



**The Secretary of Energy**  
Washington, DC 20585

December 5, 2012

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DNF SAFETY BOARD

The Honorable Peter S. Winokur  
Chairman  
Defense Nuclear Facilities Safety Board  
625 Indiana Avenue NW, Suite 700  
Washington, DC 20004

Dear Mr. Chairman:

Enclosed is the Department of Energy's (DOE) Implementation Plan (IP) for the Defense Nuclear Facilities Safety Board's (Board) Recommendation 2012-1, *Savannah River Site Building 235-F Safety* identifying the Department's actions to reduce the hazards associated with the material at risk that remains as residual contamination within Building 235-F.

On July 10, 2012, DOE accepted Recommendation 2012-1, and on October 24, 2012, requested additional time to complete the IP.

The IP details a strategy that will address the Board's concern regarding the residual Plutonium-238 in Building 235-F and will eliminate the potential for a full facility fire in an accident situation. We intend to implement the Plan in a disciplined and methodical manner and will keep you informed of our progress in accordance with the IP.

If you have any further questions, please feel free to contact me or Mr. David Huizenga, Senior Advisor for Environmental Management, at (202) 586-7709.

Sincerely,

A handwritten signature in black ink that reads "Steven Chu".

Steven Chu

Enclosure



# United States Department of Energy

## Implementation Plan for Defense Nuclear Facilities Safety Board Recommendation 2012-1 Revision 0

*Savannah River Site Building 235-F Safety*



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## EXECUTIVE SUMMARY

The purpose of this Implementation Plan (IP) is to specify the United States Department of Energy (DOE) actions for addressing Defense Nuclear Facilities Safety Board (DNFSB) (Board or DNFSB) Recommendation 2012-1, *Savannah River Site (SRS) Building 235-F Safety*. The recommendation addressed the need for the DOE to execute actions that can reduce the hazards associated with the plutonium-238 (Pu-238), material at risk (MAR), that remains as residual contamination within Building 235-F. Building 235-F at the SRS houses nine partially deactivated processing cells, associated ventilation ductwork and other process lines that contain residual Pu-238 contamination which poses a potential dose risk consequence associated with a radiological release.

The Basis for Interim Operation (BIO) contains a postulated accident scenario in which there is an earthquake that causes a breach of the facility containment structure. This seismic event is also postulated to initiate a fire which would propagate and evolve into a full facility fire which engulfs the MAR, causing it to become airborne and released from the building. The unmitigated consequence of this event could be greater than 27,000 rem to a co-located worker at 100 meters from the Building 235-F.

This IP focuses on addressing the corrective actions necessary to physically remove as much residual Pu-238 as practical and the removal of potential ignition sources to confirm assurance of adequate collocated worker protection regardless of the accident scenario.

The DNFSB's recommendations concerning the residual material remaining in process cells in Building 235-F are identified in Recommendation 2012-1 as:

1. Take action to immobilize and/or remove the Pu-238 that remains as residual contamination within Building 235-F.
2. Take near-term actions and implement compensatory measures to improve the safety posture of Building 235-F and reduce the potential for and severity of a radiological release including but not limited to the following:
  - a. To the extent feasible, remove from Building 235-F all transient and fixed combustibles that are not directly necessary for surveillance and maintenance activities and ensure that the transient combustible loading in the facility remains as low as reasonably achievable.
  - b. Ensure that all electrical equipment not necessary to support facility safety systems, life safety, or surveillance and maintenance activities is de-energized and air-gapped. Remove all electrical and support equipment remaining within former process areas that is not necessary for surveillance and maintenance.

- c. Evaluate the condition and operability of early detection and alarm systems in the Plutonium Fuel Form (PuFF) facility such as the heat and smoke detectors (with the exception of those located within the PuFF facility cells if evaluating them would require intrusion into the cells). Take action as necessary to ensure that these systems are credited in the Safety Basis (SB), are remotely monitored, provide reliable detection of hazards, and are maintained in accordance with National Fire Protection Association (NFPA) 72, *NFPA and Signaling Code*.
3. Take action to ensure that the SRS emergency response to a radiological release from Building 235-F is adequate and effective, including but not limited to, the following:
  - a. Ensure that an integrated emergency response plan is in place that considers the co-located workers in facilities, construction sites, and trailers located adjacent to Building 235-F. Development of this plan should include an evaluation of the specific locations where co-located workers are directed to shelter in place to mitigate radiological consequences during and following a potential radiological release from Building 235-F.
  - b. Ensure that periodic coordinated drills in response to a simulated event at Building 235-F are conducted. Such drills should include appropriate response actions by personnel in the adjacent facilities and construction sites, such as sheltering in place or evacuating depending on proximity to the simulated plume of radioactive material.

The direct and underlying cause of Building 235-F conditions continuing to exist has been the lack of sustained funding to mitigate or eliminate the risk and is not the result of any technical problems. For the past 20 years, SRS has safely managed the risk associated with the residual Pu-238 materials in cells, associated duct work and other process lines.

On July 10, 2012, the Secretary of Energy sent the Board a letter acknowledging receipt of Recommendation 2012-1 and accepting the Recommendation. The letter also stated that "DOE agrees with the Board that action must be taken to reduce the hazards associated with the material at risk that remains as residual contamination". The letter described DOE's initial actions to remove transient combustibles from and limit access to the building. This IP outlines the actions DOE and its contractors will take to address safety issues at Building 235-F. After completion of all commitments in the IP, DOE will have:

- Reduced the MAR in the facility to meet the requirements of 10 C.F.R. Part 830 to protect the maximally exposed off-site individual to within the established DOE-STD-3009 evaluation guidelines and protect the co-located and facility worker within the accepted SRS guidelines of 100 rem.

- De-energized and, where practical, air-gapped electrical components or circuits to reduce the likelihood of a facility fire.
- Reduced, to the extent feasible, the risk associated with Building 235-F transient and fixed combustibles that are not directly necessary for surveillance and maintenance activities.
- Assured a reliable PuFF fire detection system is maintained and operated consistent with National Fire Protection Association 72 requirements.
- Implemented an F-Area drill program that demonstrates that emergency plans protect collocated personnel from the hazards associated with a radiological release from Building 235-F.

The Manager of the Savannah River Operations Office (SR) is the Responsible Manager for the execution of this IP. The Assistant Manager for Nuclear Material Stabilization Project (AMNMSP) is the point of contact responsible for the site-specific actions of this Recommendation and will ensure the activity is satisfactorily completed and formally closed.

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## 1.0 BACKGROUND

Building 235-F is a Hazard Category 2 (HC2) Defense Nuclear Facility that was constructed in the 1950s as part of the original Savannah River Plant's weapons materials production and fabrication missions. The facility was used primarily for plutonium and neptunium component production processes within shielded cells and glove box lines.

Building 235-F is 222 feet long, 109 feet wide and 28 feet tall. The two story structure has double reinforced 14-inch thick concrete exterior walls. Air from the process area passes through double High Efficiency Particulate Air filtration before exiting the building via an exhaust tunnel through a sand filter drawn by fans and exhausting through a 134 foot stack.

In the mid-1970s the PuFF Facility was installed on the first level of Building 235-F. The facility was comprised of shielded (hot) cells housing manipulators, glove boxes, and ventilation system. Spheres or pellets of Pu-238 oxide encased in iridium shells were produced. The radioactive decay heat was used to produce electricity when assembled into Radioisotope Thermoelectric Generators (RTG), which provided stable long-term power for spacecraft.

In 1983, when the last process line was idled, the facility's remaining mission was vault storage, surveillance, and repackaging of containerized Special Nuclear Material (SNM). That storage and repackaging mission was terminated in 2006. All SNM was removed from the building except for "holdup", defined as nuclear material deposits adhering to process equipment, piping, filters, and containment walls. The majority of the holdup is in cells and glove boxes, with small amounts identified in the process exhaust systems.

Building 235-F process systems have been shut down and initially de-inventoried. Building 235-F is currently in the Surveillance & Maintenance (S&M) mode. S&M activities include support for the electrical, diesel generator, ventilation, instrument air, alarm monitoring, steam supply, and chilled water systems that are used for containment, monitoring of residual radiological holdup, and general building habitability.

The bounding holdup inventory in Building 235-F, including statistical uncertainty of the measurement methodology that is used in the S&M BIO accident analysis, is 1588 grams Pu-238 and 287 grams Np-237, and is defined as the MAR. This material primarily resides in various process enclosures (e.g. shielded cells and glove boxes) as a thin surface film. Most of the Pu-238 is in the form of plutonium oxide, which consists of consists of fine, dry particulates (average diameter of 1.7 microns) that adhere to interior surfaces of these enclosures. This holdup represents an inhalation exposure risk to the facility and co-located workers if aerosolized.

The current safety envelope is defined in a Justification for Continued Operations (JCO) which addresses the S&M mode and manages the associated risks. Various potential accidents and events associated with the holdup have been analyzed in the BIO and the resulting appropriate controls have been established and implemented.

The BIO contains an accident scenario in which there is an earthquake that causes a breach of the facility containment structure. This seismic event also initiates a fire. This propagates and evolves into a full facility fire which engulfs the MAR causing it to become airborne and be released from the building. The unmitigated consequences of this event could be greater than 27,000 rem to the collocated worker at 100 meters.

From mid-2004 to the present time, DOE and Savannah River Nuclear Solutions (SRNS) have initiated a number of activities aimed at improving safety at Building 235-F.

In 2004 an Upgraded Interim Control Posture analysis was performed on the 235-F facility to identify its vulnerabilities. That analysis was documented in a JCO. The JCO contained controls to improve the safety posture of the facility by implementing ventilation changes to properly contain and filter releases from a facility fire event.

In 2008, the Cf Shuffler instrument was removed from the facility. The instrument contained and was surrounded by a large amount of High Density Polyethylene used as neutron moderator shielding, which represented a significant fire loading.

In 2010, the American Recovery and Reinvestment Act (ARRA) provided the funding necessary to reduce the height of Building 235 F's exhaust stack and the initial BIO development.

In 2012 the facility maintenance budget funded a roof replacement. The intrusion of rainwater had led to electrical safety issues, contamination control concerns, and fire system impairments due to ceiling tile degradation.

On May 9, 2012, the Board issued Recommendation 2012-1 which identified three specific sub-recommendations:

1. Take action to immobilize and/or remove the Pu-238 that remains as residual contamination within Building 235-F.
2. Concurrent with sub-Recommendation 1, take near-term actions and implement compensatory measures to improve the safety posture of Building 235-F and reduce the potential for and severity of a radiological release, including but not limited to the following:
  - a. To the extent feasible, remove from Building 235-F all transient and fixed combustibles that are not directly necessary for surveillance and maintenance activities and ensure that the transient combustible loading in the facility remains as low as reasonably achievable.
  - b. Ensure that all electrical equipment not necessary to support facility safety systems, life safety, or surveillance and maintenance activities is de-energized and air gapped. Remove all electrical and support equipment remaining within former process areas that is not necessary for surveillance and maintenance.



- c. Evaluate the condition and operability of early detection and alarm systems in the PuFF facility such as the heat and smoke detectors (with the exception of those located within the PuFF facility cells if evaluating them would require intrusion into the cells). Take action as necessary to ensure that these systems are credited in the SB, are remotely monitored, provide reliable detection of hazards, and are maintained in accordance with NFPA 72, *NFPA and Signaling Code*.
3. Concurrent with sub-Recommendation 1 take action to ensure that the SRS emergency response to a radiological release from Building 235-F is adequate and effective, including but not limited to the following:
  - a. Ensure that an integrated emergency response plan is in place that considers the collocated workers in facilities, construction sites, and trailers located adjacent to Building 235-F. Development of this plan should include an evaluation of the specific locations where collocated workers are directed to shelter in place to mitigate radiological consequences during and following a potential radiological release from Building 235-F.
  - b. Ensure that periodic coordinated drills are conducted in response to a simulated event at Building 235-F. Such drills should include appropriate response actions by personnel in the adjacent facilities and construction sites such as sheltering in place or evacuating depending on proximity to the simulated plume of radioactive material.

On July 10, 2012, the Secretary of Energy sent the Board a letter acknowledging receipt of Recommendation 2012-1 and accepting the Recommendation. The letter stated that “DOE agrees with the Board that action must be taken to reduce the hazards associated with the material at risk that remains as residual contamination.” The letter also described DOE’s initial actions to remove transient combustibles and limit access.

## **2.0 UNDERLYING CAUSES**

While SRS has extensive experience with deactivation of glove box facilities containing Pu-238, deactivation of “hot” cells has not been attempted. For the past 20 years SRS has safely managed the risk associated with the residual Pu-238 materials in cells, associated duct work and other process lines. The Department’s response letter dated July 10, 2012, stated DOE will address all sub-recommendations with the ultimate goal of reducing to the extent feasible the radiological hazards from residual contamination and the fire hazards due to excessive combustible materials and electrical sources.

There have been several studies on the need to mitigate the risk posed by Building 235-F and as recent as 2010 a Building 235-F Risk Reduction Mission Need Document was developed. The rough-order-of-magnitude cost estimate had an upper range of \$96 Million (M) to remove the PuFF cells and associated glove boxes, and proposed a five year project schedule.

The proposed set of goals will be an operationally funded project starting Fiscal Year (FY) 2013. In FY 2012 \$2.1M was allotted for safety document development and planning activities.

### **3.0 BASELINE ASSUMPTIONS**

The strategy of the MAR reduction includes starting with lower hazard PuFF cells 6-9, which will provide valuable insights and lessons learned that can be applied to work in cells 1-5, which pose a higher risk because they have a higher inventory of Pu-238 material.

This will be an operational activity in accordance with the Office of Environmental Management (EM) Operations Activities Protocol. Deactivation of the facility will use a graded approach for incorporating the relevant DOE project management principles in a tailored manner for a cleanup endeavor. Currently, the plans are in the conceptual phase; DOE plans to issue a Project Deactivation Plan that will detail the tailored approach, evaluation techniques and technologies evaluation requirements to project implementation. Base funding for surveillance and maintenance activities in Building 235-F is approximately \$8M annually. This maintains the facility safety envelope which includes conducting SB credited surveillance requirements, preventive maintenance and repairs of equipment and systems and maintaining facility habitability (life safety).

### **4.0 NEAR-TERM ACTIONS AND RELATED ACTIVITIES**

The initial work performed on the D&D BIO transitioned to an S&M BIO that would serve as an updated safety basis until future intrusive deactivation work could be funded and planned. The S&M BIO and accompanying Technical Safety Requirements (TSRs) are currently approved by DOE.

Following several stakeholder meetings in late 2011 concerning the safest S&M posture for the facility, removal of transient combustibles was completed from all areas throughout Building 235-F. Transient combustibles minimization is presently enforced by administratively controlling Building 235-F access, limiting combustibles brought into the building, and performing periodic inspections for transient combustibles (i.e., monthly fire protection coordinator walk downs).

An initial evaluation of all Building 235-F facility fire detection and alarm systems for functionality and maintainability relative to facility missions is being developed. The facility and DOE are presently evaluating the recommendations. A path forward will be developed and tracked as an action relative to sub-recommendation 2C-3.

A source term removal/deactivation project has been initiated to address disposition of the residual contamination hazard within Building 235-F (primarily Pu-238 holdup). The FY12 scope (approved January 2012) provided the groundwork for the formation of an Integrated Project Team to initiate development of the strategies and means to perform source term removal/deactivation scope for Building 235F.

A Deactivation BIO and TSR will be developed, and will provide controls for the deactivation scope of activities that are planned in the facility for FY 2014. The FY 2014 scope will involve activities in cells 6-9 that will demonstrate invasive cell techniques that will be used to

characterize and disposition the majority of the Pu-238 holdup that is contained in cells 1-2. This scope will expand to a multi-year project that de-inventories cells 1-5, and is expected to reduce the MAR in the facility to meet the requirements of 10 C.F.R. Part 830 to protect the maximally exposed off-site individual to within the established DOE-STD-3009 evaluation guidelines and protect the collocated and facility worker within the accepted SRS guidelines of 100 rem.

Once the FY 2014 activities are complete this will enable the cells 1-5 characterization/deactivation scope to be finalized. If needed, the Deactivation BIO will be revised to incorporate lessons learned and added controls that may be needed to safely accomplish the work in cells 1-5.

There were 36 employees supporting the Mixed Oxide and Waste Solidification Building (WSB) projects housed in three trailers within the Building 235-F facility fence line. Those employees were not associated with Building 235-F operations, but were most proximate to the Building 235-F accident scenario hazard and were relocated in October 2012.

## **5.0 SAFETY ISSUE RESOLUTION**

The Department agrees with the Board that action must be taken to reduce the hazards associated with the material at risk that remains as residual contamination. This IP defines the approach and commitments necessary to address safety issues at Building 235-F. After completion of all commitments in the IP, DOE will have:

- Reduced the MAR in the facility to meet the requirements of 10 C.F.R. Part 830 to protect the maximally exposed off-site individual to within the established DOE-STD-3009 evaluation guidelines and protect the co-located and facility worker within the accepted Savannah River Site guidelines of 100 rem.
- De-energized and, where practical, air-gapped electrical components or circuits to reduce the likelihood of a facility fire.
- Assured a reliable PuFF fire detection system is maintained and operated consistent with NFPA 72 requirements.
- Implemented an F-Area drill program that demonstrates emergency plans protect co-located personnel from the hazards associated with a radiological release from Building 235-F.

The building will remain a HC2 facility following removal of Pu-238 and nuclear safety will continue to be managed through established safety basis documents (i.e., BIO, TSRs and Authorization Agreement) until it can be placed in a final end-state.

When the DNFSB issued its recommendation, SRS had already initiated a number of actions described above. The Secretary committed to further actions in his response to Recommendation 2012-1 and through the development of this IP.

### Resolution Approach

The Secretary of Energy approved this plan which provides direction and tracks progress to assure effective completion and validation of actions listed herein. The Secretary of Energy designated the DOE-SR Manager as the Responsible Manager for Recommendation 2012-1.

DOE is committed to the safe design and operation of its nuclear facilities consistent with the principles of Integrated Safety Management (ISM). ISM is a commitment to perform work in a disciplined manner within the safety basis to protect safety of the workers, co-located workers and the public. Under the ISM process, the scope of the work to be performed is defined first. A Consolidated Hazards Analysis (CHA) then provides input to development of controls to address the hazards. These controls become part of the BIO. The work is then performed within the defined safety envelope for the facility. Feedback as “lessons learned” then improves the techniques/control strategy that gets reflected in the next BIO revision. The Department’s approach to address the Board’s three sub-recommendations is described below:

### **5.1 Sub-Recommendation 1 - Take action to immobilize and/or remove the Pu-238 that remains as residual contamination within Building 235-F**

#### Issue Description/Discussion

A need exists to reduce the risk associated with Building 235-F, including its associated process equipment, such as the hot cells, and glove boxes containing residual Pu-238 holdup material. Much of the material in cells 1-5 and related wing cabinet glove boxes is in the form of micronized particles (ball-milled). The disposition of the PuFF Facility is considered highly hazardous due to Pu-238’s high specific activity and extreme mobility as a result of its very small particle size and significant alpha decay recoil.

The cells are box-like structures which have a front wall of heavily shielded concrete and a thick window. The lining of the cells is stainless steel. Remotely controlled manipulators and equipment were controlled from the front or operating side. The floor is approximately waist high. There are no side walls between cells 1-5 and a tunnel connects to cells 6-9 on the opposite side of the operating area. The maintenance side includes the backs of the cells. These have windows with glove ports or connections to wing cabinets. The wing cabinets contained high pressure presses and vacuum pumps as well as staging areas for maintenance of in-cell equipment. Pu-238 oxide was introduced in cells 1 and 2 for the PuFF fabrication process and contained furnaces and ball mills. Non-Destructive Assay (NDA) measurements, incorporating bounding uncertainties, estimate cells 1 and 2 contain 86 percent of the PuFF holdup inventory. Cells 3-5 are estimated to contain 4.5 percent of the holdup, with the associated wing cabinets containing 6.6 percent of the holdup. Combined, these cells and wing cabinets represent 93 percent of the entire facility holdup inventory with the remainder spread over a larger number of glove boxes with lower levels of contamination contained in other processing areas of the facility.

#### Resolution Approach

The strategic approach to mitigate the risk associated with residual Pu-238 holdup materials in Building 235-F is to physically remove as much MAR as practical, and then evaluate new

characterization results to confirm sufficient material has been removed. This will be accomplished through execution of deactivation activities commencing with the PuFF cells and, if necessary, may also include Plutonium Experimental Facility (PEF), the Actinide Billet Line (AB Line) and the Old Met Lab (OML). In the context of this IP, deactivation is defined as reducing the MAR in the facility to meet the requirements of 10 C.F.R. Part 830 to protect the maximally exposed off-site individual to within the established DOE-STD-3009 evaluation guidelines and protect the co-located and facility worker within the accepted Savannah River Site guidelines of 100 rem.

As described earlier in this plan, the underlying cause of the MAR remaining in Building 235F PuFF cells was lack of sustained funding to mitigate or eliminate the hazards. After considering options to fund removal of MAR from the PuFF cells as either a Capital Line Item or as an Operations Activity, DOE concluded that proceeding with deactivation as an operations activity represents the choice that best allows the quick and efficient initiation of remediation activities.

In a Memorandum dated March 15, 2012, EM established policy and protocols for Operational Activities that described an integrated system of program management elements for planning and executing Operational Activities. At SRS, the process that implements that Policy is institutionalized in Manual 6B, *Program Management Manual*. Manual 6B tailors project management and control processes based upon factors that include project type (e.g., Operations Activity); duration; cost; and complexity to determine the amount of planning and coordination that will be necessary to develop performance baselines and accomplish project objectives and goals.

At SRS, procedures in Manual 1C, *Facility Deactivation Manual*, define the disposition activities for facilities that are being deactivated. Disposition activities include identifying residual hazards, deactivation end points, and a project plan for reaching those end points. The process of identifying residual hazards includes actions necessary to analyze facility hazards and revise facility safety basis documents to reflect any new or revised controls that prevent or mitigate those hazards. Further, a safety basis strategy will be developed for planning how important safety issues will be addressed in the design and development of the safety basis document revision(s) necessary to address deactivation activities. The results, including project planning and execution are then documented in a project Deactivation Plan.

In accordance with Site Manual 1C, SRNS will develop and approve a Building 235-F Deactivation Plan. The Deactivation Plan includes: identification of project scope, including safety basis documentation and constraints; surveillance and maintenance requirements; technology development (e.g. enhanced MAR holdup characterization survey equipment), project execution including organization and responsibilities, cost, schedule and performance measures; regulatory considerations; and safety standards and waste management. The Deactivation Plan will also identify the material removal and decontamination methods and will evaluate various technical approaches with regard to applying those methods in order to define a strategy for their application. Lessons learned during execution of the deactivation project will be used to revise that strategy to improve the effectiveness of MAR removal.

Deactivation of the PuFF cells and associated process systems will build upon the research and preliminary work accomplished under previous Building 235-F deactivation projects. The major project steps for removing plutonium holdup and deactivating the PuFF facility are:

1. Development of tools and the work techniques necessary for cell entry and decontamination/deactivation activities.
2. Deployment of enhanced characterization instruments to locate concentrations of Pu-238 holdup for subsequent decontamination or equipment removal.
3. Waste handling, packaging and shipping.
4. Decontamination of Pu-238 from cell surfaces and potential removal of cell support equipment (e.g., wing cabinets) where characterization results indicate there may be a significant Pu-238 holdup material.

Due to the unknowns associated with the interior configuration and condition of some cells and due to the hazardous material involved, the Pu-238 removal and deactivation activities start with the less contaminated cells 6-9, and work towards the cells that contain the majority of source material (cells 1 and 2). Current NDA characterization data indicates that cells 6-9 contain approximately 8.2 grams of Pu-238 (including measurement error) as compared to hundreds of grams of Pu-238 in cells 1-5. Decontamination and deactivation will include isolating the cells 6-9 from the more highly contaminated cells 1-5.

Performance of decontamination, deactivation, and enhanced characterization activities in the lower contamination levels present in cells 6-9 will provide a safe and progressive learning environment for developing deactivation tooling and decontamination techniques. Activities anticipated to support decontamination and equipment removal include restoration of cell services; inventory of cell contents; characterization, and waste handling/disposal. Anticipated techniques for Pu-238 removal and deactivation include: vacuuming, application of strippable coatings or fixatives, use of articulated long-handled tools, decontamination/possible removal of wing cabinets connected to cells 1-5, and possible implementation of new technologies.

Restoration of cell services (e.g., lighting, cell window cleaning, reactivating glove ports, etc.) can be performed under the scope of the S&M BIO and will be completed prior to entering cells to begin decontamination and deactivation work.

Decontamination of the PuFF cells will be accomplished by first removing, assaying and disposing of loose equipment within the cells and wing cabinets. Visual observations will be made to determine if other equipment within the cells can be disassembled utilizing standard hand tools via the glove ports without undue risk to the workers. Loose material within the cells will be removed by standard techniques involving vacuums or scoops and buckets. Strippable coatings or other improved technologies may be used on flat surfaces to remove contamination. The decontamination process will be an iterative process where characterization surveys are performed between decontamination activities in order to determine a decontamination factor. Initial decontamination factors are expected to show considerable success in removing the contamination followed by diminishing returns as decontamination efforts continue. A final survey of the cells will be performed to determine the remaining quantity of radionuclides within

the cells. It is anticipated that any remaining contamination will be immobilized using fixatives, grout, or other means that have been fully evaluated and researched before application.

All Pu-238 removal and deactivation scope (both west side cells 6-9, and east side cells 1-5) will be preceded by the development and implementation of the appropriate SB controls commensurate with the deactivation scope. First SRNS will implement a Building 235-F S&M BIO. This BIO will provide controls for restoration of cell infrastructure, which lays the groundwork for beginning intrusive MAR-removal activities in FY 2014 in cells 6-9. Intrusive MAR-removal activities in FY 2014 and beyond will be controlled through a separate Deactivation BIO which will provide controls for the initial cell 6-9 activities to demonstrate deactivation techniques and gain experience in their use. Once the deactivation techniques have been demonstrated and sufficient experience has been obtained, lessons learned will be incorporated into the project and another CHA will be completed for work in cells 1-5. If necessary, a revised Deactivation BIO will be issued. However, since only the magnitude (rather than the type) of hazard varies between cells 1-5 and 6-9, significant modifications to the control set are not expected for cells 1-5. Work will then commence in cells 1-5 where larger quantities of Pu-238 can be removed.

Several years may be necessary to complete deactivation once cells 1-5 have been entered. The scope and duration of specific activities will depend upon conditions encountered once deactivation in those cells has commenced. Project schedules such as the baseline schedule contained in the Deactivation Plan will be refined as more in-situ information is obtained and used to plan and manage execution of deactivation activities. The Department will periodically update the DNFSB with more detailed scope and schedule information concerning deactivation activities.

Disposition of waste resulting from the decontamination effort will use currently active programs with most of the hazardous materials being characterized as Transuranic Waste meeting the Waste Acceptance Criteria for the Waste Isolation Pilot Plant facility in New Mexico.

A significant objective during the deactivation process is to perform enhanced characterization of the cells in order to better locate and quantify the residual Pu-238 contamination and lower uncertainty involved with MAR derivation. This characterization is anticipated to provide “before” and “after” measurements to be used in evaluating the effectiveness of the decontamination effort for each cell. It is anticipated that the characterization performed as part of this IP will employ new technology and new techniques with detection and measurement equipment placed inside the cell(s) versus the external NDA measurements performed in 2004 and 2006, thus resulting in a more thorough process. The enhanced characterization results will be used to determine a new MAR value for Building 235-F. Combined with reducing the possibility of a full facility fire and reducing the consequences of a large radiological release will mitigate the risk posed by facility hazards.

#### Deliverables/Milestone

Action1-1: Complete project deactivation planning for PuFF Cells 1-9.

Deliverable: Provide project Deactivation Plan (to include project scope, alternatives, cost estimate and schedule) to the DNFSB.

Expected Delivery Date: **May 30, 2013.**

Lead: AMNMSP

Action 1-2: Issue the Building 235-F Deactivation BIO (which supersedes the S&M BIO) to include deactivation activities in PuFF cells 6 through 9.

Deliverable: Letter to the DNFSB forwarding the Deactivation BIO.

Expected Delivery Date: **July 30, 2013.**

Lead: AMNMSP

Action1-3: Restore cell infrastructure in PuFF cells 6 through 9.

Deliverable: Letter to the DNFSB reporting completion.

Expected Delivery Date: **October 30, 2013**

Lead: AMNMSP

Action 1-4: Complete a Readiness Assessment (RA) for initiation of deactivation activities in PuFF cells 6 through 9 and implement the Deactivation BIO.

Deliverable: Letter to the DNFSB reporting initiation of deactivation activities and providing the RA report.

Expected Delivery Date: **October 30, 2013.**

Lead: AMNMSP

Action 1-5: Update planning schedule to reflect PuFF cells 1 through 5 deactivation actions for the upcoming 12 months.

Deliverable: Letter to the DNFSB reporting planned deactivation actions for 2014. This may be combined with the annual report described in Section 6.0 of this IP.

Expected Delivery Date: **December 31, 2013.**

Lead: AMNMSP

Action 1-6: Update planning schedule to reflect PuFF cells 1 through 5 deactivation actions for the upcoming 12 months.



Deliverable: Letter to the DNFSB reporting planned deactivation actions for 2015. This may be combined with the annual report described in Section 6.0 of this IP.

Expected Delivery Date: **December 31, 2014.**

Lead: AMNMSP

Action 1-7: Revise the Hazard Analysis, and if necessary the Building 235-F Deactivation BIO to include deactivation activities in PuFF cells 1 through 5.

Deliverable: Letter to the DNFSB reporting DOE approval of the revised Deactivation BIO and forwarding a copy, or notify the DNFSB that a BIO revision was not required.

Expected Delivery Date: **June 30, 2015.**

Lead: AMNMSP

Action 1-8: If needed, complete a readiness assessment for initiation of deactivation activities in PuFF cells 1 through 5 and implement the revised Deactivation BIO.

Deliverable: Letter to the DNFSB reporting initiation of deactivation and MAR removal activities in cells 1 through 5 and provide RA report.

Expected Delivery Date: **September 30, 2015.**

Lead: AMNMSP

Action 1-9: Using enhanced characterization techniques, identify a list of significant components and/or equipment to be removed for MAR reduction in Cells 1 through 5.

Deliverable: List of items to be removed for MAR reduction in Cells 1 through 5.

Expected Delivery Date: **September 30, 2015.**

Lead: AMNMSP

Action 1-10: Update planning schedule to reflect PuFF cells 1 through 5 deactivation actions for the upcoming 12 months.

Deliverable: Letter to the DNFSB reporting planned deactivation actions for 2016. This may be combined with the annual report described in Section 6.0 of this IP.

Expected Delivery Date: **December 31, 2015.**

Lead: AMNMSP

Action 1-11: Restore cell infrastructure in PuFF cells 1 through 5.

Deliverable: Letter to the DNFSB reporting completion.

Expected Delivery Date: **May 31, 2016.**

Lead: AMNMSP

Action 1-12: Update planning schedule to reflect PuFF cells 1 through 5 deactivation actions for the upcoming 12 months.

Deliverable: Letter to the DNFSB reporting planned deactivation actions for 2017. This may be combined with the annual report described in Section 6.0 of this IP.

Expected Delivery Date: **December 31, 2016.**

Lead: AMNMSP

Action 1-13: Update planning schedule to reflect PuFF cells 1 through 5 deactivation actions for the upcoming 12 months.

Deliverable: Letter to the DNFSB reporting planned deactivation actions for 2018. This may be combined with the annual report described in Section 6.0 of this IP.

Expected Delivery Date: **December 31, 2017.**

Lead: AMNMSP

Action 1-14: Complete the deactivation of Cells 1 through 9. This will include waste removal.

Deliverable: Letter to the DNFSB reporting completion of deactivation and MAR removal activities.

Expected Delivery Date: **December 31, 2017.**

Lead: AMNMSP

Action 1-15: Using enhanced characterization techniques, derive a final [post deactivation] MAR value to be used for end-state selection and regulatory acceptance. This will demonstrate mitigation of the hazard and resultant risk reduction.

Deliverable: Letter to the DNFSB reporting remaining MAR value for Building 235-F.

Expected Delivery Date: **June 30, 2018.**

Lead: AMNMSP

Action 1-16 Revise the 235-F Deactivation BIO once the MAR is removed and acknowledge the facility meets the requirements of 10 C.F.R. Part 830 to protect the maximally exposed off-site individual to within the establish DOE-STD-3009 evaluation guidelines and protect the co-located and facility worker within the accepted Savannah River Site guidelines of 100 rem.

Deliverable: Letter to the DNFSB reporting DOE approval and providing a copy of the revised Deactivation BIO.

Expected Delivery Date: **December 31, 2018.**

Lead: AMNMSP

**5.2 Sub-Recommendation 2 - Concurrent with sub-Recommendation 1 take near-term actions, and implement compensatory measures to improve the safety posture of Building 235-F and reduce the potential for and severity of a radiological release including but not limited to the following:**

- a. To the extent feasible remove from Building 235-F all transient and fixed combustibles that are not directly necessary for surveillance and maintenance activities and ensure that the transient combustible loading in the facility remains as low as reasonably achievable.**

#### Issue Description/Discussion

Transient combustibles removal from all areas throughout Building 235-F was completed in April 2012. Currently, transient combustibles minimization is enforced by administratively controlling Building 235-F access, limiting combustibles brought into the building, and performing periodic inspections for transient combustibles (i.e. - monthly fire protection coordinator walk downs). An evaluation of fixed combustibles in Building 235-F for removal, encapsulation or isolation is in development, to reduce the fuel loading as reasonably achievable.

#### Resolution Approach

Combustibles within Building 235-F are to be removed, or minimized in order to minimize the risk and severity of a potential fire. In addition a Transient Combustible control program will be a credited feature in the S&M BIO SB implementation in order to maintain combustible load as low as reasonably achievable.

A comprehensive list of fixed combustibles targeted for removal is currently under development, and will serve as basis for an additional [new] Risk Reduction project scope to commence in FY 2013. Alternative approaches to fixed combustible removal may be considered (e.g., encapsulation, fire retardant coatings, cable-tray fire barriers, penetration seals, isolation, etc.).

Impacts for evaluation include the presence of asbestos and contamination control/ventilation flow when considering removal of fixed combustibles, such as walls, carpet, floor molding, and ceiling tiles.

Development of specific criteria for determining whether a fixed combustible will remain in place or be removed is to be considered. General issues for consideration are situations where a fixed combustible:

- Is required for surveillance and maintenance.
- Is required for support of future deactivation.
- Has an adverse impact to building and/or process Heating, Ventilation, and Air Conditioning (HVAC).
- Would create significant radiological concerns, if removed.
- Has a minimal impact to fire loading.
- Is necessary to support operation of a fire detection system.

Once the evaluation is completed, it will be reviewed again prior to commencing deactivation activities, completion of Cells 6-9 decontamination, and completion of Cells 1-5 decontamination.

A Transient Combustible control program will be included and credited in the Building 235-F S&M BIO. The Transient Combustible control measures will serve as formal and disciplined means for minimizing transient combustibles fuel load severity identified in the Fire Hazard Analysis (FHA) as the S&M and deactivation phases progress.

#### Deliverables/Milestone

Action 2a-1: Development of Building 235-F specific Transient Combustible Control Program.

Deliverable: Letter to the DNFSB submitting Transient Combustible Control program procedure.

Expected Delivery Date: **February 15, 2013.**

Lead: AMNMSP

Action 2a-2: Evaluate fixed combustibles and define the fixed combustible removal, encapsulation, or isolation scope.

Deliverable: Letter to the DNFSB defining the criteria, scope, and schedule for fixed combustible removal, encapsulation, or isolation.

Expected Delivery Date: **March 4, 2013.**

Lead: AMNMSP

Action 2a-3: Complete removal, encapsulation or isolation of fixed combustibles scope.

Deliverable: Letter to the DNFSB reporting completion.

Expected Delivery Date: **October 30, 2013.**

Lead: AMNMSP

- b. Ensure that all electrical equipment not necessary to support facility safety systems life safety or surveillance and maintenance activities is de-energized and air-gapped. Remove all electrical and support equipment remaining within former process areas that is not necessary for surveillance and maintenance.**

#### Issue Description/Discussion

The cessation of Building 235-F operational missions (RTG production and SNM storage) did not include a disciplined deactivation phase that would have addressed the disposition of unnecessary electrical equipment. Electrical circuits presently energized include those required to maintain building HVAC, radiation monitoring, lighting, process control and alarms, remote surveillance and fire detection. Certain equipment that was identified during the DNFSB assessment (e.g., welding equipment) can be totally removed from the facility. Air-gapping is intended to be applied to individual equipment, not entire electrical distribution systems.

#### Resolution Approach

Similar to the evaluation of fixed combustibles described under 2a, electrical equipment will be evaluated against a set of criteria to determine what non-essential electrical equipment can be de-energized, or removed from the facility. Identified components or circuits will be de-energized, and where practical air-gapped. Specific criteria will be developed for selecting electrical equipment to remove or de-energize. General issues to be considered are situations where an electrical component within Building 235-F should remain energized are:

- Required for life safety.
- Required for surveillance and maintenance.
- Required in support of future deactivation.
- Otherwise required in support of facility safety systems.

Note that the term “air-gapping” at SRS is, from a practical standpoint, irreversible and differs from mere de-energization. Air-gapping in the context of this IP may also include removal of equipment or severing of conductors to equipment. Air-gapping will be performed to the extent practical. In other cases de-energization may be achieved by opening a circuit and controlling it open. The configuration of the de-energized or air-gapped components will be controlled programmatically and periodically verified.

#### Deliverables/Milestone

Action 2b-1: Evaluate electrical components and define the scope for de-energization of components and the process for control of the resultant configuration.

Deliverable: Letter to the DNFSB defining the criteria, scope and schedule for de-energization of components and the process for control of the resultant configuration.

Expected Delivery Date: **March 4, 2013.**

Lead: AMNMSP

Action 2b-2: Complete electrical de-energization scope, including equipment removal, as practical.

Deliverable: Letter to the DNFSB reporting completion.

Expected Delivery Date: **December 19, 2013.**

Lead: AMNMSP

- c. Evaluate the condition and operability of early detection and alarm systems in the PuFF facility, such as the heat and smoke detectors (with the exception of those located within the PuFF facility cells, if evaluating them would require intrusion into the cells). Take action as necessary to ensure that these systems are credited in the SB, are remotely monitored, provide reliable detection of hazards, and are maintained in accordance with NFPA72, NFPA and Signaling Code.**

#### Issue Description/ Discussion

Five active fire systems provide Building 235-F Fire Detection and Alarm System (FDAS) capability. These systems provide coverage for all facility rooms containing MAR, and some rooms currently de-inventoried. The systems were installed at various times, ranging from 1975 to 2001, and to various codes of record. Some of the systems installed had Halon suppression capability, but have since had that suppression capability disconnected. All of the systems provide FDAS functionality independent of their previous suppression capability.

#### Resolution Approach

All Building 235-F facility fire detection and alarm systems will be evaluated for functionality and maintainability. In particular the PuFF fire detection and alarm systems are known to require high maintenance, and parts are no longer supported by the manufacturer, and thus, are considered obsolete. The Building 235-F S&M FHA credits the Building 235-F fire systems as Defense in Depth/Important to Safety to include fire detection systems (heat and smoke) equipped with manual pull stations, local alarms and remote alarms transmitted to the 772-1F Control Room. Any recommended changes to the systems or interim protective measures will be

consistent with the requirements in the Building 235-F FHA. All FDAS systems are maintained in accordance with NFPA 72 “NFPA and Signaling Code”.

The Defense in Depth/Important to Safety (DID/ITS) systems were designated as defense in depth controls during the development of the Consolidated Hazards Analysis. The DID/ITS systems were brought forward into the BIO. The DID/ITS systems are controlled through the TSR Administrative Controls. The controls include the Un-reviewed Safety Question program, Configuration Control Program, Facility Fire Protection Program, Quality Assurance Program, and Equipment Maintenance Program. The inclusion or removal of a DID/ITS system in the BIO is controlled by DOE.

#### Deliverables/Milestone

Action 2c-1: Complete evaluation of existing FDAS for functionality and maintainability.

Deliverable: Evaluation report.

Expected Delivery Date: **Complete**

Lead: AMNMSP

Action 2c-2: Develop a Fire Alarm and Detection design study that will recommend the PuFF FDAS system design enhancements (to include criteria, scope and schedule) for S&M and deactivation phases.

Deliverable: Letter describing the PuFF FDAS design enhancements (to include criteria, scope and schedule), operation and maintenance necessary to assure PuFF fire detection and alarm system reliability is commensurate with its safety functions.

Expected Delivery Date: **April 1, 2013.**

Lead: AMNMSP

Action 2c-3: Complete installation and acceptance testing of the PuFF FDAS for S&M and deactivation phases.

Deliverable: Letter to inform FDAS installation and acceptance test completion.

Expected Delivery Date: **December 20, 2013.**

Lead: AMNMSP

**5.3 Sub-Recommendation 3 - Concurrent with sub-Recommendation 1 take action to ensure that the SRS emergency response to a radiological release from Building 235-F is adequate and effective including, but not limited to the following:**

- a. **Ensure that an integrated emergency response plan is in place that considers the co-located workers in facilities, construction sites, and trailers located adjacent to Building 235-F. Development of this plan should include an evaluation of the specific locations where co-located workers are directed to shelter in place to ensure their adequate protection during and following a potential radiological release from Building 235-F.**
- b. **Ensure that periodic coordinated drills in response to a simulated event at Building 235-F are conducted. Such drills should include appropriate response actions by personnel in the adjacent facilities and construction sites such as sheltering in place, or evacuating depending on proximity to the simulated plume of radioactive material.**

#### Issue Description

The emergency response action for a radiological release from Building 235-F following a seismically induced full facility fire is to remain indoors (shelter in place), if safe to do so. In its recommendation, the DNFSB documented its concerns that the amount of mitigation provided by remaining indoors, if safe to do so, may not be sufficient to protect nearby workers, especially in the event of seismically-induced fires since the same seismic event may also damage nearby trailers and administrative buildings. The Board further expressed concern that periodic drills have not included the Mixed Oxide Fuel Fabrication Facility or WSB construction sites to examine how these facilities would respond to a significant radiological release from Building 235-F.

#### Resolution Approach

An updated F-Area drill plan will be developed and implemented that explicitly includes the participation expectations for all facilities and construction sites surrounding Building 235-F. At least one formally assessed drill will be executed annually, based on a postulated radiological release from Building 235-F that includes successful demonstration of the ability to adequately protect workers in all facilities and construction sites surrounding 235-F.

In accordance with 10 C.F.R. Part 830, bounding accident analyses were performed for Building 235-F. The results of these analyses indicated safety-related controls are necessary to mitigate the consequences to collocated workers resulting from a seismically induced full facility fire. Current natural phenomena hazards performance category (PC) requirements of PC-3 were not incorporated into the design of the Building 235-F structure and its associated safety systems at the time it was constructed in the early 1950s. Since structure integrity (i.e., no cracking) and safety system operation cannot be assured following an earthquake, the facility's safety basis conservatively assigns no mitigation functions to them. Therefore emergency response actions are relied upon to mitigate potential radiological consequences to workers collocated to Building 235-F until it can be decontaminated and deactivated.

DOE will review emergency plans and procedures to determine whether an appropriate strategy for protecting site workers has been established at all facilities and construction sites surrounding



235-F, including a qualitative evaluation of existing structures where workers are directed to take shelter. This assessment will include such topics as whether adequate procedural guidance is provided, accessibility and suitability of existing structures to provide adequate protection to a facility's work force, adequacy of guidance relative to longer-term, i.e. after plume passage, protective actions, and guidance provided to decision makers relative to alterations to planned protective actions. SCD-7, *SRS Emergency Plan*, is the integrated emergency response plan for Savannah River Site and is the guiding document for the operation of the emergency management program at SRS. The conduct of the evaluations, as well as any procedural/plan changes, will be governed by the requirements set forth in SCD-7.

As long as the hazard at 235-F remains, periodic coordinated drills will be conducted involving the facilities and construction sites adjacent to 235-F. DOE will continuously evaluate the plans, procedures, and protective actions to determine their effectiveness. This is consistent with the multi-organizational/facility philosophy that is being applied across the entire site.

Following the completion of each drill, formal player and controller/evaluator assessments will be conducted and corrective actions will be identified for improvement. Corrective actions may include the conduct of additional training and/or drills.

#### Deliverables/Milestones

Action 3-1: Develop a Calendar Year (CY) 2013 drill schedule for F-Area detailing planned drill dates involving Building 235-F including participation by all facilities and construction sites surrounding Building 235-F.

Deliverable: CY 2013 F-Area drill schedule with drills involving Building 235-F and participation by all facilities and construction sites surrounding Building 235-F.

Expected Delivery Date: **January 31, 2013.**

Lead: Director, Office of Safeguards, Security, and Emergency Services (OSSES)

Action 3-2: Perform review of existing protective action plans and procedures to ensure that personnel are protected from the hazards associated with a radiological release from Building 235-F, and implement additional controls, as required.

Deliverable: Documented review of plans and procedures applicable to all F-Area tenants that identifies potential improvements and provides expected due dates for needed revisions.

Expected Delivery Date: **February 28, 2013.**

Lead: Director, OSSES

Action 3-3: Develop an updated F-Area drill plan that explicitly includes the participation expectations for all facilities and construction sites surrounding Building 235-F and planned drill dates. Continue to include in F-Area drill plan until the hazard is removed or mitigated.

Deliverable: Updated F-Area drill plan.

Expected Delivery Date: **April 1, 2013** (initially); annual updates are expected to be provided in December each calendar year until the hazard is removed or mitigated.

Lead: Director, OSSES

Action 3-4: Execute at least one formally assessed drill each year, based on a postulated radiological release from Building 235-F that includes successful demonstration of the ability to adequately protect workers in all facilities and construction sites surrounding Building 235-F.

Deliverable: After-Action Report detailing drill conduct including lessons learned, and a documented path forward to address identified areas for improvement.

Expected Delivery Date: **August 30, 2013** (initially); annual updates are expected to be provided in December each calendar year until the hazard is removed or mitigated.

Lead: Director, OSSES

## **6.0 ORGANIZATION AND MANAGEMENT**

The Manager, SR is the Responsible Manager for the execution of this IP. The AMNMSP is the point of contact for the site-specific actions of this Recommendation.

The DOE-SR Manager will review status of IP actions through periodic (approximately bi-monthly) reports and regular briefings from the Building 235-F Integrated Project Team.

To ensure that the various departmental implementing elements and the Board remain informed of the status of plan implementation, the Department will provide an annual, written report that identifies commitments completed during the year and summarizes progress made that year on open commitments. The written report may be augmented, as appropriate, with briefings to the Board.

Complex long-range plans require sufficient flexibility to accommodate changes in commitments, actions, or expected completion dates due to additional information, improvements, or changes in baseline assumptions. The Department's policy is to: (1) provide prior, written notification to the Board on the status of any implementation plan commitment that will not be completed by the planned date; (2) have the Secretary approve all revisions to the scope and schedule of plans; and (3) clearly identify and describe the revisions and basis for the

revisions. Fundamental changes to the plan's strategy, scope, or schedule will be provided to the Board through formal revision and reissuance of the implementation plan. Other changes to the scope or schedule of planned commitments will be formally submitted in appropriate correspondence approved by the Secretary of Energy, along with the basis for the changes and appropriate corrective actions.

#### **REFERENCES**

Board Recommendation 2012-1, SRS Building 235-F Safety, May 9, 2012.

Secretary's Response to Recommendation 2012-1, July 10, 2012.

## ATTACHMENTS

None