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

June 3, 2020

The Honorable Bruce Hamilton
Chairman
Defense Nuclear Facilities Safety Board
65 Indiana Avenue, NW, Suite 700
Washington, DC 20004

Dear Chairman Hamilton:

Enclosed is a copy of the Department of Energy's (DOE) Revised Implementation Plan (IP) for addressing concerns raised in the Defense Nuclear Facilities Safety Board's Recommendation 2012-1, *Savannah River Site Building 235-F Safety*. The Recommendation identified the need to execute actions that can reduce the hazards associated with plutonium-238 (Pu-238) that remains as residual contamination within Building 235-F. The hazards identified are those associated with the potential release of residual Pu-238 due to a postulated seismic event and/or an ensuing facility fire.

The purpose of the revision is to specify changes to DOE's approach to address the Recommendation. Changes are based on work experience and lessons learned during Pu-238 removal activities at 235-F and current safety analysis of the facility.

The original IP addressed actions necessary to physically remove as much residual Pu-238 as practical, reduce potential ignition sources, and demonstrate effective emergency preparedness. In 2019, following a year of Pu-238 removal, DOE paused activities associated with the removal of the remaining residual Pu-238 after measurements indicated that cleaning was only partially effective. DOE decided that continuing the effort to remove Pu-238 from the building would subject the workers to undue risk due to a potential upset condition (i.e., breach/puncture of personal protective equipment).

With this revision, DOE is focusing on protecting the public and collocated workers with a strategy to eliminate fire risks associated with postulated seismic events. This strategy will be supported and influenced by our activities to develop a revised Consolidated Hazard Analysis, perform accident analysis calculations for the release of radiological material due to seismic and non-seismic events, characterize the remaining Pu-238, and revise the Safety Basis. Other potential accident scenarios involving a loss of hot cell confinement (e.g., seal failure) have been evaluated as part of the safety basis analysis and it was determined that they would not have any significant consequences to the public and collocated workers. Together, the actions reflected in the Revised IP will continue to ensure the adequate protection of workers and public health and safety from the hazards in Building 235-F.

We appreciate the Board's continuing efforts to work with DOE to ensure worker and public safety.

Sincerely,

Dan Brouillette

Enclosure

# United States
# Department of Energy

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

***Savannah River Site Building 235-F Safety***

**Washington, DC 20585**

**May 2020**

## EXECUTIVE SUMMARY

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

The Secretary of Energy accepted Recommendation 2012-1 on July 10, 2012, and issued Revision 0 of the IP on December 5, 2012. The original IP addressed actions necessary to physically remove as much residual Pu-238 as practical, reduce potential ignition sources, and demonstrate effective emergency preparedness. In November 2014, DOE issued a schedule change to the original IP which modified the dates for completion of some IP commitments. In July 2019, DOE paused activities associated with the removal of Pu-238 after measurements indicated that cleaning was only partially effective at removing the remaining residual MAR. The MAR was not as readily dispersible or removable as envisioned when DOE developed the original IP for Recommendation 2012-1. Thus, DOE has determined that cleaning efficiency will not be sufficient to achieve the objective of Recommendation 2012-1.

Given that the originally desired end state of MAR removal is not feasible, DOE-Savannah River Operations Office (DOE-SR) decided that continuing the Pu-238 removal effort would subject the workers to undue dose and risk of a significant dose due to an upset condition (i.e., breach/puncture of personal protective equipment). Pausing MAR removal was prudent in order to evaluate the remaining scope of work, associated hazards, and controls. Pausing work also preserved remaining funding for exploring a new strategy to address the safety concerns identified in Recommendation 2012-1 while minimizing the potential dose to facility workers.

With this revision, DOE is focusing on achieving the objective of Recommendation 2012-1 in protecting the public and collocated workers by replacing the three remaining actions of the original IP with a strategy to eliminate fire risks associated with postulated seismic events. This strategy will be supported and informed by our activities to develop a revised Consolidated Hazard Analysis, perform accident analysis calculations for the release of radiological material due to seismic and non-seismic events, characterize the remaining MAR, and revise the Safety Basis. Together, these activities will demonstrate that DOE is continuing to ensure the adequate protection of workers and public health and safety from the hazards in Building 235-F.

## TABLE OF CONTENTS

## PURPOSE

The purpose of this revision to the DOE IP for Board Recommendation 2012-1 is to specify changes to the approach and actions that DOE believes are needed, based on work experience with Pu-238 removal activities and current safety analysis of the facility, while being responsive to the Board's recommendation. These actions stem from information and lessons learned during performance of work activities in Building 235-F.

The original IP identified the need for sufficient flexibility to accommodate changes in commitments, actions, or due dates that may be necessary due to additional information, improvements, or changes in baseline assumptions. The original IP stated that a formal revision of the IP for fundamental changes in the plan's strategy, scope, or schedule would be provided to the Board.

## BACKGROUND

On May 9, 2012, the Board issued Recommendation 2012-1, *Savannah River Site Building 235-F Safety*, because safety analyses indicated release of residual Pu-238 contained in Building 235-F, due to a postulated seismic event and an ensuing facility fire, could pose a significant radiological hazard to collocated workers, and the public. On July 10, 2012, the Secretary of Energy sent the Board a letter acknowledging receipt of Recommendation 2012-1 and accepting the Recommendation.

In December of 2012, the Secretary issued Revision 0 of the IP for Recommendation 2012-1. The plan identified specific actions the Department would take to address the concerns identified by the Board in Recommendation 2012-1. The IP targeted removing enough residual Pu-238 contamination from the facility to demonstrate hazards from a radiological release would be mitigated to below DOE Standard 3009 Evaluation Guidelines for the public and 100 Rem to the collocated worker. To achieve this, removal activities were identified that significantly reduced residual Pu-238 within Building 235-F.

On November 28, 2014, the Secretary transmitted *Implementation Plan Schedule Changes for Board Recommendation 2012-1*. The changes only impacted scheduled completion dates and did not change any of the actions.

DOE has been executing the actions identified in the IP in accordance with the November 2014 schedule. Of the twenty-eight actions identified in the IP, twenty-five have been completed. A summary of the actions contained in the original IP is provided in Attachment 1. Recommendation 2012-1 and the IP focused efforts along the lines of the three sub-recommendations below.

### 2012-1 Sub-Recommendation 1: Reduce Material at Risk

DOE had planned to remove and/or immobilize as much MAR as practical to demonstrate public protection (<25 Rem) and collocated/facility worker protection

(< 100 Rem at 100 m). MAR removal commenced in October 2018. The focus was on MAR removal from Plutonium Fuel Form (PuFF) Cell 1, Cell 2, and the Cell 1 Maintenance Wing Cabinet. These areas were selected because they contained about 60 percent of the MAR in the building. The removal activities included sweeping, vacuuming, and scrubbing with abrasive pads. Waste was bagged out and assayed to determine the amount of MAR removed. MAR removal activities were completed in these areas in the spring of 2019. Measurements of the waste bagged out of these areas were lower than expected and revealed that cleanout activities had succeeded in only removing approximately 64 percent (of the original 60 percent goal) of the anticipated amount of MAR in those areas. As a result of the above activities, DOE recognized that this material was not as readily removable or dispersible as expected during development of the original IP. Planned cleanout activities were determined to be impractical in reducing residual Pu-238 levels enough to ensure that, upon a postulated seismic event, the collocated worker dose from a facility fire would be less than 100 Rem at 100 meters using the existing hazards analysis and control set.

With removal activities unlikely to achieve the desired IP end state, DOE-SR concluded that continuing to place facility workers at risk while attempting to remove additional MAR is not acceptable. Thus, DOE-SR paused MAR removal activities to avoid the additional potential dose to workers and risk of puncture wounds. Since July 2019, DOE-SR has been pursuing a strategy that is focused on elimination of fire risk and mitigation of potential seismic consequences. This effort will be supported and informed by our activities to revise the Consolidated Hazard Analysis, perform accident analysis calculations for the release of radiological material due to seismic and non-seismic events, characterize the remaining MAR, and revise the Safety Basis. Together, these activities support DOE's continuing commitment to ensure the adequate protection of workers and public health and safety from the residual contamination hazards within Building 235-F.

**2012-1 Sub-Recommendation 2: Improve Safety Posture of Building 235-F and Reduce the Potential for and Severity of a Radiological Release**

DOE planned to: remove combustibles to minimize the risk and severity of a facility fire; de-energize and (where practical) air gap electrical components to reduce the likelihood of a facility fire; and maintain and operate a reliable fire detection system.

Transient combustibles were removed from the building. Fixed combustibles were evaluated and removed to the extent practical. A transient combustible control program was implemented to control and track the introduction of combustibles into the facility and credited in the facility Safety Basis. The removal, encapsulation or isolation of fixed combustibles was completed in September 2014. Electrical components were evaluated, and a de-energization scope of work was defined. The de-energization actions were completed in September 2014. Installation of a fire detection system was completed in January 2015 and credited as a System Important to Safety in the facility Safety Basis.

DOE has completed all IP actions associated with Sub-Recommendation 2.

**2012-1 Sub-Recommendation 3: Ensure Effectiveness of Emergency Response**

DOE planned to ensure that emergency response is both adequate and effective. Existing emergency response plans were reviewed and updated as necessary. The F-Area drill plan was updated to explicitly address the Building 235-F hazard and at least one assessed drill has been conducted annually since 2013.

Actions 3-3 and 3-4 of the original IP are ongoing and will continue to be accomplished on an annual basis.

**2012-1 Remaining Open Commitments**

The remaining actions in the original IP that have not yet been completed and will be superseded by this revision. They are:

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.

1-16 Revise the Building 235-F Deactivation Basis for Interim Operation (BIO) once the MAR is removed and acknowledgement that the facility meets the requirements of 10 CFR Part 830 to protect the maximally exposed off-site individual to within the established DOE-STD-3009-1994 evaluation guidelines and protect the collocated and facility worker within the accepted Savannah River Site guidelines of 100 Rem.

**CURRENT ACTIVITIES and PATH FORWARD**

Savannah River Nuclear Solutions (SRNS) engaged the services of an independent fire protection engineering service, which provided a subject matter expert (SME) with extensive experience throughout private industry, the commercial nuclear power industry, and the DOE Complex. The SME identified some combustible materials that should be evaluated or removed. His evaluation concluded once these additional combustible sources were addressed, that it was not credible for a fire to initiate (including following a seismic event), and then propagate such that it could impact the MAR. The Department directed a peer review by another independent SME, who validated this conclusion. The combustibles of concern include installed ceiling tiles, and the oil/fluid in a welding machine. Modifications to address these additional combustibles are in-progress, and revised Safety Basis documents are being developed. Preliminary analyses indicate that the revised Safety Basis is expected to demonstrate that there are no credible release mechanisms which could result in a collocated worker receiving 100 Rem at 100 meters. Completing these actions will satisfy the objectives of the Safety Issue Resolution (Section 5) provided in the original IP.

The specific actions DOE will take to address the lessons learned from execution of the original IP are provided in Attachment 2 and are listed below:

Action 1: Evaluate removal of designation of Building 235-F Fire Detection System as Defense in Depth/Important to Safety.
Deliverable: Revised Building 235-F Safety Basis Document, Basis for Interim Operations (BIO)
Completed: November 2019

Action 2: DOE peer review of contractor analysis of Building 235-F fire hazards.
Deliverable: Peer Review Report
Completed: December 2019

Action 3: Remediate welder as a source of fire concern.
Deliverable: Revised Building 235-F Safety Basis Document, BIO
Completed: January 2020

Action 4: Remediate ceiling tiles as a source of fire concern.
Deliverable: Revised Building 235-F Safety Basis Document, BIO
Completed: March 2020

Action 5: Revise Consolidated Hazard Analysis to eliminate fires as a credible event which can affect MAR.
Deliverable: Revised Building 235-F Safety Basis Document, BIO
Completed: January 2020

Action 6: Revise accident analysis calculation for release of radiological material due to postulated seismic and non-seismic events.
Deliverable: Revised Building 235-F Safety Basis Document, BIO
Completed: January 2020

Action 7: Revise the facility Safety Basis.
Deliverable: Revised Building 235-F Safety Basis Document, BIO
Completed: April 2020

Action 8: Complete characterization of MAR remaining in Building 235-F.
Deliverable: Final SRNL Assay Report
Completed: January 2020

Within the background section of Recommendation 2012-1, the Board noted that continued deterioration of the elastomer seals around cell and glovebox penetrations increased the potential for spread of contamination outside of the cells. A loss of confinement would greatly increase the complexity and hazard associated with decontamination and decommissioning of Building 235-F. Programs and procedures are implemented which prescribe the ongoing surveillance and maintenance of Building 235-F. These include operator rounds, radiation protection surveys, building ventilation testing and surveillance, and confinement surveillance and leak tests. DOE is confident that the existing programs and procedures will identify and mitigate any loss of confinement and address any spread of contamination. These programs and procedures

have been demonstrated to be effective in other site facilities such as F-Canyon and FB-Line. No additional actions have been identified within this revised IP to address this potential issue.

## REFERENCES

DNFSB Recommendation 2012-1*, Savannah River Site Building 235-F Safety*, May 9, 2012.

Letter from The Secretary of Energy to The Honorable Peter S. Winokur, Chairman, DNFSB accepting DNFSB Recommendation 2012-1, July 10, 2012.

DOE Implementation Plan for DNFSB Recommendation 2012-1, *Savannah River Site Building 235-F Safety,* December 2012.

DOE IP Schedule Changes for DNFSB Recommendation 2012-1, *Savannah River Site Building 235-F Safety,* November 2014.

## LIST OF ATTACHMENTS

1. Recommendation 2012-1 IP Rev 0 Actions
2. Recommendation 2012-1 IP Rev 1 Actions

ATTACHMENT 1
Recommendation 2012-1 IP Rev 0 Actions

| Action Number | Action Description | Expected Completion Date | Completion Date |
|---|---|---|---|
| 1-1 | Complete project deactivation planning for PuFF Cells 1 -9. | 5/30/13 | 5/21/13 |
| 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. | 7/30/13 | 10/31/13 |
| 1-3 | Restore cell infrastructure in PuFF cells 6 through 9. | 7/30/15 | 1/28/16 |
| 1-4 | Complete a Readiness Assessment (RA) for initiation of deactivation activities in PuFF cells 6 through 9 and implement the Deactivation BIO. | 5/31/16 | 7/10/15 |
| 1-5 | Update planning schedule to reflect PuFF cells 1 through 5 deactivation actions for the upcoming 12 months. | 12/31/13 | 12/9/13 |
| 1-6 | Update planning schedule to reflect PuFF cells 1 through 5 deactivation actions for the upcoming 12 months. | 1/30/15 | 12/31/14 |
| 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. | 4/30/18 | 11/3/17 |
| 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. | 7/31/18 | 10/17/18 |
| 1-10 | Update planning schedule to reflect PuFF cells 1 through 5 deactivation actions for the upcoming 12 months. | 1/29/16 | 12/22/15 |

| Action Number | Action Description | Expected Completion Date | Completion Date |
|---|---|---|---|
| 1-11 | Restore cell infrastructure in PuFF cells 1 through 5. | 11/30/18 | 8/10/18 |
| 1-12 | Update planning schedule to reflect PuFF cells 1 through 5 deactivation actions for the upcoming 12 months. | 1/31/17 | 12/31/16 |
| 1-13 | Update planning schedule to reflect PuFF cells 1 through 5 deactivation actions for the upcoming 12 months. | 1/31/18 | 12/31/17 |
| 1-14 | Complete the deactivation of Cells 1 through 9. This will include waste removal. | 1/31/20 | 7/10/2019 |
| 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. | 6/30/20 | Superseded by Revision |
| 1-16 | Revise the Building 235-F Deactivation BIO once the MAR is removed and acknowledge the facility meets the requirements of 10 CFR 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 | 5/31/21 | Superseded by Revision |
| 2a-1 | Development of Building 235-F specific Transient Combustible Control Program. | 1/15/13 | 1/28/13 |
| 2a-2 | Evaluate fixed combustibles and define the fixed combustible removal, encapsulation, or isolation scope. | 3/4/13 | 2/13/13 |
| 2a-3 | Complete removal, encapsulation or isolation of fixed combustibles scope. | 1/30/15 | 9/24/14 |
| 2b-1 | Evaluate electrical components and define the scope for de-energization of components | 3/4/13 | 2/13/13 |

| Action Number | Action Description | Expected Completion Date | Completion Date |
|---|---|---|---|
| | and the process for control of the resultant configuration. | | |
| 2b-2 | Complete electrical de-energization scope including equipment removal as practical. | 1/30/15 | 9/24/14 |
| 2c-1 | Complete evaluation of existing FDAS for functionality and maintainability. (Action 2c-1 was completed prior to issuance of the IP, Rev 0) | | 10/30/12 |
| 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. | 4/1/13 | 3/4/13 |
| 2c-3 | Complete installation and acceptance testing of the PuFF FDAS for S&M and deactivation phases. | 1/30/15 | 1/30/15 |
| 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. | 1/31/13 | 1/31/13 |
| 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. | 2/28/13 | 2/13/13 |
| 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. | 12/31/14 & Annually | Completed Annually |

| Action Number | Action Description | Expected Completion Date | Completion Date |
|---|---|---|---|
| 3-4 | Execute at least one formally assessed drill each year based on a 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. | 12/31/14 & Annually | Completed Annually |

ATTACHMENT 2
Recommendation 2012-1 IP Rev 1 Actions

| Action Number | Action Description | Expected Completion Date | Completion Date |
|---|---|---|---|
| R1-1 | Approve removal of designation of Building 235-F Fire Detection System as Defense in Depth/Important to Safety. | November 2019 | November 2019 |
| R1-2 | DOE peer review of contractor analysis of Building 235-F fire hazards. | December 2019 | December 2019 |
| R1-3 | Remediate welder as a source of fire concern | January 2020 | January 2020 |
| R1-4 | Remediate ceiling tiles as a source of fire concern. | March 2020 | March 2020 |
| R1-5 | Revise Consolidated Hazard Analysis to eliminate fires as a credible event which can affect MAR. | January 2020 | January 2020 |
| R1-6 | Revise accident analysis calculation for release of radiological material due to seismic and non-seismic events. | January 2020 | January 2020 |
| R1-7 | Revise the facility Safety Basis. | April 2020 | April 2020 |
| R1-8 | Complete characterization of MAR remaining in Building 235-F. | January 2020 | January 2020 |