

Joyce L. Connery, Chair  
Thomas A. Summers, Vice Chair  
Jessie H. Roberson

## DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Washington, DC 20004-2901



August 26, 2021

The Honorable Jennifer M. Granholm  
Secretary of Energy  
US Department of Energy  
1000 Independence Avenue, SW  
Washington, DC 20585-1000

Dear Secretary Granholm:

The Defense Nuclear Facilities Safety Board performed a review of the safety basis for the Radioactive Waste Facilities (RWF) at the Nevada National Security Site (NNSS) and identified several safety issues which, if they remain unaddressed, could adversely impact workers and public health and safety. The safety issues include: (1) deficiencies in safety basis submittals and federal reviews; (2) continued delays in submitting a fully developed annual safety basis update; (3) lack of a required formal process for handling noncompliant waste; and (4) improper implementation of a specific administrative control. These issues are discussed further in the enclosed report.

The Board understands that the NNSS contractor, Mission Support and Test Services, LLC (MSTS), plans to address most of the safety issues identified by the Board in the upcoming annual update to the RWF safety basis. However, these safety issues have existed for at least five years and remained in a draft safety basis that MSTS submitted in 2018.

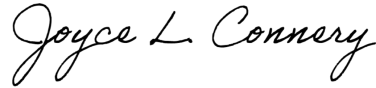
The Board recently reaffirmed Recommendation 2020-1, *Nuclear Safety Requirements*, which includes a sub-recommendation on establishing requirements for timely periodic reviews of safety basis documents. Such requirements could have led the National Nuclear Security Administration's (NNSA) Nevada Field Office to identify the latent errors in the RWF safety basis.

Pursuant to 42 United States Code § 2286b(d), the Board requests a briefing and report within 90 days that addresses the following safety questions:

- What actions have been taken or are planned by the NNSA's Nevada Field Office to ensure that the site contractor is submitting high quality safety basis documents and updating the safety basis documents when required?

- What actions have been taken or are planned by the NNSA's Nevada Field Office to ensure that the identified technical issues in the RWF safety basis are addressed?

Sincerely,

A handwritten signature in black ink that reads "Joyce L. Connery". The signature is written in a cursive style with a large, looped "J" and "C".

Joyce L. Connery  
Chair

Enclosure

c: Mr. Joe Olencz  
Dr. David Bowman

# DEFENSE NUCLEAR FACILITIES SAFETY BOARD

## Staff Report

June 2, 2021

### Nevada National Security Site Radioactive Waste Facilities Safety Basis Review

**Summary.** Members of the Defense Nuclear Facilities Safety Board's (Board) staff reviewed the safety basis for the Radioactive Waste Facilities (RWF) at the Nevada National Security Site (NNSS) [1–3]. The objective of the review was to assess the adequacy of the safety analysis and determine if the safety basis identified appropriate controls to protect workers and the public.

The staff team initially conducted an onsite scoping review on June 19, 2019, with personnel from the National Nuclear Security Administration's (NNSA) Nevada Field Office (NFO) and Mission Support and Test Services, LLC (MSTS). The scoping review primarily focused on transuranic (TRU) waste accident scenarios in the safety basis. MSTS declared a potential inadequacy of the safety analysis (PISA) due to questions raised by the staff team during the scoping review. Given the concerns with TRU waste accident scenarios, the staff team expanded the scope of its review to the whole RWF safety basis and conducted a teleconference review with NFO and MSTS on October 28, 2020. MSTS plans to address most of the safety issues that the staff team identified in the June 2019 and October 2020 interactions in the upcoming annual update to the safety basis. These safety issues include:

1. ***Deficiencies in Safety Basis Submittals and NFO Review:*** The approved and implemented RWF safety basis does not appropriately analyze the hazard and accident scenarios per the requirements in Department of Energy (DOE) directives. An inappropriate safety analysis could result in an inadequate control set. The safety deficiencies that the staff team identified in the hazard and accident analyses have existed in the safety basis for at least five years and were not identified by MSTS during development of the draft 2018 annual update submittal. Further, NFO reviewed the draft 2018 submittal and provided no comments related to these safety deficiencies.
2. ***Continued Delays Submitting an Annual Safety Basis Update:*** MSTS identified the need for an RWF safety basis update in 2018 but has yet to provide an annual safety basis update with sufficient quality for NFO's approval. As a result, MSTS continues to rely on a safety basis with known deficiencies.
3. ***Lack of Formal Process for Handling Noncompliant Waste:*** MSTS does not have a formal process for handling noncompliant waste at a receiving facility, as required by DOE directives. As a result, there are no requirements for taking immediate actions to ensure the safety of operators and workers in the field.
4. ***Improper Implementation of the Protective Overburden Specific Administrative Control (SAC):*** The implementing procedures for the protective overburden SAC, which ensures that waste is protected during low altitude flights, do not protect an

assumption in the safety basis. Accordingly, it is unclear how this SAC will perform its credited safety function.

**Background.** The mission for RWF at NNS is to serve as the western region's national disposal site for low-level and mixed low-level radioactive waste generated from DOE and Department of Defense facilities. RWF includes the Radioactive Waste Management Site (RWMS) in Area 3 and the Radioactive Waste Management Complex (RWMC) in Area 5. The Area 3 RWMS consists of five disposal cells created using subsidence craters formed from underground nuclear tests conducted in the early 1960s. MSTS currently uses these cells to dispose of low-level waste that is generated within the state of Nevada.

The Area 5 RWMC consists of constructed disposal pits that MSTS uses to dispose of low-level and mixed low-level radioactive waste. Area 5 also has the TRU Pad Cover Building (TPCB), where MSTS is only permitted to accept and stage NNS-generated TRU waste pending shipment to the Waste Isolation Pilot Plant (WIPP) for disposal. Currently, MSTS stages spent targets from the Joint Actinide Shock Physics Experimental Research facility and two internally contaminated explosion-proof spheres in the TPCB.

Low-level radioactive waste received at RWF may consist of containerized and packaged waste, as well as non-containerized bulk waste. Bulk low-level waste consists primarily of contaminated soil, contaminated construction debris, and large contaminated equipment that may be awkward for packaging or handling. Waste generators are responsible for characterizing/certifying waste and providing documentation compliant with the NNS waste acceptance criteria (WAC) [4] to RWF.

While RWF has a DOE Office of Environmental Management mission, NNSA's NFO provides nuclear safety support and is responsible for approving the RWF safety basis [5]. The approved and implemented RWF safety basis was written to DOE Standard 3009-94, Change Notice 3, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses* [6].

In 2019, the Board's staff performed a scoping review of the safety basis that focused on TRU waste accident scenarios. MSTS declared a PISA and implemented an operational restriction that limited which TRU waste could be accepted at RWF due to the questions raised by the staff team during the scoping review. Given the concerns with the TRU waste accident scenarios, the staff team expanded the scope of its review to the whole RWF safety basis. The objective of this review was to assess the adequacy of the safety analysis and determine if the safety basis identified appropriate safety controls to protect workers and the public. The staff team completed the review interaction for the whole safety basis in October 2020.

**Discussion.** The Board's staff team identified several concerns during its review of the RWF safety basis, which are discussed further below. Additional details for specific concerns with the hazard and accident analyses in the RWF safety basis are included in Appendix A. The staff team also identified several opportunities for improvement, which are discussed in Appendix B.

*Deficiencies in Safety Basis Submittals and NFO Review*—The Board’s staff team found that the approved and implemented RWF safety basis does not appropriately analyze the hazard and accident scenarios per the requirements in DOE Standard 3009-94 and DOE Standard 5506-2007, *Preparation of Safety Basis Documents for Transuranic (TRU) Waste Facilities* [7]. In particular, the staff team identified several safety concerns with the technical basis and level of conservatism for inputs and assumptions used in the hazard and accident analyses. These safety concerns include the following: improper accident progression for several accident scenarios; nonconservative inputs and missing documentation for the dispersion analysis; selection of lung absorption for different waste streams; and inappropriately relying on safety management programs in the unmitigated analysis for hazard scenarios. As noted above, these concerns are discussed in more detail in Appendix A. A non-conservative safety analysis could result in an inadequate control set for protection of the workers and public.

The approved and implemented RWF safety basis was developed in 2015 by the previous management and operating contractor, National Security Technologies, LLC (NSTec). In December 2017, MSTS became the new management and operating contractor at NNS and inherited this version of the safety basis. During the contract transition, MSTS assumed that the DOE approved RWF safety basis was compliant and effective. As a result, MSTS did not find substantial concerns with the existing safety basis. While this assumption was documented in the transition work package, MSTS acknowledges that it is responsible for updating, maintaining, and correcting the safety analyses, regardless of when the issue(s) originated.

MSTS began to develop its first annual safety basis update for the RWF safety basis in 2018, prior to the review interactions with the staff team. During its development, MSTS did not identify significant safety basis concerns that were present in the submittal (e.g., the deficiencies discussed in Appendix A). MSTS submitted the draft annual update to NFO in December 2018 [8]. The safety basis strategy for the annual update [9] indicates that the scope of the update did not include reanalysis of the hazard and accident analyses. As a result, the deficiencies in the approved and implemented safety basis remained in the draft 2018 annual update.

NFO has reviewed the RWF safety basis several times (i.e., initial submittal and annual updates). However, in each case, NFO did not identify any of the safety deficiencies noted in Appendix A. Most recently, NFO completed its review of the draft 2018 annual update and provided comments to MSTS in March 2019 [10]. Based on the comments provided to MSTS, NFO did not identify significant safety concerns. The scope of NFO’s review primarily focused on the changes to the safety basis. This review approach is consistent with DOE Standard 1104-2016, *Review and Approval of Nuclear Facility Safety Basis and Safety Design Basis Documents* [11], which states, “Review and approval of revisions and annual updates are a matter of endorsing the incorporation of changes in the safety basis since the last approval rather than performing a new assessment of the previously approved safety basis documents.” The staff team is concerned that this review approach could result in allowing existing issues in DOE-approved safety bases to go unidentified for multiple years.

Both MSTS and NFO agreed with the safety concerns raised by the staff team during the review interactions. Given that these safety concerns were present in the draft 2018 annual safety basis update submittal, MSTS decided to withdraw the draft update and developed a new safety

basis strategy for a 2020 annual update [12]. The scope for the 2020 annual safety basis update includes addressing most of the safety concerns that were identified during the staff team's scoping review in June 2019. Lastly, MSTs requested that NFO allow additional time [13] to submit the draft 2020 annual safety basis update so that it could address the deficiencies identified in the staff team's 2020 review of the whole RWF safety basis. MSTs submitted a 90 percent complete draft of the 2020 annual safety basis update to NFO in March 2021 and expects to submit a complete product in October 2021.

The staff team recognizes that NFO had raised concerns regarding the quality of MSTs' previously submitted safety basis documents for other facilities prior to the staff review interactions [14]. NFO's concerns included missing information in annual safety basis updates, gaps in hazard identification, and unresolved federal comments. In response, MSTs identified corrective actions [15], which included developing a central database to capture items needed for annual updates, conducting meetings with stakeholders throughout the safety basis development process, completing a comment resolution form for stakeholder comments, and addressing safety concerns with previously submitted draft safety basis documents. MSTs also has taken an active approach in directly hiring safety analysts to perform safety basis changes, rather than relying on subcontractors (a practice that NSTec used). As of April 2021, MSTs has achieved a net increase of 12 nuclear safety analysts since becoming the NNSS contractor.

The staff team concludes that these corrective actions will help improve the quality of MSTs' annual safety basis submittals. However, even if MSTs had implemented the corrective actions prior to development of the draft 2018 annual safety basis update, they would not have led MSTs to find the significant safety deficiencies that were present in the hazard and accident analyses. Therefore, the staff team concludes that NFO and MSTs would not have identified these safety deficiencies until the RWF safety basis was re-written or upgraded to meet the requirements in DOE Standard 3009-2014, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis* [16], which would likely include performing a new hazard and accident analysis. The Board recently reaffirmed Recommendation 2020-1, *Nuclear Safety Requirements* [17], which includes a sub-recommendation on establishing requirements for timely periodic reviews of safety basis documents. Such requirements could have led NFO to identify the latent errors in the RWF safety basis.

*Continued Delays Submitting an Annual Safety Basis Update*—Title 10, Code of Federal Regulations, Part 830, *Nuclear Safety Management* [18], requires the contractor responsible for maintaining the safety basis for a hazard category 1, 2, or 3 DOE nuclear facility to annually submit to DOE either an updated documented safety analysis or a letter stating that there have been no changes in the documented safety analysis since the prior submission. The staff team found that the NNSS contractor has not fully developed an annual safety basis update to the RWF safety basis since its last approval in October 2016 [19].

As discussed earlier, NSTec developed the currently approved and implemented RWF safety basis. In October 2017, NSTec submitted a letter to NFO stating that there had been no significant changes to the RWF safety basis since the prior submission [20]. In its first year as the site contractor, MSTs developed a safety basis strategy for an annual update in June 2018 [9] and submitted a draft to NFO in December 2018 [8]. However, MSTs withdrew this product after it

became aware of the safety deficiencies identified by the staff team during the scoping review in 2019. MSTs subsequently developed a new safety basis strategy for the annual update in April 2020 [12], which would address the safety concerns raised in the staff team’s scoping review. MSTs planned to submit a draft of the 2020 annual safety basis update to NFO in June 2020 and a final product in September 2020. However, MSTs requested two extensions from NFO to submit the draft 2020 annual safety basis update. In the September 2020 request [13], MSTs noted that the delay was due to a significant amount of ongoing and upcoming safety basis changes at other NNSS defense nuclear facilities. MSTs also wanted additional time to address safety deficiencies identified by the Board’s staff team’s review of the whole safety basis.

The staff team is concerned with the timeliness of the annual safety basis update because MSTs is continuing to rely on a safety basis with known safety concerns. In addition, MSTs has not updated the safety basis to formally incorporate four PISAs that have resulted in the development of evaluation of the safety of the situation (ESS) documents. These PISAs include:

1. The RWF aircraft crash analysis did not reflect current information [21];
2. 9979 containers received at RWF contained waste that could potentially generate hydrogen gas, which was inconsistent with the analyses in the safety basis [22];
3. The Y-12 National Security Complex (Y-12) waste shipments received at RWF contained pressurized components, which was inconsistent with the analyses in the safety basis [23]; and
4. Various safety issues identified in the RWF accident analysis [24].

The ESS documents that addressed these four PISAs identified operational restrictions that include restricting waste retrieval activities and limiting TPCB to only receiving and staging NNSS-generated TRU waste.

As discussed in DOE Guide 424.1-1B, Change 2, *Implementation Guide for Use in Addressing Unreviewed Safety Question Requirements* [25], ESS documents are temporary in nature and should be incorporated into the annual update to the safety basis.<sup>1</sup> However, MSTs has implemented several RWF ESS documents for over three years. While MSTs uses timely orders to implement these operational restrictions, the staff team concludes that they should be formally integrated into the RWF safety basis. The 90 percent draft update to the RWF safety basis that MSTs submitted to NFO in March 2021 addresses the ESS documents and the operational restrictions.

*Lack of Formal Process for Handling Noncompliant Waste*—DOE Manual 435.1-1, Change 3, *Radioactive Waste Management Manual* [26], states that for radioactive waste acceptance at a receiving facility, “A process for the disposition of non-conforming wastes shall be established.” The staff team found that MSTs does not have a formal process for handling

---

<sup>1</sup>Recommendation 2020-1 includes a sub-recommendation to establish clear requirements for the unreviewed safety question (USQ) and justification for continued operation processes in an order or invoked standard, including elevation of key concepts and guidance from DOE Guide 424.1-1.

radioactive waste that does not comply with the NNSS WAC. Instead, the applicable RWF procedure only requires notifying DOE or waste generator personnel of the noncompliance [27]. The procedure does not list any immediate actions to ensure the safety of operators and workers in the field. The staff team notes that the operators may need to take immediate safety actions if a noncompliant waste container has the potential to over-pressurize and explode.

MSTS relies on the PISA/USQ process to analyze a noncompliant waste container and identify any necessary corrective actions, operational restrictions, and/or compensatory measures. However, the MSTS USQ procedure [28] states that it can take hours to days until any operational restrictions are identified, which is consistent with DOE Guide 424.1-1B. The staff team concludes that having planned operator actions for this situation could strengthen the response strategy. The staff team communicated to MSTS personnel the approach used in the technical safety requirements for WIPP [29], which include limiting conditions for operation that require operator actions within a specific time period for certain noncompliant containers (e.g., place waste containers in a safe configuration, suspend waste handling activities, evacuate the area, and post signage and/or erect barricades). The MSTS personnel informed the staff that they plan to evaluate taking such an approach in a future annual safety basis update.

*Improper Implementation of the Protective Overburden SAC*—The protective overburden SAC requires a layer of soil (overburden) that covers the disposed low-level radioactive waste to be present at the RWMS in Area 3 during overflights. This SAC protects an initial condition in the hazard analysis that low-level radioactive waste present at Area 3 will not be impacted by potential aircraft crashes from low altitude flights. Based on this initial condition, the safety basis assumes the unmitigated dose consequences of an aircraft crash are negligible. The control evaluation in the safety basis states that low altitude flights over Area 3 must be coordinated with the Operations Command Center. However, the staff team found that the implementing procedures for this SAC [30, 31] do not describe this coordination effort. DOE Standard 1186-2016, *Specific Administrative Controls* [32], recommends that the procedures for SACs include specifications for implementation. Without clear specifications on implementing the coordination effort, the staff team could not determine how this SAC will perform its credited safety function.

In addition, based on DOE Standard 3009-2014, using a SAC as an initial condition in the hazard analysis may be inappropriate. Specifically, DOE Standard 3009-2014, which clarifies DOE Standard 3009-94, states, “The following conditions shall not be assumed to be available for unmitigated analysis of plausible accident scenarios...ACs [administrative controls] or safety management programs in the unmitigated analysis. Other ACs, such as combustible controls, that are elevated to a SAC as an initial condition for the unmitigated analysis would circumvent the control selection process considering the hierarchy of preferences, and place greater reliance on ACs over available engineered controls.”

**Conclusion.** The Board’s staff team identified several safety deficiencies in the approved and implemented RWF safety basis, which was developed by the previous site contractor, NSTec. While MSTS plans to address most of these safety concerns in the upcoming 2020 annual safety basis update, the staff team is concerned that these safety issues were not



found during the contract transition in 2017, during the development of the draft 2018 annual safety basis update, or during NFO's review of the draft 2018 annual safety basis update.

The staff team recognizes that MSTS has already implemented several corrective actions to improve the quality of its annual safety basis update submittals. However, even if MSTS had implemented these corrective actions prior to the development of the draft 2018 annual safety basis update, they would not have led MSTS to find the safety deficiencies that the staff team identified in the hazard and accident analyses. The staff team concludes that NFO and MSTS would not have identified these safety deficiencies until the RWF safety basis was re-written or upgraded to meet the requirements in DOE Standard 3009-2014.

## Appendix A: Deficiencies in the Approved and Implemented Safety Basis

Members of the Defense Nuclear Facilities Safety Board's (Board) staff reviewed the safety basis for the Radioactive Waste Facilities (RWF) at the Nevada National Security Site (NNSS) [1–3]. The Board's staff team found that the approved and implemented RWF safety basis does not appropriately analyze the hazard and accident scenarios per the requirements in Department of Energy (DOE) Standard 3009-94, Change Notice 3, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses* [6], and DOE Standard 5506-2007, *Preparation of Safety Basis Documents for Transuranic (TRU) Waste Facilities* [7]. In particular, the staff team identified several safety concerns with the technical basis and level of conservatism for inputs and assumptions used in the hazard and accident analyses. A non-conservative safety analysis could result in an inadequate control set to protect workers and members of the public. Safety concerns with the RWF safety basis include:

- The safety basis does not appropriately analyze the accident progression for different accident scenarios per DOE Standard 5506-2007. For example, the staff team found that the vehicle accident scenarios do not analyze a combined impact and fuel pool fire, the seismic accident scenario does not analyze a combined spill then subsequent fire, and various accident scenarios underestimate the number of TRU waste containers involved in the accident. In addition, the safety basis does not analyze the minimum set of accident events described in DOE Standard 5506-2007.
- The dispersion analysis in the safety basis uses input parameters that are non-conservative and inconsistent with modern DOE directives. For example, the staff team found that plume lofting is enabled when calculating the radiological dose consequences for indoor fire scenarios. This is inconsistent with DOE Standard 5506-2007, which states, "Plume buoyancy may only be used when modeling fires that are outdoors or venting through a large breach in the facility (use of plume buoyancy should not be credited in a non-conservative manner)." Also, the staff team found that the dispersion analysis used a deposition velocity of 1 cm/s without appropriate technical justification. DOE guidance in 2011 stated that the default value of 1 cm/s may not be reasonably conservative and recommended a default value of 0.1 cm/s [33]. Lastly, the safety basis did not provide all the input parameters needed to perform a credible review of the dispersion analysis. When the staff team requested the applicable calculations, Mission Support and Test Services, LLC (MSTS), could not locate them.
- The safety basis does not distinguish between lung absorption Type S and lung absorption Type M categorized waste at the RWF. Instead, the safety basis assumes all radioactive waste is lung absorption Type S, which is less conservative than Type M. The staff team recognizes that this assumption may be appropriate given the current TRU waste inventory. However, the safety basis lacks a technical basis for this conclusion. Further, if the RWF were to receive Type M waste, it is unclear how MSTS would analyze this radioactive waste and how it would be compared to the overall material-at-risk (MAR) limit.

- The safety basis relies on a statistical methodology to determine the MAR limits at the RWF, which is consistent with what is outlined in DOE Standard 5506-2007. However, this methodology was based on the inventory at RWF in 2007 and does not reflect the current and/or future inventory. Although this methodology bounds the current inventory, the MAR limit derived using the statistical methodology may not remain conservative if future radioactive waste receipts have different characteristics than what is analyzed.
- The safety basis references a Hanford model to determine how much waste undergoes unconfined burning during a fire scenario. The Hanford model may be less conservative than the methodology outlined in DOE Standard 5506-2007. As a result, the potential dose consequences calculated in the RWF safety basis for fire scenarios may be underestimated.
- The safety basis relies on safety management programs (SMPs) when determining the uncontrolled frequency estimates for specific types of accident initiators (e.g., human error, waste drum over-pressurization, and equipment failure). This approach is inconsistent with DOE Standard 3009-94, which states, “The unmitigated release calculation represents a theoretical limit to scenario consequences assuming that all safety features have failed, so that the physical release potential of a given process or operation is conservatively estimated.”
- The safety basis credits SMPs to reduce the potential dose consequences in some hazard scenarios. The safety basis states that an additional bin reduction in potential dose consequences was applied in some cases due to the presence of SMPs. However, crediting SMPs to reduce the risk in the hazard and accident analyses is inappropriate, as noted in DOE directives.
- The safety basis inappropriately “double-counts” the presence of waste containers in some hazard scenarios. Specifically, MSTS uses a “quasi-quantitative” approach to determine the unmitigated dose consequences to the public in the hazard analysis. When calculating the unmitigated dose consequences for some hazard scenarios, MSTS accounts for the presence of the container in the calculation by using airborne release fractions and respirable fractions that factor in how much material is released from the waste drum after it experiences an insult. For these hazard scenarios, the MSTS mitigated analysis again credits the design integrity for the waste containers as another factor that further reduces the potential dose consequences to the public.
- The safety basis does not have a hazard analysis scenario for the over-pressurization of a low-level radioactive waste drum. The staff team recognizes that the NNSS waste acceptance criteria (WAC) [4] restricts waste that can potentially generate gas, leading to over-pressurization or explosion. While the NNSS WAC is an important control, MSTS should not rely on the WAC as an initial condition that prevents analyzing the full suite of hazards. Relying on this initial condition circumvents the control selection process and is inconsistent with DOE directives. If this scenario were appropriately analyzed, MSTS might identify the need to credit additional

controls to protect the facility worker from specific hazards, such as the waste drum lid or fragments that are ejected due to a deflagration or over-pressurization event.

- The RWF technical safety requirements (TSR) [2, 3] do not include a “bases” section for design features. The bases section of the TSR states that this section is not needed because there are no limiting conditions for operations, limiting control settings, or surveillance requirements applicable to the TRU waste material activities at RWF. However, the safety basis relies on several design features, some of which are supported by in-service inspections. The TSR documentation does not explicitly define the basis for the frequency of these inspections. The staff team concludes it would be appropriate for this section to include a discussion on the waste container inspection frequency and the underlying basis that demonstrates why the frequency is appropriate.

MSTS personnel informed the staff team that they have taken actions to address some of these safety deficiencies in the 2020 annual update to the RWF safety basis. MSTS submitted a draft of the 2020 annual safety basis update to the National Nuclear Security Administration’s Nevada Field Office in March 2021 and anticipates submitting the final product in October 2021.

## Appendix B: Opportunities for Improvement

Members of the Defense Nuclear Facilities Safety Board's (Board) staff reviewed the safety basis for the Radioactive Waste Facilities (RWF) at the Nevada National Security Site (NNSS) [1–3]. In addition to the deficiencies summarized in Appendix A, the Board's staff team identified the following opportunities for safety improvement:

**Effectiveness of Waste Acceptance Criteria (WAC) Enforcement.** The staff team identified that the implementation of radioactive waste management processes may not provide the rigor necessary to ensure compliance with the requirements established in the NNSS WAC [4]. Department of Energy (DOE) Order 435.1, Change 2, *Radioactive Waste Management* [34], and DOE Manual 435.1-1 Change 3, *Radioactive Waste Management Manual* [26], require the radioactive waste generator sites to develop, review, approve, and implement a program for waste generation planning, characterization, certification, and transfer. The receiving facility, such as RWF, shall evaluate waste for acceptance, including confirmation that the technical and administrative requirements have been met. However, the incidents involving the 9979 containers and the shipments from the Y-12 National Security Complex, both of which were noncompliant with the NNSS WAC, call into question the effectiveness of the program. While Mission Support and Test Services, LLC (MSTS), has identified and implemented corrective actions due to these events, MSTS still primarily relies on the waste generator to determine that radioactive waste is compliant with the NNSS WAC. The staff team concludes that MSTS could improve the verification and validation process at RWF by taking a more active role in ensuring radioactive waste compliance. MSTS stated that it is working with the state of Nevada to enhance verification that waste is compliant with the WAC. Process improvements would require more oversight and additional travel by NNSS personnel to waste generator sites to review waste streams.

**In-Service Inspection Criteria for Transuranic (TRU) Waste Container Vents.** The staff team found that the checklist in the RWF in-service inspection procedure [35] does not include specific inspection and/or failure criteria for the vent on a TRU waste container. The RWF safety basis states, "The safety function of the vent is to allow flammable gases that are generated inside the container from radiolytic decomposition of waste material and other reactions to vent to atmosphere and not build up to an explosive concentration." While the checklist includes criteria to visually inspect the waste container for evidence of bulging or pressurization, the staff team found that this procedure could be strengthened by including specific vent inspection criteria, which could include ensuring a clear vent pathway, no accumulation of foreign material around the vent, and no visible signs of corrosion. Including such specific inspection criteria would help ensure that the vent is able to perform its safety function. Lastly, the staff team notes that MSTS only requires inspecting the TRU waste containers on an annual basis. The staff team concludes that more frequent inspections would better ensure that containers remain compliant with the safety basis. Historical inspection results could be used to establish an appropriate periodicity for inspection.

**RWF Fire Hazards Analysis Update.** The staff team identified that the RWF fire hazards analysis [36] was not fully updated after MSTS restarted Area 3 operations in October 2018. DOE Order 420.1C, Change 3, *Facility Safety* [37], requires the fire hazards analysis to be

revised every three years, if needed, or whenever there are changes to the facility that impact the analysis. Although MSTS updated the fire hazards analysis in March 2019, there are still several areas within the analysis that inappropriately describe Area 3 as abandoned in place or unused. Because the operations at Area 3 are similar to the low-level radioactive waste operations at Area 5, the staff team concludes that the Area 3 fire hazards analysis should be similar to Area 5.

**Controls for Fuel Pool Fire Scenarios.** The accident scenarios with the highest potential dose consequences at most TRU waste facilities in the DOE complex involve vehicle crashes and/or fuel pool fires. Many of these facilities have reduced the risks associated with the fuel pool fire and vehicle crash hazards by replacing fueled forklifts with electric forklifts for TRU waste handling operations and installing vehicle barriers around TRU waste handling areas. However, MSTS still relies on diesel forklifts for radioactive waste handling operations and does not have vehicle barriers at RWF. The staff team concludes that using electric forklifts and vehicle barriers where appropriate could improve the defense-in-depth approach at RWF, consistent with the hierarchy of controls outlined in DOE directives. MSTS informed the staff team that it is investigating the use of an electric forklift for the TRU waste pad.

**Radiological Release Detection Capabilities.** The staff team identified that the TRU Pad Cover Building (TPCB) at RWF does not have the capability to immediately detect releases from TRU waste containers. Immediate detection of radiological releases would allow timely initiation of emergency response actions and help protect workers from inadvertently entering an area where a release has occurred.

DOE has fined other sites for the lack of detection capability and determined the absence of detection constituted a violation of federal regulations. Specifically, DOE issued a preliminary notice of violation in relation to the 2018 waste drum over-pressurization event at the Idaho National Laboratory [38]. DOE stated that “None of the hazard controls in the ARP [Accelerated Retrieval Project] V facility were adequate to notify workers and emergency responders of abnormal radiological conditions within the airlock prior to entry (i.e., airborne radioactive contamination).” DOE found that this constituted a violation of Title 10, Code of Federal Regulations, Part 830, *Nuclear Safety Management* [18], and Title 10, Code of Federal Regulations, Part 835, *Occupational Radiation Protection* [39].

In addition, DOE Manual 435.1-1 includes a design requirement for “transuranic waste storage, treatment, and disposal facilities to provide rapid identification of failed confinement and/or other abnormal conditions.” While this requirement is applicable to facility design and was not required at the time TPCB was constructed, it illustrates the importance of monitoring. The staff team recognizes that the current TRU waste staged in TPCB is well-characterized and unlikely to over-pressurize and release radiological material. MSTS also has an operational restriction in place that limits the building to accepting only NNSS-generated TRU waste. MSTS implemented this operational restriction after several concerns were identified in the RWF safety basis. However, this operational restriction could be lifted once the safety basis concerns are addressed. As a result, the waste streams staged in this building could change to include containers that pose a higher risk of release.

## References

- [1] National Security Technologies, LLC, *Documented Safety Analysis for the NNSS Area 3&5 Radioactive Waste Facilities*, DSA-2151.100, Revision 7, Change Notice 1, August 2016.
- [2] National Security Technologies, LLC, *Technical Safety Requirements for the Area 5 Radioactive Waste Management Complex TRU Waste Activities*, TSR-2156.02, Revision 12, November 2015.
- [3] National Security Technologies, LLC, *Technical Safety Requirements for the Area 3 and 5 Radioactive Waste Management Sites Low-Level Waste Activities*, TSR-2156.03, Revision 9, November 2015.
- [4] National Nuclear Security Administration, *Nevada National Security Site Waste Acceptance Criteria*, DOE/NV—325-16-00, November 2016.
- [5] Department of Energy, *Management Agreement between the Office of Environmental Management and the National Nuclear Security Administration for Management of Nevada Field Office EM Resources*, December 2016.
- [6] Department of Energy, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*, DOE Standard 3009-94, Change Notice 3, March 2006.
- [7] Department of Energy, *Preparation of Safety Basis Documents for Transuranic (TRU) Waste Facilities*, DOE Standard 5506-2007, May 2007.
- [8] Mission Support and Test Services, LLC, letter to the Nevada Field Office, *Contract DE-NA0003624, Submittal of the 90 Percent (%) Draft 2018 Annual Update to the Area 3 & 5 Radioactive Waste Facilities (RWFs) Documented Safety Analysis (DSA), Rev. 8, Technical Safety Requirements (TSR) for the Area 3 and 5 Radioactive Waste Management Sites Low-Level Waste Activities, Rev. 10, and TSR for the Area 5 Radioactive Waste Management Complex TRU Waste Activities, Rev. 13, for U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office (NNSA/NFO) Review*, A000-JC-19-0001, December 2018.
- [9] Mission Support and Test Services, LLC, *Safety Basis Strategy: Area 3 & 5 RWF 2018 Annual Update*, Revision 0, June 2018.
- [10] Nevada Field Office letter to Mission Support and Test Services, LLC, *Contract DE-NA0003624, Submittal of the 90 Percent Draft 2018 Annual Update to the Area 3 & 5 Radioactive Waste Facilities Documented Safety Analysis (DSA), Rev. 8, Technical Safety Requirements (TSR) for the Area 3 and 5 Radioactive Waste Management Sites Low-Level Waste Activities, Rev. 10, and TSR for the Area 5 Radioactive Waste Management Complex TRU Waste Activities, Rev. 13, for U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office (NNSA/NFO) Review*, OAMOS:WLP-19037, March 2019.

- [11] Department of Energy, *Review and Approval of Nuclear Facility Safety Basis and Safety Design Basis Documents*, DOE Standard 1104-2016, December 2016.
- [12] Mission Support and Test Services, LLC, *Safety Basis Strategy: Area 3 & 5 RWF Annual Update*, Revision 0, April 2020.
- [13] Mission Support and Test Services, LLC, letter to the Nevada Field Office, *Contract DE-NA0003624, Request for Approval of Enclosed Device Assembly Facility (DAF)/National Criticality Experimental Research Center (NCERC) Safety Basis Changes and an Extension on the Area 3&5 Radioactive Waste Facilities (RWF) Safety Basis Annual Update (AU)*, E000-MM-20-0069, September 2020.
- [14] Nevada Field Office letter to Mission Support and Test Services, LLC, *Contract DE-NA0003624, Device Assembly Facility (DAF) Documented Safety Analysis (DSA) Rewrite Project (DDRP) 90 Percent Document Package for Review*, OAMOS:BCC-19052, May 2019.
- [15] Mission Support and Test Services, LLC, *Apparent Cause Analysis (ACA) Report: Safety Basis Submittal LTA Quality/Tech. Justification*, July 2019.
- [16] Department of Energy, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis*, DOE Standard 3009-2014, November 2014.
- [17] Defense Nuclear Facilities Safety Board, *Nuclear Safety Requirements*, Recommendation 2020-1, May 2021.
- [18] Title 10, Code of Federal Regulations, Part 830, *Nuclear Safety Management*, October 2020.
- [19] Nevada Field Office letter to National Security Technologies, LLC, *Contract DE-AC52-06NA25946, Approval of Change Notice (CN) 1 to the Area 3 and 5 Radioactive Waste Facilities Documented Safety Analysis, Revision 7*, OAMSS:BCC-16157, October 2016.
- [20] National Security Technologies, LLC, letter to the Nevada Field Office, *Contract DE-AC52-06NA25946, Area 3 and 5 Radioactive Waste Facilities Documented Safety Analysis (DSA) and Technical Safety Requirements (TSR) 2017 Annual Update*, E000-JH-18-0006, October 2017.
- [21] National Security Technologies, LLC, *PISA – Radioactive Waste Management Complex (RWMC) Aircraft Crash Analysis Was Not Maintained Current*, RWF-15-0124-D-ESS, Revision 0, July 2015.
- [22] Mission Support and Test Services, LLC, *PISA – Potential hydrogen gas generation in 9979 packages containing low-level waste (LLW) at the Area 5 RWMC*, RWF-18-0089-D-ESS, Revision 0, May 2018.
- [23] Mission Support and Test Services, LLC, *PISA-Noncompliance with NNSS WAC requirements-Y-12 shipments*, RWF-19-0079-D-ESS, Revision 0, September 2019.
- [24] Mission Support and Test Services, LLC, *PISA-Deficiencies Identified for the Area 3&5 RWFs Accident Analysis*, RWF-19-0116-D-ESS, Revision 0, January 2020.



- [25] Department of Energy, *Implementation Guide for Use in Addressing Unreviewed Safety Question Requirements*, DOE Guide 424.1-1B, Change 2, June 2013.
- [26] Department of Energy, *Radioactive Waste Management Manual*, DOE Manual 435.1-1, Change 3, January 2021.
- [27] Mission Support and Test Services, LLC, *Low-Level Waste Shipment Administrative Procedure*, OP-2151.233, Revision 13, April 2020.
- [28] Mission Support and Test Services, LLC, *Unreviewed Safety Question Process*, CD-NENG.019, Revision 8, June 2018.
- [29] Nuclear Waste Partnership, LLC, *Waste Isolation Pilot Plant Technical Safety Requirements*, DOE/WIPP 07-3373, Revision 7, April 2020.
- [30] Mission Support and Test Services, LLC, *Low-Level Waste Handling and Storage Program (SBI)*, SOP-2151.203, Revision 20, May 2019.
- [31] Mission Support and Test Services, LLC, *RWMC Inspections (SBI)*, SOP-2151.207, Revision 10, January 2019.
- [32] Department of Energy, *Specific Administrative Controls*, DOE Standard 1186-2016, December 2016.
- [33] Department of Energy Office of Health, Safety, and Security, *Accident Analysis Parameter Update*, HSS Safety Bulletin No. 2011-02, May 2011.
- [34] Department of Energy, *Radioactive Waste Management*, DOE Order 435.1, Change 2, January 2021.
- [35] Mission Support and Test Services, LLC, *RWMC In-Service Inspection Program (SBI)*, SOP-2151.613, Revision 6, January 2019.
- [36] Mission Support and Test Services, LLC, *Area 3 and 5 Radioactive Waste Facilities Fire Hazards Analysis*, RWF-FHA-01, Revision 2, March 2019.
- [37] Department of Energy, *Facility Safety*, DOE Order 420.1C, Change 3, November 2019.
- [38] Department of Energy, *Preliminary Notice of Violation*, NEA-2020-02, November 2020.
- [39] Title 10, Code of Federal Regulations, Part 835, *Occupational Radiation Protection*, January 2011.