



Assessment of Radioactive Waste Management at the Knolls Atomic Power Laboratory and the Kesselring Site

Interim Report

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Office of Enterprise Assessments
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Assessment of Radioactive Waste Management at the Knolls Atomic Power Laboratory and the Kesselring Site January 13-16 and 27-30, 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. This assessment focused on the management of radioactive waste and mixed waste by Fluor Marine Propulsion, LLC (FMP) for the Naval Nuclear Propulsion Program (NNPP) at the Knolls Atomic Power Laboratory (KAPL) and the Kesselring Site. FMP waste management activities include characterizing, packaging, and shipping low-level waste (LLW), mixed low-level waste (MLLW), and LLW containing polychlorinated biphenyl (PCB), categorized as hazardous in the state of New York, for disposal. FMP forecasts generating transuranic (TRU) waste at KAPL around calendar year 2025.

At the Kesselring Site, FMP manages the waste it generates and the waste generated by its subcontractor for demolishing the D1G nuclear propulsion plant prototype (BWSR) and its industrial subcontractor Newport News Shipbuilding – Kesselring Site (NNS-KS). NNS-KS waste includes waste generated by three naval shipyards supporting refueling of the S8G nuclear propulsion plant prototype in accordance with the respective shipyards' processes. At KAPL, FMP manages the waste that it and BWSR generate and characterizes classified NNPP components for shipment from private shipbuilders and naval shipyards to the Savannah River Site for disposal.

The assessment team, identified in Appendix A, examined a sample of waste operations by each FMP organization and subcontractor that generates radioactive and mixed waste. Team members observed 17 waste-generating work activities, walked down 9 facilities used to generate and/or manage radioactive waste, inspected 14 radioactive waste staging and accumulation areas, and reviewed 21 waste certifications. FMP's defense-in-depth strategy for its waste management processes, from the generator to final packaging, is illustrated in Appendix B.

This report provides the interim results of the assessment of radioactive waste management at KAPL and the Kesselring Site. 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.

Summary

FMP's radioactive waste management program ensures proper characterization, packaging, and shipping of radioactive waste for disposal. The Office of the Assistant Manager for Operations – Schenectady

(OAMO-S) and the Naval Reactors Representative Office – West Milton (NRRO-WM) maintain detailed operational awareness of radioactive waste management activities at KAPL and the Kesselring Site, respectively, for the Deputy Administrator for Naval Reactors (NA-30).

As shown in Appendix B, FMP has established and maintained many layers of defense (defense-in-depth) in its radioactive waste management program at KAPL and the Kesselring Site, effectively integrating workers' training, work instructions, and supervision and providing more resiliency than found at other sites across the DOE complex. This assessment identified no findings, deficiencies, or areas of weakness. Contributing to superior performance, FMP, OAMO-S, and NRRO-WM use more extensive oversight and FMP self-critical assessments to continually monitor and improve radioactive waste management at KAPL and the Kesselring Site. Many of the positive attributes demonstrated by FMP, OAMO-S, and NRRO-WM and listed below could be employed across the rest of the DOE complex to improve radioactive waste management.

In addition to the self-critical assessments performed by FMP personnel at KAPL and the Kesselring Site, FMP personnel periodically review their peers' performance across the Naval Nuclear Laboratory (NNL) sites that FMP manages (i.e., Bettis Atomic Power Laboratory and the Naval Reactors Facility, in addition to KAPL and the Kesselring Site). For example, FMP teams of 40 to 50 people comprehensively assess performance at Bettis, the Naval Reactors Facility, and KAPL biennially. Additionally, members of the FMP Radioactive Material Transportation Committee assess radioactive waste management, with a scope similar to this EA assessment, every three years. Teams from Naval Reactors headquarters assess performance at each NNL site at least every two years (annually at the Kesselring Site), including detailed reviews of radioactive waste management, to ensure that NNPP program principles and requirements are adequately implemented and overall site performance improves.

Positive Attributes

Radioactive Waste Management Program

- Generation of radioactive and mixed wastes at KAPL and the Kesselring Site are governed by the “Know Before Do” principle during work planning and execution at the activity level.
 - Prior to waste generation, department-specific process evaluation lists for each process document chemicals, consumables, and hazardous constituents used; the specific wastes to be generated; storage requirements; and the regulatory status and disposal path.
 - At the work activity level, technical work documents (TWDs) are required for all radioactive work (including research) and must include a Material Disposition List (MDL) identifying the task-specific wastes to be generated and the associated disposal path. Discrepancies in TWDs (including the MDLs) require resolution by engineering personnel before work resumes.
 - The “Know Before Do” principle is comprehensively and effectively implemented at both sites. The integration of waste generation planning and disposition during work planning and execution of TWDs is more rigorous than normally implemented at DOE sites and is a key element of successful management of radioactive waste within the NNPP. For example, FMP is proactively developing an action plan supporting use of the Central Characterization Program for disposal of TRU waste at the Waste Isolation Pilot Plant, on a campaign basis, beginning around calendar year 2030.
- Per the NNPP “Cradle to Grave” principle, organizations generating waste within FMP are responsible for their waste from generation through disposition. Implementation of this principle:

- facilitates characterization of radioactive waste, since the organizations generating this waste have detailed knowledge of the processes and materials or equipment being disposed of.
- prompts organizations that generate waste to more actively use equipment and non-hazardous materials in radioactive work (including research) to avoid generating MLLW (e.g., no MLLW is generated by reactor servicing operations while refueling the S8G prototype).
- At the Kesselring Site, FMP developed detailed memoranda of agreement and a communication plan that clearly establishes the roles and responsibilities among FMP, BWSR, NNS-KS, and the supporting naval shipyards, and identifies organizational responsibilities for radioactive waste certification, issues management (including weekly communication of ongoing issues), and independent assessment activities required by the respective NNPP radiological control manuals.
- FMP proactively developed Knowledge Management Action Plans (KMAPPs) listing individuals considered to be: (1) experts in elements of waste management; (2) proficient in day-to-day operations, and/or; (3) developing toward fulfilling certain waste management roles. KMAPPs project the time needed to establish expertise in these areas and the associated personnel development actions, which are part of individuals' annual performance objectives, training plans, and travel budgets. These actions result in resilient waste management organizations prepared for projected retirements.
- FMP developed a Waste and Shipping Community of Practice to share knowledge between NNL sites via monthly teleconferences on significant ongoing issues, lessons learned, training opportunities, and potential process improvement ideas, as well as contact information for subject matter experts at the NNL sites, to promote knowledge sharing among working-level personnel.

Waste Characterization

- The “Know Before Do” and generator “Cradle to Grave” ownership principles have resulted in a high degree of process knowledge associated with waste being generated, which is then used as the primary method for characterizing the waste. A variety of supplemental characterization methods (e.g., sampling, analytical techniques, and computer modeling) were also used effectively as needed to certify waste for the 21 waste certifications reviewed by the EA team.

Waste Stream Control

- Waste generator training is required for all workers (including maintenance personnel, radiological control technicians, and BWSR and NNS-KS personnel) to support accurate waste characterization.
- Radioactive Waste Representatives are designated individuals within each organization that generates radioactive waste. Their detailed process knowledge and waste certification training enable them to more effectively coordinate and oversee waste generation and certification processes.
- Traceability of the contents of waste items (e.g., bags) is facilitated by a waste inventory form filled out by the organization generating the waste and kept with the waste through certification.
- FMP tags and tracks radioactive material movements throughout KAPL and the Kesselring Site from the point of generation through handling, storage, packaging, and container disposition via systems on each site's intranet that readily provide additional information on waste.
- FMP requires formal, annual justification for retention of radioactive material to ensure timely disposition.

- Locks and tampering-indicating devices are placed on waste containers in some areas within KAPL and the Kesselring Site, providing an additional layer of defense (defense-in-depth) for precluding the introduction of prohibited or uncertified items into waste containers. (See **OFI-FMP-1**.)

Packaging and Shipping

- An in-depth review of 12 shipping records (6 at each site), which compared the documented package and contents with the requirements and waste profiles, confirmed compliance with U.S. Department of Transportation regulations and the disposal facility's waste acceptance criteria.
- KAPL manual LAB-HMT-1, *Transportation of Hazardous Materials*, delineates a progression of management engagement (i.e., a graded approach) based on complexity and risk to ensure compliance with radioactive shipping requirements. At a minimum, every shipment includes a shipping organization peer review, management review, independent review, and an administrative review.
- FMP proactively performs comprehensive surveys of trailers and transport rigs for operability and radioactive contamination (via direct frisk for alpha, beta, and gamma radiation) before allowing them to be used for shipping NNPP radioactive waste. Trailers and transport rigs that are not free of radioactive contamination are rejected. Over the years, FMP has fostered a mutual understanding of these expectations with its shippers, who now dedicate certain known clean and compliant vehicles for use at NNPP sites. These practices ensure that trailers and transport rigs used for NNPP waste shipments are releasable per applicable NNPP requirements and DOE and U.S. Department of Transportation regulations.

Quality Assurance

- The FMP Regulated Materials Engineering (RME) and Regulated Materials (RM) subunits monitor ongoing performance and at least annually perform critical self-assessments of their management of the radioactive waste programs at KAPL and the Kesselring Site, respectively. Assessments conducted in the past year proactively identified and took action to resolve weaknesses before significant deficiencies or non-compliances occurred.
- FMP RME and RM functional leads for radioactive waste processing and shipping critically assessed performance and processes in their functional areas every trimester. Assessments conducted in the past year proactively identified and took action to resolve cross-organizational weaknesses before significant deficiencies or non-compliances occurred.
- Independent assessment groups at KAPL and the Kesselring Site have also developed and effectively implemented annual surveillance, audit, evaluation, and assessment plans as required by the respective NNPP radiological control manuals. These activities thoroughly assess the implementation of radioactive waste processing and shipping across each site and follow up on issues documented in RME and RM organizational and functional area assessments.
- FMP uses the same issues management system, Site Tracking and Trending System (STaTS), across NNL sites, facilitating sharing and oversight of issues management including resolution. The STaTS entries that EA reviewed demonstrated a willingness to identify issues, NNPP's expectation for maintaining a "questioning attitude," and FMP's commitment to resolve the causes of problems in a timely manner.

Federal Oversight

- Naval Reactors DOE Directive Implementation Bulletin Number 226.1-142 establishes NNPP policies and practices that are consistent with DOE Order 226.1B, *Implementation of Department of*

Energy Oversight Policy. OAMO-S and NRRO-WM oversight is provided by subject matter experts and is based on NNPP principles with a relatively small number of base requirements.

- Annual oversight plans are independent and do not rely on shadowing FMP’s assessments. Records for the past three years show that for both sites, these plans were fully implemented and the results were well documented.
- Field office personnel have a strong field presence. Personnel routinely perform surveillances, technical reviews, audits, and assessments, as well as field observations of training, work performance, and packaging and storage of waste. The frequency of these activities is based on trends in contractor/subcontractor performance.
- Findings or deficiencies are documented in surveillance reports, technical review reports, audit reports, or assessment reports and are tracked until corrective actions are closed.
- In support of the NNPP “Defense in Depth” principle, field office personnel review nearly all radioactive waste shipments before shipments are released off site.

Findings, Deficiencies, Other Areas of Weakness, and Interim Recommendations

This assessment identified no findings, deficiencies, areas of weakness, or interim recommendations applicable to FMP radioactive waste management at KAPL and the Kesselring Site.

Opportunities for Improvement

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

- **OFI-FMP-1:** Consider requiring locks or tamper-indicating devices on all waste containers that are not located in controlled-access areas to provide an additional layer of defense (defense-in-depth). These devices are used effectively at DOE sites, and in some areas within KAPL and the Kesselring Site, to preclude the introduction of prohibited or uncertified items into waste containers.

Appendix A
Supplemental Information

Dates of Office of Enterprise Assessments (EA) Onsite Assessment

January 13-16 and 27-30, 2020

Assessment Team

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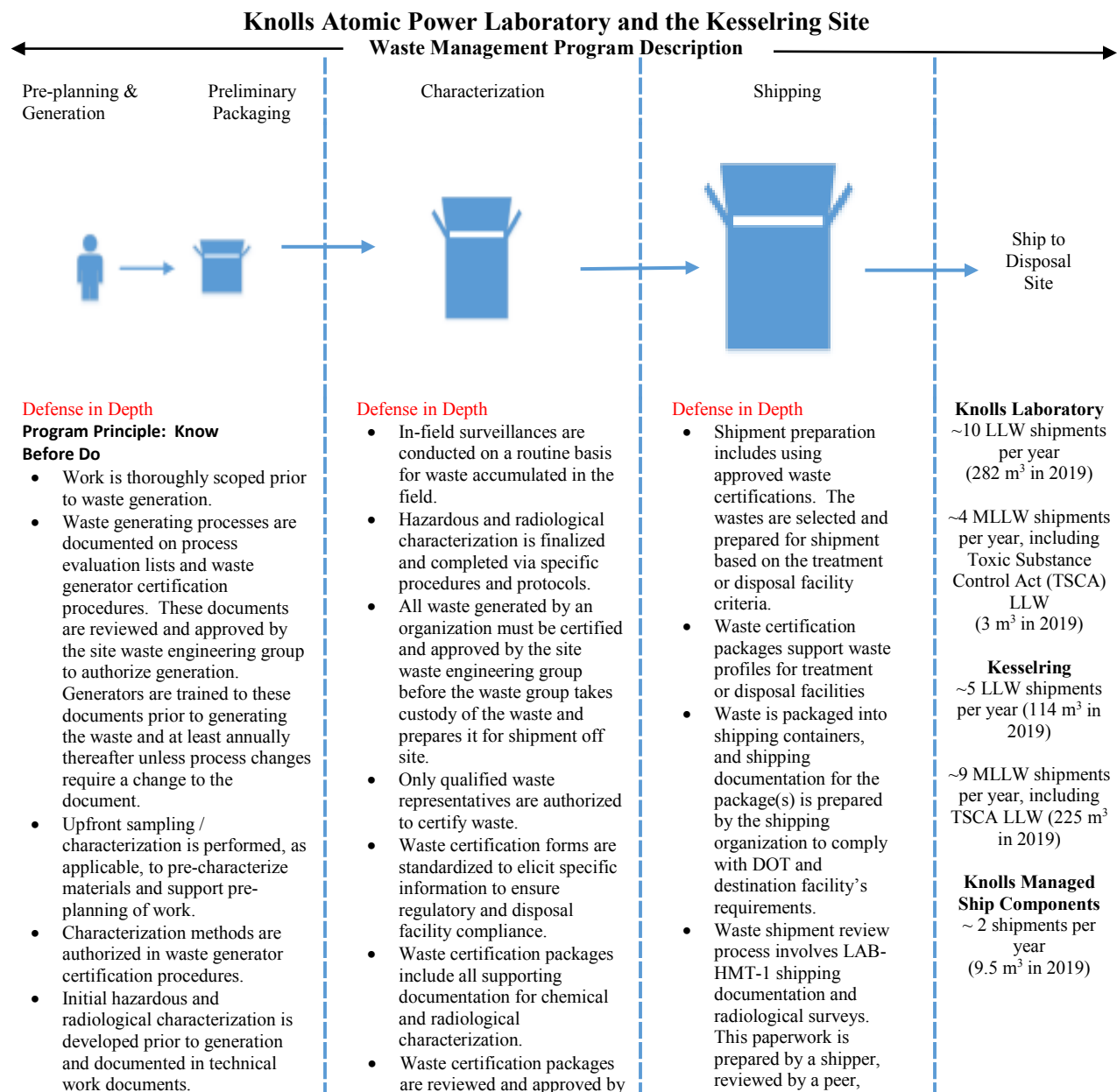
Charles E. Comeau – DOE Savannah River Operations Office

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Appendix B

Description of Waste Control Defense-in-Depth as Applied at KAPL and the Kesselring Site

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. Once finally packaged, the waste is certified to have met all requirements and is shipped to its final treatment or disposal site.



- Workforce is briefed prior to the start of work to ensure work teams are knowledgeable of waste generation and responsibilities.
- Planned waste is compared to waste disposal/treatment criteria and Department of Transportation (DOT) requirements.

Cradle to Grave

- Waste is generated per approved technical work documents.
- Waste is managed and dispositioned in accordance with work document material disposition lists.
- Waste is inventoried by generators during generation, documented, and controlled by electronic accountability systems.
- If unplanned waste is encountered, the work stops and technical review and documentation occur prior to proceeding.
- In-field surveillances are conducted on a routine basis for the generation and packaging of waste at the jobsite.
- 100% of mixed and PCB waste and a minimum of 10% of radioactive waste are verified by the site waste group via visual observation of the generation, packaging, and inventory to ensure disposal facility compliance.

Generators own their own waste

- Work teams receive specific waste-related training tailored to job function (generators, supervisors, and engineers).
- Minimization and segregation principles are trained at all levels, and instructions are incorporated into the technical work document.
- Each generating organization is required to designate at least one qualified waste representative who must receive extensive training on waste characterization and management.

the site waste group engineers to confirm disposal facility selection and preliminary DOT categorization.

- Upon waste certification approval, the site waste group transfers the waste to a central waste management facility where the waste group takes custody as they prepare for shipment.

management, independent reviewer (outside of the shipping organization), and administrative review prior to shipment.

- A graded management review is conducted based on the complexity/visibility/risk of waste being shipped.
- In-field surveillances are conducted on a routine basis for the final onsite transport and final containerization of waste.
- Day of shipment: paperwork completed is certified by the shipper and reviewed by an independent reviewer.
- Shipper tracks package to destination and requests disposal facility to provide a signed document stating they received all material as anticipated.