DEFENSE NUCLEAR FACILITIES SAFETY BOARD
Washington, DC 20004-2901

December 12, 2023

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

Dear Secretary Granholm:

The Nevada National Security Site (NNSS) contractor, Mission Support and Test Services, LLC (MSTS), is rewriting the documented safety analysis for the Device Assembly Facility (DAF) in accordance with Department of Energy (DOE) Standard 3009-2014, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis*. This is an important safety effort that should lead to improved protection of workers and the public. The Defense Nuclear Facilities Safety Board (Board) performed a review of a 90 percent complete DSA submittal. While this is not a final product, the National Nuclear Security Administration's (NNSA) Nevada Field Office has expressed the expectation that 90 percent submittals be ready for approval.

From the review, the Board has identified several safety issues within the 90 percent complete DSA, which are discussed further in the enclosed report. The NNSA's Nevada Field Office also had a significant number of comments on the 90 percent submittal. The Board previously communicated a safety concern with the quality of DSA submittals at NNSS in a letter to the Secretary of Energy dated August 26, 2021. In its response to the Board's letter, NNSA highlighted several corrective actions MSTS was implementing to improve the quality of its DSA submittals. Given the number of safety issues identified in the 90 percent DSA submittal for DAF, additional quality improvement actions may be warranted.

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

- How does NNSA's Nevada Field Office measure the effectiveness of the MSTS corrective actions to improve the quality of DSA submittals? Has NNSA's Nevada Field Office found these corrective actions to be effective for the DAF DSA rewrite project and other safety basis submittals at NNSS?

- What additional measures, if any, are being considered by NNSA's Nevada Field Office to improve the quality of DSA submittals?

- What actions have been taken or are planned by NNSA's Nevada Field Office to ensure that MSTS addresses the identified safety issues in its final version of the DSA for DAF?

Sincerely,

Joyce L. Connery
Chair

Enclosure

c: Mr. Joe Olencz

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Report

November 7, 2023

Review of the 90 Percent Complete Documented Safety Analysis for the Device Assembly Facility at the Nevada National Security Site

Summary. The management and operating contractor at the Nevada National Security Site (NNSS), Mission Support and Test Services, LLC (MSTS), is currently rewriting the documented safety analysis (DSA) for the Device Assembly Facility (DAF). MSTS is developing this new DSA in accordance with the requirements and guidance in Department of Energy (DOE) Standard 3009-2014, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis*. Members of the Defense Nuclear Facilities Safety Board's (Board) staff reviewed the second 90 percent complete submittal of the DSA [1]. While this is not a final product, the National Nuclear Security Administration's (NNSA) Nevada Field Office (NFO) expects 90 percent safety basis deliverables to be approval ready.

The objective of the review was to assess the adequacy of the safety analysis and determine if MSTS identified appropriate controls to protect workers and the public. The staff team conducted several interactions with the site, which included personnel from NFO, MSTS, Lawrence Livermore National Laboratory, and Los Alamos National Laboratory. From its review, the staff team identified several safety issues with the MSTS submittal. NFO also had a significant number of comments on the submittal. MSTS plans to address most of the safety issues identified by the staff team in the next DSA submittal. However, previously identified corrective actions to improve the quality of safety basis submittals at NNSS do not appear to have been sufficiently effective for the DAF DSA rewrite project. Additional measures may be warranted.

Background. DAF supports the NNSS mission by providing a modern, safe, and secure facility for conducting a variety of national security missions. Operations at DAF include assembling, disassembling, modifying, staging, handling, transferring, and testing of nuclear assemblies and components, as well as operations with unencapsulated fissionable material. Operations at DAF can involve high explosives and radioactive material, including fissionable material.

DAF also houses the National Criticality Experiments Research Center (NCERC). NCERC supports a variety of nuclear security missions, including nuclear criticality safety research and training, nuclear emergency response, nuclear nonproliferation, and support for other government agencies. Operations at NCERC include (1) handling, storage, and packaging of significant quantities of fissionable material; (2) hand-assembly of standardized sub-critical configurations of fissile material for training purposes; (3) preparation of non-standard sub-critical configurations of fissile material for experimentation; and (4) operation of remotely operated critical assembly machines for experiments involving operations near or above a delayed critical configuration.

Currently, the DSA for NCERC operations is an addendum [2] to the current DAF DSA [3]. Both safety analyses were developed in accordance with DOE Standard 3009-94, Change Notice 3, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*. MSTS and NFO are executing the DAF DSA rewrite project (DDRP) with the goal to develop a new consolidated safety basis that covers both DAF and NCERC and complies with DOE Standard 3009-2014. With DOE's approval, MSTS has also removed the nuclear explosive operations mission from the safety analysis for DAF [4]. As a result, the quantity of special nuclear material allowed to be co-located with high explosives as well as the overall quantities of high explosives allowed have been significantly reduced compared to the existing DSA for DAF. The potential dose consequences for certain accident scenarios (e.g., explosions) have been reduced correspondingly.

On January 30, 2019, MSTS transmitted a 90 percent complete version of the DSA for DDRP to NFO and the NNSA safety basis review team (SBRT) [5]. Both the Board's staff and the NNSA SBRT identified numerous safety issues with this DSA submittal. In its letter transmitting the SBRT comments [6], NFO informed MSTS that this 90 percent complete DSA "did not meet expectations for a 90 percent complete submittal," which NFO expects to be approval-ready. NFO directed MSTS to address all the SBRT's significant comments and respond to the Board's staff's safety concerns in the next DSA submittal.

On August 24, 2021, MSTS transmitted its second 90 percent complete DSA for DDRP to NFO and the NNSA SBRT [7]. The Board's staff team reviewed this version of the DSA and supporting documents to assess the adequacy of the safety analysis and determine if MSTS identified appropriate safety controls to protect workers and the public. The staff team conducted onsite interactions during the weeks of October 31, 2022, and April 17, 2023, and a remote follow-up discussion on June 29, 2023. The staff team discussed its findings from the review with NNSS personnel on August 1, 2023.

Discussion. The Board's staff team identified safety issues with the second 90 percent complete DSA submittal in the following areas: (1) specific administrative controls; (2) incorporation of known deficiencies at DAF; (3) material at risk assumptions for plutonium oxide powders; and (4) other areas impacting DSA quality. These safety issues are discussed in more detail in Appendix A.

Based on these findings, the staff team continues to have safety concerns with the quality of MSTS's DSA submittals. The Board previously communicated with the Secretary of Energy on this issue in a letter dated August 26, 2021, based on the results of the Board's review of the safety basis for the Radioactive Waste Facilities (RWF) at NNSS [8]. From that review, the Board found that the approved and implemented safety basis for RWF did not appropriately analyze the hazard and accident scenarios per DOE directives. The deficiencies in the RWF safety basis had existed for at least five years and were perpetuated in a draft safety basis that MSTS submitted in 2018. The staff report forwarded by the Board's letter noted that NFO had raised a similar concern regarding the quality of MSTS's submitted safety basis documents.

NFO first documented the quality concern in the 2019 letter that transmitted the NNSA SBRT's comments on MSTS's first 90 percent complete DSA submittal for DDRP [6]. From its

review, the SBRT identified 120 "significant" comments[1] and 90 "not significant" comments. In addition to sending the SBRT's comments, the NFO letter informed MSTS that the deficiencies identified by the SBRT would render the final document noncompliant with DOE Standard 3009-2014 if not corrected. Lastly, NFO stated that the quality of the submittal indicated systemic weaknesses in MSTS's safety basis processes. As a result, NFO directed MSTS to develop a mechanism to ensure adequate quality for future submittals.

In response, MSTS performed a causal analysis and identified corrective actions [9]. The corrective actions included (1) acquiring outside expertise with experience in DOE Standard 3009-2014 to participate in the DDRP product development, (2) conducting alignment sessions with NFO to address safety basis comments, (3) incorporating the safety basis authors for the existing and implemented DAF DSA into the review of DDRP products, (4) providing a comment resolution form to stakeholders with appropriate detail to validate comment closure, (5) developing a review checklist to ensure necessary topics have been reviewed and signed for, and (6) incorporating the new review checklist into the appropriate company directive. One metric that MSTS developed to measure the effectiveness of the corrective actions involved the number and significance of NFO comments on safety basis submittals. NNSA's response to the Board's August 26, 2021, letter highlighted several of these corrective actions [10]. Additionally, the enclosure to NNSA's letter states, "In general, a positive performance trend in safety basis quality has been observed, although continued maturation is still in progress."

As noted above, MSTS transmitted the second 90 percent complete DSA submittal to NFO and the NNSA SBRT on August 24, 2021. On November 3, 2022, NFO transmitted the SBRT's comments on this DSA submittal to MSTS [11]. The SBRT identified 132 "significant" comments and 108 "non-significant" comments. Given the safety issues identified by the Board's staff team and the increase in the number of comments from the SBRT, the corrective actions to improve the quality of DSA submittals may not have been effective for DDRP. It would be appropriate for NFO and MSTS to evaluate the effectiveness of these corrective actions and consider if additional measures need to be taken to improve the quality of DSA submittals at NNSS.

Conclusion. The Board's staff team identified several safety issues in the second 90 percent complete DSA submittal for DDRP. NFO also had a significant number of comments on the second submittal. While MSTS plans to address most of the safety issues identified by the staff team in its next submittal to NFO, it does not appear that previously identified corrective actions to improve the quality of DSA submittals have been fully effective for DDRP. It would be appropriate for NFO and MSTS to evaluate the effectiveness of these corrective actions and consider if additional measures need to be taken.

[1] DOE Standard 1104-2016, *Review and Approval of Nuclear Facility Safety Basis and Safety Design Basis Documents*, states, "A significant issue is a problem or concern that affects the utility or validity of the safety basis documentation…. For issues transmitted to the preparer as significant, the preparer should prepare written resolutions and submit them to the review team leader."

Appendix A: Safety Issues Identified during the Review of the 90 Percent Complete Submittal for the Device Assembly Facility (DAF) Documented Safety Analysis (DSA) Rewrite Project (DDRP)

Members of the Defense Nuclear Facilities Safety Board's (Board) staff reviewed the second 90 percent complete DSA submittal for DDRP [1]. The Board's staff team identified safety issues in the following areas: (1) specific administrative controls (SAC); (2) incorporation of known deficiencies at DAF; (3) material at risk assumptions for plutonium oxide powders; and (4) other areas impacting DSA quality. Mission Support and Test Services, LLC (MSTS), plans to address most of these safety issues in the next DSA submittal. The staff team also identified an observation regarding automated emergency defibrillators (AED) located in the DAF main corridor. The staff team is providing these findings so that MSTS can address them as it moves forward to the 100 percent complete DSA submittal.

Specific Administrative Controls. DOE Standard 3009-2014 defines a SAC as an administrative control (i.e., a control requiring human action) "that is identified to prevent or mitigate a hazard or accident scenario and has a safety function that would be safety significant or safety class if the function were provided by a structure, system or component." The staff team found several inadequacies with SACs. In particular, the 90 percent complete DSA credits SACs involving essentially the same actions as providing multiple levels of risk reduction for hazard scenarios, does not define operator action for some SACs, and does not define performance criteria for structures, systems, and components (SSCs) that are used to implement SACs. For the hazard scenarios where these SACs are credited, the risk may not be sufficiently reduced, and additional controls might be needed. Below are specific examples identified by the staff team and the response from MSTS and the Nevada Field Office (NFO).

Similar, Overlapping, and/or Non-specific SACs—The hazard analysis credits multiple SACs with similar actions and safety functions as providing multiple levels of risk reduction for various hazard scenarios. For example, the 90 percent complete DSA specifies three different walkdown and spotter SACs prior to and during subcritical experiment (SCE) package movements outside of DAF (i.e., the DAF Yard). As a result, MSTS takes credit for multiple levels of risk reduction for three SACs that essentially perform the same function, which may be inappropriate if they could reasonably be rewritten as a single control. Therefore, the safety risk for these scenarios may not be sufficiently reduced, and additional controls might be needed. The hazard analysis also credits various SACs that do not have specific operator actions associated with them, including the Qualified Explosives Handlers SAC and the Forklift Restrictions SAC. Crediting these SACs for risk reduction is inappropriate, given that they do not clearly spell out the human performance aspects and cannot be reliably verified. The Qualified Explosives Handlers SAC, for example, requires high explosives operations be performed or supervised by qualified personnel, but does not specify any actions to be completed. MSTS received a similar comment from the SBRT and will re-evaluate how SACs are formulated and credited in the safety basis.

Qualified Explosives Handlers SAC—The hazard analysis includes an explosion scenario due to high explosives sliding, striking, or abrading against surfaces. The only credited control identified for this scenario is the Qualified Explosives Handler SAC. The resulting mitigated

risk remains "high" to the co-located worker for this scenario. The 90 percent complete DSA states, "Since assembly operations require hands-on activity with the HE [high explosive], engineered controls are not feasible during these operations." However, in the hierarchy of controls (e.g., as discussed in Appendix A.8 of Department of Energy [DOE] Standard 3009-2014, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis*), facility safety controls are preferred over administrative controls. The Pantex Plant makes use of a variety of credited engineered safety controls (e.g., special tooling, work surfaces) in addition to administrative controls in similar operations, which may be available for consideration at NNSS. Further, the Qualified Explosives Handlers SAC is not suitable to credit for risk reduction for the reasons stated above. MSTS plans to remove this SAC.

Use of Respirator SAC—MSTS personnel stated that certain plutonium oxide powder operations need to be conducted outside of credited confinement boundaries (i.e., a robust container or glovebox). An accident resulting in dispersal of powder during this type of operation could lead to high unmitigated dose consequences to the facility worker. For these hazards, the 90 percent complete DSA credits the Use of Respirator SAC to protect the facility worker.

In the hierarchy of controls, facility safety controls are preferred over personal protective equipment (PPE). MSTS and NFO maintain that engineered controls for these plutonium oxide powder operations are not feasible because manual operation is required, and existing equipment is not suited to provide confinement. Consistent with DOE Standard 3009-2014, MSTS and NFO should explore options to add engineered controls and reduce reliance on PPE for worker safety.

DOE Standard 3009-2014 additionally states, "If equipment is required to implement the SAC and it is not designated as" safety-class or safety-significant, then the DSA "…provides performance criteria imposed on the SSC so it can meet functional requirement(s) and, thereby, satisfy the SAC safety function." The 90 percent complete DSA does not specify required levels of performance (e.g., protection factor) for the respirators, and instead states that personnel performing these operations wear respiratory protection as specified by radiological control personnel. Without specified performance criteria, satisfaction of the SAC's safety function is not ensured. MSTS informed the staff team that it will improve the level of detail for this SAC.

High Energy Initiators (HEI) and Electrical Equipment Used for High Explosive Operations—The Electrical Equipment Used for High Explosive Operations SAC and the Use of HEIs[2] SAC are intended to ensure that only approved electrical equipment is used when

[2] Per DOE Standard 1212-2019, Change Notice 1, *Explosives Safety*, an electro-explosive device (EED) is a component "containing some reaction mixture (explosive or pyrotechnic) that is electrically initiated." Within subcritical experiments, EEDs—more commonly known as initiators—are used to detonate high explosive charges to evaluate special nuclear material responses for stockpile stewardship applications. DOE Standard 1212-2019 goes on to specify two types of initiators—low-energy initiators (LEI) and HEIs—based on the electrical input necessary to result in their initiation. HEIs are defined as "[e]xploding bridgewire systems, slapper detonators, and EEDs with similar energy requirements for initiation," and LEIs as "[a]ll EEDs except [exploding bridgewire] detonators and slapper detonators." LEIs are more susceptible to actuation from inadvertent electrical stimuli than high-energy initiators.

connecting to high explosive configurations, and that these configurations use HEIs. Neither the various pieces of electrical equipment (e.g., testers) nor the HEIs themselves are credited engineered controls. The performance criteria for the SACs do not specify required levels of performance (e.g., initiation energies for HEIs or specific thresholds representing safe levels of electrical energy) against which to evaluate the HEIs and electrical equipment. The 90 percent complete DSA instead refers to the explosives safety program or the nuclear weapon laboratories to ensure the items meet the functional requirements of the SACs. Without specified performance criteria, satisfaction of the SAC's safety function is not ensured. MSTS informed the staff team that it will improve the level of detail for these SACs.

Low Energy Initiators—The 90 percent complete DSA permits experiment setups that include LEIs, with a SAC that requires the LEIs be approved for use. The LEIs themselves are not credited engineered controls. The performance criteria for the SAC do not specify required levels of performance against which to evaluate LEIs. Without specified performance criteria, satisfaction of the SAC's safety function is not ensured.

The SAC also indicates that protective features or configurations may need to be installed as determined by the nuclear weapon laboratories. As such, the current credited control set may not include all physical and administrative controls necessary to prevent accidents involving LEIs. During the interaction, MSTS personnel stated that DAF currently does not have any operations that use LEIs, and NFO personnel agreed the control should be removed and the DSA should not authorize operations with LEIs. Any future plans to perform operations involving LEIs would therefore be handled through the unreviewed safety question or DSA change processes, with appropriate controls identified.

Existing DAF Safety Issues. The 90 percent complete DSA did not adequately address known and existing safety issues at DAF. These issues are related to (1) procurement of a new transport container for SCEs, (2) updates to the seismic evaluations, and (3) a deficient fire water tank.

In each case, the existing safety issues represent potential vulnerabilities with unclear paths to closure and leave DAF reliant on less robust controls. While MSTS plans to clarify the safety basis on these safety issues, it remains uncertain whether this will drive MSTS to address them. At a minimum, the safety basis should fully describe the vulnerabilities, the status of long-term improvements, and justify the selection (or lack thereof) of compensatory measures. Below are the specific examples identified by the staff team and the response from MSTS and NFO.

Device Container—The container used to transfer SCE packages from DAF to the U1a Complex is not credited to prevent a high explosive violent reaction due to thermal or electrical insults. Instead, MSTS credits various SACs to prevent fire or electrically induced high explosive violent reactions in the current DSA and in the 90 percent complete DSA. As noted above, the 90 percent complete DSA specifies three different walkdown and spotter SACs prior to and during SCE package movements outside of DAF (i.e., the DAF Yard). As a result, MSTS takes credit for multiple levels of risk reduction for three SACs that essentially perform the same function, which may be inappropriate if they could reasonably be rewritten as a single control. The Board sent the Secretary of Energy a letter on December 19, 2018, that identified an

overreliance on administrative controls to protect SCE packages at the U1a Complex [12]. This safety concern is applicable to protection of SCE packages at DAF as well. Equivalent containers are already in use at the Pantex Plant and credited as engineered controls for staging and onsite movement of nuclear explosives and components instead of relying upon SACs.

The 90 percent complete DSA lists a planned improvement to determine the feasibility of using a different container that would protect SCEs from mechanical, electrical, and thermal impacts. This evaluation was completed in 2019 [13]. In 2020, Los Alamos National Laboratory initiated a project to design, procure, and test a replacement device container, with the conceptual design schedule indicating a completion date of September 2026. However, the project is on hold pending funding.

MSTS personnel indicated they would update the planned improvement discussion in the DAF safety basis to acknowledge the current situation and list the remaining actions needed to procure the new device container. Prioritizing procurement of a more robust container and crediting it as an engineered control for multiple hazards would be an improvement in the control strategy and consistent with the hierarchy of controls as discussed in DOE Standard 3009-2014.

Seismic Evaluations—The discussion of the current state of DAF seismic analysis in the 90 percent complete DSA is out of date in various places. The DSA does not discuss the following activities that have occurred for this project: (1) evaluation of need for updating the seismic hazard assessment for DAF that was completed in 2017 [14]; (2) the seismic hazard sensitivity analysis completed in 2018 [15]; (3) the ongoing soil-structure interaction analysis; or (4) the ongoing evaluations of whether an increased seismic hazard would impact the effectiveness of any credited safety controls (which are expected to be completed in 2025). NFO made a similar comment during its review. MSTS personnel indicated they would improve the discussion of the seismic upgrade project to reflect the status of the analyses and remaining efforts.

For various engineered controls with a seismic safety function, the 90 percent complete DSA references the increased seismic hazard but does not list any vulnerabilities or provide a detailed discussion of the consideration of compensatory measures. Section 3.4 of DOE Standard 3009-2014 states, "If performance criteria are not met, the evaluation shall identify noted deficiencies and any compensatory measures necessary to ensure the safety function of the SSCs. These compensatory measures may need to be identified as additional TSR [technical safety requirement] controls, subject to the considerations for safety classification of controls." It would be appropriate for MSTS to analyze whether compensatory measures are needed for credited seismic controls to ensure they can perform their safety function during and after an earthquake. This analysis should be documented in the DSA.

Fire Water Tank—The 90 percent complete DSA contains a planned improvement to build a new fire water tank for DAF. The current tank, which is part of the fire suppression system that is a credited safety control, has not been shown to be able to survive the design basis earthquake. Procurement of the new water tank was scheduled to start in fiscal year 2021 but was cancelled in August 2021 due to the vendor proposal exceeding the budget. Currently, funding is estimated to be available by fiscal year 2026.

In addition to being structurally deficient, the tank has extensive internal corrosion, which may impact its ability to supply water to the credited fire suppression system. MSTS developed a justification for continued operation for the deficient fire water tank [16], which was approved by NFO [17] and implemented by MSTS in October 2023. As noted in the justification for continued operation, MSTS will rely on general service tanks to supply water to the credited fire suppression system while the existing tank is taken out of service for repair. MSTS has no plans to address the seismic deficiencies for the existing tank. MSTS indicated that it would expand discussion of this planned improvement in the DSA. This expanded discussion should address the current vulnerabilities of the fire water tank, the plan and schedule for repairs, compensatory measures being taken while the tank is under repair, vulnerabilities that will remain after the tank is back in service (and associated compensatory measures), and the plan and schedule for providing a seismically qualified water source for the DAF fire suppression system.

Material at Risk (MAR) Assumptions for Plutonium Oxide Powder. The 90 percent complete DSA uses MAR limits for plutonium oxide powder that exceed the quantity needed for operations and makes inappropriate packaging assumptions for certain hazard scenarios. For some of the hazard scenarios where these assumptions are used, the potential consequences to the public and workers are high. The 90 percent complete DSA relies on SACs to reduce the risk, rather than removing the hazard or crediting engineered controls. Specific examples identified by the staff team and the responses from MSTS and NFO are summarized below.

Excessive MAR Limits and Inappropriate Packaging Assumptions—The 90 percent complete DSA establishes a MAR limit that allows kilogram quantities of plutonium oxide powder. The hazard analysis analyzes the plutonium oxide powder in containers that are assumed to undergo a pressurized release in the event of a fire. The dose consequences of this event are very high to the co-located worker. For design basis fire scenarios involving pressurized releases of plutonium oxide powders, the DSA states, “There are no mitigative controls available to credit for the CW [co-located worker] to reduce the dose to below 100 rem.” In the consequence analysis, 99.4 percent of the powder is assumed to be in safety class containers with a damage ratio of 0.0, with the remaining 0.6 percent of the powder in other containers subject to a pressurized release with a damage ratio of 1.0. The resultant damage ratio of 0.006 results in significantly lower mitigated dose consequences, but doses to the co-located worker still exceed 100 rem. In these cases, the DSA credits SACs to reduce event likelihoods, resulting in acceptable mitigated risk bins.

The staff team questioned the necessity of allowing plutonium in containers with a damage ratio of 1.0 in so many locations around DAF, including in the DAF Yard. MSTS personnel indicated that this container configuration is never encountered during shipping and receiving operations, nor in certain DAF operational areas. MSTS plans to evaluate the facility flow sheet to identify areas where MAR limits can be lowered and where a damage ratio of 0 is justified based on allowed packaging configurations.

Material Acceptance SAC—Recent experimental testing [18] has shown that safety-class plutonium oxide powder containers may undergo a pressurized release in the event of a design basis facility fire, depending on the type and quantity of non-plutonium impurities present.

MSTS personnel plan to consider developing a material acceptance SAC to ensure the containers can survive credible accident conditions.

Other DSA Quality Concerns. The staff team identified various other issues in the 90 percent complete DSA. The number of incomplete or inadequate aspects shows additional effort remains to arrive at an adequate and approvable DSA. MSTS plans to address a number of these concerns in the next DSA submittal. Specific examples identified by the staff team and the responses from MSTS and NFO are summarized below.

Credited Container SAC—The 90 percent complete DSA provides performance criteria for various credited containers and refers to the credited container list for evaluation and vulnerabilities. However, the credited container list is not complete and may not be developed until safety basis implementation; i.e., after NFO approves the DSA. The completed list and supporting evaluations are needed to show that these SSCs can perform their credited safety functions. NFO indicated that it would not approve a DSA with an incomplete control set and that MSTS would have to finish the list prior to approval.

The 90 percent complete DSA lists several potential types of safety-class plutonium oxide powder containers (e.g., DOE Standard 3013 compliant containers, non-certified DOE Standard 3013 containers, measurement standard containers, ConFlat® containers). Not all these containers have testing or supporting analyses showing they survive design basis fire conditions. Unless this supporting information is supplied in the credited container list, additional restrictions will be needed on the types of containers approved for storage of plutonium oxide powder.

Lightning Protection and Standoff Distance—The current DAF lightning control strategy includes the facility structure, air terminals, lightning detection, and a SAC that implements a 1-meter standoff distance between high explosives and the building walls. The standoff distance SAC is a compensatory measure for the facility structure, because in certain DAF buildings the structure does not provide the functionality of a complete Faraday-like shield. For certain hazard scenarios, however, the hazard analysis credits and takes risk reduction for both the standoff distance SAC and for the building structure. MSTS personnel indicated they would reevaluate whether it is appropriate to credit both the high explosive standoff distance SAC and the Faraday-like shield SSC when one is a compensatory measure for the other.

The 90 percent complete DSA lists an in-service inspection for the Faraday-like shield components. MSTS personnel indicated that these inspections are not currently being performed on the system because the standoff distance compensatory measure is relied on to provide the safety function. The DSA should not specify in-service inspections that will not be implemented. Moreover, pending the results of an ongoing lightning hazard mitigation study, it may be more appropriate for MSTS to perform the in-service inspections to ensure the building structure performs its safety function in the event of a lightning strike.

Linkage between What-If Scenarios and Control Set—The hazard analysis combines various "What-If" scenarios into a single process hazard analysis table. This practice can make it difficult to determine what controls are credited to prevent or mitigate a specific initiating event.

The staff team found instances where some initiating events may not have the appropriate controls applied to sufficiently reduce the safety risk. MSTS indicated it would reevaluate the scenarios to determine if additional controls need to be applied. MSTS also indicated it may revise the DSA to include a crosswalk that explicitly ties credited controls to specific "What-If" scenarios to clearly identify the controls sets for each initiating event.

High-Efficiency Particulate Air (HEPA) Filters—The 90 percent complete DSA describes the downdraft table confinement and the glovebox confinement systems as design features. This includes the HEPA filters in these systems. This approach is not consistent with DOE's expectations for design features described in Section 4.3.6 of DOE Guide 423.1-1B, *Implementation Guide for Use in Developing Technical Safety Requirements*. HEPA filters are not permanently built-in features, and instead of infrequently required surveillance (e.g., a five-year inspection for degradation), the DSA specifies efficiency testing every 18 months and a monthly verification of differential pressure. MSTS agreed with this observation and committed to control the HEPA filters with limiting conditions of operation in the 100 percent complete DSA submittal.

Post-Seismic Fire Analysis—The 90 percent complete DSA acknowledges the potential for simultaneous seismic impacts to multiple DAF buildings during a design basis earthquake. However, the DSA's evaluation of a post-seismic fire yields a control set that prevents propagation of a fire initiated in a single DAF building. The evaluations and control sets do not address the potential for simultaneous fires initiating in multiple DAF buildings. The DSA notes factors justifying the assumption that only one building will undergo a seismically induced fire, such as DAF not having a natural gas supply. However, DAF does have other ignition sources (e.g., pyrophoric materials in the glovebox building) that are not typical of general commercial or industrial facilities. Additional technical analysis is needed to justify the selection of a single fire in one DAF building following a design basis earthquake.

Supporting Calculations—The staff team learned during the review interactions (i.e., between October 2022 and April 2023) that MSTS is still developing several calculations that will support the 100 percent complete DSA submittal. These calculations can impact the results of the safety analyses and the resulting control set. Topics for these supporting calculations include:

- Blast effects in buildings/corridor;
- Frequency of accidental weapon discharge that could lead to radiological release;
- Airborne release fraction and respirable fraction from a blast event;
- Lightning hazard mitigation study; and
- Final analyses of fire events.

Automated Emergency Defibrillators: In addition to the issues identified with the 90 percent complete DSA discussed above, the staff team identified an observation regarding AEDs located in the DAF main corridor. MSTS implements administrative and programmatic controls to ensure unapproved electrical devices and radiofrequency sources are not brought into buildings where high explosives are present due to the potential to initiate a high explosive violent reaction. For this reason, AEDs are not permitted to be brought into DAF buildings that

contain high explosives (with an exception for high explosive transfers through the corridor). DAF personnel are trained regarding the rules for access and use of electrical equipment in DAF buildings but are not specifically trained that AEDs are not permitted in buildings containing high explosives. Furthermore, there are no postings with that information on or near the AEDs.

MSTS offers cardiopulmonary resuscitation (CPR) and first aid training to the workers at DAF; however, this training does not include how to safely relocate a victim. Given that typical CPR training teaches bringing an AED to a cardiac arrest victim, conflicting imperatives would confront DAF personnel who witness a cardiac arrest in a building with high explosives present. This situation could be improved by providing additional training regarding AED use, adding postings or operator aids on or near the AEDs, and including such scenarios in emergency drills and exercises. To date, MSTS has not conducted drills or exercises involving this type of scenario to ensure response actions meet MSTS and NFO expectations. MSTS indicated it is obtaining additional information from the AED manufacturer to potentially establish more specific restrictions on AED usage.

References

[1] Mission Support and Test Services, LLC (MSTS), *Documented Safety Analysis of the Nevada National Security Site Device Assembly Facility*, DAF-DSA-XX, Revision 0, July 2021.

[2] MSTS, *Device Assembly Facility Documented Safety Analysis Addendum for the National Criticality Experiments Research Center*, NCERC-DSA.100, Revision 1, September 2021.

[3] MSTS, *Nevada National Security Site Device Assembly Facility Documented Safety Analysis*, DAF-DSA-01, Revision 5, September 2021.

[4] Department of Energy (DOE), *Approval of the Cessation of Nuclear Explosives Safety Change Control at the Device Assembly Facility (DAF)*, September 14, 2018.

[5] MSTS letter to the Nevada Field Office (NFO), *Contract DE-NA0003624, Device Assembly Facility (DAF) Documented Safety Analysis (DSA) Rewrite Project (DDRP) 90 Percent (%) Document Package for Review*, January 31, 2019.

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