



# **Assessment of Radioactive Waste Management at the Y-12 National Security Complex**

**Interim Report**

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Office of Enterprise Assessments  
U.S. Department of Energy

# Assessment of Radioactive Waste Management at the Y-12 National Security Complex January 13-23, 2020 Interim Report

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## 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 the waste management performance of the Y-12 National Security Complex (Y-12) management and operating contractor, Consolidated Nuclear Security, LLC (CNS). Although CNS also manages the Pantex Plant, radioactive waste is managed at the site level, and therefore this report only applies to Y-12. Oversight provided by the National Nuclear Security Administration (NNSA) Production Office (NPO) was also evaluated in this assessment as it related to Y-12. In addition, EA assessed the event response and corrective action plan for the non-compliant weapons-related material (WRM) shipment discovered in July 2019. Waste management activities include characterizing, packaging, and shipping low-level waste (LLW) and mixed low-level waste (MLLW) for disposal; CNS does not generate transuranic waste. In addition, CNS has a waste stream for disposition of WRM as classified LLW. The assessment team, identified in Appendix A, examined a sample of waste generator operations representing about 80% of the total waste (by volume) shipped to a disposal facility. CNS's diverse control strategy (defense-in-depth) for its waste management processes, from the generator to final shipping, is illustrated in Appendix B.

This report provides the interim results of the assessment of radioactive waste management at Y-12, addressing non-compliances and apparent causes contributing to weaknesses. 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, CNS has implemented a waste management program that ensures proper characterization, packaging, and shipping of radioactive waste for disposal. In addition, NPO maintains adequate operational awareness of the CNS radioactive waste management activities. This assessment found no findings, three deficiencies, and two opportunities for improvement for consideration by CNS. The three CNS deficiencies are in issues management, conduct of operations, and the oversight of WRM disposition. Although these deficiencies did not result in mishandling of LLW, MLLW, or WRM, management attention is warranted to reduce the risk of mishandling in the future. Additionally, one

interim recommendation related to the DOE Automated Transportation Logistics and Analysis System (ATLAS) shipping software system was identified for consideration by the DOE Office of Environmental Management.

This report presents the results of this assessment in two parts: Part 1 addresses CNS's waste management performance and NPO oversight, and Part 2 addresses CNS's response to an event involving previous non-compliant shipments to the Nevada National Security Site (NNSS) that was discovered in July 2019. Because of that event, the NNSS Radioactive Waste Acceptance Program (RWAP) suspended CNS's Waste Certification Program for Y-12, withholding approval of any waste and WRM shipments until appropriate corrective actions are completed and verified.

CNS has completed its causal analysis of the event and developed a corrective action plan to formalize the WRM disposition process and improve the LLW/MLLW program. The EA assessment team reviewed the investigation report, the causal factors, and the scope of identified corrective actions to address the root cause, contributing causes, and missed opportunities associated with the event. Overall, CNS's response to the July 3, 2019, notification of non-compliant WRM shipments was timely and comprehensive. In addition, NPO provided effective support and oversight following the discovery of the non-compliant shipments, including review and approval, as appropriate, of CNS's response. The RWAP is responsible for, and in the process of, validating the closure and implementation of all corrective actions; therefore, the EA assessment team did not perform a detailed examination of the basis for closing the corrective actions that have been closed thus far.

In response to the self-assessment directed by the NNSA Chief of Staff's July 16, 2019, memorandum, CNS performed a self-assessment (shadowed by NPO) that identified four findings, three weaknesses, two observations, three opportunities for improvement, and two strengths. NPO's shadow assessment found CNS's self-assessment generally adequate, and identified one finding, three performance problems, and eight observations. The EA assessment team found that these self-assessments were adequately responsive to the NNSA direction. The NNSA peer review was completed subsequent to the completion of the assessment; results were not available at the time of the completion of our site visit. The results of the peer reviews across the enterprise will be addressed in the final compilation report.

## **Part 1: Waste Management Performance**

### **Positive Attributes**

#### *Waste Characterization*

- CNS personnel involved with waste characterization are adequately trained and knowledgeable of the source terms and the counting processes and technologies, have detailed process knowledge of the materials and radiological constituents for all production-related (non-WRM) waste streams, and use sampling and analysis processes effectively to aid radiological and chemical characterization of waste streams.
- CNS validates radiological compositions and quantities for wastes using direct measurements, including gamma spectroscopy and neutron emissions, as necessary. Data quality objectives for these measurements are applied to a wide range of applications, such as radiological protection, criticality safety, material control and accountability, and waste facility waste acceptance criteria (WAC) compliance, thus minimizing the need for multiple measurements and excess handling.
- CNS validates non-destructive assay (NDA) detector array efficiencies and the potential error associated with non-homogeneous distributions in large waste containers (e.g., ST-90 containers) by simulating actual waste container configurations.

### *Waste Stream Control*

- Each CNS waste generating facility has an assigned Environmental Officer, who supports waste characterization, documentation, segregation, packaging, labeling, and storage in accordance with waste management procedures.
- The Environmental Compliance organization (which is independent of the Waste Management organization) embeds Waste Package Certifiers in waste generating facilities to routinely observe generating activities and monitor the integrity of waste streams.
- The Waste Management organization assigns waste engineers to facilities that generate waste to provide a high level of expertise to ensure conformance with waste management requirements and expectations.

### *Packaging and Shipping*

- CNS demonstrates a strong defense-in-depth for offsite shipment documentation and certification. When a shipping document is completed by the CNS subcontractor (LATA-Atkins Technical Services, LLC, or LATS) certified shipper, it immediately undergoes a peer review by another LATS certified shipper, followed by an independent review by a CNS certified shipper before transit.
- One of CNS's certified shippers is also a certified instructor for advanced U.S. Department of Transportation (DOT) training and is considered an expert in applying DOT shipping regulations. Having this level of expertise within the organization benefits all shippers, who are required to develop and maintain their technical expertise.
- During the assessment, CNS shipping personnel exhibited attention to detail by identifying two inaccuracies in the DOE ATLAS automated data system. In some cases, the drop down menus in the ATLAS program do not accurately list the appropriate options, requiring the shipper to manually write in the correct information. This could result in a violation of DOT requirements if a shipment was sent without the proper shipping name. (See Interim Recommendation.)

### *Quality Assurance*

- CNS conducts effective assessments and surveillances consistent with documented procedures. The assessments verify the adequacy of waste characterization and packaging in complying with the disposal facility WAC, applicable DOE transportation directives, and DOT regulations. In reviewing a sample of 91 assessments and surveillances, EA determined that the assessments include a blend of compliance- and performance-based activities (field observations) and cover all elements of waste management, except the WRM disposition activities of Y-12 Operations, the primary mission organization (see D-CNS-3).
- CNS Environmental Compliance leadership maintains a suite of waste management performance metrics in their Consolidated Information System. These metrics are rolled up and used by senior management to maintain awareness of overall organizational performance and to focus additional management attention where needed.

### *Federal Oversight*

- Interviews of NPO personnel, document reviews, and facility walkdowns with an NPO Facility Representative (FR) demonstrated that NPO has sufficient staff, technical competence, and experience to evaluate the adequacy and effectiveness of the radioactive waste management program and its implementation.

- NPO effectively implemented a succession plan for environmental/waste management program personnel by hiring a qualified Transportation and Traffic Management individual who is currently qualifying to a waste management standard. Hiring this individual early allows for sufficient transition time and knowledge transfer before the anticipated staff departure.
- As a result of the triennial FR self-assessment and the discovery in July 2019 of CNS non-compliant shipments of WRM to NNSS, NPO entered an action into their issues management system (IMS) to update the FR facility-specific qualification standards. This update will include discrete competencies on radioactive waste management and environmental compliance, which will enhance the FRs' training and knowledge in this area.

## 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-CNS-1:** Contrary to the Y15-312, *Issues Management Process*, “Applies To” section, not all procedural non-compliances related to waste handling are entered into the IMS. Specific examples include:
  - The lead Waste Certification Official’s informal tracking of instances of prohibited items found in the waste stream show that there have been repeated occurrences. Actions have been taken to address some of these occurrences, including development of a training video to remind workers of prohibited items and conducting briefings to reinforce awareness. However, these occurrences were not entered into the IMS to allow a more formal review, causal determination, and corrective actions.
  - During a walkdown, the FR and assessment team observed one waste box with missing bolts and another with a broken tamper-indicating device. Neither of these deficient conditions had been entered into the IMS. When questioned, the waste management representative stated that non-conforming items that are found and corrected on the spot are not typically entered into the IMS.
  - Four waste containers were chosen to verify that the computer waste tracking system (SAP Waste) inventory was current with field conditions. One of the four waste containers had not been entered into SAP Waste, as required by procedure Y77-903, *Y-12 Waste Management*. CNS took actions that included an extent-of-condition review, but the incident was not entered into the IMS.

Not following the requirement to enter procedural non-compliances in the IMS misses opportunities to establish accountability, ensure that corrective actions are tracked and completed, and support the identification of trends with common causes to help improve performance. After the assessment team discussed this deficiency, CNS entered the items listed above into the IMS.

- **Deficiency D-CNS-2:** Contrary to the requirements of DOE Order 422.1 *Conduct of Operations* Attachment 2, paragraph 2.p.(3), items a and i, Procedure Y77-903, *Y-12 Waste Management*,

does not follow basic conduct-of-operations standards for procedure structure. For example, some steps contain more than one action, some notes contained actions to perform, and some steps do not clearly list the action that is expected. In addition, the procedure was written to address all aspects of waste management in one procedure, making it difficult to follow.

### **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.

#### *Waste Characterization*

- The NDA counting system data analysis processes are designed primarily to confirm assumed process knowledge rather than identify potential anomalies. The box counting system uses a combined array of sodium iodide (NaI) and high purity germanium (HPGE) detectors, but the data reporting process bins the gamma spectroscopy data into "regions of interest" rather than focusing on individual gamma emission lines. Although the software performs a peak search and reports the region of interest for the peak, the data analysis processes are set up with isotope identification libraries focused on the expected nuclides. Regions of interest that are not in the library are marked in the report as "no library match." The process then depends on the NDA engineer to identify the unknown peaks, but the identification is not required by procedure. Furthermore, the process depends on the attentiveness and expertise of the NDA engineer and the peer reviewer. Concentrating only on the expected isotopes could allow anomalies to be overlooked.
- The array of detectors used for box counting uses obsolete detectors, electronics, and analysis software that are no longer supportable. CNS recognizes the need for replacements and has a vendor under subcontract to upgrade all box counting systems.
- CNS procedures for hazardous material control do not fully address chemical reactivity and compatibility in all waste streams. CNS analyzes incompatible combinations of chemicals in facility safety bases, and the procedures specific for the Analytical Chemistry Organization address incompatibilities in wastes during generation, staging, and bulking. However these analysis techniques are not broadly applied to waste management across all generator organizations at Y-12. A potential for unanalyzed incompatibilities could result from comingling waste from various other generators during final waste packaging. (See OFI-CNS-1.)

#### *Waste Stream Control*

- Y77-903 and the *NNSS WAC Implementation Crosswalk (NIC)* do not specifically exclude WRM, giving the false impression that the requirements apply to WRM.

### **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.

- The DOE Office of Environmental Management should evaluate the integrity of the DOE ATLAS automated data system, given the inaccuracies identified by CNS shipping personnel during EA’s assessment in December 2019.

### **Opportunities for Improvement**

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

- **OFI-CNS-1:** CNS should consider developing and implementing a process to evaluate potential reactions from comingling incompatible materials in waste containers (similar to those used for facility safety basis evaluations and in the Analytical Chemistry Organization), and implement preventive controls as appropriate.

### **Part 2: CNS’s Non-compliant Shipment Event Response (Investigation Report and Corrective Action Plan)**

CNS’s response to the July 3, 2019 notification of non-compliant WRM shipments was timely and comprehensive. Following the discovery of a prohibited item in a past classified waste shipment to the NNSS disposal site, CNS immediately notified NNSS. An extent of condition review identified additional non-compliant shipments to NNSS, going back to 2013. CNS appropriately suspended all waste shipments (LLW/MLLW and WRM) the following day.

Within a week of discovery, CNS commissioned an experienced causal analysis team who identified the direct cause, root cause, contributing causes, and recommendations to prevent recurrence. EA reviewed the causal analysis and concluded that it demonstrated a detailed evaluation of CNS’s processes and actions leading to the event.

The root cause of the non-compliant shipments was “failure to adequately flow down weapon dismantlement and disposition requirements into implementing procedures for WRM disposition.” This root cause had allowed a process to exist for WRM disposition that differed from the more detailed process for the disposition of LLW/MLLW. The causal analysis team also identified contributing causes and missed opportunities that gave an insight into areas that would provide for a broader set of corrective actions and decrease likelihood of similar non-compliances.

CNS subsequently developed a comprehensive corrective action plan addressing needed improvements in LLW/MLLW and WRM handling processes. CNS has initially focused their efforts on completing those actions that would lead to recertification of their program for LLW/MLLW shipments to NNSS. Those corrective actions are currently under review by RWAP. A subsequent set of corrective actions focuses on WRM and eventual recertification of WRM shipments.

NPO promptly responded to the discovery in July 2019 of CNS non-compliant shipments of WRM to NNSS, and oversaw CNS’s response actions, including the event investigation, extent of condition review, causal analysis, and identification of corrective actions.

### **Positive Attributes**

- CNS’s response to the employee who initially identified the Y-12 event was immediate and supportive; the CNS President and Chief Executive Officer’s recognition of this employee among his peers involved with the WRM shipment investigation reinforces CNS’s commitment to excellence and a questioning attitude.

- CNS employed a large group of diverse professionals (including retired and past employees) led by an experienced causal analysis expert and championed by a designated senior manager to perform the causal analysis.

### Deficiencies

- **Deficiency D-CNS-3:** Contrary to Y15-312, Section F, Note 2, which requires issue owners to “Develop a CAP [Corrective Action Plan]/Issue response... considering... actions to correct and prevent the causal factors,” CNS did not address oversight, which is identified in Contributing Cause Number 4, *Ineffective Management and Oversight of the WRM Disposition Activity*. The CNS causal analysis team leader explained that “management and oversight” was used in a broad sense to reflect on managers’ roles. Consequently, the corrective action plan does not address weapons disposition oversight (e.g., management and independent assessments). Furthermore, over the past three years, CNS assessments of Y-12 Operations weapons disposition activities upstream of packaging do not address ultimate NNSS WAC compliance (when WRM is declared waste). This approach represents a missed opportunity to focus on WRM disposition activities so as to identify and address performance gaps or weaknesses impacting final disposal at NNSS. CNS’s waste management organization leadership agrees that the program would benefit from assessments focused on waste handling activities at the point of generation.

### Other Areas of Weakness

- The investigation report exhibits some weaknesses that should be addressed to ensure that this type of event does not recur:
  - The causal analysis discussed previous WRM issues, but these issues were not entered into the IMS, resulting in a missed opportunity. The report indicates that there were precursor events as well as a level of “uneasiness” among personnel in the waste management program as to how WRM was handled, but there was no IMS entry to address this concern. Although some activities were initiated to address aspects of the concern, the lack of a formal action tracking process allowed the actions to stall and remain incomplete because of other priorities. Formal documentation as an issues management item would have ensured a broader level of causal analysis, corrective actions, and accountability for tracking actions through to completion.
  - The causal analysis did not identify that bypassing the CNS readiness process was a missed opportunity. The presence of unacceptable materials could have been identified if the change in processing WRM was evaluated through implementation of procedure Y15-190, *Readiness Manual*, which contains elements of waste management, quality assurance, and configuration management.
  - CNS’s access to classified records needed for dismantlement was impeded by need-to-know information restrictions. CNS’s currently planned response to “issue a procedure for developing weapon material waste characterization records” does not include concurrence from the design authority, to address this concern. (See OFI-CNS-2.)

### Opportunities for Improvement

- **OFI-CNS-2:** CNS should consider including Design Authority participation in the planning of dismantlement activities for WRM that is manufactured at other facilities. This approach would



strengthen defense-in-depth to ensure that WRM is properly characterized (similar to the Pantex “dismantlement kick-off” process).

**Appendix A**  
**Supplemental Information**

**Dates of Office of Enterprise Assessments (EA) Onsite Assessment**

January 13-23, 2020

**Assessment Team**

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## Appendix B

### Description of Waste Control Defense-in-Depth as Applied by Consolidated Nuclear Security, LLC at the Y-12 National Security Complex

This figure shows the various engineering and administrative controls implemented 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. 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.

