



Assessment of Radioactive Waste Management at the Nevada National Security Site

Interim Report

April 2020

Office of Enterprise Assessments
U.S. Department of Energy

Assessment of Radioactive Waste Management at the Nevada National Security Site February 4-13, 2020 Interim Report

Overview

This assessment is in response to the Deputy Secretary of Energy's July 9, 2019, memorandum directing the Office of Enterprise Assessments (EA) to undertake a U.S. Department of Energy (DOE)-wide assessment of the procedures and practices for packaging and shipping radioactive waste. The assessment activities focused on waste management performance at the Nevada National Security Site (NNSS), as implemented by the management and operating (M&O) contractor, Mission Support and Test Services, LLC (MSTS), and the environmental management contractor, Navarro Environmental Program Services (NEPS). In addition, the assessment evaluated NNSS activities conducted by Los Alamos National Laboratory and Lawrence Livermore National Laboratory that generate radioactive waste, and the associated waste management support provided by MSTS.

MSTS waste management activities include characterizing, packaging, and shipping low-level waste (LLW) and mixed low-level waste (MLLW) for disposal, primarily at the NNSS Radioactive Waste Management Complex (RWMC). In addition, one transuranic waste stream is managed by MSTS and staged at the RWMC prior to eventual shipment to the Waste Isolation Pilot Plant. MSTS also manages and conducts daily operations at the RWMC.

NEPS waste management activities include characterizing, packaging, and shipping LLW and implementing the radioactive waste acceptance program (NEPS/RWAP) for NNSS. NEPS/RWAP personnel also maintain the NNSS waste acceptance criteria (NNSS WAC); perform site waste profile reviews throughout the DOE complex, leading to recommending approval to Office of Environmental Management Consolidate Business Center, Field Site, Nevada (EM-NV) with Nevada Field Office (NFO) concurrence; and assess generator sites' waste certification programs and implementation to ensure compliance with the NNSS WAC.

The assessment team, identified in Appendix A, examined a sample of waste generator operations representing about 80% of the total onsite generated waste (by volume) transferred to the RWMC. NNSS's diverse control strategy (defense-in-depth) for its waste management processes, from the generator to shipping, is illustrated in Appendix B.

This report provides the interim results of the assessment of LLW and MLLW management at NNSS, addressing non-compliances and apparent causes contributing to weaknesses. The results of this assessment are presented in two parts in this report: contractor waste management performance and Federal oversight (Part 1), and NEPS/RWAP performance (Part 2). At the conclusion of the enterprise-wide assessment, a final compilation report will include the results of this summary. The perspective gained by conducting this assessment could change as additional information becomes available from subsequent site assessments. The final compilation report will identify best practices, lessons learned, and cross-cutting recommendations.

DOE Order 227.1A, *Independent Oversight Program*, describes and governs the DOE independent oversight program, which EA implements through a comprehensive set of internal protocols, operating practices, assessment guides, and process guides. DOE Order 227.1A defines the terms best practices, findings, deficiencies, opportunities for improvement, and recommendations. In accordance with DOE

Orders 227.1A and 226.1B, *Implementation of Department of Energy Oversight Policy*, it is expected that the site will analyze the causes of findings and deficiencies identified in this summary, develop corrective action plans for findings, and implement compensatory corrective actions for program and performance deficiencies.

Summary

Overall, MSTS's and NEPS's waste management programs ensure proper characterization, packaging, and shipping of radioactive waste for disposal. In addition, MSTS adequately manages receipt of waste at RWMC, the disposal facility. NEPS/RWAP personnel have also conducted effective assessments of site generator waste certification programs and are in the process of making further improvements. NFO and EM NV maintain adequate Federal operational awareness of waste management activities. This assessment found no findings, one interim recommendation (addressing the approval process to resume Y-12 waste shipments), and seven opportunities for improvement for consideration by DOE Federal and contractor management. This assessment also found two MSTS deficiencies associated with conducting an annual waste profile review and assigning roles and responsibilities for waste management programs. Although these deficiencies did not result in an issue with the appropriate disposal of LLW and MLLW, management attention is warranted to reduce the risk of waste issues in the future. NFO did not collaborate with its M&O contractor to perform a self-assessment directed by the National Nuclear Security Administration (NNSA) Chief of Staff's July 16, 2019, memorandum. However, EM NV, in collaboration with NEPS and MSTS, performed a thorough oversight assessment that fully responded to the July 23, 2019, memorandum from the DOE EM Principal Deputy Assistant Secretary. The NNSA peer review was conducted concurrent with this EA assessment; results were not available at the time of the completion of this site assessment.

Part 1: Contractor Waste Management Performance and Federal Oversight

MSTS

Positive Attributes

Waste Characterization

- MSTS has robust waste characterization procedures that use process knowledge and a well-known source term as documented in supporting experimental records.
- All waste containers from the Device Assembly Facility (DAF) are measured by gamma spectroscopy. Waste streams from other facilities are well characterized by process knowledge and confirmed by sample analysis.
- Personnel performing characterization measurements are knowledgeable of the measurement processes, equipment quality assurance (e.g., calibration, configuration management), probable source terms, and data quality objectives.
- Relatively few chemicals are authorized in NNSA facilities' inventories and operations, and their use is well analyzed through work control processes that support process knowledge for waste characterization. To assist personnel in proper storage and handling of chemicals, procedures include tables that provide a listing of chemical incompatibilities.

Waste Stream Control

- MSTS uses visual inspection to identify the presence of prohibited items in waste units during handling and packaging. During waste inspection for final packaging, the assessment team observed the MSTS Waste Generator Services (WGS) inspector identifying multiple prohibited items in a

waste unit (i.e., bags or containers of LLW) and appropriately setting the waste unit aside for further disposition. The waste stream non-compliance was subsequently entered into the MSTS issues management system (caWeb), and MSTS conducted a thorough critique and identified actions to prevent recurrence.

- MSTS waste engineers and the Waste Certification Officials (WCOs) have the appropriate security clearances and sufficient access to waste streams and supporting information to allow proper characterization of classified waste streams.

Packaging and Shipping

- WGS maintains a waste stream data package for all waste streams that captures the acceptable knowledge for waste characterization, provides documentation that aligns the waste stream with the approved profile, and supports traceability of the waste from origination to disposal.
- WGS maintains positive control of all waste packages from initial loading to final closure. When waste loading activities are not occurring, procedures require the waste package to be secured with a tamper-indicating device to prevent the introduction of prohibited items or other waste constituents inconsistent with the approved waste profile.

Quality Assurance

- MSTS radiological control technicians (RCTs), who receive annual waste management training, exhibited a thorough understanding of and a commitment to their role in assisting waste generators in keeping waste streams free from prohibited articles. Facility workers expressed that they depend primarily on MSTS RCTs for waste management direction. An MSTS DAF RCT exhibited a questioning attitude when an unfamiliar waste material was identified at a contamination control boundary in 2017, leading to the recognition (after further investigation) that the incorrect waste profile had been selected for disposal.
- Two performance-based assessments provided self-critical perspectives and identified substantive performance improvement opportunities. The 2019 *Independent Assessment of the Rad Waste Complex*, was broad and comprehensive, covering all applicable NNSW WAC requirements, and identified the production of certain WCO records that were not being handled as records or identified by procedure. Additionally, the 2019 M&O contractor *Waste Certification Program Assessment* (a management assessment) comprehensively addressed a review of all waste profiles with associated shipment documents, and all previously-identified issues and corrective actions for the past five years; that assessment identified the need to indicate the organizational change for WCOs (since the M&O contract change) on the MSTS Certification Personnel List required by the NNSW WAC.
- MSTS uses the OPEXShare website, which permits registered users to identify topics of interest, automatically receive related lessons learned (LLs), and provide feedback. WGS has submitted nine LLs to OPEXShare over the past five years for sharing with the DOE complex. MSTS's most recently generated LL (January 2020) addresses an error in recording a delivery address on the bill of lading that resulted in attempted delivery to an incorrect Los Alamos National Laboratory location; the LL was shared with MSTS shipping personnel to increase their attention to detail when completing shipping bills of lading.
- MSTS RWMC personnel, in collaboration with NEPS/RWAP personnel, recognize the value of continued use of real-time radiography (RTR) and have incorporated this process into routine waste container verification operations.

Federal Oversight

- NFO has a thorough and well-documented process for oversight planning and execution. Oversight of waste management activities is appropriately documented in Facility Representative (FR) weekly reports and operational awareness activity reports.
- NFO demonstrated it has appropriate technical competence and experience to evaluate the adequacy of radioactive waste program implementation using the NFO FRs, an NFO senior advisor, a radiological protection subject matter expert (SME), and collaborative technical support from EM NV. NFO is currently proceeding with the authorization to hire a waste management SME.

NEPS

Positive Attributes

Waste Characterization

- NEPS uses a well-developed process to establish data quality objectives. This process includes sampling, data acquisition from accredited contract laboratories, and data review.
- Subcontracts that address laboratory sample analysis provide specific requirements for measurement and the identification of anomalies when analytical results indicate characterization information beyond that anticipated through the original process knowledge.
- NEPS integrates radiation protection professionals into characterization planning activities and uses RCT measurements to monitor cleanup waste stream characteristics.
- NEPS RCTs are knowledgeable of waste characterization data quality objectives, thus ensuring that monitoring results are obtained and recorded with sufficient accuracy and precision to meet those objectives and U.S. Department of Transportation requirements.

Waste Stream Control

- NEPS waste handlers are well trained in waste management activities.
- NEPS waste processes require independent verification of supporting waste documentation by a Waste Verification Official prior to WCO waste certification. This position is unique to NEPS and provides an additional level of defense in depth to help ensure a compliant waste package. No similar level of verification has been observed during other enterprise-wide assessments.

Quality Assurance

- NEPS conducted nine management and independent assessments over the past five years covering the key elements of the waste management process. The assessments were self-critical and included substantive items for performance improvement. For example, the recent *Clean Slate III Safety, Rad Con, and Waste Management Assessment* identified the need to establish restart criteria following work pauses due to environmental conditions.
- NEPS recently used LLs from two challenges to the integrity of a soft-sided U.S. Department of Transportation container to improve waste management performance: a manufacturing seam defect identified during offloading at disposal site, and a surface abrasion due to an S-ring tie-down connector. A packaging and shipping checklist was modified to address these LLs.

Federal Oversight

- EM NV has two qualified waste management SMEs who are technically competent and have the experience to adequately evaluate radioactive waste program implementation.

- EM NV has a well-documented process for oversight planning and execution. EM NV assessments of NEPS's compliance with the NNSW WAC are appropriately documented in Oversight Assessment reports. Additionally, routine oversight of waste management and environmental restoration activities is appropriately documented in operational awareness activity reports.
- EM NV, in collaboration with NEPS and MSTS, performed a thorough oversight assessment that fully responded to the July 23, 2019, memorandum from the DOE EM Principal Deputy Assistant Secretary. The scope of the assessment encompassed waste management activities conducted by NEPS, NEPS/RWAP, MSTS, and related Federal oversight conducted by EM NV.

Findings

The assessment identified no findings.

Deficiencies

Deficiencies are inadequacies in the implementation of an applicable requirement or standard. Deficiencies that did not meet the criteria for findings are listed below, with the expectation from DOE Order 227.1A for site managers to apply their local issues management processes for resolution.

- **Deficiency D-MSTS-1:** Contrary to OP-2151.316, *Radioactive Waste Stream Characterization*, Section 4.5[18], MSTS WGS did not conduct the annual profile review to the depth specified in the procedure.
- **Deficiency D-MSTS-2:** Contrary to roles and responsibilities of the waste generators defined in the safety management program for radioactive waste management in Chapter 9 of the DAF documented safety analysis, MSTS credits the DAF RCTs as the first line of defense to identify prohibited items in the waste stream. This reliance on RCTs relieves the waste originator of their responsibility and reduces the defense-in-depth control at the point of waste generation.

Other Areas of Weakness

Other areas of weakness represent potential vulnerabilities that warrant site management's consideration but do not rise to the level of a finding or deficiency as defined in DOE Order 227.1A. The site should review these vulnerabilities and take appropriate actions. These weaknesses will be further reviewed against subsequent enterprise-wide site assessments to determine whether the vulnerability is cross-cutting and warrants an enterprise-wide response.

MSTS

Waste Characterization

- Waste characterization assay practices currently rely on SME knowledge, instead of written guidance, to identify potential anomalies. This approach may be susceptible to inconsistent long-term performance if personnel changes occur. Procedures for waste characterization do not incorporate guidance for determining the chemical compatibility of waste constituents. The procedures for waste characterization depend on transfer of process knowledge from the originators, which currently focuses on MLLW Resource Conservation and Recovery Act (RCRA) compliance, rather than on direct measurements or analysis to ensure that incompatible materials are not introduced into the waste streams.

Waste Stream Control

- MSTS does not define the required training for waste originators (e.g., national laboratory workers) to ensure a consistent understanding of waste stream control requirements. In some instances, waste generators receive very little training in waste stream control, including the identification of prohibited items, and there are no operator aids in the field to assist generators in understanding what objects cannot enter the waste stream. (See OFI-MSTS-1.)

Packaging and Shipping

- MSTS has not implemented formal procedures and practices to address remedial response to potentially non-conforming waste items identified upon receipt at the RWMC. Potentially non-conforming waste items include items with inconsistent shipping documentation, damaged packaging, and indeterminate items identified through RTR. The disposal facility does not currently have the capability to open, inspect, and remove these items for repackaging. (See OFI-MSTS-2.)

Quality Assurance

- MSTS personnel at the DAF and Big Explosive Experiment Facility have not performed management assessments/surveillances or independent assessments/surveillances of onsite waste generator performance at the point of origination. This omission represents a missed opportunity to expand MSTS's defense-in-depth controls to ensure the continued integrity of waste stream conformance with assigned waste profiles. (See OFI-MSTS-3.)
- MSTS entered 22 RWMC-related facility issues ("track until fixed") into caWeb during calendar year 2019 with a generic statement regarding "discovered conditions" but did not include details of the discovered conditions. This omission represents a missed opportunity to identify and correct potential repetitive problems.
- An MSTS DAF procedure was revised in response to a DAF RCT identifying unapproved waste material in a waste stream, but the revision does not adequately implement effective change control. Although the procedure provides for "expansion of activities" by laboratory workers, it does not define this term, thereby increasing the risk that users will use their own discretion for compliance.

Federal Oversight

- NFO does not currently have a qualified radioactive waste management SME to oversee the NNS waste management program. NFO has recognized this weakness and identified compensatory measures using the combined oversight talents of other SMEs (i.e., a senior advisor, FRs, and radiological protection). NFO indicated its intention to pursue Headquarters approval for an additional site office position to fill this void.
- The current FR facility-specific qualification standards do not include discrete competencies on radioactive waste management. Normally, the facility-specific qualification standard focuses on the significant hazards of the facility mission. However, given the compensatory measures addressed above, additional radioactive waste management competencies may be warranted. (See OFI-DOE-NFO-1.)
- NFO did not collaborate with its M&O contractor to perform the internal self-assessment as directed in the July 16, 2019, DOE memorandum *NNSA Enterprise-Wide Assessment of Certification, Packaging, and Shipping of Radioactive Waste and Operational Pause for Safety Training*, and Federal oversight was not reviewed as part of the assessment. This omission represents a missed opportunity to perform a critical self-evaluation of Federal radiological waste management oversight and provide input on MSTS's performance and oversight in this area.

NEPS

Waste Characterization

- NEPS waste characterization processes address chemical constituents for RCRA compliance but do not provide direction for performing chemical compatibility evaluations for combinations of multiple chemicals. The organization solely depends on SMEs' professional judgment of the potential for chemical incompatibilities, rather than a documented, process-based approach. While current waste streams do not present a significant vulnerability, the lack of a formal, documented evaluation process could result in vulnerabilities as projects change or anomalies occur.

Opportunities for Improvement

Opportunities for improvement are suggestions that are offered to assist cognizant managers in improving programs and operations.

MSTS

- **OFI-MSTS-1:** MSTS should consider establishing training requirements for non-MSTS personnel who may generate waste.
- **OFI-MSTS-2:** MSTS should consider establishing capabilities and processes to address remedial actions in response to non-conforming waste items identified upon receipt at the RWMC.
- **OFI-MSTS-3:** MSTS should consider including on onsite waste generator performance at the point of origination in the scope of management assessments/surveillances and independent assessments/surveillances.
- **OFI-DOE-NFO-1:** NFO should consider revising the FR facility-specific qualification standards to include additional specificity in the waste management and environmental compliance competencies to support additional waste management duties assigned.

Part 2: Radioactive Waste Acceptance Program Performance

EM NV and NEPS/RWAP personnel manage and conduct the reviews of waste generator procedures and practices to evaluate compliance with the NNSS WAC and associated DOE order and regulatory requirements. Following the Y-12 National Security Complex (Y-12) notification that previous waste shipments to NNSS did not comply with two requirements from the NNSS WAC, EM NV and NEPS conducted a thorough cause analysis of the NEPS/RWAP processes. The cause analysis was a detailed evaluation of the RWAP processes and appropriately identified a direct cause, root cause, and several contributing causes. The identified direct cause was that RWAP received an inadequate waste profile that did not have enough information to support identification of sub-components, and the associated root cause was that the NNSS WAC and waste profile instructions provided inadequate directions to ensure that generators provide sufficient information in their waste profiles. Evaluations of the contributing causes were comprehensive, and the associated proposed recommendations should decrease the likelihood of non-compliances similar to the Y-12 event.

EM NV and NEPS are in the early stages of implementing corrective actions for the recommendations identified in the cause analysis. A performance improvement plan to implement the corrective actions is scheduled for completion by June 2020. The improvement plan focuses on enhancing the NNSS WAC requirements for a waste certification program and improving the NEPS/RWAP's performance-based approach to verify adequate site implementation of the NNSS WAC. The NEPS/RWAP improvements

target the following three waste certification areas (i.e., Programmatic Verification, Waste Profile Verification, and Container Verification):

- NEPS/RWAP facility evaluation improvements for programmatic verification will increase the rigor and depth of onsite audits and surveillances of waste certification programs.
- Site profile verification will be accomplished through the improved Waste Acceptance Review Panel processes after implementation of the corrective actions from the cause analysis, with the intention of ensuring that waste profiles contain a minimum set of information for consistency. Also, the lines of inquiry (LOIs) that strengthen profile content will continue to be used, and the profile review process will include additional onsite NEPS/RWAP verification before approval of prioritized higher-risk profiles.
- Container verification will include a standard set of processes to verify that individual containers conform to the waste profile. RTR is currently deployed at the RWMC, and other improvements are under consideration; for example, expanding RTR to classified and MLLW streams, and using non-destructive assay.

RWAP improvements will be implemented as developed to progressively enhance the NEPS/RWAP oversight processes. Specifically, NEPS/RWAP has developed and deployed new LOIs that are being applied to specific higher-risk profiles. LOIs provide NEPS/RWAP personnel with a more complete understanding of the waste characteristics to ensure NNSW WAC compatibility.

The NEPS/RWAP facility evaluations have not consistently evaluated the sites' oversight performance in compliance with NNSW WAC. Contributing to this condition, NNSW WAC Section 2.2.2 does not clearly convey the requirement for sites to assess and verify that waste stream field performance has remained consistent with the approved waste profile. (See OFI-RWAP-1.) In addition, the NNSW WAC does not clearly state the actions required to obtain re-approval if NNSW suspends a waste generator site's waste shipments. (See OFI-RWAP-2.)

Positive Attributes

- NEPS/RWAP entered an issue related to the Y-12 event into its issues management system, performed a cause analysis of its role in the Y-12 event, and developed a corrective action plan to adequately address the root cause and contributing causes. EM NV has drafted a revision of the fiscal year 2020 contract performance evaluation plan to include new metrics that incentivize NEPS/RWAP improvements.
- NEPS/RWAP, in collaboration with MSTW RWMC personnel, has recognized the value of continued use of RTR and has incorporated this process into routine waste container verification operations.

Other Areas of Weakness

Other areas of weakness represent potential vulnerabilities that warrant site management's consideration but do not rise to the level of a finding or deficiency as defined in DOE Order 227.1A. The site should review these vulnerabilities and take appropriate actions. These weaknesses will be further reviewed against subsequent enterprise-wide site assessments to determine whether the vulnerability is cross-cutting and warrants an enterprise-wide response.

- NEPS/RWAP has not maintained a readily retrievable record of each profile review to show that the site or NEPS/RWAP has verified that waste stream field performance has remained consistent with

the approved waste profile. Consequently, the NEPS/RWAP assessors must rely on their knowledge and instincts to intuitively select waste profiles, so some profiles have been examined multiple times and others have not been reviewed. (See OFI-RWAP-3.)

- The Waste Acceptance Review Panel charter does not include NFO participation with associated roles and responsibilities for final approval. Revision of the charter is identified in the draft NEPS/RWAP performance improvement plan.
- NEPS/RWAP and EM/NV have not developed a plan to identify all actions required to resume Y-12 waste shipments to NNSS. The assessment team was informed by EM waste management staff that it is unclear whether additional actions will be required to grant approval to resume Y-12 waste shipments. (e.g., corrective action verification, Headquarters program office briefings/approvals, and Nevada state official briefings).

Interim Recommendations

Interim recommendations are intended to capture the evolving need for possible DOE management attention based on identified conditions from a single or multiple-site assessment. Interim recommendations should be considered suggestions for improving program or management effectiveness.

- NFO and EM NV should consider developing a plan to identify all actions required to resume Y-12 waste shipments to NNSS.

Opportunities for Improvement

Opportunities for improvement are suggestions that are offered to assist cognizant managers in improving programs and operations.

NEPS/RWAP

- **OFI-RWAP-1:** NEPS/RWAP should consider revising the NNSS WAC to clearly convey the requirement that sites are to assess and verify that waste stream field performance remains consistent with the approved waste profile.
- **OFI-RWAP-2:** NEPS/RWAP should consider revising NNSS WAC Section 2.4, *Suspending Approval*, to clarify the required actions to be completed by both NNSS and the waste generator site to regain approval for waste shipments to NNSS.
- **OFI-RWAP-3:** NEPS/RWAP should consider establishing a process that allows for developing and maintaining a readily retrievable record of each profile review to show that the site or NEPS/RWAP has verified that waste stream field performance has remained consistent with the approved waste profile in order to support a systematic review of priority profiles.

Appendix A
Supplemental Information

Dates of Office of Enterprise Assessments (EA) Onsite Assessment

February 4-13, 2020

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Appendix B

Description of Waste Control Defense-in-Depth as Applied at Nevada National Security Site

This figure shows the various engineering and administrative controls implemented by MSTS throughout the radioactive waste management process to ensure that waste shipped to a disposal site meets all waste acceptance criteria and that no prohibited items are accidentally introduced into waste streams. (The MSTS process is depicted since MSTS has more waste streams and profiles at NNSS than NEPS; however, NEPS implements a similar waste management process.) Defense in depth is intended to reduce the likelihood of a non-compliant waste package by implementing a diverse defensive control strategy, so that if one layer of defense turns out to be inadequate, another layer of defense will prevent a non-compliance. In this figure, the generator is the point of origin of any waste stream. As waste progresses through the process, it can be accumulated and stored at various locations. Along the way, the waste is characterized and verified to be appropriate for the approved waste stream. Once finally packaged, the waste is certified to have met all requirements and is shipped to its final disposal site.

