EM-5.22 Lessons Learned Bulletin	**October 2025**
	Lessons Learned on Using the Operations Performance Information from a CERCLA Landfill to Inform the Design of its Successor
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In 2020, as a result of a waste projections analysis, the current waste disposal facility, the Idaho Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Disposal Facility (ICDF) was nearing its full capacity. for disposal of CERCLA and Deactivation and Decommission (D&D) wastes the Idaho National Laboratory (INL) would generate during the life of that facility. A crucial aspect of the design for the additional cell, Cell 3, was informed by two decades of operational experience from that facility. Leveraging operational experience from existing facilities is crucial for refining the designs of their successors. By systematically capturing and applying 'lessons learned,' organizations can proactively optimize performance, bolster safety protocols, and achieve superior efficiency through their program activities through the site's life cycle. This iterative process ensures that the designs successor facilities are not only robust and adaptable but also consistently meet evolving operational demands with enhanced effectiveness.

Discussion:

Background

In 2020, as a result of a waste projections analysis, it was determined that the Idaho Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Disposal Facility (ICDF) was nearing its full capacity for disposal of CERCLA and Deactivation and Decommission (D&D) wastes the Idaho National Laboratory (INL) would generate during the life of that facility. Both of its disposal cells (Cells 1 and 2) have been filled with the wastes from a wide variety of CERCLA activities across Idaho National Laboratory. This includes the recently generated waste from the demolition of the S1W prototype facility at the Naval Reactors Facility (NRF) Site in Idaho. A decision was made that an additional disposal cell would be required to dispose of future wastes from CERCLA and D&D activities needed to complete the cleanup mission. Required environmental documents were approved by the regulatory agencies with input from the public and tribes, which provided for increased capacity for the existing Cells 1 and 2, as well as provided for a new disposal cell, Cell 3, to be constructed. Construction of Cell 3 (and its supporting infrastructure – e.g., ponds) is now underway, when completed, it will meet the increased demand for radioactive waste disposal from upcoming projects, such as the demolition of the A1W nuclear submarine training reactor as well as ancillary facilities (i.e., NRF-626A/B, NRF-640, and NRF-641) and the S1G prototype, which are all facilities to be demolished under an ongoing Memorandum of Understanding between NNSA Naval Reactors (NR) and the Department's Environmental Management Program.

A crucial aspect of the additional cell design is that it has been influenced by two decades of experience from ICDF waste management operations. This proved important during discussions with state and federal regulators, whose approval for the new facility's design is essential.

Discussion

In October 2022, representatives from both Jacobs (the cleanup contractor for INL at that time) and Idaho Environmental Cleanup (IEC), the new cleanup contractor, conducted an onsite tour of ICDF Cells 1 and 2 to gather

feedback and 'Lessons Learned' (i.e., knowledge gained by operations experience) for incorporation into the Additional ICDF Expansion Project (Cell 3) design. These lessons, derived from approximately 20 years of operating Cells 1 and 2, aim to enhance operation and maintenance activities for the new Cell 3 landfill. Following advanced conceptual design consideration, specific lessons learned were identified for inclusion in the ICDF expansion project design. Notably, all lessons pertaining to the ponds—which are designed to collect, store, and treat contaminated water (leachate) and manage stormwater—have been integrated into the final design report, resulting in the following:

- **Pond Separation:** The larger pond needed separation, requiring the construction of an access road between ponds to ensure adequate vehicle access for pond washdowns.
- **Increased Pond Capacity:** Ponds require larger capacities, each needing a freeboard area, a storage area, and a sediment management area. The sediment management area, housing ballasts, must be covered with liquid to mitigate airborne radiation concerns.

The resultant design of the evaporation pond for Cell 3 proposed an increased storage capacity from the original evaporation ponds Cells 1 and 2 (combined) – approximately a 300% increase. This is based on leachate generation modeling for Cell 3 and the observed performance of Cells 1 and 2 in addition to the evaporation ponds over their operation. Engineering Design File (EDF)-11506, "Evaporation Pond Sizing with Water Balance and Make-Up Water Calculations" (Appendix B), details the evaporation pond sizing calculation, which was updated using anticipated operating conditions as part of the final design.

In order to enhance pumping system efficiency an alternative configuration for the Leachate Collection and Recovery System (LCRS) primary leachate collection sump for Cell 3's evaporation pond was also proposed. This design improvement also involved installing a pump trough within the sump footprint. However, this alternative design posed a challenge regarding Applicable or Relevant and Appropriate Requirements (ARARs) for hazardous waste landfills, which are specified as a standard requirement in Federal Law: 40 CFR 264.301. This regulation dictates that leachate depth over the liner must not exceed 30 centimeters (approximately 1 ft). The proposed pump trough's design would, at times, exceed this ARAR.

While altering existing ARARs for the ICDF is feasible, it requires robust engineering studies and a clear statement of advantages, supported by regulatory review. An engineering analysis, detailed in TFR-1119 ("Engineering Design File Leachate Collection Trough Equivalency Demonstration, Document ID: 11551n Revision ID:1"), which concluded the following:

1. The alternative Cell 3 LCRS can be developed within a smaller area and volume, reducing leachate storage impact within the cell.
2. Theoretical calculations for leakage through the LCRS geomembrane at maximum and minimum storage heads is lower for the alternative Cell 3 LCRS sump configuration.

This report was reviewed and accepted by the regulators, a key requirement for this project. These insights were formally incorporated into the Jacobs Statement of Work for Cell 3 (SOW-1090) in November 2022 and later integrated into the design of the additional cell, currently under construction.

Conclusion

Leveraging operational experience from existing facilities is crucial for refining the designs of their successors. By systematically capturing and applying operations experience, incorporating organizations can proactively optimize performance, bolster safety protocols, and achieve superior efficiency through their program activities through the site's life cycle. This iterative process ensures that the designs for successor facilities are not only robust and adaptable but also consistently meet evolving operational demands with enhanced effectiveness.

Recommended Actions:

Consider the operational history of the existing landfill facilities when designing their successors. This can lead to significant design improvements, which when properly engaging stakeholders (e.g., state and federal regulators, contractors, etc.) can result in an improved replacement facility.

Critical Decision(s):	CD-1, CD-2
Facility Type(s):	Landfill
Work Functions(s):	Project Management
Technical Discipline(s):	All

References:

1. Engineering Design File (EDF)-11506, "Evaporation Pond Sizing with Water Balance and Make-Up Water Calculations" (Appendix B).
2. Engineering Design File Leachate Collection Trough Equivalency Demonstration, Document ID: 11551n Revision ID: 1
3. A Discussion of the Cost Estimate Classification System: As applied in Engineering, Procurement, Construction and Operations for the Environmental Remediation Industries, Dan Melamed, CCP EVP; Bryan A. Skokan, PE CCP; Gregory Mah-Hing, PE; Rodney Lehman; Jake Lefman, Cost Engineering, Vol. 63, No. 04, AACE International, Morgantown, WV, 2021, page 27.