5.6 DESCRIPTION OF PRINCIPAL STRUCTURES, SYSTEMS, AND COMPONENTS

This section provides a general description of the principal SSCs and their required support systems identified in Section 5.5.2. The identification of principal SSCs and their support systems is based on the analysis presented in Sections 5.4 and 5.5.

5.6.1 Description of Principal SSCs and Required Support Systems

Table 5.6-1 lists the principal SSCs, required support systems, and associated safety functions required to satisfy the performance requirements of 10 CFR §70.61.[1] These support systems are also designated as principal SSCs. The receptors associated with each principal SSC are provided in Section 5.5.2. Principal SSCs are described in the following chapters:

- Chapter 5, Integrated Safety Analysis
- Chapter 6, Nuclear Criticality Safety
- Chapter 7, Fire Protection
- Chapter 8, Chemical Process Safety
- Chapter 10, Environmental Protection
- Chapter 11, Plant Systems
- Chapter 15, Management Measures.

Radiation and environmental protection during normal operation and anticipated occurrences (i.e., non-accident conditions) are related to facility safety and are described in Chapters 9 and 10, respectively.

A reference to the applicable SA section describing the design basis for the principal SSC is provided in Table 5.6-1. The level of detail is consistent with the SA purpose of identifying principal SSCs and required safety functions. Management measures required to ensure the availability and reliability of the listed principal SSCs are described in Chapter 15. More detailed descriptions will be provided in the ISA Summary to satisfy the purpose of demonstrating that IROFS are capable of performing their intended safety functions.

5.6.2 MFFF Administrative Controls

The designation of principal SSCs also includes required administrative controls. Administrative controls are those provisions associated with personnel actions necessary to ensure the safe operation of the MFFF. The MFFF design has placed an emphasis on engineered controls over administrative controls to ensure a high degree of system reliability such that a limited number of administrative controls have been identified as principal SSCs. Required administrative controls are listed in Table 5.6-1 and are identified with an asterisk. A description of each administrative control is provided below.

[1] Table 5.6-1 also lists defense-in-depth SSCs that are not required or credited in the analysis to meet the performance criteria of 10 CFR §70.61.

5.6.2.1 Chemical Safety Controls

Chemical safety controls minimize the likelihood of explosions by ensuring the chemical makeup of the reagents and/or chemical species produced in the AP process are acceptable and that incompatible chemicals are segregated. This program includes both administrative controls and engineering features.

The reagent system chemical safety controls in the reagents building include the following:

1. Use of certified chemicals that have been independently certified prior to delivery to the reagents building for storage and use
2. Preparation of the reagents by utilizing measured quantities of chemicals and solvents
3. Transfer to AP Building (BAP) by the Control Room Operator only if the test results meet reagent chemical composition requirements
4. Chemical preparation conducted by trained personnel in accordance with approved procedures
5. Limiting quantities of materials stored and maintained

These measures ensure that the proper chemicals are delivered to the AP process from the reagents building.

Low usage reagent chemicals, such as manganese nitrate, are prepared in the BAP from aqueous-based reagent grade chemicals with known compositions that are mixed with measured quantities of chemical additives and the aqueous solvent. Before use, however, these prepared reagents undergo redundant testing procedures to ensure chemical composition. Transfer to head tanks or supply tanks by the Control Room Operator occurs only if the test results meet chemical composition requirements.

To ensure that incompatible chemical species do not propagate through the process, the AP process employs sampling measures to detect for incompatible chemical species. The principal SSC chemical safety controls is used to implement this sampling process and it utilizes the following engineering and administrative measures:

1. Isolation of process vessels, as necessary, to ensure a representative sample is obtained and to prevent inadvertent additions after sample is taken and prior to processing of sampled process fluid
2. Acquisition of sufficient number of samples to obtain a representative measurement
3. Redundant testing of samples to ensure chemical composition
4. A means to ensure results of tests performed on samples are correctly conveyed from the laboratory to process unit controller

In addition, chemical safety controls will ensure the chemicals used in the MFFF laboratories are properly controlled; assuring incompatible chemicals are separated/segregated. To establish these incompatibilities for the laboratory and reagents in general, a complete chemical interaction evaluation will be provided as part of the ISA.

As an additional protection feature, the chemicals in the reagents building are physically separated by type (for example, to ensure that oxidizers are not mixed with reducing compounds). Similarly, the nitric oxide (NOx), solvent (diluent with tributylphosphate), and hydroxylamine nitrate (HAN) are prepared in separate rooms to ensure segregation from incompatible chemicals. These measures, in addition to providing control of the chemical makeup of the reagents prior to piping into the BAP, also provide non-safety protection against chemical events in the BRP. Chapter 8 provides more details related to the chemical safety of the MFFF.

5.6.2.2 Combustible Loading Controls

The principal SSC, combustible loading controls, is used to describe the control of combustible and transient combustible loads by design and the control of transient combustible loads during operations. The design limits the combustible loads inherent in the fixtures and equipment within a fire area. The safety function of these administrative controls is to limit the amount of transient combustible material within a fire area to allowable quantities during operations to ensure that the design basis fire is not exceeded. The administrative controls are enhanced by training, posting, routine house-keeping and periodic surveillance. Fire models will be performed as part of the ISA to demonstrate that combustible loading controls are effective. Refer to Section 7.1 for details about the Fire Protection Program.

5.6.2.3 Material Handling Controls

Material handling controls require loads to be handled using safe practices such that the resulting impacts are within the design basis of the container being handled or that impacts do not damage principal SSCs such that they would be unable to perform their safety functions. The design basis for containers (i.e., 3013 canister, 3013 transport cask, MOX fuel transport cask, waste containers) being lifted is discussed in Section 11.4.11. The safety function of the material handling controls is to ensure that primary confinement containers are handled properly such that, if dropped, there would be no release of radioactive material that could cause consequences that exceed 10 CFR §70.61 or that a drop of a load would not damage a principal SSC such that it would not be able to perform its safety function (such as a breach of a primary confinement that could cause consequences that exceed 10 CFR §70.61).

Loads are handled by qualified personnel, following an approved procedure controlling material to be moved, equipment (including specialized lifting fixtures), training, and precautions and limitations for the movement as applicable. Materials that will be handled by operators as part of the normal production process (pre-engineered production lifts) will have the same requirements as any other load. In addition to trained operators and proper procedures, material handling controls will also ensure the proper equipment is used having a sufficient capacity for the type and weight of load being lifted. Controls associated with the safety function of the principal SSC cranes include required testing and surveillance.

5.6.2.4 Material Maintenance and Surveillance Programs

The primary means of preventing corrosion-related failures of principal SSCs is through the use of compatible materials within the MFFF fluid systems and to provide separation and segregation of incompatible chemicals. The safety function of the material maintenance and surveillance programs is to supplement these corrosion prevention measures by establishing programs to detect and limit the damage resulting from corrosion (principally to reduce failures associated with corrosion occurring to laboratory and AP gloveboxes containing corrosive chemicals, confinement ducting, and pneumatic transfer lines).

Material maintenance and surveillance programs consist of periodic system-level walkdowns, as well as non-destructive testing programs that can identify corrosion problems within the facility prior to catastrophic failures occurring, and provide a means of taking corrective actions to prevent such failures. These programs are not required to prevent corrosion which could result in small leaks. The frequency of surveillance and maintenance programs will be established based on industry experience.

5.6.2.5 Process Cell Entry Controls

The safety function of the process cell entry controls is to prevent the entry of personnel into process cells during normal operations and to ensure that workers do not receive a dose in excess of limits while performing maintenance in the process cells. The health physics program for the facility, described in chapter 9, includes process cell access controls during normal operations in order to limit radiation exposures. Work within the process area is performed via radiation work permits that are authorized by radiation protection staff. Work activities within radiation areas are monitored by health physics staff and radiation monitors. Process cells and gloveboxes are sealed during normal operations to avoid personnel exposures to airborne plutonium particulate contamination. Radiation monitors are positioned throughout the facility for fast response to confinement failures. Access to such sealed areas is strictly controlled under the health physics program, which also precludes exposures during accident conditions.

5.6.2.6 Facility Worker Action

Where events are obvious to a facility worker and the worker has time to respond by taking self-protecting action, that action is credited in mitigating radiological or chemical consequences to the worker. Section 5.5 identifies several events that may require facility workers to evacuate the room where an event occurs.

Execution of training/qualification programs and the use of procedures are part of the qualitative demonstration of likelihood with respect to a facility worker's actions to protect themselves (e.g., by evacuation). In such circumstances, the facility worker will be aware of the event, and take appropriate action to minimize radiological or chemical exposures.

Worker actions to take self-protection measures are credited in certain scenarios. Much of the training and procedures that constitute management measures in support of these worker actions are provided under the health physics program. The health physics program is established as good management practice for a facility such as this, and pursuant to 10 CFR 20; it also provides for maintaining exposures ALARA, and provides additional protection features in support of

worker safety. Continuous air radiation monitors are positioned close to work locations and within the ventilation air flow from potential release points. This feature provides additional assurance of an immediate response to a confinement failure. Other fixed air monitors are positioned within the process room for general surveillance. Monitors are designed for extremely high plutonium alpha radiation sensitivity – activity as low as 4 DAC-hours is detected (equivalent to doses in the range of a few millirem). Gloves are routinely surveyed for contamination. Gloves are also replaced frequently to prevent loss of confinement due to glove degradation. All workers are provided with respirators that are designed to filter plutonium particulate. The health physics program, including appropriate training with respect to worker evacuation, the use of respirators, etc., is a management measure that supports the principal SSC of worker actions for self-protection. The health physics program would also control activities associated with the longer-term response to and recovery from events to ensure that exposures are maintained within appropriate limits. The basic elements of the program are summarized in Section 9.2 of the CAR.

5.6.2.7 Laboratory Material Controls

Laboratory material controls consist of administrative procedures that will be used to control the quantity of radiological and chemical materials in the laboratory. The safety function of the laboratory material controls program is to limit the extent of any potential explosion by limiting the quantity of hazardous chemicals that may be involved in the explosion and to limit the quantity of radiological/chemical material available for dispersion following a potential explosion.

Procedures will be developed to establish limits on sample size, the number of samples that may be stored and used in the laboratory overall and in any one laboratory location, and the quantity of chemicals, reagents or other hazardous materials that may be stored and used in a laboratory. Procedures will also be developed to ensure laboratory operations are performed in accordance with safe laboratory operating practices.

5.6.2.8 Hazardous Material Delivery Controls

The safety function of hazardous material delivery controls is to ensure that the quantity of delivered hazardous material and its proximity to the MOX Fuel Fabrication Building structure, Emergency Generator Building structure, and the waste transfer line are controlled to within the bounds of the values used to demonstrate that the consequences of outside explosions are acceptable.

5.6.2.9 Facility Worker Controls

The principal SSC facility worker controls credit the facility worker with taking proper actions prior to commencing an activity that could result in an event with unacceptable dose consequences. This differs from the principal SSC facility worker action where the facility worker is credited with taking self-protective measures to minimize dose consequences as a result of an event. Precautions associated with the radiation protection program (such as the use of a mask) are implemented prior to beginning operations involving, or potentially near to,

primary confinements thereby ensuring the facility worker is protected in case radioactive material is released.

Specifically, in cases where the facility worker is performing a task with transient primary confinements within C3 areas (e.g., during bagout operations), facility worker controls ensure that facility workers take proper actions prior to commencing bag-out operations to prevent and/or limit their dose. Additionally, facility workers take proper actions prior to commencing maintenance activities in AP/MP C3 Areas to prevent and/or limit their exposure.

Similar to facility worker actions, many of the procedures and training that constitute management measures in support of these facility worker controls are provided under the health physics program. These measures provide a basis for the good planning of work tasks associated with the aforementioned activities. The health physics program is established as good management practice for a facility such as this, and pursuant to 10 CFR 20; it also provides for maintaining exposures ALARA, and provides additional protection features in support of worker safety. The basic elements of the program are summarized in Section 9.2 of the CAR.

5.6.3 Sole Principal IROFS

A list identifying IROFS that are the sole item preventing or mitigating an accident sequence whose risk could exceed the performance requirements of 10 CFR §70.61 will be provided in the ISA Summary submitted with the license application for possession and use of SNM.

Tables

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Table 5.6-1. MFFF Principal SSCs

Principal SSC	Safety Function	SA Design Basis Reference
3013 Canister	Withstand the effects of design basis drops without breaching	11.4.11
3013 Transport Cask	Withstand the design basis fire without breaching	11.4.11
	Withstand the effects of design basis drops without release of radioactive material	
Backflow Prevention Features	Prevent process fluids from back-flowing into interfacing systems.	11.8.7
C2 Confinement System Passive Barrier	Limit the dispersion of radioactive material	11.4.11
C3 Confinement System	Provide filtration to mitigate dispersions from the C3 areas	11.4.11
	Remain operable during design basis fire and effectively filter any release	
	Limit the dispersion of radioactive material	
	Provide exhaust to ensure that temperature in the 3013 canister storage structure is maintained within design limits	
	Provide cooling air exhaust from designated electrical rooms	
C4 Confinement System	Provide design features to ensure that final C4 HEPA filters are not impacted by fire	11.4.11
	Maintain a negative glovebox pressure differential between the glovebox and the interfacing systems	
	Maintain minimum inward flow through small glovebox breaches	
	Ensure that C4 exhaust is effectively filtered	
	Operate to ensure that a negative pressure differential exists between the C4 glovebox and the C3 area	
	Contain a chemical release within a glovebox and provide an exhaust path for removal of the chemical vapors	

Table 5.6-1. MFFF Principal SSCs (continued)

Principal SSC	Safety Function	SA Design Basis Reference
Chemical Safety Controls*	Ensure that explosive concentrations of hydrogen peroxide do not occur	5.6.2.1
	Ensure a diluent is used that is not very susceptible to either nitration or radiolysis	
	Ensure that quantities of organics are limited from entering process vessels containing oxidizing agents and at potentially high temperatures	
	Ensure that hydrazoic acid is not accumulated in the process or propagated to units that might lead to explosive conditions	
	Ensure metal azides are not introduced into high temperature process equipment	
	Ensure the sodium azide has been destroyed prior to the transfer of the alkaline waste to the waste recovery unit	
	Ensure the valance of the plutonium prior to oxalic acid addition is not VI	
	Ensure that nitric acid, metal impurities, and HAN concentrations are controlled and maintained to within safety limits	
	Ensure concentrations of HAN, hydrazine nitrate, and hydrazoic acid are controlled to within safety limits	
	Ensure the proper concentration of hydrazine nitrate is introduced into the system	
	Ensure control of the chemical makeup of the reagents and ensure segregation/ separation of vessels/components from incompatible chemicals	

Table 5.6-1. MFFF Principal SSCs (continued)

Principal SSC	Safety Function	SA Design Basis Reference
Combustible Loading Controls*	Limit the quantities of combustibles in the filter area to ensure that the C4 final HEPA filters are not adversely impacted by a filter room fire	5.6.2.2
	Limit the quantity of combustibles in fire areas containing a storage glovebox such that any fire that may occur will not encompass a large fraction of the stored radiological material.	
	Limit the quantity of combustibles in a fire area containing 3013 canisters to ensure that the canisters are not adversely impacted by a fire	
	Limit the quantity of combustibles in a fire area containing 3013 transport casks to ensure that the cask design basis fire is not exceeded	
	Limit the quantity of combustibles in a fire area containing fuel rods to ensure that the fuel rods are not adversely impacted by a fire	
	Limit the quantity of combustibles in a fire area containing MOX fuel transport casks to ensure that the cask design basis fire is not exceeded	
	Limit the quantity of combustibles in a fire area containing transfer containers to ensure that the containers are not adversely impacted by a fire	
	Limit the quantity of combustibles in areas containing the pneumatic transfer system to ensure this system is not adversely impacted	
Criticality Control	Prevent criticality events	6.4
Double-Walled Pipe	Prevent leaks from pipes containing process fluids from leaking into C3 areas	11.8.7

Table 5.6-1. MFFF Principal SSCs (continued)

Principal SSC	Safety Function	SA Design Basis Reference
Emergency AC Power System	Provide AC power to emergency DC system battery charger	11.5.7
	Provide AC power to emergency diesel generator fuel oil system	
	Provide AC power to high depressurization exhaust system	
	Provide AC power to C4 confinement system	
	Provide AC power to emergency control room air-conditioning system	
	Provide AC power to emergency diesel generator ventilation system	
	Provide AC power to emergency control system	
	Provide AC power to seismic monitoring system and seismic isolation valves	
Emergency Control Room Air-Conditioning System	Ensure habitable conditions for operators	11.4.11
Emergency Control System	Provide controls for high depressurization exhaust system	11.6.7
	Provide controls for C4 confinement system	
	Provide controls for emergency control room air-conditioning system	
	Provide controls for emergency AC system	
	Provide controls for emergency DC system	
	Provide controls for emergency generator ventilation system	
	Provide controls for emergency diesel generator fuel oil system	
	Shut down process on loss of power	
	Shut down and isolate process and systems, as necessary, in response to an earthquake	

Table 5.6-1. MFFF Principal SSCs (continued)

Principal SSC	Safety Function	SA Design Basis Reference
Emergency DC Power System	Provide DC power for high depressurization exhaust system	11.5.7
	Provide DC power for C4 confinement system	
	Provide DC power for emergency AC power system controls	
	Provide DC power for emergency control room air-conditioning system	
	Provide DC power for emergency control system	
	Provide DC power for emergency generator ventilation system	
Emergency Generator Building Structure	Maintain structural integrity and prevent damage to internal SSCs from external fires, external explosions, earthquakes, extreme winds, tornadoes, missiles, rain, and snow and ice loadings	11.1.7
Emergency Generator Ventilation System	Provide emergency diesel generator ventilation	11.4.11
Emergency Diesel Generator Fuel Oil System	Provide emergency diesel generator fuel oil for the emergency diesels	11.5
Facility Worker Action*	Ensure that facility worker takes proper action to limit chemical and radiological exposure	5.6.2.6
Facility Worker Controls*	Ensure that facility workers take proper actions prior to bag-out operations to limit radiological exposure.	5.6.2.9
	Ensure that facility workers take proper actions during maintenance activities to limit radiological exposure.	5.6.2.9
Fire Barriers	Contain fires within a single fire area	7.5.3
Fire Detection and Suppression	Support fire barriers as necessary	7.5.3

Table 5.6-1. MFFF Principal SSCs (continued)

Principal SSC	Safety Function	SA Design Basis Reference
Fluid Transport Systems	Ensure that vessels, tanks, and piping are designed to prevent process deviations from creating over-pressurization events	11.8.7
	Withstand as necessary the effects of the DBE such that confinement of radionuclides is maintained	11.8.7
Glovebox	Maintain confinement integrity for design basis impacts	11.4.11
Glovebox Pressure Controls	Maintain glovebox pressure within design limits	11.4.11
Hazardous Material Delivery Controls*	Ensure that the quantity of delivered hazardous material and its proximity to the MOX Fuel Fabrication Building structure, Emergency Generator Building structure, and the waste transfer line are controlled to within the bounds of the values used to demonstrate that the consequences of outside explosions are acceptable.	5.6.2.8
Instrument Air System (Scavenging Air)	Provide sufficient scavenging airflow to dilute the hydrogen produced by radiolysis such that an explosive condition does not occur	11.9.5
Laboratory Material Controls*	Minimize quantities of hazardous chemicals in the laboratory	5.6.2.7
	Minimize quantities of radioactive materials in the laboratory	5.6.2.7
Material Handling Controls*	Ensure proper handling of primary confinement types outside of gloveboxes	5.6.2.3
	Ensure that design basis lift heights of primary confinement types (3013 canister, 3013 transport cask, MOX fuel transport cask, and transfer containers) are not exceeded	
	Prevent load handling activities that could potentially lead to a breach in the final C4 HEPA filters	

Table 5.6-1. MFFF Principal SSCs (continued)

Principal SSC	Safety Function	SA Design Basis Reference
Material Handling Controls*	Prevent impacts to the glovebox during normal operations from loads outside or inside the glovebox that could exceed the glovebox design basis	5.6.2.3
	Prevent load handling events that could breach primary confinements	
Material Handling Equipment	Limit damage to fuel rods/assemblies during handling operations	11.7.7
	Prevent impacts to the glovebox through the use of engineered equipment	
Material Maintenance and Surveillance Programs*	Detect and limit the damage resulting from corrosion	5.6.2.4
MFFF Tornado Dampers	Protect MFFF ventilation systems from differential pressure effects of the tornado	11.4.11
Missile Barriers	Protect MOX Fuel Fabrication Building and Emergency Generator Building internal SSCs from damage caused by tornado- or wind-driven missiles	11.1.7
MOX Fuel Fabrication Building Structure (including vent stack)	Maintain structural integrity and prevent damage to internal SSCs from external fires, external explosions, earthquakes, extreme winds, tornadoes, missiles, rain, and snow and ice loadings	11.1.7
	Withstand the effects of load drops that could potentially impact radiological material	
MOX Fuel Transport Cask	Withstand the design basis fire without breaching	11.4.11
	Withstand the effects of design basis drops without release of radioactive material	
Offgas Treatment System	Provide an exhaust path for the removal of gases in process vessels	11.4.11
Pressure Vessel Controls	Ensure that primary confinements are protected from the impact of pressure vessel failures (bulk gas, breathing air, service air, and instrument air systems)	11.9.5
Process Cells	Contain fluid leaks within process cells	11.4.11

Table 5.6-1. MFFF Principal SSCs (continued)

Principal SSC	Safety Function	SA Design Basis Reference
Process Cell Entry Controls*	Prevent the entry of personnel into process cells during normal operations	5.6.2.5
	Ensure that workers do not receive a radiological or chemical exposure in excess of limits while performing maintenance in the AP process cells	
Process Cell Fire Prevention Features	Ensure that fires in the process cells are highly unlikely	7.5.3
Process Cell Ventilation System Passive Boundary	Provide filtration to limit the dispersion of radioactive material	11.4.11
Process Safety Control Subsystem		System design basis provided in 11.6.7. As necessary, basis for parameters provided as shown
	Prevent the formation of an explosive mixture of hydrogen within the MFFF facility associated with the use of the hydrogen-argon gas	8.5
	Ensure isolation of sintering furnace humidifier water flow on high water level	11.4.11 (See Sintering Furnace)
	Ensure the temperature of solutions containing HAN is limited to temperatures within the safety limits	8.5
	Control the flowrate into the oxidation column	8.5
	Ensure the temperature of solutions containing organic is limited to temperatures within safety limits	8.5
	Limit the residence time of organics in process vessels containing oxidizing agents and potentially exposed to high temperatures and in radiation fields	8.5
	Ensure the temperature of solutions potentially containing hydrazoic acid is limited to prevent an explosive concentration of hydrazoic acid from developing	8.5

Table 5.6-1. MFFF Principal SSCs (continued)

Principal SSC	Safety Function	SA Design Basis Reference
Process Safety Control Subsystem (continued)	Limit and control conditions under which dry-out can occur	8.5
	Ensure the temperature of solutions potentially containing metal azides is insufficient to overcome the activation energy needed to initiate the energetic decomposition of the azide	8.5
	Ensure the normality of the nitric acid is sufficiently high to ensure that the offgas is not flammable and to limit excessive hydrogen production	8.5
	Warn operators of glovebox pressure discrepancies prior to exceeding differential pressure limits	11.4.11
	Shut down process equipment prior to exceeding temperature safety limits	11.4.11
	Ensure the temperature of solutions containing solvents is limited to temperatures within safety limits	8.5
	Ensure the flow rate of nitrogen dioxide/ dinitrogen tetroxide is limited to the oxidation column of the purification cycle	8.5
Seismic Monitoring System and Associated Seismic Isolation Valves	Prevent fire and criticality as a result of an uncontrolled release of hazardous material and water within the MFFF Building in the event of an earthquake	11.6.7 – for system 11.8.7 – for valves
Sintering Furnace	Provide a primary confinement boundary against leaks into C3 areas	11.4.11
Sintering Furnace Pressure Controls	Maintain sintering furnace within design limits	11.4.11
Supply Air System	Provide unconditioned emergency cooling air to the storage vault and designated electrical rooms	11.4.11
Transfer Container	Withstand the effects of design basis drops without breaching	11.4.11

Table 5.6-1. MFFF Principal SSCs (continued)

Principal SSC	Safety Function	SA Design Basis Reference
Waste Containers	Ensure that hydrogen buildup in excess of limits does not occur while providing appropriate confinement of radioactive materials	11.4.11
Waste Transfer Line	Ensure that the waste transfer line is protected from activities taking place outside the MOX Fuel Fabrication Building	10.5
	Prevent damage to the line from external fires, explosions, earthquakes, extreme winds, tornadoes, missiles, rain, and snow and ice loadings	10.5

* Administrative control

5.7 GENERAL SA AND ISA COMMITMENTS

The SA is the first step in the ISA process. In the ISA Summary submitted with the license application for possession and use of SNM, IROFS will be identified. The safety function of each of the IROFS required to satisfy the performance requirements of 10 CFR §70.61 will be included. Methods for conducting the ISA and additional detailed analyses have been discussed previously in this and other chapters. The following sections describe DCS' programmatic commitments for performance and continuation of the ISA process.

5.7.1 Process Safety Information

DCS will maintain written process safety information for the MFFF, which will be used to update the ISA and to identify and understand the hazards associated with the processes. The process safety information will include the following:

- A description of the hazards, including information of the pertinent chemical or physical properties of hazardous materials (e.g., toxicity, acute exposure limits, reactivity, chemical and thermal stability, or other applicable information that would typically be included on Material Safety Data Sheets)
- A description of the equipment used in the process (e.g., information of a general nature on such topics as the materials of construction, piping and instrumentation diagrams, ventilation, design codes and standards employed, material and energy balances, safety systems, interlocks, detection or suppression systems, electrical classification, relief system design, and the design bases)
- A description of the technology of the process (e.g., block flow diagrams or simplified process flow diagrams, a brief outline of the process chemistry, safe upper and lower limits for controlled parameters, and an evaluation of the health and safety consequences of process deviations).

This information is contained in analyses, specifications, drawings, and other documentation that is prepared, reviewed, and approved in accordance with design control and configuration management processes described in Chapter 15.

5.7.2 ISA Updating

To ensure the continued accuracy of the ISA, DCS has made commitments to management measures, such as quality assurance, the configuration management system, and operating procedures. These commitments are contained in Chapter 15 and ensure the timely updating of the ISA. In particular, the ISA will be conducted in accordance with approved QA procedures for performing (and maintaining), reviewing, and approving analyses in accordance with design control procedures, and maintaining associated documentation in accordance with records management procedures. These processes and procedures are controlled under the MPQAP. Organizational responsibilities and administrative policies are given in Chapter 4.

Following issuance of the license for possession and use of SNM:

- DCS will update the ISA Summary annually if changes occur that affect the ISA Summary. Changes in the process safety information or other site or facility changes that may alter the parameters of accident sequences will be evaluated. DCS will revise the ISA using an ISA team with qualifications appropriate for the nature of the change. IROFS and appropriate management measures will be implemented based on the results of the ISA.
- DCS commits to promptly addressing any safety-significant vulnerabilities or unacceptable performance deficiencies identified in the ISA. Whenever the ISA is updated, DCS will take prompt and appropriate actions to address any vulnerabilities that may have been identified. If a proposed change results in a new type of accident sequence or results in a change in the consequences, as defined in 10 CFR §70.61, to an unacceptable level, DCS commits to promptly evaluating the adequacy of existing IROFS and associated management measures and making necessary changes, if required.

5.7.3 Facility Changes

Upon issuance of the license to possess and use SNM, DCS will control facility changes in accordance with the following requirements:

- DCS will implement a configuration management system, as described in Chapter 15, to evaluate, implement, and track each change to the site, structures, processes, systems, equipment, components, computer programs, and activities of personnel. This system will be documented in written procedures. The following will be addressed prior to implementing any change:
  - The technical basis for the change;
  - Impact of the change on safety and health or control of licensed material;
  - Modifications to existing operating procedures including any necessary training or retraining before operation;
  - Authorization requirements for the change;
  - For temporary changes, the approved duration (e.g., expiration date) of the change; and
  - The impacts or modifications to the ISA, ISA Summary, or other safety program information, developed in accordance with 10 CFR §70.62.
- Any change to the site, structures, processes, systems, equipment, components, computer programs, and activities of personnel will be evaluated, as described above, before the change is implemented. The evaluation of the change will determine, before the change is implemented, if an amendment to the license is required to be submitted in accordance with 10 CFR §70.34.
- Pursuant to 10 CFR §70.72, DCS may make changes to the site, structures, processes, systems, equipment, components, computer programs, and activities of personnel, without prior NRC approval, if the change:

- Does not create new types of accident sequences that, unless mitigated or prevented, would exceed the performance requirements of 10 CFR §70.61 and that have not previously been described in the ISA Summary; or
- Does not use new processes, technologies, or control systems for which DCS has no prior experience;
- Does not remove, without at least an equivalent replacement of the safety function, an item relied on for safety that is listed in the ISA Summary;
- Does not alter any item relied on for safety, listed in the ISA Summary, that is the sole item preventing or mitigating an accident sequence that exceeds the performance requirements of 10 CFR §70.61; and
- Is not otherwise prohibited by 10 CFR §70.72, license condition, or order.

- Changes will be communicated to the NRC as follows:
  - For changes that require pre-approval under 10 CFR §70.72, DCS will submit an amendment request to the NRC in accordance with 10 CFR §70.34 and §70.65.
  - For changes that do not require pre-approval under 10 CFR §70.72, DCS will submit to the NRC annually, within 30 days after the end of the calendar year during which the changes occurred, a brief summary of all changes to the records required by 10 CFR §70.62(a)(2).
  - For all changes that affect the ISA Summary, DCS will submit to the NRC annually, within 30 days after the end of the calendar year during which the changes occurred, revised ISA Summary pages.
- If a change covered by 10 CFR §70.72 is made, the affected onsite documentation will be updated promptly.
- DCS will maintain records of changes to its facility carried out under 10 CFR §70.72. These records will include a written evaluation that provides the bases for the determination that the changes do not require prior NRC approval under paragraph (c) or (d) above. These records will be maintained until termination of the license.

Changes to the design prior to issuance of the license to possess and use SNM are discussed in Section 15.2.

5.7.4 Other Commitments

DCS will use personnel with appropriate experience and expertise in engineering and process operations to update the ISA and keep it current. The ISA team for a process will include individuals knowledgeable in ISA methodology and in the operation and hazards of the particular process. The SA team described in Section 5.2 will be supplemented with personnel with such experience as appropriate.

DCS commits to implementing and maintaining IROFS to ensure the required reliability and availability to satisfy the performance requirements of 10 CFR Part 70. The management

measures described in Chapter 15 comprise the principal mechanism by which the reliability and availability of IROFS are ensured.

5.8 REFERENCES

AIChe (American Institute of Chemical Engineers), 1992. *Guidelines for Hazard Evaluation Procedures: With Worked Examples*, 2nd Edition, American Institute of Chemical Engineers, New York, NY

ANSI/ANS (American National Standards Institute/American Nuclear Society), 1983. *Nuclear Criticality Safety in Operations with Fissionable Material Outside Reactors*, ANSI/ANS-8.1, La Grange Park, IL

DOE (U.S. Department of Energy), 1994. *Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities, Volume I – Analysis of Experimental Data*, DOE-HDBK-3010-94, U.S. Department of Energy, Washington, DC, December

EPA (U.S. Environmental Protection Agency), 1989. *Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion*, Federal Guidance Report No. 11, EPA-520/1-88-020, September

NRC (U.S. Nuclear Regulatory Commission), 1972. *Assumptions Used for Evaluating the Potential Radiological Consequences of a Fuel Handling Accident in the Fuel Handling and Storage Facility for Boiling and Pressurized Water Reactors*, Regulatory Guide 1.25, U.S. Nuclear Regulatory Commission, Washington, DC

NRC, 1973. *Design Response Spectra for Seismic Design of Nuclear Power Plants*, Regulatory Guide 1.60, Revision 1, U.S. Nuclear Regulatory Commission, Washington, DC

NRC, 1974. *Assumptions for Evaluating the Habitability of a Nuclear Power Plant Control Room During a Postulated Hazardous Chemical Release*, Regulatory Guide 1.78, U.S. Nuclear Regulatory Commission, Washington, DC

NRC, 1977. *Design Basis Floods for Nuclear Power Plants*, Regulatory Guide 1.59, Revision 2, U.S. Nuclear Regulatory Commission, Washington, DC

NRC, 1978a. *Design, Testing, and Maintenance Criteria for Post Accident Engineered-Safety-Feature Atmosphere Cleanup System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants*, Regulatory Guide 1.52, Revision 2, Office of Standards Development, U.S. Nuclear Regulatory Commission, Washington, DC

NRC, 1978b. *Evaluations of Explosions Postulated to Occur on Transportation Routes Near Nuclear Power Plants*, Regulatory Guide 1.91, U.S. Nuclear Regulatory Commission, Washington, DC

NRC, 1979. *Assumptions Used for Evaluating the Potential Radiological Consequences of Accidental Nuclear Criticality in a Plutonium Processing and Fuel Fabrication Plant*, Regulatory Guide 3.35, U.S. Nuclear Regulatory Commission, Washington, DC

NRC, 1981. NUREG-0800, Standard Review Plan, SRP 2.2.1-2.2.2, "Identification of Potential Hazards in Site Vicinity," U.S. Nuclear Regulatory Commission, Washington, DC, July

NRC, 1992. *Methods for External Event Screening Quantification: Risk Methods Integration and Evaluation Program (RMIEP) Methods Development*, NUREG/CR-4839, SAND87-7156, U.S. Nuclear Regulatory Commission, Washington, DC

NRC, 1997. *Atmospheric Relative Concentrations in Building Wakes, Rev. 1*, NUREG/CR-6331, PNNL-10521, U.S. Nuclear Regulatory Commission, Washington, DC

NRC, 1998a. *Code Manual for MACCS2: Volume 1, User's Guide*, NUREG/CR-6613, SAND97-0594, U.S. Nuclear Regulatory Commission, Washington, DC

NRC, 1998b. *Nuclear Fuel Cycle Facility Accident Analysis Handbook*, REG/CR-6410, U.S. Nuclear Regulatory Commission, Washington, DC

NRC, 1998c. *Nuclear Criticality Safety Standards for Fuels and Material Facilities*, Regulatory Guide 3.71, U.S. Nuclear Regulatory Commission, Washington, DC

NRC, 1999. *Integrated Safety Analysis Guidance Document*, Draft NUREG-1513, U.S. Nuclear Regulatory Commission, Washington, DC

SAND (Sandia National Laboratories), 1981. *Transportation Accident Scenarios for Commercial Spent Fuel*, SAND80-2124, TTC-0156 UC-71, By E.L. Wilmot, Sandia National Laboratories, Albuquerque, NM

SAND, 1987. *Site Characterization Plan Conceptual Design Report, Vol. 4*, SAND84-2641, By H.R. MacDougall, L.W. Scully, and J.R. Tillerson, Nevada Nuclear Waste Storage Investigations Department, Sandia National Laboratories, Albuquerque, NM

SAND, 1991. *Effects of a Potential Drop of a Shipping Cask, a Waste Container, and a Bare Fuel Assembly During Waste-Handling Operations*, SAND87-7082, UC-814, By C.L. Wu, J. Lee, D.L. Wu, and L.J. Jardine, San Francisco, CA

Appendix 5A Tables

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Table 5A-1. Unmitigated Event Description - Example

Event Type/ Workshop or Location/ Event Number	Unmitigated Event Description/ Specific Location/ Hazard Sources	Cause
Event type: fire, explosion, dispersion of radioactive material, etc. Applicable Workshop or Support Group: Aqueous Polishing, Powder, Pellet, etc. Alphanumeric event number. Event type designator: E-1 through E-9.	Description of unmitigated event including equipment, effects of event and applicable hazardous materials, without application of principal SSCs. Specific Location: Specific process unit(s) in which event may occur. Mode: Applicable facility operating mode. Normal Operation, Startup, Short Shutdown, Long Shutdown, All Hazard Sources: Hazardous material involved in event, radioactive or hazardous chemical	Event cause

Table 5A-2. Unmitigated Events, Aqueous Polishing

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Internal Fire Aqueous Polishing AP-1 E-1	A fire involving the AP Calcining Furnace results in an energetic breach of the AP Calcining Furnace Glovebox and the dispersal of radiological materials. Specific Location: AP-Precipitation-Filtration-Oxidation (Calcining Furnace Glovebox) Mode: Normal Operation Hazard Sources: Radiological Material (maximum inventory in AP Calcining Furnace)	1. Oxygen line leak or break and high temperature ignition source
Internal Fire Aqueous Polishing AP-2 E-1	A solvent fire involving AP Glovebox results in an energetic breach of the AP Glovebox and the dispersal of radiological materials. Specific Location: AP-Solvent recovery AP-Purification cycle AP-Sampling Mode: All Hazard Sources: Radiological Material (maximum inventory in fire area)	1. Temperature of solvent above flashpoint and ignition source

Table 5A-2. Unmitigated Events, Aqueous Polishing (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Internal Fire Aqueous Polishing AP-3 E-1	A solvent fire involving AP vessels, tanks and piping in AP Process Cell results in an energetic breach of the AP vessels, tanks and piping and the dispersal of radiological materials. Specific Location: AP-Solvent recovery AP-Purification cycle AP-Liquid Waste Reception Mode: All Hazard Sources: Radiological Material (maximum inventory in AP Process Cell including inventory in AP vessels, tanks and piping)	1. Temperature of solvent above flashpoint and ignition source
Internal Fire Aqueous Polishing AP-4 E-1	A fire involving AP vessels, tanks and piping and combustible material in AP Process Cell results in an energetic breach of the AP vessels, tanks and piping and the dispersal of radiological materials. Specific Location: AP-Solvent recovery AP-Precipitation-Filtration-Oxidation AP-Sampling AP-Oxalic mother liquors recovery AP-Off gas treatment AP-Liquid waste reception AP-Dissolution AP-Dissolution of chlorinated feed AP-Acid recovery AP-Purification cycle Mode: All Hazard Sources: Radiological Material (maximum inventory in AP Process Cell including inventory in AP vessels, tanks and piping)	1. Combustible material and ignition source

Table 5A-2. Unmitigated Events, Aqueous Polishing (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Internal Fire Aqueous Polishing AP-40 E-1	A fire involving combustible materials and a tank containing raffinates in AP Process Cell results in an energetic breach of the AP vessels, tanks and piping and the dispersal of radiological materials. Specific Location: AP-Acid recovery AP-Purification cycle AP-Liquid Waste Reception Mode: All Hazard Sources: Radiological Material (maximum inventory in raffinates tank in AP Process Cell)	1. Combustible material and ignition source
Internal Fire Aqueous Polishing AP-5 E-1	All Internal Fire events for MFFF-Gloveboxes apply to Aqueous Polishing, as far as description and causes are concerned, and are bounding in terms of consequences. (Refer to MFFF Gloveboxes, Events GB-1 and GB-2) Specific Location: AP-Acid recovery AP-Solvent recovery AP-PuO2 Decanning AP-Recanning AP-Pre-polishing Milling AP-PuO2 Canning AP-Precipitation-Filtration-Oxidation AP-Homogenization-Sampling AP-Dissolution AP-Dissolution of chlorinated feed AP-Purification cycle AP-Sampling AP-Oxalic mother liquors recovery AP-Liquid Waste Reception Mode: All Hazard Sources: Radiological Material (maximum inventory in AP glovebox)	

Table 5A-2. Unmitigated Events, Aqueous Polishing (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Explosion Aqueous Polishing AP-6 E-2	Radiolysis induced hydrogen buildup in the vapor space of an AP vessel, tank or piping (in AP process cell or glovebox) results in a hydrogen explosion (given an ignition source), an energetic breach of the AP vessel, tank or piping, and the dispersal of radiological materials. Specific Location: AP-PuO2 Decanning AP-Solvent recovery AP-Precipitation-Filtration-Oxidation AP-Oxalic mother liquors recovery AP-Dissolution AP-Dissolution of chlorinated feed AP-Purification cycle Mode: All Hazard Sources: Radiological Material (maximum inventory in AP vessel)	1. Loss of normal dilution air flow 2. Loss of offgas exhaust flow
Explosion Aqueous Polishing AP-41 E-2	Radiolysis induced hydrogen buildup in the vapor space of a raffinates tank (in AP process cell) results in a hydrogen explosion (given an ignition source), an energetic breach of the AP vessel, tank or piping, and the dispersal of radiological materials. Specific Location: AP-Acid recovery AP-Purification cycle AP-Liquid Waste Reception Mode: All Hazard Sources: Radiological Material (maximum inventory in raffinates tank in AP Process Cell)	1. Loss of normal dilution air flow 2. Loss of offgas exhaust flow

Table 5A-2. Unmitigated Events, Aqueous Polishing (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Explosion AP-7 E-2	A process-related chemical over-pressurization involving flammable, explosive, or reactive chemicals in AP vessels, tanks and piping (in AP process cell or glovebox) results in an energetic breach of the AP vessels, tanks and piping and the Dispersal of Nuclear Materials. Specific Location: AP-Solvent recovery AP-Precipitation-Filtration-Oxidation AP-Homogenization-Sampling AP-Oxalic mother liquors recovery AP-Off gas treatment AP-Liquid waste reception AP-Dissolution AP-Dissolution of chlorinated feed AP-Uranium Dissolution AP-Acid recovery AP-Purification cycle Mode: All Hazard Sources: Radiological Material (maximum inventory in AP vessels, tanks and piping)	1. Corrosive chemicals interact with vessels/piping/associated equipment 2. Incorrect chemical handling 3. Incorrect reagent preparation 4. Temperature of chemical(s) above flashpoint 5. Hydrogen or other explosive gas released due to incompatible chemical addition errors 6. Explosive gas and electrical short 7. Explosive gas and unknown ignition source
Explosion Aqueous Polishing AP-8 E-2	A process-related chemical explosion involving HAN/Nitric Acid in AP vessels, tanks and piping (in AP process cell or glovebox) results in an energetic breach of the AP vessels, tanks and piping and the Loss of Confinement / Dispersal of Nuclear Materials. Specific Location: AP-Purification cycle AP-Precipitation-Filtration-Oxidation AP-Solvent Recovery AP-Acid Recovery AP-Oxalic Mother Liquors Recovery Mode: All Hazard Sources: Radiological Material (maximum inventory in AP vessels, tanks and piping)	1. Incorrect or excessive chemical addition 2. Incorrect or excessive chemical addition and failure to perform required sampling of AP solutions 3. Incorrect reagent preparation 4. Reagent concentration due to evaporation 5. Explosive gas and electrical short 6. Explosive gas and unknown ignition source

Table 5A-2. Unmitigated Events, Aqueous Polishing (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Explosion Aqueous Polishing AP-9 E-2	A process-related chemical explosion involving hydrazoic acid in AP vessels, tanks and piping (in AP process cell or glovebox) results in an energetic breach of the AP vessels, tanks and piping and the Loss of Confinement / Dispersal of Nuclear Materials. Specific Location: AP-Purification cycle AP-Solvent Recovery AP-Precipitation-Filtration-Oxidation AP-Off gas treatment AP-Oxalic Mother Liquors Recovery Mode: All Hazard Sources: Radiological Material (maximum inventory in AP vessels, tanks and piping)	1. Incorrect or excessive chemical addition 2. Incorrect or excessive chemical addition and failure to perform required sampling of AP solutions 3. Incorrect reagent preparation 4. Temperature of chemical(s) above flashpoint 5. Explosive gas and electrical short 6. Explosive gas and unknown ignition source
Explosion Aqueous Polishing AP-20 E-2	Over-pressurization involving AP vessels, tanks and piping (i.e., evaporator or boiler) inside an AP Process Cell results in an energetic breach of the AP vessels, tanks and piping, and the dispersal of radiological materials. Specific Location: AP-Oxalic mother liquors recovery AP-Acid recovery Mode: Normal Operation Hazard Sources: Radiological Material (maximum inventory in evaporator in AP Process Cell)	1. Control system failure

Table 5A-2. Unmitigated Events, Aqueous Polishing (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Explosion Aqueous Polishing AP-37 E-2	A process-related chemical explosion involving hydrogen peroxide (in AP process cell or glovebox) in AP vessels, tanks and piping results in an energetic breach of the AP vessels, tanks and piping and the Loss of Confinement / Dispersal of Nuclear Materials. Specific Location: AP-Dissolution AP-Dissolution of chlorinated feed Mode: All Hazard Sources: Radiological Material (maximum inventory in AP vessels, tanks and piping)	1. Human error or equipment failure
Explosion Aqueous Polishing AP-38 E-2	A process-related chemical explosion involving solvents in AP vessels, tanks and piping (in AP process cell or glovebox) results in an energetic breach of the AP vessels, tanks and piping and the Loss of Confinement / Dispersal of Nuclear Materials. Specific Location: AP-Purification cycle AP-Solvent recovery AP-Liquid Waste Reception Mode: All Hazard Sources: Radiological Material (maximum inventory in AP vessels, tanks and piping)	1. Explosive concentration of solvent vapors in a confined space with an ignition source

Table 5A-2. Unmitigated Events, Aqueous Polishing (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Explosion Aqueous Polishing AP-39 E-2	A process-related chemical explosion involving red oil formation (nitrates or nitric acid solutions of heavy metals and TBP at temperatures in excess of 135 C) in AP boiler, vessel, or tank (in AP process cell or glovebox) results in an energetic breach of the AP boiler, vessel, or tank and the Loss of Confinement / Dispersal of Nuclear Materials. Specific Location: AP-Purification cycle AP-Solvent recovery AP-Acid recovery AP-Liquid Waste Reception AP-Precipitation-Filtration-Oxidation AP-Oxalic mother liquors recovery Mode: All Hazard Sources: Radiological Material (maximum inventory in AP vessels, tanks and piping)	1. Temperature above 135 C in boiler, vessel, or tank and presence of nitrates or nitric acid solutions of heavy metals and TBP
Explosion Aqueous Polishing AP-44 E-2	A process-related chemical explosion involving an azide (other than hydrazoic acid) in an AP boiler, vessel, or tank (in an AP cell or glovebox) results in an energetic breach of the AP boiler, vessel, or tank and the Loss of Confinement / Dispersal of Nuclear Materials. Specific Location: AP-Purification cycle AP-Solvent recovery AP-Liquid Waste Reception Mode: All Hazard Sources: Radiological Material (maximum inventory in AP vessels, tanks and piping)	1. Temperature above 135 C in boiler, vessel, or tank and presence of azide solutions.

Table 5A-2. Unmitigated Events, Aqueous Polishing (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Explosion Aqueous Polishing AP-47 E-2	Electrolysis-induced hydrogen buildup in the vapor space of an electrolyzer results in a hydrogen explosion and the dispersal of radiological materials. Specific Location: AP-Dissolution AP-Dissolution of chlorinated feed Mode: All Hazard Sources: Radiological Material (maximum inventory in AP vessels, tanks and piping)	1. Incorrect chemical handling 2. Incorrect reagent preparation 3. Hydrogen or other explosive gas released due to incompatible chemical addition errors 4. Explosive gas and electrical short 5. Explosive gas and unknown ignition source
Explosion Aqueous Polishing AP-48 E-2	A process-related chemical explosion involving plutonium (VI) in the calcining furnace results in an energetic breach of the furnace and glovebox and the dispersal of radiological materials. Specific Location: AP-Precipitation-Filtration-Oxidation Mode: All Hazard Sources: Radiological Material (maximum inventory in AP vessels, tanks and piping)	1. Incorrect chemical handling 2. Incorrect reagent preparation 3. Hydrogen or other explosive gas released due to incompatible chemical addition errors 4. Explosive gas and electrical short 5. Explosive gas and unknown ignition source
Explosion Aqueous Polishing AP-49 E-2	A process-related chemical explosion involving liquid addition to the calcining furnace results in an energetic breach of the furnace and glovebox and the dispersal of radiological materials. Specific Location: AP-Precipitation-Filtration-Oxidation Mode: All Hazard Sources: Radiological Material (maximum inventory in AP vessels, tanks and piping)	1. Corrosive chemicals interact with vessels/piping/ associated equipment 2. Incorrect chemical handling 3. Incorrect reagent preparation 4. Temperature of chemical(s) above flashpoint 5. Hydrogen or other explosive gas released due to incompatible chemical addition errors 6. Explosive gas and electrical short 7. Explosive gas and unknown ignition source

Table 5A-2. Unmitigated Events, Aqueous Polishing (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Loss of Confinement / Dispersal of Nuclear Material Aqueous Polishing AP-10 E-3	Excessive temperature of AP Calcining Furnace results in high temperature damage to and breach of the AP Calcining Furnace Glovebox and the dispersal of radiological materials. Specific Location: AP-Precipitation-Filtration-Oxidation (Calcining Furnace Glovebox) Mode: Normal Operation Hazard Sources: Radiological Material (maximum inventory in AP Calcining Furnace Glovebox)	1. Control system failure 2. Loss of cooling of process equipment by glovebox ventilation
Loss of Confinement / Dispersal of Nuclear Material Aqueous Polishing AP-11 E-3	Excessive temperature of AP Electrolyzer results in high temperature damage to and breach of the AP Electrolyzer and damage to the glovebox panels and the dispersal of radiological materials. Specific Location: AP-Dissolution (Electrolyzer Glovebox) AP-Dissolution of chlorinated feed Mode: Normal Operation Hazard Sources: Radiological Material (maximum inventory in AP Electrolyzer Glovebox)	1. Control system failure 2. Electric isolation failure 3. Loss of cooling to process equipment

Table 5A-2. Unmitigated Events, Aqueous Polishing (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Loss of Confinement / Dispersal of Nuclear Material Aqueous Polishing AP-12 E-3	Corrosion of an AP Glovebox by corrosive chemicals results in a breach (i.e., material failure) of glovebox confinement and dispersal of radiological materials. Specific Location: AP-Acid recovery AP-Solvent recovery AP-Precipitation-Filtration-Oxidation AP-Sampling AP-Dissolution AP-Dissolution of chlorinated feed AP-Purification cycle AP-Oxalic mother liquors recovery AP-Liquid Waste Reception Mode: All Hazard Sources: Radiological Material (maximum inventory in AP glovebox)	1. Corrosive chemicals interact with AP glovebox leading to failure
Loss of Confinement / Dispersal of Nuclear Material Aqueous Polishing AP-13 E-3	Back-flow from the AP Calcining Furnace through a nitrogen or oxygen supply line to an interfacing system followed by the opening of this interfacing system (during operation or maintenance) results in a breach of glovebox primary confinement and dispersal of radiological materials to areas where workers might be present. Specific Location: AP-Precipitation-Filtration-Oxidation (Calcining Furnace Glovebox) Mode: All Hazard Sources: Radiological Material (maximum inventory in AP Calcining Furnace)	1. Loss of gas flow through the supply line and failure of pipes and valves

Table 5A-2. Unmitigated Events, Aqueous Polishing (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Loss of Confinement / Dispersal of Nuclear Material Aqueous Polishing AP-14 E-3	Back-flow from AP vessels, tanks and piping through a supply line (e.g., compressed air, bubbler transmitter line) to an interfacing system followed by the opening of this interfacing system (during operation or maintenance) results in a breach of primary confinement and dispersal of radiological materials to areas where workers might be present. Specific Location: AP-PuO2 Decanning AP-PuO2 Canning AP-Solvent recovery AP-Precipitation-Filtration-Oxidation AP-Homogenization-Sampling AP-Oxalic mother liquors recovery AP-Off gas treatment AP-Liquid waste reception AP-Dissolution AP-Dissolution of chlorinated feed AP-Uranium Dissolution AP-Acid recovery AP-Purification cycle AP-Sampling Mode: All Hazard Sources: Radiological Material (maximum inventory in AP vessel, tank or piping)	1. Loss of gas flow through the supply line and failure of pipes and valves

Table 5A-2. Unmitigated Events, Aqueous Polishing (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Loss of Confinement / Dispersal of Nuclear Material Aqueous Polishing AP-16 E-3	A break or leakage in AP vessels, tanks and piping within AP Process Cell results in a breach of confinement, and the dispersal of radiological materials. Specific Location: AP-Solvent recovery AP-Precipitation-Filtration-Oxidation AP-Oxalic mother liquors recovery AP-Off gas treatment AP-Liquid waste reception AP-Dissolution AP-Dissolution of chlorinated feed AP-Acid recovery AP-Purification cycle Mode: All Hazard Sources: Radiological Material (maximum inventory in the effected equipment in AP Process Cell)	1. Corrosion of AP vessels, tanks and piping 2. Mechanical failure of AP vessels, tanks and piping
Loss of Confinement / Dispersal of Nuclear Material Aqueous Polishing AP-42 E-3	A break or leakage of a raffinates tank in an AP Process Cell results in a breach of confinement, and the dispersal of radiological materials. Specific Location: AP-Acid recovery AP-Purification cycle AP-Liquid Waste Reception Mode: All Hazard Sources: Radiological Material (maximum inventory in raffinates tank in AP Process Cell)	1. Corrosion of raffinates tank 2. Mechanical failure of raffinates tank
Loss of Confinement / Dispersal of Nuclear Material Aqueous Polishing AP-46 E-3	Excessive temperature (due to decay heat) of PuO2 Buffer Storage Unit (powder storage area). Specific Location: AP-Pre-Polishing Milling Storage Mode: All Hazard Sources: Radiological Material (maximum inventory in buffer storage unit)	1. Loss or blockage of HVAC cooling system 2. Loss of power to HVAC cooling system

Table 5A-2. Unmitigated Events, Aqueous Polishing (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Loss of Confinement / Dispersal of Nuclear Material Aqueous Polishing AP-17 E-3	Back-flow from AP vessels, tanks and piping through a liquid supply line (e.g., steam or condensate lines, acid recovery line, hot water lines) to an interfacing system results in a breach of confinement (i.e., leakage into an interfacing system) and dispersal of radiological materials. Specific Location: AP-Precipitation-Filtration-Oxidation AP-Oxalic mother liquors recovery AP-Off gas treatment AP-Liquid waste reception AP-Dissolution AP-Dissolution of chlorinated feed AP-Uranium Dissolution AP-Acid recovery AP-Sampling Mode: All Hazard Sources: Radiological Material (maximum inventory in AP vessel, tank or piping)	1. Loss of liquid flow through the supply line and failure of pipes and valves
Loss of Confinement / Dispersal of Nuclear Material Aqueous Polishing AP-18 E-3	Back-flow from AP vessels, tanks and piping through a reagent supply line to an interfacing system followed by the opening of this interfacing system (during operation or maintenance) results in a breach of confinement and dispersal of radiological materials to areas where workers might be present. Specific Location: AP-Reagents AP-Solvent recovery AP-Precipitation-Filtration-Oxidation AP-Oxalic mother liquors recovery AP-Off gas treatment AP-Liquid waste reception AP-Dissolution AP-Dissolution of chlorinated feed AP-Uranium Dissolution AP-Acid recovery AP-Purification cycle Mode: All Hazard Sources: Radiological Material (maximum inventory in AP vessel, tank or piping)	1. Loss of gas or liquid flow through the supply line and failure of pipes and valves

Table 5A-2. Unmitigated Events, Aqueous Polishing (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Loss of Confinement / Dispersal of Nuclear Material Aqueous Polishing AP-21 E-3	A loss of exhaust flow involving the Off-Gas Process Confinement System for AP vessels, tanks and piping results in degraded performance of the off-gas system (affecting both AP process cells and AP gloveboxes). Specific Location: AP-Solvent recovery AP-Precipitation-Filtration-Oxidation AP-Homogenization-Sampling AP-Oxalic mother liquors recovery AP-Off gas treatment AP-Liquid waste reception AP-Dissolution AP-Dissolution of chlorinated feed AP-Uranium Dissolution AP-Acid recovery AP-Purification cycle Mode: Normal Operation Hazard Sources: Radiological Material (maximum inventory in single AP vessel)	1. Loss of normal electrical power 2. Mechanical failure of off-gas exhaust fans
Loss of Confinement / Dispersal of Nuclear Material Aqueous Polishing AP-22 E-3	Internal Flood due to a leak or rupture of cooling water pipes to an AP electrolyzer results in breach of the AP electrolyzer glovebox and the dispersal of radiological materials. Specific Location: AP-Dissolution AP-Dissolution of chlorinated feed Mode: Normal Operation Hazard Sources: Radiological Material (maximum inventory in AP Electrolyzer Glovebox)	1. Corrosive chemicals interact with cooling water piping

Table 5A-2. Unmitigated Events, Aqueous Polishing (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Loss of Confinement / Dispersal of Nuclear Material Aqueous Polishing AP-23 E-3	All Loss of Confinement / Dispersal of Nuclear Material events for MFFF-Gloveboxes apply to Aqueous Polishing, as far as description and causes are concerned, and are bounding in terms of consequences. (Refer to MFFF Gloveboxes Events GB-3 through GB-7 and GB-11) Specific Location: AP-Acid recovery AP-Solvent recovery AP-PuO2 Decanning AP-Recanning AP-Pre-polishing Milling AP-PuO2 Canning AP-Precipitation-Filtration-Oxidation AP-Homogenization-Sampling AP-Dissolution AP-Dissolution of chlorinated feed AP-Purification cycle AP-Oxalic mother liquors recovery AP-Liquid Waste Reception Mode: All Hazard Sources: Radiological Material (maximum inventory in AP glovebox)	
Loss of Confinement / Dispersal of Nuclear Material Aqueous Polishing AP-50 E-3	A leak outside of a glovebox in piping results in a release of radioactive material inside a room with C-3 ventilation. Specific Location: AP-Precipitation-Filtration-Oxidation Mode: Normal Operation Hazard Sources: Radiological Material (maximum inventory in single AP vessel)	1. Corrosive chemicals interact with piping 2. Mechanical failure of AP piping.

Table 5A-2. Unmitigated Events, Aqueous Polishing (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
External Exposure Aqueous Polishing AP-24 E-4	Operator is inadvertently exposed to excessive direct radiation in Aqueous Polishing resulting in excessive radiation exposure. Specific Location: Aqueous Polishing Mode: All Hazard Sources: Maximum Direct Radiation Source	1. Exposure due to unintended radioactive material buildup 2. Unplanned or unintended access to High Radiation Area 3. Human error or equipment failure
Criticality Aqueous Polishing AP-25 E-5	Re-configuration of fissile material potentially results in nuclear criticality and the release of radiological material. Specific Location: Aqueous Polishing Mode: All Hazard Sources: Fissile and Radiological Material	1. Excessive quantity of fissile material is accumulated in process unit 2. Incorrect sample analysis 3. Inadvertent concentration of process solution 4. Human error or equipment failure 5. Change in geometry of process unit 6. Internal flooding of process unit.
Load Handling Aqueous Polishing AP-36 E-6	A break or leakage in AP vessels, tanks and piping within an AP Glovebox results in a breach of confinement, and the dispersal of radiological materials. Specific Location: AP-Acid recovery AP-Solvent recovery AP-Precipitation-Filtration-Oxidation AP-Homogenization-Sampling AP-Dissolution AP-Dissolution of chlorinated feed AP-Purification cycle AP-Oxalic mother liquors recovery AP-Liquid Waste Reception Mode: All Hazard Sources: Radiological Material (maximum inventory in AP glovebox including inventory in AP vessels, tanks and piping)	1. Human error or equipment failure during load handling operations inside a glovebox

Table 5A-2. Unmitigated Events, Aqueous Polishing (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Load Handling Aqueous Polishing AP-26 E-6	All Load Handling events for MFFF-Gloveboxes apply to Aqueous Polishing, as far as description and causes are concerned, and are bounding in terms of consequences. (Refer to MFFF Gloveboxes Events GB-8 through GB-10) Specific Location: AP-Acid recovery AP-Solvent recovery AP-PuO2 Decanning AP-Recanning AP-Pre-polishing Milling AP-PuO2 Canning AP-Precipitation-Filtration-Oxidation AP-Homogenization-Sampling AP-Dissolution AP-Dissolution of chlorinated feed AP-Purification cycle AP-Oxalic mother liquors recovery AP-Liquid Waste Reception Mode: All Hazard Sources: Radiological Material (maximum inventory in glovebox)	
Load Handling Aqueous Polishing AP-27 E-6	A Load Handling event involving miscellaneous load handling devices and AP vessels, tanks, and piping within an AP Process Cell results in a dispersal of radiological materials. Specific Location: AP-Solvent recovery AP-Precipitation-Filtration-Oxidation AP-Oxalic mother liquors recovery AP-Off gas treatment AP-Liquid waste reception AP-Dissolution AP-Dissolution of chlorinated feed AP-Acid recovery AP-Purification cycle Mode: All Hazard Sources: Radiological Material (maximum inventory in AP Process Cell – dissolution - including inventory in AP vessels, tanks and piping)	1. Human error or equipment failure during maintenance activities

Table 5A-2. Unmitigated Events, Aqueous Polishing (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Load Handling Aqueous Polishing AP-43 E-6	A Load Handling event involving miscellaneous load handling devices and a raffinates tank in an AP Process Cell results in a dispersal of radiological materials. Specific Location: AP-Acid recovery AP-Purification cycle AP-Liquid Waste Reception Mode: All Hazard Sources: Radiological Material (maximum inventory in raffinates tank in AP Process Cell)	1. Human error or equipment failure during maintenance activities
Chemical Aqueous Polishing AP-28 E-7	A chemical release due to fire in a C2 Area (e.g., Reagents rooms) involving flammable or reactive chemicals in AP vessels, tanks and piping results in a chemical release with potential impact on the worker and on control area habitability. Specific Location: AP-Reagents Mode: All Hazard Sources: Hazardous Chemicals	1. Ignition of combustible material by electrical equipment (e.g., spark) 2. Incorrect reagent addition and subsequent reaction 3. Other causes for ignition
Chemical Aqueous Polishing AP-30 E-7	A break or leakage in AP vessels, tanks and piping in C2 Areas results in a chemical release with potential impact on the worker and on control area habitability. Specific Location: AP-Reagents Mode: All Hazard Sources: Hazardous Chemicals	1. Mechanical failure of AP vessels, tanks and piping 2. Corrosive failure of AP vessels, tanks and piping

Table 5A-2. Unmitigated Events, Aqueous Polishing (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Chemical Aqueous Polishing AP-31 E-7	A loss of tank venting in AP vessels, tanks and piping in C2 Areas results in a chemical release with potential impact on the worker and on control area habitability. Specific Location: AP-Reagents Mode: All Hazard Sources: Hazardous Chemicals	1. Mechanical failure of ventilation system
Chemical Aqueous Polishing AP-32 E-7	Excessive temperature (due to chemical reaction) involving AP vessels, tanks and piping in C2 Areas results in a chemical release with potential impact on the worker and on control area habitability. Specific Location: AP-Reagents Mode: Normal Operation, Startup Hazard Sources: Hazardous Chemicals	1. Incorrect reagent addition
Chemical Aqueous Polishing AP-33 E-7	Pressure higher than the design pressure of tank venting in AP vessels, tanks and piping in C2 Areas results in a chemical release with potential impact on the worker and on control area habitability. Specific Location: AP-Reagents Mode: Normal Operation, Startup Hazard Sources: Hazardous Chemicals	1. Pressurizing chemical reaction 2. Pressurizing steam injection

Table 5A-2. Unmitigated Events, Aqueous Polishing (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Chemical Aqueous Polishing AP-45 E-7	A break or leakage in AP vessels, tanks and piping results in a release of chemical by-products. Specific Location: Aqueous Polishing Mode: All Hazard Sources: Chemical by-products	1. Mechanical failure of AP vessels, tanks and piping. 2. Corrosive failure of AP vessels, tanks and piping.
External Events AP-34 E-8	See external events at the end of the hazard evaluation table.	
Natural Phenomena AP-35 E-9	See natural phenomena events at the end of the hazard evaluation table.	

Table 5A-3. Unmitigated Events, Receiving Workshop

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Internal Fire MFFF-Receiving Workshop RC-1 E-1	Fire (due to transient combustibles, electrical equipment, etc.) affects C2 Storage Area (powder storage area) and results in an energetic breach of powder cans and dispersal of radiological materials from the powder storage area. Specific Location: PuO2 3013 Storage Unit PuO2 Receiving Unit Mode: All Hazard Sources: Radiological Material (maximum inventory in powder storage area)	1. Ignition of transient combustible material 2. Combustibles and unknown ignition source
Internal Fire MFFF-Receiving Workshop RC-2 E-1	Fire (due to transient combustibles, electrical equipment, etc.) affects UO2 Receiving or Storage Area (powder storage area) and results in an energetic breach of UO2 drum and dispersal of radiological materials from the powder storage area. Specific Location: UO2 Receiving Unit UO2 Storage Unit Mode: All Hazard Sources: Radiological Material (maximum inventory in UO2 drum)	1. Ignition of transient combustible material 2. Combustibles and unknown ignition source

Table 5A-3. Unmitigated Events, Receiving Workshop (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Internal Fire MFFF-Receiving Workshop RC-3 E-1	A fire in the truck bay (e.g., fuel fire) involving transport packages results in an energetic breach of the containers (transport packages) and the dispersal of radiological materials. Specific Location: PuO2 Receiving Unit, Truck Bay Mode: All Hazard Sources: Radiological Material (maximum inventory in transport packages and maximum number of packages)	1. Ignition of combustible material due to electrical short 2. Combustibles and unknown ignition source
Internal Fire MFFF-Receiving Workshop RC-16 E-1	A container of contaminated or radioactive material (i.e., a waste drum) fails or is involved in a fire and results in breach of the container and the dispersal of radiological materials. Specific Location: PuO2 Receiving Unit-Truck Bay Mode: Normal Operation Hazard Sources: Radiological Material (maximum inventory in container)	1. Ignition of combustible material due to electrical short 2. Combustibles and unknown ignition source

Table 5A-3. Unmitigated Events, Receiving Workshop (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Internal Fire MFFF- Receiving Workshop RC-4 E-1	All Internal Fire events for MFFF-Gloveboxes apply to this workshop, as far as description and causes are concerned, and are bounding in terms of consequences. (Refer to MFFF Gloveboxes Events GB-1 and GB-2) Specific Location: PuO2 Buffer Storage Unit UO2 Drum Emptying Unit Mode: All Hazard Sources: Radiological Material (maximum inventory in glovebox)	
Loss of Confinement / Dispersal of Nuclear Material MFFF-Receiving Workshop RC-5 E-3	Excessive temperature (due to decay heat) of C2 Storage Area (powder storage area). Specific Location: PuO2 3013 Storage Unit Mode: All Hazard Sources: Radiological Material (maximum inventory in powder storage area)	1. Loss or blockage of HVAC cooling system 2. Loss of power to HVAC cooling system

Table 5A-3. Unmitigated Events, Receiving Workshop (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Loss of Confinement / Dispersal of Nuclear Material MFFF-Receiving Workshop RC-6 E-3	Excessive temperature (due to decay heat) of PuO2 Buffer Storage Unit (powder storage area). Specific Location: PuO2 Buffer Storage Unit Mode: All Hazard Sources: Radiological Material (maximum inventory in buffer storage unit)	1. Loss or blockage of HVAC cooling system 2. Loss of power to HVAC cooling system
Loss of Confinement / Dispersal of Nuclear Material MFFF- Receiving Workshop RC-8 E-3	All Loss of Confinement / Dispersal of Nuclear Material events for MFFF-Gloveboxes apply to this workshop, as far as description and causes are concerned, and are bounding in terms of consequences. (Refer to MFFF Gloveboxes Events GB-3 through GB-7 and GB-11) Specific Location: PuO2 Buffer Storage Unit UO2 Drum Emptying Unit Mode: All Hazard Sources: Radiological Material (maximum inventory in glovebox)	

Table 5A-3. Unmitigated Events, Receiving Workshop (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
External Exposure MFFF-Receiving Workshop RC-9 E-4	Operator is inadvertently exposed to excessive direct radiation in the MFFF Receiving Workshop resulting in excessive radiation exposure. Specific Location: PuO2 Receiving Unit PuO2 3013 Storage Unit PuO2 Buffer Storage Unit PuO2 Receiving Unit-Truck Bay UO2 Receiving Unit UO2 Storage Unit UO2 Drum Emptying Unit Mode: All Hazard Sources: Maximum Direct Radiation Source	1. Exposure due to unintended radioactive material buildup 2. Unplanned or unintended access to High Radiation Area 3. Human error or equipment failure
Criticality MFFF-Receiving Workshop RC-10 E-5	Re-configuration of fissile material potentially results in nuclear criticality and the release of radiological material. Specific Location: PuO2 Receiving Unit PuO2 3013 Storage Unit PuO2 Buffer Storage Unit PuO2 Receiving Unit-Truck Bay Mode: All Hazard Sources: Fissile and Radiological Material	1. Excessive quantity of fissile material is accumulated in process unit 2. Improper placement of fissile material outside of criticality safe storage locations 3. Human error or equipment failure 4. Introduction of moderator (e.g., internal flooding of process unit)

Table 5A-3. Unmitigated Events, Receiving Workshop (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Load Handling MFFF-Receiving Workshop RC-7 E-6	Inadvertent opening or damage to the inner can of a 3013 storage can, while opening the 3013 storage can, resulting in the breach of the inner can and the dispersal of radiological materials. Specific Location: PuO2 Receiving Unit PuO2 3013 Storage Unit Mode: Normal Operation Hazard Sources: Radiological Material (maximum inventory in 3013 container in a glovebox)	1. Human error or equipment failure
Load Handling MFFF-Receiving Workshop RC-11 E-6	A UO2 drum fails or is damaged, while being handled by miscellaneous load handling devices, resulting in a breach of the drum and the dispersal of radiological materials contained in the drum. Specific Location: UO2 Receiving Unit UO2 Storage Unit Mode: All Hazard Sources: Radiological Material (maximum inventory in UO2 drum)	1. Human error or equipment failure during load handling operations

Table 5A-3. Unmitigated Events, Receiving Workshop (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Load Handling MFFF-Receiving Workshop RC-12 E-6	The drop of a radioactive material container (i.e., a 3013 can) onto another radioactive material container (i.e., another 3013 can) while utilizing hoisting equipment results in a breach of the container, and the dispersal of radiological material. Specific Location: PuO2 Receiving Unit PuO2 3013 Storage Unit Mode: All Hazard Sources: Radiological Material (maximum inventory in two 3013 containers in C2 Area)	1. Human error or equipment failure during hoisting operations
Load Handling MFFF-Receiving Workshop RC-13 E-6	A load drop onto a radioactive material container (i.e., a 3013 can) while utilizing hoisting equipment results in a breach of the container, and the dispersal of radiological material. Specific Location: PuO2 Receiving Unit PuO2 3013 Storage Unit Mode: All Hazard Sources: Radiological Material (maximum inventory in 3013 container(s))	1. Human error or equipment failure during hoisting operations

Table 5A-3. Unmitigated Events, Receiving Workshop (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Load Handling MFFF-Receiving Workshop RC-17 E-6	The drop of a radioactive material container (i.e., a 3013 transport package) onto another radioactive material container (i.e., another 3013 transport package) or onto the floor while utilizing hoisting equipment results in a breach of the package, and the dispersal of radiological material. Specific Location: PuO2 Receiving Unit PuO2 3013 Storage Unit Mode: All Hazard Sources: Radiological Material (maximum inventory in two 3013 packages in C2 Area)	1. Human error or equipment failure during hoisting operations
Load Handling MFFF-Receiving Workshop RC-15 E-6	A container of contaminated or radioactive material (i.e., a waste drum) fails or is damaged while being handled by miscellaneous handling devices and results in breach of the container and the dispersal of radiological materials. Specific Location: PuO2 Receiving Unit PuO2 Receiving Unit-Truck Bay Mode: Normal Operation Hazard Sources: Radiological Material (maximum inventory in container)	1. Human error or equipment failure during waste drum handling operations

Table 5A-3. Unmitigated Events, Receiving Workshop (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Load Handling MFFF-Receiving Workshop RC-14 E-6	All Load Handling events for MFFF-Gloveboxes apply to this workshop, as far as description and causes are concerned, and are bounding in terms of consequences. (Refer to MFFF Gloveboxes Events GB-8 through GB-10) Specific Location: PuO2 Buffer Storage Unit UO2 Drum Emptying Unit Mode: All Hazard Sources: Radiological Material (maximum inventory in glovebox)	

Table 5A-4. Unmitigated Events, Powder Workshop

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Internal Fire MFFF-Powder Workshop PW-1 E-1	All Internal Fire events for MFFF-Gloveboxes apply to this workshop, as far as description and causes are concerned, and are bounding in terms of consequences. (Refer to MFFF Gloveboxes Events GB-1 and GB-2) Specific Location: PuO2 Container Opening & Handling Unit Jar Storage and Handling Primary Dosing Unit Final Dosing Unit Powder Auxiliary Scrap (Powder) Processing Unit Ball Milling Units Homogenization and Pelletizing Units AP-Pre-polishing Milling Mode: All Hazard Sources: Radiological Material (maximum inventory in glovebox)	
Loss of Confinement / Dispersal of Nuclear Material MFFF-Powder Workshop PW-2 E-3	All Loss of Confinement / Dispersal of Nuclear Material events for MFFF-Gloveboxes apply to this workshop, as far as description and causes are concerned, and are bounding in terms of consequences. (Refer to MFFF Gloveboxes Events GB-3 through GB-7 and GB-11) Specific Location: PuO2 Container Opening & Handling Unit Jar Storage and Handling Primary Dosing Unit Final Dosing Unit Powder Auxiliary Scrap (Powder) Processing Unit Ball Milling Units Homogenization and Pelletizing Units AP-Pre-polishing Milling Mode: All Hazard Sources: Radiological Material (maximum inventory in glovebox)	

Table 5A-4. Unmitigated Events, Powder Workshop (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
External Exposure MFFF-Powder Workshop PW-3 E-4	Operator is inadvertently exposed to excessive direct radiation in the MFFF-Powder Workshop resulting in excessive radiation exposure. Specific Location: PuO2 Container Opening & Handling Unit Jar Storage and Handling Primary Dosing Unit Final Dosing Unit Powder Auxiliary Scrap (Powder) Processing Unit Ball Milling Units Homogenization and Pelletizing Units AP-Pre-polishing Milling Mode: All Hazard Sources: Maximum Direct Radiation Source	1. Exposure due to unintended radioactive material buildup 2. Human error or equipment failure
Criticality MFFF-Powder Workshop PW-4 E-5	Re-configuration of fissile material potentially results in nuclear criticality and the release of radiological material. Specific Location: PuO2 Container Opening & Handling Unit Jar Storage and Handling Primary Dosing Unit Final Dosing Unit Powder Auxiliary Scrap (Powder) Processing Unit Ball Milling Units Homogenization and Pelletizing Units AP-Pre-polishing Milling Mode: All Hazard Sources: Fissile and Radiological Material	1. Excessive quantity of fissile material is accumulated in process unit 2. Improper placement of fissile material outside of criticality safe storage locations 3. Human error or equipment failure 4. Introduction of moderator (e.g., internal flooding of process unit)

Table 5A-4. Unmitigated Events, Powder Workshop (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Load Handling MFFF-Powder Workshop PW-5 E-6	All Load Handling events for MFFF-Gloveboxes apply to this workshop, as far as description and causes are concerned, and are bounding in terms of consequences. (Refer to MFFF Gloveboxes Events GB-8 through GB-10) Specific Location: PuO2 Container Opening & Handling Unit Jar Storage and Handling Primary Dosing Unit Final Dosing Unit Powder Auxiliary Scrap (Powder) Processing Unit Ball Milling Units Homogenization and Pelletizing Units AP-Pre-polishing Milling Mode: All Hazard Sources: Radiological Material (maximum inventory in glovebox)	

Table 5A-5. Unmitigated Events, Pellet Workshop

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Internal Fire MFFF-Pellet Workshop PT-1 E-1	All Internal Fire events for MFFF-Gloveboxes apply to this workshop, as far as description and causes are concerned, and are bounding in terms of consequences. (Refer to MFFF Gloveboxes Events GB-1 and GB-2) Specific Location: Pellet Inspection and Sorting Units Ground and Sorted Pellet Storage Green Pellet Storage Sintering Furnaces Sintered Pellet Storage Scrap Pellet Storage Quality Control and Manual Sorting Scrap Box Loading Pellets Handling Grinding Units Pellets Repackaging Mode: All Hazard Sources: Radiological Material (maximum inventory in glovebox)	
Internal Fire MFFF-Pellet Workshop PT-2 E-1	A fire in Pellet Storage involving MP Glovebox combustibles (e.g., electrical equipment, and transient combustibles) results in an energetic breach of Pellet Storage and the dispersal of radiological materials. Specific Location: Green Pellet Storage Sintered Pellet Storage Ground and Sorted Pellet Storage Scrap Pellet Storage Mode: All Hazard Sources: Radiological Material (maximum inventory in MP Glovebox: Pellet Storage)	1. Ignition of combustible material due to electrical short 2. Combustibles and unknown ignition source

Table 5A-5. Unmitigated Events, Pellet Workshop (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Internal Fire MFFF-Pellet Workshop PT-3 E-1	A fire involving MP Glovebox combustibles and ignition sources (e.g., transient combustibles and grinding or laser equipment) results in an energetic breach of the MP Glovebox and the dispersal of radiological materials. Specific Location: Grinding Units Mode: Normal Operation Hazard Sources: Radiological Material (maximum inventory in MP glovebox)	1. Ignition of combustible material due to electrical short 2. Ignition of combustibles during grinding operations 3. Combustibles and unknown ignition source
Explosion MFFF-Pellet Workshop PT-4 E-2	Hydrogen and oxygen buildup in a sintering furnace or in the sintering furnace room results in a hydrogen explosion, an energetic breach of the sintering furnace confinement, and the dispersal of radiological materials. Specific Location: Sintering Furnaces Facility Wide (pipes) Mode: Normal Operation, Startup Hazard Sources: Radiological Material (maximum inventory in Sintering Furnace)	1. Excessive hydrogen introduced to furnace 2. Hydrogen accumulation in room or in adjoining furnace entry/exit or cooling gloveboxes (hydrogen leak) 3. Oxygen leaks into furnace or airlocks 4. Improper mixing of hydrogen in C4 exhaust stream.

Table 5A-5. Unmitigated Events, Pellet Workshop (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Loss of Confinement / Dispersal of Nuclear Material MFFF-Pellet Workshop PT-5 E-3	All Loss of Confinement / Dispersal of Nuclear Material events for MFFF-Gloveboxes apply to this workshop, as far as description and causes are concerned, and are bounding in terms of consequences. (Refer to MFFF Gloveboxes Events GB-3 through GB-7 and GB-11) Specific Location: Pellet Inspection and Sorting Units Ground and Sorted Pellet Storage Green Pellet Storage Sintering Furnaces Sintered Pellet Storage Scrap Pellet Storage Quality Control and Manual Sorting Scrap Box Loading Pellets Handling Grinding Units Pellets Repackaging Mode: All Hazard Sources: Radiological Material (maximum inventory in glovebox)	
Loss of Confinement / Dispersal of Nuclear Material MFFF-Pellet Workshop PT-6 E-3	Sintering Furnace seal failure or overpressurization (e.g. excessive pressurization by hydrogen/argon line) affects the Sintering Furnace(s) and results in a breach of the Sintering Furnace(s) confinement, and the dispersal of radiological materials. Specific Location: Sintering Furnaces Mode: Normal Operation, Startup Hazard Sources: Radiological Material (maximum inventory in both Sintering Furnaces)	1. Failure of control system for hydrogen/argon supply line 2. Sintering Furnace exhaust system failure 3 Sintering Furnace seal leakage

Table 5A-5. Unmitigated Events, Pellet Workshop (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Loss of Confinement / Dispersal of Nuclear Material MFFF-Pellet Workshop PT-7 E-3	Excessive temperature of Sintering Furnace(s) results in high temperature damage to and breach of the Sintering Furnace(s), the furnace entry/exit air locks, or the connecting gloveboxes. Specific Location: Sintering Furnaces Mode: Normal Operation Hazard Sources: Radiological Material (maximum inventory in a single Sintering Furnace)	1. Control system failure 2. Loss of cooling
External Exposure MFFF-Pellet Workshop PT-8 E-4	Operator is inadvertently exposed to excessive direct radiation in the MFFF-Pellet Workshop resulting in excessive radiation exposure. Specific Location: Pellet Inspection and Sorting Units Ground and Sorted Pellet Storage Green Pellet Storage Sintering Furnaces Sintered Pellet Storage Scrap Pellet Storage Quality Control and Manual Sorting Scrap Box Loading Pellets Handling Grinding Units Pellets Repackaging Mode: All Hazard Sources: Maximum Direct Radiation Source	1. Exposure due to unintended radioactive material buildup 2. Unplanned or unintended access to High Radiation Area 3. Human error or equipment failure

Table 5A-5. Unmitigated Events, Pellet Workshop (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Criticality MFFF-Pellet Workshop PT-9 E-5	Re-configuration of fissile material potentially results in nuclear criticality and the release of radiological material. Specific Location: Pellet Inspection and Sorting Units Ground and Sorted Pellet Storage Green Pellet Storage Sintering Furnaces Sintered Pellet Storage Scrap Pellet Storage Quality Control and Manual Sorting Scrap Box Loading Pellets Handling Grinding Units Pellets Repackaging Mode: All Hazard Sources: Fissile and Radiological Material	1. Excessive quantity of fissile material is accumulated in process unit 2. Improper placement of fissile material outside of criticality safe storage locations 3. Human error or equipment failure 4. Introduction of moderator (e.g., internal flooding of process unit)
Load Handling MFFF-Pellet Workshop PT-10 E-6	A Load Handling Event involving miscellaneous load handling devices within the MP Glovebox Area surrounding the Sintering Furnace results in a breach of the Sintering Furnace, the furnace entry/exit air locks, or the connecting gloveboxes, and the dispersal of radiological materials. Specific Location: Sintering Furnaces Mode: All Hazard Sources: Radiological Material (maximum inventory in Sintering Furnace)	1. Human error or equipment failure during load handling operations around the furnace

Table 5A-5. Unmitigated Events, Pellet Workshop (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Load Handling MFFF-Pellet Workshop PT-11 E-6	All Load Handling events for MFFF-Gloveboxes apply to this workshop, as far as description and causes are concerned, and are bounding in terms of consequences. (Refer to MFFF Gloveboxes Events GB-8 through GB-10) Specific Location: Pellet Inspection and Sorting Units Ground and Sorted Pellet Storage Green Pellet Storage Sintering Furnaces Sintered Pellet Storage Scrap Pellet Storage Quality Control and Manual Sorting Scrap Box Loading Pellets Handling Grinding Units Pellets Repackaging Mode: All Hazard Sources: Radiological Material (maximum inventory in glovebox)	
Explosion MFFF-Pellet Workshop PT-12 E-2	Water entry in to the sintering furnace from the sintering furnace humidifier results in a steam explosion, an energetic breach of the sintering furnace confinement, and the dispersal of radiological materials. Specific Location: Sintering Furnaces Facility Wide (pipes) Mode: Normal Operation, Startup Hazard Sources: Radiological Material (maximum inventory in Sintering Furnace)	1. Humidifier level controller failure

Table 5A-5. Unmitigated Events, Pellet Workshop (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Loss of Confinement / Dispersal of Nuclear Material MFFF-Pellet Workshop PT-13 E-3	Sintering Furnace gases from the normally pressurized sintering furnace leak into the process room due to a breach in the furnace confinement barrier. Specific Location: Sintering Furnaces Mode: Normal Operation, Hazard Sources: Radiological Material (maximum inventory in Sintering Furnace)	1. Furnace seal failure

Table 5A-6. Unmitigated Events, Cladding and Rod Control Workshop

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Internal Fire MFFF-Cladding and Rod Control Workshop RD-1 E-1	Fire (due to electrical equipment, transient combustibles, etc.) affects C2 Area (fuel rods) and results in an energetic breach of fuel rod confinement and dispersal of radiological materials. Specific Location: Rod Storage X-ray Inspection Unit Helium Leak Test Rod Scanning Rod Tray Handling Rod Tray Loading Rod Inspection and Sorting Mode: All Hazard Sources: Radiological Material (maximum inventory in rods)	1. Ignition of combustible material due to electrical short 2. Combustibles and unknown ignition source
Internal Fire MFFF-Cladding and Rod Control Workshop RD-2 E-1	All Internal Fire events for MFFF-Gloveboxes apply to this workshop, as far as description and causes are concerned, and are bounding in terms of consequences. (Refer to MFFF Gloveboxes Events GB-1 and GB-2) Specific Location: Rod Cladding and Decontamination Rod De-cladding Unit Mode: All Hazard Sources: Radiological Material (maximum inventory in glovebox)	

Table 5A-6. Unmitigated Events, Cladding and Rod Control Workshop (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Internal Fire MFFF-Cladding and Rod Control Workshop RD-3 E-1	A fire involving MP Glovebox combustibles (e.g., transient combustibles, welding equipment, isopropanol used in decontamination) results in an energetic breach of the MP Glovebox and the dispersal of radiological materials. Specific Location: Rod Cladding and Decontamination Mode: Normal Operation Hazard Sources: Radiological Material (maximum inventory in MP glovebox)	1. Ignition of combustible material due to electrical short 2. Ignition of combustibles during welding operations 3. Combustibles and unknown ignition source
Loss of Confinement / Dispersal of Nuclear Material MFFF-Cladding and Rod Control Workshop RD-4 E-3	Excessive temperature (due to decay heat) of C2 Storage Area (other than powder storage area) results in breach of fuel rod confinement. Specific Location: Rod Storage Mode: All Hazard Sources: Radiological Material (maximum inventory in fuel rod storage area)	1. Loss of normal ventilation system 2. Loss of power

Table 5A-6. Unmitigated Events, Cladding and Rod Control Workshop (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Loss of Confinement / Dispersal of Nuclear Material MFFF-Cladding and Rod Control Workshop RD-5 E-3	Leakage from fuel rods in C2 Areas results in breach of confinement, and dispersal of radiological materials. Specific Location: X-Ray Inspection Unit Rod Tray Handling Rod Tray Loading Rod Inspection and Sorting Helium Leak Test Rod Storage Rod Scanning Mode: All Hazard Sources: Radiological Material (maximum inventory in fuel rod or rods)	1. Defective fuel rod(s)
Loss of Confinement / Dispersal of Nuclear Material MFFF-Cladding and Rod Control Workshop RD-6 E-3	All Loss of Confinement / Dispersal of Nuclear Material events for MFFF-Gloveboxes apply to this workshop, as far as description and causes are concerned, and are bounding in terms of consequences. (Refer to MFFF Gloveboxes Events GB-3 through GB-7 and GB-11) Specific Location: Rod Cladding and Decontamination Rod De-cladding Unit Mode: All Hazard Sources: Radiological Material (maximum inventory in glovebox)	

Table 5A-6. Unmitigated Events, Cladding and Rod Control Workshop (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Loss of Confinement / Dispersal of Nuclear Material MFFF-Cladding and Rod Control Workshop RD-11 E-3	The fracture of one or multiple fuel rods while utilizing fuel rod handling equipment results in breach of confinement, and dispersal of radiological materials. Specific Location: X-Ray Inspection Unit Rod Tray Handling Rod Tray Loading Rod Inspection and Sorting Helium Leak Test Rod Storage Rod Scanning Mode: Normal Operation Hazard Sources: Radiological Material (maximum inventory in fuel rod or fuel rods)	1. Human error or equipment failure
External Exposure MFFF-Cladding and Rod Control Workshop RD-7 E-4	Operator is inadvertently exposed to excessive direct radiation in the MFFF-Cladding and Rod Control Workshop resulting in excessive radiation exposure. Specific Location: Rod Cladding and Decontamination X-Ray Inspection Unit Rod Tray Handling Rod Tray Loading Rod Inspection and Sorting Helium Leak Test Rod Storage Rod Scanning Rod De-cladding Unit Mode: All Hazard Sources: Maximum Direct Radiation Source	1. Human error or equipment failure 2. Unplanned or unintended exposure to x-rays

Table 5A-6. Unmitigated Events, Cladding and Rod Control Workshop (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Criticality MFFF-Cladding and Rod Control Workshop RD-8 E-5	Re-configuration of fissile material potentially results in nuclear criticality and the release of radiological material. Specific Location: Rod Cladding and Decontamination X-Ray Inspection Unit Rod Tray Handling Rod Tray Loading Rod Inspection and Sorting Helium Leak Test Rod Storage Rod Scanning Rod De-cladding Unit Mode: All Hazard Sources: Fissile and Radiological Material	1. Excessive quantity of fissile material is accumulated in process unit 2. Improper placement of fissile material outside of criticality safe storage locations 3. Introduction of moderator (e.g., internal flooding of process unit) 4. Human error or equipment failure
Load Handling MFFF-Cladding and Rod Control Workshop RD-9 E-6	The drop of a heavy load onto fuel rods while utilizing miscellaneous load handling devices results in breach of confinement, and dispersal of radiological materials. Specific Location: X-Ray Inspection Unit Rod Tray Handling Rod Tray Loading Rod Inspection and Sorting Helium Leak Test Rod Storage Rod Scanning Mode: All Hazard Sources: Radiological Material (maximum inventory in fuel rod or rods)	1. Human error or equipment failure

Table 5A-6. Unmitigated Events, Cladding and Rod Control Workshop (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Load Handling MFFF-Cladding and Rod Control Workshop RD-10 E-6	The drop of fuel rods onto the floor while utilizing hoisting equipment results in breach of confinement, and dispersal of radiological materials. Specific Location: X-Ray Inspection Unit Rod Tray Handling Rod Tray Loading Rod Inspection and Sorting Helium Leak Test Rod Storage Rod Scanning Mode: Normal Operation Hazard Sources: Radiological Material (maximum inventory of rod tray)	1. Human error or equipment failure
Load Handling MFFF-Cladding and Rod Control Workshop RD-12 E-6	All Load Handling events for MFFF-Gloveboxes apply to this workshop, as far as description and causes are concerned, and are bounding in terms of consequences. (Refer to MFFF Gloveboxes Events GB-8 through GB-10) Specific Location: Rod Cladding and Decontamination Rod De-cladding Unit Mode: All Hazard Sources: Radiological Material (maximum inventory in glovebox)	

Table 5A-7. Unmitigated Events, Assembly Workshop

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Internal Fire MFFF-Assembly Workshop AS-1 E-1	Fire (due to electrical equipment, transient combustibles, etc.) affects C2 Area (assemblies) and results in an energetic breach of fuel rod confinement and dispersal of radiological materials from the assembly storage areas. Specific Location: Assembly Packaging Assembly Mockup Loading Assembly Handling and Storage Assembly Mounting Unit Assembly Dry Cleaning Assembly Dimensional Inspection Assembly Final Inspection Mode: All Hazard Sources: Radiological Material (maximum inventory in assembly storage area)	1. Ignition of combustible material due to electrical short 2. Combustibles and unknown ignition source
Internal Fire MFFF-Assembly Workshop AS-2 E-1	Fire (due to ignition of pyrophoric zircaloy chips or shavings) affects C2 Area (assemblies) and results in an energetic breach of fuel rod confinement and dispersal of radiological materials from the assembly dry cleaning unit. Specific Location: Assembly Dry Cleaning Mode: All Hazard Sources: Radiological Material (maximum inventory of fuel assembly)	1. Ignition of pyrophoric material

Table 5A-7. Unmitigated Events, Assembly Workshop (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Internal Fire MFFF-Assembly Workshop AS-11 E-1	Fire (due to electrical equipment, transient combustibles, etc.) affects Fuel Assembly Truck Bay and results in an energetic breach of fuel assemblies in shipping cask(s) and dispersal of radiological materials from the truck bay. Specific Location: Assembly Packaging (Truck Bay) Mode: All Hazard Sources: Radiological Material (maximum inventory in shipping package(s))	1. Ignition of combustible material due to electrical short 2. Combustibles and unknown ignition source
Internal Fire MFFF-Assembly Workshop AS-13 E-1	A container of contaminated or radioactive material (i.e., a waste drum) is involved in a fire and results in breach of the container and the dispersal of radiological materials. Specific Location: Assembly Packaging (Truck Bay) Mode: All Hazard Sources: Radiological Material (maximum inventory in container)	1. Ignition of combustible material due to electrical short 2. Combustibles and unknown ignition source
Loss of Confinement / Dispersal of Nuclear Material MFFF-Assembly Workshop AS-3 E-3	Excessive temperature (due to decay heat) of C2 Storage Area (other than powder storage area) results in breach of fuel rod confinement. Specific Location: Assembly Handling and Storage Mode: All Hazard Sources: Radiological Material (maximum inventory in fuel rod or rods)	1. Loss of normal ventilation system 2. Loss of power

Table 5A-7. Unmitigated Events, Assembly Workshop (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Loss of Confinement / Dispersal of Nuclear Material MFFF-Assembly Workshop AS-10 E-3	The fracture of multiple fuel rods while utilizing assembly handling equipment results in breach of confinement, and dispersal of radiological materials. Specific Location: Assembly Mockup Loading Assembly Mounting Unit Mode: Normal Operation Hazard Sources: Radiological Material (maximum inventory in multiple fuel rods)	1. Human error or equipment failure
Loss of Confinement / Dispersal of Nuclear Material MFFF-Assembly Workshop AS-4 E-3	Leakage from fuel rods in C2 Areas results in breach of confinement, and dispersal of radiological materials. Specific Location: Assembly Packaging Assembly Mockup Loading Assembly Handling and Storage Assembly Mounting Unit Assembly Dry Cleaning Assembly Dimensional Inspection Assembly Final Inspection Mode: All Hazard Sources: Radiological Material (maximum inventory in fuel rod or rods)	1. Defective Fuel rod(s)

Table 5A-7. Unmitigated Events, Assembly Workshop (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
External Exposure MFFF-Assembly Workshop AS-5 E-4	Operator is inadvertently exposed to excessive direct radiation in the MFFF-Rod/Assembly Workshop resulting in excessive radiation exposure. Specific Location: Assembly Packaging Assembly Mockup Loading Assembly Handling and Storage Assembly Mounting Unit Assembly Dry Cleaning Assembly Dimensional Inspection Assembly Final Inspection Mode: All Hazard Sources: Maximum Direct Radiation Source	1. Human error or equipment failure
Criticality MFFF-Assembly Workshop AS-6 E-5	Re-configuration of fissile material potentially results in nuclear criticality and the release of radiological material. Specific Location: Assembly Packaging Assembly Mockup Loading Assembly Handling and Storage Assembly Mounting Unit Assembly Dry Cleaning Assembly Dimensional Inspection Assembly Final Inspection Mode: All Hazard Sources: Fissile and Radiological Material	1. Excessive quantity of fissile material is accumulated in process unit 2. Improper placement of fissile material outside of criticality safe storage locations 3. Introduction of moderator (e.g., internal flooding of process unit) 4. Human error or equipment failure

Table 5A-7. Unmitigated Events, Assembly Workshop (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Load Handling MFFF-Assembly Workshop AS-7 E-6	A suspended fuel assembly in motion impacts an object or another assembly while utilizing a crane or hoisting equipment and results in breach of confinement, and dispersal of radiological materials. Specific Location: Assembly Handling and Storage Assembly Dry Cleaning Assembly Dimensional Inspection Mode: Normal Operation Hazard Sources: Radiological Material (maximum inventory of two fuel assemblies)	1. Human error or equipment failure
Load Handling MFFF-Assembly Workshop AS-8 E-6	The drop of a heavy load onto an assembly or assemblies while utilizing miscellaneous load handling devices results in breach of confinement, and dispersal of radiological materials. Specific Location: Assembly Packaging Assembly Mockup Loading Assembly Handling and Storage Assembly Mounting Unit Assembly Dry Cleaning Assembly Dimensional Inspection Assembly Final Inspection Mode: All Hazard Sources: Radiological Material (maximum inventory of fuel assembly or assemblies)	1. Human error or equipment failure

Table 5A-7. Unmitigated Events, Assembly Workshop (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Load Handling MFFF-Assembly Workshop AS-9 E-6	The drop of an assembly onto the floor or onto another assembly while utilizing hoisting equipment results in breach of confinement, and dispersal of radiological materials. Specific Location: Assembly Packaging Assembly Mockup Loading Assembly Handling and Storage Assembly Mounting Unit Assembly Dry Cleaning Assembly Dimensional Inspection Assembly Final Inspection Mode: Normal Operation Hazard Sources: Radiological Material (maximum inventory of two fuel assemblies)	1. Human error or equipment failure
Load Handling MFFF-Assembly Workshop AS-12 E-6	A container of contaminated or radioactive material (i.e., a waste drum) fails or is damaged while being handled by miscellaneous handling devices and results in breach of the container and the dispersal of radiological materials. Specific Location: Assembly Packaging (Truck Bay) Mode: Normal Operation Hazard Sources: Radiological Material (maximum inventory in container)	1. Human error or equipment failure during waste drum handling operations

Table 5A-7. Unmitigated Events, Assembly Workshop (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Load Handling MFFF-Assembly Workshop AS-14 E-6	The drop of an assembly transport package onto the floor while utilizing hoisting equipment results in breach of confinement, and dispersal of radiological materials. Specific Location: Assembly Packaging Assembly Packaging (Truck Bay) Mode: Normal Operation Hazard Sources: Radiological Material (maximum inventory of one fuel assembly transport package)	1. Human error or equipment failure

Table 5A-8. Unmitigated Events, Waste Handling

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Internal Fire Waste Handling WH-1 E-1	Waste containers are involved in a fire and are damaged while being handled outside a glovebox, which results in the dispersal of radiological materials. Specific Location: Waste storage areas Waste Nuclear Counting Maintenance and Mechanical Dismantling Filter Dismantling Mode: Normal Operation Hazard Sources: Radiological Material (maximum inventory in waste containers)	1. Combustibles and electrical short 2. Combustion of waste from exposure to chemicals 3. Ignition of Zircaloy swarf waste 4. Combustibles and unknown ignition source
Internal Fire Waste Handling WH-2 E-1	All Internal Fire events for MFFF-Gloveboxes apply to this workshop, as far as description and causes are concerned, and are bounding in terms of consequences. (Refer to MFFF Gloveboxes Events GB-1 and GB-2) Specific Location: Maintenance and Mechanical Dismantling Filter Dismantling Mode: All Hazard Sources: Radiological Material (maximum inventory in glovebox)	

Table 5A-8. Unmitigated Events, Waste Handling (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Explosion Waste Handling WH-3 E-2	Radiolysis induced hydrogen accumulation in a waste container involving radioactive materials with hydrocarbons results in a hydrogen explosion with impact on the worker and on control area habitability. Specific Location: Waste storage areas Waste Nuclear Counting Maintenance and Mechanical Dismantling Filter Dismantling Mode: All Hazard Sources: Radiological Material (maximum inventory in a waste container)	1. Presence of organic and radioactive material in container
Loss of Confinement / Dispersal of Nuclear Material Waste Handling WH-4 E-3	A waste container fails or is damaged while being handled outside a glovebox and results in the dispersal of radiological materials. Specific Location: Waste storage areas Waste Nuclear Counting Maintenance and Mechanical Dismantling Filter Dismantling Mode: Normal Operation Hazard Sources: Radiological Material (maximum inventory in waste container, e.g., filters)	1. Human error or equipment failure

Table 5A-8. Unmitigated Events, Waste Handling (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Loss of Confinement / Dispersal of Nuclear Material Waste Handling WH-5 E-3	All Loss of Confinement / Dispersal of Nuclear Material events for MFFF-Gloveboxes apply to this workshop, as far as description and causes are concerned, and are bounding in terms of consequences. (Refer to MFFF Gloveboxes Events GB-3 through GB-7 and GB-11) Specific Location: Maintenance and Mechanical Dismantling Filter Dismantling Mode: All Hazard Sources: Radiological Material (maximum inventory in glovebox)	
External Exposure Waste Handling WH-6 E-4	Operator is inadvertently exposed to excessive direct radiation in the MFFF-Waste Handling resulting in excessive radiation exposure. Specific Location: Waste storage areas Waste Nuclear Counting Maintenance and Mechanical Dismantling Filter Dismantling Mode: All Hazard Sources: Maximum Direct Radiation Source	1. Exposure due to unintended radioactive material buildup 2. Human error or equipment failure

Table 5A-8. Unmitigated Events, Waste Handling (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Criticality Waste Handling WH-7 E-5	Re-configuration of fissile material potentially results in nuclear criticality and the release of radiological material. Specific Location: Waste storage areas Waste Nuclear Counting Maintenance and Mechanical Dismantling Filter Dismantling Mode: All Hazard Sources: Fissile and Radiological Material	1. Excessive quantity of fissile material is accumulated in process unit 2. Improper placement of fissile material outside of criticality safe storage locations 3. Introduction of moderator (e.g., internal flooding of process unit) 4. Human error or equipment failure
Load Handling Waste Handling WH-8 E-6	A dropped waste drum or waste disposal bag fails or is damaged, while being handled by miscellaneous load handling devices, resulting in a breach of the drum and the dispersal of radiological materials contained in the drum. Specific Location: Waste storage areas Waste Nuclear Counting Maintenance and Mechanical Dismantling Filter Dismantling Mode: All Hazard Sources: Radiological Material (maximum inventory in waste container)	1. Human error or equipment failure during load handling operations

Table 5A-8. Unmitigated Events, Waste Handling (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Load Handling Waste Handling WH-9 E-6	All Load Handling events for MFFF-Gloveboxes apply to this workshop, as far as description and causes are concerned, and are bounding in terms of consequences. (Refer to MFFF Gloveboxes Events GB-8 through GB-10) Specific Location: Maintenance and Mechanical Dismantling Filter Dismantling Mode: All Hazard Sources: Radiological Material (maximum inventory in glovebox)	

Table 5A-9. Unmitigated Events, Miscellaneous Areas

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Internal Fire MFFF-Miscellaneous Areas) MA-1 E-1	A fire involving combustibles and ignition sources (e.g., transient combustibles, solvents, flammable gases, and electrical equipment, plasma torches, evaporators, furnaces, heating plates) in a laboratory with a Glovebox results in an energetic breach of the Glovebox and the dispersal of radiological materials. Specific Location: Laboratories Mode: Normal Operation Hazard Sources: Radiological Material (maximum inventory in laboratory glovebox)	1. Combustibles and electrical short 2. Combustion of waste from exposure to chemicals 3. Maintenance activities 4. Multiple ignition sources
Internal Fire MFFF-Miscellaneous Areas MA-2 E-1	A fire in a C2 Area involving combustibles (e.g., electrical equipment, transient combustibles, HEPA filter) results in a breach of a container of contaminated or radioactive material (i.e., a transfer container) and the dispersal of radiological materials. Specific Location: AP-Liquid Waste Reception MFFF-Air locks, corridors, stairways, and safe areas Mode: All Hazard Sources: Radiological Material (maximum inventory in container)	1. Combustibles and electrical short 2. Combustion of waste from exposure to chemicals 3. Maintenance activities 4. Combustibles and unknown ignition source

Table 5A-9. Unmitigated Events, Miscellaneous Areas (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Internal Fire MFFF-Miscellaneous Areas MA-12 E-1	A fire in a C2 Area involving combustibles (e.g., electrical equipment, transient combustibles, HEPA filter) results in a breach of a container of contaminated or radioactive material (i.e., a waste drum) and the dispersal of radiological materials. Specific Location: AP-Liquid Waste Reception MFFF-Air locks, corridors, stairways, and safe havens Mode: All Hazard Sources: Radiological Material (maximum inventory in container)	1. Combustibles and electrical short 2. Combustion of waste from exposure to chemicals 3. Maintenance activities 4. Combustibles and unknown ignition source
Internal Fire MFFF-Miscellaneous Areas MA-3 E-1	A fire (due to electrical equipment, transient combustibles, etc.) affecting miscellaneous areas (e.g., air locks, corridors, stairs, etc.) in a C2 area results in fire damage but no safety related impact. Specific Location: MFFF-Air locks, corridors, stairways, and safe areas MFFF-Storage Areas (non-waste) MFFF-Offices and personal access areas Mode: All Hazard Sources: None	1. Combustibles and electrical short 2. Maintenance activities 3. Combustibles and unknown ignition source

Table 5A-9. Unmitigated Events, Miscellaneous Areas (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Explosion MFFF-Miscellaneous Areas MA-4 E-2	An explosion in a laboratory involving flammable, explosive, or reactive chemicals (e.g., organics or explosive gases) results in the dispersal of radiological material. Specific Location: Laboratories Mode: All Hazard Sources: Radiological Material (maximum inventory in laboratory)	1. Leak or spill of flammable liquids or gasses 2. Chemical reaction releases explosive gasses
Loss of Confinement / Dispersal of Nuclear Material MFFF-Miscellaneous Areas MA-5 E-3	A container of contaminated or radioactive material (i.e., a transfer container or a 3013 container) fails or is damaged while being handled by miscellaneous handling devices in a C2 Area and results in breach of the container and the dispersal of radiological materials. Specific Location: AP-Liquid Waste Reception MFFF-Airlocks, corridors, and stairways Mode: Normal Operation Hazard Sources: Radiological Material (maximum inventory in container)	1. Human error or equipment failure during container handling operations
Loss of Confinement / Dispersal of Nuclear Material MFFF-Miscellaneous Areas MA-6 E-3	Corrosion of a laboratory glovebox by corrosive chemicals results in a breach (i.e., material failure) of glovebox confinement and dispersal of radiological materials. Specific Location: Laboratories Mode: All Hazard Sources: Radiological Material (maximum inventory in laboratory glovebox)	1. Corrosive chemicals interact with glovebox leading to failure

Table 5A-9. Unmitigated Events, Miscellaneous Areas (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
External Exposure MFFF-Miscellaneous Areas MA-7 E-4	Operator is inadvertently exposed to excessive direct radiation in the MFFF-Miscellaneous Areas resulting in excessive radiation exposure. Specific Location: Laboratories Mode: All Hazard Sources: Maximum Direct Radiation Source	1. Exposure due to unintended radioactive material buildup 2. Human error or equipment failure
Criticality MFFF-Miscellaneous Areas MA-8 E-5	Re-configuration of fissile material potentially results in nuclear criticality and the release of radiological material. Specific Location: Laboratories Mode: All Hazard Sources: Fissile and Radiological Material	1. Excessive quantity of fissile material is accumulated in process unit 2. Improper placement of fissile material outside of criticality safe storage locations 3. Introduction of moderator (e.g., internal flooding of process unit) 4. Human error or equipment failure
Load Handling MFFF-Miscellaneous Areas MA-11 E-6	A container of contaminated or radioactive material (i.e., a waste drum) fails or is damaged while being handled by miscellaneous handling devices in a C2 Area and results in breach of the container and the dispersal of radiological materials. Specific Location: AP-Liquid Waste Reception MFFF-Airlocks, corridors, and stairways Mode: Normal Operation Hazard Sources: Radiological Material (maximum inventory in container)	1. Human error or equipment failure during waste drum handling operations

Table 5A-9. Unmitigated Events, Miscellaneous Areas (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Chemical MFFF-Miscellaneous Areas MA-9 E-7	A fire affects the Additives Preparation Area and results in toxic chemicals being released from the chemical containers with potential impact on the worker and on control area habitability. Specific Location: MFFF-Additives Preparation Area Mode: All Hazard Sources: Hazardous Chemicals	1. Combustibles and electrical short 2. Combustion of waste from exposure to chemicals 3. Maintenance activities 4. Combustibles and unknown ignition source
Chemical MFFF-Miscellaneous Areas MA-10 E-7	A breach of hazardous chemical containers in the Additives Preparation Area results in a chemical release with potential impact on the worker and on control area habitability. Specific Location: MFFF-Additives Preparation Area Facility Wide Mode: All Hazard Sources: Hazardous Chemicals	1. Human error or equipment failure 2. Corrosion of containers 3. Drop of container(s)

Table 5A-10. Unmitigated Events, Support Facilities Outside MFFF

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Internal Fire Support Facilities Outside MFFF SF-1 E-1	A fire (involving diesel fuel storage, gas storage platform, the Reagents Processing Building, etc.) occurs and affects the MFFF Building resulting in structural damage. Specific Location: General Plant and Outside Areas Reagents Processing Building Gas Storage Facility Emergency Diesel Generator Building Standby Diesel Generator Building Secured Warehouse Building Access Control Building Administration Building Technical Support Building Mode: All Hazard Sources: Radiological Material (maximum inventory in MFFF susceptible to the consequences of external fires or explosions)	1. Combustibles and electrical short 2. Combustion of waste from exposure to chemicals 3. Maintenance activities 4. Combustibles and unknown ignition source
Internal Fire Support Facilities Outside MFFF SF-2 E-1	A fire (involving electrical equipment, transient combustibles, etc.) affects UO2 drums outside the AP/MP Building (e.g., in the Secured Warehouse Building) and results in a breach of confinement and the dispersal of radiological materials. Specific Location: General Plant and Outside Areas Secured Warehouse Building Mode: All Hazard Sources: Radiological Material (maximum inventory of UO2 in Secured Warehouse Building)	1. Combustibles and electrical short 2. Combustibles and unknown ignition source

Table 5A-10. Unmitigated Events, Support Facilities Outside MFFF (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Explosion Support Facilities Outside MFFF SF-3 E-2	An explosion at a nearby support facility (e.g., diesel fuel storage, gas storage platform, the Reagents Processing Building, nearby MFFF support facility on the MFFF site) outside the MFFF Building results in structural damage to the MFFF. Specific Location: General Plant and Outside Areas Reagents Processing Building Gas Storage Facility Emergency Diesel Generator Building Standby Diesel Generator Building Access Control Building (Armory) Mode: All Hazard Sources: Radiological Material (maximum inventory in MFFF susceptible to disruption by structural damage)	1. Fuel oil or gas leak combined with electrical short or Combustibles and unknown ignition source 2. Unintended interaction of chemicals which are explosively incompatible 3. Human error or equipment failure
Loss of Confinement / Dispersal of Nuclear Material Support Facilities Outside MFFF SF-14 E-3	A leak or break in an underground waste pipeline outside MFFF results in a breach of confinement, and the dispersal of radiological materials. Specific Location: General Plant and Outside Areas Mode: All Hazard Sources: Radiological Material (maximum inventory of waste tank)	1. Mechanical failure of piping 2. Corrosion induced failure of piping 3. Human error results in pipe break

Table 5A-10. Unmitigated Events, Support Facilities Outside MFFF (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Load Handling Support Facilities Outside MFFF SF-13 E-6	A handling accident, a fire or natural phenomena affects UO2 drums outside the AP/MP Building (e.g., in the Secured Warehouse Building) and results in a breach of confinement and the dispersal of radiological materials. Specific Location: General Plant and Outside Areas Secured Warehouse Building Mode: All Hazard Sources: Radiological Material (maximum inventory of UO2 in Secured Warehouse Building)	1. Human error or equipment failure during load handling operations 2. Combustibles and electrical short 3. Combustibles and unknown ignition source
Chemical Support Facilities Outside MFFF SF-4 E-7	A diesel fuel oil leak from a diesel fuel tank or associated piping results in a chemical release with potential impact on the worker and on control area habitability. Specific Location: Emergency Diesel Generator Building Standby Diesel Generator Building Mode: All Hazard Sources: Hazardous Chemicals	1. Mechanical failure of fuel tank 2. Inadvertent puncture of fuel tank

Table 5A-10. Unmitigated Events, Support Facilities Outside MFFF (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Chemical Support Facilities Outside MFFF SF-6 E-7	A loss of ventilation in the Reagents Processing Building results in toxic chemicals being released from the vessels, tanks, and piping in the building (but not being ventilated) and potentially impacting the worker and control area habitability. Specific Location: Reagents Processing Building Mode: All Hazard Sources: Hazardous Chemicals	1. Loss of all normal control systems 2. Loss of power 3. Mechanical failure of ventilation system
Chemical Support Facilities Outside MFFF SF-7 E-7	Extreme weather affects the Reagents Processing Building and results in toxic chemicals being released from the vessels, tanks, and piping in the building and potentially impacting the worker and control area habitability. Specific Location: Reagents Processing Building Mode: All Hazard Sources: Hazardous Chemicals	1. Extreme weather

Table 5A-10. Unmitigated Events, Support Facilities Outside MFFF (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Chemical Support Facilities Outside MFFF SF-8 E-7	An external or internal impact affects the Reagents Processing Building and results in toxic chemicals being released from the vessels, tanks, and piping in the building and potentially impacting the worker and control area habitability. Specific Location: Reagents Processing Building Mode: All Hazard Sources: Hazardous Chemicals	1. Human error or equipment failure
Chemical Support Facilities Outside MFFF SF-11 E-7	A pipe break or leak from vessels, tanks, and piping in the Reagents Processing Building results in toxic chemicals being released from the vessels, tanks, and piping and potentially impacts the worker and control area habitability. Specific Location: Reagents Processing Building Mode: All Hazard Sources: Hazardous Chemicals	1. Mechanical failure of vessels, tanks, or piping
Chemical Support Facilities Outside MFFF SF-12 E-7	A loss of tank venting in vessels, tanks and piping in the Reagents Processing Building results in a chemical release with potential impact on the worker and on control area habitability. Specific Location: Reagents Processing Building Mode: All Hazard Sources: Hazardous Chemicals	1. Mechanical failure of ventilation system

Table 5A-11. Unmitigated Events, HVAC Systems

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Internal Fire MFFF-HVAC Systems HV-1 E-1	A fire in the C4 VHD System (i.e., C4 Dynamic Confinement) disables the system or damages the HEPA filters and results in a loss of negative pressure in the gloveboxes, breach of confinement, and dispersal of radiological materials. Specific Location: AP-Acid recovery AP-Solvent recovery AP-PuO2 Decanning AP-Recanning AP-Pre-polishing Milling AP-PuO2 Canning AP-Precipitation-Filtration-Oxidation AP-Homogenization-Sampling AP-Dissolution AP-Dissolution of chlorinated feed AP-Uranium Dissolution AP-Purification cycle AP-Sampling AP-Oxalic mother liquors recovery AP-Liquid Waste Reception Receiving Workshop Powder Workshop Pellet Workshop Cladding and Rod Control Workshop Miscellaneous Areas (Laboratories) Mode: All Hazard Sources: Radiological Material (maximum inventory in HEPA filters and maximum inventory airborne in the gloveboxes)	1. Combustibles and electrical short circuit 2. Other causes for ignition of combustible material

Table 5A-11. Unmitigated Events, HVAC Systems (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Internal Fire MFFF-HVAC Systems HV-17 E-1	A fire in the AP Process Offgas System disables the system or damages the HEPA filters and results in a loss of negative pressure in the AP pipes and vessels, breach of confinement, and dispersal of radiological materials. Specific Location: AP-Acid recovery AP-Solvent recovery AP-Precipitation-Filtration-Oxidation AP-Dissolution AP-Dissolution of chlorinated feed AP-Uranium Dissolution AP-Purification cycle AP-Oxalic mother liquors recovery AP-Liquid waste reception AP-Off gas treatment AP-Reagents Mode: All Hazard Sources: Radiological Material (maximum inventory in HEPA filters and maximum inventory airborne in the AP pipes and vessels)	1. Combustibles and electrical short circuit 2. Other causes for ignition of combustible material

Table 5A-11. Unmitigated Events, HVAC Systems (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Internal Fire MFFF-HVAC Systems HV-2 E-1	A fire in the C3 HVAC System (i.e., C3 Dynamic Confinement), the C2 HVAC System, or the Process Cell Ventilation System involving electrical equipment disables the system or damages the HEPA filters and results in a breach of confinement, and dispersal of radiological materials. Specific Location: AP-Acid recovery AP-Solvent recovery AP-PuO2 Decanning AP-Recanning AP-Pre-polishing Milling AP-PuO2 Canning AP-Precipitation-Filtration-Oxidation AP-Homogenization-Sampling AP-Dissolution AP-Dissolution of chlorinated feed AP-Uranium Dissolution AP-Purification cycle AP-Sampling AP-Oxalic mother liquors recovery AP-Process Off-Gas Treatment AP-Liquid Waste Reception Receiving Workshop Powder Workshop Pellet Workshop Cladding and Rod Control Workshop Miscellaneous Areas (Laboratories) Mode: All Hazard Sources: Radiological Material (maximum inventory in C3 HVAC System)	1. Combustibles and electrical short circuit 2. Other causes for ignition of combustible material

Table 5A-11. Unmitigated Events, HVAC Systems (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Loss of Confinement / Dispersal of Nuclear Material MFFF-HVAC Systems HV-3 E-3	A loss of negative pressure or a flow perturbation involving the C3 Dynamic Confinement results in a ventilation air flow reversal into a C2 Area. Specific Location: AP-Acid recovery AP-Solvent recovery AP-PuO2 Decanning AP-Recanning AP-Pre-polishing Milling AP-PuO2 Canning AP-Precipitation-Filtration-Oxidation AP-Homogenization-Sampling AP-Dissolution AP-Dissolution of chlorinated feed AP-Uranium Dissolution AP-Purification cycle AP-Sampling AP-Oxalic mother liquors recovery AP-Liquid Waste Reception Receiving Workshop Powder Workshop Pellet Workshop Cladding and Rod Control Workshop Miscellaneous Areas (Laboratories) Mode: All Hazard Sources: Radiological Material	1. Loss of all normal control systems 2. Loss of power 3. Mechanical failure of ventilation system

Table 5A-11. Unmitigated Events, HVAC Systems (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Loss of Confinement / Dispersal of Nuclear Material MFFF-HVAC Systems HV-4 E-3	A loss of negative pressure or a flow perturbation involving the Process Cells HVAC results in a ventilation air flow reversal into a C2 Area. Specific Location: AP-Solvent recovery AP-Oxalic mother liquors recovery AP-Off gas treatment AP-Liquid waste reception AP-Dissolution AP-Dissolution of chlorinated feed AP-Acid recovery AP-Purification cycle Mode: All Hazard Sources: Radiological Material (maximum airborne inventory in AP Process Cell not including inventory in AP vessels, tanks and piping)	1. Loss of all normal control systems 2. Loss of power 3. Mechanical failure of ventilation system

Table 5A-11. Unmitigated Events, HVAC Systems (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Loss of Confinement / Dispersal of Nuclear Material MFFF-HVAC Systems HV-5 E-3	A loss of negative pressure or a flow perturbation involving the C4 Dynamic Confinement results in a ventilation air flow reversal into a C3 Area. Specific Location: AP-Acid recovery AP-Solvent recovery AP-PuO2 Decanning AP-Recanning AP-Pre-polishing Milling AP-PuO2 Canning AP-Precipitation-Filtration-Oxidation AP-Homogenization-Sampling AP-Dissolution AP-Dissolution of chlorinated feed AP-Uranium Dissolution AP-Purification cycle AP-Sampling AP-Oxalic mother liquors recovery AP-Liquid Waste Reception Receiving Workshop Powder Workshop Pellet Workshop Cladding and Rod Control Workshop Miscellaneous Areas (Laboratories) Mode: All Hazard Sources: Radiological Material (maximum airborne inventory in all connected gloveboxes)	1. Loss of normal control system 2. Loss of all power 3. Mechanical failure of ventilation system

Table 5A-11. Unmitigated Events, HVAC Systems (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Loss of Confinement / Dispersal of Nuclear Material MFFF-HVAC Systems HV-6 E-3	Back-flow from a glovebox room through a C3 ventilation system supply duct to another glovebox room results in a breach of C3 ventilation system confinement and cross contamination of MP and AP ventilation systems. Specific Location: AP-Acid recovery AP-Solvent recovery AP-PuO2 Decanning AP-PuO2 Canning AP-Recanning AP-Pre-polishing Milling AP-Precipitation-Filtration-Oxidation AP-Homogenization-Sampling AP-Dissolution AP-Dissolution of chlorinated feed AP-Purification cycle AP-Sampling AP-Oxalic mother liquors recovery Receiving Workshop Powder Workshop Pellet Workshop Cladding and Rod Control Workshop Miscellaneous Areas (Laboratories) Mode: All Hazard Sources: Radiological Material (maximum inventory in C3 area outside of gloveboxes)	1. Loss of air flow through a C3 ventilation system supply duct
Loss of Confinement / Dispersal of Nuclear Material MFFF-HVAC Systems HV-10 E-3	A loss of negative pressure or a flow perturbation involving the C2 Dynamic Confinement results in a ventilation air flow reversal into adjacent areas and contamination of those areas. Specific Location: AP-Reagents MFFF-Miscellaneous Areas Assembly Workshop Cladding and Rod Control Workshop Mode: All Hazard Sources: Radiological Material (maximum unconfined inventory in C2 Areas)	1. Loss of all normal control systems 2. Loss of power 3. Mechanical failure of ventilation system

Table 5A-11. Unmitigated Events, HVAC Systems (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Loss of Confinement / Dispersal of Nuclear Material MFFF-HVAC Systems HV-11 E-3	Leakage from C3 Ventilation System, C2 Ventilation System, or Process Cell Ventilation Duct, facility wide, results in a breach of confinement, and the dispersal of radiological material. Specific Location: HVAC, Facility Wide Mode: All Hazard Sources: Radiological Material (maximum inventory in C3 Ventilation System or Process Cell Ventilation Duct)	1. Corrosion and penetration of ventilation duct
Loss of Confinement / Dispersal of Nuclear Material MFFF-HVAC Systems HV-12 E-3	Leakage from C4 HVAC System or Process Offgas Ventilation Duct, facility wide, results in a breach of confinement, and the dispersal of radiological material. Specific Location: HVAC, Facility Wide Mode: All Hazard Sources: Radiological Material (maximum inventory in C4 Ventilation System or Process Cell Ventilation Duct)	1. Corrosion and penetration of ventilation duct

Table 5A-11. Unmitigated Events, HVAC Systems (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Load Handling MFFF-HVAC Systems HV-14 E-6	A Load Handling Event involving miscellaneous load handling devices, which impact and penetrate the HVAC system and HEPA filter(s), results in a breach of confinement, and the dispersal of radiological materials Specific Location: HVAC, Filter Rooms Mode: All Hazard Sources: Radiological Material contained in C4 HVAC system and filters	1. Human error or equipment failure during load handling operations around the HVAC system
Load Handling MFFF-HVAC Systems HV-15 E-6	A Load Handling Event involving miscellaneous load handling devices, which impacts the HVAC system, results in a bumped HEPA filter or HEPA filter(s), the cascade of contamination through the HVAC system, and the dispersal of radiological materials. Specific Location: HVAC, Filter Rooms Mode: Long Shutdown Hazard Sources: Radiological Material contained in HVAC system and filters	1. Human error or equipment failure during load handling operations around the ventilation system
Chemical MFFF-HVAC Systems HV-16 E-7	A loss of ventilation air flow involving the C2 Dynamic Confinement System results in a chemical release with potential impact on the worker and on control area habitability. Specific Location: AP-Reagents MFFF-Miscellaneous Areas Mode: All Hazard Sources: Hazardous Chemicals	1. Loss of all normal control systems 2. Loss of power 3. Mechanical failure of ventilation system

Table 5A-12. Unmitigated Events, Gloveboxes

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Internal Fire MFFF-Gloveboxes GB-1 E-1	A fire involving glovebox combustibles (e.g., electrical equipment, transient combustibles, flammable liquids, HEPA filter) results in a breach of the Glovebox and the dispersal of radiological materials. Specific Location: AP-Acid recovery AP-Solvent recovery AP-PuO2 Decanning AP-Recanning AP-Pre-polishing Milling AP-PuO2 Canning AP-Precipitation-Filtration-Oxidation AP-Homogenization-Sampling AP-Dissolution AP-Dissolution of chlorinated feed AP-Purification cycle AP-Sampling AP-Oxalic mother liquors recovery AP-Liquid Waste Reception Receiving Workshop Powder Workshop Pellet Workshop Cladding and Rod Control Workshop Miscellaneous Areas (Laboratories) Waste Handling Mode: All Hazard Sources: Radiological Material (maximum inventory in a fire area)	1. Combustibles and electrical short 2. Combustion of waste from exposure to chemicals 3. Ignition of flammable liquid (e.g., isopropanol used in rod cleaning) 3. Maintenance activities 4. Combustibles and unknown ignition source 5. Spontaneous heating of UO_2/PuO_2.

Table 5A-12. Unmitigated Events, Gloveboxes (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Internal Fire MFFF-Gloveboxes GB-2 E-1	A transfer container (containing contaminated process equipment or contaminated HEPA filters) is involved in a fire and is damaged while outside a glovebox and results in the dispersal of radiological materials. Specific Location: AP-Acid recovery AP-Solvent recovery AP-PuO2 Decanning AP-Recanning AP-Pre-polishing Milling AP-PuO2 Canning AP-Precipitation-Filtration-Oxidation AP-Homogenization-Sampling AP-Dissolution AP-Dissolution of chlorinated feed AP-Purification cycle AP-Sampling AP-Oxalic mother liquors recovery AP-Liquid Waste Reception Receiving Workshop Powder Workshop Pellet Workshop Cladding and Rod Control Workshop Miscellaneous Areas (Laboratories) Waste Handling Mode: All Hazard Sources: Radiological Material (maximum inventory in waste container)	1. Combustibles and electrical short 2. Combustion of waste from exposure to chemicals 3. Maintenance activities 4. Combustibles and unknown ignition source

Table 5A-12. Unmitigated Events, Gloveboxes (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Loss of Confinement / Dispersal of Nuclear Material MFFF-Gloveboxes GB-3 E-3	Over-pressurization of the glovebox (i.e., C4 Dynamic Confinement) by rupture of a high flow or high pressure supply line or by HEPA filter clogging results in a ventilation air flow reversal into a C3 Area. Specific Location: AP-Acid recovery AP-Solvent recovery AP-PuO2 Decanning AP-Recanning AP-Pre-polishing Milling AP-PuO2 Canning AP-Precipitation-Filtration-Oxidation AP-Homogenization-Sampling AP-Dissolution AP-Dissolution of chlorinated feed AP-Purification cycle AP-Sampling AP-Oxalic mother liquors recovery AP-Liquid Waste Reception Receiving Workshop Powder Workshop Pellet Workshop Cladding and Rod Control Workshop Miscellaneous Areas (Laboratories) Waste Handling Mode: All Hazard Sources: Radiological Material (maximum inventory in glovebox)	1. Rupture of a high flow or high pressure supply line 2. Clogged outlet HEPA filter

Table 5A-12. Unmitigated Events, Gloveboxes (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Loss of Confinement / Dispersal of Nuclear Material MFFF-Gloveboxes GB-4 E-3	Failure of a glove during normal operation or maintenance results in a breach of glovebox confinement and dispersal of radiological materials. Specific Location: AP-Acid recovery AP-Solvent recovery AP-PuO2 Decanning AP-Recanning AP-Pre-polishing Milling AP-PuO2 Canning AP-Precipitation-Filtration-Oxidation AP-Homogenization-Sampling AP-Dissolution AP-Dissolution of chlorinated feed AP-Purification cycle AP-Sampling AP-Oxalic mother liquors recovery AP-Liquid Waste Reception Receiving Workshop Powder Workshop Pellet Workshop Cladding and Rod Control Workshop Miscellaneous Areas (Laboratories) Waste Handling Mode: All Hazard Sources: Radiological Material (maximum inventory in glovebox)	1. Human error results in glove failure during normal operation or maintenance 2. Equipment failure

Table 5A-12. Unmitigated Events, Gloveboxes (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Loss of Confinement / Dispersal of Nuclear Material MFFF-Gloveboxes GB-5 E-3	Back-flow from glovebox through interfacing gas line (e.g., nitrogen, helium) to interfacing system followed by the opening of this interfacing system (during operation or maintenance) results in a breach of glovebox primary confinement and dispersal of radiological materials to areas where workers might be present. Specific Location: AP-Acid recovery AP-Solvent recovery AP-PuO2 Decanning AP-Recanning AP-Pre-polishing Milling AP-PuO2 Canning AP-Precipitation-Filtration-Oxidation AP-Homogenization-Sampling AP-Dissolution AP-Dissolution of chlorinated feed AP-Purification cycle AP-Sampling AP-Oxalic mother liquors recovery AP-Liquid Waste Reception Receiving Workshop Powder Workshop Pellet Workshop Cladding and Rod Control Workshop Miscellaneous Areas (Laboratories) Waste Handling Mode: All Hazard Sources: Radiological Material (maximum inventory in glovebox)	1. Loss of gas flow through the supply line

Table 5A-12. Unmitigated Events, Gloveboxes (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Loss of Confinement / Dispersal of Nuclear Material MFFF-Gloveboxes GB-6 E-3	Excessive temperature of process equipment inside a glovebox results in high temperature damage to and breach of the glovebox and the dispersal of radiological materials. Specific Location: AP-Acid recovery AP-Solvent recovery AP-PuO2 Decanning AP-Recanning AP-Pre-polishing Milling AP-PuO2 Canning AP-Precipitation-Filtration-Oxidation AP-Homogenization-Sampling AP-Dissolution AP-Dissolution of chlorinated feed AP-Purification cycle AP-Sampling AP-Oxalic mother liquors recovery AP-Liquid Waste Reception Receiving Workshop Powder Workshop Pellet Workshop Cladding and Rod Control Workshop Miscellaneous Areas (Laboratories) Waste Handling Mode: All Hazard Sources: Radiological Material (maximum inventory in glovebox)	1. Failure of process control system 2. Loss of cooling to process equipment

Table 5A-12. Unmitigated Events, Gloveboxes (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Loss of Confinement / Dispersal of Nuclear Material MFFF-Gloveboxes GB-7 E-3	A plastic bag (containing contaminated process equipment or contaminated HEPA filters) fails or is damaged while being handled outside a glovebox and results in the dispersal of radiological materials. Specific Location: AP-Acid recovery AP-Solvent recovery AP-PuO2 Decanning AP-Recanning AP-Pre-polishing Milling AP-PuO2 Canning AP-Precipitation-Filtration-Oxidation AP-Homogenization-Sampling AP-Dissolution AP-Dissolution of chlorinated feed AP-Purification cycle AP-Sampling AP-Oxalic mother liquors recovery AP-Liquid Waste Reception Receiving Workshop Powder Workshop Pellet Workshop Cladding and Rod Control Workshop Miscellaneous Areas (Laboratories) Waste Handling Mode: All Hazard Sources: Radiological Material (maximum inventory in waste container)	1. Human error or equipment failure during load handling operations outside a glovebox

Table 5A-12. Unmitigated Events, Gloveboxes (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Loss of Confinement / Dispersal of Nuclear Material MFFF-Gloveboxes GB-11 E-3	A transfer container (containing contaminated process equipment or contaminated HEPA filters) fails or is damaged while being handled outside a glovebox and results in the dispersal of radiological materials. Specific Location: AP-Acid recovery AP-Solvent recovery AP-PuO2 Decanning AP-Recanning AP-Pre-polishing Milling AP-PuO2 Canning AP-Precipitation-Filtration-Oxidation AP-Homogenization-Sampling AP-Dissolution AP-Dissolution of chlorinated feed AP-Purification cycle AP-Sampling AP-Oxalic mother liquors recovery AP-Liquid Waste Reception Receiving Workshop Powder Workshop Pellet Workshop Cladding and Rod Control Workshop Miscellaneous Areas (Laboratories) Waste Handling Mode: All Hazard Sources: Radiological Material (maximum inventory in waste container)	1. Human error or equipment failure during load handling operations outside a glovebox

Table 5A-12. Unmitigated Events, Gloveboxes (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Load Handling MFFF-Gloveboxes GB-8 E-6	A container handling accident within a glovebox (e.g., a container impact with the glovebox) results in a breach of the container and the glovebox, and the dispersal of radiological materials. Specific Location: AP-Acid recovery AP-Solvent recovery AP-PuO2 Decanning AP-Recanning AP-Pre-polishing Milling AP-PuO2 Canning AP-Precipitation-Filtration-Oxidation AP-Homogenization-Sampling AP-Dissolution AP-Dissolution of chlorinated feed AP-Purification cycle AP-Sampling AP-Oxalic mother liquors recovery Receiving Workshop Powder Workshop Pellet Workshop Cladding and Rod Control Workshop Miscellaneous Areas (Laboratories) Waste Handling Mode: All Hazard Sources: Radiological Material (maximum inventory in glovebox)	1. Human error or equipment failure during load handling operations inside a glovebox

Table 5A-12. Unmitigated Events, Gloveboxes (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Load Handling MFFF-Gloveboxes GB-9 E-6	A Load Handling Event involving miscellaneous load handling devices outside a glovebox results in a breach of the glovebox, and the dispersal of radiological materials. Specific Location: AP-Acid recovery AP-Solvent recovery AP-PuO2 Decanning AP-Recanning AP-Pre-polishing Milling AP-PuO2 Canning AP-Precipitation-Filtration-Oxidation AP-Homogenization-Sampling AP-Dissolution AP-Dissolution of chlorinated feed AP-Purification cycle AP-Sampling AP-Oxalic mother liquors recovery AP-Liquid Waste Reception Receiving Workshop Powder Workshop Pellet Workshop Cladding and Rod Control Workshop Miscellaneous Areas (Laboratories) Waste Handling Mode: All Hazard Sources: Radiological Material (maximum inventory in glovebox)	1. Human error or equipment failure during load handling operations outside a glovebox

Table 5A-12. Unmitigated Events, Gloveboxes (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Load Handling MFFF-Gloveboxes GB-10 E-6	A container handling accident or container failure within a glovebox (i.e., a leak, break, or spill) results in a breach of the container, and the dispersal of radiological materials within the glovebox. Specific Location: AP-Acid recovery AP-Solvent recovery AP-PuO2 Decanning AP-Recanning AP-Pre-polishing Milling AP-PuO2 Canning AP-Precipitation-Filtration-Oxidation AP-Homogenization-Sampling AP-Dissolution AP-Dissolution of chlorinated feed AP-Purification cycle AP-Sampling AP-Oxalic mother liquors recovery Receiving Workshop Powder Workshop Pellet Workshop Cladding and Rod Control Workshop Miscellaneous Areas (Laboratories) Waste Handling Mode: All Hazard Sources: Radiological Material (maximum inventory in glovebox)	1. Human error or equipment failure during load handling operations inside a glovebox

Table 5A-13. Unmitigated Events, Facility Wide

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Internal Fire Facility Wide FW-1 E-1	A facility wide fire (due to electrical equipment, transient combustibles, etc.) involves the MFFF Building and results in a breach of confinement, and the dispersal of radiological material. Specific Location: All Process Units and Support Units with radioactive material present Mode: All Hazard Sources: Radiological Material (maximum inventory in MFFF susceptible to a facility wide fire)	1. Combustibles and electrical short 2. Combustion of waste from exposure to chemicals 3. Maintenance activities 4. Combustibles and unknown ignition source
Internal Fire Facility Wide FW-2 E-1	A fire (due to electrical equipment, transient combustibles, etc.) involves the Pneumatic Pipe Automatic Transfer System and results in a breach of confinement, and the dispersal of radiological material. Specific Location: Facility Wide (Two pneumatic transfer systems) Mode: All Hazard Sources: Radiological Material (maximum inventory in Pneumatic Pipe Automatic Transfer System)	1. Combustibles and electrical short 2. Combustion of waste from exposure to chemicals 3. Maintenance activities 4. Combustibles and unknown ignition source

Table 5A-13. Unmitigated Events, Facility Wide (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Explosion Facility Wide FW-3 E-2	Pressure vessel or gas bottle failure, facility wide, results in explosive release and potential worker injury along with damage to process areas and confinement zones. Specific Location: All Process Units and Support Units with a pressure vessel or gas bottle and radioactive material present Mode: All Hazard Sources: Radiological Material (maximum inventory in nearby confinements)	1. Pressure vessel overpressurization and pressure vessel located close to areas containing plutonium 2. Pressure vessel overpressurization and pressure vessel not in accordance with ASME Code 3. Pressure vessel overpressurization and pressure vessel relief not provided
Explosion Facility Wide FW-4 E-2	An explosion due to flammable, explosive, or reactive chemicals in the contaminated drains, facility wide, results in a breach of confinement, and the dispersal of radiological material. Specific Location: All Process Units and Support Units with contaminated drains Mode: All Hazard Sources: Radiological Material (maximum inventory in contaminated drain)	1. Explosive gas and unknown ignition source

Table 5A-13. Unmitigated Events, Facility Wide (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Explosion Facility Wide FW-6 E-2	Over-pressurization due to flammable, explosive, or reactive chemicals in the contaminated drains, facility wide, results in a breach of confinement, and the dispersal of radiological material. Specific Location: All Process Units and Support Units with contaminated drains Mode: All Hazard Sources: Radiological Material (maximum inventory in contaminated drain)	1. Over-pressurization due to unanticipated chemical reaction 2. Human error or equipment failure
Loss of Confinement / Dispersal of Nuclear Material Facility Wide FW-5 E-3	Leakage from contaminated drains, facility wide, results in a breach of confinement, and the dispersal of radiological material. Specific Location: All Process Units and Support Units with contaminated drains Mode: All Hazard Sources: Radiological Material (maximum inventory in contaminated drain)	1. Corrosion of contaminated drains 2. Mechanical failure of contaminated drains
Loss of Confinement / Dispersal of Nuclear Material Facility Wide FW-7 E-3	Accident (e.g., Fire) leads to Radiation Air Monitoring System HEPA filter failures (i.e., breach of C3 confinement) and spreads contamination through the centralized air monitoring system. Specific Location: All Process Units and Support Units with radiation monitors associated with the centralized air monitoring system Mode: Normal Operation Hazard Sources: Radiological Material (maximum inventory in C3 HVAC system)	1. Fire due to combustibles and unknown ignition source

Table 5A-13. Unmitigated Events, Facility Wide (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Loss of Confinement / Dispersal of Nuclear Material Facility Wide FW-8 E-3	During normal operation, contamination spreads through the Radiation Air Monitoring System resulting in a breach of Secondary Confinement (i.e., leakage into an interfacing system) and dispersal of radiological materials. Specific Location: All Process Units and Support Units with radiation monitors associated with the centralized air monitoring system Mode: Normal Operation Hazard Sources: Radiological Material (maximum inventory in a Secondary Confinement)	1. Leak in Radiation Air Monitoring System
Loss of Confinement / Dispersal of Nuclear Material Facility Wide FW-9 E-3	Over-pressurization or under-pressurization of the Pneumatic Pipe Automatic Transfer System due to improper operation of the Pneumatic Transfer Vacuum System results in a breach of confinement and dispersal of radiological materials. Specific Location: Facility Wide (Two pneumatic transfer systems) Mode: Normal Operation Hazard Sources: Radiological Material (maximum inventory in Pneumatic Pipe Automatic Transfer System)	1. Control system failure
Loss of Confinement / Dispersal of Nuclear Material Facility Wide FW-11 E-3	Corrosion of the Pneumatic Pipe Automatic Transfer System due to corrosive chemicals results in a breach of confinement and dispersal of radiological materials. Specific Location: Facility Wide (Two pneumatic transfer systems) Mode: All Hazard Sources: Radiological Material (maximum inventory in Pneumatic Pipe Automatic Transfer System)	1. Corrosion of the Pneumatic Pipe Automatic Transfer System

Table 5A-13. Unmitigated Events, Facility Wide (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Loss of Confinement / Dispersal of Nuclear Material Facility Wide FW-12 E-3	Back-flow (from a support system outside a glovebox) through a liquid supply line (e.g., Chilled Water or Cooling Water) to Secondary Confinement, facility wide, results in a breach of confinement (i.e., leakage into an interfacing system) and dispersal of radiological materials. Specific Location: All Process Units and Support Units with support systems with liquid supply lines to a glovebox Mode: All Hazard Sources: Radiological Material (Contamination in support system)	1. Loss of liquid flow through the supply line
Load Handling Facility Wide FW-15 E-6	A heavy load impacts and damages MFFF structure while utilizing miscellaneous load handling devices resulting in a breach of a primary confinement or in a breach of a container holding nuclear materials. Specific Location: All Process Units and Support Units with radioactive material present Mode: All Hazard Sources: Radiological Material (maximum inventory in container or primary confinement)	1. Human error or equipment failure

Table 5A-13. Unmitigated Events, Facility Wide (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Load Handling Facility Wide FW-16 E-6	External impact on contaminated drains while utilizing miscellaneous load handling devices results in breach of confinement, and dispersal of radiological materials. Specific Location: All Process Units and Support Units with contaminated drains Mode: All Hazard Sources: Radiological Material (maximum inventory in contaminated drain)	1. Human error or equipment failure
Load Handling Facility Wide FW-17 E-6	A load impacts the Pneumatic Pipe Automatic Transfer System while utilizing miscellaneous load handling devices resulting in a breach of confinement and dispersal of radiological materials. Specific Location: Facility Wide (Two pneumatic transfer systems) Mode: All Hazard Sources: Radiological Material (maximum inventory in Pneumatic Pipe Automatic Transfer System)	1. Human error or equipment failure during load handling operations around the pneumatic transfer piping
Load Handling Facility Wide FW-20 E-6	A transfer container is dropped onto the floor and results in a breach of the transfer container and the dispersal of radiological materials. Specific Location: All Process Units and Support Units with transfer containers Mode: All Hazard Sources: Radiological Material (maximum inventory in container, e.g. HEPA filters)	1. Human error or equipment failure during container handling operations

Table 5A-13. Unmitigated Events, Facility Wide (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Load Handling Facility Wide FW-21 E-6	A load is dropped onto a radioactive material container and results in a breach of the container and the dispersal of radiological materials. Specific Location: All Process Units and Support Units with radioactive material containers Mode: All Hazard Sources: Radiological Material (maximum inventory in container)	1. Human error or equipment failure during waste drum handling operations
Chemical Facility Wide FW-18 E-7	A breach of hazardous chemical containers, facility wide, results in a chemical release with potential impact on the worker and on control area habitability. Specific Location: Facility Wide Mode: All Hazard Sources: Hazardous Chemicals	1. Human error or equipment failure 2. Corrosion of containers

Table 5A-14. Unmitigated Events, General Hazard

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
External Event (Industrial and Transport Infrastructure Accidents) General Hazard GH-2 E-8	A transportation accident (fire or explosion) outside the MFFF Building results in structural damage to the MFFF or negatively impacts control area habitability. Specific Location: Outside AP/MP Building Mode: All Hazard Sources: Radiological Material (maximum inventory in MFFF susceptible to disruption by structural damage)	1. Transportation accident
External Event (Industrial and Transport Infrastructure Accidents) General Hazard GH-3 E-8	A fire or explosion at a nearby facility outside the MFFF Building (e.g., other SRS facility, Pit Disassembly and Conversion Facility, etc.) results in structural damage to the MFFF or negatively impacts control area habitability. Specific Location: Outside AP/MP Building Mode: All Hazard Sources: Radiological Material (maximum inventory in MFFF susceptible to disruption by structural damage)	1. Human error or equipment failure
External Event General Hazard GH-13 E-8	A fire (involving other nearby facilities, nearby vegetation, or vehicles) occurs and affects the MFFF Building resulting in structural damage. Specific Location: General Plant and Outside Areas Mode: All Hazard Sources: Radiological Material (maximum inventory in MFFF susceptible to the consequences of external fires or explosions)	1. Forrest fire 2. Nearby vehicle fire 3. Combustibles and unknown ignition source at nearby facility

Table 5A-14. Unmitigated Events, General Hazard

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
External Event General Hazard GH-14 E-8	A container spill occurs within the site boundary resulting in the dispersal of radioactive material. Specific Location: Outside Areas Mode: Transportation Hazard Sources: Radiological Material (maximum inventory in MFFF susceptible to the consequences of a spill).	1. Vehicular accident

Table 5A-14. Unmitigated Events, General Hazard (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Natural Phenomena (Tornado related chemical release) General Hazard GH-4 E-9	Extreme weather (i.e., a tornado, tornado missiles, or high velocity straight wind) affects the Reagents Processing Building and results in toxic chemicals being released from the vessels, tanks, and piping in the building and potentially impacting the worker and control area habitability. Specific Location: Reagents Processing Building Mode: All Hazard Sources: Hazardous Chemicals	1. Tornado 2. High velocity straight wind
Natural Phenomena (Earthquake) General Hazard GH-5 E-9	An earthquake up to and including the Design Basis Earthquake occurs and affects the MFFF Building. Specific Location: Facility Wide Mode: All Hazard Sources: Radiological Material (maximum inventory in MFFF susceptible to an earthquake)	1. Earthquake
Natural Phenomena (External Flooding) General Hazard GH-6 E-9	Extreme weather occurs and affects the MFFF Building resulting in flooding. Specific Location: Facility Wide Mode: All Hazard Sources: Radiological Material (maximum inventory in MFFF susceptible to flooding)	1. Flooding rain

Table 5A-14. Unmitigated Events, General Hazard (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Natural Phenomena (Tornado) General Hazard GH-7 E-9	Extreme weather (tornado or high velocity straight winds) occurs and affects the MFFF Building resulting in failure of dynamic confinement systems due to pressure differential. Specific Location: Facility Wide Mode: All Hazard Sources: Radiological Material (maximum inventory in MFFF susceptible to tornado)	1. Tornado 2. High velocity straight wind
Natural Phenomena (Tornado or High Winds) General Hazard GH-8 E-9	Extreme weather (e.g., high velocity straight winds, tornado, or tornado missiles) occurs and affects the MFFF Building resulting in structural damage. Specific Location: Facility Wide Mode: All Hazard Sources: Radiological Material (maximum inventory in MFFF susceptible to high velocity straight winds, tornado, or tornado missiles)	1. Tornado 2. High velocity straight wind
Natural Phenomena General Hazard GH-9 E-9	Extreme weather (e.g., rain, snow or hail) occurs and affects the MFFF Building resulting in structural damage. Specific Location: Facility Wide Mode: All Hazard Sources: Radiological Material (maximum inventory in MFFF susceptible to disruption by structural damage)	1. Rain, snow, or hail

Table 5A-14. Unmitigated Events, General Hazard (continued)

Event Type/Workshop or Location/ Event Number	Unmitigated Event Description/Specific Location/Hazard Sources	Cause
Natural Phenomena General Hazard GH-10 E-9	Extreme weather (excessive high temperature) occurs and affects the MFFF Building resulting in a thermal excursion in the process areas or in the PUO2 storage area. Specific Location: Facility Wide Mode: All Hazard Sources: Radiological Material (maximum inventory in MFFF susceptible to excessive high temperature in the environment)	1. High Temperature in the environment
Natural Phenomena General Hazard GH-11 E-9	Extreme weather (lightning) occurs and affects the MFFF Building resulting in failures of electrical equipment or external fires or explosions potentially impacting control area habitability. Specific Location: Facility Wide Mode: All Hazard Sources: Radiological Material (maximum inventory in MFFF susceptible to the consequences of failures of electrical equipment or external fires or explosions)	1. Lightning
Natural Phenomena General Hazard GH-12 E-9	Land subsidence affecting the MFFF Building results in structural damage. Specific Location: Facility Wide Mode: All Hazard Sources: Radiological Material (maximum inventory in MFFF susceptible to disruption by structural damage)	1. Land subsidence