1994).

The original facility was comprised solely of seven concrete cells rising from a basement level to approximately one story above ground and a wood-frame office and control gallery attached to the north side of the cells. In 1950, a new structure was built around the cells for containment, laboratory space, and control rooms. In 1954, a "hot analytical facility" was built onto the west end of Building 3019B. Past interior alterations include the removal of all original processing equipment, modernization of equipment in the control rooms, and installation of a new ventilation system (Carver and Slater 1994).

Buildings 7572 and 7574 were constructed in 1995 in the Melton Valley area of ORNL. The facilities are located on Melton Valley Drive and are isolated from the historical areas of ORNL.

3.7 SOCIOECONOMICS

The region of influence (ROI) for this analysis includes Anderson, Knox, Loudon, and Roane counties. The region includes the cities of Clinton, Oak Ridge, Knoxville, Lenoir City, Loudon, Harriman, and Kingston. These counties are geographically close to ORNL and account for over 90% of DOE-related employment. This distribution has been relatively stable for the last decade (DOE 2002a). This results in a relatively conservative estimate of impacts, since Anderson

County is also part of the Metropolitan Statistical Area for the city of Knoxville, and draws commuters from at least 12 counties in eastern Tennessee (DOE 2002a). Actual impacts may be distributed over a wider area, which would reduce the overall impact on the counties included in this analysis.

3.7.1 Demographic and Economic Characteristics

Table 3.1 summarizes population, per capita income, and wage and salary employment from 2000 to 2004, the latest year for which data are available. Population has increased over the 5-year period and employment for the region rose slightly at 0.65%, from 364,041 in 2000 to 376,318 in 2004. Total personal income grew over the same period (Bureau of Economic Analysis 2004). However, Knox County accounted for most of the growth, while population increased slightly in Anderson County, while employment declined in Roane County during these years.

Table 3.1 Demographic and Economic Characteristics in the Oak Ridge Region of Influence

County	2000	2001	2002	2003	2004	Annual growth 2000-2004 (%)
Anderson						
Population	71,284	71,441	71,691	71970	72,244	0.26%
Per capita income ($)	26,473	27,194	26,798	27,664	28,588	1.46%
Total employment	50,903	50,975	50,601	51,907	51,693	0.30%
Roane						
Population	51,944	51,982	52,245	52,557	52,920	0.36%
Per capita income ($)	21,957	22,017	23,936	24,949	26,051	3.14%
Total employment	24,008	20,953	20,975	20,847	20,606	-3.30%
Knox						
Population	382,803	385,585	391,494	396,672	400,061	0.86%
Per capita income ($)	28,440	29,186	29,587	30,265	32,040	2.25%
Total employment	273,270	272,556	275,868	277,519	286,689	0.94%
Loudon						
Population	39,939	39,939	40,778	41,646	42,237	1.09%
Per capita income ($)	25,257	25,718	26,374	27,286	29,270	2.74%
Total employment	15,860	15,834	16,075	16,622	17,330	1.70%
Region Totals						
Population	545,970	548,947	556,208	562,845	567,462	0.75%
Per capita income ($)	25,531	26,029	26,674	27,541	28,987	2.38%
Total employment	364,041	360,318	363,519	366,895	376,318	0.65%

Source: Bureau of Economic Analysis 2004.

3.7.2 Distribution of Minority and Economically Disadvantaged Populations for Environmental Justice Concerns

For the purposes of this analysis, a minority population consists of any census tract in which minority representation is greater than the national average of 30.7%. Minorities include individuals classified by the U. S. Bureau of the Census as Black or African-American,

American Indian and Alaska Native, Asian, Native Hawaiian and Other Pacific Islander, and Hispanic or Latino, and those classified under "two or more races." This provides a conservative estimate consistent with Office of Management and Budget guidance (OMB 2000). Hispanics may be of any race and are excluded from the totals for individual races in order to avoid double counting.

The distribution of minority and economically disadvantaged populations changed little between 1990 and 2000. Only one of the census tracts that immediately surround the ORR currently includes a minority population greater than the national average of 30.7%. As of the 2000 census, minorities represented 40.1% of the population in Tract 201. As in 1990, Black or African-American residents comprised the largest group (29.6%). The proportion of minority residents in all other Oak Ridge census tracts was below the national average, ranging from 17.4% in Tract 205 to 8.8% in Tract 206 (Census 2001). No Federally recognized Native American groups live within 50 miles of the project area.

According to the 2000 Census, 12.4% of the U. S. population and 13.5% of the Tennessee population had incomes below the poverty level in 1999 (Census 2001). In this analysis, a low-income population consists of any census tract in which the proportion of individuals below the poverty level exceeds the national average. Within the ROI, 13.1% of the population in Anderson County had incomes below the poverty level. The proportion in Knox County was 12.6%, in Loudon County it was 10.0%, and in Roane County it was 13.9%. Within Oak Ridge, low-income populations were located in census tracts 201 (15.8% below poverty level) and 205 (27.9%). Tract 201 roughly corresponds to the Scarboro community, and Tract 205 includes the area between Oak Ridge Turnpike and West Outer Drive, bounded on the west by Louisiana Avenue, and on the east by Highland Avenue and Robertsville Road. In other Oak Ridge census tracts, the percentages ranged from 12.1% in Tract 204 to 1.9% in Tract 301 (Census 2001).

3.7.3 Fiscal Characteristics

Oak Ridge City general fund revenues and expenditures for FY 2006 and projected revenues and expenditures for 2007 are presented in Table 3.2. The general fund supports the ongoing operations of local governments, as well as community services, such as police protection and parks and recreation. The largest revenue sources have traditionally been local taxes (which include taxes on property, real estate, hotel/motel receipts, and sales) and intergovernmental transfers from the federal or state government (City of Oak Ridge 2006).

Table 3.2 City of Oak Ridge Revenues and Expenditures, FY 2006 and FY 2007 ($)

Revenues	2006 Actual	2007 Projected
Taxes	20,080,703	20,436,810
Licenses and permits	220,000	220,000
Intergovernmental revenues	10,726,163	11,731,263
Charges for services	386,000	346,000
Fines and forfeitures	314,000	289,000
Other revenues	503,500	558,500
Total revenues	32,230,366	33,581,573
Expenditures and other financing		
Expenditures	15,362,347	16,326,766
Other financing uses	(17,939,950	(18,506,328)
Total expenditures and other financing	(1,071,931)	(1,251,521)

Source: City of Oak Ridge 2006.
FY = Fiscal Year.

3.8 INFRASTRUCTURE

ORNL is similar to a small city and is supported by a dedicated fire department, a medical center, a security force, a wastewater treatment plant, and a steam plant. Major utilities required by ORNL, including electricity, natural gas, water, and telecommunications are available. These utilities are supplied by other entities. The ORNL produces steam and compressed air and operates and maintains systems for the collection and treatment of sanitary, process, and industrial-type wastes. Utilities available to the Building 3019 Complex from ORNL include steam, potable, process and fire water, electricity, plant air, storm sewer and sanitary sewer. The following information about the utility and transportation infrastructure serving ORNL is taken from the *Oak Ridge National Laboratory Land and Facilities Plan* (ORNL 2002b).

3.8.1 Utilities

Electrical

Electrical power used at ORNL is fed from the Tennessee Valley Authority Oak Ridge area. Current power supply is sufficient to accommodate virtually any facility or program that may be located at ORNL, including the proposed actions within the Building 3019 Complex. No on-site electrical power generation is conducted at ORNL; however, thirty-four backup generators have been installed at specific facilities. These standby generators provide essential power to allow functions associated with environment, safety, health, security, quality, and infrastructure to continue unaffected during power outages. Building 3019 Complex has three dedicated backup generators sufficient to meet the needs of the proposed action in the event of a loss of power. No additional generators are expected to be needed.

Electrical power, telephone, and alarm lines are routed to Buildings 7572 and 7574 overhead. Fluorescent lighting is provided in the buildings for normal operations. The equipment rooms are heated to prevent pipes from freezing and to protect the alarm and electrical panels inside. Battery-powered emergency lighting fixtures are mounted 15 feet above the floor near the entrance to provide back-up lighting for personnel during a power failure. The above information implies that emergency lighting applies to both facilities. However, only Building 7574 has emergency lighting. The equipment rooms are heated to prevent pipes from freezing and to protect the alarm and electrical panels inside.

Natural Gas

Natural gas is supplied to ORNL from the main line, and the three pressure-reducing stations that make up the supply system to the ORR. Natural gas would be available to supply the distribution grid for the facilities in the main ORNL Bethel Valley complex, and the infrastructure is in good condition and capable of meeting the needs of the proposed action. Agreements with ORNL to provide natural gas would be in place prior to initiating activities.

Sewage

The ORNL sewage system includes the main system, the 7900 Area system, and the other minor systems. The main system serves Bethel Valley, which includes the areas of 1000, 2000, 3000, 4500, and 5500 building series. The ORNL Sewage Treatment Plant, built in 1985, consists of a 300,000-gallons per day packaged, extended aeration plant that provides primary and secondary treatment and a sand/gravel filter and ozonator system to provide tertiary treatment. Treated effluent is discharged into White Oak Creek. The subcomponents of the main sewage system are a collection system comprising 6-in., 8-in., and 10-in. vitrified clay pipes, pumping stations, treatment and discharge systems, and related services and equipment.

ORNL sends its sanitary sewage sludge to the city of Oak Ridge for inclusion in the city's biosolids land application program. While not all sludge can be transferred because of low levels of residual radiological contamination, the portion that can be disposed of in this manner reduces the quantity of solid, low-level contaminated waste generated. Efforts continue to determine possible sources of ground-based contamination that is leaching into the ORNL sewage collection system, and much of the system has been renovated to eliminate inflow and infiltration.

Water

Treated water to ORNL (Bethel Valley and Melton Valley) is supplied by the city of Oak Ridge from the water treatment plant located across from the Y-12 Complex, on Bear Creek Road. Water to ORNL is provided via a single 24-in. gravity line from the water plant into the ORNL plant site. ORNL is responsible for compliance with the rules of the TDEC Division of Water Supply and operates and maintains the water distribution system. The water line feeds the ORNL reservoir system, which consists of one 3-million-gallon concrete reservoir, a 1.5-million-gallon reservoir on Chestnut Ridge, and two 1.5-million-gallon steel reservoir tanks on Haw

Ridge. From these reservoirs, water flows by gravity in the plant distribution grid. The water is used for domestic, sanitary, fire protection, and process purposes. A water reservoir is in service for the SNS. Although constructed for the primary use of the SNS, it is on the ORNL distribution grid and is considered by TDEC in the reserve storage capacity compliance requirement. The potable water and process water distribution system at ORNL consists of 100,000 feet of piping. The general condition of the system can be described as fair to good and is continuously improved. System breaks are sporadic, and the cause of failure is primarily due to mechanical loading and improper bedding placement of older installations. A number of expansions and improvements to the water system are in construction and more are being planned.

Storm Water Collection System

The Building 3019 Complex contains 102 drain sources that send wastewaters, process wastewaters, domestic wastewater, storm water runoff, cooling water, and condensate via piped collection systems to ORNL treatment facilities or outfalls, depending on the nature of the wastewater. The storm water collection system consists of drainage ditches, catch basins, manholes, and collection pipes which transport storm water, condensate, and cooling water flows to receiving streams. White Oak Creek traverses the site and ultimately receives the primary discharges from ORNL, as well as normal flows from the tributaries, which feed it. Rainfall, snowmelt, and other authorized flows are directed to the gravity-drainage system. The ORNL NPDES permit covers 164 outfalls; 146 of the outfalls are listed for constituents, including storm water runoff from the storm water collection system. These outfalls are periodically monitored at several in-stream points for various parameters as required by the NPDES permit. The ORNL collection system for process wastewaters consists of a series of underground pipes that transfer wastewater from the source facility to a pumping station for transfer to the Process Waste Treatment Complex—either Building 3544 (for radiological treatment) or Building 3608 (for non-radiological treatment).

Fire Protection

Most ORNL facilities are protected from fire by remotely monitored fire alarm and sensing systems coupled with automatic sprinkler devices. Fire protection is provided primarily through the potable water system and is crucial to the facilities and personnel protection. During the winter months, steam heating protects the fire protection water lines. Many of the old, outdated fire alarm systems in Laboratory facilities are being updated, and new systems are being added to facilities currently not covered. These improvements will enhance fire protection capability for the Laboratory and ensure compliance with requirements in fire protection standards.

Buildings 7572 and 7574 are equipped with a supervised fire alarm system which is connected directly to the ORNL Fire Department in each building. Each system consists of a Fire Alarm Control Panel and annunciator, a local-energy Master Fire Alarm Box, two manual fire alarm pull stations, two evacuation horns/strobe lights, two sprinkler system valve tamper switches, a low temperature supervisory switch, a low air pressure switch, and a sprinkler system pressure switch. The Fire Alarm Control Panel is capable of monitoring fire alarm and trouble conditions.

The Fire Alarm Control Panel is located in the equipment room. The Master Fire Alarm Box number for Building 7572 is 812, and the Master Fire Alarm Box number for Building 7574 is 816. The pull stations are located at the personnel entry doors. Each building is provided with three 10-lb. ABC-type portable fire extinguishers. The extinguishers are located directly outside each personnel doorway.

Compressed Air

Compressed air powers all of ORNL's major pneumatically operated control systems, which include many experimental programs and processes as well as many building ventilation systems. Compressed air would be needed for the proposed action to operate the muffle furnace, instrumentation, and other minor equipment. Clean, dry, instrument-quality, 100-pounds per square inch compressed air is produced at the ORNL Steam Plant for users in the Bethel Valley area by one or more of six air compressors. In addition, a single, diesel-powered air compressor is used in emergency situations such as power outages or when maintenance or breakdowns on the other compressors require their use.

Heating, Ventilating, and Air-Conditioning (HVAC)

Heating and cooling of the buildings and equipment are primarily provided by space conditioning units. The HVAC design in each building includes refurbishment of HVAC system heating and cooling equipment, ductwork, filters, stacks, scrubbers, and alarm and backup systems. The ORNL central chilled water system located in Building 4509 generates the cooling water used in the air-conditioning of some 4500, 5500, and 6000 series buildings. The total chilled water system is comprised of seven compressor/chiller units with a total capacity of 5800 tons, about 8500 feet of distribution piping, and serves close to one million square feet of floor area. Regardless of outside temperatures, several facilities require year-round cooling from the chilled water system for computers, accelerators, and some laboratories.

Steam

The steam production system consists of four dual-fired boilers and two package-type boilers located in the Steam Plant (Building 2519). Total capacity of the six boilers is around 300,000 pounds per hour of saturated steam. The steam plant supplies steam to Bethel Valley and to the 7500 and 7900 series buildings in Melton Valley. Major refurbishment of the steam and air distribution systems took place in 1998, and the supply system was refurbished to convert systems to gas-fired with oil-fired backup. Approximately 90% of the steam produced is used primarily for heating approximately 135 buildings, and the remainder is used for driving the emergency off-gas turbines in the 3039 Stack in the event of power outage.

Telecommunications

The ORNL network backbone will remain fiber-optic based but will evolve from its current Fiber Distributed Data Interface (FDDI) technology base to a set of parallel FDDI, Gigabit Ethernet, and automatic teller machine networks that provide the flexibility to accommodate almost any network-intensive computing project while holding the line on costs for less demanding applications.

3.8.2 Transportation

ORNL main site locations are accessible only by road. Vehicle circulation at ORNL may be divided into two sectors, off-site and on-site circulation. Off-site circulation consists of staff movements to and from work and among the various Oak Ridge installations for work assignments and to deliver materials. Off-site roads include State Route (SR) 95 (White Wing Road), which provides access to the west end of the Bethel Valley area, and SR 62 and Scarboro Road, which provide access to the eastern end of Bethel Valley and the ORNL facilities at the Y-12 Complex. On-site circulation consists of materials handling, movement of personnel between buildings and to and from parking lots, and contractor and vendor personnel movement.

The main road is Bethel Valley Road, which is currently closed to non-authorized traffic. This east-west road provides access to the site and leads to all the parking lots. Completion of several construction and expansion projects has helped alleviate some of the chronic parking problems experienced at the Bethel Valley site. Several main roads and access roads provide on-site transportation. The primary north and south corridors are First, Second, Third, Fourth, and Fifth streets. The major east and west corridors are White Oak and Central Avenues. Materials are transported via the same routes used by employees and visitors.

The main roads in Melton Valley are Melton Valley Drive, Ramsey Drive, and Melton Valley Access Road. These roads lead to the principal experimental facilities, including the HFIR, the Consolidated Fuel Reprocessing Center, and the Robotics and Process Systems Complex. Several other access roads serve the numerous solid waste storage areas.

By far, the largest portion of the off-site traffic circulation generated by ORNL is personnel commuting to and from work. The average commute of an ORNL employee working in Bethel Valley is about 35 miles. Peak traffic occurs between 7 a.m. and 8 a.m. with the arrival of workers at the site, and between 4 p.m. and 5 p.m. with their departure. Minimal traffic delays are experienced during these peaks since work shifts are staggered, car and vanpooling are practiced, and most deliveries to and shipments from ORNL are timed to avoid the rush hour. Road maintenance and the movement of heavy equipment or escorted shipments typically occur during the workday after traffic flow has subsided.

3.9 WASTE MANAGEMENT

During demolition of hot cells and laboratories, construction of new hot cells and equipment placement, process operations and facility stabilization, secondary waste will be generated. Secondary wastes are newly generated, discarded materials such as used personal protective equipment, demolition debris, used disposable sampling equipment, etc. The ^{233}U Stabilization Project would be responsible for dispositioning secondary waste. In 1999, Bechtel Jacobs Company LLC (BJC) assumed responsibility for onsite storage, treatment, and disposal for the reservation. BJC currently operates onsite facilities for the treatment of liquid and gaseous waste and onsite storage facilities for TRU waste. BJC also provides services for the transportation, treatment, and disposal of low level radioactive, RCRA hazardous, mixed, and toxic wastes.

Where it is determined to be economically feasible, Isotek will utilize BJC for waste storage, treatment, transportation, and disposal during project implementation. Wastes expected to be generated are managed in six categories: conventional (i.e., non-hazardous industrial wastes and sanitary sewage), low-level radioactive, transuranic, RCRA hazardous, mixed, and toxic (ORNL 2002b). The manner in which these wastes are managed is briefly described below. Sanitary sewage collection and treatment, which is categorized as a conventional waste, is discussed in Section 3.8.1.

3.9.1 Sanitary/Industrial Wastes

Sanitary/industrial wastes consist of paper, garbage, wood, metal, glass, plastic, demolition and construction debris, sanitary and food wastes from cafeteria operations, sludge from water and air treatment, and other special wastes. The Y-12 Complex Centralized Sanitary Landfill II is used for disposal of non-hazardous wastes such as construction debris and most other sanitary wastes.

3.9.2 Process Wastewater

The ORNL collection system consists of a series of underground pipes where process wastewater flows from the source facility to a pumping station for transfer to the Process Waste Treatment Complex—either Building 3544 (for radiological treatment) or Building 3608 (for non-radiological treatment). Manholes equipped with alpha and beta-gamma radiation monitors, pH monitors, and flow monitors are located at strategic points throughout the collection system and are continuously monitored at the Waste Operations Control Center to allow personnel to detect any unusual activity within the system. Wastewater goes to either the radiological or non-radiological treatment process based on radiation limits monitored at these manholes. Wastewater requiring radiological treatment is transferred to the storage tanks (two 350,000-gallon and one 1,000,000-gallon capacity each) at Building 2600. An underground pipe is used to transfer the wastewater to an isolated water softening system dedicated for radioactive wastewaters in Building 3608 prior to its transfer to Building 3544 for radiological treatment.

The Building 3544 treatment process consists of three basic operations: precipitation (which actually takes place at Building 3608), filtration, and ion exchange. The first two of these, together called head-end treatment, use conventional water treatment equipment: a sludge recycle tank, a sludge-blanket-type precipitator-clarifier, and pressure filters. The ion-exchange equipment uses a process with strong acid cation exchange resins. The process equipment allows treatment rates of 300 gallons per minute (gpm) and operated 24 hours (432,000 gallons per day), 7 days per week, 365 days per year.

The Building 3608 facility was designed to treat process wastewater from Building 3544, the 4500, 2000, and 1505 Areas, and the HFIR/Radiochemical Engineering Development Center site to remove particulates, heavy metals, and organics, as well as to adjust the pH of the wastewater before discharge to White Oak Creek. Building 3608 was designed to segregate incoming waste streams into two streams, one containing heavy metals and one not containing heavy metals. At the facility are two 325,000-gallon surge tanks. One receives heavy metals wastewater, and the other receives the nonmetals wastewater. The facility consists of the following unit operations: precipitation, filtration, air stripping, treatment through granular-activated carbon columns, and pH adjustment. Building 3608 has the capacity to treat up to 760 gallons per minute (1.1 million gallons per day) of wastewater and is operated 24 hours per day, 7 days per week.

3.9.3 Liquid Low-Level Waste System

The LLLW system at ORNL collects, neutralizes, concentrates, and stores aqueous radioactive waste solutions from various sources at the ORNL. The sources of these waste solutions are "hot" sinks and drains in research and development laboratories, radiochemical pilot plants (e.g., Building 3019A), and nuclear reactors located in both Bethel and Melton Valleys. The LLLW system/facilities are located throughout ORNL. The LLLW storage tanks are located near the LLLW source buildings, the LLLW Evaporator Facility is located near Third Street, and the Melton Valley Storage Tanks and LLLW Solidification Facility are located in Melton Valley.

Waste is generated from buildings and sent to collection tanks near the facility or directly to the LLLW Evaporator Service Tanks W-21 or W-22. These tanks store evaporator concentrate and dilute radioactive LLLW and are connected directly to the LLLW Evaporator systems. The contents of the tanks are transferred on a batch basis to the evaporator facility for volume reduction. Two 600 gallon per hour evaporator systems, housed in Building 2531, are used to concentrate the LLLW. Condensate from the evaporator systems receives treatment at the Building 3544 process waste treatment complex for the removal of radiochemicals from the evaporation process. The LLLW concentrate is stored in 50,000-gallon evaporator storage tanks until a pipeline transfers it to the Melton Valley Storage Tanks.

LLLW is also transported by surface vehicles to the LLLW collection system for treatment as an alternative to the LLLW collection system, which utilizes a network of underground piping and tanks. Bulk liquid wastes that are not transferred by pipeline are transported from the generating facility by tank motor vehicle to the collection header in the South Tank Farm for further transport by pipeline to the storage tanks and Building 2531 for treatment. Smaller quantities of liquid waste, such as those produced in some of the research laboratories, are bottled and transferred from the generating facility by motor vehicle directly to Building 2531 for treatment.

3.9.4 Stack Ventilation System

The Building 3019 Complex has four multi-zone ventilation systems. The four systems are the Cell Off-Gas, Laboratory Off-Gas, Glove-box Off-Gas, and Vessel Off-Gas. The ventilation systems for the main building (Building 3019A) can exhaust approximately 40,000 cubic feet per minute, which passes through roughing and HEPA filters. The Laboratory and Cell Off-Gas systems also provide ventilation to the out-of-service hot cells in the adjoining 3019B facility. The majority of the process source emissions from the Building 3019 Complex (Cell Off-Gas, Laboratory Off-Gas, and Glove-box Off-Gas) are discharged through the 3020 Stack. However, some emissions (Vessel Off-Gas) are vented through the 3039 Stack Ventilation System. The primary functions of these ventilation systems are to safely and efficiently collect process gaseous waste streams from various ORNL facilities, provide the necessary filtration, monitor the streams for radionuclide and hazardous material contents, and discharge the combined streams to the atmosphere at a central location. The systems are designed to provide continuous, uninterrupted operation by utilizing backup fans, cross-connected systems, redundant capacity, and backup power supplies.

3.9.5 Solid Low-Level Radioactive Waste

SLLW is waste that contains radioactivity but is not classified as high-level waste, TRU waste, spent nuclear fuel, or by-product material as defined by DOE Order 435.1, "Radioactive Waste Management." SLLW does not contain RCRA hazardous waste as regulated by RCRA and as defined in 40 CFR 260-268 (and equivalent state of Tennessee standards) or PCB-contaminated or PCB-detectable waste as regulated by Toxic Substances Control Act (TSCA) and as defined in 40 CFR 761. DOE Order 435.1 and the Atomic Energy Act of 1954, as amended, provide the primary regulatory guidance and requirements for the management of SLLW. Waste acceptance criteria and an implementing procedure are in place at ORNL to address the storage, treatment, and disposal of SLLW.

SLLW is generated throughout ORNL, and after characterization and waste certification, it is staged at the generating location until it is shipped to an off-site treatment, storage, or disposal facility or certified and transferred to BJC. BJC determines the most suitable management option for all SLLW transferred to them. Based on the characteristics and certification of the waste, BJC may: (1) store the waste in one of several storage facilities dedicated to SLLW; (2) utilize treatment options, such as compaction and incineration, offered by commercial facilities or in-house treatment options; or, (3) ship the waste to an approved off-site disposal facility such as the Nevada Test Site or Energy*Solutions,* Inc.

3.9.6 Transuranic Waste

TRU waste is waste that is contaminated with alpha-emitting transuranium elements (atomic number greater than 92) with half-lives greater than 20 years and concentrations greater than 100 nanocuries per gram at the time of assay. Waste acceptance criteria and an implementing procedure are in place for TRU wastes generated at ORNL.

TRU waste is generated by a limited number of generators and facilities at ORNL. TRU secondary waste generated during the ^{233}U Stabilization Project may either be packaged and certified for shipment by the ^{233}U Stabilization Project or transferred to BJC through the waste certification process. TRU secondary waste that requires interim storage may be managed in one of many on-site facilities that are permitted to store TRU waste.

3.9.7 Hazardous Waste

Hazardous wastes are defined by specific source lists, nonspecific source lists, characteristic hazards, and discarded commercial chemical product lists in 40 CFR 261 and equivalent state of Tennessee standards. Characteristic wastes are those that exhibit the characteristics of ignitability, corrosivity, reactivity, or toxicity, as defined in 40CFR 261 and equivalent state of Tennessee standards.

Hazardous wastes are generated throughout ORNL and are stored in generator satellite accumulation areas or in (90-day) hazardous waste accumulation areas operated by the generator or Laboratory Waste Services. Hazardous waste generated as a result of the ^{233}U Stabilization Project will be managed by the ^{233}U Stabilization Project or transferred to BJC through the waste certification program. For wastes transferred to BJC, BJC will determine the most suitable management option for all RCRA hazardous waste generated. Based on the characteristics and certification of the waste, BJC may: (1) immediately transport the waste to an off-site commercial facility for treatment and/or disposal; (2) store the waste in one of several storage facilities dedicated to RCRA hazardous and mixed waste, pending off-site treatment or disposal; or, (3) utilize other on-site treatment. Waste acceptance criteria and an implementing procedure are in place for RCRA hazardous wastes generated at ORNL.

3.9.8 Mixed Waste

Mixed waste is waste that contains both hazardous and radioactive components and must be managed to meet the requirements applicable to both. "Hazardous," in this instance, refers to both those wastes addressed under RCRA and those under the TSCA. Like RCRA hazardous wastes, mixed wastes are generated throughout ORNL and are stored in accumulation areas operated by the generator. Mixed waste may be disposed by ^{233}U Stabilization Project or transferred to BJC after certification. In the case where the waste is transferred to BJC, BJC determines the most suitable management option for all mixed wastes generated. Based on the characteristics of the waste, BJC may store the waste in one of several storage facilities dedicated to RCRA hazardous and mixed waste, pending determination of suitable treatment, storage, and disposal options. Many of ORNL's mixed wastes are treated in the TSCA Incinerator located at the East Tennessee Technology Park (ETTP).

3.9.9 TSCA Waste

TSCA waste consists of PCB waste and asbestos waste and is regulated by the Environmental Protection Agency (EPA) under TSCA. In accordance with 40 CFR 761, Subpart D, TSCA governs the management and regulation of PCB materials (wastes/contaminated equipment), including mixed PCB/radioactive wastes, typically based on PCB concentration. The ORR PCB Federal Facilities Compliance Agreement between EPA Region 4 and DOE-Oak Ridge Office (ORO) addresses PCB compliance issues at ORNL. This agreement specifically addresses the unauthorized use of PCBs, storage and disposal of PCB wastes, spill cleanup and/or decontamination, PCBs mixed with radioactive materials, and records and reporting requirements. The majority of ORNL's PCB/radioactive wastes are treated at the TSCA Incinerator at ETTP, whereas other PCB wastes are sent to commercial facilities within a year of generation.

TSCA also addresses the manufacturing, importing, and processing of asbestos and establishes requirements for asbestos abatement projects not covered by: (1) the Asbestos Standard of the Occupational Safety and Health Administration (OSHA), 29 CFR 1926.58; (2) an asbestos standard adopted by a state as a part of a plan approved by OSHA under Section 18 of the Occupational Safety and Health Act; or, (3) a state asbestos regulation which the EPA has determined to be comparable to, or more stringent than, that established in 40 CFR 763.120. Since ORNL does not manufacture, import, or process asbestos, and since asbestos activities are covered by an approved Asbestos Standard, any waste with asbestos-containing material is not regulated under TSCA. Asbestos-containing material is either managed as sanitary waste, SLLW, TRU waste, TSCA/RCRA waste, or TSCA/RCRA mixed waste if the asbestos-containing material has come into contact with such constituents. Accordingly, asbestos is managed as a TSCA PCB waste only if it has come into contact with PCBs.

Waste acceptance criteria and implementing procedures are in place at ORNL for PCB wastes and asbestos wastes. Generators initially store these wastes until transfer to BJC for either on-site storage or off-site storage or disposal. PCB wastes received, treated, and disposed are routinely included in the totals for RCRA hazardous and mixed wastes.

3.10 HUMAN HEALTH

Past activities at ORNL have resulted in releases of radionuclides and chemicals to the environment. Such releases combine with natural sources and can augment the exposure to humans both on-and off-site. Natural background sources include cosmic radiation and uranium and thorium in native soils. Inorganic elements, such as arsenic and manganese, are also found in native soils on the ORR, including ORNL. These naturally existing sources of radiological and chemical exposures become the background exposure to which the effects of the man-made releases would be added. The *Oak Ridge Reservation Annual Site Environmental Report for 2005* (DOE 2006) summarizes releases or environmental contamination levels of chemicals and radiation and resulting exposures for calendar year 2005.

In general, human exposure pathways include direct contact, inhalation, and ingestion. Radiation exposure is commonly categorized as either external (exposure to penetrating radiation) or internal (ingestion and inhalation). Ingestion of radionuclides can be through the intake of water or foodstuffs (e.g., vegetation and fish).

DOE Order 5400.5, *Radiation Protection of the Public and the Environment,* limits the effective dose equivalent (EDE) that an off-site individual may receive from all exposure pathways and all radionuclides released from ORR during one year to no more than 100 millirem (mrem). DOE regulations (10 CFR 835, *Occupational Radiation Protection)* establish radiation protection standards and program requirements for DOE and DOE contractor operations with respect to the protection of workers from ionizing radiation. DOE's limiting control value for a worker's radiation dose is 5000 mrem per year total EDE from combined internal and external sources. A maximum DOE Administrative Control Level (ACL) of 2000 mrem/yr (20mSv/yr) per person is established to further limit occupational dose for all DOE activities.

3.10.1 Radiological Exposure to the Public

The average annual background radiological EDE from natural and man-made sources to an individual residing in the United States is approximately 360 mrem. Approximately 300 mrem of the 360 mrem are from natural sources (e.g., radon, cosmic radiation), about 55 mrem of which are from natural external radiation sources (i.e., cosmic and terrestrial radiation) [NCRP

1987]. External radiation exposure rates from background sources have been measured in Tennessee. The measured rates are equivalent to an average annual EDE of 42 mrem, ranging between 19 and 72 mrem (Myrick et al. 1981). This average is less than the U. S. annual average of 55 mrem.

For 2005, the Maximally Exposed Individual (MEI) dose from ORNL was calculated to be 0.02 mrem for an individual located on Gallaher Bend, approximately 4259 meters North by Northeast of the HFIR stack. The radionuclides of greatest concern were Cs-138 (37.2% of the dose) and Ar 31 (31.6 of the dose). The ORNL 2005 maximum EDE was 0.1 mrem. The MEI and maximum EDE were the same (when rounded) as those in 2004.

3.10.2 Radiological Exposure to Workers

Workers at Building 3019 Complex are potentially exposed to radioactive hazards. Most areas of the facility contain out-of-date, surface-contaminated equipment remaining from pilot operations and other work involving spent fuel, plutonium, ^{233}U, thorium, and other radionuclides. An extensive health physics program is used to track any migration of contamination, which is impeded by a combination of engineered physical boundaries (e.g., gloveboxes, cells, etc.) and multi-zoned ventilation control. The chemical explosion that occurred in 1959 distributed plutonium contamination throughout the interior and exterior of the building. Extensive decontamination was conducted, but most interior and exterior surfaces of the building required paint bonding to prevent the spread of the residual alpha contamination. The out-of-service sample conveyor, which crosses the roof from Building 3019A to 3019B, has been a recurring source of contamination to areas of the exterior roof, and the older exterior ventilation ducting requires periodic sealing to prevent leakage of radioactive contaminants.

Storage of ^{233}U in the Building 3019 Complex also presents a radiological risk to workers. High dose rates of penetrating radiation can be encountered when handling or storing ^{233}U that contains a high concentration of ^{232}U. The decay of ^{232}U produces a chain of isotopes, including ^{220}Rn and ^{208}Tl, leading to the potential for release of airborne alpha, beta, and gamma-emitting radionuclides. This is the reason for the unique shielding, ventilation, inspection, and remote-handling requirements that protect personnel from the radiation hazards associated with the ^{233}U storage.

3.10.3 Chemical Exposure to the Public

Health effects attributed to chemical exposures can be categorized as carcinogenic or noncarcinogenic. Chemical carcinogenic risks are reported here as a lifetime probability of developing an excess cancer. EPA defines a target cancer risk range of $1x\ 10^{-4}$ (1 in 10,000) to $1x10^{-6}$ (1 in 1,000,000), which defines when cleanup actions are to be considered under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980. Noncarcinogenic hazards are reported as hazard quotients (HQ) where unity: (1) or greater represents a potential for adverse health effects. An HQ less than unity indicate an unlikely potential for adverse health effects. The sum of more than one HQ for multiple toxicants and/or multiple exposure pathways is called a hazard index. Pathways of concern for noncarcinogens are defined as those with a hazard index greater than one.

DOE (2005) estimates the human health risks from chemicals found in the environs of the ORR. The primary exposure pathways considered are ingestion of drinking water and fish. For ingestion of drinking water HQs were estimated upstream [Clinch River kilometer (CRK) 70] and downstream (CRK 16) of ORR discharge points. HQs were less than one for detected chemical analytes for which there are reference doses or maximum contaminant levels (i.e., barium, manganese, zinc, etc.).

To evaluate the potential health effects from the fish consumption pathway, HQs were estimated for the consumption of noncarcinogens, and intake/chronic-daily-intake ratios, I/I(10^{-5}), were estimated for the consumption of carcinogens detected in sunfish and catfish collected both upstream and downstream of the ORR discharge points. For consumption of sunfish and catfish, an HQ greater than one was calculated for the PCB Aroclor-1260 at all three locations (CRK 70, CRK 32, and CRK 16). I/I (10^{-5}) ratios greater than one were calculated for the intake of Aroclor-1260 found in sunfish and catfish collected at all three locations. In catfish, an I/I (10^{-5}) ratio greater than one was calculated for aldrin at CRK 16.

3.10.4 Chemical Exposure to Workers

Chemical hazards to personnel working in the Building 3019 Complex include uncoated lead shielding, lead paint, PCBs, asbestos, combustible foam insulation, and perchlorate contamination. RCRA hazardous, TSCA, and PCB wastes are produced in the course of routine operations and maintenance of the facility. A portion of the ^{233}U inventory is known to contain cadmium which was deliberately added to act as a neutron poison during the stabilization program. Oversight for control of occupational chemical exposures at Building 3019 Complex currently is under the responsibility of the UT-Battelle Environment, Safety and Health organization, which ensures compliance with the provisions of DOE Order 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees* (DOE 1998). However, this responsibility would be transferred to the ^{233}U Disposition Project with the transfer of the facility. This Order includes a requirement that contractors comply with Federal OSHA regulations.

3.10.5 Emergency Services

Fire protection and emergency services at for the Building 3019 Complex will be provided by ORNL through established work authorizations with the Project. These work authorizations provide emergency preparedness planning, fire protection, and shift operations coordination that enable operations in the Building 3019 Facility to be conducted in a manner that protects and enhances human health and the environment. The ORNL emergency responders have mutual aid agreements in place with local response agencies to provide support as necessary.

The Fire Protection (FP) Department maintains a fire-safe posture at ORNL by ensuring that an effective fire emergency response force (fire department) is in place and that ORNL fire protection is consistent with DOE guidance and national standards. In turn, the Project maintains a fire protection program that ensures fire protection systems are inspected and maintained.

Emergency preparedness is maintained by the ORNL emergency response organization. Working with the Project, it is ensured that all credible emergencies (including criticality events) and that the emergency plans and procedures to respond to them are identified and documented and that adequate resources are available for emergency preparedness, emergency response, and required recovery activity. This system provides continued readiness of the emergency preparedness program.

The Laboratory Shift Superintendent (LSS) Department manages shift operations for the Building 3019 Facility by staffing the laboratory Shift Superintendent office with trained, qualified personnel familiar with normal plant operations, as well as emergency response. The LSS Department participates in Laboratory Emergency Planning, review local emergency manuals, and coordinate training for the emergency response organization. This department serves as the Laboratory Emergency Director during emergencies and operates the Laboratory Emergency Response Center that serves as the central location for monitoring and controlling site activities.

4. ENVIRONMENTAL IMPACTS (EFFECTS)

This section focuses on the impact analysis and discussion of project attributes that could have the potential for significant impacts.

4.1 LAND USE

4.1.1 No-Action Alternative

Based on a review of the *Oak Ridge National Laboratory Land and Facilities Plan* (ORNL 2002b), there would be no change to the existing land use for the area around the Building 3019 Complex or Buildings 7572 and 7574 under the no-action alternative. The Building 3019 Complex would continue to operate as the storage location for the ^{233}U inventory at ORNL, and the surrounding area is expected to continue to be used for industrial purposes. The Building 3019 Complex would require significant improvements to protect against damage from weather, seismic and other natural phenomenon (see DNFSB Technical Report, *Uranium-233 Storage Safety at Department of Energy Facilities*, February 1997). Furthermore, due to the age of the facility, routine upgrades for continual occupancy, such as replacement roofing and facility maintenance, would be required. Buildings 7572 and 7574 would continue to store contact-handled Transuranic waste (CH-TRU) waste until the facility inventory could be shipped to WIPP for disposal without additional impacts. There has been no other programmatic need identified beyond the current operations.

4.1.2 Proposed Action

Under the proposed action, there would be no impact on land use immediately surrounding the Building 3019 Complex or Buildings 7572 and 7574 since the area is currently used for industrial purposes and is part of the industrialized portion of ORNL. All processing activities would occur within the existing footprint of the Building 3019 Complex. New construction would only include modifications to the interior and exterior of Building 3019A to accommodate various process activities (e.g., new process cells, chemical storage tanks, or small buildings attached to 3019A). Off-site waste treatment and disposal would only occur at existing permitted/licensed facilities that currently conduct these activities.

The Building 3019 Complex would be placed in safe and stable shutdown for transition to the D&D program after the completion of the processing activities. No timetable has been established for D&D, and the land use in the area is expected to remain industrial.

Buildings 7572 and 7574 are currently utilized to store RCRA regulated CH-TRU mixed waste. The buildings are within a fenced in area of the Melton Valley portion of ORNL. The ^{233}U Stabilization project would utitilize these existing facilities to store the downblended inventory. The surrounding area is graveled to allow trucks access to load and unload containers. The facilities would not require modification; however, a loading facility would be constructed between Buildings 7572 and 7574 to allow for loading of containers for future shipments.

4.2 AIR QUALITY AND NOISE

4.2.1 No-Action Alternative

Only negligible air quality impacts would result from the no-action alternative. Ongoing surveillance and maintenance activities would continue for the ^{233}U inventory stored at Building 3019 Complex. Currently, most off-gas emissions from ongoing operations are discharged through Stack 3020, although some are vented through the 3039 Stack Ventilation System. Extended storage of the ^{233}U in Building 3019 Complex would require additional structural and confinement systems upgrades. These upgrades, if extensive, could result in temporary and localized emissions of criteria air pollutants, e.g., NO_x carbon monoxide (CO), and sulfur dioxide (SO_2) that could be generated from the operation of any heavy equipment and transportation vehicles associated with construction activities. Off-gas emissions from ongoing operations would be expected to remain the same as they are currently.

Noise levels at ORNL around the Building 3019 Complex are typical of other industrial areas and are primarily associated with ongoing operations, traffic, and construction activities. Workers associated with the continued storage of ^{233}U at Building 3019 Complex should not be subjected to excessive noise levels. Workers involved in any future facility upgrades would be expected to wear hearing protection, as appropriate, or as required by OSHA. Sound from the ongoing operation of Building 3019 Complex is generally confined within the building, and since no sensitive noise resources are located in the immediate vicinity of the Building 3019 Complex, no adverse impacts would occur.

Buildings 7572 and 7574 would continue to store CH-TRU waste until shipments to Waste Isolation Pilot Plant (WIPP) have been completed without additional impacts. There has been no other programmatic need identified beyond the current operations.

4.2.2 Proposed Action

Air emissions, under the proposed action would result from two sources: (1) operation of any heavy equipment and transportation vehicles during construction activities, and the construction activities themselves, and (2) air emissions from the process off-gas. Air emissions from process off-gas include filterable particulate, entrained nitric acid, NO_x, uranium oxides, and other trace radioactive contaminants.

Construction activities would primarily be located within the Building 3019 Complex. Equipment used during construction will include trucks, backhoes, loaders, cranes, and compressors. Temporary and minor quantities of fugitive emissions and other criteria air pollutants, e.g., NO_x, CO and SO_2, will be generated from the operation of heavy equipment and transportation vehicles associated with construction activities. Noise will be also generated by construction equipment entering and leaving the facility. Odors may also be generated from construction equipment exhaust. Emissions generated by construction equipment used within the facility will be generally confined within the building and vented through the Stack 3020 after HEPA filtration. The nearest receptors to odors, noise, and dust associated with construction of the proposed action are within ORNL. Because the facility is located within an active industrialized area of ORNL and since no sensitive noise resources are located in the immediate vicinity of the Building 3019 Complex, no adverse impacts would occur. Construction activities within the building will generate asbestos and radioactive material emissions.

Processing operations having the potential to generate hazardous (including radioactive) emissions under normal conditions would be conducted within an enclosed building. Emissions from the proposed action would not contribute significantly to the overall emissions from ORNL (see Section 3.2). As discussed in Section 3.2, ORNL's radiological emissions that are the major contributors to off-site dose are H-3 (73 Ci), I-131 (0.04 Ci), Ar-41 (210 Ci) and Cs-138 (1200 Ci). Of these values, no contribution was made from the emissions from stack 3020 for Ar-41, Cs-138, H-3 and I-131. (DOE/ORO/2220) Due to no process off-gas discharge through this point, there is no potential impact from stack 3039 from the proposed project. Emissions from 3020 will be monitored during the proposed project to ensure releases will have no impact in excess of current release levels for ORNL.

The primary means of mitigating process related emissions would be effective off-gas systems. In addition to continuing to use the existing ventilation systems that are routed to stacks 3020 and 3039, additional off-gas treatment capabilities would be permitted and installed in the Building 3019 Complex as part of the proposed action. The proposed process off-gas system would be routed to the appropriate stack (either stack 3020 or 3039) for discharge. The proposed new process off-gas treatment system for processing would include the following:

- Quench/cooling system – Hot gases from the process furnaces would be cooled before introduction into downstream pollution control processes.
- NO_x removal systems – NO_x emissions would be controlled by state-of-the-art pollution control equipment capable of maintaining total NO_x emissions below the Prevention of Significant Deterioration level for NO_x.

- Heater – An electric heater would heat the off-gas steam to keep the downstream filter and fan dry.
- HEPA filters – HEPA filters would be placed at the duct outlets to reduce particulate and metals buildup in the ducts and in the exhaust gas.
- Fans – The entire off-gas system would be maintained at a negative pressure by standard axial fan(s). Airflow would be from areas of lower potential contamination toward areas of higher contamination.
- On-line analysis – The Building 3020 stack system would continue to be sampled to allow measurement of chemical and radiological attributes of emissions exiting the 3020 Stack.
- Radon capture and decay – Special features and controls (e.g., radon traps) would be used to mitigate release of radon, as appropriate. The proposed "radon trap" would consist of a hold-up device and a HEPA filter.

All other emission points associated with the Building 3019 Complex are considered general exhaust, such as room ventilation, bathroom vents, etc.

Air emissions are regulated through air quality standards and permits found in Tennessee Rule 1200-3. ORNL is located within an attainment area for all NAAQS for criteria pollutants. The only significant criteria pollutant emissions from process operations are NO_x formed from the dissolvers and denitration unit operations. NO_x will be in the form of nitrogen oxide and nitrogen dioxide in near equal proportions. Potential emissions of NO_x before controls from the dissolvers and denitration operations are 32 pounds per hour, or 140 tons per year. Emission controls will limit actual NO_x emissions to less than the Prevention of Significant Air Quality Deterioration significance level 40 tons per year throughout the process operations. After controls, NO_x emissions will be less than 10 pounds per hour. It is assumed operations will be performed for 2080-hours a year up through construction and 6240-hours a year during processing. Particulate emissions are controlled primarily by HEPA filtration with an efficiency of 99.97%, and will be less than 0.1 pound per hour. The proposed action will comply with 24-hour and annual particulate matter standards.

The proposed action would generate radionuclide emissions. Radioactive material would be strictly controlled through engineering controls, such as physical process cell containment and administrative controls such as nuclear material accountability and health physics procedures. The highest potential for airborne emissions of radionuclides would exist where uranium is converted from a dissolved liquid state to a dry powder and packaged into drums. Airborne radionuclides would be captured primarily in scrubbers. All process and cell exhausts would pass through HEPA filters prior to stack discharge. Additionally, a radon traps will be used. Radionuclide emissions from the process would be subject to Title 40 of the Code of Federal Regulations, Part 61 (40 CFR 61), Subpart H – National Emission Standard for Emissions of Radionuclides other than Radon from Department of Energy Facilities. (The ORNL is currently subject to this regulation.). Uncontrolled, radionuclide emissions would be expected to result in a dose to the most exposed member of the public of 0.1 mrem per year compared to the ORNL 2005 maximum EDE of also 0.1 mrem (see Section 3.2).

The process to convert the ^{233}U to a granular UO_3 form effectively reduces the potential for radioactive releases during upset conditions. In addition, downblended inventory stored in Buildings 7572 and 7574 would be packaged in stainless steel containers equipped with HEPA filtered vents and radon delay tubes to minimize any radioactive emissions. Primary containers would be overpacked, providing secondary containment. Buildings 7572 and 7574 are insulated, pre-engineered, steel-frame buildings located on a concrete pad and accessed by electric forklifts. The facility is located in Melton Valley and isolated from the main ORNL campus. Shipments into or out of the facility would not exceed six per week. Impacts to air quality or noise would occur as a result of transport vehicles accessing the facility.

After the processing activities were completed, the Building 3019 Complex would be placed in safe and stable shutdown prior to transfer to the D&D program. This would have the positive effect of reducing potential air emissions from the current storage activities and the proposed processing of the ^{233}U inventory. No additional emissions would be expected from shutdown of the facility.

4.3 GEOLOGY, SOILS, AND SEISMICITY

4.3.1 No-Action Alternative

No effects to geological resources or soils would occur under the no-action alternative since the activities associated with the continued storage of ^{233}U at Building 3019 Complex, and any future facility upgrades, would occur within the existing facility in a previously disturbed area used for industrial applications. Based on the subsurface conditions for the Building 3019 Complex and the surrounding area, foundation soils for the facility are predominantly residual clays with fair to hard consistencies. Generally, these types of clays are not susceptible to liquefaction. Therefore, the soil-supported foundation of the Building 3019 Complex should remain stable against liquefaction during and after a seismic event (ORNL 2004). The process cells and storage tube vaults within Building 3019A are designated as a Performance Category 3 structure in accordance with DOE-STD-1021-93. However, the remainder of the facility is designated as a
PC-1 structure, with one area which is PC-2. Modifications and upgrades to the Building 3019 Complex would be designed and constructed to meet PC-3 criteria for natural events if required. Other modifications and upgrades would be designed to PC-1 or PC-2 criteria, as appropriate. DOE would review the design package, including applicable specifications and standards, for any process or facility modifications.

4.3.2 Proposed Action

Under the proposed action, no effects to geological resources or soils would occur since the activities associated with the proposed project would occur within previously disturbed areas used for industrial applications. Potential impacts associated with seismicity would be similar to those described for the no-action alternative.

4.4 WATER RESOURCES

4.4.1 No-Action Alternative

Under the no-action alternative, surface and groundwater monitoring and appropriate environmental restoration measures would be continued at ORNL. The Building 3019 Complex contains 102 drain sources that send wastewaters, process wastewaters, domestic wastewater, storm water runoff, cooling water, and condensate via piped collection systems to ORNL treatment facilities or outfalls, depending on the nature of the wastewater. The no-action alternative would not result in any changes to these sources, and no additional adverse effects to water resources would occur. Impacts to surface water or groundwater could occur as the result of a spill or leak from ongoing operations. Surface and groundwater protection measures, such as spill prevention and spill response plans, are already in place at ORNL for ongoing operations.

Buildings 7572 and 7574 would continue to store CH-TRU waste until emptied without any additional impacts. There are no identified programmatic needs beyond the current mission.

4.4.2 Proposed Action

Potential impacts to water resources from storm water effluents under the proposed action would be similar to those described in the no-action alternative. Existing surface and groundwater protection measures at the Building 3019 Complex, such as spill prevention and spill response plans, would be reviewed and modified or continued as appropriate based on the final design for the processing and facility shutdown activities. No change in existing storm water capacity or handling would be expected. The existing Building 3019 Complex area is a primarily impervious surface that would not be appreciably altered. The existing storm water collection system would continue to collect runoff from the project area, and no new storm water-handling facilities would be required. Water discharged into the ORNL storm water collection system ultimately discharges into White Oak Creek via NPDES-permitted storm water outfalls. Concentrations of toxic and conventional pollutants and radionuclides would be expected to remain within the existing permit limits. Responses to spills would be in accordance with ISO-ENV-215, Spill Response and Discovery of Shock-Sensitive Materials, and ORNL spill response procedures.

The safe and secure shutdown of the Building 3019 Complex at the completion of the proposed processing activities would substantially reduce the amount of waste and wastewater generated by the existing operations and the proposed processing of the ^{233}U. This would also have the positive effect of reducing the potential for a spill or release into the storm water collection system or groundwater.

Storage of the downblended inventory will be conducted at Buildings 7572 and 7574 which are existing facilities permitted for storage of hazardous wastes. The buildings are constructed and operated to comply with 40 CFR Part 264 Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities and equivalent state of Tennessee regulations. Buildings 7572 and 7574 are insulated, pre-engineered, steel-frame buildings located on a concrete pad. Building 7572 measures approximately 50 × 140 ft, and Building 7574 is approximately 50 × 80 ft. The waste containers provide primary confinement for the radioactive waste. The building structure provides some secondary confinement for the radioactive wastes stored in the waste containers. Concrete dikes around the entire perimeter inside the building provide RCRA spill control. The dikes are 4-in. wide and 6-in. tall. Downblended inventory would be contained in a primary stainless steel container and placed inside an overpack providing double containment. Based on the fact that the inventory will be in a dry-powder form and stored inside a diked facility, impacts due to releases to the environment that could affect surface water or groundwater are not expected.

4.5 ECOLOGICAL RESOURCES

4.5.1 No-Action Alternative

Under the no-action alternative, no adverse environmental impacts would occur to any habitat or wildlife. The Building 3019 Complex and Buildings 7572 and 7574 are located in a highly disturbed area of ORNL used for industrial operations. Habitat in the vicinity of the Building 3019 Complex is limited and mostly maintained by mowing. Habitat surrounding Buildings 7572 and 7574 is graveled to allow for transportation in and out of the facility.

4.5.2 Proposed Action

No adverse environmental impacts would occur to any habitat or wildlife as a result of implementing the proposed action. All activities associated with ^{233}U stabilization, and the shutdown of the Building 3019 Complex would occur within previously disturbed areas used for industrial operations. Habitat in the vicinity of the Building 3019 Complex and Buildings 7572 and 7574 is highly disturbed and mostly maintained by mowing. This type of habitat precludes the presence of rare, threatened, and endangered plant and animal species. The U.S. Fish and Wildlife Service, in a letter dated May 17, 2004, stated that available endangered species collection records do not indicate that Federally listed or proposed endangered or threatened species occur within the impact area of the project (see Appendix A). A fence provides limited access of wildlife to Buildings 7572 and 7574. Gravel covers the area inside the fence and is maintained to allow for unobstructed truck access.

4.6 CULTURAL RESOURCES

4.6.1 No-Action Alternative

Ongoing activities at the Building 3019 Complex would have no impact on the historical integrity of the Building 3019 Complex. Prior to any facility modification or upgrades, DOE would conduct a review of the proposed modifications, make a determination that the undertaking would or would not adversely affect the eligibility for listing Building 3019 Complex on the National Register of Historic Places, and would consult with the Tennessee State Historic Preservation Office.

4.6.2 Proposed Action

Although there have been modifications to the structure since it was constructed, much of the original integrity of Building 3019 Complex remains intact. However, the interior of the facility has lost its historical integrity because of extensive internal modifications that were made to provide support for past and current missions. As part of the proposed action, modifications would be made to the interior and exterior of the building to accommodate various process activities. The exact modifications would not be completely known until the final design is completed. Based on the preliminary design, modifications would be made to Cell 2, Room 201, Room 147, and Room 22 to support the installation of new processing equipment. Existing radiological contaminated equipment in other rooms would be disconnected, characterized, segregated (RCRA and non-RCRA), and packaged as waste. All waste will be stored and shipped in accordance with appropriate regulations. Rooms will be altered as necessary to allow for the installation of new processing equipment. The existing building utility systems would be modified, as necessary, to support the project, and piping would be installed at various locations to permit the transfer of material and waste solutions. Chemical storage tanks and hazardous material transfer and storage areas would be constructed outside the Building 3019 Complex. Solution transfer equipment and spill containment would be modified and/or installed as necessary. Access to Building 3100 might need to be improved for the storage of drums, and additional construction access might need to be provided at two sides of Building 3019A to allow larger pieces of equipment and material to enter.

DOE prepared a Project Summary and Archaeological and Historical Review for the proposed modifications to Building 3019 Complex and determined that the proposed action would not have an adverse effect on the exterior physical structure or visual appearance of the building. DOE determined that no exterior archaeological resources would be affected by the proposed action. The Tennessee State Historic Preservation Office, in a letter dated October 12, 2004 concurred with the determination made by DOE that the then-proposed modifications to the facility would not adversely affect any property eligible for listing in the National Register of Historic Places. DOE's current proposed action, described in this EA, would not involve any different effects on the exterior physical structure or visual appearance of the building. In addition, the proposed action will have no effect on the adjacent Graphite Reactor, which is considered a National Historic Landmark. DOE will consult with Tennessee State Historic Preservation Office prior to initiating any D&D activities of the Building 3019 Complex. Future D&D activities are outside the scope of this EA.

Buildings 7572 and 7574 were constructed in 1995 to provide indefinite retrievable storage for waste materials in the Melton Valley area of ORNL. The area to be used is surrounded by a fence and isolated from the main campus. The project would utilize the existing structures for the temporary storage of the downblended inventory.

4.7 SOCIOECONOMICS

4.7.1 No-Action Alternative

Under the No-Action Alternative, it is assumed that facility upgrade and repackaging activities would occur and that these activities would result in a small, temporary increase in employment. Current operating expenditures are estimated at $5 to $6 million per year and account for roughly 31 full-time-equivalent (FTE) jobs. Repackaging activities are expected to cost an additional $8 to $10 million per year for five to six years, while construction activities to upgrade the facility are estimated to cost about $20 million. It is assumed that continued monitoring and maintenance after these activities are completed would require the same 31 positions that are currently assigned to this task.

The maximum impact would occur if all of the construction occurred in a single year, at the same time as the repackaging activities. The total expenditure of $30 million in one year would represent a negligible change (<0.2%) in the region's income. Moreover, construction activities are more likely to occur over several years, resulting in a smaller annual change in expenditures. Since employment would thereafter return to around current levels, no long-term change in employment or income is expected. No demographic or environmental justice impacts would occur under the no-action alternative.

4.7.2 Proposed Action

It is assumed for this analysis that the proposed action would generate up to 127 direct jobs at peak employment (Phase II) for 30 months. The peak employment figure includes workers required for the continued monitoring and maintenance of the ^{233}U material in storage, which currently accounts for 31 jobs. The net result would be a temporary net gain of 96 jobs. Since employment during other phases of the project would be considerably lower, this represents an upper bound for the purpose of analysis. Once the proposed action is complete, staffing levels would be reduced to support long-term surveillance and maintenance until D&D begins.

4.7.2.1 Demographics

Population
Based on the small number of jobs created, and the pool of qualified local residents available, no impact on population is anticipated.

Environmental Justice
Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," requires agencies to identify and address disproportionately high and adverse human health or environmental effects its activities may have on minority and low-income populations. Current information suggests that there would be no high and adverse human health or environmental impacts under normal operations. As discussed in Section 3.7.2, of the census tracts in the city of Oak Ridge, only Tract 201 includes a higher proportion of minorities in the population than the national average. Other tracts in the

city, and tracts closer to ORNL, have low proportions of minorities in their populations. In the event that adverse impacts occur, they are likely to have at least as much effect on these closer populations as on the residents of Tract 201.

Similarly, some low-income populations are located within the city and near the ORR. However, these populations are scattered among higher income populations. Any adverse impacts that affect the low-income tracts are also likely to affect the higher income populations. Therefore, any adverse health and environmental impacts that may occur are not expected to have a disproportionate effect on low-income and minority populations.

4.7.2.2 Employment and Income

This analysis assumes that the proposed action would create a net gain of 96 direct, FTE jobs during peak operations. This figure represents a negligible increase (<0.1%) from the 2001 total employment shown in Table 3.1. As an upper bound, if it is assumed that each of the newly generated direct jobs pays the 2001 average annual wage of $47,349 for DOE-related employment (Murray and Dowell 2002), the direct impact on ROI income would be an increase of $4.5 million, or <0.1% of the 2004 ROI income. Once the project is complete, the 31 net jobs lost would also have a negligible impact on ROI employment and income.

4.8 UTILITIES

4.8.1 No-Action Alternative

Under the no-action alternative, normal operations of the Building 3019 Complex and any future upgrades or modifications of the Building 3019 Complex would not increase utility usage, and current building space allocation would not be affected. Changes to utilities would be limited to normal maintenance activities.

4.8.2 Proposed Action

All equipment to be used during the proposed action would be electrically powered. Equipment would be laboratory-scale with moderate power requirements. Existing diesel generators within the Building 3019 Complex would provide backup electrical power. Since the project would occur within an existing facility within an industrial complex, it is expected that the current electrical power supply and transmission system would be adequate to supply the needed electricity without major modifications or upgrades. Electrical service would be provided under site use agreements with ORNL prior to implementation.

Based on material balance data, estimated water usage (potable and process) would range from 1,000 to 3,000 gallons per day depending on the various stages of the project. It is expected that this estimated usage could be readily accommodated by the existing ORNL water supply system.

It is estimated that project operations would generate approximately 3000 gallons per day of sanitary wastewater that would be discharged to the ORNL Sewage Treatment Plant for subsequent treatment. The ORNL Sewage Treatment Plant has enough existing capacity to handle the additional discharge of the sanitary wastewater that would be generated from this project. LLLW generated from process activities is addressed in Section 4.10.2. After the Building 3019 Complex is placed in safe and stable shutdown, the major utility systems serving the facility (i.e., electrical, process, potable, and fire protection water, compressed air, steam, and standby diesel generators) would remain operational until D&D occurs.

4.9 TRANSPORTATION

4.9.1 No-Action Alternative

Under the no-action alternative, the ^{233}U inventory would continue to be stored at the Building 3019 Complex at ORNL. Therefore, there would be no transportation or transportation risk. Traffic would likely continue to remain close to current levels, and no impacts would occur.

4.9.2 Proposed Action

Transportation associated with the proposed action is grouped into four general categories: (1) transport of construction materials and equipment; (2) transport of DUO_3; (3) on-site transport of downblended UO_3; and, (4) shipments of secondary waste. Each of these transportation categories is discussed in more detail below. Transportation of secondary waste to off-site treatment and/or disposal locations is discussed in Section 4.10.

The transport of materials and equipment associated with the limited construction and modification activities that would take place at the Building 3019 Complex would be over regional and local roadways to the site. Demolition and construction/startup activities are expected to last over a period of 54 months with transportation of materials and equipment to the facility. Similar transportation of materials to and through the ORNL occurs routinely; however, the proposed action would produce a minor increase the traffic flow overall. Trucks entering and leaving the Building 3019 Complex would increase from the no-action alternative during the 54 months of construction. The existing facility fence line would be expanded to allow for safer, more secure truck access along Hillside Avenue (see Figure 2.1.), moving deliveries from the north side of the Building 3019A, to a proposed additional loading area constructed to the Building 3019 Complex south of Building 3001. Relative to recently completed construction activities at the ORNL campus, the increased traffic to and from the Building 3019 Complex during construction will have less of an impact overall at the site.

DUO_3 for the project would be shipped via truck from SRS to the NFS facility in Erwin, Tennessee, for further processing. To minimize transportation and handling, the DUO_3 blendstock would be shipped from SRS in truckload quantities on an as-needed basis. The preferred route would use Interstates 26 and 40 passing through Columbia, South Carolina, and Asheville, North Carolina. From Asheville the preferred route would use Interstate 26 to Erwin, Tennessee.

It is estimated that about 14 truck shipments would be required to transport the required amount of DUO_3 from SRS to the uranium-processing facility, a distance of approximately 251 miles. Each shipment would consist of about 30 drums of material inside of a Sea-Land-type container. The first shipment would be scheduled to arrive at NFS approximately 3 months prior to the start of

Building 3019 Complex processing operations. Thereafter, shipments of blendstock to Erwin would be scheduled about every 11 weeks. The processing phase of the project would continue over a 30 month period. Overall, the transportation impacts are offset due to the proximity of NFS to SRS as opposed to disposal sites resulting in a reduction in miles traveled and reduced NO_x and CO emissions.

Approximately 205,000 kgs of depleted uranyl nitrate (DUN) solution at NFS in Erwin, Tennessee, is proposed to be transported to Building 3019 at the ORNL in Oak Ridge, Tennessee. The DUN solution will be transported from Erwin using NRC certified liquid cargo tank trailers (NRC Certificate of Compliance Number 5059), or other DOT-approved Type A fissile packaging to Oak Ridge. The NFS facility in Erwin is approximately 145 miles from ORNL. This project (transportation of DUN for downblending) will require approximately 137 truckloads (approximately 16,800 kgs each) of DUN solution. Each shipment would contain approximately 1500 kgs of uranium per truckload. The impact from non-radiological accidents is estimated to be $3.4x10^{-3}$ fatalities for the entire project. The risk from a radiological accident is estimated to be $3.6x10^{-5}$ fatalities for the entire project. The impacts from normal (accident-free) transportation, including handling and air pollution are estimated to be $1.8x10^{-2}$ fatalities. The combined impact for the total campaign is estimated to be $2.1x10^{-2}$ fatalities.

Using DOE/EIS-0240-S "Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement" as a basis, the impact of non-radiological accidents resulting from transportation of the depleted uranyl nitrate from NFS to the Building 3019 Complex is estimated to be $3.4x10^{-3}$ fatalities for the entire project. The risk from a radiological accident is estimated to be $3.6x10^{-5}$ fatalities for the entire project. The impacts from normal (accident-free) transportation, including handling and air pollution, are estimated to be $1.8x10^{-2}$ fatalities. The combined impact for the total campaign is estimated to be $2.1x10^{-2}$ fatalities.

After processing, the downblended UO_3 would be packaged into approved containers and placed into government-furnished overpacks for transport by truck from Building 3019 Complex to Buildings 7572 and 7574 for storage. According to the mass balance of the ^{233}U Stabilization Project (ISO-PLN-001, Revision 4, *Project Execution Plan*), it is estimated that around 1,100 containers would need to be transported. The weight of the packaged blended product could limit the number of containers per shipment. Shielded vans would be used for transportation of high dose rate containers to Buildings 7572 and 7574. Shielded overpacks would be used for storage of high dose rate containers. The on-site transportation of the downblended UO_3 to the storage location would comply with DOE Order 460.1A, 10 *CFR* 830 and the Oak Ridge Transportation Safety Report. The Type B packaging used for transport has approved safety analysis reports (SAR) that authorize the transport of specific radioactive materials, including ^{233}U and ^{232}U.

Transportation activities would result in an increase in NO_x, CO, and other pollutants resulting from operation of diesel engines. Additionally, the shipments would add additional truck traffic to the roads to and from SRS and Nevada Test Site. The volume of traffic is small and spread across 30 months, with less than two shipments per week on average. Required packaging, trained personnel, and transportation plans for the radioactive materials minimize the potential for accidents. Potential effects are offset also by the benefit of the proximity between ORNL and

NFS, and much of the transportation would occur on the ORR during processing operations. Overall, the transportation impact is offset by the benefit of safeguarding and securing the material.

4.10 WASTE MANAGEMENT

4.10.1 No-Action Alternative

Under the no-action alternative, waste storage, transport, and disposal activities associated with the Building 3019 Complex would continue to be handled under ORNL's Waste Management Program, which is described in Section 3.9. Facility upgrades would be required to support security and safety requirements; therefore, waste generation would increase periodically over current rates until the inventory is removed and the facility placed in safe shutdown.

4.10.2 Proposed Action

All secondary waste generated would be characterized to allow proper segregation, treatment, storage, and disposal. Characterization activities would meet all applicable quality assurance and other waste management requirements. Characterization activities would include the measurement of the physical, chemical, and radiological properties of the waste streams, and analytical parameters selected would be based on the waste acceptance criteria applicable to each waste stream and disposal site. Only existing operating disposal facilities would be used, and those facilities are expected to have enough existing capacity for the quantities of secondary waste to be generated. Waste minimization measures would also be used to the extent practicable in order to reduce the amount of process and secondary wastes generated and to minimize the overall volume of waste sent to disposal. A waste management plan would be developed to ensure that all waste streams would meet required packaging requirements and the disposal site acceptance criteria. Qualified transportation subcontractors would be used for the shipment of waste to off-site treatment and disposal facilities in full compliance with NRC and DOT.

The ^{233}U Stabilization Project plans include the proper management and disposal of secondary wastes generated during each phase of the project. The material is being processed into a form that could be dispositioned at the WIPP in Carlsbad, NM, or at the NTS. WIPP and NTS personnel have been actively involved in determining if the form of the downblended material can be received by the WIPP and NTS personnel have also been involved in project planning.

Secondary wastes will be stored, handled, managed, and disposed of in accordance with all applicable state and Federal regulations, and applicable DOE Orders, and will be packaged in accordance with disposal site waste acceptance criteria prior to being transported for disposal. Secondary waste anticipated to be generated from the project consists of six general categories:

- liquid waste from processing, analytical laboratory, and maintenance activities;
- solid waste from heterogeneous debris generated during construction, operations, and safe shutdown activities;

- Radioactive low level waste and mixed waste made up of homogeneous solids (i.e., spent ion/cation exchange resins and P-24 Tank disposition waste) and heterogeneous debris (i.e., ^{233}U packaging waste, empty DUO_3 drums, process cell waste off-gas filtration media, personal protective equipment, other dry active waste, construction/facility modification waste, and maintenance waste);
- RCRA hazardous waste primarily from analytical laboratory waste;
- PCB waste (i.e., asbestos, paint waste, and light ballast/debris generated during construction/facility modifications, maintenance activities, and safe shutdown); and,
- Radioactive PCB (same as other PCB waste sources but with radioactive contamination).

Liquid wastes would also be generated, including LLLW from the process, RCRA (non-radioactive and mixed) from analytical laboratory waste and maintenance waste, and PCB (non-radioactive and mixed) due primarily to PCBs that are present in the Building 3019 Complex. DOE estimates that approximately 21,000 gallons of LLLW would be generated during the project through the use of laboratory drains and cleaning systems and about 300,000-gallons would be generated from process liquids. A large portion of the process wastewater would be generated from the de-nitration of the downblended uranyl nitrate solution. All LLLW generated would be sampled and analyzed and, if it met the LLLW facility acceptance criteria, would be discharged to an appropriate collection system (see Section 3.9.3). Storage and treatment capacities of the existing ORR liquid waste treatment systems are adequate for the estimated amounts of liquid effluent that would be generated throughout the processing campaign. Other liquid wastes would be characterized, recycled as much as possible, and most likely would be stabilized through some form of treatment prior to disposal.

Personal protection equipment, concrete, and structural debris from in-plant modifications during construction of new process facilities would be minimized by reducing the modification area and packaging in large-size containers. LLW construction debris would be disposed of at permitted/licensed disposal facilities, and non-radioactive construction debris would be sent to a local construction/demolition landfill for disposal. Other solid waste would be disposed of in a local sanitary landfill.

Most solid LLW and high-activity process wastes would be shipped off-site for disposal (e.g., NTS or Energy*Solutions*, Inc.). Some small amounts of mixed waste (i.e., analytical residues and used oils) would likely be managed by commercial mixed-waste facilities. Non-radioactive RCRA hazardous and PCB waste would be managed for treatment and disposal through a RCRA hazardous waste broker. P-24 Tank liquids would be addressed in a detailed P-24 Tank Content Disposition Plan that would be prepared during Phase II of the project. The plan would include collection of additional characterization data, identification of environmental requirements, and evaluation of specific treatment and disposition approaches. The P-24 Tank liquids would likely be transported to a commercial waste treatment facility for stabilization then disposed at an appropriately permitted facility.

Based on the characteristics of the stored ^{233}U material and the facility, there is the possibility of TRU waste being generated from facility modifications, process activities, and cleanup. If TRU waste is generated, it could be transferred to the Oak Ridge TRU waste facility or to another site for treatment and disposal.

Table 4.1 summarizes the secondary waste forecasted for the propose action.

Table 4.1, Secondary Waste Identification and Forecasting

No.	Waste Description	Forecast Waste Volume (Estimate)	Projected Waste Category
1	Dry active waste from construction, on-going routine operations, surveillance and maintenance	1,200 ft^3 Annually	LLW
2	Excess chemical and other waste from historical operations	50 lbs Annually	RCRA and PCB
3	Radioactively contaminated excess chemical and other waste from historical operations	500 lbs Annually	MLLW
4	Waste from prior operations at the 3019 Complex	75 ft^3	TRU
5	Containers	700 ft^3 Annually	LLW
6	Secondary wastes from Operations	300 ft^3 Annually	LLW
7	Radioactively contaminated construction debris	33,000 ft^3	Construction/Demolition Waste
8	Radioactively contaminated soil	7,000 ft^3	LLW
9	Treated (stabilized) P24 tank contents	2,600 ft^3	MLLW
10	Office trash	3,000 ft^3 Annually	Sanitary
11	Construction debris	2,000 ft^3	Construction/Demolition Waste

Overall, wastes generated are similar to those wastes currently generated and managed within the ORR. The number and types of shipments made will not require additional road or organizational infrastructure within ORNL. Permitting for RCRA hazardous waste storage will be required to store the waste prior to shipment to disposal. Buildings 7572 and 7574 are currently permitted and will meet the criteria for RCRA permitted units when storage is required.

Waste generation will increase above that for the no-action alternative, for the 73 months that the proposed action is under demolition, construction, and operation. All secondary wastes have disposal paths and can be safely managed. Overall, the costs associated with the temporary increase in waste generation will be offset by the costs of long term continued storage.

4.11 HUMAN HEALTH

The following sections evaluate the human health effects for the no-action alternative and the proposed action under both routine operations and for various accident scenarios. The potential effects are evaluated for the three populations, the facility worker, the collocated worker, and the public. The types of hazards that are present include: radiological exposure, chemical exposure, and energetic hazards (explosions, fire, electrical, and structural collapse). Initiating events for the accidents analyzed include natural phenomena events, mechanical failure, human error, and malevolent acts.

4.11.1 No-Action Alternative

Human health effects for the no-action alternative are analyzed in the current *Building 3019 Complex Safety Analysis Report (SAR*) [ORNL 2004]. The hazards involve principally the containers of material stored in the storage tube vaults. The duration of the hazard is indefinite, given that the no-action alternative is to continue long-term surveillance and maintenance of the facility. It should be noted that the facility was constructed over sixty years ago and that the cost of maintaining the facility in a safe condition will continue to rise due to aging of the structure and components, and the risk that a failure could result in an environmental release will increase.

The hazards associated with routine operations are predominantly radiation exposure to the facility worker, particularly during retrieval of cans from the tube vaults. This exposure is controlled by the ORNL Radiological Protection program and is well below the DOE guidelines for radiation workers. The physical structure of the process cell and tube vault structure shields on-site workers and the public from any external radiation exposure. Another hazard during routine operations, particularly maintenance activities, is the disturbance of fixed radioactive contamination, creating an airborne, respirable particulate. From decades of reprocessing and radioactive material-handling operations, and, particularly from a chemical explosion in 1959, there is fixed contamination that may be encountered.

Normal operations within the Building 3019 Complex have a minimal impact on operating personnel and members of the public. Several controls are implemented to protect on-site personnel and maintain off-site consequences below the evaluation guideline during accident conditions.

The accidents analyzed for the no-action alternative identified several "families" of potential events, including: (1) natural phenomena, (2) fires, (3) material handling accidents and can failures, (4) process accidents, (5) can failure while in a storage tube vault, and, (6) external man-made events. The accident analysis credited the ability of the storage tube vaults and the process cells to withstand facility fire events and the evaluation-basis earthquake event with no structural failure that results in significant damage to the stored materials. The process cell structures were credited with the ability to provide a confinement function for accidental releases that occur within the process cells when ventilation systems are not operational. Room 201 is credited with the ability to provide a confinement function for non-fire events to protect on-site personnel.

The most credible accident that would potentially have an impact on the public is a fire. For small fires in the process cells and outside, the material is assumed to be released at ground level, not resulting in a large plume. Also, based on the fire hazard analysis [*Fire Hazard Analysis for the Radiochemical Development Facility, Building 3019 Complex, at Oak Ridge National Laboratory, Oak Ridge, Tennessee* (UT-B 2003)], a large fire in Cells 1, 2, and 3 is not credible due to the lack of sufficient combustible material in the cell. The cell structure prevents spread of fire from outside the cell into the cell. For large fires in Room 201 and fires involving the whole facility, a heated plume rise was assumed. Still a natural phenomena event (e.g., earthquake or tornado) involving a pressurized can failure produces the highest quantity of respirable airborne material. The consequences were determined assuming the off-site receptors may be at the Graphite Reactor Visitor's Center, Highway 95, Bethel Valley Road, or outside the DOE reservation boundary. The maximum amount of oxide powder or its equivalent permitted outside of Type B packaging in Room 201 (can removed from a tube vault) is 180 g Pu-EID (equivalent inhalation dose). With existing controls in place, the maximum consequence to the public of the bounding scenario was determined to be a dose of 13.1 rem which is below the evaluation guideline requiring designation of safety-class structures, systems and components, as provided in Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports, DOE-STD-3009-94, w/CN 3, US. Department of Energy, Washington, D.C., March 2006. For the majority of the accidents analyzed, the dose was well below one rem.

The material also has a criticality hazard, which is addressed by the criticality safety program. There are no operational drivers that would lead to a scenario wherein criticality could be achieved, and there are minimal opportunities for spilled or otherwise released fissionable material to accumulate and be effectively moderated in an unsafe geometry. Due to the extremely unlikely physical conditions required to achieve criticality without intentional human intervention, occurrence of a criticality accident is not considered credible.

Other hazards evaluated in the SAR and determined either not to pose a substantial risk or not to be present include toxic materials (including combustion products), carcinogens, biohazards, asphyxiants, flammable materials, reactive materials, explosive materials, incompatible chemical reaction products, electrical energy sources, kinetic energy sources, thermal energy sources, high-pressure energy sources, potential energy sources, lasers, accelerators, and X-ray machines.

The SAR identified no accidents which would cause widespread major environmental damage. Numerous controls that act to protect the human receptor will also protect the environment from nonstandard industrial hazards. These features help ensure that facility operations will not adversely impact the environment and that consequences to the environment from accidents are minimized to the extent reasonably achievable.

No unusual, non-nuclear hazards are associated with the Building 3019 Complex. All non-nuclear hazards were determined to be insignificant, routine, or standard industrial hazards.

4.11.2 Proposed Action

Human health effects for the proposed action alternative are analyzed in the Building 3019 Complex SAR (ORNL 2004), and the Draft Preliminary Documented Safety Analysis (PDSA) (Rev. 0-I) [Isotek 2006]. The proposed action can be broken into four project phases with regard to accident analysis as seen in Table 4.2. Each phase is listed below, along with its anticipated duration, based on the proposed schedule:

Table 4.2, Project Phases for Accident Analysis

Phase	Duration
(1) Ongoing surveillance and maintenance	Over life of project, diminishing as material is removed and downblended
(2) Construction and building modifications	Beginning with facility modifications (May 2008 to March 2011)
(3) Material processing and downblending	Beginning after modifications are made and continuing over life of project (July 2012 to Dec. 2014)
(4) Facility stabilization	Beginning after material processing is complete (December 2014 to September 2015)

Ongoing surveillance and maintenance entails the same operations as the no-action alternative, except that it would diminish over the life of the project. Therefore, the hazards would be the same as those discussed in the previous section.

Hazards associated with the construction and building modification phase are similar to those encountered conducting maintenance activities, except that the activities are more extensive and have greater potential for an accident. Handling of radioactive materials would not routinely occur during construction activities. This restriction minimizes the probability of a construction related accident resulting in a release of inventory quantities of radioactive materials. For routine construction activities, the greatest health effect potential would be from disturbing the fixed contamination in the facility. The ^{233}U Stabilization Project's proposed health and safety programs would characterize the areas prior to undertaking any activities and ensure that if contamination is present, workers are wearing the proper personal protection equipment. Localized ventilation and filtration would ensure that the contamination does not spread to other parts of the facility, or beyond the facility, where it could affect on-site workers. The ^{233}U Stabilization Project would implement an Integrated Safety Management Program to evaluate the risks of each activity in order to prevent accidents.

Material processing and downblending includes the processes described in Section 2.1 and, for the purposes of this analysis, Tank P-24 thorium disposition, and NaF trap disposition. Hazards introduced during the material processing and downblending phase of the project include predominantly the radioactive solutions, chemical reagent storage, and ovens (thermal energy) that are not currently present in the Building 3019 Complex. During routine operations, health effects would be limited to the facility worker and would again be exposure to radiation, as well as potential exposure to chemical fumes. The ^{233}U Stabilization Project would have an Industrial Safety program and a Radiation Protection program in place to limit worker exposure to hazardous chemicals to below OSHA guidelines and to radiation to as low as reasonably achievable below DOE guidelines.

Chemical hazards predominantly stem from the potential for exposure to corrosive chemicals that would occur in the unlikely event of system or component failure. In addition to system or component failure, operational failures such as inadvertent activation of the transfer pump during connection of the download line between the tank and the delivery vehicle may also result in chemical exposure. The worst case potential consequences resulting from chemical releases were evaluated in ISO-SAC-004. With the exception of a bulk release of the depleted uranyl nitrate, all potential chemical exposures were determined to be below temporary emergency exposure limits (TEEL-1) off-site and below TEEL-2 on-site. A bulk release of the uranyl nitrate could result in on-site exposures above TEEL-2 levels, but below TEEL-3 levels. The results of this calculation indicate that severe health consequences resulting from the chemical hazards in the proposed process are limited to the facility workers. Protection of the facility workers is provided by the facility health and safety programs which ensures that the facility workers are appropriately trained, aware of potential hazards, and provided the appropriate protective clothing when working with or near hazardous materials.

The quantity of sodium hydroxide (~1000 gal) and nitric acid (~400 gals) is far less than quantities used in commercial applications and in other facilities on the ORNL site. Both of these chemicals are well understood industrial chemical hazards that can be controlled adequately through the implementation of appropriate safety management programs. The uranyl nitrate hazard has been evaluated and determined to have the potential to have significant health effects to facility workers. All of the process chemicals have negligible vapor pressures. Thus the volatilization of these substances and their migration toward receptors that would experience adverse health consequences as a result of exposure is negligible. In addition, the design of handling and distribution systems by which process chemicals will be received and distributed include features such as sumps and double-walled piping to collect any material that breaches containment.

Conceptually, failure of containment of a MSRE sodium fluoride trap could result in the release of a limited amount (a few grams) of fluorine. The concentration of fluorine resulting from such a failure would promptly diminish through hydrolysis of released fluorine to hydrofluoric acid. In the unlikely event of a trap containment failure, the hazard associated with the fluorine and resulting hydrofluoric acid would be limited to the immediate area of the release and pose negligible risk to off-site receptors.

The limits in the Table 4.3 will be utilized in controlling exposures to these chemicals.

Table 4.3, Work Place Exposure Levels

		ACGIH				AIHA		
Substance	**CAS #**	**TWA_8**	**Ceiling**	**STEL**	**Skin Notation**	**ERPG-1**	**ERPG-2**	**ERPG-3**
Sodium hydroxide	1310-73-2	NE	2 mg/m^3	NE	No	0.5 mg/m^3	5 mg/m^3	50 mg/m^3
Nitric acid	7697-37-2	2 ppm	NE	4 ppm	No	1 ppm	6 ppm	78 ppm
Hydrogen fluoride	7664-39-3	0.5 ppm	2 ppm	NE	Yes	2 ppm	20 ppm	50 ppm
Fluorine	7782-41-4	1 ppm	NE	2 ppm	No	0.5 ppm	5 ppm	20 ppm
Uranyl nitrate	10102-06-4	NE	NE	NE	No	NE	NE	NE

Legend:

CAS	Chemical Abstract Service
ACGIH	American Conference of Governmental Industrial Hygienists
TWA_8	Time weighted average exposure averaged over eight hours
STEL	Short term exposure limit averaged over the fifteen minutes of highest exposure
Skin Notation	An indicator established by ACGIH that the dermal route of exposure to a substance is a significant contribution to total body burden of the substance and should be taken into consideration when monitoring and when developing exposure controls.
AIHA	American Industrial Hygiene Association
ERPG	Emergency Response Planning Guide
ERPG-1	The maximum airborne concentration below which nearly all individuals could be exposed for up to one hour without experiencing or developing effects other than mild transient health effects or without perceiving a clearly defined objectionable odor.
ERPG-2	The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action
ERPG-3	The maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to one hr without experiencing or developing life-threatening health effects.

In addition to corrosive chemicals, a limited number of toxic metals are associated with process materials. For example, some materials include cadmium (Cd) as a component. Health effects associated with Cd can be both acute (e.g., metal fume fever and acute pulmonary edema) and chronic (e.g., cancer of the lung and prostate, kidney damage, pulmonary emphysema and bone disease). The Cd-bearing material is present in solid material which is stored in sealed canisters. The canisters will only be opened in a hot cell and immediately dissolved into solution. The likelihood of personnel exposure to Cd-bearing solids is negligible. Where a worker may be exposed to Cd-bearing solutions, radiation protection measures will be adequate to reduce the likelihood of personnel exposure to Cd-bearing liquids to negligible levels. The same conditions and controls will similarly reduce personnel exposure to the non-radiological hazards associated with uranium to negligible levels as well. In the unlikely event of canister failure or uncontrolled release of Cd- or uranium-bearing solutions, the resulting non-radiological hazards would be limited to the immediate area of the release and pose negligible risk to off-site receptors.

Radiological hazards include exposure to both gamma and alpha emitting nuclides. Health effects are dependent on the type of radiation and amount of exposure. An ALARA program will be utilized to ensure exposure to radiation remains ALARA. The following occupation limits will be utilized for general employees:

- Whole Body Total Effective Dose Equivalent (TEDE): 5 rem
- Lens of the Eye: 15 rem
- Shallow Dose Equivalent to the skin: 50 rem
- Dose to the Extremities: 50 rem
- Individual Organ Dose: 50 rem

The PDSA found that the principal difference between hazards associated with the proposed action and those analyzed in the SAR for the current activities in the Building 3019 Complex is the increased risk of a nuclear criticality accident and the increased potential for project activities to disperse radioactive material without the appropriate preventive and mitigative measures (ISO-PDSA-001; Isotek 2006).

The nuclear criticality prevention aspects are integral to the design. Generally the high equity material is handled in safe geometry equipment (4 to 5 inches in diameter). Credible accidents are evaluated to determine the impact during spills, equipment upsets, technician error, and natural phenomena. Design elements (and administrative controls) are adjusted as needed so that an accidental criticality becomes incredible. Criticality control parameters include geometric constraints, spacing, moderation, and the use of sumps. The design and operations are evaluated to ensure criticality safety, and all calculations are independently verified using validated codes in accordance with the ANSI/ANS 8-series standards.

The hazard exposure to off-site receptors was evaluated, and the unmitigated TEDE for the worst-case accident of an earthquake induced fire was found to be ~10 rem which is below the levels requiring designation of safety-class structures, systems and components, as provided in Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports, DOE-STD-3009-94, w/CN 3, U.S. Department of Energy, Washington, D.C., March 2006. However, the design features recommended in the PDSA are expected to reduce the unmitigated dose by one or more orders of magnitude. No accident analyzed exceeded the evaluation guideline; however, if the estimated TEDE exceeded 1 rem, additional design features or controls were recommended.

The initiating event frequencies were qualitatively estimated to fall into one of four annual frequency ranges: $< 10^{-6}$, $10^{-4} > p \geq 10^{-6}$, $10^{-2} > p \geq 10^{-4}$, $10^{-1} > p \geq 10^{-2}$. The frequency estimates is determined using operating experience, industry failure data, standard human error probabilities, natural phenomena frequency data, or engineer judgment, as appropriate and are provided in Table 4.4. This effort is based on the guidance established by the DOE for preparation of nonreactor nuclear facility safety analyses and does not constitute the need for, or expectation of, a probabilistic/quantitative risk assessment (DOE-STD-3009-94).

Table 4.4 Qualitative Likelihood Classification

Range	Estimate Annual Frequency of Occurrence	Description
Anticipated	$10^{-1} > p \geq 10^{-2}$	Incidents that may occur several times during the lifetime of the facility (i.e., incidents that commonly occur)
Unlikely	$10^{-2} > p \geq 10^{-4}$	Accidents that are not anticipated to occur during the lifetime of the facility
Extremely unlikely	$10^{-4} > p \geq 10^{-6}$	Accidents that will probably not occur during the lifetime of the facility
Beyond extremely unlikely	$p > 10^{-6}$	Accidents that will probably not occur during the lifetime of the facility

Reference: DOE-STD-3009-94

Other than the determination of whether or not an event is credible (i.e., frequency $> 10^{-6}$ per year), the frequency is only used for the relative likelihood of the accidents (DOE 2002b).

The health effects associated with facility stabilization are similar to those of maintenance and facility modification; i.e., facility worker exposure to airborne contamination created by disturbing fixed contamination. Also, there would be a hazard due to radioactive and hazardous liquids remaining in process vessels that need to be drained.

Operations associated with the proposed action outside of the Building 3019 Complex have been evaluated to determine the potential human health consequences. These operations include transportation of the product material from the Building 3019 Complex to Buildings 7572 and 7574, storage of the product material in Buildings 7572 and 7574, and configuration of the final shipping package for shipment off-site. A summary of the evaluation based on the potential accident, mitigated consequences and affected population is provided in Table 4.5.

Table 4.5, Summary of Potential Accidents and Consequences

Potential Accidents	Mitigated Consequences	Estimated Annual Frequency	Affected Population
Processes Inside Facility			
Release of radioactive materials due to earthquake	Inhalation of radionuclides resulting in internal off-site dose less than 1 rem	10^{-3}	Facility worker, co-located worker, public
Release of radioactive materials due to high winds/tornados	Inhalation of radionuclides resulting in internal off-site dose of less than 1 rem	10^{-3}	Facility worker, co-located worker, public
Release of radionuclide materials due to fire	Inhalation of radionuclides resulting in internal off-site dose of ~2 rem	10^{-3}	Facility worker, co-located worker
Release of radioactive materials from a pressurized ^{233}U storage canister inside of Process Cell 301	Release contained by Process Cell 301 confinement system, no consequence.	1	Not applicable.
Release of radioactive process materials due to equipment leaks, etc.	Release contained by process cells confinement system.	1	Not applicable.
Failure of uranium oxide containers in storage-container spill during handling	Inhalation of radionuclides resulting in internal off-site dose of less than 1 rem	10^{-3}	Facility worker, co-located worker
Nitric acid release inside facility due to process leak	Exposure may result in severe chemical burns and/or respiratory irritation	10^{-5}	Facility worker
Sodium hydroxide release inside facility due to process leak	Exposure may result in severe chemical burns and/or respiratory irritation	10^{-5}	Facility worker
Inert gases released inside facility due to process leak	Exposure may result in asphyxiation in confined areas	10^{-5}	Facility worker
Uranyl or thorium nitrate solution released inside facility due to process leak	Exposure may result in severe chemical burns and/or respiratory irritation, dermal irritation, and alpha contamination	10^{-5}	Facility worker
Mechanical damage to tank from bumping or other collision	Potential major release of uranyl or thorium nitrate solution	10^{-5}	Facility worker
Chemical corrosion or erosion of uncontained piping	Possible personnel contamination, exposure, and environmental release	10^{-5}	Facility worker
Power outage in Building 3019Complex (due to equipment, operator, or maintenance failure)	Process shutdown resulting in potential exposure to uranium materials and acids	10^{-3}	Facility worker
Loss of ventilation (due to system failure, filter plugging, or malfunction)	Potential positive pressures inside the hot cells, resulting in gas vapors and radionuclides leaking into the work spaces or atmosphere Potential uranium-bearing powder within the hood/equipment; leakage from piping and ductwork into the building work spaces	10^{-3}	Facility worker

Potential Accidents	Mitigated Consequences	Estimated Annual Frequency	Affected Population
Process off-gas failure (due to blower failure, filter plugging, or operator error)	Potential personnel contamination with uranium-bearing powder Potential personnel exposure to gas vapors	10^{-3}	Facility worker
Fan failure (due to filter plugging or operator error)	Potential personnel contamination with uranium-bearing powder	10^{-3}	Facility worker
Catastrophic failure of uranyl nitrate, nitric acid, or NaOH tank	Potential exposure to both personnel co-located and possible exposure to the general public	10^{-4}	Facility worker, co-located worker
Loss of containment during downloading of tanks	Potential exposure of personnel to uranyl nitrate, nitric acid, or NaOH	10^{-4}	Facility worker, co-located worker
Transfer pump inadvertently turned on at the control room while personnel are hooking up the download line to the truck	Potential exposure of personnel to uranyl nitrate, nitric acid, or NaOH	10^{-5}	Facility worker, co-located worker
Failure of the gasket at the truck hookup of the transfer line	Loss of containment and personnel exposure to uranyl nitrate, nitric acid, or NaOH	10^{-5}	Facility worker, co-located worker
Power loss during pumped download of thorium nitrate to truck	No health consequences are associated with this accident	10^{-3}	Facility worker, co-located worker
Blockage of the vent line for the truck to the tank while pumping to the truck	No health consequences are associated with this accident	10^{-5}	Facility worker, co-located worker
Nitric Acid Leak-Receiving Tank			
Catastrophic failure of the nitric acid tank Loss of containment during downloading of tanks Transfer pump inadvertently turned on at the control room while personnel are hooking up the download line to the tank truck Failure of the gasket at the truck hookup of the transfer line	Potential nitric acid exposure to personnel on site and possible environmental release Potential personnel exposure to nitric acid Potential personnel exposure to nitric acid Loss of containment and personnel exposure to nitric acid	10^{-4}	Facility worker, co-located worker

Potential Accidents	Mitigated Consequences	Estimated Annual Frequency	Affected Population
Uranyl Nitrate-Receiving Tank			
Catastrophic failure of the uranyl nitrate tank Loss of containment during downloading of tanks Transfer pump inadvertently turned on at the control room while personnel are hooking up the download line to the tank truck Failure of the gasket at the truck hookup of the transfer line	Potential uranyl nitrate exposure to personnel on site and possible environmental release Potential personnel exposure to uranyl nitrate Potential personnel exposure to uranyl nitrate Loss of containment and personnel exposure to uranyl nitrate	10^{-4}	Facility worker, co-located worker
Other Accidents			
Criticality event with U-233	Criticality event with exposure to both personnel on-site as well as possible release to the environment and exposure to the general public	10^{-6}	Facility worker, Co-located worker

Note: 10^{-5} = 1 in 10,000 chance of occurring

Preliminary calculations indicate that the maximum unmitigated inhalation consequences associated with the product material are:

- Off-site: 0.05 rem per container
- On-site: 3.1 rem per container

These values are for the bounding product container. Transportation activities may involve from 1 to 6 shielded overpack containers resulting in a maximum on-site unmitigated consequence of 18.6 rem. This is a conservative estimate that assumes all of the material is the same as the worst case individual batch of material and the entire volume is released during the unmitigated accident. The impact from this would include a small release and localized contamination. It is clear that even a totally unmitigated accident resulting in release of all material in the containers being transported does not result in on-site or off-site consequences that are above those typical of radioactive material handling operations.

Because each product container may contain more than the Category 3 Threshold Quantity of radioactive materials, a Transportation Safety Document will be required for the on-site transportation of the product containers from Building 3019A to Buildings 7572 and 7574. Safety documentation shall be prepared for the transportation activity between Building 3019A and Buildings7572 and 7574, and these efforts are part the project scope, schedule and budget. However, approved transportation safety documentation is not required until oxide product material is being produced and ready for transport out of Building 3019A.

Once at Building 7572 and 7574, the material will be stored inside the shielded overpack containers. The shielded overpack containers are rugged and heavy containers with lead shielding. The inner product container is also a rugged container with stainless steel walls. The contact dose of the containers is approximately 100 mR/h. It is not anticipated that typical handling accidents in Building 7572 and 7574 will result in release of materials from the rugged packaging. The Documented Safety Analysis (DSA) for current operations at Buildings 7572 and 7574 (DSA-OR-MVSWSF-0019, Rev. 8C, *Documented Safety Analysis for the Melton Valley Solid Waste Storage Facilities*) states that the allowable inventory in each facility is 85 times the Category 2 threshold quantity (TQ) values stated in DOE-STD-1027-92. This equates to 76,500 g of Pu-239 per building.

The material at risk for each of the accident scenarios evaluated in the DSA is given in terms of Pu-EID. This is a method used to provide an "apples to apples" approach to comparing inhalation dose from different mixtures of isotopes. The term 239Pu equivalent inhalation dose (Pu-EID) is used to describe an amount of an isotope or mixture of isotopes that presents an equivalent inhalation dose potential as a quantity of 239Pu. Specific to the proposed action, there are varying amounts of 233U, 232U and Pu in the 3019 inventory. Utilizing Pu-EID normalizes this isotopic mixture to determine and equivalent inhalation dose.

The total current inventory limit for both facilities is above the amount proposed to be stored in the facilities. The product material will be in robust packaging. The potential accident consequences are bounded by the current facility operations.

When the inner containers are being removed from the shielded overpacks and loaded into the shipping container, a maximum of three product containers would be exposed outside of the shielded overpack. Unmitigated consequences resulting from accidents involving three containers will be of a similar magnitude to those associated with the on-site transportation activity.

4.11.3 Malevolent Acts

Malevolent acts were considered during this assessment regarding the release of radioactive material. The potential consequences were analyzed in the PDSA. The PDSA is a mechanism for early agreement between the DOE and its contractor regarding what safety systems and design features are necessary to modify the Building 3019 Complex. Contained in the PDSA is the identification of hazards associated with the project (including malevolent acts) and the evaluation of potential off-site and on-site accident scenarios associated with these hazards. The PDSA has determined that the consequences due to malevolent acts to be no greater than consequences due to natural phenomena events analyzed in this section.

Similar consequences of malevolent acts were analyzed in an Emergency Planning Hazards Assessment (EPHA) that provides the technical basis for emergency planning efforts. The EPHA evaluated hostile acts against the facility including major and minor scenarios and the associated magnitude of release.

After review, consequences due to malevolent acts were determined no greater than those from natural phenomena.

4.12 PERMITS

Permit requirements would apply to all liquid and gaseous emissions from the Building 3019 Complex. The existing ORNL site wide NPDES permit (TN0002941) was issued on December 6, 1996. All liquid effluents are subject to the terms and conditions of the permit or the appropriate waste acceptance criteria. Compliance requirements include sampling and analysis to confirm that total activity, fissile isotopes, and other parameters are within the waste acceptance criteria of the receiving wastewater treatment facility.

The majority of process source emissions from the Building 3019 Complex are discharged through Stack 3020, and some emissions are vented through Stack 3039. 40 CFR 61, Subpart H, monitoring and reporting requirements are applicable to these Building 3019 Complex emission points. Stack 3020 is permitted as Source 73-0112-02 in Title-V Operating Permit Number-556850 issued to DOE as the "Owner" and UT-Battelle as "Operator" on October 21, 2004. Stack 3039 is permitted as Source 73-0112-93 in Title V Operating Permit Number-547563 issued to DOE as the "Owner" and BJC as "Operator" on October 21, 2004. Both permits are scheduled to expire on October 21, 2009, but DOE will initiate the required activities to renew the permits before they expire.

Emission compliance requirements of the permit include limits on particulate matter and visible emissions and no operation of source without control device(s) listed in the application unless otherwise specified in Rule 1200-3. Application to operate a source of radiological and non-radiological process emissions will be prepared by the ^{233}U Stabilization Project and the TDEC will determine whether the source will be permitted separately from other ORNL sources or whether existing ORNL permits will be modified.

The Building 3019 Complex has no RCRA permits, but has RCRA hazardous and PCB waste generator areas. The Building 3019 Complex currently has several satellite accumulation areas and Used Oil collection areas. Generation of RCRA hazardous and PCB wastes would be minimized and appropriate accumulation areas would be established and maintained to accommodate project wastes.

Buildings 7572 and 7574 are currently permitted for storage of RCRA hazardous wastes. The permits will remain in place, with modifications expected to be made to the operator listed on the permit. A RCRA hazardous waste permit will be needed for storage of mixed low level wastes and mixed TRU wastes in Buildings 7572 and 7574.

Permitting efforts related to the ^{233}U Stabilization Project would be routine, with no unusual circumstances expected. Sufficient information exists to prepare applications, and it is expected that permits could be received in a timely manner. No impacts related to permitting are expected.

5. CUMULATIVE IMPACTS

This chapter considers the impacts from other actions that could, along with the potential effects from the proposed action, result in cumulative impacts to the environment. Cumulative impacts are defined as "..the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR 1508.7). Impacts are considered on a cumulative basis because significant effects are often the result of individually minor direct and indirect effects of multiple actions that occur over time. Cumulative impacts should be considered over the "lifetime" of the impacts, rather than only the duration of the action.

Impacts were evaluated in Chapter 4 using the no action alternative as a baseline for comparison against the proposed action. Other actions with similar potential effects to the proposed action could act synergistically or additively with the effects discussed in Chapter 4, thereby increasing the potential adverse or beneficial impacts on a cumulative basis. If a resource area would not be affected as a result of taking an action, there would, of course, be no cumulative impact potentially resulting from the action either.

Identification of other actions that could result in cumulative impacts when combined with the proposed action is based on actions likely to have similar potential impacts within the same geographic area and over the same timeframe. Several projects that involve similar activities resulting in similar impacts have been, or would be, initiated very near the proposed project. These include ORR environmental restoration and D&D actions, continued revitalization of ORNL, operation of the SNS facility in Bethel Valley, and the operation and decommissioning of the Oak Ridge TRU waste treatment facility in Melton Valley.

Cumulative Impacts by Resource Area

Land Use

No major land use changes are anticipated for the area surrounding the Building 3019 Complex. Most of the new construction associated with the revitalization of ORNL is occurring in other portions of the laboratory, and the land use of the Building 3019 Complex area is assumed to remain industrialized. Buildings 7752 and 7754 are located within a fenced in area of Melton Valley and are currently utilized to store RCRA regulated CH-TRU waste. An addition will be added between the two facilities to allow for loading containers for off-site transportation. The buildings are permitted for RCRA waste storage. No cumulative impact to land use would occur.

Air Quality and Noise

Additional air emissions or changes to air quality, as a result of implementation of the proposed action, would be within permit conditions. However, after the completion of the proposed processing activities, the contribution of air emissions from the Building 3019 Complex would be reduced when the facility is put into safe and stable shutdown. This could result in a slight, positive cumulative effect on air quality in the vicinity of ORNL. No cumulative noise impacts were identified.

Geology and Soils
Implementation of the proposed action would not contribute to cumulative impacts on the geology or soils of ORNL or the surrounding area since the proposed activities would occur within a previously disturbed area of the laboratory.

Water Resources
The impact on water resources from the proposed action would be negligible and would not have a cumulative impact. Placing the facility in safe and stable shutdown at the completion of processing activities would have a positive impact.

Ecological Resources
Because the area of the proposed action is a highly disturbed industrial area with limited habitat, impacts on ecological resources would be negligible and would not contribute to cumulative impacts.

Cultural Resources
Building 3019A is a contributing property to the ORNL Historic District. DOE, in consultation with the Tennessee State Historic Preservation Office, determined that the proposed modifications to Building 3019A would not have an adverse effect on the property's eligibility for listing in the NRHP. Therefore, the implementation of the proposed action would not contribute to cumulative effects on historic cultural resources of the ORR.

Socioeconomics and Environmental Justice
Environmental effects from the proposed action on the economy and community infrastructure of the ROI would be negligible. Since most of the construction and operations employment would be filled by the existing area labor force and the short-term nature of the activities, there would be no cumulative impact or change to regional income, housing markets, or the demand for community services. No potential effects to environmental justice were identified from the proposed action or for other projects with a potential to contribute to cumulative effects. Therefore, there would be no cumulative effects on environmental justice.

Utilities
Incremental increases in utilities by addition of identified reasonably foreseeable projects (e.g., new ORNL facilities and the SNS) could have minor cumulative impacts to ORNL and ORR utility infrastructures. However, the proposed action would not contribute to any cumulative impacts.

Transportation
Implementation of the proposed action would not result in appreciable changes to traffic. Likewise, the transport of materials to ORNL for the proposed action and the anticipated transport of waste off-site would not increase substantially from routine operations. No cumulative impacts would be expected.

Waste Management

Cumulative impacts from offsite disposal are expected to be minimal compared to impacts from the quantities of waste already disposed of at disposal sites to be selected for secondary waste.

Human Health

No operations included under the proposed action would increase chemical or radiological emissions for ORNL because operations would be similar to the historical operations of the Building 3019 Complex. However, completion of the project would have many positive impacts, including the elimination of need for safeguards, security, and nuclear criticality controls for the existing ^{233}U material. Placing the facility into safe and stable shutdown for D&D would also have a positive cumulative impact on human health for workers and the public.

Off-site Quantities of ^{233}U

Small quantities of ^{233}U bearing materials are currently stored at Brookhaven National Laboratory, Los Alamos National Laboratory, Materials and Fuels Complex (formerly Argonne West), and other DOE locations. Although there are no current plans to ship these materials to ORNL; if such shipment were to occur, these materials would account for less than a 1% increase in the total amount of material containing ^{233}U at ORNL. If such materials were shipped, materials would be required to meet acceptance criteria for processing in Building 3019A and the shipments would be in full compliance with U. S. Department of Transportation and DOE regulations. Shipping from off-site would be subject to appropriate NEPA review. A one percent increase in material acceptance would equate to approximately twelve drums incoming on four shipments, and six drums of downblended oxide outgoing from the 3019 Building Complex on two shipments to storage. These relatively small quantities would have minimal effect on the schedule, operation, waste generation, storage capacity, or utilities required for the project. However, processing of these small quantities of ^{233}U would have a positive impact on the originating facilities by reducing their inventory subject to safeguard and security controls. Impacts due to the transfer of the MSRE NaF traps are addressed in the MSRE Transportation Documented Safety Analysis. Impacts due to receipts outside of Building 3019 are documented in the Building 3019 PDSA.

Savannah River Site

The proposed action is expected to a have a positive impact on the SRS. Accepting the DUO_3 is consistent with SRS' intent to disposition all DUO_3 and close storage facilities. SRS will experience a cost savings from providing DUO_3 to the project and reduce on-site risks from the continued storage of the material.

Nuclear Fuel Services, Inc

The dissolving of DUO_3 is typical of operations conducted at NFS' Erwin, Tennessee, facility. NFS provides depleted and natural uranium blendstock to clients throughout the southeast. Tankers used in commercial transport and licensed by the NRC will be utilized to ship depleted uranyl nitrate to ORNL. Up to three shipments could be received every two weeks for a period of two months, normalizing thereafter at one shipment every two weeks. The corresponding increase in traffic, accident risk, and air pollution is negligible. No cumulative effects would be anticipated.

Disposal of the ^{233}U

In its current form, the ^{233}U is not in a form suitable for disposal at any licensed and/or permitted disposal facility. The proposed action would have a positive impact of converting the ^{233}U to a form that can be safely managed, treated to the extent necessary to optimize disposal options, and disposed at DOE sites after acceptance criteria are established for those sites. Additional NEPA analysis would be needed to address transportation and disposal.

Decontamination and Decommissioning

The proposed action will prepare the Building 3019 Complex for D&D. No decision has been made on D&D. D&D would be addressed through implementation of the Integrated Facility Disposition Project (IFDP) which would include regulatory document preparation; legacy material and facility characterization; deactivation, decontamination, decommissioning, and demolition; waste and equipment disposition; and remediation of underlying contaminated soil and groundwater. D&D of Building 3019 would be conducted under CERCLA as specified by the Federal Facility Agreement and the Records of Decision for ORNL. While the end state has not been determined, impacts of D&D would be positive in the fact that it supports the Department's mission of completing environmental cleanup of the DOE Oak Ridge Reservation; eliminates a contaminated and deteriorating facility; reduces the costs of surveillance and maintenance of the facility; and eliminates a safety, health, and environmental liability to the Department. In addition, it would positively impact on the landscape adjacent to the Graphite Reactor, which is a National Landmark.

6. LIST OF AGENCIES AND PERSONS CONSULTED

In addition to those persons who provided comments on the draft EA (see Appendix A), the following agencies and persons were contacted for information and data used in the preparation of this EA.

Name	Affiliation	Location	Topic
Lee Barclay	U. S. Fish and Wildlife Service	Cookeville, TN	Endangered Species Act, Section 7 – Informal Consultation
Joseph Garrison	Tennessee Historical Commission	Nashville, TN	National Historic Preservation Act, Section 106 – Compliance

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Attachment
Comment Response Table

	Barry Allen, Director, Centre for Experimental Radiation Oncology ***Letter to Brian DeMonia, December 19, 2006***	
No.	**Comment**	**Response**
1.	I do hope that efforts can be made to extract the Th-229. If so, then other laboratories may be able to take this material for further processing for cancer therapy.	According to the 2004 analysis DOE prepared on this option, thorium extraction does not meet the purpose and need of the current project because it does not eliminate worker safety concerns, particularly over the long term and does not prepare the U-233 from Building 3019 for ultimate disposition offsite. In accordance with the November 2005, Conference Report for the Energy and Water Development and Related Agencies Appropriations Act for Fiscal Year (FY) 2006 and The Department's report to Congress in February 2006 ("Management of ^{233}U Stored at Building 3019, Oak Ridge National Laboratory, Oak Ridge, Tennessee, Preliminary Report to Congress," dated February 8, 2006, to The Honorable Pete V. Domenici, et al.), the thorium extraction has been removed from the project.
	Leonard A. Abbatiello, Chair, LOC, Inc., Oak Ridge Reservation Local Oversight Committee ***Letter to Brian DeMonia, December 19, 2006***	
2.	The LOC regrets that the stored material is no longer slated to be a resource for medical isotope production….The LOC hopes that Congress will reconsider the action that bars DOE from extracting medical isotopes from the U-233 inventory prior to downblending it. It would be unfortunate to lose the opportunity for this part of Oak Ridge's dangerous radioactive legacy to make a positive contribution to humanity, particularly if forgoing the opportunity to extract this valuable isotope does not reduce the human health risks and other potential adverse impacts from processing and storing the U-233. To help fulfill the National Environmental Policy Act objective of effectively informing decision makers (which in this instance may include members of Congress), we ask DOE:	1) The comment deadline was extended to January 12, 2007. 2) The project maintains the primary objectives of eliminating concerns relating to long term storage of 233U in Building 3019, reducing the attractiveness level as weapons material, eliminating the possibility of a nuclear criticality event and to reduce the substantial annual costs associated with safeguards and security. The purpose and need for the proposed action evaluated in the EA to address safeguards and security requirements, eliminate long-term worker safety and criticality concerns, and place the ^{233}U material in storage in preparation for future decisions regarding disposal. See response to Comment 1.

	1) Extend the comment deadline on the draft EA to January 12, 2007…; and, 2) Expand this EA to address the proposal presented in DOE/EA-1488 as an alternative to the current proposal, including presentation of a direct comparison between the estimated costs and the environmental, health and safety, and security and safeguards impacts of this proposal and the proposal considered two years ago.	
Pete Bereolos, PhD, ***Letter to Brian DeMonia, December 21, 2006***		
3.	The major inadequacy of the draft EA is the failure in Section 4.11 to assess the impact on Human Health of the transportation to and indefinite storage of the downblended materials in Buildings 7572 and 7574. Is there an approved SAR for these facilities that covers the type and quantity of materials to be stored there under the Proposed Action?	There is an approved DSA for current operations at Buildings 7572 and 7574 (DSA-OR-MVSWSF-0019, Rev. 8C, Documented Safety Analysis for the Melton Valley Solid Waste Storage Facilities) that states that the allowable inventory in each facility is 85 times the Category 2 TQ values stated in DOE-STD-1027-92. This equates to 76,500 g of Pu-239 EID per building. Please refer to the response to Comment 4 for clarification on Pu-EID. Table 3.6 of the Building 7572 and 7574 DSA provides the total facility radiological limit for the buildings in terms of DOE-STD-1027 Hazard Category 2 threshold quantity (TQ) sum of the fractions (SOF). The limit listed for each facility is 85 (85 times the Category 2 TQ value listed in DOE-STD-1027). The Category 2 TQ for Pu-239 is 900 g. Therefore the facility limit for each building is 76,500 g of Pu-239 with a combined total limit for both facilities of 153,000 g Pu-239. The total inventory of material to be processed by the proposed action is in the range of 130,000 – 135,000 g Pu-EID. It is anticipated that shipment of product material off-site will be on-going during and following processing operations such that the entire inventory is not expected to be present in the storage facilities. However, in the worst case situation where no off-site shipments occur until after processing operations are complete, the total facility inventory would still be lower than that currently allowed in the facilities.

		The storage of downblended materials has been evaluated in a preliminary bounding situation. These calculations (discussed in more detail below) indicate that the potential consequences to the off-site public, co-located on-site workers and facility/transportation workers can be maintained at minimal levels through packaging, tie-down, and administrative controls applied normally for on-site transportation activities associated with radioactive materials. The EA will be revised to include the results of these preliminary evaluations. See the specific revision to the EA provided in the Comment 4 Response. The project also acknowledges the need for safety documentation for the operation of Buildings 7572 and 7574 to store the down-blended material. This is due to the changes in material type, containers and accident scenarios between the current DSA and those accident scenarios associated with the downblended material. This effort is included in the project scope, schedule, and budget and will be initiated upon turnover of the facilities to Isotek. Approval of this safety documentation is not required until oxide product material is being produced and ready for transport to Buildings 7572 and 7574. The results of preliminary scoping calculations (discussed in more detail below) indicate that the potential consequences to the off-site public, co-located on-site workers, and facility workers can be maintained at minimal levels through a combination of packaging and handling requirements. No significant structural or ventilation upgrades are anticipated for the buildings.
4.	These facilities will have accident scenarios similar to those in the No-Action Alternative, but the consequences will be much greater as Buildings 7572 and 7574 do not have the safety structures, systems and components (facility structure, ventilation system, robust storage containers, surveillance program, administrative controls, etc.) currently present in Building 3019A. Natural phenomena, fire and sabotage events will involve the entire inventory of downblended material which will be several orders of magnitude greater than the 180 g Pu-EID of the No-Action Alternative. Based on the values in DOE/EA-1488 and ORNL/TM-2002/167, this quantity will be on the order of 30000 g Pu-EID. Thus, the 13.1 rem bounding dose from the Building 3019A SAR proportions to a dose of over 2000 rem to the public. The dose to facility workers and collocated workers will be higher still. The lack of mitigators in Buildings 7572 and 7574 will likely also result in greater release fractions during accident scenarios and may also increase the probability of such accidents, both of which would increase the dose further.	The Department disagrees with the commenter's assumptions and analysis; however, the EA has been revised to provide additional information concerning the storage in Buildings 7572 and 7574. In the Building 3019 Complex, the potential consequences are determined using several conservative assumptions based on the uncertainty associated with material form and packaging conditions. The existing material is contained in numerous different packaging configurations and exists in various material forms. Packaging ranges from thin walled produce cans to heavy walled steel packages. Material forms vary from finely divided powders to solid oxide monoliths. The maximum dose referenced by the comment results from a pressurized release of an oxide powder. The pressurized release results in a very high potential airborne release fraction. The pressurized release is assumed to result from rapid release of gases assumed to have built up in the sealed canister during the decades of storage inside Building 3019A. The material form and packaging associated with the radioactive materials to be stored in Building 7572 and 7574 are quite different from those in Building 3019A.

		The assumption that the quantity being on the order of 30,000 g Pu-EID is incorrect. The material will be a granular UO_3 material. The product material will have much larger typical particle size than that assumed in the existing facility safety basis documentation resulting in a lower potential airborne release fraction (ref. ISO-WP-2006-016, Determination of Airborne Release Fractions (ARFs) and Respirable Fractions (RFs) for the Oxide Product Material). Additionally, the product material will be packaged inside of a vented primary container and, during transport and storage, will be inside a shielded overpack container that will provide significant physical protection from external forces. The comment states that the entire inventory of material will be at risk to natural phenomena, fire and sabotage events. Theoretically, the entire inventory of material could be present in the buildings awaiting transportation to the final disposition location. However, the actual inventory will be much lower during most of the time the facilities are used to store the downblended material. No accident event has been identified that could credibly result in damage to large numbers of the shielded overpacks. However, assuming that 100% of the product material is present in the facility and all of the material in the facility is released from its packaging, preliminary scoping calculations indicate that the unmitigated off-site consequence is approximately 14-rem. Significant on-site consequences could result. The safety basis approach to prevent significant on-site consequences takes into account the inner container and shielded overpack packaging configuration to prevent common mode failure of multiple containers during postulated design basis accidents. The product material will be in robust packaging. Current analyses show that the potential accident consequences are less than the No Action Alternative. The EA has been revised to add the following to the end of Section 4.11.2: *"Operations associated with the proposed action outside of the Building 3019 Complex have been evaluated to determine the potential human health consequences. These operations include transportation of the product material from the Building 3019 Complex to Buildings 7572 and 7574, storage of the product material in Buildings 7572 and 7574, and configuration of the final shipping package for shipment off-site.*

		Preliminary calculations indicate that the maximum unmitigated inhalation consequences associated with the product material are: • *Off-site: 0.05 rem per container* • *On-site: 3.1 rem per container* *These values are for the bounding product container. Transportation activities may involve from 1 to 6 shielded overpack containers resulting in a maximum on-site unmitigated consequence of 18.6 rem. This is a conservative estimate that assumes all of the material is the same as the worst case individual batch of material and the entire volume is released during the unmitigated accident. The impact from this would include a small release and localized contamination. It is clear that even a totally unmitigated accident resulting in release of all material in the containers being transported does not result in on-site or off-site consequences that are above those typical of radioactive material handling operations.* *Because each product container may contain more than the Category 3 Threshold Quantity of radioactive materials, a Transportation Safety Document will be required for the on-site transportation of the product containers from Building 3019A to Buildings 7572 and 7574. Safety documentation shall be prepared for the transportation activity between Building 3019A and Buildings 7572 and 7574, and these efforts are part of the project scope, schedule, and budget. However, approved transportation safety documentation is not required until oxide product material is being produced and ready for transport out of Building 3019A.* *Once at Building 7572 and 7574, the material will be stored inside the shielded overpack containers. The shielded overpack containers are rugged and heavy containers with lead shielding. The inner product container is also a rugged container with stainless steel walls. The contact dose of the containers is approximately 100 mR/h. It is not anticipated that typical handling accidents in Building 7572 and 7574 will result in release of materials from the rugged packaging. The DSA for current operations at Buildings 7572 and 7574 (DSA-OR-MVSWSF-0019, Rev. 8C, Documented Safety Analysis for the Melton Valley Solid Waste Storage Facilities) states that the allowable*

		inventory in each facility is 85 times the Category 2 TQ values stated in DOE-STD-1027-92. This equates to 76,500 g of Pu-239 per building. *The material at risk for each of the accident scenarios evaluated in the DSA is given in terms of Pu-EID. This is a method used to provide an "apples to apples" approach to comparing inhalation dose from different mixtures of isotopes. The term 239Pu equivalent inhalation dose (Pu-EID) is used to describe an amount of an isotope or mixture of isotopes that presents an equivalent inhalation dose potential as a quantity of 239Pu. Specific to the proposed action, there are varying amounts of 233U, 232U and Pu in the 3019 inventory. Utilizing Pu-EID normalizes this isotopic mixture to determine an equivalent inhalation dose.* *The total current inventory limit for both facilities is above the amount proposed to be stored in the facilities. The product material will be in robust packaging. The potential accident consequences are bounded by the current facility operations.* *When the inner containers are being removed from the shielded overpacks and loaded into the shipping container, a maximum of three product containers would be exposed outside of the shielded overpack. Unmitigated consequences resulting from accidents involving three containers will be of a similar magnitude to those associated with the on-site transportation activity."*
5.	Section 2 discusses a limited number of alternatives to the Proposed Action. In 1999, a report (ORNL/TM-13553) considered a number of disposition options for U-233. Most of these options are unsuitable for medical isotope extraction and likely were not considered in DOE/EA-1488 for that reason. However, now that medical isotope extraction is no longer proposed, these options should all be reconsidered versus the aqueous nitrate blending process of the Proposed Action (which was identified as a high-cost option). A few of the more likely candidates are the following: - Melt dilute. This option was selected by DOE for dealing with spent nuclear fuel. This technology has been demonstrated on a pilot-scale at the SRS and a mobile module is being developed. Since this process dissolves U-233 and its package, this option has the advantage of avoiding most unpackaging operations, which are particularly difficult for monolithic materials (~40% of the packages in the U-233 inventory).	The commenter is correct in concluding that most of the disposition options for the ^{233}U that were included in the technical evaluations documented by ORNL/TM-13553 are unsuitable. They will be added to the EA in Section 2.3 as described in this response as alternatives considered but not analyzed in detail. ORNL/TM-13553 was considered in developing the 2004 EA/FONSI and the current EA (DOE/EA-1574).. These technical evaluations included conclusions about the then current (1999) state of the available technologies. Generally the state of the technologies has not changed substantially since that time and the Department has selected a path forward that offers the lowest overall risk in accomplishing Congress' direction for processing and dispositioning the ^{233}U materials in an expeditious manner.

	- Co-processing with TRU waste. This is a low-cost option. Since the1999 report, facilities have been built and are operational at ORNL and Hanford. - Chemical dilution. This is the lowest cost option because it relies on mass limits rather than isotopic dilution as the criticality control strategy. Essentially, U-233 is discarded in small quantities with other TRU wastes	All of the options suggested by the commenter require the creation of new facilities due to the peculiar properties of ^{233}U. The cost of these facilities is driven by the radiological and fissile properties of the ^{233}U material. That is, the material must be remotely handled behind heavy shield walls and must be handled in small quantities or in small diameter pipes (i.e., 4-5 inches). These characteristics dictate the equipment arrangements that in turn drive the cost of design, construction, startup-up and operation. The opportunities for cost savings lie in the ancillary and supporting systems such as waste generation, ventilation, maintenance, analytical support, etc. Due to the various forms of the current inventory the Department has selected the aqueous process based on its ability to stabilize the inventory while minimizing preprocessing requirements. As identified in the Department's implementation plan for Defense Nuclear Facilities Safety Board recommendation 97-1, many of the canisters do not meet the criteria for ^{233}U storage as defined in DOE-STD-3028. While these canisters are safe in the Building 3019 vaults, they would have to be repackaged to be able to transport the material away from Building 3019. Equipment needed for such repackaging is similar to the canister opening operation already planned for the U233 Stabilization Project. Such repackaging adds an unnecessary handling operation, introduces additional worker risk and extends project completion regardless of technology deployed. This and the need to construct new facilities elsewhere are primary considerations in the Department's conclusion that processing in other than Building 3019 does not represent the lowest risk, best value to the government. The ORNL/TM-13553, Section ES.4.3 discussion on aqueous processing concluded "…This is the only process that has been used on an industrial scale, and it is the only fully demonstrated technology...The process might be more expensive than some of the other options, however, it is the only process for which risks are fully understood and cost estimates can be easily developed." The Department agrees that there may be opportunities to process small volumes from the inventory (in current form) in established on-site processes. If deemed cost effective and if processing can be conducted safely, the Department may exercise on-site options on a limited basis. In response to comments on the suggested alternative technologies, the following text has been added to Section 2.3.6 of the EA,

		"Melt and Dilute is another alterative based at the SRS, in conjunction with Argonne National Laboratory, developing the process for dispositioning spent research reactor fuel by melting the fuel assemblies in molten aluminum and diluting with depleted uranium. Proof of principle testing has been performed (reference: WSRC-MS-2004-00782 A Mobile Melt-Dilute Module For The Treatment Of Aluminum Research Reactor Spent Fuel). The technology has three significant disadvantages: • *It has not been demonstrated under production conditions.* • *It will increase the disposal volume by 3 to 20 times due to the aluminum that is added to dissolve the canister and the uranium.* • *It could not be used to disposition the fluoride materials due to their volatility when heated; an additional process would have to be established to first convert the fluoride material to an oxide or metallic form.* *The Department concludes that while the technology may have merit, pilot testing, design and construction of production facilities would significantly extend the duration of the U233 Dispositioning Project and therefore was eliminated from further consideration."* Section 2.3.8 has been added to the EA as follows: ***"2.3.8 Co-Processing with TRU Waste*** *Most of the ^{233}U material has plutonium contamination such that the material, after blenddown, will meet the 100 nanoCuries per gram threshold for being classified as TRU material. Since such processing would require design and construction (or modification) of facilities on the ORNL reservation to be able to process and downblend the ^{233}U material, there is no advantage to considering this as a viable alternative to processing in Building 3019. It would require the additional operations of retrieval, packaging for transport, and transporting the canisters of material to an alternate processing facility.*

		In addition, current information indicates that the total volume of TRU at OR will be significantly less than the original estimate and most of it will have been dispositioned prior to having capabilities in place on an industrial scale to handle the ^{233}U. Thus there is not enough TRU material to dilute a significant portion of the ^{233}U This may be a viable disposition path for small quantities of fissile material but is not considered to be viable for the amount of material stored in Building 3019." Section 2.3.9 has been added to the EA as follows: ***"2.3.9 Chemical dilution*** *This technology involves adding 200 grams or less of fissile material to a burial package that contains other materials such as concrete, steel, grout or other materials. The ^{233}U and other fissile material would remain as weapons-usable assay so policy questions would have to be addressed relative to safeguarding the material after dispositioning. Most of the canisters contain more than 200 grams of fissile material so facilities would need to be designed and installed to open the canisters, subdivide the contents into quantities not exceeding 200 grams then adding the fissile material to the other material matrix. The product packaging must also address the extent of immobilization of the fissile material and treatment of hazardous constituents to meet transportation and waste acceptance criteria. If such material were to be dispositioned at WIPP, the number of waste canisters would increase by about a factor of 10 and would extend the project completion by about 80 years. This may be a viable disposition path for small quantities of fissile material but is not considered to be viable for the amount of material stored in Building 3019."*
6.	These, among other options, would all put the material in a form that would be suitable for disposal at the WIPP (which is the DOE's stated pathway for disposal of this material despite the fact that the downblended materials will not meet the WIPP's current waste acceptance criteria). The 1999 report also details several options that would put the material in a form suitable for disposal in a Yucca Mountain-type repository. Why are none of these previously identified alternatives considered in the draft EA?	The Department's License Application for Yucca Mountain will address intact and canistered spent nuclear fuel and vitrified high level waste only. The ^{233}U in its current or downblended forms will not meet the anticipated WAC for Yucca Mountain. The schedule for Yucca Mountain and the capacity for Yucca Mountain cannot accommodate this project's needs further reinforcing this as an unviable option. Also see the response to Comment 34.

7.	There are also a couple of alternatives beyond those proposed in the 1999 report. In June 2006, DOE announced agreements between INL and NorthStar Nuclear Medicine, Inc. to extract medical isotopes from the U-233 fuel stored at INL. INL has a reported inventory of U-233 similar in quantity to ORNL's, but it is mixed with ~14 metric tons of natural thorium. The U-233 in storage at ORNL is much more suitable for that program as it does not have the natural thorium contamination. Furthermore, the INL/North Star agreement means that the materials indicated in Section 2.3.4 will likely not be available if thorium fuel cycle development is resumed.	In addition to the response to Comment 5, see also the response to Comment 1.
8.	DOE is also pursuing a disposition path for highly-enriched uranium which involves downblending it to a level suitable for use in a reactor. This pathway would recover the energy value of the material and be suitable for U-233 with low-levels of U-232, which does not have an elevated radiation level. Much of the U-233 inventory was created for use in fuel programs. Why are neither of these alternatives considered in the draft EA?	The disposition path for highly-enriched uranium is dependent on the existing fuel processing and fabrication infrastructure for supplying commercial nuclear reactors. The ^{233}U material was created for the purpose of providing an alternate fissionable material to be used in reactors. Since the early 1950s, both uranium supplies and enrichment capabilities have grown and their economics have improved to render the ^{233}U fuel cycle non-competitive. There are no U.S. facilities capable of fabricating downblended ^{233}U into fuel rods and assemblies for use in reactors; therefore, this is not considered a viable alternative.
9.	In Section 2.3.6, the option to process the material at SRS is rejected partially on the basis of cost. However, the costs mentioned in this section appear inconsistent with those of the Proposed Action. The cost of the Proposed Action has been reported to be ~$380M. The estimate to process the materials in H-Canyon (above the costs of repackaging it into a form that can go directly into the process) is estimated to be over $1B dollars. Why does it cost so much more to run the same process at SRS? There should be considerable cost savings as there would be no construction costs (H-Canyon is already an operating facility), security upgrades, or transportation of DU (which is already at SRS). It appears that either the SRS estimate is grossly high or the Proposed Action estimate is grossly low.	The $1 billion cost for processing at H-Canyon includes the pre-processing that would have to be performed at ORNL to prepare the material for transport to SRS. Approximately 85% of the current planned operations at Building 3019 would need to be conducted in order to prepare the material for shipment to SRS. In addition, the DU at SRS would still require shipment offsite to NFS for processing to a DUN solution. The Building 3019 costs for shipment combined with the DU processing and H-Canyon operations result in elimination of this alternative from further evaluation.
10.	The document needs to go through technical editing. Editing marks are still visible on nearly every page. Text discussing Figure 2.1 refers to Figure 2.2 and vice versa.	Technical editing of the final EA was completed prior to its release.

11.	Overall, this draft does an insufficient job in assessing the environmental impact of the Proposed Action. There will be significant impact from storing the downblended materials in Buildings 7572 and 7574 and this hazard is not evaluated at all. Several previously identified alternatives to the Proposed Action are not considered. Based on the information in this draft, I do not believe it supports a Finding of No Significant Impact.	Bounding calculations have been performed to evaluate the hazards associated with storage in Buildings 7572 and 7574 and a summary provided in Section 4.11.2. Final design of the project includes the preparation of safety documentation for transportation and for Building 7572 and 7574 operations. Details of these preliminary bounding evaluations for storage in Buildings 7572 and 7574 have been added to the EA. See response to comment 4 above. Section 2.3 of the EA details alternatives, in addition to the response to Comment 4 above, that were considered but not analyzed and provides the basis of why these were not considered for further evaluation
	Alan M. Krichinsky, ***Letter to Brian DeMonia January 10, 2007***	
12.	A small portion of the ORNL inventory is very pure material that is ***essential*** for qualifying analytical techniques used in quantitatively determining uranium concentrations and isotopic compositions (see EA Section 2.3.5) that are needed for safeguards, homeland security, NNSA, environmental monitoring, etc. According to the responsible DOE supervisory scientist, the material needed for this use is "the purest U-233 available, but preferably at least 99.9% pure." Material currently identified for retention is less than 98.5% U-233 isotopic purity and, as such, is not suitable for this crucial need. The DOE supervisory scientist responsible for maintaining this capability is **Steven A. Goldberg.** Contact Information from the online directory is: Phone: 630-252-2464 Fax: 630-252-6256 Route Symbol: SC-CH Building: BLDG 350 Location: ARGONNE IL Organization: Mass Spectrometry and Spectroscopy Division Title: SUPERVISORY PHYSICAL SCIENTIST (MASS SPECTROMETRIST) Internet Address: Steven. Goldberg(ch.doe.gov It is crucial that this most pure U-233 be retained for this essential use.	To date, no interested parties have established the priority and funding to transfer the material for continued storage and possible future use. The Department continues to work with parties expressing interest in the material.

13.	A large portion of the inventory is comprised of the highly radioactive, low isotopic quality material known as CEU or CEUSP (acronyms for the Consolidated Edison Uranium and its Solidification Program). In many ways, this material resembles spent nuclear fuel (SNF) from reactors fueled with highly enriched uranium (HEU) – based on the CEU's fissile concentration, radiation levels, monolithic material form (which is not dispersible, and which is a disposal form itself), and packaging (welded-shut, clad-like stainless steel cans). It is recommended that this material **not** be down blended. Instead, it is recommended that it be over-packed in 4-inch diameter, welded shut, stainless-steel pipe with five or six cans stacked end-to-end within the over-pack and managed in a manner similar to SNF. In this configuration and due to its similarity to SNF, each filled over-pack: • Will resemble – and may be handled as if they were – SNF fuel rods from a physical standpoint (regarding both the material form and the packaging). • Will contain HEU at concentrations similar to SNF from HEU-fueled reactors (requiring similar precautions). • Will emit radiation levels exceeding those of SNF from research reactors, and even approach that of low burn-up power-reactor fuel. Radiation levels from packages in this configuration also will allow characterizing the CEU packages as moderately self-protecting (Attractiveness Level B), and will avoid Safeguards Category I requirements. It is suggested further that, once it has been reconfigured for handling in a manner similar to SNF, the CEU be transferred to INL for storage with stainless steel-clad SNF containing HEU awaiting disposition/treatment decisions. Any processing to be employed for dealing with SNF containing HEU could be applied directly to the CEU material. In exchange for Idaho receiving this material, Tennessee could offer services to Idaho related to destroying toxic wastes in the TSCA incinerator located at the East Tennessee Technology Park. Handling the CEU in this manner will avoid the risks of processing this hazardous material (which poses the greatest hazard of any single batch in the entire U-233 inventory); will avoid the use, recovery and disposal of the majority of nitric acid needed for the entire down blend project; and will shorten operations by saving processing time (although, admittedly, some of the saved time will be used in preparing for and performing the much-less-hazardous over-packing operations).	The Department's license application for Yucca Mountain only addresses canistered spent nuclear fuel and vitrified high level waste. The CEUSP is neither of these and therefore, this is not considered to be a viable option.

	This opportunity to reduce substantially the environmental risk related to processing the CEU material should be considered seriously, evaluated, and pursued.	
14.	In next to last paragraph of Section 1.2.1, the threshold for non-weapons usable 233U is indicated parenthetically as <12 wt% 233U in 238U. This threshold should be verified. [I recall a <10 wt% threshold.]	ORNL/TM-13517 *Definition of Weapons-Usable Uranium-233* concluded that 12% is the threshold for ^{233}U.
15.	In the discussion in Section 1.2.4 on the adjoining 3019B facility, there is no mention of the issue regarding perchlorate residues in the ventilation ducts. Since perchlorates are notoriously unstable (and destructive) and since these ducts are connected to 3019A ducts, then the potential impact of this hazard should be recognized and evaluated in the EA.	Perchlorate residues are addressed and evaluated in the existing facility DSA. Damage due to a postulated perchlorate explosion is limited to the ventilation ductwork located on the roof. The proposed operations will have no impact on either the likelihood or the consequences of this event. Perchlorate contamination is included in the list of legacy issues in Section 1.2.4 (3rd bullet). Impact from a perchlorate explosion would result in damage to the ventilation system resulting in shutdown of downblending operations until the ventilation system was repaired.
16.	Figure designations in the text throughout Section 2 reference the wrong figures (e.g., based on the text of Section 2: the first reference to Figure 2.1 should reference Figure 1.1, the second reference of Figure 2.1 should reference Figure 2.2, etc. - as the figures currently appear in the report).	Figure designations have been corrected throughout the document.
17.	In Section 2.1.5, there is mention of shielded overpacks but there is no further discussion of these items. What is the shielding material? What is the environmental impact of using this material? Is there any synergy ("credit" due to reducing overall environmental impact) that will result because the over packs will be employing some hazardous waste materials (e.g., contaminated lead) as shielding that otherwise would be more difficult and more costly to dispose?	Section 2.1.5 of the EA has been revised to add the following in the fourth paragraph: *"The shielded overpacks will have lead on all sides to allow the material to be contact handled. The environmental impact of using this material is expected to be favorable since lead used to fabricate the procured shielded overpacks is anticipated to come primarily from the recycling of lead stored at DOE sites. The use of recyclable lead (contaminated or not) that is currently in storage is expected to reduce the potential for environmental impacts such as contamination of stormwater runoff. The fabrication of shielded overpacks also provides a beneficial use for the lead and will potentially preclude having to spend federal dollars on the continued storage, management, and ultimate disposal of this material."*

18.	In Section 2.1.6 and Section 3.9.3, there is no mention of the substantial liquid wastes that will be generated from scrubbing the NOx-laden off-gas stream. Based on the third paragraph in Section 4.10.2, the resultant nitric acid will not be reconstituted and recycled. The discussion of impact in this paragraph indicates that the ORNL LLW treatment system ***can*** handle the increased generation rate of liquid low-level waste (LLLW) anticipated during the down blend project. However, does this conclusion consider reductions in LLLW treatment capacity that are planned before down blend operations?	The volume of liquid low-level waste generated from the NO_x scrubber is estimated to be approximately 6,300 gallons per week. Preliminary planning discussions have been held with ORNL LLW Treatment Facility personnel, and treatment capacity is expected to be available during the duration of the project. Section 4.10.2, 1st full paragraph after the bullets, second to last sentence, has been revised to add the following to the end of the sentence: *"throughout the processing campaign"*.
19.	The last sentence of Section 2.2 states that: "Due to its fissile content of the Building 3019 inventory the material must be processed prior to determining final disposition." However, the determination of final disposition must be made ***prior to processing*** to avoid the need for additional processing to meet a final disposition that may be different from that originally planned. One must know where the material is going ***before*** getting it ready to go there!	See response to Comment 34, second paragraph.
20.	In Section 2.3.4, the materials cited as being available from Idaho National Laboratory also are slated for ultimate disposition to a waste repository and will not be available for possible use in the future as stated.	The Department has no current plans to pursue the Thorium Fuel Cycle. Therefore, the unavailability of the INL inventory has not impact on the conclusions of the EA.
21.	The discussion of alternatives in Section 2.3 ignores several alternative processes (presented in ORNL/TM-13553) that were discarded previously - in most cases, due solely to the intended recovery of thorium-229 for cancer trials and subsequent therapeutic use. Without thorium recovery, the premature discard of these alternative processes needs to be revisited. I recommend that a trade study be performed to re-evaluate prior decisions that led to selecting the aqueous process.	ORNL/TM-13553 was considered in developing the path forward for the 2004 EA/FONSI and for the more recent DOE/EA-1574. These technical evaluations included conclusions about the then current (1999) state of the available technologies. Generally the state of the technologies has not changed substantially, and the Department has selected a path forward that offers the lowest overall risk in accomplishing Congress' direction for dispositioning the ^{233}U materials in an expeditious manner.

		All of the options require the creation of new facilities due to the peculiar properties of ^{233}U. The cost of these facilities is driven by the radiological and fissile properties of the ^{233}U material. That is, the material must be remotely handled behind heavy shield walls and must be handled in small quantities or in small diameter pipes (i.e., 4-5 inches). These characteristics dictate the equipment arrangements that in turn drive the cost of design, construction, startup-up and operation. The opportunities for cost savings lie in the ancillary and supporting systems such as waste generation, ventilation, maintenance, analytical support, etc. Due to the various forms of the current inventory the Department has selected the aqueous process based on its ability to stabilize the inventory while minimizing preprocessing requirements As identified in the Department's implementation plan for Defense Nuclear Facilities Safety Board recommendation 97-1, many of the canisters do not meet the criteria for ^{233}U storage as defined in DOE-STD-3028. While these canisters are safe in the Building 3019 vaults, they would have to be repackaged to be able to transport the material away from Building 3019. Equipment needed for such repackaging is similar to the canister opening operation already planned for the ^{233}U Stabilitzation Project. Such repackaging adds an unnecessary handling operation and extends project completion regardless of technology deployed. This and the need to construct new facilities elsewhere are primary considerations in the Department's conclusion that processing in other than Building 3019 does not represent the lowest risk, best value to the government. The Department agrees that there may be opportunities to process small volumes from the inventory (in current form) in established on-site processes. If deemed cost effective and if processing can be conducted safely, the Department may exercise on-site options on a limited basis. The ORNL/TM-13553, Section ES.4.3 discussion on aqueous processing concluded "…This is the only process that has been used on an industrial scale, and it is the only fully demonstrated technology...The process might be more expensive than some of the other options, however, it is the only process for which risks are fully understood and cost estimates can be easily developed."

22.	Some of the arguments against the alternative processes lack discussion on par with the proposed (aqueous nitrate) down blend process. For example, the argument in Section 2.3.7 that the smaller particle size poses a substantial health hazard due to deep lung exposure does not mention, for comparison, the particle size of the starting material as currently stored. Nor does this hazard discussion provide any perspective regarding the (presumably lower) hazard of the proposed process. In addition, the argument that dry blending would require 17 years of processing (due to small batch size) does not seem to consider multiple, small blending units operating in parallel - as is done during denitration for the proposed process. It should be realized that scale up of blending is not as difficult as scale up of wet processes. The major need for ensuring operability of a V-blender is unit testing to determine an optimal operating time for effecting the desired blending. If each V-blender could handle up to 185 grams of U-233 (the minimum critical mass for a fully moderated and reflected U-233 system; according to LA-12659-MS) plus ~37 kg of DU (to result in 0.5 wt% U-233 in the down blend), and if each blender could blend a batch within 8 hours (a reasonable period that includes blender filling, blending, sampling, analysis and blender cleanout), then each blender should be able to produce over 22,000 kg of heavy metal (HM) down blended each year (operating 3 cycles per day, 5 days per week). If there are 4 blenders operating in parallel (similar to the parallelism in the proposed process), then the annual throughput would be over 88,000 kg HM down blended each year! If ~212,000 kg of depleted uranium are needed for the down blend project (based on amount given in EA Section 2.1.4 and a presumed 83.2% uranium content), then total processing time for a four blender system would be less than 2-½ years! Furthermore, dry blending has two additional, significant advantages over denitration equipment: • Dry blending avoids the substantial liquid waste generation, treatment, and disposal that is inherent to denitration. • Blenders are more reliable to operate than denitrators (which are prone to plugging and molten salt freezing).	The reference to small particle size relates to the dry blending option that requires micronization of the powder to achieve inseparable blending. As a result, essentially all of the dry material (including the depleted uranium) then falls into the respirable size since the particle size is less than 10 micron. In the aqueous processing, small quantities being input into the dissolver may be less than 10 micron, and these have been conservatively modeled in the safety basis. The process for conversion to oxide has been selected because it is demonstrated to produce a material size significantly greater than that considered to be respirable. Due to lack of available floor space in 3019 the scenario described in the comment would not be feasible. A dry blending facility concept was suggested by INEEL (*Nuclear Isotopic Dilution Of Highly Enriched Uranium By Dry Blending Via The Rm-2 Mill Technology*, Raj K Rajamani et al, August 2003). The 10 by 52 foot facility would produce 40 kilograms of blended product per operating day. The 233U Stabilization Project will generate up to 250,000 kilograms of blended product, so a similar dry-blending facility would require more than 5000 operating days. Assuming 250 operating days per year, this is about 20 years of operation. The operations would have to take place in shielded hot cells, instead of glove boxes identified in the report, which adds complexity in design, startup and operation. Dry blending increases the solid waste volume due to the grinding medium used (it becomes part of the waste). Dry blending cannot handle the fluoride salts, and additional facilities must be constructed to convert the salts into an oxide form. For these reasons the option is not considered to be viable. Relative to the advantages of dry blending described by the commenter, the capacity to manage the liquid waste resulting from the denitration process exists at ORNL facilities. Any advantage that the dry blending process offers in the way of reduced liquid waste generation is offset by the volume of solid secondary waste generated that would require disposal off-site. Liquid waste generated can be transferred to on-site treatment facilities through a totally enclosed system minimizing handling and worker exposure. In addition, the denitrators have operated successfully in the Oak Ridge area for over 30 years. Therefore, the generation of liquid waste is not considered to be a disadvantage of dry blending.

23.	In Section 3.3 and Section 4.3.2, the geology under Building 3019 Complex is discussed without any conclusion of stability. Also, the stability of the geology under Buildings 7572 and 7574 is not discussed at all. All three of these buildings are or will be Hazard Category II nuclear facilities. The ground stability for all 3 buildings should be discussed.	The potential effects of seismic forces on the Building 3019 facility structure have been evaluated both in the existing DSA for the facility and in the PDSA for the proposed operations. The results of these evaluations are currently presented in the EA. The DSA for 7572 and 7574 is for operation of a Hazard Category II nuclear facility. The potential effects of seismic forces on the buildings, as documented in the DSA for current operations and potential consequences, are determined to be in the "Low" category.
24.	In the third paragraph of Section 4.2.2, the conclusions in the discussion on emissions during processing operations (that there was no contribution from stack 3020) are drawn from experience gained during a period of dormant U-233 storage (2005) – when one would not even suspect U-233-related emissions to be a major contributor to off-site doses. Some evaluation should be included to demonstrate that the expected emissions from U-233 down blend operations, indeed, will not be a major contributor to off-site doses. Furthermore, given imperfect emission reduction equipment, process upsets and equipment malfunction, it is not reasonable to conclude that, "…..there is no potential impact from stack 3039 from the proposed project."	Appropriate filtering, radioactive decay and scrubbing systems will be employed to ensure that radioactive releases are as low as is reasonably achievable. Air permits will be maintained to address the emissions associate with the project. Emissions from 3020 will be monitored during the proposed project to ensure releases will have no impact in excess of current release levels for ORNL. The project does not include changes that will increase the stack 3039 effluents. As stated in the EA, there is no process off-gas discharge through this point and therefore there is no adverse impact from stack 3039 from the proposed project. Process upset and equipment malfunction are discussed in Section 4.11 Human Health under various accident scenarios.
25.	In the fifth paragraph of Section 4.2.2, the discussion on NOx emissions leads one to conclude that over 1/ 4 of all NOx generated (40 tons of the 140 tons generated per year) will be released to the atmosphere. This seems like a high release fraction that should be able to be reduced within the facility space constraints and without incurring substantial additional operating cost (although larger or additional equipment would be required). This should be evaluated.	The NOx emissions are bounding estimates for the purpose of determining environmental impact. A NOx scrubber is planned to reduce the air emissions to as low as is practical below permitted limits.

26.	In Section 4.2.2, there seems to be a contradiction between statements in the sixth and seventh paragraphs. The sixth paragraph says: **"**The highest potential for airborne emissions of radionuclides would exist where uranium is converted from a dissolved liquid state to a dry powder and packaged into drums." While the seventh paragraph says: "The process to convert the ^{233}U to UO_3 powder effectively reduces the potential for radioactive emissions." Which statement is correct and what measure(s) will be in place to mitigate the elevated potential for airborne emissions?	Both statements are correct. The first statement is related to the processing operations. During processing, the potential for airborne emissions is greatest when unpackaging and handling uranium that is in a dry dispersible form. The potential for the particles to become airborne would be reduced by" - Using a demonstrated technology that has been deployed for more than 3 decades in the Oak Ridge area and is known to produce an oxide form containing a high percentage of large particles - Performing operations in hot cells with special confinement barriers - Using HEPA filtration for process off-gas to remove particulates - Using scrubbers to remove uranium particulates and NOx. The second statement is referring to the material after it has been downblended. Section 4.2.2 of the EA has been modified to state in the 7th paragraph: *"The process to convert the ^{233}U to a granular UO_3 form effectively reduces the potential for radioactive releases during upset conditions."*
27.	Section 4.11.3 concludes that, "... the consequences due to malevolent acts [have been determined] to be no greater than the consequences due to natural phenomena events analyzed...." I feel that it is somewhat naive to consider that a targeted "attack" on an unhardened storage building could not inflict significantly more damage than that anticipated for a natural phenomena event. This conclusion warrants more detailed consideration and analysis.	Current safeguards are appropriate to meet established DOE threat guidance for Building 7572 and 7574. Buildings 7572 and 7574 meet current security requirements for storage of radioactive waste. Results of malevolent acts against the downblended material storage facilities, Buildings 7572 and 7574, are included in the answer to question 4. In the event that security requirements change, a security analysis will be performed prior to the introduction of material and appropriate security measures and enhancements will be implemented based on the analysis.

Raj K. Rajamani, Professor, Metallurgical Engineering Department, University of Utah, Memo to Brian DeMonia		
28.	The ground product size of submicron sizes is stated to cause substantial health hazard because it is known that less than 10-micron particles pose such hazards. These uranium-bearing materials are hazardous to begin with and hence all of the processing steps are going to be done in a manner that operators do not ever come in contact with the material during processing. That being the case how does the size of the particles going to cause any harm. The uranium oxides are hazardous any way. In many processes such as ceramics preparation and others, particles are ground to sub micron sizes. It is everyday practice in many industries. There are facemasks and others to protect operators.	The commenter is correct that the material is hazardous. The project will install engineered features to minimize worker exposure to the hazards. During normal operations, protective equipment such as face masks are not planned; however during upset conditions such measures may be required. Even with extensive engineered controls, including shielded hot cells and filtered ventilation, bounding analysis are performed to determine the impact of equipment failure. Hence the discussion on the particle sizes. Health Physics experts have determined that uranium particles above about 10 micron will be excreted from the body with negligible adverse impact. Smaller particles, however, can become lodged in the lungs and create adverse health consequences due to heavy metal or radioactivity exposure.

29.	50 tons of additional secondary waste that is grinding media will be generated. The generation of additional contaminated material as grinding media can be readily avoided. We add a screening step after the RM-2 mill-grinding step. The screening can be done in airtight compartments. The recovered grinding media can be reused in the RM-2 mill. In the report DE-AC26-01NT41312 the screening step was not shown because the plan was to send the down blended material containing canisters were to be transported to Savannah River facility. The task was security during transportation from Idaho to Savannah River site.	The abrasive action of the grinding media and uranium oxide causes the media itself to break apart. This media would be contaminated with ^{233}U and therefore would require special handling (i.e., inside hot cells) to be reusable. Ultimately the media has to be disposed as waste. Some optimization in media usage might be possible; however, even if there were no increase in waste volume the option is not practical for the other reasons mentioned in the response to comment 22.
30.	The RM-2 process will take up additional 17 years when compared to aqueous process. Small RM-2 mill was proposed in the report DE-AC26-01NT41312 . The reason being the objective was to disposition 1700 kg of UO3 stored in the INTEC cpp-651 vault facility. The task was boiled down to processing 8 kg per day using two RM-2 mills. For processing 250,000 kg of UO3 during a five year period the task boils down to 200kg per day. The RM-2 mill can be scaled up to handle 50 kg UO3 plus required amount of depleted uranium stock. That means four such RM-2 mills can do the total dispositioning task in five years. The cost of such a facility would be roughly $50 million.	Report DE-AC26-01NT41312 suggested a concept that installed two RM-2 mill is in a glove-box type of containment to input a total of 8 kgs HEU oxide and produce 40 kgs of blended product per operating day. Using the stated output of the RM-2 mills in Report DE-AC26-01NT41312 of 40 kgs UO3, then 250,000 kgs would require over 6000 operating days or more than 24 years of processing. Even with optimization, the duration is significantly longer than planned. The 8 kgs HEU in four canisters on 2 separate mills equates to about 1 kg HEU per canister which would be appropriate using the safe geometry canisters for nuclear criticality control. Scale-up, as described by the commentor, would require detailed analysis of canister sizes due to nuclear criticality controls and due to centrifugal forces during the blending operation. The comment does not provide details for this facility cost estimate of "roughly $50 million" so it is not possible to determine if the cost includes provisions for processing under safeguards Category 1 conditions, in hot cells, using remote handling (in lieu of glovebox type of containment specified in the report). The RM-2 mills would not handle all forms of material (for example volatile fluoride compounds), so additional facilities would have to be constructed for these types of materials.

		The U233 Project estimate is based on demonstrated technologies that have been evaluated for safety impacts and appropriate nuclear criticality controls. Therefore the U233 Project estimate has a high degree of certainty. The Project estimate includes provisions for processing all of the material in the Building 3019 inventory.
31.	The RM-2 mill technology is not proven in a larger scale. This larger scale testing can be done in a facility in two years max. Perhaps a single RM-2 mill capable of handling 50 kg UO3 per day can be built and tested. The cost of such a testing may be about $10 million. Safe guard and security performance can be tested simultaneously. The RM-2 mill once proven at the 50 kg scale becomes the final process unit.	It may be possible to demonstrate the dry blending technology by investing 2 years and $10 million. If the testing were successful, then the full scale facility (i.e., 4 of the 50 kg scale mills) would have to be designed, constructed then started up. There is no advantage to investing in an alternate technology since it will be more costly than the selected technology (see prior Response).The EA, as written, explains the basis for selection of the Proposed Action.
32.	Many of the impacts under the no action option were attributed to RM-2 technology. This conclusion is at best irrelevant since RM-2 mill is a technology for dispositioning action. The only action item is that a 50 kg scale unit must be tested.	The EA, as written, explains the basis for selection of the Proposed Action. The Department has selected a demonstrated technology for which risks, costs and schedule can be accurately identified. Additional expenditure and project delays associated with additional technology review are not warranted and would not meet the Project's requirements or Congressional intent.
33.	The RM-2 mill technology can be employed readily for dispositioning 250,000 kg of UO3. The cost of facility to process 200 kg per day is estimated as $50 million. This facility would operate for five years to disposition 250,000 kg.	To achieve the stated through put, a facility equivalent to four of the pilot facilities would have to be constructed. The uncertainties, cost and schedule to design, construct, startup and operate a pilot facility then to design, construct, startup and operate the full scale production process offers no advantages over the selected technology that will operate over a three year period.

Tennessee Department of Environment and Conservation, DOE Oversight Division, Letter to Brian DeMonia January 12, 2007		
34.	(TDEC's) main concern is the handling and disposition of wastes generated during the project. Wastes will need to be treated (as needed) and dispositioned in a timeframe consistent with current regulations. Although not addressed in this document, the concern is over the plans for the eventual disposition of the down blended U-233. Furthermore, the end chemical product of this process should be compatible with permanent disposition.	The EA has been revised to add the following to the 3rd paragraph of 4.10.2.: *"Secondary wastes will be stored, handled, managed, and disposed of in accordance with all applicable state and federal regulations, and applicable DOE Orders, and will be packaged in accordance with disposal site waste acceptance criteria prior to being transported for disposal."* The material is being processed into a form that could be dispositioned at the Waste Isolation Pilot Plant (WIPP) in Carlsbad, NM or at the Nevada Test Site (NTS). WIPP and NTS personnel have been actively involved in determining that the form of the downblended material can be received and the downblended material will have to be certified to meet the waste acceptance criteria. If DOE were to propose disposal of the downblended material at WIPP or NTS, DOE would complete an appropriate National Environmental Policy Act review to evaluate the impacts DOE of transportation, receipt and disposal. DOE would obtain all necessary regulatory approvals prior to disposal.
35.	The document should be broadened to incorporate a definitive timeline, decision making process, and a funding package for storage and transportation of the U-233 to final disposition. The present time estimate for storage of the down blended material could easily reach into the 2020-2025 range. Plans should to be made to move this material to final disposition in a timelier manner.	Estimates are conservatively based on information received from WIPP and NTS. Current plans facilitate optimization of packages and shipping containers. However, to the extent that final disposition efforts can be accelerated in concert with other DOE disposition priorities, the Department will pursue such acceleration.
36.	The document makes no reference to what emergency response planning has been incorporated into the project. For example, what would he the protocol for an emergency situation, such as a criticality event? These plans should be discussed in this document.	The EA has been revised to add Section 3.11 as follows: *"3.11 Emergency Services* *Fire protection and emergency services at for the Building 3019 Complex will be provided by ORNL through established work authorizations with the Project. These work authorizations provide*

		emergency preparedness planning, fire protection, and shift operations coordination that enable operations in the Building 3019 Facility to be conducted in a manner that protects and enhances human health and the environment. The ORNL emergency responders have mutual aid agreements in place with local response agencies to provide support as necessary. *The Fire Protection (FP) Department maintains a fire-safe posture at ORNL by ensuring that an effective fire emergency response force (fire department) is in place and that ORNL fire protection is consistent with DOE guidance and national standards. In turn, the Project maintains a fire protection program that ensures fire protection systems are inspected and maintained.* *Emergency preparedness is maintained by the ORNL emergency response organization. Working with the Project, it is ensured that the emergency plans and procedures to respond to all credible emergencies (including criticality events) are identified and documented and that adequate resources are available for emergency preparedness, emergency response, and required recovery activity. This system provides continued readiness of the emergency preparedness program.* *The Laboratory Shift Superintendent (LSS) Department manages shift operations for the Building 3019 Facility by staffing the laboratory Shift Superintendent office with trained, qualified personnel familiar with normal plant operations, as well as emergency response. The LSS Department participates in Laboratory Emergency Planning, review local emergency manuals, and coordinate training for the emergency response organization. This department serves as the Laboratory Emergency Director during emergencies and operates the Laboratory Emergency Response Center that serves as the central location for monitoring and controlling site activities."*
37.	Page-7. Figure 1.3 Building 3019 Complex, Last Bullet, Tank P-24: Where is the location of Tank P-24, and what is the concentration of U-233 stored in the solution?	Tank P-24 is located adjacent to Building 3019. The concentration is less than 0.007 g/L.

38.	Page 11, Figure 2.1 Conceptual ^{233}U Downblending, Last Sentence of the Paragraph; states that "....the *solution (uranyl nitrate) would be transferred from the tanker truck to a tank external to the Building 3019 Complex."* No description of this tank is given in the document. Is it an existing tank? Is it a new tank? What is/will it be made of? Will there be secondary containment? Is this an underground or aboveground tank? This type of descriptive information is relevant to environmental aspects of this document.	The uranyl nitrate will be transferred into an existing Tank P-23. The stainless steel tank is located in a pit surrounded by concrete shielding adjacent to Building 3019. The EA has been modified as follows: Section 2.1.4, 2nd paragraph , "to a tank" was clarified to refer to "*Tank P-23*" Section 2.1.4, the following text was added to the end of the page: *"Tank P-23 is an existing 10,000 gallon stainless steel tank located adjacent to Building 3019A in a concrete bunker. The bunker is partially below ground and partially above ground and is accessible by removing concrete shield hatches. In the event of a leak, the bunker would serve as secondary containment. The bunker is equipped with a sump pump should the need arise to pump the pit. The tank will be equipped with a high level alarm and the sump shall also be alarmed."*
39.	Page 11, Figure 2.1 Conceptual ^{233}U Downblending: The figure indicates that the empty ^{233}U containers will go to burial. Where exactly are these planned for disposition?	Based on past practice and waste characterization data DOE expects that the empty ^{233}U containers will be disposed of off-site as LLW. The Department will confirm this by characterization once containers are empty and prior to disposal.
40.	Page 19, Section 3.4.2 Groundwater. Last Paragraph: Comprehensive Environmental Response Compensation and Liability Act (CERLCA) is not in the acronym list.	The acronym list has been updated.
41.	Page 30 Section 3.10.1 Radiological Exposure to the Public, First Paragraph: DOE's lower administrative limits and As Low As Reasonably Achievable (ALARA) should be discussed here.	The last paragraph of Section 3.10 of the EA has been modified to include at the end of the paragraph: *"A maximum DOE Administrative Control Level (ACL) of 2000 mrem/yr (20 mSv/yr) per person is established to further limit occupational dose for all DOE activities."*
42.	Page 38. Section 4.6.2 Pressed Action. Line 8: *"Existing equipment in other rooms would be disconnected, packaged, and set aside for later disposition, and the rooms would be refurbished and/or altered, as necessary."* Will the equipment taken from these rooms be RCRA or radiologically contaminated? To what timeframe does "for later disposition" refer?	Any equipment that is removed will undergo a hazardous waste determination at the time of removal from service. If the material is determined to be RCRA hazardous waste or low level waste, then all applicable DOE Orders and state and federal regulations governing the proper management of such waste will be adhere to. No item should remain on-site for longer than allowed by appropriate regulations.

		Section 4.6.2, middle of the paragraph - replaced the sentence beginning with "Existing equipment ……." with: *"Existing radiologically contaminated equipment in other rooms would be disconnected, characterized, segregated (RCRA and non-RCRA), and packaged as waste. All waste will be stored, transported and disposed in accordance with appropriate regulations."*
43.	Page 44. Secondary Waste Identification and Forecasting Table: The table should be cited and discussed in the text of the document. Also, the table needs a table number.	Table numbering and citation have been corrected.
44.	Assuming that this EA does not include the future Decontamination and Decommissioning (D&D) work, how does one account for *the* forecast of 7,000 ft^3 radiologically contaminated soil annually (over 68 to 73 months) as seen in the table on Secondary Waste Identification and Forecasting? Will this material be generated prior to D&D?	The EA does not include future D&D work. The volume of radiologically contaminated soil in the table is not an annual amount but a total amount. This secondary waste stream will be generated from excavation activities associated with pipe chase foundations and below grade piping.
45.	Page 48, Work Place Exposure levels Table: -The Table needs a table number.	Table numbering has been corrected.
46.	Page 49, Table 4.1 Summary of Potential Accidents and Consequences, Potential Accidents, Column 1, Row 3: *"Release of radionuclide materials due to fire"* Does this mitigated consequence include the effects of a uranium fire?	This mitigated consequence does include the effects of a uranium fire. Typically, "uranium fires" refer to small metal chips or fines exhibiting pyrophoric characteristics during oxidation (burning). The vast majority of the facility inventory, prior to processing, is in the form of various oxides. Oxidized materials do not exhibit the pyrophoric properties of metallic fines. A small percentage of the cans contain uranium metal and fewer still contain small chips or fines. The material-at-risk evaluation, referenced by the PDSA, considered all identified release mechanisms for the various material types in storage at Building 3019 including burning of uranium metal. It should be noted that the canisters containing uranium metal do not represent the worst case consequence potential for accidents involving material before processing. Once the materials are dissolved, they are in a uranyl nitrate form until denitration where they are once again in an oxide form. Design of the hot cell includes an inert atmosphere to prevent potentially pyrophoric materials from igniting. Additionally, design includes pretreatment of the materials to ensure that uranium fires do not occur.

47.	Page-5l, Section 4.11.2 Proposed Action. Last Paragraph: The topic of a criticality and planned safeguards needs to be addressed in considerable detail, given that very small quantities of ^{233}U (590 grams, Comber 1983), particularly when dissolved in aqueous solutions, will become critical in appropriate configurations. Procedures for eliminating the possibility, such as maximum processed quantities of ^{233}U, configuration of masses of ^{233}U' container shape, administrative and engineered controls need to be more thoroughly covered.	This section of the EA has been modified to read: *"The nuclear criticality prevention aspects are integral to the design. Generally the high equity material is handled in safe geometry equipment (4 to 5 inches in diameter). Credible accidents are evaluated to determine the impact during spills, equipment upsets, technician error and natural phenomena. Design elements (and administrative controls) are adjusted as needed so that an accidental criticality becomes incredible. Criticality control parameters include geometric constraints, spacing, moderation and the use of sumps. The design and operations are evaluated to ensure criticality safety and all calculations are independently verified using validated codes in accordance with the ANSI/ANS 8-series standards."*
48.	Page-52, Section 4.11.2 Proposed Action, First Paragraph: An earthquake induced fire is discussed but the potential of a uranium fire is not mentioned. This should be clarified.	The design includes provisions to prevent a uranium fire. See response to comment 46.
49.	Page 52, Qualitative Likelihood Classification Table: The table needs a table number and that table number should be cited in the text.	Table numbering and citation have been corrected.
50.	Page 53. Section 4.11.3 Malevolent Acts, Second Paragraph: EPHA is not in the acronym list.	The acronym list has been updated.
51.	Page 55. Cultural Resources: NRHP is not in the acronym list. Also, it should be defined on Page 6, Paragraph I where it is first used.	The acronym list has been updated and NRHP defined.

52.	<u>Page 55, Waste Management:</u> The statement *"(i.e., approximately 68 months from start of demolition/construction activities to end of operations; see Table 2.1.)"* does not agree with the total time listed in Table 2.1. The total time in the table is 73 months not 68.	The schedule has been changed since preparation of the draft EA. In addition, the draft EA did not contain the duration associated with startup activities. Table 2.1 has been updated to included these changes as follows: Demolition: 11 months Construction/Startup: 43 months Processing: 30 months Shutdown: 10 months A note will be added to this table to reflect the 5 month overlap between demolition and construction, making the total schedule from start of demolition to completion of shutdown 89 months. These changes will be applied throughout the EA.
53.	The statement "*Because ample capacity for waste is available, no cumulative effects would be anticipated*." is confusing. Does this mean ample on-site (i.e., on ORNL) storage capacity or does it mean ample capacity at disposal facilities? Waste will need to be dispositioned according to regulations as the project is conducted.	The statement is referring to off-site storage facility. The Department acknowledges that waste will need to be dispositioned according to applicable regulations. Section 5 of the EA, subsection Waste Management, has been modified to read: "Cumulative impacts from offsite disposal are expected to be minimal compared to impacts from the quantities of waste already disposed of at disposal sites to be selected for secondary waste."
54.	<u>Page 56. Decontamination and Decommissioning:</u> IFDP is not in the acronym list.	The acronym list has been updated.

Uri Gat, Public Comment Form		
55.	The ^{233}U is very valuable nuclear fuel. It should be considered for and used in nuclear reactors either present or future ones.	See response to Comment 8.
56.	^{233}U has an advantage of "self protecting", diluting it with depleted U will introduce the creation of Pu, which in turn will make it more difficult to use in a beneficial manner. We should not be shortsighted in preserving the ^{233}U for energy applications. It is the gateway to move away from the Pu fuel cycle.	See response to Comment 12.
57.	Why is not SI used exclusively?	Units are tied to their base sources or calculations that are normally accepted units in the nuclear industry.
Dr. Rose A. Boll, Chemistry Department, University of Tennessee, Letter to Brian DeMonia, January 5, 2007		
58.	Please include in the actions of this process, the separation of the Th-229 from the ^{233}U. The increased cost in the overall process for the recovery of the Th-229 from the ^{233}U is minimal (1-5%). The Th-229 isotope is being used for medical treatment and research with very promising results. Th-229 exists in limited quantities in our world. The Th-229 that is contained in the ^{233}U at ORNL is high quality material, unmatched in purity and quantity anywhere in the world. For the United States to dispose of the ^{233}U without recovery of the Th-229 would be irresponsible and a major waste of our country's resources.	See response to Comment 1.

Citizens' Advisory Panel (CAP) or the Oak Ridge Reservation (ORR) Local Oversight Committee (LOC) Letter to Brian DeMonia, January 10, 2007		
59.	Figure 1.1 is referenced only on page 15 in Section 2.3.2. It would be more reasonable to move this figure to that section and renumber it.	Figures have been appropriately deleted, added and amended based on final revisions of the EA.
60.	Add a figure similar to Figure 1.1 showing the ^{233}U decay chain.	Figures have been appropriately deleted, added and amended based on final revisions of the EA.
61.	Figure 1.3 is difficult to read in the black and white copy of the EA. Lighter shading should be used.	Figures have been appropriately deleted, added and amended based on final revisions of the EA.
62.	There is n o quantitative statement made regarding the amount of ^{233}U. The document should at least offer an order of magnitude.	Section 1.2.2 has been modified to reflect the approximate quantity of U^{233} is 450 kg.
63.	Section 2.1 – the fifth bullet should be corrected to read "downblending of the ^{233}U inventory using the depleted uranyl nitrate and conversion to a stable oxide." Also, this section introduces that ^{233}U bearing materials from elsewhere in the DOE complex are included in this assessment with no current plans to ship and that shipping from off-site would be subject to appropriate National Environment Policy Act review. It is not clear that the assessment is valid for off-site materials without more information on their physical and chemical forms. In addition, the process flow diagram needs to include additional equipment required to prepare materials such as the Molten Salt Reactor Experiment (MSRE) sodium fluoride traps.	Those items described in this section would only be accepted if they were of similar form to the material currently evaluated by this EA, in which case additional NEPA analysis of their processing is unlikely to be necessary. As the EA states, the potential transport of such materials would be subject to appropriate NEPA review. The Molten Salt Reactor Experiment (MSRE) sodium fluoride traps will be processed using the same equipment as for the baseline processing with the addition of one shielded glovebox to de-pressurize the traps prior to processing. The glovebox will vent through a scrubber to remove the fluoride effluent from the vented gas. Figure 2.1 has been modified to show the depressurization step.
64.	Table 2.1 on page 10 is only referenced on page 55. Either place the reference appropriately before the table or move the table to the page where it is first referenced and renumber it.	Tables have been appropriately placed and numbered based on final revisions of the EA.
65.	The caption and axes labels on Figure 2.2 are too small to read.	Figure 2.2 and its caption have been excerpted from an external source. Efforts have been made to attempt to enlarge this graphic and correct the caption to read "(with 100 ppm ^{232}U)"

66.	Section 2.3 – it is stated that there were two additional alternatives considered for processing without any mention of what they were or details as to why they were eliminated. Please discuss these.	These two options were the dry blending and processing at the SRS site (Sections 2.3.6 and 2.3.7). This sentence in the EA has been corrected as follows: *"Two alternatives to the proposed aqueous process were considered but were eliminated based on cost and/or the technological basis as described in Sections 2.3.6 and 2.3.7, below."*
67.	Section 3.7.2 – add "higher than the national average" or other true modifying clause to the sentence "Only one of the census tracts that immediately surround the ORR currently includes a minority population" in order to correct the statement.	The EA has been clarified to state in Section 3.7.2: *"Only one of the census tracts that immediately surround the ORR currently includes a minority population greater than the national average of 30.7%."*
68.	Section 3.8.2 – "The average commute of an ORNL employee working in Bethel Valley is about 35 miles." That seems high unless it is a round trip figure.	Based on the source document, the *Oak Ridge National Laboratory Land and Facilities Plan* (ORNL 2002b as referenced in the EA), it can be assumed that this is referencing a round-trip commute.
69.	Section 4.2.2 – "NO_x emissions would be controlled by state-of-the-art pollution control equipment capable of maintaining total NO_x emissions below the Prevention of Significant Deterioration level for NO_x " and "NO_x will be in the form of nitrogen oxide and nitrogen dioxide in near equal proportions." The control technology is not specified. If Selective Catalytic Reduction is used, handling of ammonia needs to be addressed in the EA.	Preliminary planning discussions have been held with ORNL LLW Treatment Facility personnel to handle the liquid low level waste generated from the NOx scrubber, and the needed treatment capacity is expected to be available during the duration of the project. Ammonia use in the scrubber was considered and discarded due to the fire hazards and associated controls. The control technology will be established when the final design is complete.
70.	Section 4.11 – the EA from two years ago (Environmental Assessment for U-233 Disposition, Medical Isotope Production, and Building 3019 Complex Shutdown at the Oak Ridge National Laboratory (DOE/EA-1488) included discussion of some potential accidents that are not in the current EA. Considering that much of that part of the EA is a verbatim repeat of the earlier one and the discussions omitted involve some serious impacts, the omissions are of concern.	Previous scenarios such as the earthquake scenario were based off of thorium storage which is no longer an applicable accident scenario. The fire accident was corrected and relocated under "Processes Inside Facility."

71.	Section 4.11.2 – failure of containment of MSRE sodium fluoride traps is mentioned. The hazards of handling these traps should be analyzed. According to the December 8, 2006 report of the Defense Nuclear Facilities Safety Board, depressurizing and handling the sodium fluoride traps from MSRE requires a new glovebox. The revised Preliminary Documented Safety Analysis for the ^{233}U Project as a whole has not been approved by DOE Oak Ride Office, and additional work is needed in the supporting analyses.	The bounding accident scenarios in the Environmental Assessment include handling a pressurized sodium fluoride trap. The Department has added processing of the MSRE sodium fluoride traps to the baseline program. As noted in the response to comment 63, a shielded glovebox will be installed for this processing. The PDSA is being developed in parallel with the detailed design. The Department will review the PDSA when it is submitted by the Project's contractor.
72.	Section 5: "Because ample capacity for waste is available, no cumulative effects would be anticipated." The incremental impact of managing wastes from this project on the existing environmental impact of the utilized facilities is what should be addressed, not simply whether there is under-utilized capacity in their permits. This needs to be properly evaluated.	See response to comment 53.
73.	At the September 13, 2006 Oak Ridge Site Specific Advisory Board meeting, the advisory board was told that the reason the conversion would end at the UO_3 form, instead of the more stable U3O8 form was based on it not having to meet long-term storage requirements. The EA should list all of the factors considered in ending processing at the UO_3 form.	The following paragraph has been added to Section 2.1.5: *"In selecting UO_3 as the product form, DOE considered material stability, processing costs and risk. DOE-STD-3028-2000 <u>Criteria For Packaging and Storing Uranium-233-Bearing Materials</u>, lists UO_3 as a stable form of uranium. UO_3 will absorb moisture from humid air and therefore the radiolysis of water into hydrogen and oxygen was evaluated and determined to be of no significant impact. By stopping the process after UO_3 production, the Project is able to eliminate an oxide conversion furnace, a product cooler and the associated material conveyors. This reduced the equipment costs and reduced worker exposure by eliminating equipment that would require maintenance during the life of the project." In addition, UO_3 is a form suitable for disposal at WIPP and NTS.*
74.	The EA suggests that there are no waste acceptance criteria established at potential disposal sites that would allow them to take the ^{233}U oxide. Indefinite storage in Melton Valley is an unacceptable disposition option for this material, especially if it does not have to meet long-term storage requirements. The EA should list potential disposal options and the expected length of time before the ^{233}U oxide can be shipped for offsite disposal.	See response to comment 34 for additional information on the potential disposal sites.

75.	The impact of the Melton Valley cleanup completion on the ^{233}U project should be addressed.	The Melton Valley cleanup project is completed with the Remedial Action Report for this effort scheduled for submittal in March 2007. The remediation project will not affect the proposed action. Recontamination of the Melton Valley site is not expected as a result of the proposed action, including storage in Buildings 7572 and 7574.
	Robert Peelle, Public Comment Form January 12, 2007	
76.	In the language of Sec. 102 of the National Environmental Policy Act (42USC§4332), the proposed action could be considered an "irreversible and irretrievable commitment of resources" because it would effectively foreclose the separation of thorium-229 for use in cancer therapy. It may be that this oft-discussed option must be abandoned now, but I believe the final Environmental Assessment must discuss the possibility.	See response to Comment 1. Also, the 2004 EA, Section 2.1.4, addressed this issue. Downblending without removing thorium-229 does not foreclose future separation. While the downblended material would be non-weapons usable and not pose criticality concerns, it would continue to generate ^{229}Th through radioactive decay and, thus, potentially be a source of future ^{225}Ac. Should, in the future, research on thorium cycle technology be initiated, there exists a significant quantity of legacy materials containing thorium and irradiated thorium fuels inventory at the Idaho National Laboratory, and elsewhere at DOE sites, that could also be used.
	Ellen Smith, Chairperson, City of Oak Ridge, Environmental Quality Advisory Board, Letter to Brian DeMonia, January 8, 2007	
77.	It is regrettable that the stored material is no longer slated to be a resource for medical isotope production. As was explained in the 2004 EA, the ORNL inventory of U-233 is considered to be a valuable resource for medical applications because it contains most of the readily available thorium-229 in the western hemisphere. Two radioactive progeny of the thorium-229 isotope, actinium-225 and bismuth-213, are being investigated by cancer researchers and are reported to show significant promise for treating certain cancers. When bismuth-213 is attached to monoclonal antibodies, radiation can be targeted directly on the tumor. It would be unfortunate to lose the opportunity for this part of Oak Ridge's radioactive legacy to make a positive contribution to humanity, particularly if foregoing the opportunity to extract this valuable isotope does not reduce the human health risks and other potential adverse impacts from processing and storing the U-233.	See response to Comment 1.

	EQAB hopes that Congress will reconsider the action that bars DOE from extracting medical isotopes from the U-233 inventory prior to downblending it. To help fulfill the National Environmental Policy Act objective of effectively informing decision makers, we recommend that DOE expand this EA to include a direct comparison between the estimated costs and the environmental health and safety and security and safeguards impacts of this proposal and the proposal considered two years ago. EQAB appreciates the opportunity to review and comment on this DOE environmental assessment. We look forward to similar opportunities in the future.	

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