PLUTONIUM VITRIFICATION FACILITY CONSOLIDATED HAZARD ANALYSIS (U)

March 2007

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ACRONYMS AND ABBREVIATIONS

A	Anticipated
BEU	Beyond Extremely Unlikely
BSRI	Bechtel Savannah River Inc.
BTC	Bagless Transfer Cans
BTS	Bagless Transfer System
CCC	Core Component Containers
CD	Critical Decision
CFR	Code of Federal Regulation
CHA	Consolidated Hazards Analysis
CHAP	Consolidated Hazards Analysis Process
CIM	Cylindrical Induction Melter
CSSC	Container Storage and Surveillance Capability
CW	Co-located Worker
DB	Disassembly Basin
DFA	Driver Fuel Assembly
DID	Defense-in-Depth
DMO	Direct Metal Oxidation
DOE	Department of Energy
DOE-EM	DOE Environmental Management
DOT	Department of Transportation
DSA	Documented Safety Analysis
DWPF	Defense Waste Processing Facility
EG	Evaluation Guideline
ERPG	Emergency Response Planning Guideline
EU	Extremely Unlikely
EVS	Exhaust Ventilation System
FC	Functional Classification
FESR	Failed Equipment Staging Room
FGE	Fissile Grams Equivalent
FP	Feed Preparation
FPS	Feed Preparation System
FW	Facility Worker
g	gram
GE	General Events

ACRONYMS AND ABBREVIATIONS (Continued)

GF	Green Fuel
GFDS	Green Fuel Disassembly System
HA	Hazards Analysis
HAZOP	Hazard and Operability
HE	Hazard Evaluation
HEPA	High Efficiency Particulate Air
HI	Hazard Identification
HLW	High Level Waste
HUFP	Hanford Unirradiated Fuel Package
HVAC	Heating, Ventilation, and Air Conditioning
IH	Industrial Hygiene
KAC	K-Area Complex
kg	kilogram
KIS	K-Area Interim Surveillance
LaBS	Lanthanide Borosilicate
LIBS	Laser Induced Breakdown Spectroscopy
LLW	Low Level Waste
LOC	Level of Control
LWP/T	Low Level Waste Packaging/Transport
MAA	Material Access Area
MAR	Material at Risk
MC&A	Material Control and Accountability
MCL	Magazine and Canister Loading
MHS	Material Handling System
MIX	Milling and Mixing
MLS	Magazine Loading and Storage
mm	Millimeter
Mod	Moderate
MOI	Maximally Exposed Offsite Individual
MRS	Material Receipt and Storage
N/A	Not Applicable
NCSE	Nuclear Criticality Safety Evaluation
NDA	Non-Destructive Assay
Neg	Negligible

ACRONYMS AND ABBREVIATIONS (Continued)

NFPA	National Fire Protection Association
NIM	Nuclear Incident Monitor
NMC	Neutron Multiplicity Counter
NPH	Natural Phenomena Hazard
OSHA	Occupational Safety and Health Administration
OX	Oxidation
PC	Performance Category
PDSA	Preliminary Documented Safety Analysis
PEL-TWA	Permissible Exposure Limit/Time Weighted Average
Pu Vit	Plutonium Vitrification Facility
SDD	System Design Description
SIH	Standard Industrial Hazard
SPO	Security Protection Officer
SRS	Savannah River Site
SSC	Structure, System, and Component
STD	Standard
SWM	Sodium Metal Waste
TQ	Threshold Quantity
TRU	Transuranic
TWM	Tru Waste Monitoring/Assay
TWP	Tru Waste Packaging
TWT	Tru Waste Transport
U	Unlikely
VIT	Vitrification
WAC	Waste Acceptance Criteria
WS	Waste Staging
WSMS	Washington Safety Management Solutions
WSRC	Washington Savannah River Company

EXECUTIVE SUMMARY

This Consolidated Hazards Analysis (CHA) identified and evaluated potential accident conditions that could cause, or contribute to, the uncontrolled release of hazardous material from the Plutonium Vitrification Facility (Pu Vit). Based on this analysis, the Material At Risk (MAR) for the bounding fire, explosion, loss of containment/confinement, direct radiological/chemical exposure, nuclear criticality, external hazards, natural phenomena, and the potential for significant consequences to the Offsite Public, the Facility Worker (FW), and the Co-located Worker (CW) have been accounted for in Pu Vit. Design and administrative safety controls are required to keep the consequences below the Evaluation Guidelines (EGs) for the safety of Offsite Public, CWs, and FWs. Although the trips and falls of the workers can cause moderate to severe physical injuries, these are considered Standard Industrial Hazards (SIHs) that are controlled through Occupational Safety and Health Administration (OSHA) protocol, Automated Hazards Analysis (HA), and normal worker safety review, training, and monitoring.

This HA was conducted for the Pu Vit Project utilizing the Consolidated Hazards Analysis Process (CHAP) developed at the Savannah River Site (SRS). This process is an integrated approach that covers the full spectrum of facility hazards that previously have been addressed by multiple site processes (e.g., Process Hazard Review, Preliminary HAs, and HAs).

This CHAP will result in the development of a Preliminary Documented Safety Analysis (PDSA) in the latter stages of the project. As the design progresses and the PDSA is refined/updated, the PDSA may be incorporated into the K-Area Documented Safety Analysis (DSA) or stay as a stand-alone document. This will allow the separation of operational and project funding.

1.0 INTRODUCTION

The Hazard and Operability (HAZOP) analysis is a systematic method that identifies process hazards and potential operating problems using a series of guidewords to investigate process deviations. During the identification of process deviations, causes of the deviation are identified. Each process deviation is also characterized in terms of its unmitigated frequency and consequences. Potential control strategies are developed to ensure that all hazards are properly managed. Events requiring safety controls (i.e., events whose unmitigated risks are indicated as resulting in Risk Bin A1, A2, A3, and B) are identified and control strategies are credited that reduce the frequency/consequence of the event such that the mitigated risk of the event is acceptable.

During the development of the Pu Vit design the PDSA may be maintained as a separate document. As the design progresses and PDSA is refined/updated, the PDSA may be incorporated into the K-Area DSA or stay as a stand-alone document.

The purpose of this report is to document the CHA performed for the Pu Vit. This HA performed a systematic evaluation of the hazards associated with Pu Vit using the guidance provided in the CHAP Methodology Manual (Ref. 1).

Integrated multi-disciplined teams, including personnel from Washington Safety Management Solutions (WSMS), K-Area, Savannah River National Laboratory, Criticality Engineer, and Fire Protection Administration performed the initial hazard review. These teams applied the principles of the CHAP to evaluate the hazards of the Pu Vit using the HAZOP approach.

1.1 FACILITY DESCRIPTION

The Pu Vit Project will modify areas of the K-Reactor Facility to install the process equipment that will be used to vitrify up to 13 metric tons of Department of Energy (DOE) Environmental Management (DOE-EM) owned plutonium into a Lanthanide Borosilicate (LaBS) glass matrix. This glass will then be packaged into Bagless Transfer Cans (BTCs) and placed inside a Defense Waste Processing Facility (DWPF)-type canister. The canister will be transported to DWPF and filled with High Level Waste (HLW) glass. The Pu Vit process will align with the DWPF-coupled operations, 2011 through 2017 (Ref. 2).

The proposed systems associated with the Pu Vit process material flow are as follows:

- Material Receipt and Storage
- Oxidation (DMO)
- Feed Preparation (FP)
- Milling/Mixing
- Vitrification (VIT)
- Bagless Transfer System (BTS)

- Magazine Loading/Storage, Canister Loading/Shipping
- Waste Handling
- Green Fuel Disassembly

1.2 PROCESS AREAS

1.2.1 MATERIAL RECEIPT AND STORAGE

The Pu Vit will receive both plutonium oxide and metal feeds from different locations within the DOE Complex. All plutonium metal will need to be oxidized prior to being vitrified as glass. It is anticipated that the plutonium feed will be at the K-Area Complex (KAC) when the facility is started up. The bare 3013 containers will be non-destructively assayed using the following types of equipment:

- Neutron Multiplicity Counter (NMC)
- Gamma Isotopic Counters
- Calorimeters

After being assayed, each bare 3013 container is returned to the vault for temporary storage.

1.2.2 OXIDATION

This process area is used to oxidize plutonium metal to prepare it as feed for VIT. The outer 3013 containers containing plutonium metal are opened inside a glovebox and the inner 3013 containers with the plutonium metal are moved through an airlock and opened in the furnace preparation area. The metal is introduced into the Direct Metal Oxidation (DMO) furnace where both the temperature and oxygen content are controlled to oxidize the metal without allowing it to melt. Oxide particles that are less than 1 millimeter (mm) in diameter are discharged from the furnace into a transport can. Each loaded transport can is weighed and then measured using a NMC for accountability purposes. The transport can is moved to FP for processing along with 3013 containers that contain plutonium oxide and Green Fuel.

1.2.3 FEED PREPARATION

Plutonium oxide, in sealed 3013 containers, is received from the Material Receipt storage vault and plutonium oxide from the furnace oxidation process is received separately in transport cans from the oxidation system, or pin fuel cans from Green Fuel Disassembly. Each 3013 container is placed inside a glovebox to cut the outer 3013 container and then relieve the internal pressure using a Can Puncture Device that safely vents gas from both outer and inner containers. The punctured 3013 container is removed from the Can Puncture Device to allow the outer and inner containers to be cut open to remove the convenience can of oxide powder inside. The can with the oxide is moved through an airlock to the crushing area where its contents are first weighed

and then dumped into the crusher. Green Fuel pellets, in pin fuel cans, are delivered directly to the crusher. Oxide that is processed through the crusher is weighed out as a 2 kg batch and is placed into a batch can. Transport cans of oxide from the DMO system are also used in making up 2 kg batches in the same batch cans. Accountability and elemental composition analysis, using Laser Induced Breakdown Spectroscopy (LIBS), are completed prior to movement of material and the Milling and Mixing (MIX) steps.

1.2.4 MILLING AND MIXING

Plutonium oxide in a batch can or hopper is combined with LaBS glass frit and a grinding aid in the process area. MIX takes place inside a glovebox at the same time by using an attritor or stirred ball mill. The attritor mill consists of a stationary tank whose contents are agitated at high speed by a rotating shaft with arms. This action causes impact forces and shearing that result in both particle size reduction and homogeneous mixing of the plutonium oxide with the frit. Powder is discharged from the attritor mill into a feed collection hopper where it is dispensed into a transport hopper. The transport hopper is weighed subjected to accountability measurements prior to movement to the VIT Step in the process. Two attritor mills, with chilled water jacket cooling and external drive motor units, will be required to maintain the necessary process throughput.

1.2.5 VITRIFICATION

The transport hopper containing a mixture of plutonium oxide and frit is introduced into the VIT glovebox and the Cylindrical Induction Melter (CIM) units. A total of ten CIM units will be provided. The entire contents of a transport hopper are introduced into one CIM unit using a dustless feeding technique. The CIM is heated up to a temperature between 1,400 and 1,500°C and held at that temperature for a predetermined amount of time so that the plutonium oxide feed will become a chemically homogeneous part of the molten glass. The induction coils for each CIM are cast inside a block of ceramic insulation. Cooling water is required to remove heat from the CIM induction coils and their power supplies. An offgas system may be required to remove volatile halides and particulates generated during the melting process. Each batch of molten glass that is produced in a CIM unit is poured into a VIT can. VIT cans are moved to a cooling location before being transferred to the next step.

1.2.6 BAGLESS TRANSFER SYSTEM

The BTS allows VIT cans to be removed from the glovebox without producing contamination problems. A single VIT can is placed into a BTC, in a helium atmosphere, and then welded shut. Three bagless transfer units will be required to maintain process throughput. After welding, the BTC is helium leak checked and smeared for contamination in a radiological hood. Cans that have been cleared from the bagless operation are moved to the Non-Destructive Assay (NDA) Room where calorimetry and gamma isotopic measurements are performed. After these measurements are complete, the cans are moved to interim storage on the -14 level awaiting movement to the Magazine Loading and Storage (MLS).

1.2.7 MAGAZINE LOADING AND STORAGE

BTCs are received and loaded into special magazines. Each magazine holds four BTCs and is slotted to allow glass from DWPF to flow into the magazine and contact the cans, after the magazines have been loaded into a DWPF waste canister. Once a magazine is loaded with four cans, a closure plug is placed on its open end to retain the cans. The other end has a knob that is used for remote handling, and each fully assembled magazine is placed into storage until it can be loaded inside a canister.

1.2.8 DEFENSE WASTE PROCESSING FACILITY CANISTER LOADING AND STORAGE

A robotic arm is used to grasp the knob of an assembled magazine and lower it into the DWPF canister. The robotic arm operator finds one of the seven locations for the magazines inside the canister using a video camera. The remaining locations are automatically loaded by the robotic arm control system once the first magazine is manually inserted in its location and latched. The loaded DWPF canister is transferred to a weigh station and a temporary closure plug is installed to prevent any foreign objects from entering. Loaded canisters will be stored until ready for transport to DWPF. A shielded transport trailer will be utilized to transport loaded canisters to DWPF to be filled with VIT glass and for eventual shipment to a Federal Waste Repository.

1.2.9 WASTE HANDLING

The waste types that are expected to be generated during the Pu Vit process include the following:

- Low Level Waste (LLW)
- Transuranic (TRU) and Mixed-TRU waste
- Mixed waste
- Hazardous waste

Other than water from sprinkler discharge, only solid form waste is expected to make up the entire Pu Vit process area waste stream. The predominant forms anticipated are LLW and TRU waste. The two waste types will be handled as follows:

The LLW waste sources include room waste, job control waste, and containment devices. This waste will be collected in radiological waste bags that will be labeled and segregated by waste stream, then loaded into B12/B25 containers. Loading of the B12/25s may be done all at once, or sequentially using acceptable diversion proof methods. After being loaded to capacity, a B12/25 will have a Tamper Indicating Device (TID) installed, and then moved from within the Material Access Area for temporary staging prior to shipment out of KAC. For transportation purposes, the B12/25 containers are defined as “Strong-Tight”.

The TRU waste sources include glovebox, maintenance, and related job control waste. This waste is collected in pails, polyboxes (i.e., HEPA filters), or drums and staged in a safe array, with nuclear criticality controls imposed, prior to initial assay. LLW/TRU Waste Assay system equipment will be used to assay the containers and characterize the contained MAR. Any containers that contain unacceptably high amounts of material will be sent to the Green Fuel Disassembly glovebox for repackaging. After assay, containers will be staged with close array spacing prior to repackaging into larger containers. Pail TRU waste will be loaded into drums, and polyboxes will be loaded into a SWB. The number of pails or polyboxes loaded into larger containers will be chosen based, first, on staying below Waste Acceptance Criteria limits for the container. If the container limits are not exceeded, the larger container will simply be filled to utilize the maximum volume. All containers will undergo a procedural or equipment assisted diversion check prior to leaving the Pu Vit Material Access Area (MAA), and be temporarily staged while awaiting shipment out of KAC. For transportation purposes, the drums; and SWB containers are Department of Transportation (DOT) 7A Type A compliant.

1.2.10 GREEN FUEL DISASSEMBLY

Green Fuel will be shipped from Hanford to SRS. The fuel will remain intact in casks and will be disassembled at SRS. Casks containing fuel will be received at SRS with the fuel assemblies in sealed Core Component Containers (CCC). Each CCC is 12 feet in length and weights up to 5,000 pounds. A single CCC will be opened and one Driver Fuel Assembly (DFA) or Ident-69 container placed inside a hood and opened. The hood will be approximately 25 feet by four feet to accommodate the size of a DFA or Ident-69. Individual fuel pins removed from the DFA will be transferred through an airlock into a disassembly glovebox that is exhausted through a High Efficiency Particulate Air (HEPA) filter into the KAC plutonium disposition project Exhaust Ventilation System (EVS). The fuel pins will be cut open to remove the pellets. All non-fuel pin components will be discarded as TRU waste. The pellets from approximately 17 fuel pins will be loaded into a pin fuel can and transferred to the FP glovebox for subsequent crushing. The pellets contained in a pin fuel can are roughly equivalent to the material limit for a loaded 3013 container.

1.3 HAZARDOUS MATERIAL INVENTORY

1.3.1 CHEMICAL INVENTORY

There are no hazardous chemicals associated with this process. LaBS glass frit and decontamination solutions are considered the only chemicals of substantial quantity required for this process.

1.3.2 POTENTIAL MAXIMUM RADIONUCLIDE INVENTORY

The material processed through the Pu Vit will be surplus plutonium from various DOE facilities and Green Fuel from Hanford. The surplus plutonium and Green Fuel, will be received in 3013s and Hanford Unirradiated Fuel Package (HUFP), respectively. For purposes of a conservative

analysis, the maximum MAR assumed for Pu Vit can be found in the Inputs and Assumptions Calculation (Ref. 3).

For each 3013 container, the MAR is assumed to be 4,400 grams of plutonium (or 5,000 grams of plutonium oxide). The unmitigated consequences for all plutonium releases from the Pu Vit Hazard Evaluation (HE) events were based on the isotopic composition utilized in the K-Area Interim Surveillance (KIS) Facility consequence calculation (Ref. 4). This calculation assumes that all 3013 containers contain a mass of 4,400 grams of plutonium with a conservative isotopic composition. In reality, the amount of material in a 3013 container is controlled by the heat load limit of 19 Watts per container in accordance with the requirements of DOE-STD-3013 and is normally well below 4,400 grams. For example, taking the actual worst-case isotopic composition of a 3013 container (Hanford Container H002505), and applying the heat load limit of 19 Watts, the mass of plutonium in this 3013 container is calculated to be 1,314.5 grams. The amount of heat that would be generated using the KIS isotopic composition and 4,400 gram of plutonium in a 3013 is 23.8 Watts, which exceeds the 19-Watt limit by 25 percent. Therefore, assuming each 3013 container has 4,400 grams of plutonium with the KIS isotopics provides bounding dose consequence values. For in-process plutonium oxide material that has been removed from 3013 containers and placed in non-3013 containers (Batch Cans, Butt Cans, or Transport Cans), utilizing the KIS isotopics still provides reasonably conservative values. A review of the actual isotopic composition of the approximately 5,000 3013 containers in the DOE complex revealed that only a small percentage of the 3013s contain an isotopic composition that would bound the KIS isotopics on a rem per gram basis. However, as the HA process is a qualitative exercise where consequences are estimated, this approach is judged to be adequate.

The TRU waste MAR utilized in the CHAP for each waste container is based on the Waste Acceptance Criteria (WAC) limits. Since Pu-239 is the primary constituent for most of the material being processed, WAC limits were calculated in terms of Fissile Grams Equivalent (FGE) Pu-239. The TRU waste room MAR totals are based on full staging capacity with additional potential transient containers, and each container evaluated as holding the maximum WAC Pu-239 FGE limit. The MAR values were selected because they provide a baseline for maximum quantities in a currently unknown waste stream. While an individual container may exceed the WAC limit prior to assay, it will not be allowed to leave the facility without repackaging. It is assumed that the roll-up of using the WAC limit to evaluate multiple containers is conservative for HA purposes. Other than the Unassayed Waste Staging room, and the movement of a TRU-pail from the -40 to -20 elevations, all waste will be characterized, and containers known to fall below the WAC limits. Once in operation, waste quantities will be determined utilizing the waste assay values. The waste assay values will be applied to a waste stream distribution to determine the value for each radionuclide in the waste stream. Designated radionuclide will then be converted to an equivalent Pu-239 value. The individual contributions are then summed to determine the total container FGE Pu-239 contents for comparison to the WAC limit.

The Pu Vit TRU waste stream has not yet been defined, however, the isotopic composition of the waste, for the purpose of HA, is assumed to be the same as that of the plutonium processed in Pu Vit (i.e., bounded by KIS isotopics). Once the waste stream composition is defined, a comparison of actual versus analyzed composition will be performed to assure these isotopics

remain bounding. In summary, without a well defined Pu Vit waste stream, the CHAP team determined that a sufficiently conservative evaluation would result based on the assumptions that each waste container contains the WAC Pu-239 FGE limit, staging areas are full to maximum, or greater, capacity of containers allowed with each containing the WAC Pu-239 FGE limit, and that the KIS isotopics provide a reasonably bounding composition for TRU waste.

2.0 INPUT AND ASSUMPTIONS

Input and assumptions are necessary to provide analytical baseline information used in this HA. Formal documentation of input and assumptions are summarized in the Pu Vit Input and Assumptions Engineering Calculation (Ref. 3). The following inputs were used to reach the conclusions or recommendations of this HA:

2.1 INPUTS

- FP Glovebox Sketch SK-DA-FPS-0001
- System Design Description (SDD) Input for: Feed Preparation System (FPS), Rev. A, May 25, 2006
- FP and DMO Equipment List SKDADMO0003, May 15, 2006
- FP Flowsheet SKDAFPS0002, May 9, 2006
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2.2 ASSUMPTIONS

2.2.1 GENERAL - ASSUMPTIONS:

- This HA was developed consistent with the frequency levels, evaluation levels, and risk ranking provided in the CHAP Methodology Manual (Ref. 1) and the Washington Savannah River Company (WSRC) Procedure Manual E7, Procedure 2.25, Functional Classifications (FCs) (Ref. 5). It is intended to meet the requirements for HAs set forth by the Safe Harbor method from Title 10 of the Code of Federal Regulations (CFR) Part 830 (Ref. 6).
- All releases are conservatively assumed to occur at ground level.
- Accidental firearm discharges are not considered credible in vault type rooms (FP, DMO, MIX, VIT, GFD).
- Workers will be able to react to obvious hazardous conditions and evacuate. This condition invokes the assumptions that the workers are physically able to evacuate, and that an evacuation route is available during, or immediately following, the hazardous condition.
- Criticality events involving 3013 containers do not result in a pressurized release.
- Exhaust Ventilation System consists of Duct from KAC to Sand Filter, Sand Filter, Fan house, Supply & Exhaust Fans, Emergency Power components, and Stack.

2.2.1.1 Module 1 - Assumptions

2.2.1.1.1 SECTION A: MATERIAL RECEIPT AND STORAGE

- Only the transport of sealed 3013 containers from the Storage Vault to the FP or DMO rooms is addressed in the Pu Vit HA. Other MRS operations are covered under the Container Storage and Surveillance Capability (CSSC) HA. Throughput limitations imposed by CSSC safety basis may require further evaluation and additional controls.
- Two 3013s are transported at a time from the Storage Vault to -40 level in a shielded cart.
- The upper bound of pressure that may be in an oxide 3013 container is 699 psig. Therefore, a loss of confinement event involving oxide 3013s, the release is assumed to occur at 699 psig.
- For fire events involving sealed 3013s, the release pressure is 1,000 psig.

2.2.1.1.2 SECTION B: FEED PREPARATION

- The output from FP is batch cans with 2 kg of crushed oxide with particle size less than 1 mm.

- The upper bound of pressure that may be in an oxide 3013 container is 699 psig. Therefore, an internal deflagration or a loss of confinement event involving oxide 3013s, the release is assumed to occur at 699 psig.
- For fire events involving sealed 3013 containers, the release pressure is conservatively increased to 1,000 psig.
- For fire and deflagration events involving non-3013 containers, the release pressure is less than 25 psig.
- One container puncture device is provided to support throughput requirements.
- A Container Opener (pipe cutter) will be used to open the outer and inner containers. The cutter is designed to minimize swaging of the container walls so that the inner container and convenience can are easily removed.
- The glovebox airlocks reduce the amount of dust that enters the outer 3013 opening and accountability measurement areas from the container opening/crushing area so that the outer containers can be removed as LLW.
- Oxide in 3013 containers may contain pieces up to 6 mm in diameter.
- Green Fuel pellets may be up to 10 mm in length.
- A dustless transfer system is provided to minimize dusting associated with charging and discharging the crusher.
- The crusher is designed to minimize holdup and has an installed gamma monitor to measure holdup.
- The glovebox windows are non-flammable.
- Lights are located outside gloveboxes.
- Any radiological releases bound chemical releases.
- Closed 3013s maintain confinement if dropped or tipped over.
- The FP MAR was determined as follows, (assume all oxide):
  - Staging/Material Preparation – five 3013 containers in Lag Storage (one 3013 in transit does not add to glovebox MAR) equals 30 kg
  - Can Opening – three 3013s in equipment, three 3013 containers in Lag Storage equals 30 kg
  - Crusher – three containers in equipment, three containers in Lag storage, one Butt can equals 32 kg
  - Accountability – four Batch cans in equipment (two scales, two Gamma Isotopic Counters), five Batch cans in Lag storage equals 18 kg
  - Exit Staging/Material Preparation – 10 Batch cans equals 20 kg
  - FP Room – two 3013 containers in transit equals 10 kg
  - Total FP glovebox equals 125 kg

- Total FP Room and glovebox equals 135 kg
- Airlocks are not storage areas.

2.2.1.1.3 SECTION C: OXIDATION

- 3013 containers of metal contain a maximum of 4.4 kg plutonium.
- 3013 containers of metal are not internally pressurized, so venting is unnecessary.
- The furnace prep and furnace gloveboxes are inerted to prevent rapid oxidation (sparking or burning) of the plutonium metal.
- The Container Openers are pipe cutters which will be used to open the outer and inner containers. The cutters are designed to minimize swaging of the container walls so that the inner container and convenience can are easily removed. Two container openers will be required (one in the outer container opening area and one in the furnace preparation area)
- The glovebox airlock reduces the amount of dust that enters the outer container opening area and accountability measurement area.
- The DMO furnace has an installed gamma monitor to measure holdup and is similar in design to the furnace used in the Pit Disassembly and Conversion Facility.
- The temperature and oxygen content of the furnace are controlled so that all the metal is oxidized, and the oxide particles are less than 1 mm in diameter.
- Glovebox windows are non-flammable.
- Lights are located outside gloveboxes.
- Any radiological releases bound chemical releases.
- Closed 3013 containers maintain confinement if dropped or tipped over.
- The DMO MAR was determined as follows:
  - Entry Staging/Material Preparation – five 3013 containers in Lag Storage (one 3013 in transit, does not add to glovebox MAR) equals 30 kg metal
  - Outer Can Opening – one 3013 container equals 5 kg metal
  - Furnace Preparation – four equipment positions, three Lag Storage equals 35 kg total plutonium oxide (for calculation purposes)
  - Furnaces – two 3013 containers (one in each furnace) equals 10 kg metal/oxide (assume oxide in totals below)
  - Accountability Measurement Area/Exit Staging- four equipment positions, five Lag Storage equals 45 kg plutonium oxide
  - DMO Room – two 3013 containers in transit equals 10 kg metal
  - Total DMO glovebox equals 120 kg plutonium oxide

  - Total DMO Room and glovebox equals 130 kg plutonium oxide
  - The upper bound of pressure that may be in an oxide 3013 container is 699 psig. Therefore, deflagration and loss of confinement events involving oxide 3013 containers are assumed to fail at 699 psig.
  - For fire events involving sealed 3013s, the release pressure is conservatively increased to 1,000 psig.
  - For fire and deflagration events involving non-3013 containers, the release pressure is less than 25 psig.

- Five kg plutonium loading in a furnace accounts for the 0.5 kg hold-up.

2.2.1.2 Module 2 – Assumptions

2.2.1.2.1 BAGLESS TRANSFER SYSTEM

- There cannot be an explosion in BTC because an explosion is only possible when a can is cut open. The can is only cut when the weld is leaking, which means that the container cannot hold pressure.
- No criticality events are credible once material is vitrified.
- Each VIT can will hold 10 kg of Vitrified glass consisting of 9 kg Frit and 1 kg plutonium oxide.
- Gas bottles, during maintenance in the BTS room, will require de-inventory of the room prior to starting any welding or the Gas Cylinder used for welding will have to be located outside of the room.

2.2.1.3 Module 3 – Assumption

2.2.1.3.1 GENERAL

- The can-in-canister assemblies consist of a typical DWPF canister modified with a pre-fabricated internal support rack to accommodate the plutonium vitrified glass product. The internal rack is designed to hold seven magazines, with each magazine containing four BTCs.
- Magazine loading is performed outside of glovebox containment. Magazines will be loaded horizontally. A remote operation will be provided to place the bagless cans into the magazine due to the anticipated high dose rates.
- The magazine body is slotted to minimize weight and allow the HLW glass to flow into the magazine and contact the BTCs.
- The end of the magazine opposite the closure plug is equipped with a knob to allow for remote handling of the magazine assembly.

- The bagless can storage area at -14 level plus the magazine storage area at 0 level will be sufficient to accommodate enough product to coincide with a major outage in DWPF.
- When the first magazine is lowered into a canister, the robotic arm operator locates one of the seven locations using a video monitor and inserts the magazine into the canister location. The magazine is retained in the canister location by a snap ring at the base of the internal rack assembly and latches in several vertical locations in the canister.
- After the first magazine is manually loaded, the remaining magazine locations are indexed by the robotic arm control system, and the robotic arm then automatically loads the remaining six magazines into the canister.
- Loading and further movement of the DWPF canister is performed in the vertical position.
- The canister closure plug is installed to preclude any foreign objects from entering the canister during subsequent handling, and is designed so that it can easily be removed upon placement in the DWPF melt cell.
- The canister loading operation will provide storage for up to eight loaded canisters awaiting transport to DWPF.
- The canister loading station is provided with the capability to load the canister into a shielded well permanently attached to the transport trailer.
- The plutonium LaBS glass will generate neutrons through the (alpha,n) reaction. Shielding measures are provided to ensure dose rates are maintained below specified limits.
- Security measures for roll-up quantities of materials, radcon methods for radiological dose measurement, and barcode methods for inventory tracking will be required in this stage. Electronic surveillance systems (Material Control and Accountability [MC&A]) are expected to be required to monitor the location. Radcon scalers will be needed to monitor radiological conditions. A barcode reader system will be needed to identify each plutonium glass can/BTC inserted into a magazine and each DWPF canister for repository reporting.

2.2.1.3.2 MAGAZINE LOADING AND STORAGE

- Accountability measurement will be performed on bagless cans prior to transfer to the Magazine Loading System. No additional NDA will be required.
- Assume a bounding value of 0.95 kg of plutonium per bagless can
- Load four bagless cans per magazine.
- Four bagless cans at-a-time will be transported to the -20 level via dedicated transfer system and transported via shielded cart to the room 210 Hot Tunnel located below the Magazine Loading Area. The vertical transport system will transfer four bagless can to the Magazine Loading Area.

- Storage must be provided for the equivalent of four months production of bagless cans. Storage may be as individual cans or loaded magazines. A maximum of 960 bagless cans may be stored in Bagless Can Interim Storage.
- The Magazine Loading Area contains a maximum of 32 bagless cans.
- Operations in the Magazine Loading area will be performed remotely with no personnel entry during normal operations.
- No explosions or criticality accidents are postulated from events involving vitrified material.

2.2.1.3.3 CANISTER LOADING SYSTEM

- No accountability measurement will be required for the Canister Loading System.
- Seven magazines with four bagless cans each will be loaded into each canister.
- Storage of loaded magazines will be provided. The Loaded Magazine Storage Area contains a maximum of 180 loaded magazines (720 bagless cans).
- A telescoping robotic arm attached to an overhead crane will be utilized for loading magazines into the canister.
- Operations in the Canister Loading area will be performed remotely with no personnel entry during normal operations.
- No explosions or criticality accidents are postulated from events involving vitrified material.

2.2.1.3.4 CANISTER TRANSPORT SYSTEM

- A maximum of eight canisters (56 magazines/224 bagless cans) are stored in the Loaded Canister Storage Area
- Two canisters containing seven magazines with four bagless cans in each magazine will be loaded into each transport trailer.
- An overhead crane will be utilized for loading the canister into the transport container.
- Operations in the Canister Loading area will be remotely controlled. Personnel entry will be permitted after the transport trailer has been loaded.
- No explosions or criticality accidents are postulated from events involving vitrified material.

2.2.1.4 Module 4 – Assumptions

2.2.1.4.1 LAB AND WASTE

- TRU Waste and Mixed TRU Waste are all considered to be the same type of waste
- TRU Waste Assay Room is at -20 in K Area
- TRU Waste Loading is located at -20 in K Area
- SWB Loading Area is located at -20 in K Area
- Assayed Pail Staging is located at -20 in K Area
- Un-assayed Container Staging is located at -20 in K Area
- Out-going Waste Staging Area is located at -20 in K Area
- LLW Staging is located at -20 in K Area
- LLW Loading is located at -20 in K Area
- Dirty Protective Clothing Storage room is located at -20 in K Area
- Waste Staging is located at -40 in K Area
- Failed equipment storage room is located on -40 in K Area
- Mixed Non-TRU/Hazardous Waste Staging is located at -40 in K Area
- Packaging areas include TRU Waste Loading, SWB Loading Area, and Outgoing Waste Staging Area
- Monitoring include TRU Waste Assay Room
- Staging includes un-assayed container staging, and assayed pail staging
- Transport covers waste movement between all rooms located at -40, -20, and 0 level
- Only one un-assayed pail of waste can be moved in Pu Vit
- There is 195 FGE Pu-239 per pail of TRU Waste
- TRU HEPA polybox equals 225 FGE of Pu-239
- TRU drums equal 195 FGE of Pu-239
- TRU SWB equals 325 FGE of Pu-239
- LLW (B12, B25, or 55-gallon drum) equals 31 FGE of Pu-239
- Waste assay cannot be performed on the -40 level, due to background levels, so unassayed waste will have to be transported through facility to -20 and be staged until assay can be performed

2.2.1.5 Module 5 – Assumptions

2.2.1.5.1 BALANCE OF PLANT

- Material Handling system requirements are based on processing the contents of five 3013 containers in a 24-hour period
- Assume no plutonium metal in automated Material Handling system
- Assume no exposure events for plutonium oxide in Material Handling system tunnels

2.2.1.6 Module 6 – Assumptions

2.2.1.6.1 MILLING, MIXING, AND VITRIFICATION

- There are a total of 10 melters for the VIT Process.
- There will be two melters per room.
- There are a total of two hoppers lines, but only one hopper is allowed in a room at a time.
- There are a total of two runs per day per melter, resulting in a total of 20 melter runs per day.
- There are no credible explosion events in MIX or VIT.
- There are no credible criticality events in VIT.
- Melter Batch equals 1 kg plutonium oxide plus 9 kg (nominal) Frit
- Can of Pu Vit equals Cylindrical Stainless steel container with approximately 1 kg plutonium oxide plus 9 kg Frit in vitrified (glass) form.
- Mix/Mill Total plutonium oxide equal 2 kg (batch can) plus 4 kg (two attritors) plus 4 kg (two collection hoppers) plus 2 kg (transport hoppers) plus 0.2 kg (hold-up) equals 12.2 kg
- Assumed Hold-up of 0.1 kg plutonium oxide per attritor mill
- Vitrification plutonium oxide MAR (from SDD) equals 1 kg (transport hopper) plus 1 kg (per melter, 10 melters total, max six in one room)
- Cooling Rack (five Vit can capacity under melter) has four filled Vit-cans and one empty for HE.

2.2.1.7 Module 7 – Assumptions

2.2.1.7.1 HEATING, VENTILATION AND AIR CONDITIONING

- Hazards associated with the confinement systems are addressed within the process specific HE tables.
- MAR values for the HVAC system are 226 grams of plutonium oxide per Glovebox Exhaust HEPA filter, 1.815 kg plutonium oxide per Main Glovebox Exhaust HEPA filter, and 7.26 kg plutonium oxide for the filter bank (four – Main Glovebox Exhaust HEPA filters).
- The Non-process Areas Ventilation System is a re-circulated conditioned air system that services the clean areas.
- The Process Area Supply System is a once-through conditioned air system to the process rooms and potentially contaminated areas.
- The Glovebox Exhaust System provides exhaust for air gloveboxes, hoods, and maintenance airflow for inert gloveboxes through pre-filters, testable HEPA filters and fans, and discharges to the main exhaust system.
- The Main Exhaust System exhausts air from the glovebox exhaust system, process rooms, and a portion of the clean areas through a sand filter, exhaust fans, and stack.
- Seismic II/I hazards will be evaluated as part of the design.

2.2.1.8 Module 8 – Assumptions

2.2.1.8.1 GREEN FUEL

- Green Fuel Pellets are sintered and do not release airborne radiological material under normal or accident conditions such as high temperature, high pressure (i.e., pins exposed to a fire) or impact events
- One CCC goes into a HUFP
- An Assembly is equal to a DFA or Indent-69
- Worst case CCC has 67 kg of plutonium
- Ident-69 MAR is bounding case assembly for Green Fuel (11.13 kg of plutonium)
- Due to configuration and form, a direct radiation or chemical exposure cannot occur with the Green Fuel

3.0 OPEN ITEMS

Open items are unresolved potential issues, inputs, assumptions, or analyses that can significantly affect the conclusions of the HA. The following are open items:

- Drawings (process flow, building layout, etc.) used for analysis were preliminary or not approved, leaving potential hazards unreviewed
- The risk matrix in Table A-3 reflects the revised risk rank identifiers proposed in the pending revision 5 of WSRC Manual SCD-11. This approach was selected based on the recommendation of WSMS and is reflected in the CHAP tables for events with a BEU frequency. This is judged to be conservative, however, it is not consistent with the currently approved methodology in SCD-11.
- Equipment design is preliminary or not approved, leaving potential hazards unreviewed,
- Operating procedures are not developed for Pu Vit processes, leaving potential hazards unreviewed
- Operator training programs are not developed for Pu Vit processes, leaving potential hazards unreviewed
- Programs (Emergency Preparedness, Emergency Response, Material Control and Accountability, etc.) have not been developed for Pu Vit Processes, leaving potential hazards unreviewed
- In determining the Pu Vit unmitigated consequence estimates, a spreadsheet was developed utilizing the KIS isotopics and Dose Conversion Factors (Ref. 4). In the KIS consequence analysis, the Effective Dose Equivalent values were calculated with the MACCS1 computer code. The analysis assumes a surface roughness of 100 cm, rather than the 3 cm recommended in more recent guidance. In addition, the analysis assumes 50th percentile meteorology for the co-located worker rather than the 95th percentile meteorology recommended in the new guidance. At the time the CHAP was completed, the new guidance required by DOE-STD-1189 was not implemented into the WSMS methodology. Therefore, the Pu Vit unmitigated consequence estimates may not be conservative relative to the new guidance.
- The approach for staging LLW and TRU waste containers outside of the MAA, has not been finalized. During initial HE, it was assumed that a Performance Category-1 (PC-1) structure would be constructed outside of the main KAC building for short term, Pu Vit only, waste container staging prior to shipment out of the KAC. It was also assumed that a TRU waste container (i.e., DOT 7A Type A) pressurized release could be prevented by crediting the filters used to prevent the buildup of flammable gases inside the containers. During the HE, a Waste Staging structure MAR limit of 6.5 kg FGE Pu 239 was selected, based on consequence calculations, as the threshold below which no safety-related controls would be required (i.e., unmitigated release of full facility MAR). After completion of the initial Waste Management HE, it was determined that a 6.5 kg MAR limit would require a Hazard Category-2 (HC-2) classification for the Waste Staging structure per DOE-STD-1027 (Ref. 8). To meet the performance goals for an HC-2 structure, a minimum functional classification of Safety Significant would be required to

mitigate the hazards associated with the contained MAR. In addition, it was determined that while the TRU waste container vents may be credited for preventing the buildup of flammable gases (i.e., deflagration or explosion), standard accident analysis practice is to assume an unmitigated pressurized release, since the filter cannot vent fast enough to prevent container pressure build-up. Several members of the original Waste Management CHAP team reconvened to evaluate the impact of this information on the Waste Management HE tables. In regard to waste management inside the Pu Vit MAA, already defined controls were adequate to mitigate the consequences associated with pressurized container releases. For the waste staging structure, it was determined that a structure functional classification upgrade with controls would be required to mitigate consequences associated with a pressurized container release related to fire and container loss of confinement accidents. Since the design of the waste staging structure was planned as PC-1 without any safety-related controls, this conclusion had the potential to adversely impact timely completion of CD-1 project safety documents. Potential delays were determined to be unjustifiable based on likely changes in the staging approach. For this reason, it was determined that placing a "HOLD" on Waste Staging, outside of the Pu Vit MAA boundary, while finalizing safety basis documentation for the remainder of the facility design was appropriate. Current Waste Staging design options include TRU waste staging outside of the Pu Vit MAA, but inside the primary HC-2 KAC structure, which meets PC-3 criteria. The LLW staging is still planned for an outside structure, but minimal MAR associated with a large number of LLW containers would result in an HC-3 structure with PC-1 design requirements. While the portion of the facility planned for TRU waste staging does not currently have safety related ventilation or fire protection, addition of these controls to the existing facility would be less complex and costly than building a new structure and adding controls. Additional justification for placing a "HOLD" on the waste staging structure design and HE tables and moving forward with completion of the safety basis documents, is found when considering the implications of Defense Nuclear Facility Safety Board 2004-2 requirements for Confinement Ventilation. The new Waste staging structure would require the approval of a Categorical Exclusion to avoid the need for a confinement ventilation system similar to that planned for the main Pu Vit process areas. Finally, the hazard analysis for the SRS Solid Waste facility includes evaluation of substantially greater numbers of waste containers (i.e., greater MAR), for similar accidents, and in locations where required controls are not currently scoped in the design. Prior to removal of the Waste Staging "HOLD," the Solid Waste Safety documentation will be evaluated for applicability, and determination of any required controls.

For all of these reasons, consequence mitigation and control specification for the original waste staging structure design has been put on hold. The waste staging specific events, designated by WS-# in the Appendix C tables, were generated under the assumption of pressurized container release in a PC-1 structure. The mitigated consequences were determined based on limited design controls. The tables are included "For Information Only", and will be modified at a later date to evaluate a Waste Staging design that will likely consider the results of a confinement ventilation categorical exclusion request, Solid Waste Documented Safety Analysis, capacity to handle staging for all of KAC waste, and use of existing space within the main KAC building.

4.0 METHODOLOGY

4.1 CONSOLIDATED HAZARDS ANALYSIS PROCESS METHODOLOGY

The CHAP provides an integration of several HAs (Process HA, Fire HA, Emergency Protection HAs, etc.), and integrates the HA function with the scope of work and the design of safety controls (Ref. 1). CHAP includes Hazard Identification (HI), facility/process segmentation, facility hazard classification, screening of common industrial hazards, unmitigated and mitigated HA, incorporation of periodic Process Hazard Reviews, FC of Structures, Systems and Components (SSCs), and programs employed as controls for the associated hazards. CHAP incorporates a team concept for the performance of HA activities.

The CHAP was used to identify potential hazardous events applicable to the Pu Vit and to select potential control strategies that eliminate the hazards and resultant hazardous situations, reduce the likelihood of occurrence of the event, or mitigate the consequences of the event. The CHAP includes the following steps:

- Hazard Baseline Determination
- HI
- Unmitigated/Mitigated HA
- FC

4.1.1 CONSOLIDATED HAZARDS ANALYSIS PROCESS PARTICIPANTS

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Ray Sprankle	Fire Protection Engineer	WSMS
Ronnie Reynolds	Fire Protection Engineer	WSMS
Mark Nadeau	Criticality Engineer	WSMS
Jag Joshi	Criticality Engineer	WSMS
Jason Huffer	Criticality Engineer	WSMS
Dave Welliver	Lead CHAP Engineer	WSMS
Bill Osborne	Lead CHAP Engineer	WSMS

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4.1.2 FACILITY WALKDOWNS

No *physical* walkdown was performed for this CHAP. At present, the facility is in Conceptual Design (CD-1). Normally, a walkdown of the facility is performed with the Facility Engineers and the HA Engineers. The walkdown should include both a physical walkdown and an information (or paper) walkdown. Physical walkdowns permit the team to familiarize themselves, first-hand, with actual facility systems, processes, practices, equipment, and inventory. Information or paper walkdowns is the process of HA team-members reviewing existing safety documentation, design/system drawings, procedures, etc., in the context of HI and HE.

The team reviewed various conceptual system/design drawings. No procedures, safety documentation, etc., were available while developing this report. This CHAP will have to be further refined as the project progresses towards the final stages of design, and processing unknowns have been determined.

4.2 HAZARD BASELINE DETERMINATION

The primary purpose of the Facility Hazard Categorization activity is to identify hazardous material inventories and to establish the facility hazard category per 10 CFR 830, DOE Standard (STD) 1027-92, and WSRC Procedure Manual 11Q so that appropriate safety documentation can be prepared (Ref. 6, 7, 8).

4.3 HAZARD ANALYSIS

The primary purpose of the HA is to ensure a comprehensive assessment of facility hazards and focus attention on those events that pose the greatest risk to the Offsite Public, CW, and the FW.

4.3.1 HAZARD ANALYSIS METHOD

The preferred method for identifying potential hazardous situations is the HAZOP Study. This technique forces the CHAP team to examine actual facility or design configurations (Ref. 1). HAZOP guide words were used to provide structure to the HA and stimulate the identification of hazards and hazardous situations. The team examined the major process steps or nodes of the Pu Vit and analyzed each to postulate hazardous situations or events.

The scope of the HAZOP included the following:

- All major aspects of Pu Vit operations
- Natural phenomena (e.g., earthquakes, tornadoes, and high velocity straight-winds), and external events (e.g., aircraft and vehicular impact)
- Consideration of the entire spectrum of possible events for a given hazard in terms of both frequency and consequence levels
- Facility activities or systems that pose no hazards or only pose common/SIHs addressed by other programs or regulations (e.g., OSHA, Department of Transportation [DOT]) were examined to the extent only if a loss of control of the activity or system could result in a release or loss of life. This is not a comprehensive review of SIHs.

The scope of the HAZOP did not include hazards screened as common hazards or willful acts, such as sabotage.

SIHs are defined as materials or energy sources that are routinely encountered in general industry and construction and for which consensus codes and/or standards (e.g., OSHA) exist to guide safe design and operation and are implemented. In accordance with DOE-STD-3009-94, SIHs are not typically evaluated, but when evaluated, are done so only to the extent that they could act as initiators and contributors to events that result in a radiological or chemical release (Ref. 9).

4.3.2 HAZARD ANALYSIS

The unmitigated HA documents the hazards of the facility, identifies and documents common/SIHs, identifies and groups unmitigated scenarios, and bins these hazardous events according to risk without regard for any safety controls or programs. During the unmitigated HA, the MAR equaled the available hazardous inventory that could be acted upon during the postulated event.

The results of the HAZOP are documented in HI and HE tables in Appendix B and C, respectively. Information contained in the HE tables includes the following:

- Event number
- Event
- Deviation
- Causes
- Unmitigated Frequency
- Unmitigated Consequences
- Unmitigated Risk Rank
- Preventive and Mitigative Controls
- Mitigated Frequency
- Mitigated Consequences
- Mitigated Risk Rank
- Comments

4.3.2.1 Event Number

The event number identifies the event based on the node or activity.

4.3.2.2 Event

This column gives a brief description of a postulated event, which clearly defines the event. The description should include the event, location, the release mechanism or other exposure mechanism, and the affected hazardous material or MAR that may be affected by the event. Event scenarios may include a release of hazardous energy and/or material, personnel injuries, loss of equipment or facilities, or loss of production.

4.3.2.3 Deviation

A deviation is a departure from the design intention that is discovered by systematically applying the HAZOP guide words (Ref. 1) to process parameters (flow, pressure, etc.). The result is a list for the CHAP team to review (no flow, high pressure, etc.) for each process node. If a result is determined to be an SIH, the event is documented as such. An SIH is a hazard routinely encountered in industry and construction for which national consensus codes or standards, or site standards, exist to guide safe design and operation without the need for a special HA.

4.3.2.4 Causes

A cause specifically states the failure, error, and operational and/or environmental condition that initiated the release event. Causes may be hardware failures, human errors, unanticipated process states (e.g., change of composition), and external disruptions (e.g., loss of power). By

identifying the cause(s) of the postulated event, the team is able to better determine the initiating frequency and achieve a better understanding of preventive and mitigative features necessary for that event.

4.3.2.5 Unmitigated Frequency

The unmitigated event frequency was determined through a qualitative and/or semi-quantitative process that involved assigning a frequency level to each event identified that could result in a release of hazardous energy and/or material, personnel injuries, loss of equipment or facilities, or loss of production. Frequency levels and descriptions, as specified in the CHAP Methodology Manual, are outlined in Table A-1 (Ref. 1).

The team determined which frequency level was appropriate for a particular event based on the event's cause(s). Sources of frequency information included: generic initiator frequency data, existing safety documentation, engineering calculations, generic failure rate data, and facility expert opinion. The frequency level was recorded in the Unmitigated Frequency column of the HA tables.

Uncertainties in frequency levels were accommodated by erring in the conservative direction from best-estimate values. This practice is particularly important when an event frequency is just below the next highest frequency level. For example, 9.7E-03 per year is at the high end of the "Unlikely" level. The CHAP team, considering the sources, methods, and uncertainty associated with this value, might collectively decide to call this event frequency "Anticipated" rather than "Unlikely."

4.3.2.6 Unmitigated Consequences

Event consequences are documented by specifying the impact on the receptors (described below). For HA purposes, unmitigated consequences are defined as the dose or exposure at specified receptor locations that have been determined without taking credit for barriers or controls, which could reduce the consequences. Consequences are a function of the type and characteristics of the hazard, the quantity released, the release mechanism, relative location of the release, and any relevant transport characteristics. Consequences can be determined from: (1) simple source term calculations, (2) existing safety documentation, and/or (3) qualitative assessment supported by simple calculations. The CHAP team utilized a spreadsheet calculation for consequence determination. Detailed information on the inputs and assumptions utilized in the calculations is provided in the Pu Vit Input and Assumptions Engineering Calculation (Ref. 3).

Consequence evaluation is the process of determining which of the consequence levels in Table A-2 are relevant to the three receptors for a particular release event. Table A-2 gives the radiological and chemical consequence levels for the specified receptor locations. Receptors are as follows:

Facility Worker — FWs are workers immediately adjacent to, or in the occupied area of, the hazard. "Occupied area of the hazard" refers to the area within the

last possible means of physically controlling the hazard or controlling access to the hazard (i.e., building, fence, permanent chain with multiple warning signs, etc.). FWs equate to the Worker Groups 1 and 2 (Ref. 5).

Co-located Worker — CWs are workers outside the occupied area of the hazard. If there is no defined physical means of controlling the hazard or controlling access to the hazard, the location is assumed to be at the worst possible location, but no closer than 100 meters to the hazard. CWs equate to the FC Worker Group 3. For this analysis, CW consequences were qualitatively determined from the dose at 100 meters.

Offsite Public — Offsite Public receptors are the Offsite Public or everyone outside the site boundary at the time of the event. For this analysis, Public receptor consequences were qualitatively determined from the dose at 8.9 kilometers.

The unmitigated HA is concerned with the maximally exposed individual at each of the receptor locations.

The unmitigated HA tables provide the impact (in Table A-2 terms: High, Moderate, Low, or Negligible) of the event on the three receptors for each of the postulated release events in the Unmitigated Consequence column.

4.3.2.7 Unmitigated Risk Rank

The objective of risk binning is to focus attention on those events that pose the greatest risk to the Offsite Public, the CW, and the FW. Higher risk events might be candidates for additional analysis and/or FC evaluation. Using event frequency and consequence levels, events are placed into "bins" to assess the relative risk for each of the receptor locations. Table A-3 are the risk rank matrices for the three receptor locations considered in the HA. Each bin contains a letter designation corresponding to the Level of Control (LOC) that may potentially be necessary to protect each receptor. Five regions are defined: "A1, A2, A3, B, and C." Regions may have different control selection requirements depending on receptor locations as shown below.

Table A-3 is the Risk Criteria Matrix.

Region "A1" — Unmitigated events falling in Region "A1" due to radiological release require controls (Safety Class for the Offsite Public and Safety Significant for the CWs and FWs) and are highly recommended for additional LOCs for all receptors as specified in WSRC Procedure Manual E7, Procedure 2.25 (Ref. 5). Unmitigated events falling in Region "A1," due to chemical release or prompt fatality (etc.), require Safety Significant controls and highly recommended for additional LOCs as specified in WSRC Procedure Manual E7, Procedure 2.25 (Ref. 5). The desired result is that the mitigated consequence is moved well into the "B" region, and possibly the "C" region or the event is prevented.

Region "A2" Unmitigated events falling in Region "A2" due to radiological release require controls (Safety Class for the Offsite Public and Safety Significant for the CWs and FWs) and are recommended for additional LOCs for all receptors as specified in WSRC Procedure Manual E7, Procedure 2.25 (Ref. 5). Unmitigated events falling in Region "A2" due to chemical release or prompt fatality (etc.), require Safety Significant controls and are recommended for additional LOCs as specified in WSRC Procedure Manual E7, Procedure 2.25 (Ref. 5). The desired result is that the mitigated consequence is moved well into the "B" region, and possibly the "C" region or the event is prevented.

Region "A3" Unmitigated events falling in Region "A3" due to radiological release require controls (Safety Class for the Offsite Public and Safety Significant for the CWs and FWs) and are considered for additional LOCs for the CW or the Offsite Public as specified in WSRC Procedure Manual E7, Procedure 2.25 (Ref. 5). Unmitigated events falling in Region "A3" due to chemical release or prompt fatality (etc.), require Safety Significant controls and considerations for additional LOCs as specified in WSRC Procedure Manual E7, Procedure 2.25 (Ref. 5). The desired result in the mitigated consequence is from "High" to "Low" or "Negligible."

Region "B" Events having moderate "B" consequences that challenge "A" region consequences require Safety Class (Offsite Public) or Safety Significant (CW or FW) controls. Otherwise, events falling in Region "B" require Facility Controls. The desired result is that the mitigated combination of consequence and frequency is moved toward, and possibly into, the "C" region.

Region "C" Events falling in Region "C" are not considered for controls. However, there may be events in this region that require the addition of Facility Controls because the frequency is higher than desired, or the occurrence of the uncontrolled event is unacceptable to management in any event, or the uncontrolled event is unacceptable for programmatic or political reasons.

Once the team has estimated the unmitigated event frequency and consequence level, events are located on the Risk Criteria Matrix, as shown in Table A-3, to assess relative risk.

4.3.2.8 Preventive and Mitigative Controls

Preventive features are features expected to reduce the frequency of a hazardous event. Mitigative features are features expected to reduce the consequence of an event. These might include engineered features (e.g., SSCs), administrative controls (e.g., procedures, policies, or programs), laws of physics (e.g., ambient conditions, buoyancy, or gravity), or inherent features (e.g., physical or chemical properties, location, or elevation) operating individually or in combination. Identification of safety features should start during the HI phase and should be carried through the end of the analysis. Preventive and mitigative features are listed in the HE tables in a manner that a distinction is made between administrative and design features.

Following the identification of hazardous events, the CHAP team identifies controls for these events. Safety Class controls are **bolded and underlined** for events that will affect the *Offsite Public* with unmitigated frequency/consequence bins in the "A1, A2, and A3" region of the Risk Criteria of Table A-3. Safety Significant controls are **bolded** for events that will affect the *workers* with unmitigated frequency/consequence bins in the "A1, A2, and A3" region of the Risk Criteria of Table A-3. Unmitigated events falling in "B" region require Defense in Depth (DID)/Facility Controls such that the mitigated combination of consequence and frequency is moved toward, and possibly into the "C" region. DID/Facility controls are *italic* for events that will effect the worker. C" region events generally have negligible consequences. "C" region events are evaluated by the team to determine if facility controls should be identified and underlined because the frequency of the event is higher than desired, the occurrence of the uncontrolled event is unacceptable to management, or the uncontrolled event is unacceptable for programmatic, political, or cost reasons. Controls that are not credited as Safety Class or Safety Significant controls are considered as DID controls.

4.3.2.9 Mitigated Frequency

The initiating frequency level of the event is modified with the reductions due to credited preventive features. The amount of frequency reduction is dependent on the effectiveness of the selected control(s).

4.3.2.10 Mitigated Consequences

The unmitigated consequence level of the event is modified with the reductions due to credited mitigative features. The amount of consequence reduction is dependent on the effectiveness of the selected control(s). Mitigated consequence levels are assigned per Table A-2.

4.3.2.11 Mitigated Risk Rank

Based on the prevented frequency levels and the mitigated consequence levels, the events are binned in the same manner as during the unmitigated analysis. The final risk bin determined in this manner is used to demonstrate that the preventive and mitigative features selected reduce the event risk to well below the established risk criteria (Ref. 1).

4.3.2.12 Remarks/Action

Remarks regarding the development of the event, clarification of the material released, action items to be followed up etc., are noted in this column. The required number of LOCs for the Offsite Public and each worker group are also noted in this column for each event based on guidance from WSRC Procedure Manual E7, Procedure 2.25 (Ref. 5).

4.4 FUNCTIONAL CLASSIFICATION

The purpose of the FC is to identify the SSCs and administrative controls required to protect the offsite individual, protect the worker, provide DID, and prevent, monitor, or detect a nuclear criticality accident. The SSCs that provide protection for the offsite individual are classified as Safety Class. The SSCs that provide DID, criticality safety, and protection for the worker are classified as Safety Significant. DSA controls are expected for these Safety Class and Safety Significant SSCs. Administrative controls that perform Safety Class or Safety Significant functions are also identified.

4.4.1 SAFETY CLASS ITEM SELECTION

The designation of Safety Class is applied to SSCs and administrative controls determined to be necessary for the facility to satisfy offsite EGs. The process used for Safety Class determination consists of comparing predicted consequences of hazardous material releases from postulated events/accidents to specific criteria (designated as offsite EGs). It is necessary to examine the postulated event sequences for candidate Safety Class functions. The HA event consequences are assigned based on conservative release scenarios. This conservatism ensures that the FC is assigned to an adequate set of equipment in an iterative approach such that the consequences are below the offsite EGs. For Safety Class functions, the consequence of concern is the exposure of the offsite individual to hazardous material. For events with unmitigated consequences challenging the offsite EGs, credit is taken for items that are classified Safety Class, and the resulting mitigated consequences are analyzed in the accident analysis. Sufficient items are selected in the analysis to ensure that either the consequences are below the offsite EGs or the event frequency is less than 1.0E-06 per year. Generally, event frequency is conservatively evaluated to ensure proper binning of the event for comparison against the EGs. This process ensures that the event consequences are always compared to the most conservative or restrictive EGs consistent with the uncertainty applicable to the event. The purpose of this conservative selection process is to ensure that the event is assigned a frequency bin that is easily defensible. All of the non-Safety Class items are assumed to fail to a worst-case condition unless other physical considerations demonstrate that the assumed failure is unrealistic. The criteria for selecting Safety Class functions are described in more detail in WSRC Procedure Manual E7, Procedure 2.25 (Ref. 5).

4.4.2 SAFETY SIGNIFICANT ITEM SELECTION

Safety Significant controls are those features that provide for worker protection and criticality safety, and may be a significant contributor to DID for the offsite receptors. The methodology for Safety Significant classification consists of identifying hazards that pose a risk of causing significant harm to workers regardless of their location. The site worker(s) can be one of the following:

- Group 1 – The workers immediately adjacent to the hazard
- Group 2 – The workers within the occupied area of the hazard

- Group 3 – The worker outside the occupied area of the hazard

After identifying the applicable hazards, appropriate safety functions are identified to protect the worker. SSCs and administrative controls are then selected to perform these functions and are classified as Safety Significant. In some cases, an iterative approach is needed to ensure that the FC is assigned to an adequate set of equipment such that the risk is below the Onsite Hazardous Material Criteria of WSRC Procedure Manual E7, Procedure 2.25 (Ref. 5)

The WSRC FC Procedure (WSRC Procedure Manual E7, Procedure 2.25, [Ref. 5]) requires that those SSCs that "prevent, monitor, or detect a nuclear criticality accident" be functionally classified as Safety Significant. The criteria for selecting Safety Significant functions are described in more detail in WSRC Procedure Manual E7, Procedure 2.25 (Ref. 5).

It should be noted that hazards for which national consensus codes and standards exist to guide safe design and operation, as well as hazards routinely encountered in general industry, are identified as SIHs and are excluded from evaluation.

4.4.3 FACILITY CONTROL SELECTION

DID, as an approach to facility safety, builds in layers of defense against the release of hazardous materials ensuring that no one layer is completely relied upon. To compensate for potential human and mechanical failures, DID is based on several layers of protection. This approach protects the offsite individual and the onsite worker in case a barrier is not fully effective.

Due to the depth of design at SRS facilities, there are usually more controls available than the minimum requirements necessary to meet the guidelines of Procedure 2.25 of WSRC Procedure Manual E7 (Ref. 5). Those facility controls that are beyond the minimum are not classified but still exist to provide additional facility DID.

4.4.4 CONTROL STRATEGY DEVELOPMENT

The mitigated HA/control strategy development activity begins with the treatment of events requiring Safety Class or Safety Significant controls (i.e., events whose unmitigated frequency/consequence are in the A1, A2, A3, or B region of the Risk Criteria [see Table A-3]). Controls to be credited are selected from the list of controls initially identified as part of the unmitigated HA. Control strategies were chosen using the following preferred selection strategy: prevention over mitigation, passive over active, and engineered controls over administrative controls. Factors such as cost, reliability, durability, life cycle cost, and facility operating life, etc., were also considered during control selection.

NOTE

This document (WSRC-TR-2007-00068) was developed in accordance with the CHAP Methodology Manual, WSRC-IM-2002-00003 (Ref. 1) and WSRC Procedure Manual E7, Procedure 2.25, Revision 14 (Ref. 5). Process related internal events that are not covered by Natural Phenomena Hazard (NPH) or External Events are assumed to be credible events, regardless of frequency, and fall into the Region A's; however, also see related criteria in WSRC Procedure Manual E7, Procedure 2.25, att 8.8. Credible external man made events with a frequency of less than 10^{-6}/year as conservatively estimated, or less than 10^{-7}/year as realistically estimated fall into Region C. NPH events are evaluated at frequencies specified by DOE-STD-1020.

5.0 RESULTS

5.1 HAZARD BASELINE DETERMINATION

Section 3.3.2.2.1 of the KAC DSA summarizes the KAC hazard categorization as a Nuclear Hazard Category 2 facility (Ref. 10).

5.2 HAZARD ANALYSIS

The CHAP was used to identify potential hazardous events applicable to the Pu Vit and to select potential control strategies that eliminate the hazards and resultant hazardous situations, reduce the likelihood of occurrence of the event, or mitigate the consequences of the event.

Based on the operations of the Pu Vit, hazardous events were analyzed for the following Modules:

- Material Receipt, Feed Preparation, and Metal Oxidation
- Bagless Transfer
- Magazine Load, Canister Load/Transportation, Product MC&A
- Lab and Waste
- Balance of Plant
- Milling, Mixing and Vitrification
- HVAC and Confinement
- Green Fuel

Event numbers were assigned according to specific operations. HA results are documented in the HE Tables in Appendix C.

5.2.1 RESULTS OF UNMITIGATED HAZARD ANALYSIS

Using the HAZOP analysis approach, process deviations were identified for the Pu Vit. Based on the unmitigated frequency and consequence levels determined, each event was binned in frequency-consequence space to assess relative risk per Table A-3. Events with a risk rank of A1, A2, A3, and B were carried forward to the mitigated HA/control strategy development phase.

5.2.1.1 Public Risk - Radiologically

Public Region A1, A2, or A3 Events
MRS-1, MRS-2, MRS-3, MRS-5, MRS-6, MRS-8, FP-1, FP-2, FP-3, FP-6, FP-7, FP-8, FP-9, FP-10, FP-13, OX-1, OX-2, OX-3, OX-5, OX-6, OX-10, OX-11, OX-12, OX-13, OX-14, OX-19, MHS-1, GE-1, GE-2, GE-3, GE-5, GE-7, GE-8, GE-9, GE-10, GE-11, GE-13, GE-15, and GF-4
Public Region B Events
FP-4, FP-5, OX-17, WS-1, WS-7, GE-9, GF-5

5.2.1.2 Co-Located Worker Risk- Radiologically

Co-Located Worker Region A1, A2, or A3 Events
MRS-1, MRS-2, MRS-3, MRS-5, MRS-6, MRS-8, FP-1, FP-2, FP-3, FP-4, FP-5, FP-6, FP-7, FP-8, FP-9, FP-10, FP-13, OX-1, OX-2, OX-3, OX-5, OX-6, OX-10, OX-11, OX-12, OX-13, OX-14, OX-19, WS-1, WS-7, MHS-1, GE-1, GE-2, GE-3, GE-5, GE-7, GE-8, GE-9, GE-10, GE-11, GE-13, GE-14, GE-15
Co-Located Worker Region B Events
MRS-11, MRS-12, MRS-13, FP-11, FP-12, FP-17, FP-18, FP-19, FP-20, OX-17, OX-18, OX-20, OX-21, OX-24, OX-25, OX-26, OX-27, OX-28, TWP-1, TWP-3, TWP-4, TWP-5, TWP-9, TWP-13, TWM-1, TWM-2, TWM-7, TWM-8, TWT-1, TWT-2, TWT-3, TWT-7, TWT-8, TWT-10, WS-3, WS-8, WS-10, MHS-4, MHS-5, MHS-13, MHS-14, MHS-15, MHS-16, MHS-17, DB-3, DB-4, DB-5, DB-6, GE-4, GE-12, MIX-6, MIX-7, MIX-8, HVAC-20, HVAC-21, GF-1, GF-4, GF-5, GF-11, and GF-12

5.2.1.3 Facility Worker Risk- Radiologically

Facility Worker Region A1, A2, or A3 Events
MRS-1, MRS-2, MRS-3, MRS-5, MRS-6, MRS-8, MRS-11, MRS-12, MRS-13, FP-1, FP-2, FP-3, FP-4, FP-5, FP-6, FP-7, FP-8, FP-9, FP-10, FP-11, FP-12, FP-13, FP-17, FP-18, FP-19, FP-20, OX-1, OX-2, OX-3, OX-5, OX-6, OX-10, OX-11, OX-12, OX-13, OX-14, OX-17, OX-18, OX-19, OX-20, OX-21, OX-24, OX-25, OX-26, OX-27, OX-28, MCL-12, TWP-1, TWP-3, TWP-4, TWP-7, TWP-9, TWP-13, TWM-3, TWM-7, TWM-8, TWT-1, TWT-2, TWT-5, TWT-7, TWT-8, TWT-10, WS-1, WS-3, WS-4 WS-7, WS-8, WS-10, MHS-1, MHS-4, MHS-5, MHS-13, MHS-14, MHS-15, MHS-16, MHS-17, NDA-5, DB-1, DB-2, DB-3, DB-4, DB-5, DB-6, GE-1, GE-2, GE-3, GE-4, GE-5, GE-7, GE-8, GE-9, GE-10, GE-11, GE-12, GE-13, GE-14, GE-15, MIX-5, MIX-6, MIX-7, MIX-8, VIT-6, VIT-7, HVAC-20, HVAC-21, GF-1, GF-4, GF-5, GF-11, and GF-12
Facility Worker Region B Events
MRS-10, FP-16, OX-4, OX-7, OX-8, OX-9, OX-15, OX-16, OX-23, BTS-12, MCL-11, MCL-13, TWP-5, TWP-8, TWP-10, TWP-12, TWP-14, TWM-1, TWM-2, TWM-4, TWM-9, TWT -3, TWT-6, TWT-11, WS-2, WS-5, WS-9, FESR-1, FESR-2, MHS-2, MHS-8, MHS-10, MHS-11, MHS-12, NDA-4, MIX-1, MIX-2, MIX-3, MIX-4, VIT-2, VIT-3, VIT-4, VIT-5, HVAC-7, HVAC-8, HVAC-10, HVAC-12, HVAC-13, HVAC-14, HVAC-15, HVAC-17, HVAC-19, GF-2, GF-3, GF-6, GF-8, and GF-10

5.2.1.4 Standard Industrial Hazard

Standard Industrial Hazards
DB-2, GE-3a, GF-7, HVAC-1, HVAC-2, LWP/T-3, NDA-5, TWM-3, TWM-4, TWM-9, TWP-7, TWP-8, TWP-14, TWT-5, TWT-6, TWT-11, VIT-7, and WS-4

5.3 FUNCTIONAL CLASSIFICATION

5.3.1 CONTROL STRATEGY DEVELOPMENT

Control strategies are required for the hazardous events that were determined to challenge the Risk Criteria (Region A1, A2, A3, or B events). SSCs and administrative controls that function to maintain the facility within a safe configuration and to protect the Offsite Public, CWs, FWs, and the environment should be identified. The CHAP team examined each event that resulted in challenging risk criteria for the FW, CW, or Offsite Public to identify those safety functions that are required to prevent (preferred) or mitigate a release of hazardous material or energy.

The events that fell into the unmitigated Regions A1, A2, A3, or B of Table A-3 of the Public Risk Criteria Matrix require Safety Class Controls. Safety Class controls were selected to drive the risk into Region B or preferably Region C. Controls selected for these events are **bolded and underlined** in Appendix C tables.

The events that fell into the unmitigated Regions A1, A2, A3, and B of the CW and FW Risk Criteria Matrix of Table A-3, require Safety Significant controls to drive the risk into Region B or preferably Region C. Controls selected for these events are **bolded** in Appendix C tables. For unmitigated events that fall into the low Region B of the CW and FW Risk Criteria Matrix of Table A-3, facility controls were selected to drive the risk to Region C. Controls selected for these events are *italic* in Appendix C tables. The controls that are not credited as Safety Significant controls are considered DID controls.

For the events that were identified as SIH, Safety Significant and facility controls were selected, where appropriate. However, in most cases, the events are identified to inform the facility. Events that are a non-radiological initiator, but that can cause radiological releases are not considered SIH.

6.0 CONCLUSIONS

This report documents the HA for the Pu Vit. Using the criteria outlined in the CHAP Methodology Manual, process deviations were identified employing the HAZOP technique (Ref. 1). Control strategies were developed for the hazardous events that were determined to challenge risk criteria (Region A1, A2, A3, or B events). Safety Class and Safety Significant controls were selected to ensure that the mitigated risk of any postulated event results in risk Region B or C. These controls are identified in Appendix C in the HE Tables, Appendix D with the System Structure and Components Tables, or Appendix E with the Design and Administrative Controls Tables. For unmitigated events, which fall in the low Region B, facility controls were selected to result in a mitigated risk being lowered to Region B or C. Facility controls can also be found in Appendix C, D, and E.

7.0 REFERENCES

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10 K-Area Complex Documented Safety Analysis. WSRC-SA-2002-00005, Rev. 1, Change Notice 5a, Washington Savannah River Company, Savannah River Site, Aiken SC, September 2006.

APPENDIX A

METHODOLOGY TABLES

Table A-1 Frequency Evaluation Levels

Acronym	**Description**	**Frequency Level (f) ($year^{-1}$)**
A	Anticipated	$f \geq 10^{-2}$/yr
U	Unlikely	$10^{-4} \leq f < 10^{-2}$/yr
EU	Extremely Unlikely	$10^{-6} \leq f < 10^{-4}$/yr
BEU	Beyond Extremely Unlikely	$f < 10^{-6}$/yr

Table A-2 Consequence Evaluation Levels for Hazard Receptors

Consequence Level (Abbreviation)		Offsite Public	Facility Worker	Co-Located Worker
High (H)	Non-rad/Non Chemical Injury		Prompt worker fatality, acute injury that is immediately life threatening, or permanently disabling	Prompt worker fatality, acute injury that is immediately life threatening, or permanently disabling
	Radiological	C ≥ 25.0 rem	C ≥ 100 rem Or Radiological material quantity exceeds Hazard Category 3 threshold (per DOE-STD-1027) Or High consequence injury due to radiological release or exposure	Ç≥ 100 rem Or High consequence injury due to radiological release or exposure
	Chemical	C ≥ ERPG-2	Uniform distribution of total release C ≥ ERPG-3 Or High consequence injury due to chemical release or exposure	C ≥ ERPG-3 or ≥ 29 CFR 1910.119 TQ released Or High consequence injury due to chemical release or exposure
Moderate (M)	Non-rad/Non Chemical Injury		Serious injury, no immediate loss of life, no permanent disabilities, hospitalization required	Serious injury, no immediate loss of life, no permanent disabilities, hospitalization required
	Radiological	5.0 ≤ C < 25 rem	25 ≤ C < 100 rem Or Moderate consequence radiological related injury	25 ≤ C < 100 rem Or Moderate consequence radiological related injury
	Chemical	ERPG-1 ≤ C < ERPG-2	Uniform distribution of total release ERPG-2 ≤ C < ERPG-3 Or Moderate consequence chemical related injury	ERPG-2 ≤ C < ERPG-3 Or Moderate consequence chemical related injury
Low (L)			Minor injuries, no hospitalization	Minor injuries, no hospitalization
	Radiological	0.5 ≤ C < 5.0 rem	5.0 ≤ C < 25 rem Or low consequence radiological related injuries	5.0 ≤ C < 25 rem Or low consequence radiological related injuries
	Chemical	PEL-TWA ≤ C < ERPG-1	Uniform distribution of total release ERPG-1 ≤ C < ERPG-2 Or low consequence chemical related injuries	ERPG-1 ≤ C < ERPG-2 Or low consequence chemical related injuries
Negligible (N)	All	< Low	< Low	

ERPG Emergency Response Planning Guideline
TQ Threshold Quantity
PEL-TWA Permissible Exposure Limit/Time Weighted Average

Table A-3 Radiological, Chemical Hazard, and Physical Injury Related Controls Selection Criteria Matrix: Offsite Public, Co-located, and Facility Worker (See Open Items related to BEU Consequence exceptions)

Frequency → / Consequence ↓	Beyond Extremely Unlikely ($f < 10^{-6}$/yr.)	Extremely Unlikely ($10^{-6} \leq f < 10^{-4}$/yr.)	Unlikely ($10^{-4} \leq f < 10^{-2}$/yr)	Anticipated ($f \geq 10^{-2}$/yr)
**High	C/A3	A2	A1	A1
Moderate	C/B	B	B	B
Low	C/B	B	B	B
Negligible	C	C	C	C

Key:

A1 Region A1
Unmitigated events falling in Region "A1" due to radiological release require controls (Safety Class for the public and Safety Significant for the workers) and are **highly recommended** for additional LOCs for all receptors as specified in WSRC Procedure Manual E7, Procedure 2.25 (Ref. 5). Unmitigated events falling in Region "A1," due to chemical release or prompt fatality (etc.), require Safety Significant controls and **highly recommended** for additional LOCs as specified in WSRC Procedure Manual E7, Procedure 2.25 (Ref. 5). The desired result is that the mitigated consequence is moved well into the "B" region, and possibly the "C" region or the event is prevented.**

A2 Region A2
Unmitigated events falling in Region "A2" due to radiological release require controls (Safety Class for the public and Safety Significant for the workers) and are **recommended** for additional LOCs for all receptors as specified in WSRC Procedure Manual E7, Procedure 2.25 (Ref 5). Unmitigated events falling in Region "A2" due to chemical release or prompt fatality (etc.), require Safety Significant controls and are **recommended** for additional LOCs as specified in WSRC Procedure Manual E7, Procedure 2.25 (Ref. 5). The desired result is that the mitigated consequence is moved well into the "B" region, and possibly the "C" region or the event is prevented.**

A3 Region A3
Unmitigated events falling in Region "A3" due to radiological release require controls (Safety Class for the public and Safety Significant for the workers) and are considered for additional LOCs for CW or public as specified in WSRC Procedure Manual E7, Procedure 2.25 (Ref. 5). Unmitigated events falling in Region "A3" due to chemical release or prompt fatality (etc.), require Safety Significant controls and considerations for additional LOCs as specified in WSRC Procedure Manual E7, Procedure 2.25 (Ref. 5). The desired result in the mitigated consequence is from "high" to "low" or "negligible."

B Region B
Events having moderate "B" consequences that challenge "A" region consequences require Safety Class (public) or Safety Significant (worker) controls. Otherwise, events falling in Region "B" require Facility Controls. The desired result is that the mitigated combination of consequence and frequency is move toward, and possibly into, the "C" region.

C Region C
Events falling in Region C are not considered for controls. However, there may be events in this region that require the addition of Facility Controls because the frequency is higher than desired, or the occurrence of the uncontrolled event is unacceptable to management in any event, or the uncontrolled event is unacceptable for programmatic or political reasons.

* Process related internal events that are not covered by NPH or External Events are assumed to be credible events, regardless of frequency, and fall into the Region A's; however, also see related criteria in WSRC Procedure Manual E7, Procedure 2.25, att 8.8. Credible external man made events with a frequency of less than 10^{-6}/year as conservatively estimated, or less than 10^{-7}/year as realistically estimated fall into Region C. NPH events are evaluated at frequencies specified by DOE-STD-1020.

APPENDIX B

HAZARD IDENTIFICATION TABLES

Table B-A.1 Hazard Identification Table - Material Receipt and Storage

Location	Hazard Energy Sources and Materials																																		
	Electrical																		Thermal													Open Flame				
(identifier for system, sub-system, or operational feature in this facility section)	Battery Banks	Cable Runs	Diesel Generators	Electrical Equipment	Hot Plates	Heaters	High Voltage	Locomotive, electrical	Motors	Pumps	Power Tools	Switchgear	Service Outlets, fittings	Transformers	Transmission Lines	Underground Wiring	Wiring	Other	Bunsen Burner, Hot Plate	Electrical Equipment	Furnaces	Boilers	Lasers	Electrical Wiring	Welding Surfaces	Engine Exhaust	Heaters	Steam Lines	Welding Torch	Exothermic Reactions	Other	Bunsen Burners	Torches	Pilot Lights	Gas Welding	Other
Transfer Route to Elevator		X		X									X				X							X												
Elevator*		X		X					X				X				X			X				X												
Transfer Route to Feed Prep (same as FP)		X		X			X		X		X		X				X			X				X												
Transfer Route to OX		X		X			X		X		X		X				X			X	X			X												

X = Refers to the hazards considered applicable

FOOTNOTES:

*Electric and goes to -40

Table B-A.1 Hazard Identification Table - Material Receipt and Storage

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																		
							Flammable											Explosive/Pyrophoric																	
	Pyrophoric (Pu & U Metal)	Pyrophoric (Other)	SC* (Nitric Acid and Organics)	SC* (Other)	Combustible Materials	Uncontrolled Chem. Reactions	Flammable Gases	Natural Gas	Spray paint	Compressed Flammable Gases	Propane	Paint Solvent	Cleaning/Decon Solvents	Gasoline	Flammable Liquids	Flammable Mixtures	Other	Explosive Gas	Dynamite	Sodium	Hydrogen (batteries)	Primer Cord	Electric Squibs	Nitrates	Dusts	Peroxides	Caps	Plutonium/Uranium	Potassium	Superoxides	Hydrogen/Tritium	Propane	Explosive Chemicals	Other
Transfer Route to Elevator	X				1																														
Elevator	X				1																														
Transfer Route to Feed Prep (same as FP)	X				1																														
Transfer Route to OX	X				1																														

X = Refers to the hazards considered applicable

FOOTNOTES:

1- Shielding material in cart

Table B-A.1 Hazard Identification Table - Material Receipt and Storage

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																					
				Ionizing Rad.									Hazardous Materials																									
	Radiological Material	Fissile Material	Non-Ionizing Radiation	Fissile Material	Radiography Equipment	Electron Beams	X-Ray Machines	Critical masses	Contamination	Radioactive Materials	Radioactive Sources	Other	Alkali Metals	Asphyxiants	Acetone	Fluorides	Lead	Drowning	Asphyxiation	Ammonia and Compounds	Beryllium and Compounds	Chlorine and Compounds	Trichlorethylene	Decontamination Solutions	Dusts and Particles	Sandblasting particles	Metal Plating	Herbicides	Insecticides	Bacteria	Viruses	Biological	Carcinogens	Oxidizers	Corrosives	Other Toxics	Other
Transfer Route to Elevator	X	X		X						X			2			2	2				2	2											2			2	
Elevator	X	X		X						X			2			2	2				2	2											2			2	
Transfer Route to Feed Prep (same as FP)	X	X		X						X	X		2			2	2				2	2											2			2	
Transfer Route to OX	X	X		X						X	X		2			2	2		1		2	2											2			2	

X = Refers to the hazards considered applicable

FOOTNOTES:

1- Ar, He

2- Known contaminants in 3013s

Table B-A.1 Hazard Identification Table - Material Receipt and Storage

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																												
	Kinetic - Linear and Rotational (Friction)																			Potential (Pressure)									
	Belts	Bearings	Presses	Grinders	Crane Loads (in motion)	Vehicles	Rail Cars	Fork Lifts	Carts	Dollies	Centrifuges	Drills	Saws	Shears	Fans	Gears	Motors	Power Tools	Other	Gas Bottles	Gas Receivers	Pressure Vessels	Coiled Springs	Boilers	Heated Surge Tanks	Autoclaves	Furnaces	Stressed Members	Steam Headers/Lines	Other (elevator travel)
Transfer Route to Elevator									X																					
Elevator		X							X							X	X													X
Transfer Route to Feed Prep (same as FP)									X								X	X												1
Transfer Route to OX									X								X	X		2										1

X = Refers to the hazards Considered applicable

FOOTNOTES:

1- Sprinkler system flood

2- O2, Ar, He

Table B-A.1 Hazard Identification Table - Material Receipt and Storage

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																				
	Potential (Height/Mass)																					Natural Phenomena										Vehicles in Motion							
	Stairs	Lifts	Cranes	Elevated Doors	Loading Docks	Hoists	Elevators	Trucks	Jacks	Scaffolds and ladders	Pits	Elevated Work Surfaces	Mezzanines	Other	Firearm Discharge (puncturing)	Non-Facility Event (Explosion)	Non-Facility Event (Power Outage)	Non-Facility Event (Aircraft Crash)	Non-Facility Event (Transportation)	Non-Facility Event (Fire)	Non-Facility Event (Other)	Earthquake	Flood	Lightning	Rain	Snow, Ice	Freezing Weather	Straight Wind	Tornado	Other	Airplane	Helicopter	Train	Heavy construction Equipment	Truck/Car	Forklift/Lift Truck	Other (Cart, Elevator)	Crane/Hoist
Transfer Route to Elevator															X							X															X	
Elevator							X								X							X															X	
Transfer Route to Feed Prep (same as FP)															X							X															X	
Transfer Route to OX															X							X															X	

X = Refers to the hazards considered applicable

FOOTNOTES:

Table B-B.1 Hazard Identification Table - Feed Preparation

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																		
	Electrical																		Thermal													Open Flame				
	Battery Banks	Cable Runs	Diesel Generators	Electrical Equipment	Hot Plates	Heaters	High Voltage	Locomotive, electrical	Motors	Pumps	Power Tools	Switchgear	Service Outlets, fittings	Transformers	Transmission Lines	Underground Wiring	Wiring	Other	Bunsen Burner, Hot Plate	Electrical Equipment	Furnaces	Boilers	Lasers	Electrical Wiring	Welding Surfaces	Engine Exhaust	Heaters	Steam Lines	Welding Torch	Exothermic Reactions	Other	Bunsen Burners	Torches	Pilot Lights	Gas Welding	Other
3013 Staging													X				X	5																		
Airlock																																				
Puncture Vent/Can Cutter		X							1	2	1		X				X	5		X																
Crusher/Screen Oxide/Sample		X							3		3		X				X	5		X																
Accountability/Sample Area		X		X					X				X				X	5,6					10	X												12
Exit Staging													X				X	5																		
Glovebox Wide		X							8				X				X	4															11		11	
Elevator									7																						10					
Feed Prep Room		X		X			9		X	X	X		X	X			X			X			X													

X = Refers to the hazards considered applicable

FOOTNOTES:

1- Puncture vent, drill, can cutter (120-240V)
2- Vacuum pump
3- Crusher motor, vibrator on dumper
4- CCTV (low voltage)
5- Scales, bar code reader (low voltage)
6- Gamma detector (low voltage)
7- Screw Motor
8- Electric Hoist
9- Instrument cabinet
10- Laser based Laser Induced Breakdown Spectroscopy (LIBS) system with sample blender
11- Maintenance
12- Micro-plasma burst

Table B-B.1 Hazard Identification Table - Feed Preparation

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																	
							Flammable											Explosive/Pyrophoric																
	Pyrophoric (Pu & U Metal)	Pyrophoric (Other)	SC* (Nitric Acid and Organics)	SC* (Other)	Combustible Materials	Uncontrolled Chem. Reactions	Flammable Gases	Natural Gas	Spray paint	Compressed Flammable Gases	Propane	Paint Solvent	Cleaning/Decon Solvents	Gasoline	Flammable Liquids	Flammable Mixtures	Other	Explosive Gas	Dynamite	Sodium	Hydrogen (batteries)	Primer Cord	Electric Squibs	Nitrates	Dusts	Peroxides	Caps	Plutonium/Uranium	Potassium	Superoxides	Hydrogen/Tritium	Propane	Explosive Chemicals	Other
3013 Staging	X				X																													
Airlock	X				X																													
Puncture Vent/Can Cutter	X				X													1																
Crusher/Screen Oxide/Sample	X				X																													
Accountability/Sample Area			4		X																													3
Exit Staging					X																													
Glovebox Wide					X																													
Elevator					X																													
Feed Prep Room	2				X																X													

X = Refers to the hazards considered applicable

FOOTNOTES:

1- Inside Can
2- Result of mistake
3- Liquid Nitrogen
4- Unknown polymer binder

Table B-B.1 Hazard Identification Table - Feed Preparation

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																						
				Ionizing Rad.									Hazardous Materials																										
	Radiological Material	Fissile Material	Non-Ionizing Radiation	Fissile Material	Radiography Equipment	Electron Beams	X-Ray Machines	Critical masses	Contamination	Radioactive Materials	Radioactive Sources	Other	Alkali Metals	Asphyxiants	Acetone	Fluorides	Lead	Drowning	Asphyxiation	Ammonia and Compounds	Beryllium and Compounds	Chlorine and Compounds	Trichlorethylene	Decontamination Solutions	Dusts and Particles	Sandblasting particles	Metal Plating	Herbicides	Insecticides	Bacteria	Viruses	Biological	Carcinogens	Oxidizers	Corrosives	Other Toxics	Other
3013 Staging	X	X		X						X			5			5	5				5	5											5			5	
Airlock	X	X		X						X			5			5	5				5	5											5			5	
Puncture Vent/Can Cutter	X	X		X						X			5			5	5				5	5											5			5	
Crusher/Screen Oxide/Sample	X	X		X						X			5			5	5				5	5			5								5			5	
Accountability/Sample Area	X	X		X						X	2	6	5	4		5	5				5	5			5								5			5	
Exit Staging	X	X		X						X			5			5	5				5	5											5			5	
Glovebox Wide	X	X	1	X						X			5			5	5				5	5			5								5			5	
Elevator	X	X		X						X			5			5	5				5	5											5			5	
Feed Prep Room	X	X	X	X						X	X		5	4		5	5				5	5											5			5	3

X = Refers to the hazards considered applicable

FOOTNOTES:

1- Barcode reader
2- Accountability equipment
3- Water sprinkler
4- N_2
5- Known contaminants in 3013s
6- Photon Beam

Table B-B.1 Hazard Identification Table - Feed Preparation

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																												
	Kinetic - Linear and Rotational (Friction)																			Potential (Pressure)									
	Belts	Bearings	Presses	Grinders	Crane Loads (in motion)	Vehicles	Rail Cars	Fork Lifts	Carts	Dollies	Centrifuges	Drills	Saws	Shears	Fans	Gears	Motors	Power Tools	Other	Gas Bottles	Gas Receivers	Pressure Vessels	Coiled Springs	Boilers	Heated Surge Tanks	Autoclaves	Furnaces	Stressed Members	Steam Headers/Lines	Other
3013 Staging																													
Airlock																													
Puncture Vent/Can Cutter		X										X					X					3								
Crusher/Screen Oxide/Sample		X	X														X													
Accountability/Sample Area																	X													
Exit Staging																														
Glovebox Wide																	X		4											
Elevator		X							X								X													
Feed Prep Room						X			X								X		1											2

X = Refers to the hazards
Considered applicable

FOOTNOTES:

1- Transport cans
2- Pressurized Air, Service gases
3- Can puncture device is a pressure vessel
4- Trolley

Table B-B.1 Hazard Identification Table - Feed Preparation

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																				
	Potential (Height/Mass)																					Natural Phenomena									Vehicles in Motion							
	Stairs	Lifts	Cranes	Elevated Doors	Loading Docks	Hoists	Elevators	Trucks	Jacks	Scaffolds and ladders	Pits	Elevated Work Surfaces	Mezzanines	Other	Firearm Discharge (puncturing)	Non-Facility Event (Explosion)	Non-Facility Event (Power Outage)	Non-Facility Event (Aircraft Crash)	Non-Facility Event (Transportation)	Non-Facility Event (Fire)	Non-Facility Event (Other)	Earthquake	Flood	Lightning	Rain	Snow, Ice	Freezing Weather	Straight Wind	Tornado	Other	Airplane	Helicopter	Train	Heavy construction Equipment	Truck/Car	Forklift/Lift Truck	Other (Cart, Elevator)	Crane/Hoist
3013 Staging																						X																
Airlock																						X																
Puncture Vent/Can Cutter																						X																
Crusher/Screen Oxide/Sample																						X																
Accountability/Sample Area																						X																
Exit Staging																						X																
Glovebox Wide						X																X															1	
Elevator							X															X																
Feed Prep Room													X									X													X			

X = Refers to the hazards considered applicable

FOOTNOTES:
1- Pull cart

Table B-C.1 Hazard Identification Table - Metal Oxidation

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																			
	Electrical																		Thermal													Open Flame				
	Battery Banks	Cable Runs	Diesel Generators	Electrical Equipment	Hot Plates	Heaters	High Voltage	Locomotive, electrical	Motors	Pumps	Power Tools	Switchgear	Service Outlets, fittings	Transformers	Transmission Lines	Underground Wiring	Wiring	Other	Bunsen Burner, Hot Plate	Electrical Equipment	Furnaces	Boilers	Lasers	Electrical Wiring	Welding Surfaces	Engine Exhaust	Heaters	Steam Lines	Welding Torch	Exothermic Reactions	Other	Bunsen Burners	Torches	Pilot Lights	Gas Welding	Other
3013 Staging													X				X	4																		
Outer 3013 Open									X		X		X				X	4																		
Airlock																																				
Furnace Prep		X		X					X		X		X				X	4		X																
Furnace		X		X		X			X				X				X	4		X	X															
Airlock																																				
Accountability		X											X				X	5,6																		
Exit Staging													X				X	3																		
Glovebox Wide		X		X					X				X				X	2																		
OX Room		X		X			1		X	X	X		X	X			X			X																
Elevator									X																											

X = Refers to the hazards considered applicable

FOOTNOTES:

1- Instrument cabinet
2- CCTV (low voltage)
3- Scales, bar code reader (low voltage)
4- Gamma detector (low voltage)
5- Scales, bar code reader (low voltage)
6- Gamma detector (low voltage)

Table B-C.1 Hazard Identification Table - Metal Oxidation

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																	
							Flammable											Explosive/Pyrophoric																
	Pyrophoric (Pu & U Metal)	Pyrophoric (Other)	SC* (Nitric Acid and Organics)	SC* (Other)	Combustible Materials	Uncontrolled Chem. Reactions	Flammable Gases	Natural Gas	Spray paint	Compressed Flammable Gases	Propane	Paint Solvent	Cleaning/Decon Solvents	Gasoline	Flammable Liquids	Flammable Mixtures	Other	Explosive Gas	Dynamite	Sodium	Hydrogen (batteries)	Primer Cord	Electric Squibs	Nitrates	Dusts	Peroxides	Caps	Plutonium/Uranium	Potassium	Superoxides	Hydrogen/Tritium	Propane	Explosive Chemicals	Other
3013 Staging	X				X																													
Outer 3013 Open	X				X																													
Airlock	X				X																													
Furnace Prep	X				X																													
Furnace	X				X	X																												
Airlock					X																													
Accountability					X																													3
Exit Staging					X																													
Glovebox Wide					X																													
OX Room	1				X																2													
Elevator	X				X																													

X = Refers to the hazards considered applicable

FOOTNOTES:
1- 3013
2- Result of mistake
3- Liquid Nitrogen

Table B-C.1 Hazard Identification Table - Metal Oxidation

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																					
				Ionizing Rad.									Hazardous Materials																									
	Radiological Material	Fissile Material	Non-Ionizing Radiation	Fissile Material	Radiography Equipment	Electron Beams	X-Ray Machines	Critical masses	Contamination	Radioactive Materials	Radioactive Sources	Other	Alkali Metals	Asphyxiants	Acetone	Fluorides	Lead	Drowning	Asphyxiation	Ammonia and Compounds	Beryllium and Compounds	Chlorine and Compounds	Trichlorethylene	Decontamination Solutions	Dusts and Particles	Sandblasting particles	Metal Plating	Herbicides	Insecticides	Bacteria	Viruses	Biological	Carcinogens	Oxidizers	Corrosives	Other Toxics	Other
3013 Staging	X	X		X						X			6			6	6				6	6											6			6	
Outer 3013 Open	X	X		X						X			6			6	6				6	6											6			6	
Airlock	X	X		X						X			6			6	6				6	6											6			6	
Furnace Prep	X	X		X						X			6	5		6	6				6	6											6			6	
Furnace	X	X		X						X			6	1,5		6	6				6	6											6	2		6	2
Airlock	X	X		X						X			6	4,5		6	6				6	6											6			6	
Accountability	X	X		X						X			6	4		6	6				6	6											6			6	
Exit Staging	X	X		X						X			6			6	6				6	6											6			6	
Glovebox Wide	X	X		X						X	X		6			6	6				6	6											6			6	3
OX Room	X	X	X	X						X	X		6	4		6	6				6	6											6	2		6	3
Elevator	X	X		X						X			6			6	6				6	6											6	2		6	

X = Refers to the hazards considered applicable

FOOTNOTES:

1- Ar, He
2- O_2
3- Offgas
4- N_2
5- Ar
6- Known contaminants in 3013s

Table B-C.1 Hazard Identification Table - Metal Oxidation

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																													
	Kinetic - Linear and Rotational (Friction)																			Potential (Pressure)										
	Belts	Bearings	Presses	Grinders	Crane Loads (in motion)	Vehicles	Rail Cars	Fork Lifts	Carts	Dollies	Centrifuges	Drills	Saws	Shears	Fans	Gears	Motors	Power Tools	Other	Gas Bottles	Gas Receivers	Pressure Vessels	Coiled Springs	Boilers	Heated Surge Tanks	Autoclaves	Furnaces	Stressed Members	Steam Headers/Lines	Other (elevator travel)
3013 Staging																														
Outer 3013 Open		X															X													
Airlock																														
Furnace Prep		X														X	X													
Furnace		X															X										X		1	2
Airlock																														
Accountability																														
Exit Staging																														
Glovebox Wide																			3											
OX Room						X			X								X				X									4
Elevator		X							X								X													X

X = Refers to the hazards
Considered applicable

FOOTNOTES:

1- Steam potential from cooling water
2- Furnace gases (e.g., Ar, He, O_2)
3- Trolley
4- Pressurized Air, service gases

Table B-C.1 Hazard Identification Table - Metal Oxidation

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																				
	Potential (Height/Mass)																					Natural Phenomena									Vehicles in Motion							
	Stairs	Lifts	Cranes	Elevated Doors	Loading Docks	Hoists	Elevators	Trucks	Jacks	Scaffolds and ladders	Pits	Elevated Work Surfaces	Mezzanines	Other	Firearm Discharge (puncturing)	Non-Facility Event (Explosion)	Non-Facility Event (Power Outage)	Non-Facility Event (Aircraft Crash)	Non-Facility Event (Transportation)	Non-Facility Event (Fire)	Non-Facility Event (Other)	Earthquake	Flood	Lightning	Rain	Snow, Ice	Freezing Weather	Straight Wind	Tornado	Other	Airplane	Helicopter	Train	Heavy construction Equipment	Truck/Car	Forklift/Lift Truck	Other (Cart)	Crane/Hoist
3013 Staging																						X																
Outer 3013 Open																						X																
Airlock																						X																
Furnace Prep																						X																
Furnace																						X																
Airlock																						X																
Accountability																						X																
Exit Staging																						X																
Glovebox Wide						X																X															X	
OX Room								X					X									X																
Elevator							X															X													X			

X = Refers to the hazards considered applicable

FOOTNOTES:

Table B-A.2 Hazard Identification Table - Bagless Transfer System

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																			
	Electrical																		Thermal													Open Flame				
	Battery Banks	Cable Runs	Diesel Generators	Electrical Equipment	Hot Plates	Heaters	High Voltage	Locomotive, electrical	Motors	Pumps	Power Tools	Switchgear	Service Outlets, fittings	Transformers	Transmission Lines	Underground Wiring	Wiring	Other	Bunsen Burner, Hot Plate	Electrical Equipment	Furnaces	Boilers	Lasers	Electrical Wiring	Welding Surfaces	Engine Exhaust	Heaters	Steam Lines	Welding Torch	Exothermic Reactions	Other	Bunsen Burners	Torches	Pilot Lights	Gas Welding	Other
Glovebox		X		X					X				X				X							X												
Fume hoods		X		X			X		X		1		X				X			X				X	X				2							
Rework		X		X					X		3		X				X			X				X												
Bagless Transfer Room		X		X			X		X	X	X		X				X			X				X												

X = Refers to the hazards considered applicable

FOOTNOTES:

1. Bagless cutter
2. TIG weld
3. Can opener

Table B-A.2 Hazard Identification Table - Bagless Transfer System

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																	
							Flammable											Explosive/Pyrophoric																
	Pyrophoric (Pu & U Metal)	Pyrophoric (Other)	SC* (Nitric Acid and Organics)	SC* (Other)	Combustible Materials	Uncontrolled Chem. Reactions	Flammable Gases	Natural Gas	Spray paint	Compressed Flammable Gases	Propane	Paint Solvent	Cleaning/Decon Solvents	Gasoline	Flammable Liquids	Flammable Mixtures	Other	Explosive Gas	Dynamite	Sodium	Hydrogen (batteries)	Primer Cord	Electric Squibs	Nitrates	Dusts	Peroxides	Caps	Plutonium/Uranium	Potassium	Superoxides	Hydrogen/Tritium	Propane	Explosive Chemicals	Other
Glovebox					X																													
Fume hoods					1																													
Rework					X																													
Bagless Transfer Room					X																													

X = Refers to the hazards considered applicable

FOOTNOTES:
1. Swipes/swabs

Table B-A.2 Hazard Identification Table - Bagless Transfer System

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																					
				Ionizing Rad.									Hazardous Materials																									
	Radiological Material	Fissile Material	Non-Ionizing Radiation	Fissile Material	Radiography Equipment	Electron Beams	X-Ray Machines	Critical masses	Contamination	Radioactive Materials	Radioactive Sources	Other	Alkali Metals	Asphyxiants	Acetone	Fluorides	Lead	Drowning	Asphyxiation	Ammonia and Compounds	Beryllium and Compounds	Chlorine and Compounds	Trichlorethylene	Decontamination Solutions	Dusts and Particles	Sandblasting particles	Metal Plating	Herbicides	Insecticides	Bacteria	Viruses	Biological	Carcinogens	Oxidizers	Corrosives	Other Toxics	Other
Glovebox	X	X	X	X					X	X							1				4				X													
Fume hoods	X	X	X	X					X	X				2					2		4			X														
Rework	X	X	X	X					X	X							1				4				X													
Bagless Transfer Room	X	X	X	X					X	X				3			1		3		4			X														

X = Refers to the hazards considered applicable

FOOTNOTES:

1- Contained in gloves, shielding
2- Argon supply line
3- Argon and helium supply lines
4- Feed contaminant in glass

Table B-A.2 Hazard Identification Table - Bagless Transfer System

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																													
	Kinetic - Linear and Rotational (Friction)																			Potential (Pressure)										
	Belts	Bearings	Presses	Grinders	Crane Loads (in motion)	Vehicles	Rail Cars	Fork Lifts	Carts	Dollies	Centrifuges	Drills	Saws	Shears	Fans	Gears	Motors	Power Tools	Other	Gas Bottles	Gas Receivers	Pressure Vessels	Coiled Springs	Boilers	Heated Surge Tanks	Autoclaves	Furnaces	Stressed Members	Steam Headers/Lines	Other
Glovebox		X															X		1									2		2
Fume hoods		X											X			X	X	X				3								4
Rework		X											X				X	X												
Bagless Transfer Room		X							X	X					X	X	X													

X = Refers to the hazards
Considered applicable

FOOTNOTES:
1. Pneumatic transfer system
2. Pneumatic lines/cylinders
3. Bell jar (vacuum)
4. Argon lines

Table B-A.2 Hazard Identification Table - Bagless Transfer System

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																					
	Potential (Height/Mass)																				Natural Phenomena									Vehicles in Motion							
	Stairs	Lifts	Cranes	Elevated Doors	Loading Docks	Hoists	Elevators	Trucks	Jacks	Scaffolds and ladders	Pits	Elevated Work Surfaces	Mezzanines	Other	Firearm Discharge (puncturing)	Non-Facility Event (Explosion)	Non-Facility Event (Power Outage)	Non-Facility Event (Aircraft Crash)	Non-Facility Event (Transportation)	Non-Facility Event (Fire)	Non-Facility Event (Other)	Earthquake	Flood	Lightning	Rain	Snow, Ice	Freezing Weather	Straight Wind	Tornado	Other	Airplane	Helicopter	Train	Heavy construction Equipment	Truck/Car	Forklift/Lift Truck	Other	Crane/Hoist
Glovebox		X												1	X	X	X	X	X	X		X																
Fume hoods		X													X	X	X	X	X	X		X																
Rework															X	X	X	X	X	X		X																
Bagless Transfer Room		X												2	X	X	X	X	X	X		X																

X = Refers to the hazards considered applicable

FOOTNOTES:
1. Airlock doors
2. Flooding from sprinkler discharge

Module 3.0: Magazine Loading, Canister Loading/Transportation, Product Material Control & Accountability

Table B-A.3 Hazard Identification Table - Magazine Canister Loading

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																			
	Electrical																		Thermal												Open Flame					
	Battery Banks	Cable Runs	Diesel Generators	Electrical Equipment	Hot Plates	Heaters	High Voltage	Locomotive, electrical	Motors	Pumps	Power Tools	Switchgear	Service Outlets, fittings	Transformers	Transmission Lines	Underground Wiring	Wiring	Other	Bunsen Burner, Hot Plate	Electrical Equipment	Furnaces	Boilers	Lasers	Electrical Wiring	Welding Surfaces	Engine Exhaust	Heaters	Steam Lines	Welding Torch	Exothermic Reactions	Other	Bunsen Burners	Torches	Pilot Lights	Gas Welding	Other
Magazine Loading and Storage	X	X		X			X		X		X		X				X			X				X												
Canister Loading		X		X			X		X		X		X				X			X				X												
Canister Transport	X	X		X			X		X		X		X				X			X				X		X										
Bagless Can Transport	X	X		X					X		X		X				X							X												

X = Refers to the hazards considered applicable

FOOTNOTES:

Module 3.0: Magazine Loading, Canister Loading/Transportation, Product Material Control & Accountability

Table B-A.3 Hazard Identification Table - Magazine Canister Loading

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																	
							Flammable											Explosive/Pyrophoric																
	Pyrophoric (Pu & U Metal)	Pyrophoric (Other)	SC* (Nitric Acid and Organics)	SC* (Other)	Combustible Materials	Uncontrolled Chem. Reactions	Flammable Gases	Natural Gas	Spray paint	Compressed Flammable Gases	Propane	Paint Solvent	Cleaning/Decon Solvents	Gasoline	Flammable Liquids	Flammable Mixtures	Other	Explosive Gas	Dynamite	Sodium	Hydrogen	Primer Cord	Electric Squibs	Nitrates	Dusts	Peroxides	Caps	Plutonium/Uranium	Potassium	Superoxides	Hydrogen/Tritium	Propane	Explosive Chemicals	Other
Magazine Loading and Storage					X																													
Canister Loading					X																													
Canister Transport					X									X	X																			
Bagless Can Transport					X																1													

X = Refers to the hazards considered applicable

FOOTNOTES:

1. Batteries

Module 3.0: Magazine Loading, Canister Loading/Transportation, Product Material Control & Accountability

Table B-A.3 Hazard Identification Table - Magazine Canister Loading

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																				
				Ionizing Rad.									Hazardous Materials																								
	Radiological Material	Fissile Material	Non-Ionizing Radiation	Fissile Material	Radiography Equipment	Electron Beams	X-Ray Machines	Critical masses	Contamination	Radioactive Materials	Radioactive Sources	Other	Alkali Metals	Asphyxiants	Acetone	Fluorides	Lead	Drowning	Asphyxiation	Ammonia and Compounds	Beryllium and Compounds	Chlorine and Compounds	Trichlorethylene	Decontamination Solutions	Dusts and Particles	Sandblasting particles	Metal Plating	Herbicides	Insecticides	Bacteria	Viruses	Biological	Carcinogens	Oxidizers	Corrosives	Other Toxics
Magazine Loading and Storage	X	X	X	X						X							1				2																
Canister Loading	X	X	X	X						X							1				2														3		
Canister Transport	X	X	X	X						X							1				2														3		
Bagless Can Transport	X	X	X	X						X							1				2														3		

X = Refers to the hazards considered applicable

FOOTNOTES:

1- Shielding
2- Feed contaminant in glass
3- Transfer cart batteries

Module 3.0: Magazine Loading, Canister Loading/Transportation, Product Material Control & Accountability

Table B-A.3 Hazard Identification Table - Magazine Canister Loading

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																													
	Kinetic - Linear and Rotational (Friction)																			Potential (Pressure)										
	Belts	Bearings	Presses	Grinders	Crane Loads (in motion)	Vehicles	Rail Cars	Fork Lifts	Carts	Dollies	Centrifuges	Drills	Saws	Shears	Fans	Gears	Motors	Power Tools	Other	Gas Bottles	Gas Receivers	Pressure Vessels	Coiled Springs	Boilers	Heated Surge Tanks	Autoclaves	Furnaces	Stressed Members	Steam Headers/Lines	Other (elevator travel)
Magazine Loading and Storage	X	X			X											X	X	X												X
Canister Loading	X	X			X											X	X	X												
Canister Transport	X	X			X	X										X	X	X												
Bagless Can Transport	X	X						X	X							X	X	X												X

X = Refers to the hazards
Considered applicable

FOOTNOTES:

Module 3.0: Magazine Loading, Canister Loading/Transportation, Product Material Control & Accountability

Table B-A.3 Hazard Identification Table - Magazine Canister Loading

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																				
	Potential (Height/Mass)															Natural Phenomena										Vehicles in Motion							
	Stairs	Lifts	Cranes	Elevated Doors	Loading Docks	Hoists	Elevators	Trucks	Jacks	Scaffolds and ladders	Pits	Elevated Work Surfaces	Mezzanines	Other	Firearm Discharge (puncturing)	Non-Facility Event (Explosion)	Non-Facility Event (Power Outage)	Non-Facility Event (Aircraft Crash)	Non-Facility Event (Transportation)	Non-Facility Event (Fire)	Non-Facility Event (Other)	Earthquake	Flood	Lightning	Rain	Snow, Ice	Freezing Weather	Straight Wind	Tornado	Other	Airplane	Helicopter	Train	Heavy construction Equipment	Truck/Car	Forklift/Lift Truck	Other (Cart, Elevator)	Crane/Hoist
Magazine Loading and Storage		X	X			X	X								X							X																X
Canister Loading			X			X									X							X									X	X						X
Canister Transport	X		X			X		X				X			X							X									X	X			X			X
Bagless Can Transport	X	X				X	X								X							X																X

X = Refers to the hazards considered applicable

FOOTNOTES:

Table B-A.4 Hazard Identification Table – Lab and Waste

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																		
	Electrical																		Thermal													Open Flame				
	Battery Banks	Cable Runs	Diesel Generators	Electrical Equipment	Hot Plates	Heaters	High Voltage	Locomotive, electrical	Motors	Pumps	Power Tools	Switchgear	Service Outlets, fittings	Transformers	Transmission Lines	Underground Wiring	Wiring	Other	Bunsen Burner, Hot Plate	Electrical Equipment	Furnaces	Boilers	Lasers	Electrical Wiring	Welding Surfaces	Engine Exhaust	Heaters	Steam Lines	Welding Torch	Exothermic Reactions	Other	Bunsen Burners	Torches	Pilot Lights	Gas Welding	Other
TRU Waste Packaging				X									X				X			X				X												
TRU Waste Monitor/Assaying	X	X		X									X				X			X			1	X												
TRU Waste Transport	X			X									X				X			X				X												
LLW Waste Packaging				X									X				X			X				X												
LLW Waste Monitor/Assaying	X	X		X									X				X			X			1	X												
LLW Waste Transport	X			X									X				X			X				X												
Waste Staging				X									X				X			X				X												
Failed Equipment Storage Room				X									X				X			X				X												

X = Refers to the hazards considered applicable

FOOTNOTES:
1- Barcode reader

Table B-A.4 Hazard Identification Table - Lab and Waste

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																	
							Flammable											Explosive/Pyrophoric																
	Pyrophoric (Pu & U Metal)	Pyrophoric (Other)	SC* (Nitric Acid and Organics)	SC* (Other)	Combustible Materials	Uncontrolled Chem. Reactions	Flammable Gases	Natural Gas	Spray paint	Compressed Flammable Gases	Propane	Paint Solvent	Cleaning/Decon Solvents	Gasoline	Flammable Liquids	Flammable Mixtures	Other	Explosive Gas	Dynamite	Sodium	Hydrogen (batteries)	Primer Cord	Electric Squibs	Nitrates	Dusts	Peroxides	Caps	Plutonium/Uranium	Potassium	Superoxides	Hydrogen/Tritium	Propane	Explosive Chemicals	Other
TRU Waste Packaging					X								X															X			X			
TRU Waste Monitor/Assaying					X																							X			X			
TRU Waste Transport					X																							X			X			
LLW Waste Packaging					X								X															X			X			
LLW Waste Monitor/Assaying					X																							X			X			
LLW Waste Transport					X																							X			X			
Waste Staging					X								X															X			X			
Failed Equipment Storage Room					X								X															X			X			

X = Refers to the hazards considered applicable

FOOTNOTES:

Table B-A.4 Hazard Identification Table - Lab and Waste

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																					
				Ionizing Rad.									Hazardous Materials																									
	Radiological Material	Fissile Material	Non-Ionizing Radiation	Fissile Material	Radiography Equipment	Electron Beams	X-Ray Machines	Critical masses	Contamination	Radioactive Materials	Radioactive Sources	Other	Alkali Metals	Asphyxiants	Acetone	Fluorides	Lead	Drowning	Asphyxiation	Ammonia and Compounds	Beryllium and Compounds	Chlorine and Compounds	Trichlorethylene	Decontamination Solutions	Dusts and Particles	Sandblasting particles	Metal Plating	Herbicides	Insecticides	Bacteria	Viruses	Biological	Carcinogens	Oxidizers	Corrosives	Other Toxics	Other
TRU Waste Packaging	X	X		X				X	X	X			1			1	X				1	1		X	1								1			1	
TRU Waste Monitor/Assaying	X	X		X					X	X	X		1			1	X				1	1		X	1								1			1	
TRU Waste Transport	X	X		X					X	X			1			1	X				1	1		X	1								1			1	
LLW Waste Packaging	X	X		X					X	X			1			1	X				1	1		X	1								1			1	
LLW Waste Monitor/Assaying	X	X		X					X	X	X		1			1	X				1	1		X	1								1			1	
LLW Waste Transport	X	X		X					X	X			1			1	X				1	1		X	1								1			1	
Waste Staging	X	X		X				X	X	X			1			1	X				1	1		X	1								1			1	
Failed Equipment Storage Room	X	X		X				X	X	X			1			1	X				1	1		X	1								1			1	

X = Refers to the hazards considered applicable

FOOTNOTES:

1- Known contaminants in 3013s

Table B-A.4 Hazard Identification Table - Lab and Waste

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																													
	Kinetic - Linear and Rotational (Friction)																			Potential (Pressure)										
	Belts	Bearings	Presses	Grinders	Crane Loads (in motion)	Vehicles	Rail Cars	Fork Lifts	Carts	Dollies	Centrifuges	Drills	Saws	Shears	Fans	Gears	Motors	Power Tools	Other	Gas Bottles	Gas Receivers	Pressure Vessels	Coiled Springs	Boilers	Heated Surge Tanks	Autoclaves	Furnaces	Stressed Members	Steam Headers/Lines	Other
TRU Waste Packaging									X	X								X												
TRU Waste Monitor/Assaying									X	X								X		X										
TRU Waste Transport									X	X								X	3											
LLW Waste Packaging									X	X								X												
LLW Waste Monitor/Assaying									X	X								X		X										
LLW Waste Transport									X	X								X	3											
Waste Staging									X	X								X												
Failed Equipment Storage Room									X	X								X												

X = Refers to the hazards
Considered applicable

FOOTNOTES:
3- Freight elevator

Table B-A.4 Hazard Identification Table - Lab and Waste

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																					
	Potential (Height/Mass)																					Natural Phenomena									Vehicles in Motion							
	Stairs	Lifts	Cranes	Elevated Doors	Loading Docks	Hoists	Elevators	Trucks	Jacks	Scaffolds and ladders	Pits	Elevated Work Surfaces	Mezzanines	Other	Firearm Discharge (puncturing)	Non-Facility Event (Explosion)	Non-Facility Event (Power Outage)	Non-Facility Event (Aircraft Crash)	Non-Facility Event (Transportation)	Non-Facility Event (Fire)	Non-Facility Event (Other)	Earthquake	Flood	Lightning	Rain	Snow, Ice	Freezing Weather	Straight Wind	Tornado	Other	Airplane	Helicopter	Train	Heavy construction Equipment	Truck/Car	Forklift/Lift Truck	Other	Crane/Hoist
TRU Waste Packaging		X				X			X			X			X		X					X																
TRU Waste Monitor/Assaying						X			X			X			X		X					X																
TRU Waste Transport		X		X		X	X		X						X		X					X																
LLW Waste Packaging		X				X			X			X			X		X					X																
LLW Waste Monitor/Assaying						X			X			X			X		X					X																
LLW Waste Transport		X		X		X	X		X						X		X					X																
Waste Staging		X				X			X			X			X		X					X																
Failed Equipment Storage Room		X				X			X			X			X		X					X																

X = Refers to the hazards considered applicable

FOOTNOTES:

Table B-A.5 Hazard Identification Table – Balance of Plant Auxiliary and Utility Systems

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																			
	Electrical																		Thermal													Open Flame				
	Battery Banks	Cable Runs	Diesel Generators	Electrical Equipment	Hot Plates	Heaters	High Voltage	Locomotive, electrical	Motors	Pumps	Power Tools	Switchgear	Service Outlets, fittings	Transformers	Transmission Lines	Underground Wiring	Wiring	Other	Bunsen Burner, Hot Plate	Electrical Equipment	Furnaces	Boilers	Lasers	Electrical Wiring	Welding Surfaces	Engine Exhaust	Heaters	Steam Lines	Welding Torch	Exothermic Reactions	Other	Bunsen Burners	Torches	Pilot Lights	Gas Welding	Other
Material Handling System	X	X		X					X		X		X	X			X	1					X	X												
NDA Room	X	X		X					X		X		X				X																			
General	X	X		X					X		X		X	X			X	1					X	X												

X = Refers to the hazards considered applicable

FOOTNOTES:
1- Magnetic couplers

Table B-A.5 Hazard Identification Table – Balance of Plant Auxiliary and Utility Systems

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																	
							Flammable											Explosive/Pyrophoric																
	Pyrophoric (Pu & U Metal)	Pyrophoric (Other)	SC* (Nitric Acid and Organics)	SC* (Other)	Combustible Materials	Uncontrolled Chem. Reactions	Flammable Gases	Natural Gas	Spray paint	Compressed Flammable	Propane	Paint Solvent	Cleaning/Decon Solvents	Gasoline	Flammable Liquids	Flammable Mixtures	Other	Explosive Gas	Dynamite	Sodium	Hydrogen	Primer Cord	Electric Squibs	Nitrates	Dusts	Peroxides	Caps	Plutonium/Uranium	Potassium	Superoxides	Hydrogen/Tritium	Propane	Explosive Chemicals	Other
Material Handling System	X				X																2							X						
NDA Room					X																													
General	X				X																2							X						

X = Refers to the hazards considered applicable

FOOTNOTES:
2- Hydrogen from battery

Table B-A.5 Hazard Identification Table – Balance of Plant Auxiliary and Utility Systems

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																					
				Ionizing Rad.									Hazardous Materials																									
	Radiological Material	Fissile Material	Non-Ionizing Radiation	Fissile Material	Radiography Equipment	Electron Beams	X-Ray Machines	Critical masses	Contamination	Radioactive Materials	Radioactive Sources	Other	Alkali Metals	Asphyxiants	Acetone	Fluorides	Lead	Drowning	Asphyxiation	Ammonia and Compounds	Beryllium and Compounds	Chlorine and Compounds	Trichlorethylene	Decontamination Solutions	Dusts and Particles	Sandblasting particles	Metal Plating	Herbicides	Insecticides	Bacteria	Viruses	Biological	Carcinogens	Oxidizers	Corrosives	Other Toxics	Other
Material Handling System	X	X	X	X					X	X	X		1			1	1				1	1			1								1			1	
NDA Room	X	X	X	X						X	X			X			X		X		1																
General	X	X	X	X					X	X	X		1			1	1				1	1			1								1			1	

X = Refers to the hazards considered applicable

FOOTNOTES:

1- Known contaminant in Feeds

Table B-A.5 Hazard Identification Table – Balance of Plant Auxiliary and Utility Systems

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																												
	Kinetic - Linear and Rotational (Friction)																			Potential (Pressure)									
	Belts	Bearings	Presses	Grinders	Crane Loads (in motion)	Vehicles	Rail Cars	Fork Lifts	Carts	Dollies	Centrifuges	Drills	Saws	Shears	Fans	Gears	Motors	Power Tools	Other	Gas Bottles	Gas Receivers	Pressure Vessels	Coiled Springs	Boilers	Heated Surge Tanks	Autoclaves	Furnaces	Stressed Members	Steam Headers/Lines	Other
Material Handling System		X						X	X							X	X	X												
NDA Room		X			X			X								X	X	X				1								
General		X						X	X							X	X	X												

X = Refers to the hazards
Considered applicable

FOOTNOTES:

Table B-A.5 Hazard Identification Table – Balance of Plant Auxiliary and Utility Systems

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																					
	Potential (Height/Mass)																				Natural Phenomena									Vehicles in Motion							
	Stairs	Lifts	Cranes	Elevated Doors	Loading Docks	Hoists	Elevators	Trucks	Jacks	Scaffolds and ladders	Pits	Elevated Work Surfaces	Mezzanines	Other	Firearm Discharge (puncturing)	Non-Facility Event (Explosion)	Non-Facility Event (Power	Non-Facility Event (Aircraft	Non-Facility Event	Non-Facility Event (Fire)	Non-Facility Event (Other)	Earthquake	Flood	Lightning	Rain	Snow, Ice	Freezing Weather	Straight Wind	Tornado	Other	Airplane	Helicopter	Train	Heavy construction	Truck/Car	Forklift/Lift Truck	Other (Cart, Elevator)	Crane/Hoist
Material Handling System		1				X	X					X	X		X							X														X	X	
NDA Room			X												X							X														X		
General		1					X								X							X														X	X	

X = Refers to the hazards considered applicable

FOOTNOTES:

1- Scissors lift, motor driven screw lift

Table B-A.6 Hazard Identification Table - Milling, Mixing and Vitrification

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																			
	Electrical																		Thermal													Open Flame				
	Battery Banks	Cable Runs	Diesel Generators	Electrical Equipment	Hot Plates	Heaters	High Voltage	Locomotive, electrical	Motors	Pumps	Power Tools	Switchgear	Service Outlets, fittings	Transformers	Transmission Lines	Underground Wiring	Wiring	Other	Bunsen Burner, Hot Plate	Electrical Equipment	Furnaces	Boilers	Lasers	Electrical Wiring	Welding Surfaces	Engine Exhaust	Heaters	Steam Lines	Welding Torch	Exothermic Reactions	Other	Bunsen Burners	Torches	Pilot Lights	Gas Welding	Other
Milling and Mixing		X		X					X	X	1		X				X																			
Vitrification		X		X		2			X		X		X				X						X				X				3					

X = Refers to the hazards considered applicable

FOOTNOTES:

1- Maintenance Activities
2- Induction Heater
3- Melter vessel and vit can

Table B-A.6 Hazard Identification Table - Milling, Mixing and Vitrification

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																	
							Flammable											Explosive/Pyrophoric																
	Pyrophoric (Pu & U Metal)	Pyrophoric (Other)	SC* (Nitric Acid and Organics)	SC* (Other)	Combustible Materials	Uncontrolled Chem. Reactions	Flammable Gases	Natural Gas	Spray paint	Compressed Flammable	Propane	Paint Solvent	Cleaning/Decon Solvents	Gasoline	Flammable Liquids	Flammable Mixtures	Other	Explosive Gas	Dynamite	Sodium	Hydrogen (batteries)	Primer Cord	Electric Squibs	Nitrates	Dusts	Peroxides	Caps	Plutonium/Uranium	Potassium	Superoxides	Hydrogen/Tritium	Propane	Explosive Chemicals	Other
Milling and Mixing			1		X																													
Vitrification					X																													

X = Refers to the hazards considered applicable

FOOTNOTES:
1- Potential milling aid

Table B-A.6 Hazard Identification Table - Milling, Mixing and Vitrification

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																					
				Ionizing Rad.									Hazardous Materials																									
	Radiological Material	Fissile Material	Non-Ionizing Radiation	Fissile Material	Radiography Equipment	Electron Beams	X-Ray Machines	Critical masses	Contamination	Radioactive Materials	Radioactive Sources	Other	Alkali Metals	Asphyxiants	Acetone	Fluorides	Lead	Drowning	Asphyxiation	Ammonia and Compounds	Beryllium and Compounds	Chlorine and Compounds	Trichlorethylene	Decontamination Solutions	Dusts and Particles	Sandblasting particles	Metal Plating	Herbicides	Insecticides	Bacteria	Viruses	Biological	Carcinogens	Oxidizers	Corrosives	Other Toxics	Other
Milling and Mixing	X	X	X	X					X	X			3	X		3	3				3	3			3								3			3	
Vitrification	X	X	X	X					X	X	X	1	3			3	3				3	3			3								3			3	2

X = Refers to the hazards considered applicable

FOOTNOTES:

1- Magnetic field in vicinity of melter
2- Offgas contains other volatile species
3- Known contaminants in 3013s

Table B-A.6 Hazard Identification Table - Milling, Mixing and Vitrification

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																												
	Kinetic - Linear and Rotational (Friction)																			Potential (Pressure)									
	Belts	Bearings	Presses	Grinders	Crane Loads (in motion)	Vehicles	Rail Cars	Fork Lifts	Carts	Dollies	Centrifuges	Drills	Saws	Shears	Fans	Gears	Motors	Power Tools	Other	Gas Bottles	Gas Receivers	Pressure Vessels	Coiled Springs	Boilers	Heated Surge Tanks	Autoclaves	Furnaces	Stressed Members	Steam Headers/Lines	Other
Milling and Mixing	X	X		X	1												X	1				2								
Vitrification		X															X	X	3,4											

X = Refers to the hazards
Considered applicable

FOOTNOTES:

1- Maintenance Activities
2- Heat Exchanger
3- Vit can transport system
4- Hydraulic winch mover

Table B-A.6 Hazard Identification Table - Milling, Mixing and Vitrification

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																				
	Potential (Height/Mass)															Natural Phenomena										Vehicles in Motion											
	Stairs	Lifts	Cranes	Elevated Doors	Loading Docks	Hoists	Elevators	Trucks	Jacks	Scaffolds and ladders	Pits	Elevated Work Surfaces	Mezzanines	Other	Firearm Discharge (puncturing)	Non-Facility Event (Explosion)	Non-Facility Event (Power	Non-Facility Event (Aircraft	Non-Facility Event	Non-Facility Event (Fire)	Non-Facility Event (Other)	Earthquake	Flood	Lightning	Rain	Snow, Ice	Freezing Weather	Straight Wind	Tornado	Other	Airplane	Helicopter	Train	Heavy construction	Truck/Car	Forklift/Lift Truck	Other	Crane/Hoist
Milling and Mixing						X			X			X										X															
Vitrification	X					X				X		X										X															

X = Refers to the hazards considered applicable

FOOTNOTES:

Table B-A.7 Hazard Identification Table - Heating, Ventilation and Air Conditioning

Location	Hazard Energy Sources and Materials																																		
	Electrical																		Thermal												Open Flame				
(identifier for system, sub-system, or operational feature in this facility section)	Battery Banks	Cable Runs	Diesel Generators	Electrical Equipment	Hot Plates	Heaters	High Voltage	Locomotive, electrical	Motors	Pumps	Power Tools	Switchgear	Service Outlets,	Transformers	Transmission Lines	Underground Wiring	Wiring	Other	Bunsen Burner, Hot	Electrical Equipment	Furnaces	Boilers	Lasers	Electrical Wiring	Welding Surfaces	Engine Exhaust	Heaters	Steam Lines	Welding Torch	Exothermic Reactions	Other	Bunsen Burners	Torches	Pilot Lights	Gas Welding	Other
Non-process Areas Ventilation System	X	X	1	X		X			X	X		X	X				X									X	X									
Process Areas Supply System		X		X		X			X				X				X										X									
Glovebox Exhaust System		X		X					X								X																			
Main Exhaust System	2	X		X					X								X																			

X = Refers to the hazards considered applicable

FOOTNOTES:
1- Co-located equipment not supporting the system
2- Batteries located in MCC.

Table B-A.7 Hazard Identification Table – Confinement and HVAC

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																	
							Flammable											Explosive/Pyrophoric																
	Pyrophoric (Pu & U Metal)	Pyrophoric (Other)	SC* (Nitric Acid and Organics)	SC* (Other)	Combustible Materials	Uncontrolled Chem. Reactions	Flammable Gases	Natural Gas	Spray paint	Compressed Flammable	Propane	Paint Solvent	Cleaning/Decon Solvents	Gasoline	Flammable Liquids	Flammable Mixtures	Other	Explosive Gas	Dynamite	Sodium	Hydrogen (batteries)	Primer Cord	Electric Squibs	Nitrates	Dusts	Peroxides	Caps	Plutonium/Uranium	Potassium	Superoxides	Hydrogen/Tritium	Propane	Explosive Chemicals	Other
Non-process Areas Ventilation System					X									1							X													
Process Areas Supply System					X																X													
Glovebox Exhaust System					X																X													
Main Exhaust System					X																X													

X = Refers to the hazards considered applicable

FOOTNOTES:
1- Diesel fuel

Table B-A.7 Hazard Identification Table - Confinement and HVAC

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																					
				Ionizing Rad.									Hazardous Materials																									
	Radiological Material	Fissile Material	Non-Ionizing Radiation	Fissile Material	Radiography Equipment	Electron Beams	X-Ray Machines	Critical masses	Contamination	Radioactive Materials	Radioactive Sources	Other	Alkali Metals	Asphyxiants	Acetone	Fluorides (Halides)	Lead	Drowning	Asphyxiation	Ammonia and Compounds	Beryllium and Compounds	Chlorine and Compounds	Trichlorethylene	Decontamination Solutions	Dusts and Particles	Sandblasting particles	Metal Plating	Herbicides	Insecticides	Bacteria	Viruses	Biological	Carcinogens	Oxidizers	Corrosives	Other Toxics	Other
Non-process Areas Ventilation System																									X													
Process Areas Supply System													1			1	1				1	1			X								1					
Glovebox Exhaust System	X	X		X					X	X			1			1	1				1	1			X								1		2	1		
Main Exhaust System	X	X		X					X	X			1			1	1				1	1			X								1					

X = Refers to the hazards considered applicable

FOOTNOTES:

1- Known contaminants in 3013s

2- Off gas from melter glovebox, and known contaminants in process feeds

Table B-A.7 Hazard Identification Table - Confinement and HVAC

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																													
	Kinetic - Linear and Rotational (Friction)																			Potential (Pressure)										
	Belts	Bearings	Presses	Grinders	Crane Loads (in motion)	Vehicles	Rail Cars	Fork Lifts	Carts	Dollies	Centrifuges	Drills	Saws	Shears	Fans	Gears	Motors	Power Tools	Other	Gas Bottles	Gas Receivers	Pressure Vessels	Coiled Springs	Boilers	Heated Surge Tanks	Autoclaves	Furnaces	Stressed Members	Steam Headers/Lines	Other (elevator travel)
Non-process Areas Ventilation System		X													X		X					X								
Process Areas Supply System		X													X		X													
Glovebox Exhaust System		X													X		X													
Main Exhaust System		X													X		X													

X = Refers to the hazards
Considered applicable

FOOTNOTES:

Table B-A.7 Hazard Identification Table - Confinement and HVAC

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																					
	Potential (Height/Mass)																				Natural Phenomena									Vehicles in Motion							
	Stairs	Lifts	Cranes	Elevated Doors	Loading Docks	Hoists	Elevators	Trucks	Jacks	Scaffolds and ladders	Pits	Elevated Work Surfaces	Mezzanines	Other	Firearm Discharge (puncturing)	Non-Facility Event (Explosion)	Non-Facility Event (Power	Non-Facility Event (Aircraft	Non-Facility Event	Non-Facility Event (Fire)	Non-Facility Event (Other)	Earthquake	Flood	Lightning	Rain	Snow, Ice	Freezing Weather	Straight Wind	Tornado	Other	Airplane	Helicopter	Train	Heavy construction	Truck/Car	Forklift/Lift Truck	Other	Crane/Hoist
Non-process Areas Ventilation System															X	X	X	X	X	X		X	X	X	X	X	X	X	X		X	X		X	X	X		
Process Areas Supply System															X	X	X	X	X	X		X	X	X	X	X	X	X	X		X	X		X	X	X		
Glovebox Exhaust System															X							X																
Main Exhaust System															X	X	X	X	X	X		X	X	X	X	X	X	X	X		X	X		X	X	X		

X = Refers to the hazards considered applicable

FOOTNOTES:

Table B-A.7 Hazard Identification Table - Green Fuel

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																		
	Electrical																		Thermal												Open Flame				
	Battery Banks	Cable Runs	Diesel Generators	Electrical Equipment	Hot Plates	Heaters	High Voltage	Locomotive, electrical	Motors	Pumps	Power Tools	Switchgear	Service Outlets, fittings	Transformers	Transmission Lines	Underground Wiring	Wiring	Other	Bunsen Burner, Hot Plate	Electrical Equipment	Furnaces	Boilers	Lasers	Electrical Wiring	Welding Surfaces	Engine Exhaust	Heaters	Steam Lines	Welding Torch	Exothermic Reactions	Other	Bunsen Burners	Torches	Pilot Lights	Gas Welding	Other
Green Fuel Tank Room				X					X		X		X				X													1						
Green Fuel Glovebox				X					X		X		X				X													1						
Transfer Route to FP	X			X									X				X			X				X												

X = Refers to the hazards considered applicable

FOOTNOTES:

1- Potential residual sodium on pin exterior- flash (Decon records from Hanford pending)

Table B-A.8 Hazard Identification Table - Green Fuel

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																
							Flammable											Explosive/Pyrophoric															
	Pyrophoric (Pu & U Metal)	Pyrophoric (Other)	SC* (Nitric Acid and Organics)	SC* (Other)	Combustible Materials	Uncontrolled Chem. Reactions	Flammable Gases	Natural Gas	Spray paint	Compressed Flammable	Propane	Paint Solvent	Cleaning/Decon Solvents	Gasoline	Flammable Liquids	Flammable Mixtures	Other	Explosive Gas	Dynamite	Sodium	Hydrogen (batteries)	Primer Cord	Electric Squibs	Nitrates	Dusts	Peroxides	Caps	Plutonium/Uranium	Potassium	Superoxides	Hydrogen/Tritium	Propane	Explosive Chemicals	Other
Green Fuel Tank Room					X	1														1														
Green Fuel Glovebox					X	1														1														
Transfer Route to FP					X																													

X = Refers to the hazards considered applicable

FOOTNOTES:

1 - Potential residual sodium on pin exterior- (Decon records from Hanford pending)

Table B-A.8 Hazard Identification Table - Green Fuel

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																					
				Ionizing Rad.									Hazardous Materials																									
	Radiological Material	Fissile Material	Non-Ionizing Radiation	Fissile Material	Radiography Equipment	Electron Beams	X-Ray Machines	Critical masses	Contamination	Radioactive Materials	Radioactive Sources	Other	Alkali Metals	Asphyxiants	Acetone	Fluorides	Lead	Drowning	Asphyxiation	Ammonia and Compounds	Beryllium and Compounds	Chlorine and Compounds	Trichlorethylene	Decontamination Solutions	Dusts and Particles	Sandblasting particles	Metal Plating	Herbicides	Insecticides	Bacteria	Viruses	Biological	Carcinogens	Oxidizers	Corrosives	Other Toxics	Other
Green Fuel Tank Room	X	X		X						X			2			2	2				2	2			X								X				
Green Fuel Glovebox	X	X		X					X	X			2			2	2				2	2			X								X				
Transfer Route to FP	X	X		X					X	X			2			2	2				2	2			X								X				

X = Refers to the hazards considered applicable

FOOTNOTES:

2-May be present in pellets based on composition limits in specification (not part of formulation, but max values of <x ppm listed for these elements)

Table B-A.8 Hazard Identification Table - Green Fuel

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																												
	Kinetic - Linear and Rotational (Friction)																			Potential (Pressure)									
	Belts	Bearings	Presses	Grinders	Crane Loads (in motion)	Vehicles	Rail Cars	Fork Lifts	Carts	Dollies	Centrifuges	Drills	Saws	Shears	Fans	Gears	Motors	Power Tools	Other	Gas Bottles	Gas Receivers	Pressure Vessels	Coiled Springs	Boilers	Heated Surge Tanks	Autoclaves	Furnaces	Stressed Members	Steam Headers/Lines	Other
Green Fuel Tank Room					X				X				X					X												
Green Fuel Glovebox													X					X					3							
Transfer Route to FP																		X	4											

X = Refers to the hazards
Considered applicable

FOOTNOTES:
3- Small spring inside pin
4- elevator

Table B-A.8 Hazard Identification Table - Green Fuel

Location (identifier for system, sub-system, or operational feature in this facility section)	Hazard Energy Sources and Materials																																					
	Potential (Height/Mass)																					Natural Phenomena									Vehicles in Motion							
	Stairs	Lifts	Cranes	Elevated Doors	Loading Docks	Hoists	Elevators	Trucks	Jacks	Scaffolds and ladders	Pits	Elevated Work Surfaces	Mezzanines	Other	Firearm Discharge (puncturing)	Non-Facility Event (Explosion)	Non-Facility Event (Power	Non-Facility Event (Aircraft	Non-Facility Event	Non-Facility Event (Fire)	Non-Facility Event (Other)	Earthquake	Flood	Lightning	Rain	Snow, Ice	Freezing Weather	Straight Wind	Tornado	Other	Airplane	Helicopter	Train	Heavy construction	Truck/Car	Forklift/Lift Truck	Other	Crane/Hoist
Green Fuel Tank Room	X	X	X			X				X		X	X									X														X		X
Green Fuel Glovebox														5								X																
Transfer Route to FP	X	X		X		X	X										X					X																

X = Refers to the hazards considered applicable

FOOTNOTES:

5 -Winch added to remove duct end cut from DFA

APPENDIX C

HAZARD EVALUATION TABLES

Table C-A.1 Hazard Evaluation Table - Material Receipt and Storage (MRS)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
MRS-1	E-1	Fire engulfs the cart carrying 2-3013 containers resulting in a pressurized radiological release Location: Hallway MAR: 10 kg plutonium oxide (two 3013 containers)	Combustible/ flammable materials- including misc. combustibles, cart shielding material Ignition sources- including electrical shorts (outlets, lighting, wiring), thermal sources (wiring)	3013 Container Design National Fire Protection Association (NFPA) Design Cart Design	Fire Protection Program 3013 Qualification and Storage Surveillance Program Operator Training and Procedures	A	A	**<u>Building Design (Performance Category [PC-3])</u>** **<u>Exhaust Ventilation System (EVS)</u>** **Fire Detection and Alarm System** *3013 Container Design*	**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: High Offsite Public: High	FW: Low CW: Low Offsite Public: Neg	A1 A1 A1	B B C	Poly shielding encapsulated in steel to minimize cart flammability
MRS-2	E-1	Fire engulfs the cart carrying two 3013 containers resulting in a pressurized radiological release Location: Dumbwaiter MAR: 10 kg plutonium oxide (two 3013 containers)	Combustible/ flammable materials- including misc. combustibles, cart shielding material Ignition sources- including electrical shorts (outlets, lighting, wiring), thermal sources (wiring)	3013 Container Design NFPA Design Cart Design	Fire Protection Program 3013 Qualification and Storage Surveillance Program Operator Training and Procedures	A	A	**<u>Building Design (PC-3)</u>** **<u>EVS</u>** **Fire Detection and Alarm System** *3013 Container Design*	**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: High Offsite Public: High	FW: Low CW: Low Offsite Public: Neg	A1 A1 A1	B B C	Poly shielding encapsulated in steel to minimize cart flammability

Table C-A.1 Hazard Evaluation Table - Material Receipt and Storage (MRS)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
MRS-3	E-3	Impact event involving two 3013 containers resulting in a pressurized radiological release Location: Hallway MAR: 10 kg plutonium oxide (two 3013 containers)	Mishandling of cart Container impacts a stationary object during movement Cart failure	None	Operator Training and Procedures	A	A	**Building Design (PC-3)** **EVS** **3013 Container Design** Cart Design	Event Response Procedures Operator Training and Procedures 3013 Qualification and Storage Surveillance Program	FW: High CW: High Offsite Public: High	FW: Neg CW: Neg Offsite Public: Neg	A1 A1 A1	C C C	
MRS-4	E-3	Event Deleted												See general table GE-9 for firearm discharge
MRS-5	E-3	Impact event involving two 3013 containers resulting in a radiological release Location: Dumbwaiter MAR: 10 kg plutonium oxide (two 3013 containers)	Dumbwaiter failure Impact from overhead object	Dumbwaiter Design Seismic interaction II/I design	Elevator Maintenance Program	A	A	**Building Design (PC-3)** **EVS** **3013 Container Design** Cart design **Dumbwaiter Design**	Event Response Procedures Operator Training and Procedures 3013 Qualification and Storage Surveillance Program	FW: High CW: High Offsite Public: High	FW: Neg CW: Neg Offsite Public: Neg	A1 A1 A1	C C C	Dumbwaiter design is Safety Significant only for impact (brakes, etc)

Table C-A.1 Hazard Evaluation Table - Material Receipt and Storage (MRS)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
MRS-6	E-3	Impact event involving two 3013 containers resulting in a radiological release Location: FP Room MAR: 10 kg plutonium oxide (two 3013 containers)	Mishandling of cart Container impacts a stationary object during movement Cart failure Impact from overhead object	Seismic interaction II/I design	Operator Training and Procedures	A	A	**Building Design (PC-3)** **EVS** **3013 Container Design** Cart design	Event Response Procedures Operator Training and Procedures 3013 Qualification and Storage Surveillance Program	FW: High CW: High Offsite Public: High	FW: Neg CW: Neg Offsite Public: Neg	A1 A1 A1	C C C	
MRS-7	E-3	Event deleted												See General Assumptions (firearm discharge in vault type room)
MRS-8	E-3	Impact event involving two 3013 containers resulting in a radiological release Location: OX Room MAR: 10 kg plutonium oxide (two 3013 container)	Mishandling of cart Container impacts a stationary object during movement Cart failure Impact from overhead object	Seismic interaction II/I design	Operator Training and Procedures	A	A	**Building Design (PC-3)** **EVS** **3013 Container Design** Cart design	Event Response Procedures Operator Training and Procedures 3013 Qualification and Storage Surveillance Program	FW: High CW: High Offsite Public: High	FW: Neg CW: Neg Offsite Public: Neg	A1 A1 A1	C C C	
MRS-9	E-3	Event deleted												See General Assumptions (firearm discharge in vault type room)

Table C-A.1 Hazard Evaluation Table - Material Receipt and Storage (MRS)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
MRS-10	E-4	Excessive personnel radiation exposure during operations Location: MRS, FP, OX Areas Hazard: Radiation	Improperly characterized material/ containers (containers have more material or unknown contents) Excessive stay times	Shielding Cart design (shielding; limited to two positions) 3013 Container (capacity)	Operator training and Procedures Configuration Management Program MC&A Program Radiological Protection Program	A	NA	None	*Operator Training and Procedures* *Event Response Procedures* *Radiological Protection Program*	FW: Low CW: Neg Offsite Public: Neg	NA	B C C	NA	
MRS-11	E-5	Altering configuration of cart to permit 3013 containers to be in close contact resulting in a criticality event Location: Hallway, FP, or OX Room MAR: 10 kg plutonium oxide (two 3013 containers)	Operator error Improper handling, placement, or storage Failure of cart storage position spacing Improper maintenance	**Cart design**	**Nuclear Criticality Safety Program** *Operator Training and Procedures* *Configuration Management Program*	A	EU	**Building Design (PC-3)** **NIMS**	*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg	A1 B C	A2 B C	Double contingency has been implemented, see Nuclear Criticality Safety Evaluation (NCSE)

Table C-A.1 Hazard Evaluation Table - Material Receipt and Storage (MRS)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
MRS-12	E-5	Altering configuration of cart to permit 3013 containers to be in close contact resulting in a criticality event Location: Dumbwaiter MAR: 10 kg plutonium oxide (two 3013 containers)	Dumbwaiter failure Improper maintenance	**Cart design**	**Nuclear Criticality Safety Program** *Operator Training and Procedures* *Configuration Management Program* *Dumbwaiter maintenance*	A	EU	**Building Design (PC-3)** **NIMS**	*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg	A1 B C	A2 B C	Double contingency has been implemented, see NCSE
MRS-13	E-5/ E-1	Fire alters cart to permit 3013 containers to be in close contact resulting in a criticality event Location: Hallway, Dumbwaiter MAR: 10 kg plutonium oxide (two 3013 containers)	Excess combustibles with an ignition source	**Cart design**	**Nuclear Criticality Safety Program** Operator Training and Procedures Configuration Management Program Combustible Control Program	U	EU	**Building Design (PC-3)** **Fire Detection and Alarm System** **NIMS**	*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg	A1 B C	A2 B C	

Table C-B.1 Hazard Evaluation Table - Feed Preparation

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
FP-1	E-1	Fire occurs in the Entry Staging Material Prep Area of FP glovebox that releases radiological material from 3013s (pressurized) Location: FP glovebox MAR: 30 kg plutonium oxide (five 3013 containers and one in transit)	Combustible/ flammable materials- transient combustible gloves Ignition sources- bar code reader outlets	NFPA Design	Fire Protection Program	U	U	**Building Design (PC-3)** **EVS** Glovebox design Glovebox Ventilation System **Glovebox Fire Detection and Alarm System** *3013 Container Design*	**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: High Offsite Public: High	FW: Low CW: Low Offsite Public: Neg	A1 A1 A1	B B C	
FP-2	E-1	Fire occurs in the Can Opening Area of FP glovebox that releases radiological material from 3013s (pressurized) Location: FP glovebox MAR: 30 kg plutonium oxide (six 3013 containers- three in Lag Storage, three in Equipment positions)	Combustible/ flammable materials- transient combustible gloves; Installed equipment- insulation; hydrogen from 3013 can Ignition sources-two can cutters, can puncture device, bar code reader, other equipment- heat from friction	Can Puncture Device Design NFPA Design	Fire Protection Program	U	U	**Building Design (PC-3)** **EVS** Glovebox design (PC-3) Glovebox Ventilation System **Glovebox Fire Detection and Alarm System** *3013 Container Design*	**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: High Offsite Public: High	FW: Low CW: Low Offsite Public: Neg	A1 A1 A1	B B C	

Table C-B.1 Hazard Evaluation Table - Feed Preparation

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
FP-3	E-1	Fire occurs in the Crushing Area of FP glovebox resulting in a radiological release Location: FP glovebox MAR: 32 kg plutonium oxide (six cans and one Butt can)	Combustible/ flammable materials- Trans. Combustible- gloves; Installed equipment- insulation Ignition sources- Crusher, dumper, BC reader, other equipment	NFPA Design	Fire Protection Program	U	U	**Building Design (PC-3)** **EVS** Glovebox Design (PC-3) Glovebox Ventilation System **Glovebox Fire Detection and Alarm System**	**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: High Offsite Public: High	FW: Low CW: Low Offsite Public: Neg	A1 A1 A1	B B C	
FP-4	E-1	Fire occurs in the Accountability Measurement Area of FP glovebox resulting in a radiological release Location: FP glovebox MAR: 18 kg plutonium oxide (nine Batch cans- five in Lag Storage, four in Equipment positions)	Combustible/ flammable materials- Trans. Combustible- gloves; Installed equipment- insulation Ignition sources- NDA equip, BC reader, laser (turntable)	NFPA Design LIBS Chamber Design	Fire Protection Program	U	U	**Building Design (PC-3)** **EVS** Glovebox Design (PC-3) Glovebox Ventilation System **Glovebox Fire Detection and Alarm System** LIBS Chamber Design	**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: High Offsite Public: Mod	FW: Low CW: Low Offsite Public: Neg	A1 A1 B	B B C	

Table C-B.1 Hazard Evaluation Table - Feed Preparation

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
FP-5	E-1	Fire occurs in the Exit Staging Material Prep Area of FP glovebox that releases radiological mat from batch can Location: FP glovebox MAR: 20 kg plutonium oxide (10 batch cans in lag storage)	Combustible/ flammable materials-Trans. Combustible-gloves Ignition sources-Bar code reader outlets	NFPA Design	Fire Protection Program	U	U	**Building Design (PC-3)** **EVS** Glovebox Design (PC-3) Glovebox Ventilation System **Glovebox Fire Detection and Alarm System**	**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: High Offsite Public: Mod	FW: Low CW: Low Offsite Public: Neg	A1 A1 B	B B C	
FP-6	E-1	Pyrophoric fire occurs in the can opening area of FP glovebox resulting in a radiological release Location: FP glovebox MAR: 30 kg plutonium oxide (six 3013 containers-three in lag storage, three in equipment positions)	Mislabeled can at generator Operator introduces metal can instead	Barcode Readers NFPA Design Can Puncture Device Design	Fire Protection Program	A	A	**Building Design (PC-3)** **EVS** **Glovebox Design (PC-3)** **Glovebox Ventilation System** **Glovebox Fire Detection and Alarm System**	**Event Response Procedures** **Operator Training and Procedures** *MgO_2* 3013 Qualification and Storage Surveillance Program	FW: High CW: High Offsite Public: High	FW: Low CW: Low Offsite Public: Neg	A1 A1 A1	B B C	MgO_2 for manual suppression.

Table C-B.1 Hazard Evaluation Table - Feed Preparation

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
FP-7	E-1	Fire occurs in one section and spreads to entire glovebox resulting in a radiological release Location: FP glovebox MAR: 125 kg plutonium oxide (FP glovebox inventory)	Combustible/ flammable materials-Trans. Combustible-gloves Ignition sources-Bar code reader outlets, BC reader, laser (turntable), crusher, dumper, other equipment, etc.	NFPA Design Can Puncture Device Design	Fire Protection Program	EU	EU	**Building Design (PC-3)** **EVS** **Glovebox Design (PC-3)** **Glovebox Ventilation System** **Glovebox Fire Detection and Alarm System** Separation Doors Airlocks *3013 Container Design*	**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: High Offsite Public: High	FW: Low CW: Low Offsite Public: Neg	A1 A1 A1	B B C	Assumes pressurized release of at least one 3013 container, which produces bounding consequence levels.
FP-8	E-1	Fire in FP Room resulting in a radiological release Location: FP Room MAR: 135 kg plutonium oxide (FP glovebox and Room inventory)	Combustible / flammable material in Process Room including misc. combustibles Ignition sources	NFPA Design Glovebox design (PC-3) Cart Design	Fire Protection Program	U	U	**Building Design (PC-3)** **EVS** **Fire Detection and Alarm System** Glovebox Design (PC-3) Glovebox Ventilation System Glovebox Fire Detection and Alarm System *3013 Container Design*	**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: High Offsite Public: High	FW: Low CW: Low Offsite Public: Neg	A1 A1 A1	B B C	Assumes pressurized release of at least one 3013 container, which produces bounding consequence levels.

Table C-B.1 Hazard Evaluation Table - Feed Preparation

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
FP-9	E-2	Hydrogen explosion during can puncturing results in a pressurized radiological release Location: FP glovebox MAR: 5 kg plutonium oxide (one 3013 container)	Operator error Material failure	**Can Puncture Device Design** **NFPA Design**	Operator Training and Procedures	A	EU	**Building Design (PC-3)** **EVS** **Glovebox design (PC-3)** **Glovebox Ventilation System**	*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: High Offsite Public: High	FW: Low CW: Neg Offsite Public: Neg	A1 A1 A1	B C C	
FP-10	E-3	Loss of containment from glovebox in Entry Staging Area, glovebox in Can Opening Area, glovebox in Crushing Area, glovebox in Accountability Area, or Exit Staging Area of glovebox resulting in a radiological release Location: FP glovebox MAR: 25 kg plutonium oxide (five 3013 containers)	Overhead transport system falls on glovebox	Glovebox Design (PC-3) **II/I Design of Overhead Transport System**	Operator Training and Procedures Radiological Protection Program	A	U	**Building Design (PC-3)** **EVS** **Glovebox Design (PC-3)** **Glovebox Ventilation System**	*Radiological Protection Program* *Operator Training and Procedures* *Event Response Procedure*	FW: High CW: High Offsite Public: High	FW: Low CW: Neg Offsite Public: Neg	A1 A1 A1	B C C	MAR identified for this event is considered bounding, based on the maximum number of sealed 3013 containers.

Table C-B.1 Hazard Evaluation Table - Feed Preparation

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
FP-11	E-3	Loss of containment from glovebox in Entry Staging Area, glovebox in Can Opening Area, glovebox in Crushing Area, glovebox in Accountability Area, or Exit Staging Area of glovebox resulting in a radiological release Location: FP glovebox MAR: 32 kg plutonium oxide (Max glovebox section MAR-six open cans and one Butt can)	Glove failure Tear from operations Material failure Improper installation Window failure Gasket failure Breach from operation Breach from external (maintenance)	Glovebox Design (PC-3)	Operator Training and Procedures	A	A	**Building Design (PC-3)** **EVS** **Glovebox Design (PC-3)** **Glovebox Ventilation System**	*Radiological Protection Program* *Operator Training and Procedures* *Event Response Procedure*	FW: High CW: Mod Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	A1 B C	B C C	HVAC inlet HEPA design to prevent backflow material release.

Table C-B.1 Hazard Evaluation Table - Feed Preparation

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
FP-12	E-3	Loss of containment from glovebox in Entry Staging Area, glovebox in Can Opening Area, glovebox in Crushing Area, glovebox in Accountability Area, or Exit Staging Area of glovebox resulting in a radiological release Location: FP glovebox MAR: 32 kg plutonium oxide (Max glovebox section MAR- six open 3013s and one Butt can)	Fire suppression pressurizes (wrong sized bottle- too high pressure) Operator error	Glovebox Design (PC-3) Glovebox Ventilation System Design	Operator Training and Procedures	A	A	**Building Design (PC-3)** **EVS** **Glovebox Design (PC-3)** **Glovebox Ventilation System**	*Radiological Protection Program* *Operator Training and Procedures* *Event Response Procedure*	FW: High CW: Mod Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	A1 B C	B C C	HVAC inlet HEPA in design to prevent backflow material release.

Table C-B.1 Hazard Evaluation Table - Feed Preparation

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
FP-13	E-3	Loss of containment from glovebox in Can Opening Area resulting in a radiological release Location: FP glovebox MAR: 30 kg plutonium oxide (one 3013 container and loose material)	Shrapnel from can puncture explosion Operator error	**Can Puncture Device Design**	Operator Training and Procedures	A	EU	**Building Design (PC-3)** **EVS** **Glovebox Design (PC-3)** **Glovebox Ventilation System**	*Radiological Protection Program* *Operator Training and Procedures* *Event Response Procedure*	FW: High CW: High Offsite Public: High	FW: Low CW: Neg Offsite Public: Neg	A1 A1 A1	B C C	
FP-14	E-3	Spill of pin fuel can containing Green Fuel Material in FP Room resulting in a radiological release Location: FP Room MAR: 5 kg plutonium oxide (one pin fuel can)	Operator drops Pulley cart tips over/hits can Maintenance hoist hits can	None	Operator Training and Procedures	A	A	Building Design (PC-3) EVS	Radiological Protection Program Operator Training and Procedures Event Response Procedure Green Fuel Material Certification	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	Green Fuel Material Form is plutonium oxide stabilized in a ceramic matrix resulting in no dose consequences from a release
FP-15	E-3	Event deleted												See General Assumptions (firearm discharge in vault type room)

Table C-B.1 Hazard Evaluation Table - Feed Preparation

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
FP-16	E-4	Excessive exposure to FW from radiological material in glovebox Location: FP glovebox MAR: Contamination	Spills of radiological material in areas not intended for material to be spilled High radiological material introduced without proper shielding Poor housekeeping/ improper surveys	None	Operator Training and Procedures Radiological Protection Program MC&A Program	A	A	**Glovebox Design (PC-3)**	*Operator Training and Procedures* *Event Response Procedures* *Radiological Protection Program*	FW: Mod CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	B C C	Glovebox shielding design will mitigate exposure.
FP-17	E-5	Criticality in glovebox in Entry Staging Area, glovebox in Crusher Section, glovebox in Can Opening Area, glovebox in Accountability Area, or Exit Staging Area of glovebox Location: FP glovebox MAR: 32 kg plutonium oxide (Max FP glovebox section MAR- six cans (three in Lag Storage, three in Equipment positions) and one Butt can)	Too many containers arranged in critical array Excessive moderation introduced to staging area- fire sprinkler in room discharges into glovebox, plastic introduced (plutonium outside of cans i.e. cans breached)	None	Operator Training and Procedures **Nuclear Criticality Safety Program**	A	EU	**Building Design (PC-3)** **NIMS**	*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg	A1 B C	A2 B C	

Table C-B.1 Hazard Evaluation Table - Feed Preparation

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
FP-18	E-5	Criticality in glovebox in Entry Staging Area, glovebox in Crusher Section, glovebox in Can Opening Area, glovebox in Accountability Area, or Exit Staging Area of glovebox Location: FP glovebox MAR: 32 kg plutonium oxide (Max FP glovebox section MAR-six cans (three in Lag Storage, three in Equipment positions) and one Butt can)	Excessive reflection-introduction of reflective materials, e.g., Be, flesh	None	Operator Training and Procedures **Nuclear Criticality Safety Program**	A	EU	**Building Design (PC-3)** **NIMS**	*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg	A1 B C	A2 B C	

Table C-B.1 Hazard Evaluation Table - Feed Preparation

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
FP-19	E-5	Criticality in Crusher Section of glovebox Location: FP glovebox MAR: 32 kg plutonium Oxide (six cans (three in Lag Storage, three in Equipment positions) and one Butt can)	Overmass in crusher Overmass in dustless dumper	None	Operator Training and Procedures **Nuclear Criticality Safety Program**	A	EU	**Building Design (PC-3)** **NIMS**	*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg	A1 B C	A2 B C	
FP-20	E-5/ E-1	Fire occurs in room resulting in a criticality event Location: FP Room MAR: 135 kg plutonium oxide (FP glovebox Room inventory)	Excess combustibles with an ignition source Fire Suppression System	Glovebox Design (PC-3)	**Nuclear Criticality Safety Program** Operator Training and Procedures	U	EU	**Building Design (PC-3)** **NIMS** Glovebox Design (PC-3) **Fire Detection and Alarm System** **Glovebox Fire Detection and Alarm System**	*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg	A1 B C	A2 B C	

Table C-C.1 Hazard Evaluation Table - Metal Oxidation (OX)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
OX-1	E-1	Fire occurs in the Entry Staging Material Prep Area of OX glovebox that releases radiological material from 3013 (pressurized) Location: OX glovebox MAR: 30 kg plutonium Oxide (five 3013 containers and one in transit)	Combustible / flammable material- Trans. Combustible (gloves) Ignition sources- Bar code reader outlets	NFPA Design	Fire Protection Program	A	A	**Building Design (PC-3)** **EVS** Glovebox Design (PC-3) Glovebox Ventilation System **Glovebox Fire Detection and Alarm System** *3013 Container Design*	**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: High Offsite Public: High	FW: Low CW: Low Offsite Public: Neg	A1 A1 A1	B B C	
OX-2	E-1	Fire occurs in the Open Outer Can Area of OX glovebox that releases radiological material from 3013 (pressurized) Location: OX glovebox MAR: 5 kg plutonium oxide (one 3013 container)	Combustible / flammable material- Trans. Combustible- gloves; Installed equipment- insulation Ignition sources- Can cutter (1), BC reader, other equipment- heat of friction	NFPA Design	Fire Protection Program Operator Training and Procedures	U	U	**Building Design (PC-3)** **EVS** Glovebox Design (PC-3) Glovebox Ventilation System **Glovebox Fire Detection and Alarm System** *3013 Container Design*	**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: High Offsite Public: High	FW: Low CW: Low Offsite Public: Neg	A1 A1 A1	B B C	

Table C-C.1 Hazard Evaluation Table - Metal Oxidation (OX)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
OX-3	E-1	Fire occurs in the Furnace Prep Area of OX glovebox resulting in a radiological release Location: OX glovebox MAR: 35 kg plutonium oxide (four in Equipment positions and three in Lag Storage)	Combustible / flammable material-Trans. Combustible-gloves; Installed equipment-insulation Ignition sources-Can cutter, motors, BC reader, other electrical, heat of friction from can cutter	NFPA Design Ar atmosphere O_2 Sensors in glovebox	Fire Protection Program	U	U	**Building Design (PC-3)** **EVS** Glovebox Design (PC-3) Glovebox Ventilation System **Glovebox Fire Detection and Alarm System**	**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: High Offsite Public: High	FW: Low CW: Low Offsite Public: Neg	A1 A1 A1	B B C	Oxide is the worst release calculation. No suppression in this section of glovebox.
OX-4	E-1	Fire occurs in both Furnace Areas of OX glovebox resulting in a radiological release Location: OX glovebox MAR: 10 kg plutonium oxide (Total Furnace Inventory)	Combustible / flammable material-Trans. Combustible-gloves; Installed equipment-insulation; Excess O_2- Equipment failure, op. error, leak; Loss of Ar atmosphere Ignition sources-Furnace, rotating basket	NFPA Design Furnace Design O_2 Sensors in glovebox Ar atmosphere	Fire Protection Program Operator Training and Procedures	A	A	Building Design (PC-3) *EVS* Glovebox Design (PC-3) Glovebox Ventilation System *Glovebox Fire Detection and Alarm System*	*Event Response Procedures* *Operator Training and Procedures*	FW: Low CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	B C C	Oxide is the worst release calculation. No suppression in this section of glovebox.

Table C-C.1 Hazard Evaluation Table - Metal Oxidation (OX)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
OX-5	E-1	Fire occurs in the Accountability Measurement/Exit Staging Area of OX glovebox resulting in a radiological release Location: OX glovebox MAR: 45 kg plutonium oxide (four in equip positions and five storage cans)	Combustible/ flammable materials- Trans. Combustible- gloves; Installed equipment- insulation Ignition sources- NDA equip, BC reader	NFPA Design	Fire Protection Program	U	U	**Building Design (PC-3)** **EVS** Glovebox Design (PC-3) Glovebox Ventilation System **Glovebox Fire Detection and Alarm System**	**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: High Offsite Public: High	FW: Low CW: Low Offsite Public: Neg	A1 A1 A1	B B C	
OX-6	E-1	Pyrophoric fire occurs in the Furnace Prep Area of glovebox resulting in a radiological release Location: OX glovebox MAR: 35 kg plutonium oxide (four in Equipment positions and three in Lag Storage)	Pyrophoric material Failure of Ar system- equipment failure, leak, op error glovebox containment Breached	NFPA Design Glovebox Design (PC-3) O_2 Sensors in glovebox *Ar Atmosphere*	Fire Protection Program Operator Training and Procedures	A	A	**Building Design (PC-3)** **EVS** **Glovebox Design (PC-3)** **Glovebox Ventilation System** Glovebox Fire Detection and Alarm System	**Event Response Procedures)** **Operator Training and Procedures** *MgO_2*	FW: High CW: High Offsite Public: High	FW: Low CW: Low Offsite Public: Neg	A1 A1 A1	B B C	MgO_2 for manual suppression.

Table C-C.1 Hazard Evaluation Table - Metal Oxidation (OX)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
OX-7	E-1	Pyrophoric fire occurs in the Outer Can Opening Area of the glovebox resulting in a radiological release Location: OX glovebox MAR: 5 kg plutonium oxide (one 3013 container)	Pyrophoric material Operator error- Cut thru inner can (some 3013 cans do not have convenience cans) Hole/failure of inner can	NFPA Design	Fire Protection Program Operator Training and Procedures	A	A	Building Design (PC-3) EVS Glovebox Design (PC-3) Glovebox Ventilation System Glovebox Fire Detection and Alarm System	*Event Response Procedures* *Operator Training and Procedures* *MgO_2*	FW: Low CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	B C C	MgO_2 for manual suppression.
OX-8	E-1	Pyrophoric fire occurs in the Furnace of the glovebox resulting in a radiological release Location: OX glovebox MAR: 10 kg plutonium oxide (two 3013 containers)	Pyrophoric material Excess O_2 fed to furnace O_2 leak into furnace Furnace controls fail	NFPA Design Glovebox Design O_2 Sensors in glovebox Ar Atmosphere	Fire Protection Program Operator Training and Procedures	A	A	Building Design (PC-3) EVS Glovebox Design (PC-3) Glovebox Ventilation System Glovebox Fire Detection and Alarm System	*Event Response Procedures* *Operator Training and Procedures* *MgO_2*	FW: Low CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	B C C	MgO_2 for manual suppression.

Table C-C.1 Hazard Evaluation Table - Metal Oxidation (OX)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
OX-9	E-1	Molten plutonium release from Furnace in glovebox resulting in a radiological release Location: OX glovebox MAR: 5 kg metal (one Furnace charge)	Furnace gets too hot Too much O_2 or too high an O_2 feed rate into furnace Failure of furnace controls (temp too high ~ >640° C) Failure of Ar glovebox atmosphere and leakage of O_2 into furnace	NFPA Design Furnace Design O_2 Sensors in glovebox	Operator Training and Procedures	A	A	Building Design (PC-3) *EVS* *Glovebox Fire Detection and Alarm System* *Furnace Design*	*Event Response Procedures* *Operator Training and Procedures*	FW: Low CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	B C C	
OX-10	E-1	Fire occurs in one section and spreads to entire glovebox resulting in a radiological release Location: OX glovebox MAR: 120 kg plutonium (OX glovebox inventory)	Combustible / flammable material-Trans. Combustibles Ignition sources Pyrophoric material O_2 leak into furnace Failure of the inert system	NFPA Design	Fire Protection Program	U	U	**Building Design (PC-3)** **EVS** **Fire Detection and Alarm System** **Glovebox Design (PC-3)** **Glovebox Ventilation System** **Glovebox Fire Detection and Alarm System** Airlocks Separation Doors 3013 Container Design	**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: High Offsite Public: High	FW: Low CW: Low Offsite Public: Neg	A1 A1 A1	B B C	Assumes pressurized release of at least one 3013 container, which produces bounding consequence levels.

Table C-C.1 Hazard Evaluation Table - Metal Oxidation (OX)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
OX-11	E-1	Fire in OX Room resulting in a radiological release Location: OX Room MAR: 130 kg plutonium (OX Room Inventory)	Combustible/ flammable material- in Process Room including misc. combustibles Ignition sources	NFPA Design Glovebox Design Cart Design	Fire Protection Program	U	U	**Building Design (PC-3)** **EVS** **Fire Detection and Alarm System** Glovebox Design (PC-3) Glovebox Ventilation System Glovebox Fire Detection and Alarm System *3013 Container Design*	**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: High Offsite Public: High	FW: Low CW: Low Offsite Public: Neg	A1 A1 A1	B B C	Assumes pressurized release of at least one 3013 container, which produces bounding consequence levels.
OX-12	E-2	Explosion occurs while opening outer 3013 container resulting in a radiological release Location: OX glovebox MAR: 5 kg plutonium oxide (one 3013 container)	Operator error- inadvertent introduction of Oxide can, inner and outer can cut open Heat from cutting, hydrogen generation Inner can failed	NFPA Design Standards	Operator Training and procedures	EU	EU	**Building Design (PC-3)** **EVS** **Glovebox Design (PC-3)** **Glovebox Ventilation System**	*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: High Offsite Public: High	FW: High CW: Low Offsite Public: Neg	A2 A2 A2	A2 B C	

Table C-C.1 Hazard Evaluation Table - Metal Oxidation (OX)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
OX-13	E-2	Venting occurs while opening outer 3013 container resulting in a radiological release Location: OX glovebox MAR: 5 kg plutonium oxide (one 3013 container)	Operator error Inadvertent introduction of oxide can Inner and outer can cut open Can under pressure vents while cutting Inner can failed	NFPA Design Glovebox Design (PC-3)	Operator Training and Procedures	EU	EU	**Building Design (PC-3)** **EVS** **Glovebox Design (PC-3)** **Glovebox Ventilation System**	*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: High Offsite Public: High	FW: Low CW: Neg Offsite Public: Neg	A2 A2 A2	B C C	
OX-14	E-2	Venting occurs while opening inner 3013 container resulting in a radiological release Location: OX glovebox MAR: 5 kg plutonium oxide (one 3013 container)	Operator error Inadvertent introduction of oxide can Can under pressure vents while cutting	NFPA Design Glovebox Design (PC-3)	Operator Training and Procedures	U	U	**Building Design (PC-3)** **EVS** **Glovebox Design (PC-3)** **Glovebox Ventilation System**	*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: High Offsite Public: High	FW: Low CW: Neg Offsite Public: Neg	A1 A1 A1	B C C	

Table C-C.1 Hazard Evaluation Table - Metal Oxidation (OX)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
OX-15	E-2	Overpressure of furnace prep area in OX glovebox results in a radiological release Location: OX glovebox MAR: Contamination	Ar regulator fails Inert system fails Plugged HEPA Valve failure/closed (operator error or equip failure)	Glovebox Design (PC-3) Inert Ventilation System Flow orifice in supply lines limits flow	Operator Training and Procedures	A	A	*Glovebox Design (PC-3)* *Inert Ventilation System*	*Event Response Procedures* *Operator Training and Procedures*	FW: Low CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	B C C	
OX-16	E-2	Overpressure of furnace in OX glovebox resulting in a radiological release Location: OX glovebox MAR: Contamination	Ar regulator fails Exhaust system fails, plugged HEPA, valve failure/closed (op. error or equip failure) O_2/He regulator failure	Glovebox Design (PC-3) Inert Ventilation System Flow orifice in supply lines- limits flow	Operator Training and Procedures	A	A	Glovebox Design (PC-3) Inert Ventilation System	*Event Response Procedures* *Operator Training and Procedures*	FW: Low CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	B C C	Design to investigate features to prevent (e.g. Bubbler)
OX-17	E-2	Furnace explodes releasing radiological material Location: OX glovebox MAR: 5 kg plutonium oxide (one furnace charge)	Mechanical failure Water from cooling leaks into furnace or heater elements- mechanical failure, etc.	Furnace Design (relieves less than 25 PSIG) Glovebox Design (PC-3) Inert Ventilation System	Maintenance Program Operator Training and Procedures	A	A	**Building Design (PC-3)** **EVS** **Glovebox Design (PC-3)** **Inert Ventilation System**	*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: Mod Offsite Public: Low	FW: Low CW: Neg Offsite Public: Neg	A1 B B	B C C	Assumption: Furnace design pressure is less than 25 psig.

Table C-C.1 Hazard Evaluation Table - Metal Oxidation (OX)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
OX-18	E-3	Loss of containment from glovebox in Entry Staging Area, glovebox in Outer Can Opening Area, glovebox in Furnace Prep Area, or Accountability/ Exit Staging/Prep Area of OX glovebox results in a radiological release. Location: OX glovebox MAR: 45 kg plutonium oxide (Max OX glovebox MAR)	Overhead transport system falls on glovebox	Glovebox Design (PC-3) **II/I Design of Overhead Transport System**	Radiological Protection Program Operator Training and Procedure	A	U	**Building Design (PC-3)** **EVS** **Glovebox Design (PC-3)** **Glovebox Ventilation System**	*Radiological Protection Program* *Operator Training and Procedures* *Event Response Procedures*	FW: High CW: Mod Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	A1 B C	B C C	No sealed 3013 plutonium oxide containers present.

Table C-C.1 Hazard Evaluation Table - Metal Oxidation (OX)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
OX-19	E-3	Loss of containment from Entry Staging Area of OX glovebox resulting in a radiological release Location: OX glovebox MAR: 30 kg plutonium (one 3013 with oxide, and others with metal)	Glove failure Tear from operations material failure Improper installation Window failure Gasket failure Breach from operation Breach from external (bullet, maintenance)	Glovebox Design (PC-3)	Operator Training and Procedure	A	A	**Building Design (PC-3)** **EVS** **Glovebox Design (PC-3)** **Glovebox Ventilation System**	*Radiological Protection Program* *Operator Training and Procedures* *Event Response Procedures*	FW: High CW: High Offsite Public: High	FW: Low CW: Neg Offsite Public: Neg	A1 A1 A1	B C C	HVAC inlet HEPA in design to prevent backflow material release.

Table C-C.1 Hazard Evaluation Table - Metal Oxidation (OX)

				Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		
Event No.	**Event Cat.**	**Event Description**	**Causes**	**Design**	**Admin**	**Unmit**	**Mit**	**Design**	**Admin**	**Unmit Conseq**	**Mit Conseq**	**Unmit**	**Mit**	**Comments**
OX-20	E-3	Loss of containment from glovebox in Outer Can Opening Area, glovebox in Furnace Prep Area, glovebox in Furnace Area, or Accountability Measurement/ Exit Staging of OX glovebox resulting in a radiological release Location: OX glovebox MAR: 45 kg plutonium oxide (Max OX glovebox section MAR)	Glove failure Tear from operations Material failure Improper installation Window failure Gasket failure Breach from operation Breach from external (maintenance)	Glovebox Design (PC-3)	Operator Training and Procedures	A	A	**Building Design (PC-3)** **EVS** **Glovebox Design (PC-3)** **Glovebox Ventilation System**	*Radiological Protection Program* *Operator Training and Procedures* *Event Response Procedures*	FW: High CW: Mod Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	A1 B C	B C C	HVAC inlet HEPA in design to prevent backflow material release. No sealed 3013 plutonium oxide containers present.

Table C-C.1 Hazard Evaluation Table - Metal Oxidation (OX)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
OX-21	E-3	Loss of containment from glovebox in Outer Can Opening Area, or Accountability Measurement/ Exit Staging of OX glovebox resulting in a radiological release Location: OX glovebox MAR: 45 kg plutonium oxide (Max OX glovebox section MAR)	Fire suppression pressurizes (wrong sized bottle- too high pressure) Operator error	Glovebox Design (PC-3) Glovebox Ventilation System Design	Operator Training and Procedures	A	U	**Building Design (PC-3)** **EVS** **Glovebox Design (PC-3)** **Glovebox Ventilation System**	*Radiological Protection Program* *Operator Training and Procedures* *Event Response Procedures*	FW: High CW: Mod Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	A1 B C	B C C	HVAC inlet HEPA in design to prevent backflow material release. No sealed 3013 plutonium oxide containers present.
OX-22	E-3	Event deleted												See General Assumptions (firearm discharge in vault type room)
OX-23	E-4	Excessive exposure to FW from radiological material in glovebox Location: OX glovebox MAR: Contamination	Spills of radiological material in areas not intended for material to be spilled High radiological material introduced without proper shielding Poor housekeeping/ improper surveys	None	Operator Training and Procedures Radiological Protection Program MC&A Program	A	A	**Glovebox Design (PC-3)**	*Event Response Procedures* *Operator Training and Procedures* *Radiological Protection Program*	FW: Mod CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	B C C	Glovebox shielding design will mitigate exposure.

Table C-C.1 Hazard Evaluation Table - Metal Oxidation (OX)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
OX-24	E-5	Criticality in glovebox in Entry Staging Area, glovebox in Outer Can Opening Area, Area, glovebox in Furnace Prep Area, glovebox in Furnace Area, or Accountability Measurement/ Exit Staging of OX glovebox Location: OX glovebox MAR: 45 kg plutonium oxide (Max OX glovebox section MAR)	Too many containers arranged in critical array Excessive moderation introduced to staging area during fire- fire sprinkler in room discharges into glovebox, fire hoses discharged into glovebox, plastic introduced (plutonium outside of cans i.e. cans breached)	None	Operator Training and Procedures **Nuclear Criticality Safety Program**	A	EU	**Building Design (PC-3)** **NIMS**	*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg	A1 B C	A2 B C	

Table C-C.1 Hazard Evaluation Table - Metal Oxidation (OX)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
OX-25	E-5	Criticality in glovebox in Entry Staging Area, glovebox in Outer Can Opening Area, glovebox in Furnace Prep Area, glovebox in Furnace Area, or Accountability Measurement/ Exit Staging of OX glovebox Location: OX glovebox MAR: 45 kg plutonium oxide (Max OX glovebox section MAR)	Excessive reflection-introduction of reflective materials, e.g. Be, flesh	None	Operator Training and Procedures **Nuclear Criticality Safety Program**	A	EU	**Building Design (PC-3)** **NIMS**	*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg	A1 B C	A2 B C	
OX-26	E-5	Criticality in Furnace Prep Area of OX glovebox Location: OX glovebox MAR: 35 kg plutonium oxide	Overmass metal dumped in basket Overmass Oxide in dumper and transport can	None	Operator Training and Procedures **Nuclear Criticality Safety Program**	A	EU	**Building Design (PC-3)** **NIMS**	*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg	A1 B C	A2 B C	Oxide is the worst release calculation.

Table C-C.1 Hazard Evaluation Table - Metal Oxidation (OX)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
OX-27	E-5	Criticality in Furnace Area of OX glovebox Location: OX glovebox MAR: 10 kg plutonium oxide	Overmass (double batch) furnace	None	Operator Training and Procedures **Nuclear Criticality Safety Program**	A	EU	**Building Design (PC-3)** **NIMS**	*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg	A1 B C	A2 B C	
OX-28	E-5/ E-1	Fire occurs in OX Room resulting in a criticality event Location: OX Room MAR: 130 kg oxide (OX glovebox room inventory)	Excess combustibles with an ignition source Fire Suppression System	Glovebox Design (PC-3)	**Nuclear Criticality Safety Program** Operator Training and Procedures	U	EU	**Building Design (PC-3)** **NIMS** Glovebox Design (PC-3) **Fire Detection and Alarm System** Glovebox Fire Detection and Alarm System	*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg	A1 B C	A2 B C	

Table C-A.2 Hazard Evaluation Table - Bagless Transfer System

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
BTS-1	E-1	Fire results in a radiological release Location: BTS glovebox and/or Rework MAR: 9 kg Frit plus 1 kg plutonium oxide (one can Vitrified Glass)	Combustibles in glovebox with ignition source Electrical failure Mechanical failure (i.e., Acetylene Gas Bottle) Can cutter overheats Operations error	Material Form-Vitrified Glass NFPA Design Fire Detection and Alarm System	Fire Protection Program Operator Training and Procedures	A	A	Material Form-Vitrified Glass Fire Detection and Alarm System Glovebox design (PC-3) Glovebox Ventilation System	Fire Protection Program Operator Training and Procedures Event Response Procedures	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	
BTS-2	E-1	Fire results in a radiological release Location: BTS glovebox MAR: 45 kg Frit plus 5 kg plutonium oxide (five cans Vitrified Glass)	Combustibles in glovebox with ignition source Electrical failure Mechanical failure (i.e., Acetylene Gas Bottle) Can cutter overheats Operations error	Material Form-Vitrified Glass NFPA Design Fire Detection and Alarm System	Fire Protection Program Operator Training and Procedures	A	A	Material Form-Vitrified Glass Fire Detection and Alarm System Glovebox Design (PC-3) Glovebox Ventilation System	Fire Protection Program Operator Training and Procedures Event Response Procedures	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	
BTS-3	E-1	Fire results in a radiological release Location: BTS Fume hood MAR: 81 kg Frit plus 9 kg plutonium oxide (nine cans Vitrified Glass)	Combustibles in fume hood with ignition source Electrical failure Mechanical failure (i.e., Acetylene Gas Bottle) Bagless system overheats Operations error	Material Form-Vitrified Glass NFPA Design Fire Detection and Alarm System Argon gas blanket in Bagless system welder	Fire Protection Program Operator Training and Procedures	A	A	Material Form-Vitrified Glass Fire Detection and Alarm System Fume Hood Design Fume Hood Ventilation System (fire screens, HEPA filters)	Fire Protection Program Operator Training and Procedures Event Response Procedures	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	Horizontal or vertical BTS welding configuration results in no new event initiators, or hazards associated with this type of a layout change.

Table C-A.2 Hazard Evaluation Table - Bagless Transfer System

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
BTS-4	E-1	Fire results in a radiological release Location: BTS Room MAR: 180 kg Frit plus 20 kg plutonium oxide (20 cans Vitrified Glass)	Combustibles in room with ignition source Electrical failure Mechanical failure (i.e., Acetylene Gas Bottle) Operations error	Material Form-Vitrified Glass NFPA Design Fire Detection and Alarm System	Fire Protection Program Operator Training and Procedures	U	U	Material Form-Vitrified Glass Fire Detection and Alarm System Fire barriers EVS	Fire Protection Program Operator Training and Procedures Event Response Procedures	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	
BTS-5	E-1	Fire results in a pressurized radiological release Location: BTS Fume hood MAR: 9 kg Frit plus 1 kg plutonium oxide (one can Vitrified Glass)	Contamination (organic material) in can pressurized and fails can Combustibles in fume hood with ignition source Electrical failure Mechanical failure (i.e., Acetylene Gas Bottle) Can cutter overheats Operations error	Material Form-Vitrified Glass Bagless can design NFPA Design Fire Detection and Alarm System Fume Hood Design Fume Hood Ventilation System (fire screens, HEPA filters)	Fire Protection Program Operator Training and Procedures	U	U	Vitrified Glass Fire Detection and Alarm System Fume Hood Design Fume Hood Ventilation System (fire screens, HEPA filters)	Fire Protection Program Operator Training and Procedures Event Response Procedures	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	Horizontal or vertical BTS welding configuration results in no new event initiators, or hazards associated with this type of a layout change.

Table C-A.2 Hazard Evaluation Table - Bagless Transfer System

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
BTS-6	E-3	Gas cylinder missile results in a radiological release during maintenance Location: BTS Room MAR: 9 kg Frit plus 1 kg plutonium oxide (one can Vitrified Glass)	Human error handing cylinder Cylinder mechanical failure Operations error	Material Form-Vitrified Glass Vitrified Can Design Gas bottle Storage Design (gas supply location outside of room)	Operator Training and Procedures Maintenance Program	A	A	Vitrified Glass EVS	Operator Training and Procedures Event Response Procedures Radiological Protection Program	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	
BTS-7	E-3	Event deleted.												Compressed gas cylinder event moved to general events table.
BTS-8	E-3	Argon or helium gas cylinder missile results in radiological release Location: BTS Room MAR: 9 kg Frit plus 1 kg plutonium oxide (one can Vitrified Glass)	Human error handing argon or helium cylinder Mechanical failure Operations error	Material Form-Vitrified Glass Vitrified Can Design Facility Design (gas supply location outside of room)	Operator Training and Procedures	A	A	None	Operator Training and Procedures Event Response Procedures	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	

Table C-A.2 Hazard Evaluation Table - Bagless Transfer System

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
BTS-9	E-3	Failed Bagless can dropped in room resulting in radiological release Location: BTS Room MAR: 9 kg Frit plus 1 kg plutonium oxide (one can Vitrified Glass)	Operations error while moving failed bagless can from fume hood to rework station Operations error - Overturned transfer cart	Material Form-Vitrified Glass Bagless and Vitrified Can Design	Operator Training and Procedures	A	A	EVS	Operator Training and Procedures Event Response Procedures Radiological Protection Program	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	
BTS-10	E-3	VIT can dropped in glovebox during conveyance resulting in radiological release Location: BTS glovebox MAR: 9 kg Frit plus 1 kg plutonium oxide (one can Vitrified Glass)	Mechanical failure of conveyance system Operations error	Material Form-Vitrified Glass Vitrified Can Design Conveyance System Design	Operator Training and Procedures	A	N/A	Glovebox design (PC-3) EVS Conveyance System Deign	Operator Training and Procedures Event Response Procedures Radiological Protection Program	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	

Table C-A.2 Hazard Evaluation Table - Bagless Transfer System

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
BTS-11	E-3	Two cans impact in glovebox resulting in radiological release Location: BTS glovebox MAR: 18 kg Frit plus 2 kg plutonium oxide (two cans Vitrified Glass)	Mechanical failure Electrical failure Maintenance error Operations error	Remote Handling Design Vitrified Glass Vitrified and Bagless Can Design	Operator Training and Procedures	A	A	Material Form-Vitrified Glass Vitrified and Bagless Can Design	Operator Training and Procedures Event Response Procedures Radiological Protection Program	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	
BTS-12	E-4	Two bagless cans in room during conveyance resulting in radiological exposure Location: BTS Room MAR: NA	Human error handling can improperly Overturned cart Can improperly positioned/located Operations error	Transport Cart Design Remote Handling Design	Operator Training and Procedures	A	A	*Transport cart design (shielding)* *Remote Handling Design (placed into transport cart remotely)*	*Operator Training and Procedures* *Event Response Procedures* *Radiological Protection Program*	FW: Low CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	B C C	C C C	4 rem per can
BTS-13	E-6	Fire arm discharge resulting in radiological exposure Location: BTS Room MAR: 9 kg Frit plus 1 kg plutonium oxide (one can Vitrified Glass)	Security Protection Officer error Weapon inadvertently discharges	None	Operator Training and Procedures	A	A	Limits on allowed weaponry	Operator Training and Procedures Event Response Procedures Radiological Protection Program	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	

Table C-A.3 Hazard Evaluation Table - Magazine and Canister Loading (MCL)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
MCL-1	E-1	Localized fire resulting in a radiological release Location: Transfer bagless cans from -40 to -14 level and -14 to 0 level MAR: 4 kg plutonium in glass (four bagless cans)	Excess combustibles (shielding material, wiring, elevator, misc.) with an ignition source	Bagless Can Design Cart Transport System Fire Detection and Alarm System	Fire Protection Program	A	A	N/A	N/A	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	
MCL-2	E-1	Localized fire resulting in a radiological release Location: Bagless Can Interim Storage MAR: 960 kg plutonium in glass (960 bagless cans)	Excess combustibles (wiring, shielding material, misc.) with an ignition source	Bagless Can Design Fire Detection and Alarm System	Fire Protection Program	A	A	N/A	N/A	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	

Table C-A.3 Hazard Evaluation Table - Magazine and Canister Loading (MCL)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
MCL-3	E-1	Localized fire resulting in a radiological release Location: Magazine Loading/Inspection Station MAR: 32 kg plutonium in glass (32 bagless cans)	Excess combustibles (electrical equip, shielding material, robotic arm, hydraulics, crane, misc.) with an ignition source	Bagless Can Design Fire Detection and Alarm System	Fire Protection Program	A	A	N/A	N/A	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	
MCL-4	E-1	Localized fire resulting in a radiological release Location: Loaded Magazine Storage/ Canister Loading Station MAR: 720 kg plutonium in glass (180 magazines/720 bagless cans)	Excess combustibles (electrical equip, shielding material, robotic arm, hydraulics, crane, misc.) with an ignition source	Bagless Can Design Fire Detection and Alarm System	Fire Protection Program	A	A	N/A	N/A	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	

Table C-A.3 Hazard Evaluation Table - Magazine and Canister Loading (MCL)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
MCL-5	E-1	Localized fire resulting in a radiological release Location: Loaded Canister Storage MAR: 224 kg plutonium in glass (eight canisters/224 bagless cans)	Excess combustibles (electrical equip, shielding material, crane, truck, misc.) with an ignition source	Bagless Can Design Canister Design Fire Detection and Alarm System	Fire Protection Program	A	A	N/A	N/A	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	
MCL-6	E-1	Localized fire resulting in a radiological release Location: Transport Container Loading MAR: 56 kg plutonium in glass (two canisters)	Excess combustibles (electrical equip, shielding material, crane, truck, misc.) with an ignition source	Bagless Can Design Canister Design Fire Detection and Alarm System	Fire Protection Program	A	A	N/A	N/A	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	

Table C-A.3 Hazard Evaluation Table - Magazine and Canister Loading (MCL)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
MCL-7	E-1	Room/Area fire resulting in a radiological release Location: Magazine Loading and Storage/Canister Loading and Transport MAR: 1,936 kg plutonium in glass (1,936 bagless cans)	Excess combustibles (electrical equip, shielding material, crane, truck, misc.) with an ignition source	Canister Design Fire Detection and Alarm System	Fire Protection Program	U	U	N/A	N/A	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	
MCL-8	E-2	Explosion resulting in a radiological release Location: Truck Bay MAR: 56 kg. plutonium in glass (two canisters)	Inadvertent weapon discharge Truck fuel tank failure Static discharge	Canister Design Bagless Can Design	Material Receipt and Shipping Program Fire Protection Program SPO Training	U	U	N/A	N/A	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	
MCL-9	E-2	Explosion resulting in a radiological release Location: -40, -20, -14 level MAR: 960 kg plutonium in glass (960 bagless cans)	Cart battery failure	Cart Design Bagless Can Design	Fire Protection Program	A	A	N/A	N/A	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	

Table C-A.3 Hazard Evaluation Table - Magazine and Canister Loading (MCL)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
MCL-10	E-3	Loss of confinement/ containment event resulting in a radiological release Location: Magazine Storage MAR: 720 kg plutonium in glass* (720 bagless cans)	Load/crane failure drops on material Operator error using crane	Equipment Design	Hoist and Lift Program Operator Training and Procedures	A	A	N/A	N/A	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	*Bounding case for loss of confinement events
MCL-11	E-4	Excessive personnel radiation exposure during operations Location: Bagless cans Transport Hazard: Neutron radiation from alpha-n reaction (four bagless cans)	Excessive stay times Human error Inadequate shielding	None	Radiological Protection Program Operator Training and Procedures	A	A	**Bagless Can Cart Design**	*Event Response Procedures* *Radiological Protection Program* *Operator Training and Procedures*	FW: Mod CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	B C C	

Table C-A.3 Hazard Evaluation Table - Magazine and Canister Loading (MCL)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
MCL-12	E-4	Excessive personnel radiation exposure during operations Location: Bagless can storage (-14 level) Hazard: Neutron radiation from alpha-n reaction (960 bagless cans)	Excessive stay times Human error	None	Radiological Protection Program Operator Training and Procedures	A	A	**Shielding Design**	*Event Response Procedures* *Radiological Protection Program* *Operator Training and Procedures*	FW: High CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	A1 C C	B C C	*Bounding case for rad exposure event
MCL-13	E-4	Excessive personnel radiation exposure during operations Location: Crane Control Room Hazard: Neutron radiation from alpha-n reaction (4 bagless cans)	Human error Maintenance error	Shielding Design	Radiological Protection Program Operator Training and Procedures	A	A	**Shielding Design**	*Event Response Procedures* *Radiological Protection Program* *Operator Training and Procedures*	FW: Mod CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	B C C	

Table C-A.4 Hazard Evaluation Table - TRU Waste Packaging (TWP)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
TWP-1	E-1	A room fire results in a pressurized release of radiological material Location: TRU Waste Loading and SWB Loading Area and Outgoing Waste Staging Area MAR: 975 FGE MAX (four Drums of TRU Waste bounded by three SWBs)	Electrical short Unknown ignition source Operator error	Electrical Equipment Design NFPA Design	Operator Training and Procedures Fire Protection Program	A	A	TRU Waste Drum, Polybox, and SWB Design **Fire Detection and Alarm System** **EVS** **Building Design (PC-3)**	Fire Protection Program **Operator Training** **Event Response Procedures** Radiological Protection Program **Waste Management Program (control MAR)**	FW: High CW: Low Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	A1 B C	B C C	
TWP-2	E-1	A room fire results in a pressurized release (<25 psig) of radiological material Location: TRU Waste Loading MAR: 195 FGE (one TRU Waste Pail)	Electrical short Unknown ignition source Operator error	NFPA Design Electrical Equipment Design	Operator Training and Procedures Fire Protection Program	A	A	Fire Detection and Alarm System EVS	Fire Protection Program Operator Training Event Response Procedures Radiological Protection Program	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	Unassayed TRU waste pail is assumed to have the same waste content as a TRU waste drum

Table C-A.4 Hazard Evaluation Table - TRU Waste Packaging (TWP)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
TWP-3	E-1	A room fire results in a radiological release Location: Unassayed Container Staging Area MAR: 8880 FGE (TWP Room inventory-unassayed waste)	Electrical short Unknown ignition source Operator error	NFPA Design Electrical Equipment Design	Operator Training and Procedures Fire Protection Program	A	A	**Fire Detection and Alarm System** **EVS** **Building Design (PC-3)**	Fire Protection Program **Operator Training and Procedure** **Event Response Procedures** Radiological Protection Program	FW: High CW: Mod Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	A1 B C	B C C	MAR calculated based on 195 FGE per pail or drum and 225 FGE per polybox (30 pails, 10 polyboxes, and four drums)
TWP-4	E-1	A room fire results in a radiological release Location: Assayed Pail Staging Area MAR: 60 TRU waste pails (TWP Room inventory)	Electrical short Unknown ignition source Operator error	NFPA Design Electrical Equipment Design	Operator Training and Procedures Fire Protection Program	A	A	**Fire Detection and Alarm System** **EVS** **Building Design (PC-3)**	Fire Protection Program **Operator Training and Procedures** **Event Response Procedures** Radiological Protection Program **Waste Management Program (control MAR)**	FW: High CW: Low Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	A1 B C	B C C	MAR calculated based on 195 FGE per pail, 11,700 FGE.

Table C-A.4 Hazard Evaluation Table - TRU Waste Packaging (TWP)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
TWP-5	E-2	A deflagration in a TRU waste drum/SWB/ polybox results in a pressurized release of radiological material Location: TRU Waste Loading and SWB Loading Area and Outgoing Waste Staging Area and Unassayed Container Staging MAR: 195 FGE (one TRU Waste drum)	Buildup of H2 with static electricity	**TRU Waste Drum, Polybox, and SWB Design (vent)**	Operator Training and Procedures	A	BEU	TRU Waste Drum, Polybox, and SWB Design (vent) *EVS* *Building Design (PC-3)*	*Operator Training and Procedures* *Event Response Procedures* *Radiological Protection Program*	FW: Mod CW: Low Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg (Prevented)	B B C	C C C	TRU Waste Drum deflagration is bounding case.
TWP-6	E-2	A deflagration in a TRU waste pail results in a pressurized release of radiological material Location: TRU Waste Loading and Unassayed Container Staging and Assayed Pail Staging MAR: 195 FGE (one pail of TRU Waste)	Buildup of H2 with static electricity	None	Operator Training and Procedures Waste Management Program	A	A	EVS	Operator Training Event Response Procedures Radiological Protection Program	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	Unassayed TRU waste pail is assumed to have the same waste content as a TRU waste drum

Table C-A.4 Hazard Evaluation Table - TRU Waste Packaging (TWP)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
TWP-7	E-2	A deflagration in a TRU waste drum/SWB/ polybox results in operator injury Location: TRU Waste Loading and SWB Loading Area and Outgoing Waste Staging Area and Unassayed Container Staging MAR: N/A	H2 generation with static electricity Operator error	**TRU Waste Drum, Polybox, and SWB Design (vent)**	**Operator Training and Procedures** **Waste Management Program**	A	EU	EVS TRU Waste Drum, Polybox, and SWB Design (vent)	Operator Training and Procedures Waste Management Program Event Response Procedures	FW: High CW: Neg Offsite Public: Neg	FW: High CW: Neg Offsite Public: Neg	A1 C C	A1 C C	You cannot mitigate this accident. If it takes place, an operator is most likely to be hurt. SIH
TWP-8	E-2	A deflagration in a TRU waste pail results in operator injury Location: Unassayed Container Staging and Assayed Pail Staging Area and TRU Waste Loading MAR: N/A	H2 generation with static electricity Operator error	None	**Operator Training and Procedures** **Waste Management Program**	A	EU	EVS	Operator Training and Procedures Waste Management Program Event Response Procedures	FW: Mod CW: Neg Offsite Public: Neg	FW: Mod CW: Neg Offsite Public: Neg	B C C	B C C	You cannot mitigate this accident. If it takes place, an operator is most likely to be hurt. Reduced the consequence because this is only a pail and it should not kill an operator. SIH

Table C-A.4 Hazard Evaluation Table - TRU Waste Packaging (TWP)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
TWP-9	E-3	Mishandling of TRU waste results in radiological release Location: TRU Waste Loading and SWB Loading Area and Unassayed Container Staging Area and Assayed Pail Staging Area MAR: 325 FGE (one SWB)	Pallet jack impacts TRU waste container Operator error Mechanical failure Firearm discharge	None	Operator Training and Procedures Waste Management Program	A	A	**EVS** **Building Design (PC-3)** **SWB (DOT Type A Container)**	*Event Response Procedures* *Operator Training and Procedures* Waste Management Program (control MAR) Radiological Protection Program	FW: High CW: Low Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	A1 B C	B C C	
TWP-10	E-3	Mishandling of TRU waste pallet results in radiological release Location: Outgoing Waste Staging Area MAR: 780 FGE (four TRU Waste Drums)	Pallet jack impacts TRU waste container Operator error Mechanical failure	None	Operator Training and Procedures	A	A	EVS DOT Type A Container	*Event Response Procedures* *Operator Training and Procedures* *Waste Management Program (control MAR)* *Radiological Protection Program*	FW: Low CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	B C C	C C C	

Table C-A.4 Hazard Evaluation Table - TRU Waste Packaging (TWP)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
TWP-11	E-3	Mishandling of TRU waste during drum loading results in radiological release Location: TRU Waste Loading MAR: 195 FGE (one TRU waste drum)	Pallet jack impacts TRU waste container Operator error Firearm discharge	Local Ventilation System (MAC21)	Operator Training and Procedures Waste Management Program	A	A	EVS DOT Type A Container	Event Response Procedures Operator Training and Procedures Waste Management Program Radiological Protection Program	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	
TWP-12	E-4	Excessive radiation exposure from a TRU waste pail/drum/SWB/ polybox during handling operations result in operator exposure Location: TRU Waste Loading and SWB Loading Area and Outgoing Waste Staging Area and Unassayed Container Staging and Assayed Pail Staging MAR: N/A	Operator error Unassayed waste	None	Operator Training and Procedures Waste Management Program Radiological Protection Program MC&A Program	A	A	None	*Event Response Procedures* *Operator Training and Procedures* Waste Management Program *Radiological Protection Program* MC&A Program	FW: Low CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	B C C	C C C	

Table C-A.4 Hazard Evaluation Table - TRU Waste Packaging (TWP)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
TWP-13	E-5	Criticality in a TRU waste pail/drum/polybox due to improper staging Location: Unassayed Container Staging MAR: 8,880 FGE	Operator error Loss of configuration Flooding	Building Design (PC-3)	Operator Training and Procedures Waste Management Program **Nuclear Criticality Safety Program**	A	U	**NIMS** **Building Design (PC-3)**	*Event Response Procedures* *Operator Training and Procedures* Waste Management Program	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg	A1 B C	A1 B C	MAR calculated based on 195 FGE per pail or drum and 225 FGE per polybox (30 pails, 10 polyboxes, and four drums)
TWP-14	E-6	Mishandling of TRU waste container results in operator injury Location: TRU Waste Loading and SWB Loading Area and Outgoing Waste Staging Area and Unassayed Container Staging and Assayed Pail Staging MAR: N/A	Operator error	None	Operator Training and Procedures	A	A	None	Event Response Procedures Operator Training and Procedures	FW: Low CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	B C C	SIH

Table C-B.4 Hazard Evaluation Table - TRU Waste Monitoring/Assay (TWM)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
TWM-1	E-1	A room fire results in a pressurized release of radiological material Location: TRU Waste Assay Room MAR: 195 FGE (one TRU waste drum)	Electrical short in equipment Unknown ignition source Operator error	TRU Waste Drum Design NFPA Design Electrical Equipment Design	Operator Training and Procedures Waste Management Program Fire Protection Program	A	A	TRU Waste Drum Design **Fire Detection and Alarm System** **EVS** **Building Design (PC-3)**	Fire Protection Program Operator Training and Procedures Event Response Procedures Radiological Protection Program	FW: Mod CW: Low Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B B C	B C C	
TWM-2	E-2	A deflagration in a TRU waste drum results in a pressurized release of radiological material Location: TRU Waste Assay Room MAR: 195 FGE (one TRU waste drum)	Buildup of H2 with static electricity	**TRU Waste Drum Design (vent)**	Operator Training and Procedures	A	BEU	TRU Waste Drum Design (vent) **EVS** **Building Design (PC-3)**	*Operator Training and Procedures* *Event Response Procedures* *Radiological Protection Program*	FW: Mod CW: Low Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg (Prevented)	B B C	B C C	
TWM-3	E-2	A deflagration in a TRU waste drum results in operator injury Location: TRU Waste Assay Room MAR: N/A	H2 generation with static electricity Operator error	**TRU Waste Drum/SWB/ Polybox Design (vent)**	**Operator Training and Procedures** **Waste Management Program**	A	EU	None	Operator Training and Procedures Waste Management Program Event Response Procedures	FW: High CW: Neg Offsite Public: Neg	FW: High CW: Neg Offsite Public: Neg	A1 C C	A1 C C	SIH

Table C-B.4 Hazard Evaluation Table - TRU Waste Monitoring/Assay (TWM)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
TWM-4	E-2	A deflagration in a TRU waste pail results in operator injury Location: TRU Waste Assay Room MAR: N/A	H2 generation with static electricity Operator error	None	Operator Training and Procedures Waste Management Program	A	A	None	*Operator Training and Procedures* Waste Management Program *Event Response Procedures*	FW: Mod CW: Neg Offsite Public: Neg	FW: Mod CW: Neg Offsite Public: Neg	B C C	B C C	SIH
TWM-5	E-3	Mishandling of TRU waste results in a radiological release Location: TRU Waste Assay Room MAR: 195 FGE (one TRU waste drum)	Drum cart impacts TRU waste container Operator error Mechanical failure	DOT Type A Container	Operator Training and Procedures Waste Management Program	A	A	DOT Type A Container	Event Response Procedures Operator Training and Procedures Waste Management Program Radiological Protection Program	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	
TWM-6	E-4	Excessive radiation exposure from a TRU waste pail/drum during handling operations Location: TRU Waste Assay Room MAR: N/A	Operator error Unassayed waste	None	Operator Training and Procedures Waste Management Program Radiological Protection Program MC&A Program	A	A	None	Event Response Procedures Operator Training and Procedures Waste Management Program Radiological Protection Program MC&A Program	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	

Table C-B.4 Hazard Evaluation Table - TRU Waste Monitoring/Assay (TWM)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
TWM-7	E-5	Criticality in a TRU waste pail/drum due to improper handling Location: TRU Waste Assay Room MAR: 390 FGE (two TRU waste drums)	Operator error (multiple containers) Loss of configuration Flooding	Building Design (PC-3)	Operator Training and Procedures Waste Management Program **Nuclear Criticality Safety Program**	A	U	**NIMS** **Building Design (PC-3)**	*Event Response Procedures* *Operator Training and Procedures* Waste Management Program	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg	A1 B C	A1 B C	
TWM-8	E-5/ E-1	A fire induced criticality Location: TRU Waste Assay Room MAR: 195 FGE (one TRU waste drum)	Electrical short in equipment Unknown ignition source Operator error Plastic in NMC Sprinkler water/flooding	NFPA Design Electrical Equipment Design Building Design (PC-3)	Operator Training and Procedures Waste Management Program **Nuclear Criticality Safety Program** Fire Protection Program	U	EU	**Fire Detection and Alarm System** **NIMS** **Building Design (PC-3)**	*Fire Protection Program* *Operator Training and Procedures* *Event Response Procedures* *Radiological Protection Program* Waste Management Program	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg	A1 B C	A1 B C	
TWM-9	E-6	Mishandling of TRU waste container results in operator injury Location: TRU Waste Assay Room MAR: N/A	Operator error	None	Operator Training and Procedures	A	A	None	*Event Response Procedures* *Operator Training and Procedures*	FW: Low CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	B C C	SIH

Table C-C.4 Hazard Evaluation Table – TRU Waste Transport (TWT)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
TWT-1	E-1	During transport of TRU Waste a fire results in a pressurized release of radiological material Location: Transport routes MAR: 780 FGE (four TRU waste drums [max])	Electrical short in equipment Unknown ignition source Operator error	TRU Waste Drum Design NFPA Design Electrical Equipment Design	Operator Training and Procedures Waste Management Program Fire Protection Program	A	A	TRU Waste Drum Design **Fire Detection and Alarm System** **EVS** **Building Design (PC-3)**	Fire Protection Program **Operator Training** **Event Response Procedures** Radiological Protection Program **Waste Management Program (control MAR)**	FW: High CW: Low Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	A1 B C	B C C	
TWT-2	E-1	During transport of unassayed TRU Waste a fire results in a pressurized release of radiological material Location: Transport routes MAR: 780 FGE (one overfilled unassayed TRU waste drum)	Electrical short in equipment Unknown ignition source Operator error	TRU Waste Drum Design NFPA Design Electrical Equipment Design	Operator Training and Procedures Waste Management Program Fire Protection Program	A	A	TRU Waste Drum Design **Fire Detection and Alarm System** **EVS** **Building Design (PC-3)**	Fire Protection Program **Operator Training** **Event Response Procedures** Radiological Protection Program	FW: High CW: Low Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	A1 B C	B C C	Assume the contents of this drum is a overfilled by a factor of four greater than an assayed TRU waste drum

Table C-C.4 Hazard Evaluation Table – TRU Waste Transport (TWT)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
TWT-3	E-2	During transport of TRU waste a deflagration occurs resulting in a pressurized release of radiological material Location: Transport routes MAR: 325 FGE (one SWB)	Buildup of H2 with static electricity	**TRU Waste Drum, Polybox, and SWB Design (vent)**	Operator Training and Procedures Waste Management Program	A	BEU	*TRU Waste Drum, Polybox, and SWB Design (vent)* **EVS** **Building Design (PC-3)**	*Operator Training and Procedures* *Event Response Procedures* Radiological Protection Program	FW: Mod CW: Low Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg (Prevented)	B B C	B C C	TRU Waste Drum deflagration is bounding case.
TWT-4	E-2	During transport of TRU waste pail a deflagration occurs resulting in a pressurized release of radiological material Location: Transport routes MAR: 195 FGE (one TRU waste pail)	Buildup of H2 with static electricity	None	Operator Training and Procedures Waste Management Program	A	A	EVS	Operator Training and Procedures Event Response Procedures Radiological Protection Program	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	
TWT-5	E-2	A deflagration in a TRU waste drum container results in operator injury Location: Transport routes MAR: N/A	H2 generation with static electricity Operator error	**TRU Waste Drum/SWB/ Polybox Design (vent)**	**Operator Training and Procedures** **Waste Management Program**	A	EU	None	Operator Training and Procedures Waste Management Program Event Response Procedures	FW: High CW: Neg Offsite Public: Neg	FW: High CW: Neg Offsite Public: Neg	A1 C C	A1 C C	SIH

Table C-C.4 Hazard Evaluation Table – TRU Waste Transport (TWT)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
TWT-6	E-2	A deflagration in a TRU waste pail results in operator injury Location: Transport routes MAR: N/A	H2 generation with static electricity Operator error	None	**Operator Training and Procedures** **Waste Management Program**	A	U	None	Operator Training and Procedures Waste Management Program Event Response Procedures	FW: Mod CW: Neg Offsite Public: Neg	FW: Mod CW: Neg Offsite Public: Neg	B C C	B C C	SIH
TWT-7	E-3	Mishandling of TRU waste Drums/SWB results in a radiological release Location: Transport routes MAR: 325 FGE (SWB w/HEPA) or 780 FGE (four TRU waste drums)	Drum cart/pallet jack impacts TRU waste container Operator error Mechanical failure Elevator failure	Elevator Design	Operator Training and Procedures Waste Management Program	A	A	**TRU Waste Drum (DOT Type A Container)** Elevator Design **Building Design (PC-3)** **EVS** **SWB (DOT Type A Container)**	*Event Response Procedures* *Operator Training and Procedures* Waste Management Program Radiological Protection Program	FW: High CW: Low Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	A1 B C	B C C	325 FGE SWB w/ HEPA is bounding
TWT-8	E-3	Mishandling of TRU waste pails/polyboxes results in a radiological release Location: Transport routes MAR: 225 FGE (one polybox)	Drum cart/pallet jack impacts TRU waste container Operator error Mechanical failure Elevator failure Firearm discharge	Elevator Design	Operator Training and Procedures Waste Management Program	A	A	Elevator Design **Building Design (PC-3)** **EVS**	Event Response Procedures Operator Training and Procedures Waste Management Program **Radiological Protection Program**	FW: High CW: Low Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	A1 B C	B C C	Polybox release bounds pail release.

Table C-C.4 Hazard Evaluation Table – TRU Waste Transport (TWT)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
TWT-9	E-4	Radiation exposure from a TRU waste container during handling operations results in operator exposure Location: Transport routes MAR: N/A	Operator error Unassayed waste	None	Operator Training and Procedures Waste Management Program Radiological Protection Program MC&A Program	A	A	None	Event Response Procedures Operator Training and Procedures Waste Management Program Radiological Protection Program MC&A Program	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	
TWT-10	E-5/ E-1	During transport a TRU waste container in a fire results in a criticality Location: Transport routes MAR: 780 FGE (four TRU waste drums)	Electrical short Operator error Loss of configuration Flooding	Building Design (PC-3)	Operator Training and Procedures Waste Management Program **Nuclear Criticality Safety Program**	U	EU	**Fire Detection and Alarm System** **NIMS** **Building Design (PC-3)**	*Fire Protection Program* **Event Response Procedures** **Operator Training and Procedures** *Radiological Protection Program* Waste Management Program	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg	A1 B C	A1 B C	
TWT-11	E-6	Mishandling of TRU waste container results in operator injury Location: Transport routes MAR: N/A	Operator error	None	Operator Training and Procedures	A	A	None	*Event Response Procedures* *Operator Training and Procedures*	FW: Low CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	B C C	SIH

Table C-D.4 Hazard Evaluation Table – Low Level Waste Packaging/Transport (LWP/T)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
LWP/T-1	E-1	A room fire results in a release of radiological material Location: LLW Areas MAR: 124 FGE (four B12/25s)	Electrical short Unknown ignition source Operator error Maintenance activities	NFPA Design Electrical Equipment Design	Operator Training and Procedures Waste Management Program Fire Protection Program	A	A	Fire Detection and Alarm System EVS B-25 and B-12 Design	Fire Protection Program Operator Training and Procedures Event Response Procedures Radiological Protection Program Waste Management Program	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	
LWP/T-2	E-3	Mishandling of LLW results in radiological release Location: LLW Areas MAR: 31 FGE (one B12/25)	Pallet jack impacts LLW container Operator error Mechanical failure Firearm discharge	None	Operator Training and Procedures Waste Management Program	A	A	None	Event Response Procedures Operator Training and Procedures Waste Management Program Radiological Protection Program	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	
LWP/T-3	E-6	Mishandling of LLW waste container results in operator injury Location: LLW Areas MAR: N/A	Operator error	None	Operator Training and Procedures	A	A	None	*Event Response Procedures* *Operator Training and Procedures*	FW: Low CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	B C C	SIH

Table C-E.4 Hazard Evaluation Table – Waste Staging (WS)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
WS-1	E-1	A pool fire results in a release of radiological material Location: 0' Level Waste Staging MAR: Building limit of 6.5 kg of FGE Pu-239 (Max of 30 B12/B25, 60 TRU Drums, and 10 SWBs)	Combustible materials (fuel from transport vehicle) Unknown ignitions source Natural Phenomena Hazard (e.g., wild land fire) Gas operated forklift Operating vehicle Adjoining building fire Operator error Sodium metal	NFPA Design	Fire Protection Program MC&A Program Decon of green fuel DFAs	A	A	NFPA Design Fire Detection and Alarm System **Building Design (elevated storage pad)**	**Fire Protection Program (combustible controls)** *Event Response Procedures* *Operator Training and Procedures* *Decon of green fuel DFAs* **Waste Management Program (control MAR)**	FW: High CW: High Offsite Public: Low	FW: Mod CW: Low Offsite Public: Neg	A1 A1 B	B B C	
WS-2	E-2	An internal explosion results in a radiological release Location: 0 Level Waste Staging MAR: 195 FGE (one TRU Waste drum)	Hydrogen generation with static electricity Operator error	**SWB and TRU Waste Drum Design (vent)**	Operator Training and Procedures Waste Management Program	A	BEU	None	*Operator Training and Procedures* *Waste Management Program* *Event Response Procedures*	FW: Low CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg (Prevented)	B C C	C C C	TRU Waste Drum deflagration is bounding case.

Table C-E.4 Hazard Evaluation Table – Waste Staging (WS)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
WS-3	E-2	An external explosion results in a release of radiological material Location: 0' Level Waste Staging MAR: 1,625 FGE (five SWBs or one truckload)	Gas operated forklift Transport vehicle (operating)	None	Operator Training and Procedures Waste Management Program	U	U	None	**Event Response Procedures** **Operator Training and Procedures** Waste Management Program Radiological Protection Program	FW: High CW: Mod Offsite Public: Neg	FW: Mod CW: Mod Offsite Public: Neg	A1 B C	B B C	Explosion causes spill of MAR which provides bounding consequences.
WS-4	E-2	An explosion results in operator injury Location: 0' Level Waste Staging MAR: N/A	Gas operated forklift Operating vehicle	None	Operator Training and Procedures Waste Management Program	U	U	None	Event Response Procedures Operator Training and Procedures Waste Management Program Radiological Protection Program	FW: High CW: Neg Offsite Public: Neg	FW: High CW: Neg Offsite Public: Neg	A1 C C	A1 C C	SIH
WS-5	E-3	Mishandling of TRU waste results in a radiological release Location: 0' Level Waste Staging MAR: 650 FGE (two SWBs)	Forklift impacts TRU waste container Operator error Mechanical failure Accidental firearm discharge	None	Operator Training and Procedures Waste Management Program	A	A	**SWB (DOT Type A container)**	*Event Response Procedures* *Operator Training and Procedures* Waste Management Program Radiological Protection Program	FW: Mod CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	B C C	

Table C-E.4 Hazard Evaluation Table – Waste Staging (WS)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
WS-6	E-6	Large Aircraft impacts the facility resulting in a radiological release Location: 0' Level Waste Staging MAR: Building limit of 6.5 kg of FGE Pu-239 (Max of 30 B12/B25, 60 TRU Drums, and 10 SWBs)	Large aircraft crash	**Limited Area Footprint for Waste Staging Building**	None	BEU	BEU	Limited Area Footprint for Waste Staging Building	Event Response Procedures Operator Training and Procedures Radiological Protection Program	FW: High CW: High Offsite Public: Low	FW: High CW: High Offsite Public: Low (Prevented)	C C C	C C C	
WS-7	E-6	Small aircraft / helicopter crashing into the building results in a radiological release Location: 0' Level Waste Staging MAR: Building limit of 6.5 kg of FGE Pu-239 (Max of 30 B12/B25, 60 TRU Drums, and 10 SWBs)	Small aircraft / helicopter crash	Limited Area Footprint for Waste Staging Building	None	EU	EU	None	Event Response Procedures Operator Training and Procedures Waste Management Program Radiological Protection Program	FW: High CW: High Offsite Public: Low	FW: High CW: High Offsite Public: Low	A2 A2 B	A2 A2 B	

Table C-E.4 Hazard Evaluation Table – Waste Staging (WS)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
WS-8	E-7	High wind or tornado damages the containers that results in a radiological release Location: 0' Level Waste Staging MAR: Building limit of 6.5 kg of FGE Pu-239 (Max of 30 B12/B25, 60 TRU Drums, and 10 SWBs)	Strong wind Tornado Impact from missiles Atmospheric pressure changes Natural phenomena	None	None	EU	EU	None	**Event Response Procedures** **Operator Training and Procedures** Waste Management Program Radiological Protection Program	FW: High CW: Low Offsite Public: Neg	FW: Low CW: Low Offsite Public: Neg	A2 B C	B B C	
WS-9	E-7	Seismic event damages the containers that results in a radiological release Location: 0' Level Waste Staging MAR: Building limit of 6.5 kg of FGE Pu-239 (Max of 30 B12/B25, 60 TRU Drums, and 10 SWBs)	Earthquake Natural phenomena	None	None	U	U	None	**Event Response Procedures** **Operator Training and Procedures** Radiological Protection Program Waste Management Program	FW: Mod CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	B C C	

Table C-E.4 Hazard Evaluation Table – Waste Staging (WS)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
WS-10	E-7/ E-1	Seismic event /Tornado damages the containers that results in a radiological release Location: 0' Level Waste Staging MAR: Building limit of 6.5 kg of FGE Pu-239 (Max of 30 B12/B25, 60 TRU Drums, and 10 SWBs)	Seismic or Tornado induced fire	None	None	U	U	None	**Event Response Procedures** **Operator Training and Procedures** **Radiological Protection Program** **Waste Management Program**	FW: High CW: Low Offsite Public: Neg	FW: Mod CW: Low Offsite Public: Neg	A1 B C	B B C	

Table C-F.4 Hazard Evaluation Table – Failed Equipment Staging Room (FESR)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
FESR-1	E-8	Direct Metal Oxide [DMO] furnace or Melter failure results in the trapping of the plutonium Oxide/metal (infused into the equipment for DMO) Location: Waste glovebox MAR: 1 kg plutonium oxide	DMO furnace failure Melter failure (e.g., control system failure) Melter enclosure failure Electrical failure Operator error	Melter Design Melter Enclosure Hopper Design	Operator Training and Procedures SPO Qualification Program	A	A	Video Surveillance System EVS	*Radiological Protection Program* *Operator Training and Procedures* *Event Response Procedures*	FW: Low CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	B C C	Failed melter is a greater exposure hazard, than DMO, if load cannot be emptied.
FESR-2	E-8	DMO failure results in production loss Location: Waste glovebox MAR: 1 kg plutonium oxide	DMO Furnace failure Firearm discharge Electrical failure Operator error	Furnace Design Furnace Enclosure	Operator Training and Procedures SPO Qualification Program	A	A	Video Surveillance System EVS	*Radiological Protection Program* *Operator Training and Procedures* *Event Response Procedures*	FW: Low CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	B C C	Design to provide for removal of DMO Furnace from the Glovebox

Table C-G.4 Hazard Evaluation Table – Sodium Metal Waste (SWM)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
SMW-1	E-1	Sodium metal fire ignites combustibles and results in a radiological release Location: -40', -20', and 0' Levels MAR: 8,880 FGE Pu-239 (30 pails, 10 polyboxes, four drums)	Condensation Water in-leakage	None	Operator Training and Procedures Fire Protection Program Decontamination of green fuel DFAs	A	A	NFPA Design Fire Detection and Alarm System	Fire Protection Program Event Response Procedures Operator Training and Procedures	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	Water contact with sodium will extinguish combustibles, and either oxidize or consume all raw sodium present. MAR calculated based on 195 FGE per pail or drum and 225 FGE per polybox (30 pails, 10 polyboxes, and four drums)

Table C-A.5 Hazard Evaluation Table – Material Handling System (MHS)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
MHS-1	E-1/ E-2	A Localized fire during transport in cart from MRS to OX or FP glovebox causing a pressurized release resulting in a radiological release Location: 0 level hallway to dumbwaiter, dumbwaiter to -40 FP or OX room MAR: 10 kg plutonium oxide (two 3013 containers)	Combustible/ flammable materials- including misc. combustibles, cart shielding material Ignition sources- including electrical shorts (outlets, lighting, wiring), thermal sources (wiring)	3013 Container Design NFPA Design Cart Design (shielding)	Fire Protection Program 3013 Qualification and Storage Surveillance Program Operator Training and Procedures	A	A	**Building Design (PC-3)** **EVS** **Fire Detection and Alarm System**	**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: High Offsite Public: High	FW: Low CW: Low Offsite Public: Neg	A1 A1 A1	B B C	Bounding case is plutonium Oxide.

Table C-A.5 Hazard Evaluation Table – Material Handling System (MHS)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
MHS-2	E-1	Localized fire in tunnel during transport between OX and FP gloveboxes, FP glovebox to/from Milling/Mixing glovebox, Milling/Mixing glovebox to/from Vit glovebox, Vit glovebox to/from Bagless Transfer glovebox, Bagless Transfer glovebox to NDA Room resulting in a radiological release Location: Transport routes MAR: 5 kg plutonium Oxide (Max transport tunnel MAR- one Transport can)	Combustible/ flammable materials- including misc. combustibles Ignition sources- including electrical shorts (outlets, lighting, wiring), thermal sources (wiring)	NFPA Design Tunnel Design Cart Design	Fire Protection Program Operator Training and Procedures	A	A	*EVS* *Tunnel Design* Building Design (PC-3) Glovebox Ventilation System Tunnel Fire Detection System	Fire Protection Program *Operator Training and Procedures* *Event Response Procedures*	FW: Low CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	B C C	

Table C-A.5 Hazard Evaluation Table – Material Handling System (MHS)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
MHS-3	E-1	Localized fire during transport in cart from NDA Room to/from Bagless Can Storage, Bagless Can Storage to Magazine Loading resulting in a radiological release Location: Transport routes MAR: 4 kg plutonium in glass (four Bagless cans)	Combustible/ flammable materials- including misc. combustibles Ignition sources- including electrical shorts (outlets, lighting, wiring), thermal sources (wiring)	NFPA Design Cart Design	Fire Protection Program Operator Training and Procedures	A	A	Fire Detection and Alarm System EVS Material form	Fire Protection Program Operator Training and Procedures Event Response Procedures	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	
MHS-4	E-3	Loss of confinement/ containment during transport in cart from MRS to OX or FP glovebox resulting in a radiological release Location: 0 level hallway to dumbwaiter, dumbwaiter to -40 FP or OX room MAR: 10 kg plutonium oxide (two 3013 containers)	Mishandling of cart Container impacts a stationary object during movement Cart failure	3013 Container Design Cart Design	Operator Training and Procedures 3013 Qualification and Storage Surveillance Program	A	EU	**Building Design (PC-3)** **EVS** **Cart Design**	*Event Response Procedures* *Operator Training and Procedures* *Radiological Protection Program*	FW: High CW: Low Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	A1 B C	B C C	Oxide is worst case event.

Table C-A.5 Hazard Evaluation Table – Material Handling System (MHS)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
MHS-5	E-3	Loss of confinement/ containment in tunnel during transport between OX and FP gloveboxes, FP glovebox to/from Milling/Mixing glovebox, Milling/Mixing glovebox to/from Vit glovebox resulting in a radiological release Location: OX-FP glovebox transport system MAR: 5 kg plutonium oxide (Max Tunnel MAR- one Transport can)	Accidental weapon discharge Overhead object damage External impact Glove failure Window failure Fire suppression over-pressurizes tunnel	Tunnel Design Building Design (PC-3)	SPO Qualification Program Operator Training and Procedures	A	A	Building Design (PC-3) **EVS** **Glovebox Ventilation System** **Tunnel Design (remote operations)**	*Event Response Procedures* *Radiological Protection Program* *Operator Training and Procedures*	FW: High CW: Low Offsite Public: Neg	FW: Low CW: Low Offsite Public: Neg	A1 B C	B B C	

Table C-A.5 Hazard Evaluation Table – Material Handling System (MHS)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
MHS-6	E-3	Loss of confinement/ containment in tunnel during transport from Vit glovebox to/from Bagless Transfer glovebox, Bagless Transfer glovebox to NDA Room resulting in a radiological release Location: transport routes MAR: 1 kg plutonium in glass (one can)	Accidental weapon discharge Overhead object damage External impact Glove failure Window failure Fire suppression over-pressurizes tunnel	Tunnel Design Building Design (PC-3)	SPO Qualification Program Operator Training and Procedures	A	A	EVS Material form	Event Response Procedures Radiological Protection Program Operator Training and Procedures	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	
MHS-7	E-3	Loss of confinement/ containment during transport in cart from NDA Room to/from Bagless Can Storage, Bagless Can Storage to Magazine Loading resulting in a radiological release Location: Transport routes MAR: 4 kg plutonium in glass (four Bagless Cans)	Accidental weapon discharge Overhead object damage External impact Cart accident	Building Design (PC-3) Cart Design	SPO Qualification Program Operator Training and Procedures	A	A	EVS Material form	Event Response Procedures Operator Training and Procedures	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	

Table C-A.5 Hazard Evaluation Table – Material Handling System (MHS)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
MHS-8	E-4	Excessive personnel radiation exposure during transport in cart from MRS to OX or FP glovebox Location: 0 level hallway to dumbwaiter, dumbwaiter to -40 FP or OX room MAR: NA	Improperly characterized material/ containers (containers have more material or unknown contents) Operator Error (excessive stay times	Cart design	Operator training and Procedures Configuration Management Program MC&A Program Radiological Protection Program	A	A	**Cart Design**	*Radiological Protection Program* *Event Response Procedures* *Operator Training and Procedures*	FW: Mod CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	B C C	plutonium Oxide is bounding event.
MHS-9	E-4	Excessive personnel radiation exposure during transport from Cask Receiving to Green Fuel Disassembly System (GFDS) Location: 0 level - Cask Receiving. to GFDS MAR: NA	Improperly characterized material/ containers (containers have more material or unknown contents) Operator Error (excessive stay times)	Material Form	Operator training and Procedures Configuration Management Program MC&A Program Radiological Protection Program	A	A	Material Form	Radiological Protection Program Event Response Procedures Operator Training and Procedures	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	

Table C-A.5 Hazard Evaluation Table – Material Handling System (MHS)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
MHS-10	E-4	Excessive personnel radiation exposure during transport in cart from GFDS glovebox to FP glovebox Location: -40 level MAR: NA	Improperly characterized material/ containers (containers have more material or unknown contents) Operator Error (excessive stay times	Cart design	Operator training and Procedures Configuration Management Program MC&A Program Radiological Protection Program	A	A	Cart Design	*Radiological Protection Program* *Event Response Procedures* *Operator Training and Procedures*	FW: Low CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	B C C	
MHS-11	E-4	Excessive personnel radiation exposure during transport from FP glovebox to Milling/Mixing, OX glovebox to FP glovebox, Milling/Mixing glovebox to/from Vit glovebox, Vit glovebox to/from Bagless Transfer glovebox, Bagless Transfer glovebox to NDA Room Location: Transport routes MAR: NA	Human error Inadequate shielding	Tunnel Design (remote operations)	Radiological Protection Program Operator Training and Procedures	A	A	Tunnel Design (remote operations)	*Event Response Procedures* *Operator Training and Procedures* *Radiological Protection Program*	FW: Low CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	B C C	

Table C-A.5 Hazard Evaluation Table – Material Handling System (MHS)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
MHS-12	E-4	Excessive personnel radiation exposure during transport in cart from NDA Room to/from Bagless Can Storage, Location: NDA Room to/from Bagless Can Storage MAR: NA	Excessive stay times Human error Inadequate shielding	Cart Design	Radiological Protection Program Operator Training and Procedures	A	A	**Cart Design**	*Radiological Protection Program* *Event Response Procedures* *Operator Training and Procedures*	FW: Mod CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	B C C	
MHS-13	E-5	Criticality occurs during transport in cart from MRS to OX or FP glovebox Location: 0 level hallway to dumbwaiter, dumbwaiter to -40 FP or OX room MAR: 10 kg plutonium oxide/Metal (two 3013 containers)	Operator error Improper handling, placement, or storage Failure of cart storage position spacing Improper maintenance	Cart design	**Nuclear Criticality Safety Program** Operator Training and Procedures	A	U	**Building Design (PC-3)** **NIMS**	*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg	A1 B C	A1 B C	Double contingency has been implemented, see NCSE

Table C-A.5 Hazard Evaluation Table – Material Handling System (MHS)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
MHS-14	E-5	Criticality occurs during transport in cart from GFDS glovebox to FP glovebox Location: 0 level GFDS Room to -40 level FP Room MAR: 5 kg plutonium oxide (one Pin Fuel Can)	Operator error (excessive amount of fuel pellets in pin fuel can)	Pin Fuel Can Design Transport Cart Design	Operator Training and Procedures **Nuclear Criticality Safety Program**	A	U	**Building Design (PC-3)** **NIMS**	*Operator Training and Procedures* *Event Response Procedures*	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg	A1 B C	A1 B C	Double contingency has been implemented, see NCSE
MHS-15	E-5	Criticality occurs during transport between OX and FP gloveboxes , FP glovebox to/from Milling/Mixing glovebox, Milling/Mixing glovebox to/from Vit glovebox Location: OX-FP glovebox transport system MAR: 5 kg plutonium oxide (one Transport can)	Operator Error Excessive moderation introduced	Container Design	Operator Training and Procedures **Nuclear Criticality Safety Program**	A	U	**Building Design (PC-3)** **NIMS**	*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg	A1 B C	A1 B C	Double contingency has been implemented, see NCSE

Table C-A.5 Hazard Evaluation Table – Material Handling System (MHS)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
MHS-16	E-5	Criticality occurs during transport between OX and FP gloveboxes , FP glovebox to/from Milling/Mixing glovebox, Milling/Mixing glovebox to/from Vit glovebox Location: OX-FP glovebox transport system MAR: 5 kg plutonium oxide (one Transport can)	Operator Error Excessive reflective material introduced, e.g. Be, flesh	None	Operator Training and Procedures **Nuclear Criticality Safety Program**	A	U	**Building Design (PC-3)** **NIMS**	*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg	A1 B C	A1 B C	Double contingency has been implemented, see NCSE
MHS-17	E-5/ E-1	Fire induced criticality occurs during transport of material to FP and OX. Location: Transport routes MAR: 10 kg metal/plutonium oxide (two 3013 containers bounds one pin fuel can)	Fire melts shielding Excess combustibles with an ignition source Fire Suppression System	Cart Design	Operator Training and Procedures **Nuclear Criticality Safety Program**	U	EU	**Building Design (PC-3)** **NIMS** **Fire Detection and Alarm System**	**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg	A1 B C	A2 B C	Double contingency has been implemented, see NCSE

Table C-B.5 Hazard Evaluation Table –- Non-Destructive Assay Room (Material Control and Accountability)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
NDA-1	E-1	Room fire resulting in a radiological release Location: NDA Room MAR: 20 kg plutonium in glass (20 Bagless Cans)	Combustible/ flammable materials- including misc. combustibles Ignition sources- including electrical shorts (outlets, lighting, wiring), thermal sources (wiring)	NFPA Design	Fire Protection Program Operator Training and Procedures	U	A	Fire Detection and Alarm System EVS Material Form	Fire Protection Program Operator Training and Procedures Event Response Procedures	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	
NDA-2	E-2	Explosion resulting in a radiological release Location: NDA Room MAR: 20 kg plutonium in glass (20 Bagless Cans)	Accidental weapon discharge Batteries	None	SPO Qualification Program	A	A	Material Form	Radiological Protection Program Event Response Procedures	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	
NDA-3	E-3	Loss of confinement/ containment event resulting in a radiological release Location: NDA Room MAR: 20 kg plutonium in glass (20 Bagless Cans)	Load/crane failure drops on material Operator error using crane Accidental weapon discharge External impact from forklift	Building Design (PC-3) Crane Design	SPO Qualification Program Operator Training and Procedures	A	A	EVS Material Form	Event Response Procedures Radiological Protection Program Operator Training and Procedures	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	

Table C-B.5 Hazard Evaluation Table –- Non-Destructive Assay Room (Material Control and Accountability)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
NDA-4	E-4	Excessive personnel radiation exposure during operations Location: NDA Room Hazard: Neutron radiation from alpha-n reaction	Excessive stay times Human error	Building Design (PC-3)	Radiological Protection Program Operator Training and Procedures	A	A	**Building Design (PC-3)**	*Radiological Protection Program* *Operator Training and Procedures* *Event Response Procedures*	FW: Mod CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	C C C	
NDA-5	E-4	Personnel asphyxiation from Nitrogen during operations Location: NDA Room Hazard: eight Dewars (Liquid Nitrogen)	Equipment failure Human error EVS failure	**Dewar Equipment Design** EVS Design	Operator Training and Procedures Industrial Hygiene (IH) Program	A	A	EVS Design	Event Response Procedures Operator Training and Procedures	FW: High CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	A1 C C	B C C	Standard Industrial Hazard-

Table C-C.5 Hazard Evaluation Table – Disassembly Basin (DB)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
DB-1	E-4	Disassembly Basin flooding results in a radiological exposure Location: -20, -40 Processing Areas MAR: NA	Natural Phenomena Hazard (earthquake) Other	Building Design (PC-3)	None	EU	EU	None	Radiological Protection Program Operator Training and Procedures Event Response Procedures	FW: High CW: Neg Offsite Public: Neg	FW: High CW: Neg Offsite Public: Neg	A1 C C	A1 C C	
DB-2	E-4	Disassembly Basin flooding results in a operator fatality Location: -20, -40 Processing Areas MAR: NA	Natural Phenomena Hazard (earthquake) Other	Building Design (PC-3)	None	EU	EU	None	Radiological Protection Program Operator Training and Procedures Event Response Procedures	FW: High CW: Neg Offsite Public: Neg	FW: High CW: Neg Offsite Public: Neg	A1 C C	A1 C C	SIH
DB-3	E-5	Internal (Water from Pu Vit [fire water]) causes flooding which results in a criticality Location: -20, -40 Processing Areas MAR: 365 kg	Pipe failure Seismic	**Building Design (PC-3)** Glovebox Design (PC-3) Piping codes and standards NFPA Design	Operator Training and Procedures **Nuclear Criticality Safety Program** Preventative Maintenance Program Fire Protection Program	U	EU	**NIMS** **Building Design (PC-3)** *Fire Protection System Design**	*Event Response Procedures* *Operator Training and Procedures* Emergency Response Procedures	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg	A1 B C	A2 B C	* The fire system will be designed and operated to ensure that the water depth on floor does not go above 2 inches on the -40 level.

Table C-C.5 Hazard Evaluation Table – Disassembly Basin (DB)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
DB-4	E-5/E-1	Internal (fire water external to Pu Vit [consolidated water system]) flooding which results in a criticality Location: -20, -40 Processing Areas MAR: 365 kg	Pipe failure Seismic	**Building Design (PC-3)** Glovebox Design (PC-3) Piping codes and standards NFPA Design Fire Protection System design Consolidated Water System Design*	Operator Training and Procedures **Nuclear Criticality Safety Program** Preventative Maintenance Program	U	EU	**NIMS** **Building Design (PC-3)**	*Event Response Procedures* *Operator Training and Procedures* Emergency Response Procedures	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg	A1 B C	A2 B C	* Non-Pu Vit fire water and Consolidated Water System is designed to be less than 2 inches in height on floor, if released.
DB-5	E-5	Internal (confinement heat removal [connection between the Disassembly Basin and the confinement heat removal header]) flooding which results in a criticality Location: -20, -40 Processing Areas MAR: 365 kg	Basin weir failure Seismic	**Building Design (PC-3)** Glovebox Design (PC-3) Piping codes and standards NFPA Design **Weir Replacement***	Operator Training and Procedures **Nuclear Criticality Safety Program** Preventative Maintenance Program	U	EU	**NIMS** **Building Design (PC-3)**	*Event Response Procedures* *Operator Training and Procedures* Emergency Response Procedures	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg	A1 B C	A2 B C	*Replace weir with permanent blocking feature

Table C-C.5 Hazard Evaluation Table – Disassembly Basin (DB)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
DB-6	E-5	Disassembly Basin flooding results a criticality Location: -20, -40 Processing Area MAR: 365 kg	Natural Phenomena Hazard (earthquake) Missile Other	**Building Design (PC-3)**	Operator Training and Procedures **Nuclear Criticality Safety Program** Preventative Maintenance Program	U	EU	**NIMS** **Building Design (PC-3)**	*Event Response Procedures* *Operator Training and Procedures* Emergency Response Procedures	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg	A1 B C	A2 B C	

Table C-D.5 Hazard Evaluation Table – General Events (GE)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
GE-1	E-1	Propagation of a single area fire impacts the full facility inventory and results in radiological release Location: Full Pu Vit MAR: 365 kg	Combustible/ flammable materials- transient combustibles, glovebox contents and glovebox, room contents, electrical systems, etc. Ignition sources- electrical wiring, heating elements, maintenance activities, gases, lightning, etc.	NFPA Design Building Design (PC-3)	Operator Training and Procedures Fire Protection Program Configuration Control Program	EU	EU	**Building Design (PC-3)** **EVS** **Fire Detection and Alarm System** Glovebox design (PC-3) Glovebox Ventilation System **Glovebox Fire Detection and Alarm System**	Fire Protection Program **Event Response Procedures** **Operator Training and Procedures**	FW: High CW: High Offsite Public: High	FW: Low CW: Neg Offsite Public: Neg	A2 A2 A2	B C C	
GE-2	E-2	Explosion results in radiological release Location: Feed Prep room MAR: 135 kg plutonium oxide* (Room inventory)	Operator Error Compressed flammable gas cylinder leaks in room (i.e., acetylene for maintenance)	Gas Bottle System Design	Maintenance Program Operator Training and Procedures	A	A	**Gas Bottle System Design** **Building Design (PC-3)** **EVS**	*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: High Offsite Public: High	FW: Low CW: Low Offsite Public: Neg	A1 A1 A1	B B C	* Bounding compressed gas cylinder explosion
GE-3	E-3	Loss of confinement results in radiological release Location: Feed Prep room MAR: 135 kg plutonium oxide (Room inventory)	Compressed gas cylinder dropped and becomes a missile in room.	Gas Bottle System Design	Maintenance Program Operator Training and Procedures	A	A	**Gas Bottle System Design** **Building Design (PC-3)** **EVS**	*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: High Offsite Public: High	FW: Low CW: Low Offsite Public: Neg	A1 A1 A1	B B C	* Bounding compressed gas cylinder loss of confinement

Table C-D.5 Hazard Evaluation Table – General Events (GE)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
GE-3a	E-3	Argon or helium gas cylinder missile results in personnel injury Location: Pu Vit Facility MAR: N/A	Human error handing argon or helium cylinder Mechanical failure Operations error	None	Operator Training and Procedures	A	A	**Gas Bottle System Design**	**Operator Training and Procedures** **Event Response Procedures**	FW: High CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	A1 C C	C C C	Personnel may be killed due to high speed gas cylinder, impact. Standard Industrial Hazard
GE-4	E-5/ E-1	A fire occurs and the resulting fire water discharge causes a collection of fissile material in a critical configuration Location: -40 Level MAR: 365 kg	Combustible/ flammable materials- transient combustibles, glovebox contents and glovebox, room contents, electrical systems, etc. Ignition sources- electrical wiring, heating elements, maintenance activities, gases, lightning, etc.	NFPA Design Building Design (PC-3) (e.g., fire resistant construction, 2 inch water collection depth limit)	**Nuclear Criticality Safety Program** Operator Training and Procedures Fire Protection Program Configuration Control Program	U	EU	**Fire Detection and Alarm System** **Building Design (PC-3)** EVS **NIMS**	Fire Protection Program **Event Response Procedures** **Operator Training and Procedures** Radiological Protection Program	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg	A1 B C	B C C	
GE-5	E-6	External wildfire resulting in a radiological release Location: Pu Vit MAA MAR: 365 kg	Lightning Ignition of grass / forest	None	Fire Protection Program Operator Training and Procedures	A	A	**<u>Building Design (PC-3)</u>** Fire Breaks	Fire Protection Program *Event Response Procedures* *Operator Training and Procedures* Radiological Protection Program	FW: High CW: High Offsite Public: High	FW: Neg CW: Neg Offsite Public: Neg	A1 A1 A1	C C C	

Table C-D.5 Hazard Evaluation Table – General Events (GE)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
GE-6	E-6	Large Aircraft impacts the facility resulting in a radiological release Location: K-Area MAR: 365 kg	Large aircraft impact	Small footprint	None	BEU	BEU	Building Design	Event Response Procedures Radiological Protection Program Operator Training and Procedures	FW: High CW: High Offsite Public: High	FW: High CW: High Offsite Public: High (Prevented)	C C C	C C C	
GE-7	E-6	Small aircraft / helicopter crashing into the building resulting in a radiological release Location: Pu Vit MAA MAR: 365 kg	Helicopter/ small aircraft crash	Limited footprint	None	EU	EU	**Building Design (PC-3)**	Event Response Procedures Radiological Protection Program Operator Training and Procedures	FW: High CW: High Offsite Public: High	FW: Neg CW: Neg Offsite Public: Neg	A1 A1 A1	C C C	
GE-8	E-6	Radiological release due to loss of facility power Location: Pu Vit MAA MAR: 365 kg	Power failure Repairs Vehicle crash Natural phenomena	None	Preventative Maintenance	A	A	**Standby Power** **Building Design (PC-3)** **EVS**	*Event Response Procedures* *Operator Training and Procedures* Radiological Protection Program	FW: High CW: High Offsite Public: High	FW: Neg CW: Neg Offsite Public: Neg	A1 A1 A1	C C C	

Table C-D.5 Hazard Evaluation Table – General Events (GE)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
GE-9	E-3	Radiological release due to firearm discharge Location: Pu Vit MAA (outside of Vault type rooms) MAR: 10 kg plutonium oxide (two 3013 containers)	Accidental discharge of a firearm	None	Safeguards and Security Program SPO Qualification Program	A	A	**EVS** **Building Design (PC-3)** **Cart Design** **3013 Container Design**	*Event Response Procedures* *Operator Training and Procedures* Radiological Protection Program	FW: High CW: High Offsite Public: High	FW: Low CW: Neg Offsite Public: Neg	A1 A1 A1	B C C	MAR bounding for all Waste Containers
GE-10	E-7	External flooding of facility results in a radiological release Location: K-Area MAR: 365 kg	Heavy rains Dam break River overflow	None	None	U	U	Building Design (PC-3) EVS **Building elevation above flood level**	Event Response Procedures Operator Training and Procedures Radiological Protection Program	FW: High CW: High Offsite Public: High	FW: Neg CW: Neg Offsite Public: Neg	A1 A1 A1	C C C	
GE-11	E-7	Seismic event damages facility resulting in a radiological release Location: Pu Vit MAA MAR: 365 kg	Natural phenomena	None	None	A	A	**Standby Power** **Building Design (PC-3)** **EVS**	*Event Response Procedures* *Operator Training and Procedures* Radiological Protection Program	FW: High CW: High Offsite Public: High	FW: Neg CW: Neg Offsite Public: Neg	A1 A1 A1	C C C	
GE-12	E-7/ E-5	Seismic event damages facility resulting in a criticality Location: Pu Vit MAA MAR: 365 kg	Natural phenomena	None	None	A	A	**Building Design (PC-3)** **Glovebox Design (PC-3)** **Material Storage and Configuration Design (PC-3)**	*Event Response Procedures* *Operator Training and Procedures* Radiological Protection Program	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg	A1 B C	A1 B C	

Table C-D.5 Hazard Evaluation Table – General Events (GE)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
GE-13	E-7	High wind or tornado damages facility resulting in a radiological release Location: Pu Vit MAA MAR: 365 kg	Natural phenomena	None	None	A	A	**Building Design (PC-3)** **EVS**	*Event Response Procedures* *Operator Training and Procedures* Radiological Protection Program	FW: High CW: High Offsite Public: High	FW: Neg CW: Neg Offsite Public: Neg	A1 A1 A1	C C C	
GE-14	E-7	Pu Vit outside facilities are damaged by heavy snow, hail, or ice storms resulting in a containment/ confinement breach Location: K-Area MAR: 6.5 kg FGE	Natural phenomena	None	None	A	A	**Building Design** Waste containers (B12/25, SWBs, and TRU waste drums)	Event Response Procedures Operator Training and Procedures Radiological Protection Program	FW: High CW: High Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	A1 A1 C	C C C	PC-1 buildings subjected to these conditions may be damaged but will not collapse
GE-15	E-7 / E-1	Post seismic fire results in a radiological release Location: Pu Vit MAA MAR: 365 kg	Natural phenomena	None	None	U	U	**Building Design (PC-3, fire walls)** **EVS**	*Event Response Procedures* *Operator Training and Procedures* Radiological Protection Program	FW: High CW: High Offsite Public: High	FW: High CW: Neg Offsite Public: Neg	A1 A1 A1	A1 C C	

Table C-A.6 Hazard Evaluation Table - Milling and Mixing (MIX)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
MIX-1	E-1	A fire in the room results in a radiological release Location: Milling and Mixing Room MAR: 12.2 kg plutonium oxide	Electrical short Unknown ignition sources-friction/overheated seals/bearings Combustibles/ flammable materials-shielding material, hydraulic oil Maintenance Activities/Operator error	Glovebox Design (PC-3) NFPA Design Remote Operations	Maintenance Program Operator Training and Procedures Radiological Protection Program (doors locked) Fire Protection Program	A	A	Building Design (PC-3) Glovebox Design (PC-3) EVS **Fire Detection and Alarm System** Glovebox Ventilation System	**Event Response Procedures** **Operator Training and Procedures** Fire Protection Program Radiological Protection Program	FW: Mod CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	B C C	
MIX-2	E-1	A fire in the glovebox results in a radiological release Location: Milling and Mixing glovebox MAR: 12.2 kg plutonium oxide	Electrical short Unknown ignition sources-friction/overheated seals/bearings Combustibles/flammable materials-shielding material, hydraulic oil Maintenance Activities/Operator error	Glovebox Design (PC-3) NFPA Design Remote Operations	Maintenance Program Operator Training and Procedures Radiological Protection Program (doors locked) Fire Protection Program	A	A	Building Design (PC-3) **Glovebox Design (PC-3)** EVS **Fire Detection and Alarm System** **Glovebox Ventilation System**	**Event Response Procedures** **Operator Training and Procedures** Fire Protection Program Radiological Protection Program	FW: Mod CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	B C C	

Table C-A.6 Hazard Evaluation Table - Milling and Mixing (MIX)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
MIX-3	E-3	Glovebox loss of confinement results in radiological release Location: Milling and Mixing glovebox MAR: 2.1 kg plutonium oxide	Glove failure Window failure Catastrophic failure of attritor	Glovebox Design (PC-3) Attritor Design Building Design (PC-3) Remote Operations	Radiological Protection Program- glove change out/check SPO Qualification Program Operator Training and Procedures	A	A	**Glovebox Design (PC-3)** Building Design (PC-3) **Glovebox Ventilation System** **EVS**	*Radiological Protection Program* *Operator Training and Procedures* *Event Response Procedures*	FW: Mod CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	B C C	
MIX-4	E-3	Glovebox loss of confinement results in radiological release Location: Milling and Mixing glovebox MAR: 2.1 kg plutonium oxide	Maintenance activity Maintenance error	Glovebox Design (PC-3) Building Design (PC-3)	Radiological Protection Program Maintenance Control Program SPO Qualification Program Operator Training and Procedures	A	A	**Glovebox Design (PC-3)** **EVS** Building Design (PC-3) **Glovebox Ventilation System**	*Radiological Protection Program* *Operator Training and Procedures* *Event Response Procedures*	FW: Mod CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	B C C	
MIX-5	E-4	Personnel over-exposure Location: Milling and Mixing Room MAR: N/A	Operator error Door unlocked Inadvertent Remote Operations during Maintenance	Glovebox Design (PC-3) Building Design (PC-3)	Radiological Protection Program Operator Training and Procedures	A	A	Glovebox Design (PC-3) Building Design (PC-3) Remote Operations Portable shielding, if required	**Radiological Protection Program (audible dosimeter)** *Operator Training and Procedures* *Event Response Procedures*	FW: High CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	A1 C C	B C C	

Table C-A.6 Hazard Evaluation Table - Milling and Mixing (MIX)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
MIX-6	E-5	Excessive moderation resulting in a criticality Location: Milling and Mixing MAR: 2.1 kg	Limited volume processed chilled water leaks Limited volume cooling water leaks	Glovebox Design (PC-3) Piping Design Attritor Design Frit Feed-Interlock Design Limited Volume of Water **Neutron Poison in the Limited Volume Water** Milling Media Limited Volume Cooling Design-level indicator	Operator Training and Procedures **Nuclear Criticality Safety Program** Radiological Protection Program	U	EU	**NIMS** **Building Design (PC-3)** Remote Operations	Maintenance and Inspections *Operator Training and Procedures* *Event Response Procedures*	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg	A1 B C	A2 B C	Double contingency has been implemented, see NCSE
MIX-7	E-5	Criticality in the Attritor Location: Milling and Mixing MAR: 2.1 kg	Excessive reflection	Glovebox Design (PC-3) Piping Design Attritor Design	Operator Training and Procedures **Nuclear Criticality Safety Program**	BEU	BEU	**NIMS** **Building Design (PC-3)** Remote Operation Design	Operator Training and Procedures Radiological Protection Program Emergency Response Procedures	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg (Prevented)	A3 B C	A3 B C	

Table C-A.6 Hazard Evaluation Table - Milling and Mixing (MIX)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
MIX-8	E-5/ E-1	Fire occurs in room resulting in a criticality event Location: Milling and Mixing Room MAR: 2.1 kg	Fire water system Excessive reflection Electrical short	Glovebox Design (PC-3) Piping Design Attritor Design	Operator Training and Procedures **Nuclear Criticality Safety Program** Fire Protection Program	U	EU	**Building Design (PC-3)** **Fire Detection and Alarm System** **Glovebox Fire Detection and Alarm System** **NIMS**	**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg	A1 B C	A1 B C	If there is a fire, any maintenance personnel in normally unoccupied room will exit, and leave the area, reducing exposure to the criticality Double contingency has been implemented, see NCSE

Table C-B.6 Hazard Evaluation Table – Vitrification (VIT)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
VIT-1	E-1	A fire in the melter enclosure Location: VIT Room MAR: 1 kg plutonium oxide and frit plus four Pu Vit glass	Electrical short Combustibles in enclosure after maintenance-operator error Hot temp Pu Vit can acts as ignition source Runaway thermal event due to malfunctioning heater (ignition source)	Melter Design NFPA Design Melter Enclosure Design	Operator Training and Procedures Maintenance Program Fire Protection Program	A	A	Video Surveillance System Fire Detection and Alarm System Melter Design Melter Enclosure System EVS Material Form Remote Operations	Event Response Procedures Fire Protection Program	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	Room unoccupied except during maintenance
VIT-2	E-1	A fire in the room Location: VIT Room MAR: 10 batches of plutonium oxide and frit plus 40 Pu Vit glass (10 melters)	Electrical short Combustibles in room after maintenance-operator error Hot temp Pu Vit can acts as ignition source Runaway thermal event due to malfunctioning heater (ignition source)	Melter Design NFPA Design Melter Enclosure Design	Operator Training and Procedures Maintenance Program Fire Protection Program	A	A	Video Surveillance System *Fire Detection and Alarm System* Melter Design Melter Enclosure System EVS Material Form Building Design (PC-3) Remote Operations	*Operator Training and Procedures* *Event Response Procedures* Fire Protection Program Radiological Protection Program	FW: Low CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	B C C	

Table C-B.6 Hazard Evaluation Table – Vitrification (VIT)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
VIT-3	E-3	Loss of confinement resulting in a radiological release Location: VIT Room at melter enclosure MAR: 1 kg plutonium oxide	Melter failure Hopper material transport failure Melter enclosure failure	Melter Design Melter Enclosure Hopper Design	Operator Training and Procedures	U	U	Video Surveillance System EVS	*Radiological Protection Program* *Operator Training and Procedures* *Event Response Procedures*	FW: Low CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	B C C	
VIT-4	E-3	Double charged melter resulting in a radiological release Location: VIT Room- transport MAR: 2 kg plutonium oxide	Operator error Material transport hopper failure	Melter Design Melter Enclosure Hopper Design	Operator Training and Procedures	U	U	Video Surveillance System EVS **Hopper Design** **Melter Design** Melter Enclosure	*Radiological Protection Program* *Operator Training and Procedures* *Event Response Procedures* MC&A Program	FW: Mod CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	B C C	Hopper and Melter design Safety Significant features to mitigate/prevent double charge
VIT-5	E-3	Water leak into melter enclosure results in a radiological release Location: VIT Room MAR: 1 kg plutonium oxide	Air mixer Water leak	None	Operator Training and Procedures	EU	EU	Video Surveillance System EVS *Melter Design* *Melter Enclosure* *Limited Volume Water System Design*	Radiological Protection Program Operator Training and Procedures Event Response Procedures MC&A Program	FW: Low CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	B C C	C C C	

Table C-B.6 Hazard Evaluation Table – Vitrification (VIT)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
VIT-6	E-4	Excessive exposure from melter Location: VIT Room MAR: N/A	Operator error Door unlocked	Melter Enclosure Design Building Design (PC-3)	Radiological Protection Program Operator Training and Procedures	A	A	**Melter Enclosure** Building Design (PC-3)	*Radiological Protection Program* *Operator Training and Procedures* *Event Response Procedures*	FW: High CW: Neg Offsite Public: Neg	FW: Mod CW: Neg Offsite Public: Neg	A1 C C	B C C	Melter enclosure shielding or equivalent required to protect FW
VIT-7	E-4	Inductive melter results in medical device failure (e.g. pace maker) Location: VIT Room MAR: N/A	Magnetic field	None	Operator Training and Procedures Room is locked IH Program	A	A	None	**Operator Training and Procedures** **IH Program**	FW: High CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	A1 C C	C C C	May result in prompt fatality SIH

Table C-A.7 Hazard Evaluation Table –HVAC and Confinement

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
HVAC-1	E-1	Fire occurs in the non-process areas ventilation supply system Location: 0 and -20 levels MAR: N/A	Combustible/ flammable materials-wiring, electric heating coil, transient combustibles Ignition sources-electrical wiring, heating element	NFPA Design	Fire Protection Program	A	A	Fire Detection and Alarm System	Fire Protection Program Event Response Procedures Operator Training and Procedures	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	This is a SIH - no radiological consequence or risk.
HVAC-2	E-1	Fire occurs in the process areas supply system Location: 0, -20, -40 levels MAR: N/A	Combustible/ flammable materials-wiring, electric heating coil, transient combustibles Ignition sources-electrical wiring, heating element	NFPA Design	Fire Protection Program	A	A	Fire Detection and Alarm System EVS	Fire Protection Program Event Response Procedures Operator Training and Procedures	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	This is a SIH - no radiological consequence or risk.
HVAC-3	E-1	Fire occurs in the glovebox exhaust system first stage HEPA filter resulting in a radiological release Location: -40 level MAR: 226g plutonium oxide (one filter)	Combustible/ flammable materials-wiring, transient combustibles, HEPA, dust loading Ignition sources-electrical wiring, maintenance activity	NFPA Design Sand Filter	Fire Protection Program	A	A	Fire Detection and Alarm System	Fire Protection Program Event Response Procedures Operator Training and Procedures	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	Isolation interlocks are a requirement and will be incorporated into future design.

Table C-A.7 Hazard Evaluation Table –HVAC and Confinement

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
HVAC-4	E-1	Fire occurs in the glovebox exhaust system second stage HEPA resulting in a radiological release Location: -20 level MAR: 1.815 kg plutonium oxide	Combustible/ flammable materials- wiring, transient combustibles, HEPA, dust loading Ignition sources- electrical wiring, maintenance activity	NFPA Design HEPA materials of construction (non-combustible)	Fire Protection Program	U	U	Fire Detection and Alarm System	Fire Protection Program Event Response Procedures Operator Training and Procedures	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	
HVAC-5	E-1	Fire occurs in the main exhaust system resulting in a radiological release Location: 0 level MAR: 1.815 kg plutonium oxide	Combustible/ flammable materials- wiring, transient combustibles, HEPA, dust loading Ignition sources- electrical wiring, maintenance activity	NFPA Design HEPA materials of construction (non-combustible)	Fire Protection Program	A	A	Fire Detection and Alarm System Isolation and Redundancy	Fire Protection Program Event Response Procedures Operator Training and Procedures	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	
HVAC-6	E-1	Event deleted												

Table C-A.7 Hazard Evaluation Table –HVAC and Confinement

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
HVAC-7	E-2	Over-pressurization (deadhead - less than 25 psig) fan in the non-process areas supply ventilation system results in a radiological release Location: 0 and -20 level MAR: 7.26 kg plutonium oxide	Discharge damper closed while fan operating Air reversal	Building Design (PC-3) EVS	Radiological Protection Program	A	A	*Building Design (PC-3)* *EVS*	*Event Response Procedures* *Operator Training and Procedures* Radiological Protection Program	FW: Low CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	B C C	C C C	
HVAC-8	E-2	Over-pressurize (deadhead - less than 25 psig) fan in the process areas supply ventilation system resulting in a radiological release Location: 0 level (fan location) MAR: 7.26 kg	Discharge damper closed while fan operating Air reversal	Building Design (PC-3) EVS	Radiological Protection Program	A	A	*Building Design (PC-3)* *EVS*	*Event Response Procedures* *Operator Training and Procedures* Radiological Protection Program	FW: Low CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	B C C	C C C	

Table C-A.7 Hazard Evaluation Table –HVAC and Confinement

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
HVAC-9	E-3	HEPA filter break-through in the glovebox exhaust ventilation system resulting in a radiological release Location: -40 level MAR: 226g plutonium oxide (one filter)	High DP across the filter Accidental Firearm discharge	EVS	SPO Qualification Program	A	A	Glovebox Ventilation System	Event Response Procedures Operator Training and Procedures Radiological Protection Program	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	
HVAC-10	E-3	Loss of exhaust flow in the glovebox exhaust ventilation system resulting in a radiological release Location: All MAR: 7.26 kg plutonium oxide	Fan failure (power/ mechanical failure) HEPA filter plugged Damper closes	None	None	A	A	*EVS* *Glovebox Ventilation System*	*Event Response Procedures* *Operator Training and Procedures* *Radiological Protection Program*	FW: Low CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	B C C	C C C	

Table C-A.7 Hazard Evaluation Table –HVAC and Confinement

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
HVAC-11	E-3	Air flow reversal in the glovebox exhaust ventilation system resulting in a radiological release Location: -40 level MAR: 226g plutonium oxide (one filter)	Fire Maintenance (fan wired incorrectly, Room pressure lower than glovebox)	EVS	Operator Training and Procedures Fire Protection Program	A	A	Fire Detection and Alarm System Glovebox Design (PC-3)	Radiological Protection Program Event Response Procedures Operator Training and Procedures	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	
HVAC-12	E-3	Loss of containment event in the glovebox exhaust ventilation system resulting in a radiological release Location: All MAR: 7.26 kg plutonium oxide	Ductwork failure Accidental firearm discharge Impact to ductwork Fan housing failure	EVS Glovebox Ventilation System	SPO Qualification Program	A	A	*EVS* *Glovebox Ventilation System*	*Operator Training and Procedures* *Event Response Procedures* *Radiological Protection Program*	FW: Low CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	B C C	C C C	
HVAC-13	E-3	Sand filter failure in the Main exhaust ventilation system resulting in a radiological release Location: Sand filter location MAR: 7.26 kg plutonium oxide	Structural failure Maintenance Error Operator Error	None	Operator Training and Procedures	A	A	*EVS*	*Operator Training and Procedures* *Event Response Procedures* *Radiological Protection Program*	FW: Low CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	B C C	C C C	

Table C-A.7 Hazard Evaluation Table –HVAC and Confinement

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
HVAC-14	E-3	Loss of exhaust flow in the Main exhaust ventilation system resulting in a radiological release Location: All MAR: 7.26 kg plutonium oxide	Mechanical Failure (Fan failure, Damper closed)	EVS	Operator Training and Procedures	A	A	*EVS*	*Event Response Procedures* *Operator Training and Procedures* *Radiological Protection Program*	FW: Low CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	B C C	C C C	
HVAC-15	E-3	Air flow reversal in the Main exhaust ventilation system resulting in a radiological release through supply side of HVAC for FP, DMO, GFDS, MIX, VIT gloveboxes Location: -40 level MAR: 1.13 kg plutonium oxide	Mechanical Failure (Fan failure, Damper closed, Change in pressure, Ductwork failure, Main exhaust duct collapses)	EVS	Operator Training and Procedures	A	A	*EVS*	*Event Response Procedures* *Operator Training and Procedures* *Radiological Protection Program*	FW: Low CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	B C C	C C C	
HVAC-16	E-3	Excess process supply system flow pressurizes process areas resulting in a contamination Location: -20 and -40 level MAR: Contamination	Mechanical Failure (Supply fans running simultaneously)	EVS	Operator Training and Procedures	A	A	EVS	Operator Training and Procedures Event Response Procedures Radiological Protection Program	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	

Table C-A.7 Hazard Evaluation Table –HVAC and Confinement

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
HVAC-17	E-3	Excess Main exhaust system flow causes excess negative pressure in Facility resulting in a radiological release Location: 0, -20 and -40 level MAR: 7.26 kg plutonium oxide	Mechanical Error (exhaust fans running simultaneously) Operator Error Maintenance Error	EVS	Operator Training and Procedures	A	A	*EVS*	*Event Response Procedures* *Operator Training and Procedures* *Radiological Protection Program*	FW: Low CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	B C C	C C C	This creates a life safety code concern due to high delta pressure across doors.
HVAC-18	E-3	Melter off-gas causes corrosion to exhaust ductwork resulting in a contamination Location: 0, -20 and -40 level MAR: Contamination	Mechanical Failure (excessive untreated corrosive materials in off-gas) Maintenance Error	EVS	Operator Training and Procedure Radiological Protection Program	A	A	EVS	Event Response Procedures Operator Training and Procedures Radiological Protection Program	FW: Neg CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	C C C	C C C	
HVAC-19	E-4	Personnel exposure due to exhaust system failure resulting in a radiological release Location: All MAR: NA	Operator Error (buildup of plutonium oxide in ductwork)	EVS	Operator Training and Procedures MC&A Program	A	A	*EVS*	*Event Response Procedures* *Operator Training and Procedures* *Radiological Protection Program* MC&A Program	FW: Low CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	B C C	C C C	HEPA filter will prevent material build-up in duct.

Table C-A.7 Hazard Evaluation Table –HVAC and Confinement

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
HVAC-20	E-5	Criticality in glovebox and/or Main exhaust system Location: 0, -20 and -40 level MAR: 7.26 kg plutonium oxide	Excessive reflection-Introduction of reflective materials Excess moderation in the correct geometry Excessive mass of plutonium	None	**Nuclear Criticality Safety Program** Operator Training and Procedures	A	EU	**Building Design (PC-3)** **NIMS**	*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg	A1 B C	A2 B C	
HVAC-21	E-5/ E-1	Fire occurs in glovebox and/or Main exhaust system resulting in a criticality event Location: 0, -20 and -40 level MAR: 7.26 kg plutonium oxide	Excessive combustibles with an ignition source	None	**Nuclear Criticality Safety Program** Operator Training and Procedures Fire Protection Program Combustible Control Program	U	EU	**Building Design (PC-3)** **Fire Detection and Alarm System** **NIMS**	**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg	A1 B C	A2 B C	

Table C-A.8 Hazard Evaluation Table - Green Fuel (GF)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
GF-1	E-1	Fire in the room results in a radiological release Location: Green Fuel Disassembly Room MAR: 67 kg of plutonium	Human error Combustible Material Electrical Short Unknown ignition source Residual Sodium	NFPA Design Electrical Equipment Design	Operator Training and Procedures Fire Protection Program Decontamination for sodium exposed DFAs	A	A	**Fire Detection and Alarm System** **EVS** Building Design (PC-3) HUFP Design Material Form	Fire Protection Program **Operator Training and Procedures** **Event Response Procedures** Radiological Protection Program **Green Fuel Material Certification**	FW: High CW: Low Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	A1 B C	B C C	Event bounds transport of DFA/Ident to HUFP to glovebox. Green Fuel Material Form is plutonium oxide stabilized in a ceramic matrix resulting in no dose consequences from a release
GF-2	E-1	Fire in the glovebox results in a radiological release Location: Green Fuel glovebox MAR: 1 IDENT equals 11.13 kg of plutonium max	Human error Combustible Material Electrical Short Unknown ignition source Residual Sodium	NFPA Design Electrical Equipment Design	Operator Training and Procedures Fire Protection Program Decontamination for sodium exposed DFAs	A	A	*Fire Detection and Alarm System* *EVS* Glovebox Ventilation System Glovebox Design (PC-3) Building Design (PC-3) HUFP Design Pin Design Material Form	Fire Protection Program *Operator Training and Procedures* *Event Response Procedures* Radiological Protection Program *Green Fuel Material Certification*	FW: Low CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	B C C	C C C	Green Fuel Material Form is plutonium oxide stabilized in a ceramic matrix resulting in no dose consequences from a release

Table C-A.8 Hazard Evaluation Table - Green Fuel (GF)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
GF-3	E-1	Fire during transport results in a radiological release Location: Transport Route to FP MAR: < 5 kg plutonium (one Pin Fuel Can)	Human error Combustible Material Electrical Short Unknown ignition source	NFPA Design Electrical Equipment Design	Operator Training and Procedures Fire Protection Program	A	A	*Fire Detection and Alarm System* *EVS* Building Design (PC-3) Material Form	Fire Protection Program *Operator Training and Procedures* *Event Response Procedures* Radiological Protection Program *Green Fuel Material Certification*	FW: Low CW: Neg Offsite Public: Neg	FW: Neg CW: Neg Offsite Public: Neg	B C C	C C C	Green Fuel Material Form is plutonium oxide stabilized in a ceramic matrix resulting in no dose consequences from a release
GF-4	E-1	Fire suppression system discharge in the room causes an exothermic sodium fire resulting in a radiological release Location: Green Fuel Room MAR: One open HUFP container (67 kg plutonium oxide)	Fire water Human error Combustible materials Electrical short	HUFP Design	**Decontamination for sodium exposed DFAs**	A	EU	**Building Design (PC-3)** **EVS** **NFPA Design** Electrical Equipment Design	*Operator Training and Procedures* *Event Response Procedures* **Green Fuel Material Certification**	FW: High CW: Low Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	A1 B C	B C C	Only one DFA out at a time resulting in 1/7th the MAR per MC&A Program. Operator Training and Procedures for making sure that the material was washed prior to shipment.

Table C-A.8 Hazard Evaluation Table - Green Fuel (GF)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
GF-5	E-2	Fire suppression system discharge in the hood causes an exothermic sodium fire resulting in a radiological release Location: Green Fuel Room MAR: One IDENT equals 11.13 kg of plutonium max	Fire water Human error Combustible materials Electrical short	None	**Decontamination for sodium exposed DFAs**	A	U	NFPA Design Electrical Equipment Design **Fire Detection and Alarm System**	Fire Protection Program **Operator Training and Procedures** **Event Response Procedures** **Green Fuel Material Certification**	FW: High CW: Mod Offsite Public: Low	FW: Neg CW: Neg Offsite Public: Neg	A1 B B	C C C	Operator Training and Procedures for making sure that the material was washed prior to shipment.
GF-6	E-3	Loss of confinement results in a radiological release Location: Green Fuel Room MAR: 67 kg of plutonium	Crane drops HUFP in excess of 30 feet Human Error	Crane Design	Operator Training and Procedures Crane Certifications	A	A	HUFP (DOT Type B Container) Material Form Building Design (PC-3)	*Operator Training and Procedures* *Event Response Procedures* *Radiological Protection Program*	FW: Low CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	B C C	Sintered Material should not oxidize
GF-7	E-3	Dropped load results in operator injury Location: Green Fuel Room MAR: NA	Crane drops HUFP in excess of 30 ft. Human Error	Crane Design	Operator Training and Procedures Crane Certifications	A	A	None	Operator Training and Procedures Event Response Procedures	FW: High CW: Neg Offsite Public: Neg	FW: High CW: Neg Offsite Public: Neg	A1 C C	A1 C C	SIH

Table C-A.8 Hazard Evaluation Table - Green Fuel (GF)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
GF-8	E-3	Loss of confinement results in a radiological release Location: Green Fuel Room MAR=1 IDENT=11.13 kg of plutonium max	Crane drops 1 Ident-in excess of 10 ft. Human Error	Crane Design	Operator Training and Procedures Crane Certifications	A	A	Material Form Building Design (PC-3)	*Operator Training and Procedures* *Event Response Procedures* *Radiological Protection Program*	FW: Low CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	B C C	
GF-9	E-3	Event deleted												See General Assumptions (firearm discharge in vault type room)
GF-10	E-3	Loss of confinement results in a radiological release Location: Green Fuel Transport route to FP MAR: <5 kg plutonium	Transport cart overturns	None	Operator Training and Procedures	A	A	Material Form Building Design (PC-3)	*Operator Training and Procedures* *Event Response Procedures* *Radiological Protection Program*	FW: Low CW: Neg Offsite Public: Neg	FW: Low CW: Neg Offsite Public: Neg	B C C	B C C	

Table C-A.8 Hazard Evaluation Table - Green Fuel (GF)

Event No.	Event Cat.	Event Description	Causes	Suggested Preventative Features		Event Freq. Level		Suggested Mitigative Feature		Consequence Level		Risk Rank		Comments
				Design	Admin	Unmit	Mit	Design	Admin	Unmit Conseq	Mit Conseq	Unmit	Mit	
GF-11	E-5	Criticality in the glovebox Location: Green Fuel Room MAR: Bounding is 49.56 kg of plutonium oxide and uranium oxide	Excessive number of cans of pellets Operator error	Building Design (PC-3) Glovebox Design (PC-3)	Operator Training and Procedures **Nuclear Criticality Safety Program**	U	EU	**Building Design (PC-3)** **NIMS**	*Operator Training and Procedures* *Event Response Procedures*	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg	A1 B C	A2 B C	
GF-12	E-5/ E-1	Room fire with a breach of glovebox confinement results in criticality Location: Green Fuel Room MAR: Bounding is 49.56 kg of plutonium oxide and uranium oxide	Excessive number of cans of pellets Excessive moderator/reflector Confinement breach in glovebox Operator error	Building Design (PC-3) Glovebox Design (PC-3)	Operator Training and Procedures **Nuclear Criticality Safety Program**	U	EU	**Building Design (PC-3)** **NIMS** **Fire Detection and Alarm System** **Glovebox Fire Detection and Alarm System**	**Operator Training and Procedures** **Event Response Procedures**	FW: High CW: Mod Offsite Public: Neg	FW: High CW: Low Offsite Public: Neg	A1 B C	A2 B C	

APPENDIX D

SYSTEMS, STRUCTURES, AND COMPONENTS TABLE

Table D-1 Safety Class Controls

Event Number	Cat	Freq	Design Features	Admin Features	Risk Rank
MRS-1, MRS-2, FP-6, OX-1, OX-6	E-1	**A**	**Building Design (PC-3)** **EVS**		FW: High CW: High Offsite Public: High
FP-1, FP-2, FP-3, FP-8, OX-2, OX-3, OX-5, OX-10, OX-11	E-1	U	**Building Design (PC-3)** **EVS**		FW: High CW: High Offsite Public: High
FP-7, GE-1	E-1	EU	**Building Design (PC-3)** **EVS**		FW: High CW: High Offsite Public: High
MHS-1	E-1/ E-2	A	**Building Design (PC-3)** **EVS**		FW: High CW: High Offsite Public: High
FP-9	E-2	A	**Building Design (PC-3)** **EVS**		FW: High CW: High Offsite Public: High
OX-12, OX-13	E-2	EU	**Building Design (PC-3)** **EVS**		FW: High CW: High Offsite Public: High
OX-14	E-2	U	**Building Design (PC-3)** **EVS**		FW: High CW: High Offsite Public: High
GE-2	E-2	A	**Building Design (PC-3)** **EVS**		FW: High CW: High Offsite Public: High
FP-10, FP-13, OX-19, GE-3, GE-9	E-3	A	**Building Design (PC-3)** **EVS**		FW: High CW: High Offsite Public: High
MRS-3, MRS-5, MRS-6, MRS-8	E-3	A	**3013 Container Design**		FW: High CW: High Offsite Public: High

Table D-1 Safety Class Controls

Event Number	Cat	Freq	Design Features	Admin Features	Risk Rank
GE-5	E-6	A	**Building Design (PC-3)**		FW: High CW: High Offsite Public: High
GE-7	E-6	EU	**Building Design (PC-3)**		FW: High CW: High Offsite Public: High
GE-8	E-6	A	**Building Design (PC-3)** **EVS**		FW: High CW: High Offsite Public: High
GE-10	E-7	U	**Building elevation above flood level**		FW: High CW: High Offsite Public: High
GE-11, GE-13	E-7	A	**Building Design (PC-3)** **EVS**		FW: High CW: High Offsite Public: High
GE-15	E-7 / E-1	A	**Building Design (PC-3)** **EVS**		FW: High CW: High Offsite Public: High
FP-4, FP-5	E-1	U	**Building Design (PC-3)** **EVS**		FW: High CW: High Offsite Public: Mod
FP-13, GE-3	E-3	A	**Building Design (PC-3)** **EVS**		FW: High CW: High Offsite Public: High

Table D-2 Safety Significant Controls

Event Number	Cat	Freq	Design Features	Admin Features	Risk Rank
MRS-1, MRS-2	E-1	A	**Fire Detection and Alarm System**	**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: High Offsite Public: High
GE-1	E-1	EU	**Fire Detection and Alarm System** **Glovebox Fire Detection and Alarm System**	**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: High Offsite Public: High
FP-1, FP-2, FP-3, OX-2, OX-3, OX-5	E-1	U	**Glovebox Fire Detection and Alarm System**	**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: High Offsite Public: High
OX-6	E-1	A	**Glovebox Design (PC-3)** **Glovebox Ventilation System**	**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: High Offsite Public: High
FP-6	E-1	A	**Glovebox Design (PC-3)** **Glovebox Ventilation System** **Glovebox Fire Detection and Alarm System**	**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: High Offsite Public: High
OX-1	E-1	A	**Glovebox Fire Detection and Alarm System**	**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: High Offsite Public: High
FP-7	E-1	EU	**Glovebox Design (PC-3)** **Glovebox Ventilation System** **Glovebox Fire Detection and Alarm System**	**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: High Offsite Public: High
OX-10	E-1	U	**Fire Detection and Alarm System** **Glovebox Design (PC-3)** **Glovebox Ventilation System** **Glovebox Fire Detection and Alarm System**	**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: High Offsite Public: High
FP-4, FP-5	E-1	U	**Glovebox Fire Detection and Alarm System**	**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: High Offsite Public: Mod
WS-1	E-1	A	**Building Design (elevated storage pad)**	**Fire Protection Program (combustible controls)** **Waste Management Program (control MAR)**	FW: High CW: High Offsite Public: Low

Table D-2 Safety Significant Controls

Event Number	Cat	Freq	Design Features	Admin Features	Risk Rank
GF-1	E-1	A	**Fire Detection and Alarm System** **EVS**	**Green Fuel Material Certification** **Event Response Procedures** **Operator Training and Procedures**	FW: High CW: Low Offsite Public: Neg
GF-4	E-1	A	**NFPA Design** **EVS** **Building Design (PC-3)**	**Green Fuel Material Certification** **Decontamination for sodium exposed DFAs**	FW: High CW: Low Offsite Public: Neg
TWP-1, TWP-4, TWT-1	E-1	A	**Fire Detection and Alarm System** **EVS** **Building Design (PC-3)**	**Event Response Procedures** **Operator Training and Procedures** **Waste Management Program (Control MAR)**	FW: High CW: Low Offsite Public: Neg
TWT-2	E-1	A	**Fire Detection and Alarm System** **EVS** **Building Design (PC-3)**	**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: Low Offsite Public: Neg
TWP-3	E-1	A	**Fire Detection and Alarm System** **EVS** **Building Design (PC-3)**	**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: Mod Offsite Public: Neg
TWM-1	E-1	A	**Fire Detection and Alarm System** **EVS** **Building Design (PC-3)**		FW: Mod CW: Low Offsite Public: Neg
MIX-1	E-1	A	**Fire Detection and Alarm System**	**Event Response Procedures** **Operator Training and Procedures**	FW: Mod CW: Neg Offsite Public: Neg
MIX-2	E-1	A	**Fire Detection and Alarm System** **Glovebox Ventilation System** **Glovebox Design (PC-3)**	**Event Response Procedures** **Operator Training and Procedures**	FW: Mod CW: Neg Offsite Public: Neg
FP-8, OX-11	E-1	U	**Fire Detection and Alarm System**	**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: High Offsite Public: High
MHS-1	E-1/ E-2	A	**Fire Detection and Alarm System**	**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: High Offsite Public: High
OX-12, OX-13	E-2	EU	**Glovebox Design (PC-3)** **Glovebox Ventilation System**		FW: High CW: High Offsite Public: High

Table D-2 Safety Significant Controls

Event Number	Cat	Freq	Design Features	Admin Features	Risk Rank
OX-14	E-2	U	**Glovebox Design (PC-3)** **Glovebox Ventilation System**		FW: High CW: High Offsite Public: High
OX-17	E-2	A	**Building Design (PC-3)** **EVS** **Glovebox Design (PC-3)** **Inert Ventilation System**		FW: High CW: Mod Offsite Public: Low
GE-2	E-2	A	**Gas Bottle System Design**		FW: High CW: High Offsite Public: High
FP-9	E-2	A	**NFPA Design** **Can Puncture Device Design** **Glovebox Design (PC-3)** **Glovebox Ventilation System**		FW: High CW: High Offsite Public: High
GF-5	E-2	A	**Fire Detection and Alarm System**	**Green Fuel Material Certification** **Decontamination for sodium exposed DFAs** **Event Response Procedures** **Operator Training and Procedures**	FW: High CW: Mod Offsite Public: Low
WS-3	E-2	U		**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: Mod Offsite Public: Neg
TWP-7	E-2	A	**TRU Waste Drum, Polybox, and SWB Design (vent)**	**Operator Training and Procedures** **Waste Management Program**	FW: High CW: Neg Offsite Public: Neg
TWP-5	E-2	A	**TRU Waste Drum, Polybox, and SWB Design (vent)**		FW: Mod CW: Low Offsite Public: Neg
TWM-2	E-2	A	**TRU Waste Drum Design (vent)** **EVS** **Building Design (PC-3)**		FW: Mod CW: Low Offsite Public: Neg
TWT-3	E-2	A	**TRU Waste Drum, Polybox, and SWB Design (vent)** **EVS** **Building Design (PC-3)**		FW: Mod CW: Low Offsite Public: Neg

Table D-2 Safety Significant Controls

Event Number	Cat	Freq	Design Features	Admin Features	Risk Rank
WS-5	E-3	A	**SWB (DOT Type A container)**		FW: Mod CW: Neg Offsite Public: Neg
WS-2	E-2	A	**SWB and TRU Waste Drum Design (vent)**		FW: Low CW: Neg Offsite Public: Neg
OX-19	E-3	A	**Glovebox Design (PC-3)** **Glovebox Ventilation System**		FW: High CW: High Offsite Public: High
FP-10	E-3	A	**II/I Design of O/H Transport System** **Glovebox Design (PC-3)** **Glovebox Ventilation System**		FW: High CW: High Offsite Public: High
FP-11, FP-12, OX-20, OX-21	E-3	A	**Building Design (PC-3)** **EVS** **Glovebox Design (PC-3)** **Glovebox Ventilation System**		FW: High CW: Mod Offsite Public: Neg
FP-13	E-3	A	**Can Puncture Device Design** **Glovebox Design (PC-3)** **Glovebox Ventilation System**		FW: High CW: High Offsite Public: High
MRS-3, MRS-5, MRS-6, MRS-8	E-3	A	**Building Design (PC-3)** **EVS**		FW: High CW: High Offsite Public: High
MHS-4	E-3	A	**Building Design (PC-3)** **EVS** **Cart Design**		FW: High CW: Low Offsite Public: Neg
MHS-5	E-3	A	**EVS** **Glovebox Ventilation System** **Tunnel Design (remote operations)**		FW: High CW: Low Offsite Public: Neg
TWP-9	E-3	A	**EVS** **Glovebox Design (PC-3)** **SWB (DOT Type A Container)**		FW: High CW: Low Offsite Public: Neg

Table D-2 Safety Significant Controls

Event Number	Cat	Freq	Design Features	Admin Features	Risk Rank
TWT-7	E-3	A	**TRU Waste Drum (DOT Type A Container)** **Building Design (PC-3)** **EVS** **SWB (DOT Type A Container)**		FW: High CW: Low Offsite Public: Neg
TWT-8	E-3	A	**Building Design (PC-3)** **EVS**	**Radiological Protection Program**	FW: High CW: Low Offsite Public: Neg
MIX-3, MIX-4	E-3	A	**EVS** **Glovebox Design (PC-3)** **Glovebox Ventilation System**		FW: Mod CW: Neg Offsite Public: Neg
GE-3a	E-3	A	**Gas Bottle Design**	**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: Neg Offsite Public: Neg
VIT-4	E-3	U	**Hopper Design** **Melter Design**		FW: Mod CW: Neg Offsite Public: Neg
OX-18	E-3	A	**II/I Design of O/H Transport System** **Building Design (PC-3)** **EVS** **Glovebox Design (PC-3)** **Glovebox Ventilation System**		FW: High CW: Mod Offsite Public: Neg
MIX-5	E-4	A		**Radiological Protection Program (audible dosimeter)**	FW: High CW: Neg Offsite Public: Neg
MCL-12	E-4	A	**Shielding Design**		FW: High CW: Neg Offsite Public: Neg
VIT-6	E-4	A	**Melter Enclosure**		FW: High CW: Neg Offsite Public: Neg
NDA-4	E-4	A	**Building Design (PC-3)**		FW: Mod CW: Neg Offsite Public: Neg

Table D-2 Safety Significant Controls

Event Number	Cat	Freq	Design Features	Admin Features	Risk Rank
MHS-8, MHS-12	E-4	A	**Cart Design**		FW: Mod CW: Neg Offsite Public: Neg
MCL-11	E-4	A	**Bagless Can Cart Design**		FW: Mod CW: Neg Offsite Public: Neg
FP-16, OX-23	E-4	A	**Glovebox Design (PC-3)**		FW: Mod CW: Neg Offsite Public: Neg
MCL-13	E-4	A	**Shielding Design**		FW: Mod CW: Neg Offsite Public: Neg
FP-17, FP-18 , FP-19, OX-24, OX-25, OX-26, OX-27, TWP-13, TWM-7, MHS-13, MHS-14, MHS-15, MHS-16, HVAC-20	E-5	A	**Building Design (PC-3)** **NIMs**	**Nuclear Criticality Safety Program**	FW: High CW: Mod Offsite Public: Neg
MRS-11, MRS-12	E-5	A	**Building Design (PC-3)** **NIMS** **Cart Design**	**Nuclear Criticality Safety Program**	FW: High CW: Mod Offsite Public: Neg
DB-3, DB-6, GF-11	E-5	U	**NIMS** **Building Design (PC-3)**	**Nuclear Criticality Safety Program**	FW: High CW: Mod Offsite Public: Neg
DB-5	E-5	U	**Weir Replacement** **NIMS** **Building Design (PC-3)**	**Nuclear Criticality Safety Program**	FW: High CW: Mod Offsite Public: Neg
MIX-6	E-5	U	**NIMS** **Building Design (PC-3)** **Neutron Poison in the Limited Volume Water**	**Nuclear Criticality Safety Program**	FW: High CW: Mod Offsite Public: Neg

Table D-2 Safety Significant Controls

Event Number	Cat	Freq	Design Features	Admin Features	Risk Rank
MIX-7	E-5	BEU	**NIMS** **Building Design (PC-3)**	**Nuclear Criticality Safety Program**	FW: High CW: Mod Offsite Public: Neg
HVAC-21, MHS-17, GE-4	E-5/ E-1	U	**Building Design (PC-3)** **Fire Detection and Alarm System** **NIMS**	**Nuclear Criticality Safety Program** **Event Response Procedures** **Operator Training and Procedures**	FW: High CW: Mod Offsite Public: Neg
FP-20	E-5/ E-1	U	**Building Design (PC-3)** **NIMs** **Fire Detection and Alarm System** **Glovebox Fire Detection and Alarm System**	**Nuclear Criticality Safety Program**	FW: High CW: Mod Offsite Public: Neg
GF-12, MIX-8	E-5/ E-1	U	**Building Design (PC-3)** **NIMs** **Fire Detection and Alarm System** **Glovebox Fire Detection and Alarm System**	**Nuclear Criticality Safety Program** **Event Response Procedures** **Operator Training and Procedures**	FW: High CW: Mod Offsite Public: Neg
OX-28	E-5/ E-1	U	**Building Design (PC-3)** **NIMs** **Fire Detection and Alarm System**	**Nuclear Criticality Safety Program**	FW: High CW: Mod Offsite Public: Neg
DB-4	E-5/E-1	U	**NIMS** **Building Design (PC-3)**	**Nuclear Criticality Safety Program**	FW: High CW: Mod Offsite Public: Neg
TWM-8	E-5/E-1	U	**NIMS** **Building Design (PC-3)** **Fire Detection and Alarm System**	**Nuclear Criticality Safety Program**	FW: High CW: Mod Offsite Public: Neg
TWT-10	E-5/E-1	U	**NIMS** **Building Design (PC-3)** **Fire Detection and Alarm System**	**Nuclear Criticality Safety Program** **Event Response Procedures** **Operator Training and Procedures**	FW: High CW: Mod Offsite Public: Neg
MRS-13	E-5/ E-1	U	**Building Design (PC-3)** **Fire Detection and Alarm System** **NIMS** **Cart Design**	**Nuclear Criticality Safety Program**	FW: High CW: Mod Offsite Public: Neg

Table D-2 Safety Significant Controls

Event Number	Cat	Freq	Design Features	Admin Features	Risk Rank
GE-8	E-6	A	**Standby Power**		FW: High CW: High Offsite Public: High
WS-6	E-6	BEU	**Limited Area Footprint fro Waste Staging Building**		FW: High CW: High Offsite Public: Low
GE-9	E-3	A	**Cart Design** **3013 Container Design**		FW: High CW: High Offsite Public: High
GE-11	E-7	A	**Standby Power**		FW: High CW: High Offsite Public: High
GE-14	E-7	A	**Building Design**		FW: High CW: High Offsite Public: Neg
WS-8	E-7	EU		**Event Response Procedures** **Operator Training and Procedures**	FW: High CW: Low Offsite Public: Neg
WS-9	E-7	U		**Event Response Procedures** **Operator Training and Procedures**	FW: Mod CW: Neg Offsite Public: Neg
WS-10	E-7/ E-1	U		**Event Response Procedures** **Operator Training and Procedures** **Radiological Protection Program** **Waste Management Program**	FW: High CW: Low Offsite Public: Neg
GE-12	E-7/ E-5	**A**	**Building Design (PC-3)** **Glovebox Design (PC-3)** **Material Storage and Configuration Design (PC-3)**		FW: High CW: Mod Offsite Public: Neg
GF-4	E-2	A	**NFPA Design**		FW: High CW: High Offsite Public: High

Table D-2 Safety Significant Controls

Event Number	Cat	Freq	Design Features	Admin Features	Risk Rank
GE-3	E-3	A	**Gas Bottle System Design**		FW: High CW: High Offsite Public: High

Table D-3 Facility Controls

Event Number	Cat	Freq	Design Features	Admin Features	Risk Rank
MRS-1, MRS-2, OX-1	E-1	A	*3013 Container Design*		FW: High CW: High Offsite Public: High
FP-2, FP-7, FP-8, OX-2, OX-11	E-1	U	*3013 Container Design*		FW: High CW: High Offsite Public: High
FP-1	E-1	EU	*3013 Container Design*		FW: High CW: High Offsite Public: High
FP-6, OX-6	E-1	A		*MgO_2*	FW: High CW: High Offsite Public: High
OX-4	E-1	A	*EVS* *Glovebox Fire Detection and Alarm System*	*Event Response Procedures* *Operator Training and Procedures*	FW: Low CW: Neg Offsite Public: Neg
OX-7, OX-8	E-1	A		*Event Response Procedures* *Operator Training and Procedures* *MgO_2*	FW: Low CW: Neg Offsite Public: Neg
OX-9	E-1	A	*EVS* *Glovebox Fire Detection and Alarm System* *Furnace Design*	*Event Response Procedures* *Operator Training and Procedures*	FW: Low CW: Neg Offsite Public: Neg
GF-2, GF-3	E-1	A	*Fire Detection and Alarm System* *EVS*	*Operator Training and Procedure* *Event Response Procedures* *Green Fuel Material Certification*	FW: Low CW: Neg Offsite Public: Neg
WS-1	E-1	A		*Event Response Procedures* *Operator Training and Procedures* *Decon of green fuel DFAs*	FW: High CW: High Offsite Public: Low
MHS-2	E-1	A	*EVS* *Tunnel Design*	*Operator Training and Procedures* *Event Response Procedures*	FW: Low CW: Neg Offsite Public: Neg
VIT-2	E-1	A	*Fire Detection and Alarm System*	*Operator Training and Procedures* *Event Response Procedures*	FW: Low CW: Neg Offsite Public: Neg

Table D-3 Facility Controls

Event Number	Cat	Freq	Design Features	Admin Features	Risk Rank
GF-4	E-1	A		*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: Low Offsite Public: Neg
GE-2, FP-9	E-2	A		*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: High Offsite Public: High
OX-12, OX-13	E-2	EU		*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: High Offsite Public: High
OX-14	E-2	U		*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: High Offsite Public: High
OX-17	E-2	A		*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: Mod Offsite Public: Low
TWM-2	E-2	A		*Event Response Procedures* *Operator Training and Procedures* *Radiological Protection Program*	FW: Mod CW: Low Offsite Public: Neg
WS-2	E-2	A		*Event Response Procedures* *Operator Training and Procedures* *Waste Management Program*	FW: Low CW: Neg Offsite Public: Neg
TWT-3	E-2	A	*TRU Waste Drum, Polybox, and SWB Design (vent)*	*Operator Training and Procedures* *Event Response Procedures*	FW: Mod CW: Low Offsite Public: Neg
TWP-5	E-2	A	*EVS* *Building Design (PC-3)*	*Operator Training and Procedures* *Event Response Procedures* *Radiological Protection Program*	FW: Mod CW: Low Offsite Public: Neg
OX-15	E-2	A	*Glovebox Design (PC-3)* *Inert Ventilation System*	*Event Response Procedures* *Operator Training and Procedures*	FW: Low CW: Neg Offsite Public: Neg
OX-16	E-2	A		*Event Response Procedures* *Operator Training and Procedures*	FW: Low CW: Neg Offsite Public: Neg

Table D-3 Facility Controls

Event Number	Cat	Freq	Design Features	Admin Features	Risk Rank
HVAC-7, HVAC-8	E-2	A	*Building Design (PC-3)* *EVS*	*Event Response Procedures* *Operator Training and Procedures*	FW: Low CW: Neg Offsite Public: Neg
GE-3, GE-9	E-3	A		*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: High Offsite Public: High
FP-10, FP-13, OX-19	E-3	A		*Radiological Protection Program* *Operator Training and Procedures* *Event Response Procedure*	FW: High CW: High Offsite Public: High
FP-11, FP-12, OX-18, OX-20, OX-21	E-3	A		*Radiological Protection Program* *Operator Training and Procedures* *Event Response Procedure*	FW: High CW: Mod Offsite Public: Neg
MHS-4, MHS-5	E-3	A		*Event Response Procedures* *Operator Training and Procedures* *Radiological Protection Program*	FW: High CW: Low Offsite Public: Neg
TWP-9, TWT-7	E-3	A		*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: Low Offsite Public: Neg
GF-6, GF-8, GF-10	E-3	A		*Radiological Protection Program* *Operator Training and Procedures* *Event Response Procedure*	FW: Low CW: Neg Offsite Public: Neg
WS-5	E-3	A		*Operator Training and Procedures* *Event Response Procedure*	FW: Mod CW: Neg Offsite Public: Neg
TWP-10	E-3	A		*Radiological Protection Program* *Operator Training and Procedures* *Event Response Procedure* *Waste Management Program (control MAR)*	FW: Low CW: Neg Offsite Public: Neg
VIT-3	E-3	U		*Radiological Protection Program* *Operator Training and Procedures* *Event Response Procedures*	FW: Low CW: Neg Offsite Public: Neg

Table D-3 Facility Controls

Event Number	Cat	Freq	Design Features	Admin Features	Risk Rank
VIT-4	E-3	U		*Radiological Protection Program* *Operator Training and Procedures* *Event Response Procedures*	FW: Mod CW: Neg Offsite Public: Neg
MIX-3, MIX-4	E-3	A		*Radiological Protection Program* *Operator Training and Procedures* *Event Response Procedures*	FW: Mod CW: Neg Offsite Public: Neg
HVAC-10, HVAC-12	E-3	A	*EVS* *Glovebox Ventilation System*	*Event Response Procedures* *Operator Training and Procedures* *Radiological Protection Program*	FW: Low CW: Neg Offsite Public: Neg
HVAC-13, HVAC-14, HVAC-15, HVAC-17	E-3	A	*EVS*	*Event Response Procedures* *Operator Training and Procedures* *Radiological Protection Program*	FW: Low CW: Neg Offsite Public: Neg
VIT-5	E-3	EU	*Melter Design* *Melter Enclosure* *Limited Volume Water System Design*		FW: Low CW: Neg Offsite Public: Neg
MCL-12, VIT-6	E-4	A		*Event Response Procedures* *Radiological Protection Program* *Operator Training and Procedures*	FW: High CW: Neg Offsite Public: Neg
HVAC-19	E-4	A	*EVS*	*Event Response Procedures* *Operator Training and Procedures* *Radiological Protection Program*	FW: Low CW: Neg Offsite Public: Neg
MIX-5	E-4	A		*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: Neg Offsite Public: Neg
MRS-10, MHS-10, MHS-11, TWP-12	E-4	A		*Operator Training and Procedures* *Event Response Procedures* *Radiological Protection Program*	FW: Low CW: Neg Offsite Public: Neg
MHS-8, MHS-12, OX-23, MCL-11, MCL-13, NDA-4, FP-16	E-4	A		*Radiological Protection Program* *Event Response Procedures* *Operator Training and Procedures*	FW: Mod CW: Neg Offsite Public: Neg

Table D-3 Facility Controls

Event Number	Cat	Freq	Design Features	Admin Features	Risk Rank
BTS-12	E-4	A	*Transport cart design (shielding)* *Remote Handling Design (placed into transport cart remotely)**	*Operator Training and Procedures* *Event Response Procedures* *Radiological Protection Program*	FW: Low CW: Neg Offsite Public: Neg
FP-17, FP-18 , FP-19, OX-24, OX-25, OX-26, OX-27, TWP-13, TWM-7, MHS-13, MHS-14, MHS-15, MHS-16, HVAC-20	E-5	A		*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: Mod Offsite Public: Neg
DB-3	E-5	U	*Fire Protection System Design**	*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: Mod Offsite Public: Neg
MRS-11	E-5	A		*Configuration Management Program* *Event Response Procedures* *Operator Training and Procedures*	FW: High CW: Mod Offsite Public: Neg
MRS-12	E-5	A		*Configuration Management Program* *Event Response Procedures* *Operator Training and Procedures* *Dumbwaiter maintenance*	FW: High CW: Mod Offsite Public: Neg
DB-5, DB-6, MIX-6, GF-11	E-5	U		*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: Mod Offsite Public: Neg
FP-20, MRS-13, OX-28, DB-4	E-5/ E-1	U		*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: Mod Offsite Public: Neg
TWM-8	E-5/ E-1	U		*Fire Protection Program* *Operator Training and Procedures* *Event Response Procedures* *Radiological Protection Program*	FW: High CW: Mod Offsite Public: Neg
TWT-10	E-5/ E-1	U		*Fire Protection Program* *Radiological Protection Program*	FW: High CW: Mod Offsite Public: Neg

Table D-3 Facility Controls

Event Number	Cat	Freq	Design Features	Admin Features	Risk Rank
GE-5, GE-8	E-6	A		*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: High Offsite Public: High
GE-11, GE-13	E-7	A		*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: High Offsite Public: High
GE-15	E-7 / E-1	U		*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: High Offsite Public: High
GE-12	E-7/ E-5	A		*Event Response Procedures* *Operator Training and Procedures*	FW: High CW: Mod Offsite Public: Neg
FESR-1, FESR-2	E-8	A		*Radiological Protection Program* *Operator Training and Procedures* *Event Response Procedures*	FW: Low CW: Neg Offsite Public: Neg

Table D-4 Standard Industrial Hazards

Event Number	Cat	Freq	Design Features	Admin Features	Risk Rank
TWM-9, TWT-11, LWP/T-3	E-6	A		*Operator Training and Procedures* *Event Response Procedures*	FW: Low CW: Neg Offsite Public: Neg
TWM-3, TWT-5, TWP-7	E-2	A	**TRU Waste Drum/SWB/ Polybox Design (vent)**	**Operator Training and Procedures** **Waste Management Program**	FW: High CW: Neg Offsite Public: Neg
TWT-6, TWP-8	E-2	A		**Operator Training and Procedures** **Waste Management Program**	FW: Mod CW: Neg Offsite Public: Neg
TWM-4	E-2	A		*Operator Training and Procedures* *Event Response Procedures*	FW: Mod CW: Neg Offsite Public: Neg
VIT-7	E-4	A		**Operator Training and Procedures** **IH Program**	FW: High CW: Neg Offsite Public: Neg
NDA-5	E-4	A	**Dewar Equipment Design**		FW: High CW: Neg Offsite Public: Neg

APPENDIX E

DESIGN AND ADMINISTRATIVE CONTROLS TABLE

Table E-1 Safety Class Controls

Safety Class Controls	
Design Controls	**Administrative Controls**
Building Design	
3013 Container Design	
Building elevation above flood level	
EVS	

Table E-2 Safety Significant Controls

Safety Significant Controls	
Design Controls	**Administrative Controls**
Can Puncture Device Design	Fire Protection Program
Cart Design	Nuclear Criticality Safety Program
Dumbwaiter Design (fall protection)	Operator Training and Procedures
Fire Detection and Alarm System	Waste Management Program
Glovebox Design (PC-3)	IH Program
Glovebox Fire Detection and Alarm System	Event Response Procedures
Glovebox Ventilation System	Radiological Protection Program
Gas Bottle System Design	Green Fuel Material Certification
TRU Waste Drum/SWB/Polybox Design (vent)	Decontamination for sodium exposed DFAs
Hopper Design	
II/I Design of O/H Transport System	
Inert Ventilation System	
Melter Design	
Melter Enclosure	
Bagless Can Cart Design	
Material Storage and Configuration Design	
SWB (DOT Type A container)	
TRU Waste Drum (DOT Type A container)	
Building Design (Waste Staging elevated storage pad)	

Table E-2 Safety Significant Controls (Continued)

Safety Significant Controls	
Neutron Poison in the Limited Volume Water	
NFPA Design	
NIMS	
Remote Operations	
Shielding Design (Bagless Can Storage)	
Dewar Equipment Design	
Weir Replacement	
Standby Power	
Tunnel Design (remote operations)	
Limited Area Footprint for Waste Staging Building	

Table E-3 Facility Controls

Facility Controls	
Design Controls	**Administrative Controls**
3013 Container Design	Decon of green fuel DFAs
Building Design (PC-3)	Event Response Procedures
EVS	MgO2
Fire Detection and Alarm System	Operator Training and Procedures
Furnace Design	Waste Management Program
Glovebox Design (PC-3)	Radiological Protection Program
Glovebox Fire Detection and Alarm System	Configuration Management Program
Glovebox Ventilation System	Dumbwaiter Maintenance
Inert Ventilation System	Fire Protection Program
Remote Handling Design	Green Fuel Material Certification
Transport Cart Design (shielding)	
TRU Waste Drum, Polybox, and SWB Design (vent)	
Tunnel Design	
Fire Protection System Design	
Melter Design	
Melter Enclosure	
Limited Volume Water System Design	