Department of Energy
Nation Nuclear Security Administration
Washington, DC 20585

August 22, 2025

The Honorable Thomas A. Summers
Acting Chairman
Defense Nuclear Facilities Safety Board
625 Indiana Avenue NW, Suite 700
Washington, DC 20004

Dear Chairman Summers:

This letter transmits the *Extent of Condition (EOC) Summary Report for Deliverable 2.C of the Department's Implementation Plan (IP) to Address Defense Nuclear Facilities Safety Board Recommendation 2023-1, Onsite Transportation Safety*. The report documents the results of the Department of Energy's (DOE) Office of Environmental Management's (DOE-EM) and the National Nuclear Security Administration's (NNSA) EOC review of onsite transfers of radioactive materials at defense nuclear facilities.

The review identified one significant issue to be corrected, which will be addressed in deliverable 3.A of the Department's Implementation Plan: Issue 1, *Hazard Identification, Evaluation, and Controls for Los Alamos National Laboratory Onsite Transfers*.

The DOE-EM and NNSA review teams identified some inconsistencies in the DOE regulatory framework that may be contributing to differences in how sites perform onsite transfers. After consideration of the issues identified, the DOE-EM and NNSA teams concluded that sites are operating safely and providing reasonable assurance of adequate protection of the health and safety of the public, workers, and the environment.

We look forward to continued collaboration with your staff as we complete the Department's IP. If you have any questions, please contact me at (202) 586-0984.

Sincerely,

LARA BEASLEY

Digitally signed by LARA BEASLEY
Date: 2025.08.22 13:16:52 -04'00'

Lara Beasley
Acting Responsible Manager
Principal Deputy Associate Administrator
Office of Environment, Safety, and Health

Enclosure

Received by the Board 09.15.25

U. S. Department of Energy

Extent of Condition Summary Report

Deliverable 2.C of the Department's Implementation Plan to Address Defense Nuclear Facilities Safety Board Recommendation 2023-1, *Onsite Transportation Safety*

August 22, 2025

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EXECUTIVE SUMMARY

This report summarizes results from the Department of Energy's Office of Environmental Management (DOE-EM) and National Nuclear Security Administration (NNSA) Extent of Condition (EOC) reviews of onsite transfers of radioactive materials. The Department committed to the EOC reviews as part of its Implementation Plan (IP) transmitted to the Defense Nuclear Facilities Safety Board (Board or DNFSB) on October 7, 2024, to address the Board's Recommendation 2023-1, *Onsite Transportation Safety*. In the recommendation, the Board traced issues at Los Alamos National Laboratory (LANL) to the methodology DOE offers for preparing an onsite transfer Documented Safety Analysis (DSA). Consequently, the Board recommended that DOE perform an EOC review of Transportation Safety Documents (TSDs) for DOE sites with defense nuclear facilities to determine if near-term actions are necessary to ensure safety until the methodology is revised and implemented.

Five issues were identified, with one issue (Issue 1) warranting near-term NNSA action to ensure safety until the methodology is revised and implemented. DOE recommends that these issues be addressed as described in the Department's IP to address DNFSB Recommendation 2023-1, Sub-Recommendations 2.A, 2.B and 3.A.

1. **Hazard Identification, Evaluation, and Controls for LANL Onsite Transfers**: The LANL DSA for onsite transfers does not provide sufficient hazard identification or hazard evaluation during accident conditions that could result in the uncontrolled release of radioactive and other hazardous materials. This will be considered under the IP deliverables to address Sub-Recommendations 2.A, 2.B, and 3.A.
2. **Technical Safety Requirements (TSRs)**: TSRs are required under 10 CFR Part 830 Subpart B, *Safety Basis Requirements*, for Hazard Category (HC) 1, 2, or 3 nuclear facility activities. In review of TSDs across the DOE complex, the delineation between what constitutes the DSA and TSR is not always clear. TSRs are not subject to the Unreviewed Safety Question process, which potentially creates implementation challenges. Additionally, DOE approval is required for any change to TSRs. This will be considered under the IP deliverable to address Sub-Recommendation 2.A.
3. **Definition of Terms: TSD vs. DSA/TSR**: DOE Order (O) 460.1D, *Hazardous Materials Packaging and Transportation Safety,* and its implementing guide, DOE Guide (G) 460.1-1, *Implementation Guide for Use with DOE O 460.1A, Packaging and Transportation Safety,* were created to write TSDs. DOE O 460.1D requires that transfers of greater than HC-3 quantities comply with the requirements of 10 CFR 830 Subpart B. However, the order does not provide a methodology for preparing a DSA for these transfer activities. Additionally, the approval authority for a DSA is different than that for a TSD and the confusion between these terms could lead to an approval from the incorrect authority. This will be considered under the IP deliverables to address Sub-Recommendation 2.A and 2.B.

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4. **Mixed Methodologies**: Several sites are using a combination of methodologies set forth in 10 CFR Part 830, *Nuclear Safety Management*, Appendix A, Table 1 rather than using a single methodology to address the requirements of 10 CFR Part 830 Subpart B. This will be considered under the IP deliverable to address Sub-Recommendation 2.B.
5. **Definition of Terms: Department of Transportation (DOT) Compliant vs. DOT Regulated**: 10 CFR Part 830.2, *Exclusions*, excludes transportation activities that are regulated by DOT. All onsite transfers are out of commerce and are regulated by DOE. Some personnel interviewed do not understand the difference between being "DOT Compliant" vs. "DOT Regulated." If personnel confuse these terms, they may assume that an onsite transfer of greater than HC-3 quantities of material in a DOT compliant package is not subject to 10 CFR Part 830 requirements. This will be considered under the IP deliverable to address Sub-Recommendation 2.A.

The DOE-EM and NNSA EOC review teams found some inconsistencies in the DOE regulatory framework that may be contributing to differences in how sites perform onsite transfers. When writing and implementing requirements for transportation activities, the current DOE framework requires the evaluation of the full range of transportation activities and operations that fall within 10 CFR Part 830, including Nuclear Regulatory Commission and DOT requirements. However, DOE O 460.1D does not give explicit guidance on how to meet the requirements of 10 CFR Part 830, Subpart B. After consideration of the issues identified, the DOE-EM and NNSA teams conclude that with a few exceptions, sites are operating safely and providing reasonable assurance of adequate protection of the health and safety of the public, workers, and the environment.

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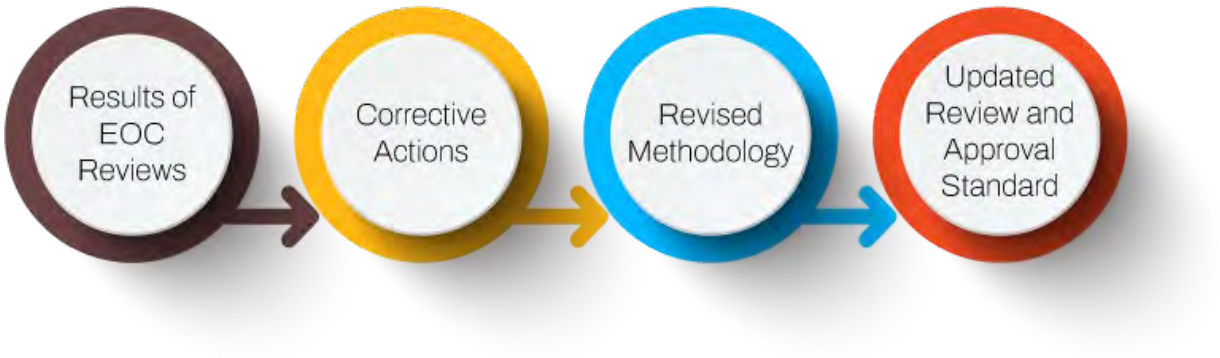
INTRODUCTION

10 CFR Part 830 Subpart B, *Safety Basis Requirements*, establishes the requirements for developing a documented safety analysis (DSA). 10 CFR Part 830, *Nuclear Safety Management*, Appendix A, provides acceptable methods for implementing the requirements of 10 CFR Part 830, Subpart B, Section 830.204. For transportation activities, a Department of Energy (DOE) contractor may prepare a DSA or develop a Transportation Safety Document (TSD) in accordance with DOE Guide (G) 460.1 *Implementation Guide for Use with DOE O 460.1A, Packaging and Transportation Safety.*

This report documents the results of DOE's Office of Environmental Management (DOE-EM) and National Nuclear Security Administration (NNSA) Extent of Condition (EOC) reviews of onsite transfers at DOE sites with defense nuclear facilities for radioactive materials equal to or greater than Hazard Category 3 (HC-3) threshold quantities, and subject to 10 CFR Part 830, Subpart B, as identified in DOE Standard (STD) 1027, *Hazard Categorization of DOE Nuclear Facilities*. The review was performed as part of the Department's Implementation Plan (IP)[1] to address Defense Nuclear Facility Safety Board's (DNFSB) Recommendation 2023-1, *Onsite Transportation Safety*. DNFSB identified concerns with hazard identification, evaluation, and controls at Los Alamos National Laboratory, traced these issues to the methodology DOE offers for preparing a TSD, and recommended DOE perform an EOC review to determine if any near-term actions are necessary to ensure safety until the methodology is revised and implemented.

The DOE IP commits to revising the methodology (Deliverable 2.a) using the results of this EOC summary review (Deliverable 2.c) and the corresponding corrective actions, to inform what changes are necessary for the revision. DOE's IP also commits to revising DOE-STD-1104-2016, *Review and Approval of Nuclear Facility Safety Basis and Safety Design Basis Documents* (Deliverable 2.b), to provide more information to Federal reviewers when evaluating transportation safety basis documents. Updates to the review standard will be primarily based on changes in the methodology. However, results of this EOC summary review will also be used to inform the Department on what should be considered in the revision of the review and approval standard.



[1] The IP was developed in accordance with the Secretary of Energy's acceptance of DNFSB Recommendation 2023-1 in a letter dated May 03, 2024.

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SCOPE

The scope of this review includes onsite[2] transfers at sites with defense nuclear facilities of radioactive materials that meet or exceed DOE-STD-1027 HC-3 threshold quantities (i.e., are subject to 10 CFR Part 830, Subpart B). DOE maintains over 30 separate DSAs for onsite transfers of radioactive materials meeting or exceeding HC-3 threshold quantities (i.e., onsite transfer DSAs). Only DOE-EM and NNSA sites fall under the limited scope of this EOC review. This report summarizes the results of the site assessments performed by DOE-EM and NNSA. The Table below summarizes the DOE-EM and NNSA DSAs that were reviewed:

Table 1: DOE-EM and NNSA DSAs

ORGANIZATION	SITE	INTERFACE WITH DEFENSE NUCLEAR FACILITIES?	NUMBER OF TRANSPORTATION DSAs
DOE-EM	Hanford	Yes	1 DSA/TSR
	Idaho Cleanup Project (ICP)	Yes	1 DSA
	Oak Ridge Environmental Management (OREM)	Yes	2 DSAs
	Savannah River Site (SRS)	Yes	1 DSA
NNSA	Y-12 National Security Complex (Y-12)	Yes	1 DSA/TSR
	Pantex Plant (Pantex)	Yes	3 (Onsite transfer operations are addressed under the site-wide, staging, and transportation SARs)/ 1 TSR
	Los Alamos National Laboratory (LANL)	Yes	1 DSA/TSR
	Nevada National Security Site (NNSS)	Yes	1 DSA/TSR
	Lawrence Livermore National Laboratory (LLNL)	Yes	1 DSA/TSR

[2] Offsite transportation activities were not part of DNFSB Recommendation 2023-1 and were not evaluated as part of this EOC review.

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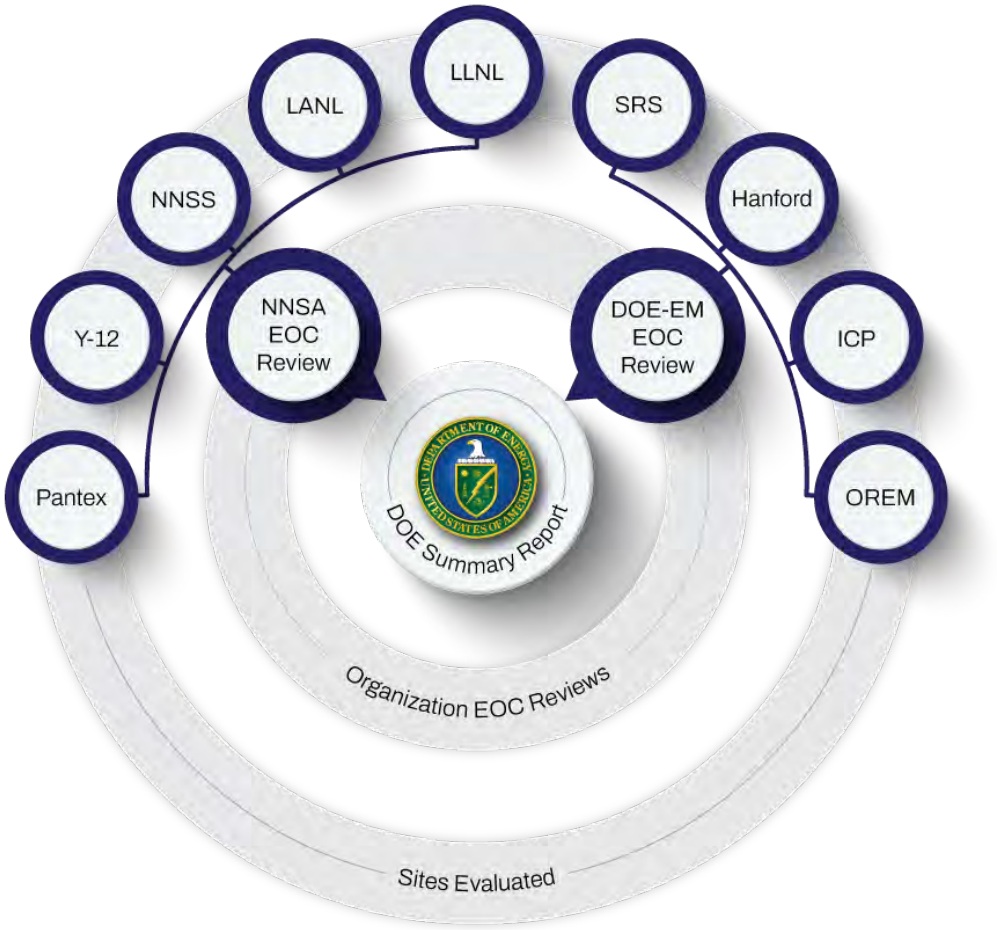

Several sites interface between multiple program offices. For example, at the Savannah River Site, a single site-wide onsite transfer DSA covers shipments for both DOE-EM facilities and the NNSA Tritium facility.

Although the reviews were led by DOE-EM and NNSA, the results were shared across DOE.

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SITE SUMMARY

Onsite transfers can vary widely depending on the materials, distance, routes, equipment, ability to implement controls, and natural phenomena hazards at a site. While Department of Transportation (DOT) and the Nuclear Regulatory Commission (NRC) set standard transportation requirements for shipments occurring over public roads (e.g., in commerce), DOE sets expectations in 10 CFR Part 830, Subpart B, for providing adequate protection from onsite operations, including the development of a safety basis that identifies and analyzes the specific hazards associated with the work, and evaluates the hazards through normal, abnormal, and accident conditions for the activity or operation. The sections below provide a summary for each site reviewed, as documented in Reference 3 of the NNSA EOC Report, and Reference 4 in the DOE-EM EOC Report.

Hanford

DOE-EM reviewed DOE/RL-2001-36, Rev. 2, *Hanford Sitewide Transportation Safety Document*, dated 2017. This is the only TSD in place for the Hanford Site. The DOE-EM EOC review team noted that Hanford previously (July 2020) identified a shortcoming in the Hanford onsite transportation safety program. The TSD did not document hazard categorizations for onsite transfers of nuclear material in accordance with DOE-STD-1027-2018. Such a categorization is essential, as DOE Order (O) 460.1D, *Hazardous Materials Packaging and Transportation Safety*, which states: "For onsite transfers involving nuclear facility HC-2 or HC-3 quantities, the TSD must comply with the Safety Basis Requirements of 10 CFR Part 830, Subpart B." Compliance with Subpart B cannot be assured if shipments are never categorized to determine if they have HC-2 or HC-3 quantities. The review revealed that while applied safety controls appeared to be adequate, several Hanford onsite transfers of $\geq$ HC-3 quantities were made without a TSD complying with 10 CFR Part 830, Subpart B.

Since discovery of this issue, all onsite transfers of $\geq$ HC-3 quantities (unless fully compliant with DOT regulations for shipments in commerce) were suspended. The current contractor, Central Plateau Cleanup Company, which completed transition from the prior contractor in January 2021, is modifying the sitewide TSD to bring it into compliance with 10 CFR Part 830 Subpart B. Except for specific shipments that may be authorized through a Justification for Continued Operations (JCO), onsite transfers of $\geq$ HC-3 material will not resume at Hanford until the new safety basis (DSA/TSDs and TSRs) is approved by the DOE Safety Basis Approval Authority (SBAA) and an appropriate readiness review has been performed. The issue identified at Hanford led DOE-EM staff to examine the implementation of onsite transportation requirements at other DOE-EM sites.

The TSD is currently using a mixed methodology of DOE-STD-3009-94, Chg. Notice 3, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*, and DOE O 460.1D to meet 10 CFR Part 830 requirements. Both the DOE-EM and NNSA EOC review teams observed variations of this issue at many of the DOE-EM and NNSA sites. The EOC review teams observed that sites are using elements of DOE-STD-3009-94 to facilitate the hazard evaluation, risk ranking, and categorization of controls for onsite transfers. The issue of using a mixed methodology to address 10 CFR Part 830 Subpart B requirements is captured in *Appendix A, Issue 4: Mixed Methodologies*.

Hanford also did not have any TSRs defined for their onsite transportation operations. 10 CFR Part 830.205, *Technical Safety Requirements*, requires TSRs, but what constitutes the "TSR" is

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unclear. DOE O 460.1D and DOE G 460.1-1 do not provide requirements or guidance on TSRs. The lack of clearly identified TSRs was observed at multiple DOE-EM sites. This issue is captured in *Appendix A, Issue 2: Technical Safety Requirements*. The DOE-EM site office is working with the contractor on the safety basis documents to ensure compliance with 10 CFR Part 830, Subpart B.

Hanford has an Unreviewed Safety Question (USQ) process in place that is applied to the TSD. The transportation program is subject to the USQ program, but the USQ process is hard to use for the current TSD because controls are not defined as TSRs. Failing to identify clear TSRs also impacts the USQ process as TSRs are not subject to the USQ process and require DOE approval for any change and potential implementation expectations. Without fully defined controls as TSRs, it is difficult for a contractor to determine if a change in control is subject to the USQ procedure or a change to a TSR that must be approved by DOE.

The DOE-EM EOC review team concluded that the requirements of 10 CFR Part 830, Subpart B were not met at Hanford, which is why the site is currently operating in a limited capacity under a JCO. These issues were self-identified with corrective actions in place prior to DNFSB Recommendation 2023-1 and the DOE-EM EOC review.

Idaho Cleanup Project (ICP)

The ICP performs onsite transfers under PRD-310, Rev. 21, *ICP Transportation Safety Document*. It is a programmatic document that categorizes shipments per DOE-STD-1027-92, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*. PRD-310 notes that shipments with radioactive material quantities greater than or equal to the HC-3 thresholds require approval by the DOE SBAA and provides a methodology for performing safety assessments. PRD-310 addresses all types of shipments: hazardous material, radioactive material in less than HC-3 quantities, and radioactive material in greater than or equal to HC-3 quantities.

ICP uses transport plan PLN-1851, Rev. 10, *Transport Plan for the Transfer of Waste Containers Between RWMC and INTEC, and RSWF and INTEC*, for onsite transfers. PLN-1851 includes a hazard categorization, safety analyses, hazard controls, etc., and is subject to 10 CFR Part 830, Subpart B.

PRD-310 is ICP-wide, and the transport plans are operation specific.

The DOE-EM EOC review team notes that ICP selected DOE-STD-3009-94 for the methodology for onsite transfers instead of DOE O 460.1D.

PRD-310 explains the types of controls that should be in the TSRs and has been approved by the SBAA. ICP does not have a standalone TSR document, rather controls are identified within PRD-310. While 10 CFR Part 830 does not require TSRs as a standalone document, this approach is preferred in DOE G 423.1-1B *Implementation Guide for Use in Developing Technical Safety Requirements*. See *Appendix A, Issue 2: Technical Safety Requirements*.

The USQ process is explicitly addressed in ICP's onsite transfer program. The DOE-EM EOC review team did not observe any concerns with the USQ program documentation or implementation. The review team concluded that the ICP onsite transfers are fully compliant with 10 CFR Part 830, Subpart B, and are operating safely.

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Oak Ridge Environmental Management (OREM)

The DOE-EM EOC review team reviewed two DSAs with the supporting Safety Evaluation Reports (SERs) for onsite transportation at OREM. The two transportation DSAs represent the current documentation governing transportation at OREM and include Specific Administrative Controls (SACs) in TSR sections of the DSAs. Like ICP, there is no standalone TSR document. See *Appendix A, Issue 2: Technical Safety Requirements*.

OREM raised a concern that they are using a mixed methodology of DOE O 460.1D and DOE-STD-3009-94 to satisfy the requirements of 10 CFR Part 830. See *Appendix A, Issue 4: Mixed Methodologies*. OREM found it difficult to use DOE O 460.1D alone to meet onsite shipping requirements and, like other sites, needed to supplement DOE O 460.1D and DOE G 460.1-1 with elements of DOE-STD-3009-94 for hazard evaluation, risk ranking, and categorizing controls.

The DOE-EM EOC review team concluded that OREM onsite transfers are compliant with the essential elements of 10 CFR Part 830, Subpart B to ensure safety. The SERs reviewed support the approval of the DSAs, per DOE-STD-1104-2016, *Review and Approval of Nuclear Safety Basis and Safety Design Basis Documents*, and have been approved by the SBAA. OREM has an established process that governs their USQ process which has been implemented for onsite transfer operations. There are no significant issues identified in the safety basis.

Savannah River Site (SRS)

The SRS site-wide TSD is SRNS-SA-2008-00004, Rev. 11, *Savannah River Site Transportation Safety Document*. This document requires that $\geq$ HC-3 quantities, as defined by DOE-STD-1027-92, be shipped under a transportation safety basis document known as an Onsite Safety Assessment (OSA), approved by the DOE SBAA. The SERs have been issued for the OSA and approved by the SBAA. Sections 7.2-7.8 of the TSD describe the safety assessment methodology for such shipments. The SRS TSD also addresses <HC-3 shipments but does not require a separate OSA.

Like Hanford and OREM, SRS uses a mixed methodology with portions of DOE O 460.1D, DOE G 460.1-1, and DOE-STD-3009-94 to satisfy the requirements of 10 CFR Part 830. See *Appendix A, Issue 4: Mixed Methodologies*. SRS found they could not use DOE O 460.1D alone to meet onsite shipping requirements.

SRS does not identify TSRs for onsite transfers. See *Appendix A, Issue 2: Technical Safety Requirements.* The TSD explains the rationale for this; some shipments have administrative-like controls and design-like features, but they are not elevated to TSR-level controls.

The SRS TSD explicitly addresses the USQ process and how it applies to the program. The DOE-EM EOC review team did not observe any concerns with the USQ program documentation or implementation.

Based on the review of the safety documentation, the DOE-EM EOC review team concluded that SRS is correctly categorizing onsite transfers, has sufficient documented safety analyses, and is correctly implementing their USQ program. However, they have not adequately defined or documented TSR level controls. TSRs establish the specific parameters and necessary actions for the safe operation of the onsite transfers.

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Y-12 National Security Complex (Y-12)

Y-12 maintains a single onsite transfer DSA (also referred to as a Safety Analysis Report (SAR), Y/TS-1315, *(U) Safety Analysis Report for the Y-12 Complex Special Nuclear Material Vehicle Operations,* Rev 17. The NNSA EOC review team reviewed the SAR along with the TSRs, Y/TS-1315, *(U) Technical Safety Requirements for the Y-12 Complex Special Nuclear Material Vehicle Operations,* Rev 16. Y-12 plans a future DSA for additional operations, but the safety basis documents were not developed or implemented at the time of the NNSA EOC review conducted between May and October 2024.

Y-12 uses four Special Nuclear Material (SNM) vehicles to transfer material between nuclear facilities within the Y-12 limited area. The vehicles are trucks with enclosed steel-lined cargo compartments, security enhancements, and diesel engines. The vehicles provide security features and non-TSR/defense-in-depth safety features, but they are not otherwise credited in the safety basis. The materials transferred include:

- Weapon assemblies and subassemblies;
- Uranium in different enrichments, physical forms (solids, liquids, and powders) and chemical compounds;
- Radioactive Materials and wastes;
- Hazardous materials; and
- Pyrophoric forms of SNM.

All transfers occur within relatively short distances (approximately 200 ft between buildings). The SAR is prepared using DOE-STD-3009-94 and covers loading, unloading, and transfer operations. The packaging and material handling operations are covered by the individual facility SARs and TSRs. Overall, Y-12 adequately identifies the primary hazards associated with the transfer operations.

The SAR evaluates a reasonable spectrum of bounding accidents. The SAR and supporting documents qualitatively estimate frequencies of an accident using industry and site-specific failure data. The bounding accident is a large vehicle fire involving significant quantities of fuel such that hazardous materials within the vehicle cargo compartment are aerosolized. The analysis shows the unmitigated consequences do not challenge the evaluation guidelines, and the maximum exposed offsite individual (MOI) at the Y-12 site boundary is exposed to less than 1 rem for the bounding accident scenario. The operations present a higher toxicological hazard than radiation hazard.

Because the bounding unmitigated analysis does not challenge the DOE MOI evaluation guideline, no safety class controls are necessary. The SAR identifies two SACs, material limits and refueling restrictions, for preventing or mitigating the consequences of the postulated accident scenarios to ensure the transfer operations are within the safety basis.

Pantex Plant (Pantex)

Pantex onsite transfer operations are discussed in the Transportation Safety Analysis Report (TSAR). The TSAR is integrated with the Sitewide and Staging SARs. The Sitewide SAR provides the analysis and controls common across the site and the Staging and Transportation

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SARs focus on the specific hazards, analysis, and controls for the transfer activities. The NNSA EOC review team reviewed the following TSAR, Staging SAR, and TSRs:

- AB-SAR-314353 *(U) Sitewide Safety Analysis Report,* Revision 393, May 2, 2024
- AB-SAR-940314 *(U) Transportation Safety Analysis Report,* Revision 132, May 2, 2024
- AB-SAR-940092 *(U) Staging Safety Analysis Report*, Revision 102, February 29, 2024
- RPT-SAR-199801 *(U) Technical Safety Requirements for Pantex Facilities*, Revision 505, June 2024.

Pantex uses forklifts, cranes, and hand-dollies to prepare shipments and NNSA's Office of Secure Transportation Safeguards Transporters (SGT) to transfer the shipments within Pantex between Zones 4 and 12. The SGT provides substantial security enhancements and safety features for the transfers and is a safety class design feature in the DSA.

The materials transferred include:

- Nuclear Explosives;
- Nuclear Explosive-like Assemblies;
- Explosive Materials; and
- Nuclear Materials - Weapon Components
  - Pits;
  - Canned Subassemblies;
  - Reservoirs; and
  - Radioisotope Thermoelectric Generators.

The TSAR was prepared using DOE-STD-3009-94 and DOE-NA-STD-3016-2018, *Hazard Analysis Report for Nuclear Explosive Operations*, for nuclear explosive operations. Weapon assemblies are transferred in their H-gear and Nuclear Materials within their respective packaging (e.g. FL, DTs, H1616s, H1700). The TSAR does not exclude nuclear material shipments within Type B packaging. The H-gear and packages are secured within the SGT using tie-downs that comply with NNSA Office of Secure Transportation manual requirements. The content Pantex ships are well defined through weapon design and drawings.

The TSAR calculates motor vehicle accident frequencies for Pantex based on DOT accident information derived from general highway statistics. However, this frequency of vehicle accidents is high when compared to vehicle traffic at Pantex, which does not have large hills, sharp curves, large road construction projects, teenage drivers, impaired drivers, or elderly drivers (e.g., over 80). Additionally, the Pantex Operations manager restricts transfer operations during inclement weather. Therefore, the calculation applies an additional "frequency factor" (one order of magnitude reduction) to the general highway statistics to account for vehicle use at Pantex. The TSAR evaluates a reasonable spectrum of bounding accidents, and the weapon response data derived from the DOE-NA-STD-3016-2018 process are used appropriately.

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The Sitewide SAR includes evaluations for criticality, aircraft crashes, light-tower impacts, and natural phenomena hazards (lightning, tornadoes, high-wind, snow, and ice accumulation). The TSAR addresses additional concerns for impacts with forklifts, impacts with the transport vehicles, steam exposure and electrical coupling, transportation fires, and firearm discharge. Pantex has adequately identified the primary hazards associated with the operations and route.

From the hazard analysis, consequences were evaluated against the DOE-STD-3009-94 evaluation guideline to the public. The analysis shows the unmitigated consequences exceed the evaluation guidelines. Thus, safety class controls are necessary to reduce frequency or mitigate the consequences to acceptable levels. Pantex implements numerous Safety Class Controls and SACs that are integrated across the Sitewide, Staging, and Transportation SARs. Overall, Pantex adequately identifies appropriate controls for preventing or mitigating the consequences of the postulated accident scenarios, and the TSRs ensure operations are within the Authorization Basis.

Los Alamos National Laboratory (LANL)

Prior to the EOC review, the Los Alamos Field Office (NA-LA) directed LANL to develop an Impact Assessment of implementing proposed compensatory measures to apply to the LANL TSD and TSRs to increase the safety of onsite shipments of nuclear materials at LANL. These proposed compensatory measures were developed by a Federal NNSA team.

LANL agreed to implement all the proposed compensatory measures, including but not limited to: implementing weather checks and restrictions, implementing speed limits for transfers, prohibiting vehicular access during high material at risk (MAR) transfers, removing unnecessary combustibles, and eliminating shipments that contain both radioactive materials and hazardous or explosive materials that are not intimately commingled. LANL also agreed to not perform any non-Transuranic (TRU) high MAR transfers until the TSD is updated without first engaging NA-LA to develop a transfer-specific set of controls.

NA-LA approved LANL's TSD and TSRs with two conditions of approval. These compensatory measures are meant to remain in place until the results of Recommendation 2.a can be implemented.

At the time of the EOC review, LANL had a single onsite transfer DSA, P&T-SA-002-R16.1, *Transportation Safety Document.* The NNSA EOC review team reviewed the following TSD and corresponding TSRs:

- P&T-SA-002-R16.1, *Transportation Safety Document,* Rev 16.1
- PT-TSR-001-R14.1, *Technical Safety Requirements,* Rev 14.1

LANL plans a future addendum to the TSD, but the addendum was not developed or implemented at the time of the NNSA EOC review.

LANL uses commercial motor vehicles for transferring radioactive materials that are designed, maintained, and inspected following the DOT Federal Motor Carrier safety regulations. The major transfer routes are on New Mexico State Roads 4, 501, and 502, and Pajarito Road. Onsite transfer operations are predominately for TRU waste. The hazardous materials transferred include:

- Radioactive material, including fissile and fissionable material
- Irradiated items and materials

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- Tritium as a solid (gas or liquid absorbed into a solid carrier)
- Pyrophoric materials (finely divided metals)
- Corrosive materials

The TSD is prepared using DOE O 460.1D and DOE G 460.1-1, which require a safety assessment to determine whether an equivalent level of safety for radioactive material transfers is achieved to that established by the DOT. The LANL TSD establishes Design Basis Conditions from 10 CFR Part 71.71, *Normal Conditions of Transport* (NCT), and 10 CFR Part 71.73, *Hypothetical Accident Conditions* (HAC); however, the TSD does not demonstrate how the packaging in concert with other controls meet performance requirements for HAC. The TSD does not document any dose consequences associated with a transfer accident. As such, neither the DOE O 460.1D containment requirement of DOT equivalent safety (5 rem) nor the DOE-STD-3009-2014 MOI evaluation guideline (i.e., 25 rem) are addressed.

The TSD identifies site-specific hazards; however, the DNFSB identified some geographical hazards on the route (e.g., cliffs along the Pajarito Corridor) that are not adequately addressed in the hazard identification. The accident sequences specified in 10 CFR Part 71.73 HAC for drop, crush, and puncture would bound drops along the transfer routes; however, the TSD and TSRs do not require using packages that maintain containment following a 10 CFR Part 71.73 HAC drop, crush, or puncture event. This situation represents an issue that DOE does not specify in DOE O 460.1D or DOE G 460.1-1 how the NCT and HAC environments are to be considered when establishing design basis conditions in a TSD.

The LANL TSRs identify controls that are called out as Design Features that are protected under 10 CFR Part 830.205, *Technical Safety Requirements*, TSR provisions, which include: the packaging, tie-down configuration, and enclosed cargo compartment. The TSD also evaluates several credited SACs and Safety Management Programs. However, because the TSD does not evaluate the probability or consequences associated with a transportation accident resulting in a hazardous material release, there is also no demonstration that the controls are adequate to eliminate, prevent, or mitigate the hazards associated with the operation. The controls are consistent with onsite transfers at other sites and are reasonably expected to reduce the risk, but there is no technical basis in the TSD for their adequacy.

The issue associated with unsatisfactory hazard evaluation for the LANL onsite transfers, and the corresponding lack of technical basis to evaluate control adequacy in mitigating the risk of these transfers is described further in *Appendix A, Issue 1: Hazard Identification, Evaluation, and Controls for LANL Onsite Transfers.* This issue is also related to DNFSB Recommendation 2023-1, Sub-Recommendation 2.a.ii, asserting that DOE needs to rewrite the methodology for onsite transfers to include robust evaluation criteria for ensuring safety controls are effective at reducing risk.

Nevada National Security Site (NNSS)

At the time of the review, NNSS maintained a site-wide onsite transfer DSA. The NNSA EOC review team reviewed the following DSA and corresponding TSRs:

- OTSD-NSAF.100 *Documented Safety Analysis Documentation Collection* (UCNI), Rev 5.

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- TSRT-NSAF.100 *Technical Safety Requirements Document Collection* (UCNI), Rev 5.

NNSS onsite transfer operations occur between the Device Assembly Facility (DAF), Radioactive Waste Management Complex (RWMC), Joint Actinide Shock Physics Experimental Research (JASPER) Facility, and the Principal Underground Laboratory for Subcritical Experimentation (PULSE) Complex, formerly known as the U1a facility. Transfer operations use various commercial vehicles and a Safe-Secure Trailer (SST). The SST provides security and safety enhancements and is required for specific transfers (i.e., Subcritical Experiments). The type of vehicle used for each operation depends on the hazard classification of the material transferred. The materials transferred include:

- Subcritical experiments (SCEs) from the DAF to the PULSE Complex;
- SNM Diagnostic Test Objects from the DAF to the PULSE Complex;
- Radioactive material components from the DAF to the JASPER Facility; and
- Radioactive material from the JASPER Facility to the RWMC.

The TSD does not cover packaging, loading, or unloading operations, which are addressed by the facility DSA and TSRs. All transfers are within NNSS, but can span distances up to 16 miles. The transfer vehicle speeds are limited to 55 miles per hour, and the packaging, load securement devices, and the allowed transfer vehicle are specified based on the material being transferred and its destination (e.g., the SST cargo compartment is a key control for SCE transfers from the DAF to the PULSE Complex). These attributes are important elements for addressing shock, vibration, and dynamic impacts. The TSD adequately identifies the primary hazards associated with the transfer operations.

The TSD identifies both DOE O 460.1D and DOE O 461.2, *Onsite Packaging and Transfer of Materials of National Security Interest*, as applicable to the transfers, and uses DOE-STD-3009-2014 in the Safety Assessment Methodology for hazard identification (Section 3.1.1) and Hazard Evaluation (3.1.3). As observed in the DOE-EM EOC review, NNSS needed to supplement DOE O 460.1D and DOE O 461.2 with DOE-STD-3009-2014 and could not use the packaging and transportation methodologies alone to meet 10 CFR Part 830 Subpart B requirements. See *Appendix A, Issue 4: Mixed Methodologies.*

The Safety Assessment compares results to those of a DOT-compliant transfer with similar quantities of radioactive material. The key evaluation criterion is whether the onsite transfer results in risk levels to workers or the public that exceed the risk levels associated with a corresponding DOT-compliant transfer. If so, the transfer does not have an equivalent level of safety when compared to a DOT-compliant transfer and is approved based on the hazard evaluation risk analysis that has controls identified to further mitigate the risk to an acceptable level. Some key assumptions are made in the TSD for onsite shipping configurations that are prohibited by DOT (e.g., SCEs that consist of Class 1.1 High Explosives mated to SNM).

In the hazard analysis, the TSD evaluates a high-speed vehicle accident resulting in a vehicle fire and consolidates vehicle accident information for NNSS from multiple sources to justify and support determination of event likelihood assessment as defined in DOE-STD-3009-2014 methodology for human error and equipment failure initiations. The TSD qualitatively estimates that the likelihood of vehicle accidents on site is no worse than on public roads. The bounding

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worse case accidents include a vehicle impact that results in a High Explosive Violent Reaction (HEVR) of the SCE transferred and a fire involving the SNM Diagnostic Test Object, both along the DAF to PULSE Complex transfer route.

From the hazard analysis, consequences were evaluated against the DOE-STD-3009-2014 evaluation guideline. The bounding accident scenario is an HEVR involving a SCE mated with high explosives that results in an unmitigated dose exceeding 5 rem but less than 25 rem to the MOI. The analysis shows safety significant controls are necessary to reduce frequency or mitigate the consequences to acceptable levels. Overall, the NNSS TSD adequately identifies appropriate controls for preventing or mitigating the consequences of the postulated accident scenarios, and the TSRs ensure operations are within the safety basis. The TSD is an example of integrating the DOE O 460.1D comparative analysis of DOT requirements with the DOE-STD-3009-2014 hazard identification and hazard evaluation requirements and should be considered by DOE when revising the methodology for preparing an onsite transfer DSA.

Lawrence Livermore National Laboratory (LLNL)

At the time of the review, LLNL maintained a site-wide onsite transfer DSA. The TSRs are incorporated in Attachment 2 within the document. The NNSA EOC review team reviewed UCRL-MA-152462, *Lawrence Livermore National Laboratory Transportation Safety Document*, Rev 9. LLNL conducts onsite transfers using standard commercial electric vehicles, forklifts, and dollies. The vehicles used for transfers do not have any special pedigree or credited safety function. LLNL transfers are divided into two types:

1) Radioactive and Hazardous Waste Management (RHWM) between B331, B332 and the Area 612 and 625 waste handling yards:
    - TRU waste;
    - Non-TRU waste;
    - Discarded radioactive-contaminated equipment; and
    - Sealed radioactive sources considered waste; and
2) Materials Management Vaults and Transportation Group transferred between the Superblock and B332, B331, B334, and B239:
    - Plutonium in different forms (metals and oxide powder);
    - Uranium in different enrichments and forms (metals and oxide powder);
    - Samples; and
    - Laser Shock Materials.

The packaging and unpackaging are the responsibility of the originating and receiving facilities, covered by the facility DSA and TSRs. The LLNL TSD covers loading, unloading, and transport of these materials using the transfer vehicles. Because all transfers are within the LLNL site at relatively short distances, vehicle speed is not a key factor impacting the hazard analysis. The TSD adequately identifies the primary hazards associated with the transfer operations.

The TSD identifies both DOE O 460.1D and DOE O 461.2 as applicable to the transfers; however, requirement 4.b.(3)(a) in DOE O 460.1D that the TSD must describe the methodology

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and compliance process to meet equivalent safety for any deviation from 49 CFR Parts 171-180 and 49 CFR Parts 350-399, is not addressed. Rather, the TSD and TSRs are prepared following DOE O 461.2 and a modified DOE-STD-3009-94 risk-binning analysis. See *Appendix A, Issue 4: Mixed Methodologies.*

The TSD estimates the likelihood of the postulated accidents based on qualitative and quantitative estimates of the likelihood of the postulated event. These estimates are primarily based on existing generic frequency data, simplified frequency assessments, existing analyses (fault trees) or engineering judgment to determine the frequency range of an event. The bounding accident is a RHWM vehicle impact followed by fire. The analysis shows the unmitigated consequences do not challenge the evaluation guidelines and the MOI at the LLNL site boundary is exposed to less than 0.5 rem for the bounding accident scenario. The TSD evaluates a reasonable spectrum of bounding accidents.

The TSD evaluates the unmitigated accident analysis against the DOE-STD-3009-94 evaluation guideline. Since the bounding unmitigated consequence does not challenge the public evaluation guideline, no safety class controls are necessary. The TSD identifies SACs for preventing or mitigating the consequences of the postulated accident scenarios that are specific to the material transported and the routes. The TSD could be improved by updating to DOE-STD-3009-2014 for the co-located and facility worker consequence evaluation. As specified in DOE O 461.2, the TSRs are a chapter within the TSD; the TSRs are consistent with the safety analysis and assure the transfer operations are within the authorization basis.

Site Summary Conclusion

The results of the EOC review confirmed the issues identified by DNFSB at LANL with respect to improper hazard identification, evaluation, and controls. However, these issues were not observed in the defense nuclear facility transportation DSAs at other DOE-EM or NNSA sites. The EOC review identified other concerns related to TSR identification, USQs, and the need to supplement the methodology for preparing a TSD with DOE-STD-3009. Because these issues were observed at multiple sites, their cause may be related to the underlying DOE regulatory framework. The EOC reviews and following sections of this report explore how DOE's regulation, directives, and standards are being applied to onsite transfer operations.

REGULATORY IMPLEMENTATION

The primary regulation associated with the DNFSB Recommendation 2023-1 and this review is 10 CFR Part 830. 10 CFR Part 830.3, *Definitions*, does not explicitly define transportation or transfer activities. However, the definition of a "nonreactor nuclear facility" is broadly defined to include facilities, activities or operations; and a "nuclear facility" is defined to include any related area, structure, facility or activity necessary to ensure implementation of Part 830 requirements. [3] While the definition of "nonreactor nuclear facility" does not explicitly state that

[3] ***Nonreactor nuclear facility*** means those facilities, activities or operations that involve, or will involve, radioactive and/or fissionable materials in such form and quantity that a nuclear or a nuclear explosive hazard potentially exists to workers, the public, or the environment, but does not include accelerators and their operations and does not include activities involving only incidental use and generation of radioactive materials or radiation such as check and calibration sources, use of radioactive sources in research and experimental and analytical laboratory activities, electron microscopes, and X-ray machines. ***Nuclear facility*** means a reactor or a nonreactor nuclear facility where an activity is conducted for or on behalf of DOE and includes any related area, structure, facility, or

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transportation is included in the definition, during the promulgation of the regulation, DOE specifically clarified that the definition does not exclude transportation activities. Further, DOE clarified that, to avoid duplicate regulation, the only transportation activities that are excluded from Part 830 are certain transportation activities regulated by DOT.[4]

10 CFR Part 830.204, *Documented Safety Analysis*, requires a DSA for HC-1, 2, or 3 DOE nuclear facilities. As discussed above, onsite transfers of radioactive material are included within the definition of a "nuclear facility." As such, the DSA for transportation activities must follow the regulatory provisions, as it would for fixed "brick and mortar" type facilities.

10 CFR Part 830, Subpart B, Appendix A, *General Statement of Safety Basis Policy*, describes DOE's expectations for the safety basis requirements of 10 CFR Part 830, acceptable methods for implementing these requirements, and criteria DOE will use to evaluate compliance with these requirements. Section F, *Documented Safety Analysis,* of Appendix A, includes Table 1 which sets forth acceptable methodologies for preparing a DSA, specifying that a TSD may be developed following DOE O 460.1 and DOE G 460.1-1.

The DOE-EM EOC review team observed that because DOE Directives also use TSDs for hazardous material shipments containing less than HC-3 quantities of radioactive materials, there is confusion among contractors and Federal staff about whether TSDs are the same document, subject to the same requirements as DSAs. This issue is captured in *Appendix A, Issue 3: Definition of Terms; TSD vs. DSA/TSR.*

TRANSPORTATION AS A NON-REACTOR NUCLEAR FACILITY

Although transportation activities are considered non-reactor nuclear facilities in accordance with 10 CFR Part 830, understanding how to implement requirements written for static facilities on dynamic transportation operations is challenging. The NNSA EOC review team observed difficulties recognizing which regulations, directives, and standards apply to an onsite transportation operation. This has led to confusion regarding requirements applicable to transfer activities and discrepancies between the packaging and transportation directives and the safety basis requirements in the DOE regulatory framework. Some examples observed in the reviews include:

1) DOE-STD-1104-2016 and DOE-STD-1183-2019, *Nuclear Safety Specialist Functional Area Qualification Standard*, which form the baseline expectations and competencies for Federal evaluation of nuclear facilities, do not address or describe how to evaluate onsite transfer activities.
2) DOE-STD-1189-2016, *Integration of Safety into the Design Process*, applies to HC 1, 2 and 3 nuclear facilities and activities but is not tailored for onsite transportation activities.
3) DOE O 420.1C, Chg. 3, *Facility Safety*, invokes DOE-STD-3009-2014 Section 3.3.1, *Safety Class Controls*, for existing nuclear facilities (regardless of the safe harbor used) with offsite dose estimates over the evaluation guideline of 25 rem. DOE O 420.1

activity to the extent necessary to ensure proper implementation of the requirements established by [Part 830]. 10 CFR 830.3.

[4] Nuclear Safety Management; Interim Final Rule, 65 Fed. Reg. 60292; 60293-60294 (Oct. 10, 2000); See 10 CFR 830.2. [5] Nuclear Safety Management, 66 Fed. Reg. 1810 (Jan. 10, 2001).

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identifies acceptable codes and standards that are relevant to static facilities, not transportation activities.

4) DOE O 460.1D specifies the Head of Operations Office or Field Office/Site Office Manager as the approval authority for onsite transfers. However, approving onsite transfer safety basis documents is a nuclear safety authority for HC-2 or HC-3 quantities or radioactive material subject to the Safety Basis Requirements of 10 CFR Part 830 Subpart B. See *Appendix A, Issue 3: Definition of Terms; TSD vs. DSA/TSR.*

Further, DOE O 460.1D and DOE G 460.1-1 do not define a safety assessment methodology for meeting 10 CFR Part 830 Subpart B; instead, the directive and guide specify a safety assessment methodology based on demonstrating equivalent safety with the DOT Hazardous Materials Regulations (HMR). The requirements and methods defined in DOE G 460.1-1 were established before Subpart B was added to 10 CFR Part 830. As such, there are potential differences between what the Packaging and Transportation (P&T) directives allow, and the requirements in 10 CFR Part 830 Subpart B for safety basis documentation. This issue is captured in *Appendix A, Issue 5: Definition of Terms: DOT Compliant vs. DOT Regulated.*

These radioactive material transfers are performed following the DOT hazardous materials regulations, but the activity is not in commerce and may not be considered "regulated by the DOT." Of further confusion, in January 2001, DOE amended 10 CFR Part 830 to add two additional "safe harbor" methods to Appendix A (DOE O 460.1A and its associated guide and DOE O 461.1 and its associated manual), as acceptable ways to satisfy the rule requirements for transportation activities.[5] 10 CFR Part 830 stated that the new safe harbor methods will endorse the methods and processes described in DOE O 460.1A and DOE O 461.1 as acceptable ways to satisfy the rule requirements for transportation activities covered by the provisions of Part 830. However, the directives were not written to address rule requirements, nor were they consistent with the rule at the time. The methods listed in Appendix A also list Safety Analysis Reports for Packaging (SARPs) as acceptable ways to prepare a DSA, even though SARPs are documents used to demonstrate compliance with DOT and NRC packaging requirements, not 10 CFR Part 830, Subpart B, safety basis requirements.

These factors create confusion among contractors and Federal reviewers about which regulations, directives, and standards apply to packaging and transportation activities, and may have contributed to the issues identified by the DNFSB for onsite transportation safety.

METHODOLOGY

Given that onsite transfers are both a "non-reactor nuclear facility" and a "transportation activity," 10 CFR Part 830, Appendix A, Table 1, provides two[6] methods for preparing the DSA.

(1) DOE O 460.1D establishes a method of comparative analysis where onsite transfers must demonstrate equivalent safety to what the DOT would require for the same shipment prepared for transport over a public road. DOE O 460.1D requires that a TSD describe

[5] Nuclear Safety Management, 66 Fed. Reg. 1810 (Jan. 10, 2001).

[6] For NNSA Sites that also transfer Nuclear Explosives and Materials of National Security Interest additional methodologies including DOE Order 461.2 and DOE-NA-STD-3016 are applicable. Those methodologies are not included in this Summary Report because they are not within the focus area of DNFSB Recommendation 2023-1. For more information on the methodologies only applicable to NNSA Sites, please see the NNSA EOC Assessment Report, Reference 3.

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the process for establishing equivalent safety for any deviation from the DOT requirements (49 CFR Parts 171-180 and 49 CFR Parts 350-399). DOE G 460.1-1 provides information about how to develop and organize the TSD, including the safety assessment demonstrating that equivalent safety is met as the basis for DOE approval.

(2) DOE-STD-3009-94 establishes a method for preparing a DSA that is acceptable to DOE for nonreactor nuclear facilities based on fundamental elements of hazard identification, hazard analysis, accident analysis, and hazard control selection. The standard provides the required products, contents, and format of a DSA. The basis for DOE approval is compliance with the requirements in 10 CFR Part 830 Subpart B, and demonstrating adequate controls based on the dose consequence evaluation guideline.

Of the two methodologies, DOT dose requirements are more restrictive. DOT specifies acceptance standards for containment, criticality and shielding along with the environments for evaluation (i.e., 10 CFR Part 71.71, *Normal Conditions of Transport*, and 10 CFR Part 71.73, *Hypothetical Accident Conditions*). The acceptance standard for containment is defined by 49 CFR Part 173, *Shippers – General Requirements for Shipments and Packaging*, and 10 CFR Part 71.51(a), *Additional Requirements for Type B Packages*, specifies allowable release rates, which translate to an exposure consequence of 5 rem, maintaining adequate subcriticality, and allowable radiation levels at specified distances from the package or conveyance surfaces during normal operations and accident environments. The EOC review teams observed that sites supplementing onsite transfer DSAs with DOE-STD-3009-94 or DOE-STD-3009-2014 could not meet the more restrictive limits established by DOT for containment.

The methodology could be improved by explicitly identifying the evaluation criteria for containment, criticality, and shielding under normal, abnormal, and accident conditions, rather than referring to DOT and NRC regulations that require additional knowledge and skills to understand and apply. The EOC review teams observed variation across contractors and Federal reviewers in how they understand, interpret, and apply what a DOT equivalent level of safety means.

DOE O 460.1D and DOE G 460.1-1 do not reference the DOE-STD-3009-2014 evaluation guideline of 25 rem to a member of the public. Because the DOT containment requirements are more restrictive, if a DSA meets the DOE O 460.1D and DOE G 460.1-1 acceptance criteria of DOT "equivalent safety" the maximum exposure to any individual (either a member of the public or worker) will not exceed 5 rem and will be under the DOE-STD-3009-2014 evaluation guideline. Additionally, DOE-STD-1104-2016 does not address Federal expectations for review of onsite transfer DSAs and applicability of the evaluation guideline when the methodology is not DOE-STD-3009-94 or DOE-STD-3009-2014.

The table below summarizes some of the differences in the dose consequences used in the two methodology options. The evaluations do not use the same baseline assumptions (e.g., receptor location or exposure differences[7]) and are not directly comparable; however, if a TSD meets the most restrictive cases in DOE O 460.1D, it should also meet the DOE-STD-1104-2016 standard for review and approval. Therefore, while the methodologies and review standards are not the same, if appropriately applied, they can be implemented together to provide adequate protection.

[7] DOE has not provided further guidance on how to determine receptor locations or duration of exposure for DOE O 460.1D evaluations, however, the DOT/IAEA Q system uses 30 minutes and 1 meter from a damaged package surface as baseline assumptions.

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The methodologies could be improved by reconciling the differences in dose evaluations by using the same evaluation criteria to ensure that DOE reviewers are consistent in how they evaluate risk across all methodologies.

Table 2: Differences in Evaluation Criteria Prescribed in DOE Methodologies

Receptor	DOE O 460.1D	DOE-STD-3009-2014
Public (maximum exposed offsite individual)	Dose ≤ 5 rem effective dose to any individual	Dose ≤ 25 rem TED at or beyond the site boundary
Co-located Worker	Dose ≤ 5 rem effective dose to any individual	Dose ≤ 100 rem TED at or beyond 100 meters

The table below summarizes each safety basis document reviewed, and the methodology used to develop the DSA.

Table 3: Methodologies Implemented for Onsite Transfer DSAs

Site	Safety Basis Documents	Methodology Implemented
Hanford	DOE/RL-2001-36, Rev. 2, Hanford Sitewide Transportation Safety Document, dated 2017. Hanford has no TSRs identified for onsite transportation.	DOE O 460.1D with its implementing guide DOE G 460.1-1, supplemented with DOE-STD-3009-94.
ICP	PRD-310, Rev. 21, *"ICP Transportation Safety Document* PLN-1851, Rev. 10, *Transport Plan for the Transfer of Waste Containers Between RWMC and INTEC, and RSWF and INTEC* The TSRs are a section within PRD-310, Rev 21.	DOE-STD-3009-94
OREM	DSA-OR-RH-0046, Rev. 16, *Documented Safety Analysis for Onsite Transportation of Remote-Handled Waste at the Oak Ridge National Laboratory* DSA-OR-TRU-0052, Rev. 6, *Documented Safety Analysis for the Onsite Transportation of Transuranic Waste Boxes and Drums*. The TSRs are a section within the DSAs, DSA-OR-RH-0046 and DSA-OR-TRU-0052.	DOE O 460.1D with its implementing guide DOE G 460.1-1, supplemented with DOE-STD-3009-94.
SRS	SRNS-SA-2008-00004, Rev. 11, *Savannah River Site Transportation Safety Document* S-OSA-G-00025, Rev. 7, *Onsite Safety Assessment of Select SRS Packaging* SRS has no TSRs identified for onsite transportation.	DOE O 460.1D with its implementing guide DOE G 460.1-1, supplemented with DOE-STD-3009-94.

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Y-12	Y/TS-1315, *(U) Safety Analysis Report for the Y-12 Complex Special Nuclear Material Vehicle Operations* Y/TS-1315, *(U) Technical Safety Requirements for the Y-12 Complex Special Nuclear Material Vehicle Operations*	DOE-STD-3009-94
Pantex	AB-SAR-314353 *(U) Sitewide Safety Analysis Report* AB-SAR-940314 *(U) Transportation Safety Analysis Report* AB-SAR-940092 *(U) Staging Safety Analysis Report* RPT-SAR-199801 *(U) Technical Safety Requirements for Pantex Facilities*	DOE-STD-3009-94, and DOE-NA-STD-3016-2018 (for weapon response)
LANL	P&T-SA-002-R16.1 *Transportation Safety Document* PT-TSR-001-R14.1 *Technical Safety Requirements*	DOE O 460.1D and DOE G 460.1-1
NNSS	OTSD-NSAF.100 *Nuclear Onsite Transportation Safety Document for the Nevada National Security Site (UCNI)* TSRT-NSAF.100 *Nuclear Onsite Transportation Technical Safety Requirements for the Nevada National Security Site (UCNI)*	DOE O 460.1D and DOE G 460.1-1* DOE O 461.2* *Supplemented with DOE-STD-3009-2014
LLNL	UCRL-MA-152462-Rev9 *Transportation Safety Document* The TSRs are defined in Chapter XII in UCRL-MA-152462 Rev 9.	DOE O 461.2 DOE O 460.1D with its implementing guide DOE G 460.1-1, supplemented with DOE-STD-3009-94.

Of the nine sites reviewed, ICP, Pantex, and Y-12 are not using DOE O 460.1D or its implementing guide, DOE G 460.1-1, as their methodology for preparing onsite transfer documented safety analysis. Instead, ICP, Pantex, and Y-12 use DOE-STD-3009-94[8]. Of the six remaining sites that do use DOE O 460.1D as their methodology, five sites identified the need to supplement DOE O 460.1D with DOE-STD-3009-94 or DOE-STD-3009-2014 to address the requirements of 10 CFR Part 830 Subpart B.

DOE G 421.1-2A, *Implementation Guide for Use in Developing Documented Safety Analyses to Meet Subpart B of 10 CFR 830,* Section 4.2.7, discusses that compliance with the requirements of DOE-STD-3009-94 is an alternative safe harbor for onsite transportation activities because it applies to all nonreactor nuclear facilities. Consistent with this guidance, some sites implement DOE-STD-3009-94 instead of DOE O 460.1D.

[8] In addition to DOE-STD-3009-94, Pantex also uses DOE-NA-STD-3016-2018 for weapons response.

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DOE G 421.1-2A does not discuss or recommend implementing multiple methodologies for a single DSA, nor does the guide discuss or recommend supplementing methodologies with portions of DOE-STD-3009-94. SBAAs and safety basis review teams (SBRTs) should carefully think through implementing a standard in part, and ensure that the portions selected are appropriate, and the portions omitted do not introduce new risks not considered.

It is unclear whether supplementing a methodology constitutes an Alternate Methodology, per DOE-STD-1083-2009, *Processing Exemptions to Nuclear Safety Rules and Approval of Alternative Methods for Documented Safety Analyses.* The standard provides specific requirements for DOE approval of Alternate Methodologies, including pre-coordination with the Chief of Nuclear Safety; Chief of Defense Nuclear Safety; and DOE Office of Environment, Health, Safety and Security. SBRTs reviewing onsite transfers are performing onsite transfer reviews individually, and lessons learned from one SBRT review are not carried over to other sites. DOE identified that numerous sites could not address 10 CFR Part 830 Subpart B using DOE O 460.1D and DOE G 460.1-1 alone. See *Appendix A, Issue 4: Mixed Methodologies.*

STANDARD FOR FEDERAL REVIEW AND APPROVAL

Although DOE offers different methods for preparing onsite transfer DSAs with different bases for approval, DOE has a single standard for reviewing and approving DSAs. As specified in DOE-STD-1104-2016, DOE recognizes the diversity and number of facility operations throughout the complex, but believes benefits are gained by standardizing fundamental elements of the review and approval process. The standard sets expectations that the SBAA ensures the size and expertise of the SBRT are commensurate with the complexity and risk associated with the document being reviewed.

DOE-STD-1104-2016 does not discuss the adequacy of control selection regarding DOT hazardous materials regulations as a sufficient basis for DOE approval. DOE-STD-1104-2016 does not provide further guidance or expectations for the expertise needed on an SBRT reviewing TSDs, such as whether any member of the SBRT should have general knowledge of the DOT hazardous materials regulations for TSDs that use the comparative analysis to DOT as the basis of approval.

DOE uses the Technical Qualification Program to ensure technical staff have the knowledge, skills, and abilities to support the mission of the Department. DOE-STD-1183-2019, *Nuclear Safety Specialist (NSS) Functional Area Qualification Standard*, does not identify any competencies that are specific to DSAs prepared using either the DOE O 460.1D or DOE O 461.2 methodologies. However, DOE-STD-1155-2002, *Transportation and Traffic Management (TTM) Functional Area Qualification Standard*, identifies several competencies associated with the DOT and NRC requirements for transportation including:

- Working level knowledge of the Hazardous Materials Regulations, 49 CFR Parts 100-185;
- Working level knowledge of the transportation of radioactive material requirements defined in 49 CFR Part 173.400, and 10 CFR Part 71.71 and Part 71.73;
- Familiarity level knowledge of the DOT emergency response information; and
- General awareness of the 49 CFR requirements (which includes the Federal Motor Carrier Safety Regulations 49 CFR Parts 350-399).

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Additionally, the TTM qualification standard recommends individuals in transportation and traffic management meet the recuring training requirements in 49 CFR Part 172.700, Subpart H, *Training*, every three years for 49 CFR activities.

An SBRT should include personnel with the knowledge, skills and abilities to review onsite transfer DSAs that are prepared under DOE O 460.1D and DOE G 460.1-1, such as NSS and TTM subject matter experts. However, DOE does not have many personnel that are qualified to the TTM standard. The TTM qualification standard has not been updated since 2002, and the EOC review team is not recommending that DOE assign personnel this qualification standard. Rather, the team is emphasizing the need to have packaging and transportation expertise on an SBRT for DSAs evaluating transportation activities.

For comparison, the EOC review team also evaluated the guidance documents and standard review plans available to Federal reviewers for offsite transportation. Comparing the level of detail in the NRC regulatory guides with DOE-STD-1104-2016 does not provide sufficient or specific guidance for Federal review and approval of onsite transfer DSAs. Specifically, DOE-STD-1104-2016 does not address unique aspects of packaging and transportation operations that differ from a fixed facility.

The EOC review team recommends DOE-STD-1104-2016 be revised after a new methodology is developed. The methodology should define explicit evaluation criteria rather than demonstrating equivalent safety to DOT and should reconcile the differences in dose consequence evaluations so that DOE reviews are evaluating nuclear safety risk consistently across all methodologies. With consistent evaluation criteria across all methodologies, there should be less of a need to augment DOE-STD-1104-2016 with transportation specific guidance for SBRT reviews.

SUMMARY OF ISSUES

Five issues were identified during the EOC reviews, some observed at multiple sites. These issues will be addressed as described in the Department's IP to address DNFSB Recommendation 2023-1, Sub-Recommendations 2.A, 2.B and 3.A. The issues are summarized below. A full description of the issue, associated requirements, background information, and significance ranking are provided in the Issue Forms in Appendix A.

1. **Hazard Identification, Evaluation, and Controls for LANL Onsite Transfers**: The LANL DSA for onsite transfers does not provide sufficient hazard identification or hazard evaluation during accident conditions that could result in the uncontrolled release of radioactive and other hazardous materials. This will be considered under the IP deliverables to address Sub-Recommendations 2.A, 2.B, and 3.A.
2. **Technical Safety Requirements (TSRs)**: TSRs are required under 10 CFR Part 830, Subpart B, for Hazard Category (HC) 1, 2, or 3 nuclear facility activities. In review of TSDs across the DOE complex, the delineation between what constitutes the DSA and TSR is not always clear. TSRs are not subject to the USQ process, which potentially creates implementation challenges. Additionally, DOE approval is required for any change to TSRs. This will be considered under the IP deliverable to address Sub-Recommendation 2.A.
3. **Definition of Terms: TSD vs. DSA/TSR**: DOE Order (O) 460.1D, *Hazardous Materials Packaging and Transportation Safety*, and its implementing Guide, DOE Guide (G) 460.1-1, *Implementation Guide for Use with* DOE O 460.1A, *Packaging and*

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Transportation Safety were created to write TSDs. DOE O 460.1D requires that transfers of greater than HC-3 quantities comply with the requirements of 10 CFR 830 Subpart B. However, the order does not provide a methodology for preparing a DSA for these transfer activities. Additionally, the approval authority for a DSA is different than that for a TSD, and confusion between these terms could lead to an approval from the incorrect authority. This will be considered under the IP deliverables to address Sub-Recommendations 2.A and 2.B.

4. **Mixed Methodologies**: Several sites are using a combination of methodologies set forth in 10 CFR Part 830, Appendix A, Table 1 rather than using a single methodology to address the requirements of 10 CFR Part 830 Subpart B. This will be considered under the IP deliverable to address Sub-Recommendation 2.B.
5. **Definition of Terms: DOT Compliant vs. DOT Regulated**: 10 CFR Part 830.2 excludes transportation activities that are regulated by DOT. All onsite transfers are out of commerce and are regulated by DOE. Some personnel interviewed do not understand the difference between being "DOT Compliant" vs. "DOT Regulated." If personnel confuse these terms, they may assume that an onsite transfer of greater than HC-3 quantities of material in a DOT compliant package is not subject to 10 CFR Part 830, Subpart B requirements. This will be considered under the IP deliverable to address Sub-Recommendation 2.A.

CONSIDERATIONS FOR SUB-RECOMMENDATIONS 2.A & 2.B

This section outlines considerations for DOE/NNSA when addressing the issues identified by DNFSB and this EOC review, and corrects the deficiencies in the regulatory framework, including revising the methodology for onsite transfer DSAs and the standard for Federal review and approval.

Consistency in the DOE Regulatory Framework

Issues 2, 3, 4, and 5 above are related to inconsistencies or confusion in terms used in the DOE Regulatory Framework. DOE should correct inconsistencies and work to improve clarity in the areas causing confusion. When writing requirements, DOE should consider the full range of onsite transfer activities and operations that fall under the definition of a nuclear facility in 10 CFR Part 830. Specific corrections needed include:

1) Clarifying the differences between TSD and DSA/TSR and reconciling the terminology as it pertains to transportation safety analysis;
2) Clarifying the differences between DOT regulated and DOT compliant;
3) Explaining how to determine and document TSRs for onsite transfer operations (or defer to other guidance for TSRs); and
4) Clarifying that the SBAA for HC-2 or HC-3 onsite transfers is a delegated authority managed through the Nuclear Safety Delegation Process rather than the Head of Operations or Field/Site Office Manager.

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Revised Methodology

DOE has committed to revise the transportation methodology in its IP to address DNFSB Recommendation 2023-1. When re-writing the methodology for onsite transfers for compliance with 10 CFR Part 830 Subpart B, DOE should consider:

1) Developing a technical standard (rather than a guide) that defines how to prepare an onsite transfer DSA. The standard needs to clearly address the requirements of 10 CFR Part 830, Subpart B, and should not establish different requirements for materials of national security interest versus other radioactive materials;
2) Using different terms for the safety documentation needed for onsite transfers that are not subject to 10 CFR Part 830 Subpart B (e.g., clarify when a DSA is required vs. TSD); and
3) Defining explicit evaluation criteria ensuring DOE reviewers are consistent in how they evaluate risk across all methodologies.
    a. Capturing beneficial elements from transportation regulations such as how 10 CFR Part 71.71 (i.e., NCT) and 10 CFR Part 71.73 (i.e., HAC) should be used to inform the DSAs for 10 CFR Part 830.204 (b)(3) for normal, abnormal, and accident conditions.
    b. Capturing beneficial elements from DOE-STD-3009-2014 that could apply to onsite transportation operations such as how to evaluate the effectiveness of controls, and how to distinguish between members of the public, the co-located worker, and the facility worker.

Revised Review Standard

DOE has committed to revising the standard for Federal review and approval in DOE's IP to address DNFSB Recommendation 2023-1. Once the methodologies are revised, DOE should add specific guidance in DOE-STD-1104-2016 for evaluating onsite transfer DSAs/TSRs that is specific to the evaluation criteria. Importantly, if the onsite transfer methodology includes explicit evaluation criteria that are consistent with other DOE methodologies, as recommended in the preceding section, fewer changes will need to be made to DOE-STD-1104-2016.

CONCLUSION

This report summarizes the results of the DOE-EM and NNSA EOC reviews. The NNSA team determined that near-term actions are necessary at LANL to ensure safety prior to the methodology and review standard being revised and issued. Specifically, the LANL onsite transfer DSA does not contain information on the risk of its onsite transfers to ensure adequate protection to the worker and the public through implementation of TSRs. Without a proper hazard evaluation of accidents, there is no technical basis for demonstrating the adequacy of the TSRs to reduce the frequency or mitigate the consequences of an accident. The issues identified by DNFSB at LANL with respect to proper hazard identification, hazard evaluation, and effectiveness of controls were not observed at other sites.

The DOE-EM and NNSA EOC review teams evaluated the methodologies DOE offers for developing onsite transfer DSAs, and the different operations for which the methodologies are applied. The team agreed with DNFSB that the methodologies for onsite transfer of greater than HC-3 quantities of radioactive materials are not fully aligned with 10 CFR Part 830, Subpart B. When re-writing the methodology, DOE should consider a technical standard rather than a guide.

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In addition to addressing 10 CFR Part 830, Subpart B requirements, the methodology should define explicit evaluation criteria rather than demonstrating equivalent safety with DOT as the basis for approval, ensuring DOE reviewers are consistent with how they evaluate risk across all safe harbors.

The EOC review teams found some inconsistencies in the DOE regulatory framework that may be contributing to compliance issues. When writing and implementing requirements, the current DOE framework requires the evaluation of the full range of transportation activities and operations that fall within 10 CFR Part 830, including NRC and DOT requirements. However, DOE O 460.1D does not give explicit guidance on how to meet the requirements of 10 CFR 830. Considering the issues identified, the DOE and NNSA teams conclude that with a few exceptions, sites are meeting the essential elements of 10 CFR Part 830 to ensure safe onsite transfers and provide reasonable assurance of adequate protection of the health and safety of the public, workers, and the environment.

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LIST OF ABBREVIATIONS

CFR	Code of Federal Regulation
DAF	Device Assembly Facility
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DSA	Documented Safety Analysis
DOE-EM	Office of Environmental Management
EOC	Extent of Condition
G	Guide
HAC	Hypothetical Accident Conditions
HC	Hazard Category
HEVR	High Explosive Violent Reaction
HMR	Hazardous Materials Regulations
ICP	Idaho Cleanup Project
IP	Implementation Plan
JASPER	Joint Actinide Shock Physics Experimental Research
JCO	Justification for Continued Operations
LANL	Los Alamos National Laboratory
LLNL	Lawrence Livermore National Laboratory
MAR	Material at Risk
MOI	Maximum Exposed Offsite Individual
NA-LA	NNSA Los Alamos Field Office
NCT	Normal Conditions of Transport
NNSA	National Nuclear Security Administration
NNSS	Nevada National Security Site
NRC	U.S. Nuclear Regulatory Commission
NSS	Nuclear Safety Specialist
O	Order
OREM	Oak Ridge Environmental Management
OSA	Onsite Safety Assessment
P&T	Packaging and Transportation
PULSE	Principal Underground Laboratory for Subcritical Experimentation
RHWM	Radioactive and Hazardous Waste Management

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RWMC	Radioactive Waste Management Complex
SAC	Specific Administrative Control
SAR	Safety Analysis Report
SARP	Safety Analysis Reports for Packaging
SBAA	Safety Basis Approval Authority
SBRT	Safety Basis Review Team
SCE	Subcritical experiments
SGT	Transportation Safeguards Transporters
SNM	Special Nuclear Material
SRS	Savannah River Site
SST	Safe-Secure Trailer
STD	Standard
TRU	Transuranic
TSAR	Transportation Safety Analysis Report
TSD	Transportation Safety Document
TSR	Technical Safety Requirement
TTM	Transportation and Traffic Management
Y-12	Y-12 National Security Complex

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REFERENCES

1. Letter to Jennifer Granholm, Secretary of Energy, From Joyce L. Connery, Chair Defense Nuclear Facilities Safey Board, Subject: *Onsite Transportation Safety,* dated January 6, 2022
2. Board Recommendation 2023-1, *Onsite Transportation Safety,* dated January 26, 2024
3. Assessment Report, *NNSA Extent of Condition Review of Onsite Transfers,* October 2024
4. Assessment Report, *DOE EM Extent of Condition Review of Onsite Transfers,* August 2024
5. DOE-STD-1027-2018, Chg. Notice 1, *Hazard Categorization of DOE Nuclear Facilities,* January 22, 2019
6. DOE-STD-1027-92, Chg. Notice 1, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports,* December 12, 1997
7. DOE O 450.2, Chg. 1 (Min. Chg.), *Integrated Safety Managemen*t, January 17, 2017
8. NNSA SD 450.2-1A, *Delegation of Nuclear Safety Authorities*, January 4, 2024
9. AB-SAR-314353 *(U) Sitewide Safety Analysis Report*, Revision 393, May 2, 2024
10. AB-SAR-940314 *(U) Transportation Safety Analysis Report*, Revision 132, May 2, 2024
11. AB-SAR-940092 *(U) Staging Safety Analysis Report*, Revision 102, February 29, 2024
12. RPT-SAR-199801 *(U) Technical Safety Requirements for Pantex Facilities*, Revision 505, June 4, 2024
13. *Safety Evaluation Report Transportation Safety Analysis Report Pantex Plant,* Pantex Site Office, issued April 29, 2003
14. Y/TS-1315, *(U) Safety Analysis Report for the Y-12 Complex Special Nuclear Material Vehicle Operations,* Revision 17, November 2022
15. Y/TS-1315, *(U) Technical Safety Requirements for the Y-12 Complex Special Nuclear Material Vehicle Operations,* Revision 16
16. RP-8015470001 *Hazard Identification and Screening for the Y-12 Complex Special Nuclear Material Vehicle Operations,* Rev 1, November 2022
17. RP-8015470002 *Hazard Evaluation Study for the Y-12 Complex Special Nuclear Material Vehicle Operations,* Rev 1, November 2022
18. RP-8015470003 *Accident Analysis for the Y-12 Complex Special Nuclear Material Vehicle Operations,* Rev 1, November 2022
19. UCRL-MA-152462_Rev9 *Transportation Safety Document*
20. P&T-SA-002-R16.1 *Transportation Safety Document*
21. PT-TSR-001-R14.1 *Technical Safety Requirements*
22. OTSD-NSAF.100 *Documented Safety Analysis Documentation Collection (UCNI)* Revision 5

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23. TSRT-NSAF.100 T*echnical Safety Requirements* TSRT-NSAF.100 Document Collection (UCNI) Revision5

24. NST-RPT-2008-016, *Safety Evaluation Report for the Nuclear Onsite Transportation Safety Document and Technical Safety Requirements*, Revision 0, August 5, 2008

25. DOE O 460.1D Chg. 1 (LtdChg), *Hazardous Materials Packaging and Transportation Safety*, June 10, 2022

26. DOE G 460.1-1 I*mplementation Guide for Use with DOE O 460.1A, Packaging and Transportation Safety*, June 5, 1997

27. Title 10, Code of Federal Regulations, Part 71, *Packaging and Transportation of Radioactive Material*

28. Title 49, Code of Federal Regulations, Parts 100-185, *Hazardous Materials Regulations*

29. SSG-26 Rev.1, 2018 Edition - Appendix I: The Q system for the Calculation and Application of A1 and A2 Values

30. DOE-STD-3009-2014, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis*, November 12, 2014

31. DOE-STD-3009-94 Chg. Notice 3, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*, July 1994, updated Nov 12, 2014

32. DOE-STD-1083-2009, *Processing Exemptions to Nuclear Safety Rules and Approval of Alternative Methods for Documented Safety Analyses,* June 2009, Reaffirmation 2015

33. DOE-STD-1104-2016, *Review and Approval of Nuclear Facility Safety Basis and Safety Design Basis Documents*, December 21, 2016

34. Title 10, Code of Federal Regulations, Part 830, *Nuclear Safety Management*

35. Nuclear Safety Management; Interim Final Rule, 65 Fed. Reg. 60292 (Oct. 10, 2000).

36. Nuclear Safety Management, 66 Fed. Reg. 1810 (Jan. 10, 2001).

37. DOE Order 420.1C, Chg. 3 (LtdChg), *Facility Safety*, November 14, 2019

38. Frequently Asked Questions Regarding DOE Order 420.1C, Chg. 3, *Facility Safety,* *Frequently Asked Questions Regarding DOE O 420.1C, Chg. 3, Facility Safety*

39. DOE-STD-1183-2019, *Nuclear Safety Specialist Functional Area Qualification Standard*, April 8, 2019

40. DOE-STD-1155-2002, *Transportation and Traffic Management Functional Area Qualification*, October 15, 2002

41. DOE G 421.1-2A, Implementation Guide for Use in Developing Documented Safety Analyses to Meet Subpart B of 10 CFR 830, December 19, 2011

42. DOE G 423.1-1B, I *Implementation Guide for Use in Developing Technical Safety Requirements*, March 18, 2015

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APPENDIX A – ISSUE FORMS

Issue 1: Hazard Identification, Evaluation, and Controls for LANL Onsite Transfers

Issue: The Los Alamos National Laboratory (LANL) Documented Safety Analysis (DSA) for onsite transfers does not provide sufficient hazard identification or hazard evaluation during accident conditions that could result in uncontrolled release of radioactive and other hazardous materials. Deficiencies in the Documented Safety Analysis include:

1) The transfer routes are not clearly defined to determine whether there is potential impact to members of the public. There are natural hazards associated with the transfer routes that are not identified in the DSA.
2) Nuclear materials associated with each transfer route are not specified in terms of type, form, and dispersibility.
3) The DSA does not evaluate the probability or dose consequences associated with a transportation accident resulting in a hazardous material release.
4) The DSA does not provide a technical basis for the effectiveness of any credited controls, administrative or engineered, to prevent or mitigate the consequences of a hazardous material release to the workers, public, and the environment.

Associated Requirement(s):

- DOE O 460.1D Section 4.b.(3)(b), *Hazardous Materials Packaging and Transportation Safety*, specifies, for onsite transfers involving nuclear facility HC-2 or HC-3 quantities, the transportation safety document (TSD) must comply with the Safety Basis Requirements of 10 CFR Part 830, Subpart B, *Nuclear Safety Management*.
- 10 CFR Part 830.204(b)(2), *Documented Safety Analysis*, requires that the DSA must provide a systematic identification of both natural and man-made hazards associated with the facility.
- 10 CFR Part 830.204(b)(3) requires that the DSA evaluate normal, abnormal, and accident conditions, including consideration of natural and man-made external events, and identification of energy sources or processes that might contribute to the generation or uncontrolled release of radioactive and other hazardous materials.
- 10 CFR Part 830.204(b)(4) requires that the DSA derive the hazard controls necessary to ensure adequate protection of workers, the public, and the environment; demonstrate the adequacy of these controls to eliminate, limit, or mitigate identified hazards; and define the process for always maintaining the hazard controls current and controlling their use.
- DOE O 460.1D Section 4.b.(3)(a) requires meeting equivalent safety for any deviation from 49 CFR Parts 171-180 (the hazardous materials regulations). The hazardous materials regulations (49 CFR Part 173, *Shippers- General Requirements for Shipments and Packagings*, and 10 CFR Part 71, *Packaging and Transportation of Radioactive Material*) establish activity limits and the allowable release rates such that there would be no loss or dispersal of radioactive

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contents greater than one A^2 in one week for hypothetical accident conditions. The allowable release rate translates to an exposure consequence of 5 rem.

- DOE G 460.1-1, *Packaging and Transportation Attachments,* Section 5.3.1 establishes expectations that TSDs describe the methodology and compliance process to meet equivalent safety measures relative to deviations from the hazardous materials regulations (49 CFR Parts 171-180). The guide is cited in 10 CFR Part 830 Appendix A as an acceptable methodology for developing TSDs.
- DOE-STD-1104-2016, *Review and Approval of Nuclear Facility Safety Basis and Safety Design Basis Documents (Invoked),* Section 4.9, specifies that for existing facilities with mitigated offsite consequence estimates over the evaluation guide, the safety basis approval authority (SBAA) shall be at the Program Secretarial Officer Level, at a minimum, with concurrence from the Central Technical Authority and with consultation from DOE's Office of Environment, Health, Safety, and Security.
- DOE O 420.1C, Chg. 3, invokes DOE-STD-3009-2014, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis (Invoked),* Section 3.3.1, on existing facilities (regardless of safe harbor) with offsite dose estimate over the evaluation guideline. DOE-STD-3009-2014 Section 3.3.1 specifies requirements for Safety Class Controls if the unmitigated release consequences for a design basis accident or evaluation basis accident exceeds the evaluation guideline (25 rem).

Background: DOE O 460.1D requires a TSD for onsite transfer of hazardous materials that are not prepared as specified in 49 CFR Parts 171-180. For onsite transfers involving nuclear facility HC-2 or HC-3 quantities, the TSD must also comply with the Safety Basis Requirements of 10 CFR Part 830, Subpart B.

DOE O 460.1D and DOE G 460.1-1 do not define a safety assessment methodology for meeting 10 CFR Part 830 Subpart B. Instead, the safety assessment methodology is based on demonstrating equivalent safety with the Department of Transportation (DOT) hazardous materials regulations. DOE O 460.1D and DOE G 460.1-1 do not discuss the DOE-STD-1104 evaluation guideline, and instead establish expectations that any credible accident will not cause any individual to receive a committed effective dose greater than 5 rem. This is the basis for the DOT and Nuclear Regulatory Commission (NRC) packaging requirements in 49 CFR Part 173 and 10 CFR Part 71. If a DSA meets the DOE O 460.1D and DOE G 460.1-1 acceptance criteria of DOT "equivalent safety," the maximum exposure to any individual (either a member of the public or worker) will not exceed 5 rem and will not challenge the DOE-STD-1104 evaluation guideline of 25 rem.

The LANL TSD uses packaging and tie-down hardware that contains the radioactive material under normal (handling, shock, and vibration) and abnormal (minor mishaps) conditions.

However, the packaging and tie-down hardware will not contain the radioactive material under accident conditions; either by meeting equivalent safety as specified in the 10 CFR Part 71.73 regulations or by establishing alternative design conditions or allowable damage ratios. The LANL TSD describes operations that can be expected to contain radioactive materials for normal and

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abnormal conditions, but not accident conditions. The LANL TSD does not evaluate the probability or consequences associated with a transportation accident, such as the dose consequences associated with radioactive material release during a transportation accident. As such, the National Nuclear Security Administration (NNSA) cannot determine if either the DOE O 460.1D requirement of DOT equivalent safety (5 rem) or the DOE-STD-1104 evaluation guidelines (25 rem) are met.

DOE O 420.1 invokes DOE-STD-3009-2014 Section 3.3.1 on existing facilities (regardless of safe harbor) with offsite dose estimate over the evaluation guideline. Without knowing if the onsite transfer activities have offsite dose estimates over the evaluation guideline, NNSA cannot determine whether DOE-STD-3009-2014 Section 3.3.1 also applies to these transfers.

Finally, the LANL TSD identifies the need for controls, and the TSRs specify engineering and Specific Administrative Controls applicable to the transfer. However, without an accident analysis, there is no technical basis for the adequacy of these controls to eliminate, limit, or mitigate the hazards during an accident. Consequence analysis is needed to determine if the controls should be safety class or safety significant.

Significance:

☒ High ☐ Medium ☐ Low

This issue is graded high because the TSD does not identify all hazards, evaluate hazards under accident conditions, and demonstrate the adequacy of the controls to protect the workers, the public, and the environment.

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Issue 2: Technical Safety Requirements

Issue: DOE's Hanford and Savannah River Site (SRS) do not explicitly identify Technical Safety Requirements (TSRs) for onsite transfers of HC-3 or greater radioactive materials.

Other sites (Idaho Cleanup Project (ICP), Oak Ridge Environmental Management (OREM), and Lawrence Livermore National Laboratory (LLNL)) are not identifying TSRs as standalone documents, but as a chapter or section within their DSAs. While a TSR contained within the DSA is a compliant option for meeting 10 CFR 830, this makes change management and the Unreviewed Safety Question (USQ) requirements difficult to implement because the USQ process applies to a DSA, but not to TSRs. DOE O 460.1D and DOE G 460.1-1 do not address TSRs.

TSRs are a 10 CFR Part 830 requirement for HC-1, 2, or 3 nuclear transportation activities.

Associated Requirement(s):

- 10 CFR Part 830.205, *Technical Safety Requirements*, requires contractors responsible for a HC-1, 2, or 3 nuclear facility to develop technical safety requirements that are derived from the documented safety analysis. DOE approval is required prior to use and to any change. DOE also must be notified of any violation of a technical safety requirement.
- 10 CFR Part 830.205 (a)(2) requires DOE approval for any change to the TSRs.
- DOE O 461.2, Annex 1, Section 2, identifies the preferred format for TSDs. This section notes that TSRs are a designated chapter within TSDs in Chapter XIII.
- DOE G 423.1-1B, *Implementation Guide for Use in Developing Technical Safety Requirements*, provides guidance for TSR document organization and development. The guide sets expectations that TSRs are stand-alone documents to ensure DOE approval is for use and for any change.

Background:

Hanford and SRS do not identify TSRs either as stand-alone documents or as a chapter within the TSD. 10 CFR 830.205 requires a TSR, but what constitutes the "TSR" is unclear in the transportation documents. This lack of clarity impacts the USQ process (as TSRs are not subject to the USQ process and require DOE approval for any change) and potential implementation expectations.

There are differences in the transportation methodologies with respect to TSRs. DOE O 460.1D and DOE G 460.1-1 do not address TSRs while DOE O 461.2 specifies that TSRs are a chapter within the TSD. DOE sets expectations in DOE G 423.1-1B that TSRs are stand-alone documents, not a chapter within the DSA. TSRs as standalone documents help ensure DOE approval is obtained for use and any change, as required in 10 CFR Part 830.205(a)(2).

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TSRs should be a separate document from the DSA. The USQ requirements apply to the DSA, but do not apply to TSRs; therefore, they should be separate documents for change control reasons. ICP, OREM, and LLNL identify TSRs not as stand-alone documents, but rather as a chapter within the DSA. Y-12 National Security Complex (Y-12), Pantex, Los Alamos National Laboratory (LANL), and Nevada National Security Site (NNSS) all have established TSRs as standalone documents, following the TSR documentation organization in DOE G 423.1-1B.
Significance: ☐ High ☒ Medium ☐ Low TSRs are the limits, controls, and related actions that establish the specific parameters for the safe operation of a nuclear facility. TSRs that are clearly identified and derived from the safety analysis are essential for safe operations.

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Issue 3: Definition of Terms: TSD vs. DSA/TSR

Issues: Some sites are confused about the differences between a TSD and a DSA/TSR. 10 CFR Part 830, Subpart B, requires a DSA and TSDs to be developed for all nuclear facilities of HC-3 or greater quantities of radioactive materials. However, DOE O 460.1D and its implementing guide, DOE G 460.1-1, use the same term (TSD) for onsite transfers of radioactive material of less than HC-3 quantities of radioactive materials, which are not subject to the requirements of 10 CFR Part 830 Subpart B. This can lead to confusion about whether a document is subject to 10 CFR Part 830 Subpart B requirements.

DOE O 460.1D specifies the Head of Operations Office or Field Office/Site Office Manager as the approval authority for onsite transfers. However, approving onsite transfer safety basis documents is a nuclear safety authority for HC-2 or HC-3 quantities or radioactive material subject to the Safety Basis Requirements of 10 CFR Part 830 Subpart B. DOE Order 450.2, *Integrated Safety Management*, requires nuclear safety authorities be delegated following a written process from DOE line management to specific individuals who possess the necessary qualifications, experience, and expertise. No site was found to be using an improper approval authority during the reviews.

Associated Requirement(s):

- 10 CFR Part 830, Appendix A to Subpart B, Table 1, Row (9), *Transportation Activities* states that a contractor responsible for onsite transfers may prepare its documented safety analysis by preparing a TSD in Accordance with DOE G 460-1-1.
- DOE G 460.1-1 Section 5.3 provides instructions for preparing TSDs, but with no distinction for those involving radioactive materials of HC-3 or higher quantities.
- DOE O 460.1D Section 4.b.(3) specifies that onsite transfer of hazardous materials, including radioactive materials, must be conducted in accordance with a TSD approved by the Head of Operations Office or Field/Site Office Manager. Section 4.b.(3)(b) further specifies that for onsite transfers involving nuclear facility HC-2 or HC-3 quantities, the TSD must comply with the Safety Basis Requirements of 10 CFR Part 830, Subpart B.
- DOE Policy 450.4A, *Integrated Safety Management Policy*, establishes a guiding principle of integrated safety management that competence is commensurate with responsibilities.
- DOE Order 450.2, *Integrated Safety Management*, Section 4.j. implements the DOE Policy, by requiring each Department's line management to develop, issue, and maintain a documented process for delegation of authorities to perform safety management functions consistent with the hazards and complexity of the work. The order further specifies in Appendix A, Section 2, requirements for delegating Nuclear Facility Safety Delegations (i.e., SBAA for documented safety analyses, technical safety requirements, and USQ procedures required pursuant to 10 CFR Part 830, Subpart B).

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- DOE O 460.1D Section 4.b.(3)(b) specifies the Head of Operations Office or Field Office/Site Office Manager approve onsite transfers involving nuclear facility HC-2 or HC-3 quantities that are subject to the safety basis requirements of 10 CFR Part 830 Subpart B.

Background:

DOE's Office of Environmental Management (DOE-EM) sites are using the terms "TSD" and "DSA/TSR" interchangeably. The are different requirements for a DSA compared to a TSD.

The responsibility of the Head of Operations Office, Cognizant DOE Field Element, or Field Office/Site Office Manager to review and approve technical safety documents for onsite transfers (TSDs) pre-dates Subpart B's addition to 10 CFR 830. When Subpart B was added, the packaging and transportation directives (DOE O 460.1A, DOE G 460.1-1, DOE O 461.1, and DOE M 461.1-1, *Packaging and Transfer of Materials of National Security Interest Manual*) were listed as acceptable methodologies for preparing a DSA in 10 CFR Part 830, Appendix A, Table 1 (originally Table 2). DOE did not revise the referenced directives to clarify that approving safety basis documents for onsite transfers subject to 10 CFR Part 830, Subpart B is an SBAA. In 2011, the DOE Policy and Directive for managing delegated nuclear safety authorities has evolved. However, DOE did not make the corresponding changes in DOE O 460.1 or 461.2 to require an SBAA as designated per DOE O 450.2 requirements to approve onsite transfers subject to 10 CFR Part 830, Subpart B.

Significance:

☐ High ☒ Medium ☐ Low

Due to DOE/NNSA sites using the terms "TSD" and "DSA/TSR" interchangeably, there has been confusion because the term "TSD" also refers to less than HC-3 shipments, including non-radioactive hazardous material. This can lead to confusion about whether a document is subject to 10 CFR Part 830 Subpart B requirements.

The review team did not observe any onsite transfer DSAs which were approved by a person other than the designated SBAA. All sites reviewed understood that the onsite transfers of HC-3 or greater quantities of radioactive material needed to be approved by the SBAA and the DSAs, where correctly approved by the SBAA. In most cases, the SBAA and Field Office Manager are the same person.

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Issue 4: Mixed Methodologies

Issue: Multiple DOE-EM and NNSA sites are using a combination of methodologies set forth in 10 CFR Part 830 Appendix A, Table 1 rather than using a single methodology to address the requirements of 10 CFR Part 830 Subpart B.

The existing DOE O 460.1D and its implementing guide, DOE G 460.1-1, do not provide sufficient information to meet the requirements of 10 CFR Part 830 Subpart B.

For Materials of National Security Interest, DOE offers a separate methodology, DOE O 461.2. Although DOE O 460.1D and 461.2 are mutually exclusive, most NNSA sites implement a hybrid of both methods so that a single TSD can cover the full range of materials the site transfers.

Use of mixed methodologies is not explicitly allowed by 10 CFR Part 830 without prior DOE permission. The transportation safe harbor method (the Order/Guide) is not adequate by itself to meet Part 830 Subpart B requirements, including hazard identification and evaluation, establishment of preventive and mitigative hazard controls, identifying hazard controls as safety class and safety significant as necessary, and support for additional Subpart B requirements related to TSRs, USQs, and DOE Approvals (SBAAs).

Associated Requirement(s):

- 10 CFR Part 830, Subpart B, Table 1, provides two methodologies for preparing a documented safety analysis for onsite transfers that are mutually exclusive: DOE O 460.1D with its implementing guide, DOE G 460.1-1, for transportation activities; and DOE M 461.1-1 (now DOE O 461.2) for onsite transfers of nuclear explosives, nuclear components, naval nuclear fuel elements, Category I and Category II special nuclear materials, special assemblies, and other materials of national security.
- DOE-STD-1083-2009, *Processing Exemptions to Nuclear Safety Rules and Approval of Alternative Methods for Documented Safety Analyses*, sets expectations that alternate methodologies will be used when none of the methods listed in 10 CFR Part 830, Subpart B Appendix A ,Table 1 fit the actual facility conditions or when minor modifications or updates to one of the methodologies are appropriate.
- DOE G 421.1-2A, *Implementation Guide for Use in Developing Documented Safety Analyses to Meet Subpart B of 10 CFR Part 830*, allows use of DOE-STD-3009 as an alternative safe harbor for onsite transportation activities because it applies to all non-reactor nuclear facilities. However, the guide does not recommend only using portions of DOE-STD-3009 to supplement the transportation safe harbors. Further, the guide also sets the expectation that the safety classification guidance for safety class and safety significant systems, structures, or components and specific administrative controls of DOE-STD-3009 will be used in developing the DSA.
- DOE O 460.1D, Section 4.b.(3)(a) requires meeting equivalent safety for any deviation from 49 CFR Parts 171-180 (the hazardous materials regulations).
- DOE G 460.1-1, Section 5.3.1 establishes expectations that TSDs describe the methodology and

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compliance process to meet equivalent safety measures relative to deviations from the hazardous materials regulations (49 CFR Parts 171-180).

- DOE -STD-3009-2014, Foreword Item 7: If a facility, site, or program office chooses to use this DOE-STD-3009 revision for upgrading an existing DSA, then this revision is required by 10 CFR Part 830 to be implemented in its entirety.

Background:

Five out of six sites in the extent of condition (EOC) reviews using the DOE O 460.1D/DOE G 460.1-1 transportation methodologies needed to supplement with DOE-STD-3009. Y-12, and ICP elected to use DOE-STD-3009. Pantex, as a nuclear explosive facility, must use DOE-STD-3009 with DOE-NA-STD-3016, *Hazard Analysis Report for Nuclear Explosive Operations*, for nuclear explosive operations. Of the remaining six sites, all but LANL supplemented their methodology with DOE-STD-3009. The primary way that sites are using DOE-STD-3009 is for the hazard evaluation and risk ranking. The risk ranking of unmitigated hazard scenarios is then used to establish the level of controls needed for the operation.

While DOE allows use of DOE-STD-3009 as an alternative safe harbor for onsite transportation activities, DOE does not recommend mixing elements of multiple methodologies for transportation. Selecting certain elements of a methodology without others could result in only implementing the easiest portions of each methodology, and the resulting mix is weaker than either of the original methodologies. DOE-STD-3009 specifies in the foreword section that the standard should be implemented in its entirety.

DOE-STD-1083 allows use of an alternate methodology when none of the methods listed in 10 CFR Part 830, Subpart B, Appendix A fit the actual facility conditions; however, the alternate methodology must be pre-coordinated with Chief Nuclear Safety; Chief of Defense Nuclear Safety; the Office of Environment, Health, Safety and Security and concurred on by the Central Technical Authority. If this process had occurred, DOE might have become aware of the widespread need to supplement the transportation methodologies.

The DOE regulatory framework differentiates onsite transfers by materials of national security interest (MNSI), which are governed by DOE Order 461.2, and all other hazardous materials governed by DOE O 460.1D. The two directives define two separate methodologies. DOE O 460.1D establishes a method of comparative analysis where transfers must demonstrate DOT equivalent safety as the basis for approval. However, for MNSI shipments, the DOT does not authorize all types of assemblies shipped (e.g., radioactive materials mated with high explosives). Therefore, there is no basis for comparison or approval. Instead, the MNSI directive requires alternative parameters for approval. For all credible accidents, the TSD must demonstrate (1) individuals cannot receive a dose greater than 25 rem and (2) criticality is prevented. These two separate methodologies are mutually exclusive. Both directives (DOE O 460.1D and DOE O 461.2) exempt operations conducted under the other directive. Of the two methodologies, establishing DOT dose requirements is more restrictive. There are more parameters beyond dose consequence and criticality during accidents and the allowed dose consequence is less (5 rem rather than 25 rem to any individual).

Most NNSA sites ship both MNSI and non-MNSI (e.g. weapon components and waste shipping

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under the same TSD). For efficiency, some sites have a single TSD that covers the full range of materials shipped and developed a hybrid approach, merging the requirements from both directives rather than treating them as mutually exclusive. The directives, guides, and standards are different enough that care should be taken for any document that is merging requirements from each. For higher hazard transfers, DOE O 461.2 recommends a more quantitative analysis be applied (i.e., DOE-STD-3009), in which supplementing the safety assessment in the TSD with portions of DOE-STD-3009 is appropriate and consistent with the methodology.

DOE O 461.2 references an archived standard, DOE-STD-1189-2008, *Integration of Safety Into the Design Process*, for the allowable dose evaluation. The directive refers to the public evaluation section of the standard. However, it applies the allowable dose to an individual, with no distinction between the public or the worker. The directive needs to be updated to reference current DOE standards and clarify whether this dose limit applies to a worker, a member of the public, or both.

Finally, sites identified problems with a methodology that is a DOE Guide. It was unclear to contractors developing their TSDs whether DOE is establishing requirements or recommendations for the format and information within the TSD.

Significance:

☐ High ☒ Medium ☐ Low

Variations of this issue were observed in many of the DOE EM and NNSA sites reviewed (of the 9 sites reviewed, this was not applicable to Pantex, Y-12, and ICP, who developed their DSAs using DOE-STD-3009). Of the remaining 6 sites, 5 out of 6 supplemented DOE O 460.1D/DOE G 460.1-1 with DOE-STD-3009.

Received by the Board 09.15.25

Issue 5: Definition of Terms: DOT Compliant Versus DOT Regulated

Issue: 10 CFR Part 830 excludes transportation activities that are DOT regulated. Onsite transfers are out of commerce and are not regulated by the DOT. Some personnel interviewed do not understand the difference between "DOT Compliant" vs. "DOT Regulated." As a result, there is confusion about the applicability of 10 CFR Part 830 for onsite transfers that are DOT compliant.

Associated Requirement(s):

- 10 CFR Part 830.2(c) excludes transportation activities which are regulated by the Department of Transportation.
- DOE O 460.1D Section 4.b. specifies that onsite transfer of hazardous materials, including radioactive materials, may be conducted following 49 CFR Parts 171.180, **OR,** a Transportation Safety Document. *If conducted following 49 CFR Parts 171-180, no additional safety analysis is required.*
- DOE O 461.2 Section 4.b(1) specifies that onsite transfers compliant with DOT regulations do not require additional authorization.

Background: The DOE Directives (DOE O 460.1 and DOE O 461.2) give sites the option to prepare onsite transfers following the DOT Hazardous Materials Regulations without additional safety analysis or justification since Subpart B was added to 10 CFR Part 830 in 2001. 10 CFR Part 830 specifically excludes shipments that are DOT regulated; however, DOE needs to clarify whether onsite transfers prepared in accordance with the HMR are, for purposes of Part 830, "DOT regulated," because these activities occur onsite within secured areas where DOT has no jurisdiction. DOT compliant package transfers "are subject to DOT requirements," because the DOT packaging, shipping papers, marking, labeling, placarding, and segregation requirements are applied for these transfers.

The methodologies listed in Appendix A list Safety Analysis Reports for Packaging (SARPs) as acceptable ways to prepare a documented safety analysis, even though SARPs are documents used to demonstrate compliance with DOT and NRC packaging requirements, not 10 CFR Part 830 Subpart B safety basis requirements, further confusing what packaging and transportation activities are included in 10 CFR Part 830 versus what activities are excluded.

Significance:

☐ High ☒ Medium ☐ Low

This issue does not represent a safety concern, rather a discrepancy in terms that is causing confusion about the scope of activities subject to 10 CFR Part 830.

Received by the Board 09.15.25