Comparative Study of NSDF Reference Sites

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NEAR SURFACE DISPOSAL FACILITY (NSDF)
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RADIOACTIVE WASTE
MANAGEMENT ASSOCIATES

Project Introduction

Purpose of the Comparative Sites Study

- In their May 2021 Environmental Impact Statement, CNL argued that “the preferred option for disposal of low-level waste (LLW) is near surface disposal facilities (IAEA 2001)” and positioned their proposed Near Surface Disposal Facility as one such facility.
- CNL identified a short list of sites, including the Oakridge National Laboratories Environmental Management Waste Management Facility, the Hanford Environmental Restoration Disposal Facility, the Portsmouth On-site Waste Disposal Facility, and the Fernald On-site Disposal Facility
- This comparative sites study examined the validity of the statements made by CNL with respect to a) the effectiveness of the referenced facilities in isolating radionuclides from the environment, b) the relevance of the example facilities for review and consideration of the Near Surface Disposal Facility and c) the alignment of this project with IAEA guidelines, as referenced by CNL

Comparative Sites Study Overview

- The four U.S. sites referenced - Oakridge National Laboratories Environmental Management Waste Management Facility, the Hanford Environmental Restoration Disposal Facility, the Portsmouth On-site Waste Disposal Facility, and the Fernald On-site Disposal Facility – are all part of the legacy of the U.S. nuclear weapons program, but each addresses only a portion of the contamination issues at its respective host site.
- The nuclear weapons production complex is vast and includes 13 nuclear weapons sites located in 10 states.
- Cleanup has been underway at the 13 nuclear weapons factories run by the Department of Energy (DOE) over the last few decades, and the four facilities cited by CNL in the 2021 EIS for the proposed Near Surface Disposal Facility are part of this cleanup effort

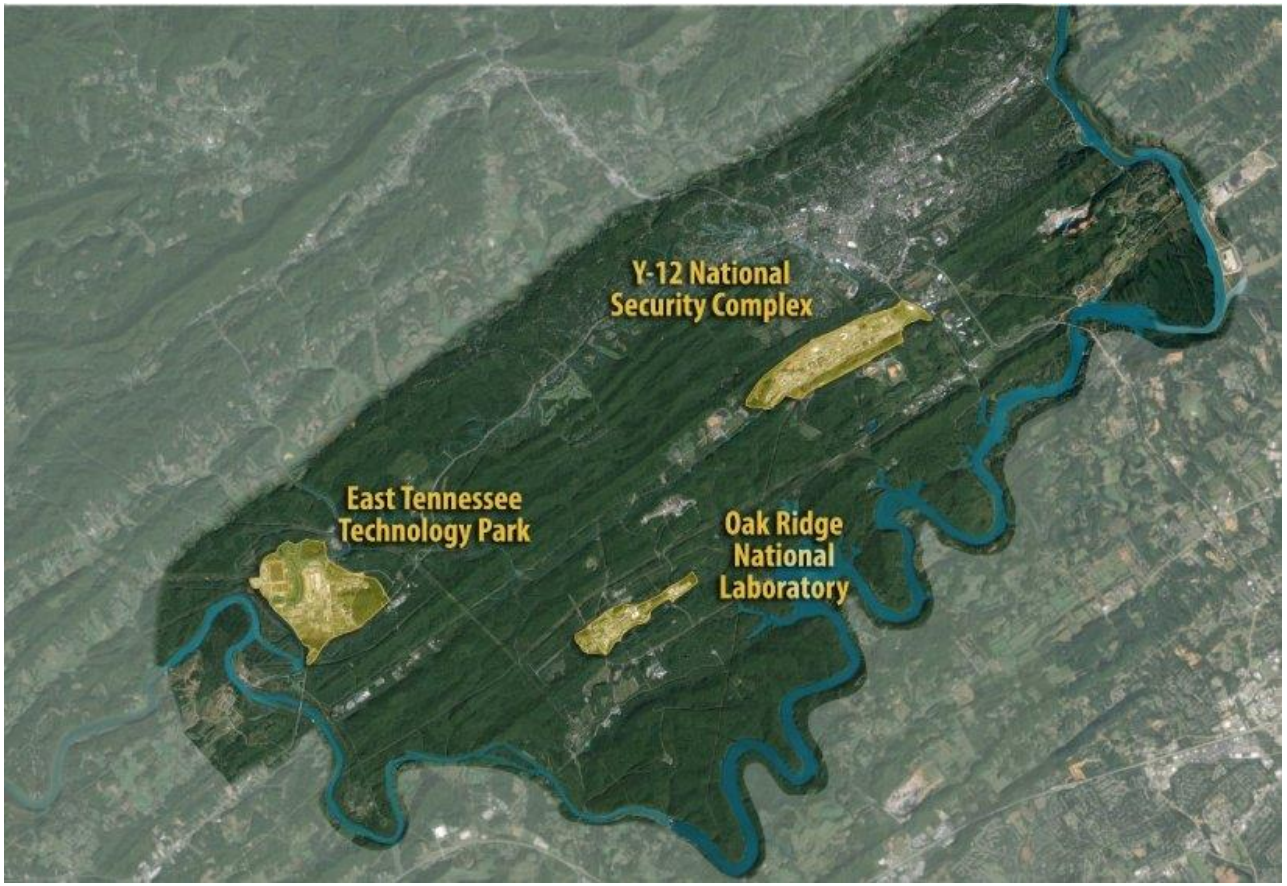
Nuclear Weapons Sites - the Challenge of Cleanup

"The Department of Energy faces monumental challenges in restoring the environment at installations that were part of the U.S. nuclear weapons production complex…

"Despite the large amount invested in DOE environmental management, progress on groundwater and soil remediation has been slow."

SOURCE: National Research Council, Groundwater and Soil Cleanup: Improving Management of Persistent Contaminants,National Academy Press, Washington, D.C. 1999

Oakridge National Laboratories Environmental Management Waste Management Facility - Context



Oak Ridge Environmental Management Waste Management Facility

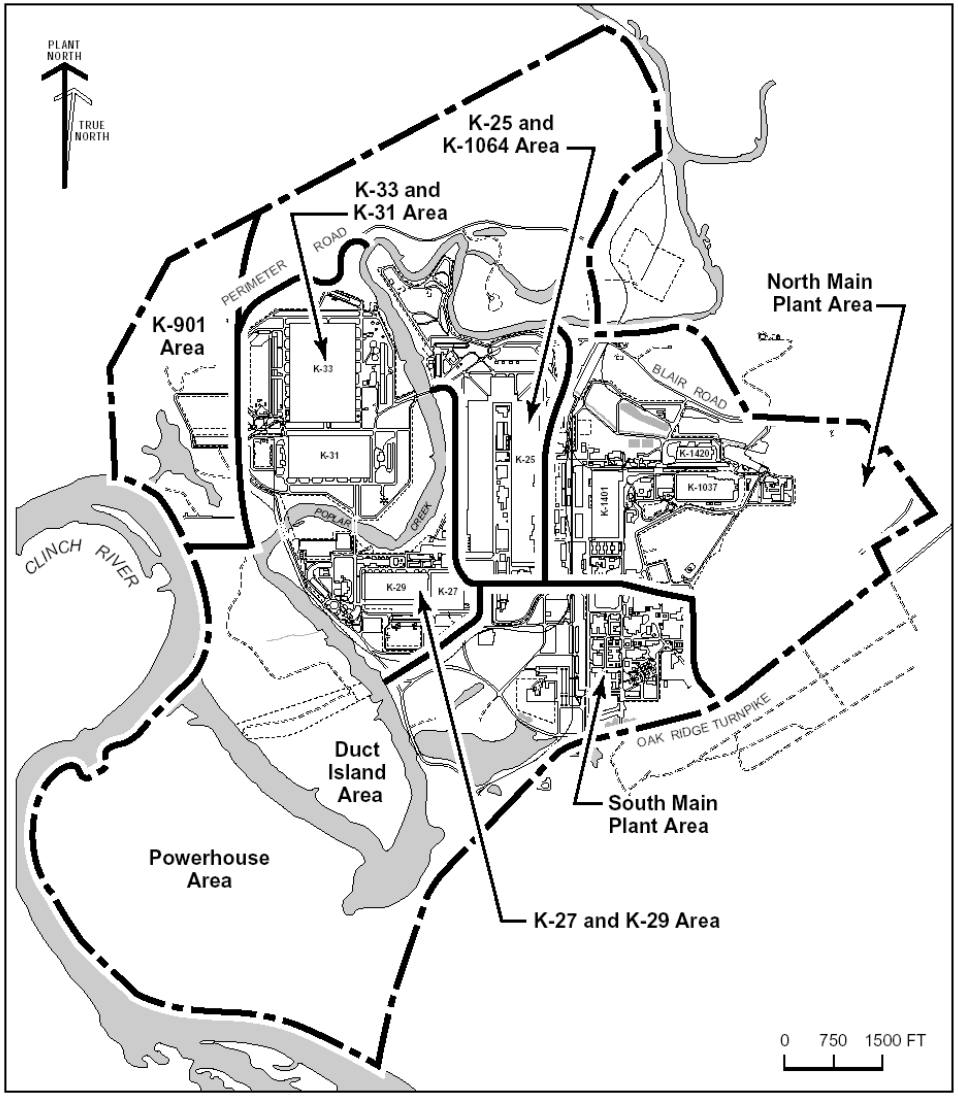
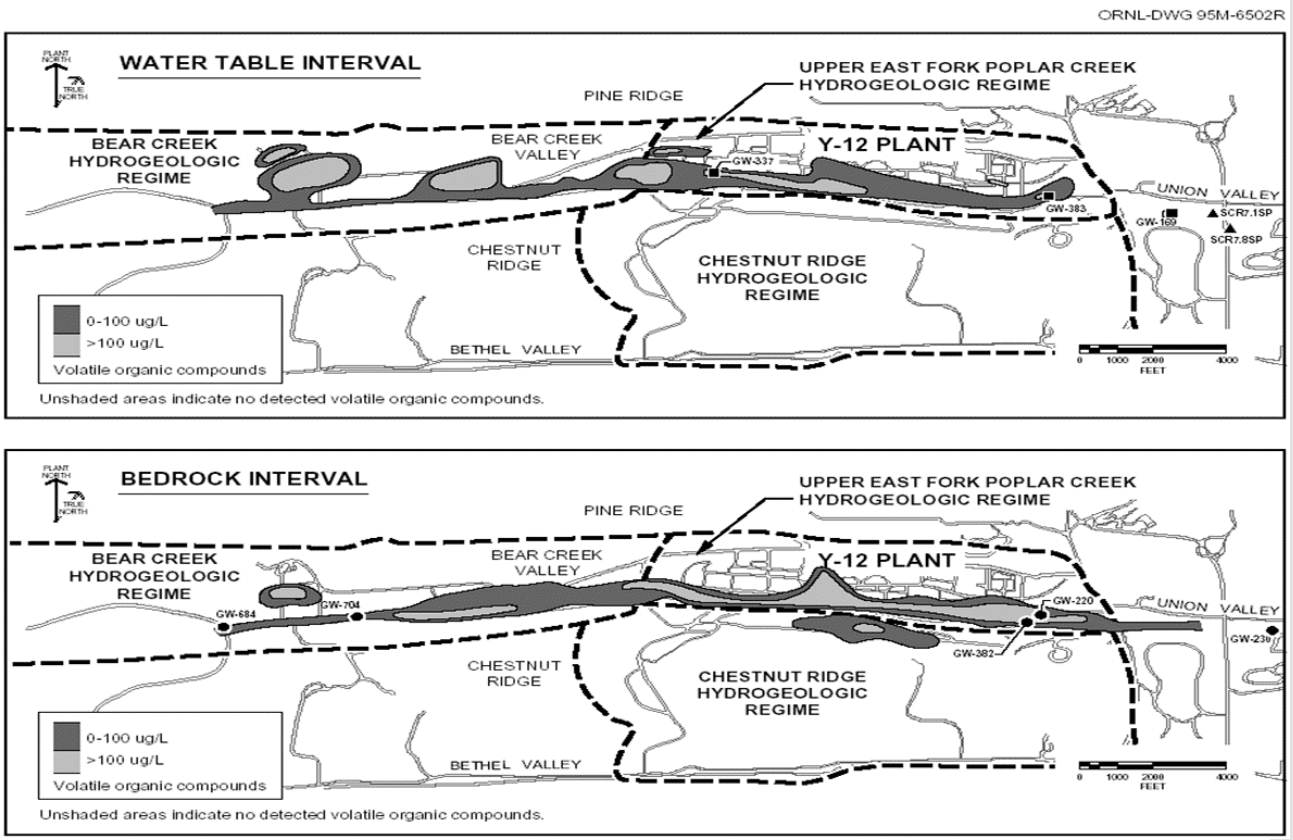


Figure 3: K-25 Site and Waste Area Grouping
Source: http://www.ornl.gov/Env_Rpt/aser95/aser.htm

Environmental Concerns at Oak Ridge EMWMF



Environmental Violations at Oak Ridge EMWMF

Bear Creek, at Oak Ridge National Laboratory Site
Source: https://www.esd.ornl.gov/BMAP/bear.htm

Observations on the Oak Ridge EMWMF

Three observations can be drawn from the example violation:

- The operation of the EMWMF does not demonstrate the effectiveness of a facility such as CNL's proposed Near Surface Disposal Facility.
- The contractor Bechtel Jacobs Limited was made aware of the situation and the associated risks to the environment prior to the events.
- The environmental violations resulted from a combination of design and operational failures: There was insufficient water storage capacity as part of the facility design and there were operational decisions made which resulted in environmental harm as a result of those design limitations

Hanford Environmental Restoration Disposal Facility – Context

Hanford Nuclear Reservation. Source: CBC

Hanford Environmental Restoration Disposal Facility – Facility

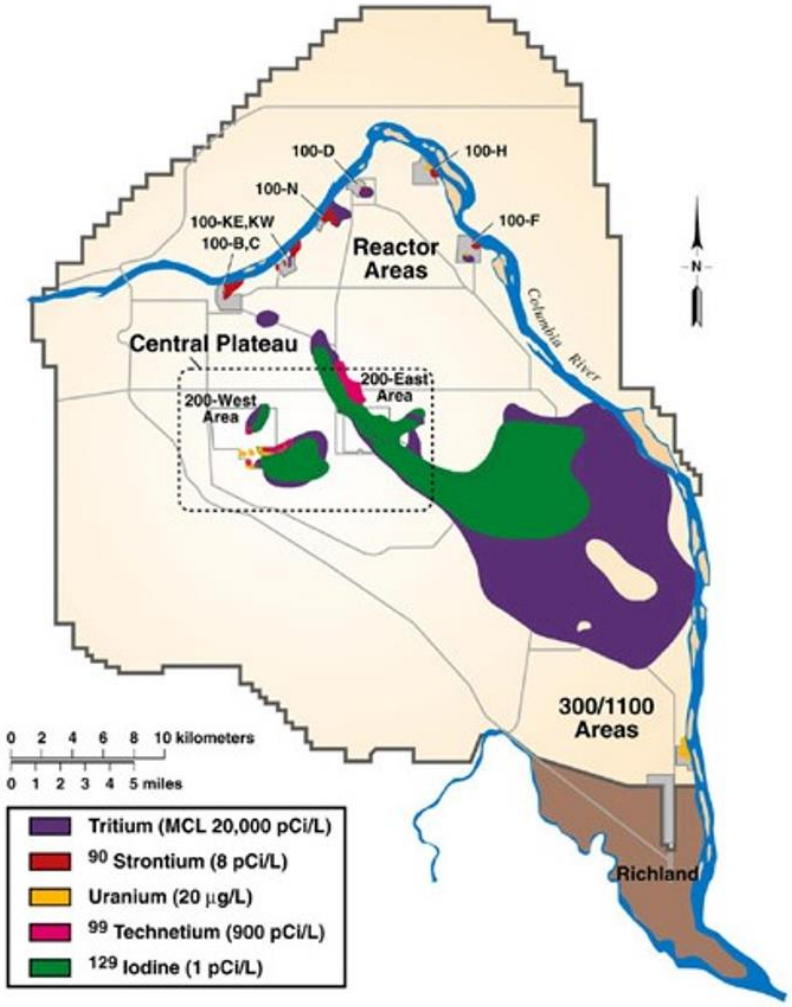


Figure 2: Groundwater Contamination at Hanford Site
Source: http://www.hanford.gov/gifs/maps/sitemap1.gif

Project Irregularities

An independent technical review found:

- Falsification of compaction data went undetected for several months due to shortcomings in past procedures, a lack of accountability of the subcontractor and lack of visual verification of testing.
- Analyses indicated that the problem would have been noticed had the pumping rate been regularly compared to historical pumping rates.
- Analysis of the impacts of the excessive leachate level did not assess the most significant impact associated with the elevated leachate level, i.e., whether the excessive leachate level cause additional leakage from the ERDF.
- The most significant issue regarding waste compaction is whether the compacted waste fill in the ERDF will provide adequate support for the final cover.
- The density methodology that has been used to evaluate compaction has many technical flaws and is of questionable value.
- Documentation was not available to confirm that the 3:1 ratio (soil to debris) was adequate to support the final cover for the ERDF.
- The the soil pressure requirement has not been directly related to compaction criterion.
- The information was insufficient to confirm that the existing compaction specification and compaction methods were adequate to ensure that the waste will provide a stable foundation for the final cover to be placed on the ERDF.

Despite these project irregularities, the CERCLA 5 Year Report for the period of 2005 to 2011 simply reported the ERDF as “operating as required to meet the objectives outlined in the ROD for disposing of waste from all Hanford CERCLA activities”

Project Evolution

Environmental Restoration Disposal Facility – Super Cells 9 & 10 Construction
Source: https://www.delhur.com/portfolio-items/environmental-restoration-disposal-facility-super-cells-9-10

Observations at the Hanford Environmental Restoration Disposal Facility

Three can be drawn from the irregularities and the project evolution observed at the ERDF:

- In the GOCO model in place at the Hanford Environmental Restoration Disposal Facility, a lack of oversight from both the contractor and the site owner was observed, which allowed key equipment failures to continue undetected for seven months and a falsification of documents to be carried out over a period of years.
- Government agency oversight reports failed to note even such significant failures as those noted immediately above.
- The initial authorization for the facility changed significantly even in the first decade of operation. It began with an expansion of the acceptable wastes in the first year after initial authorization and an expansion of the size of the facility the following year; multiple additional expansions to the authorization have continued throughout the operating period.

Fernald On-site Disposal Facility - Context

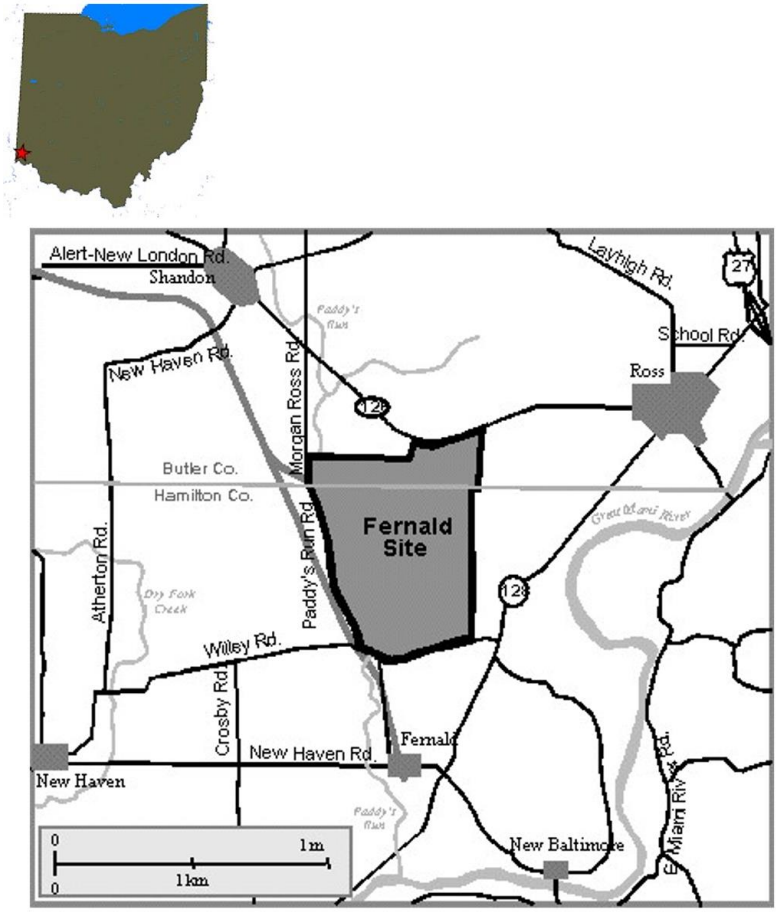


Figure 1: Location of Fernald Site

Fernald On-Site Disposal Facility

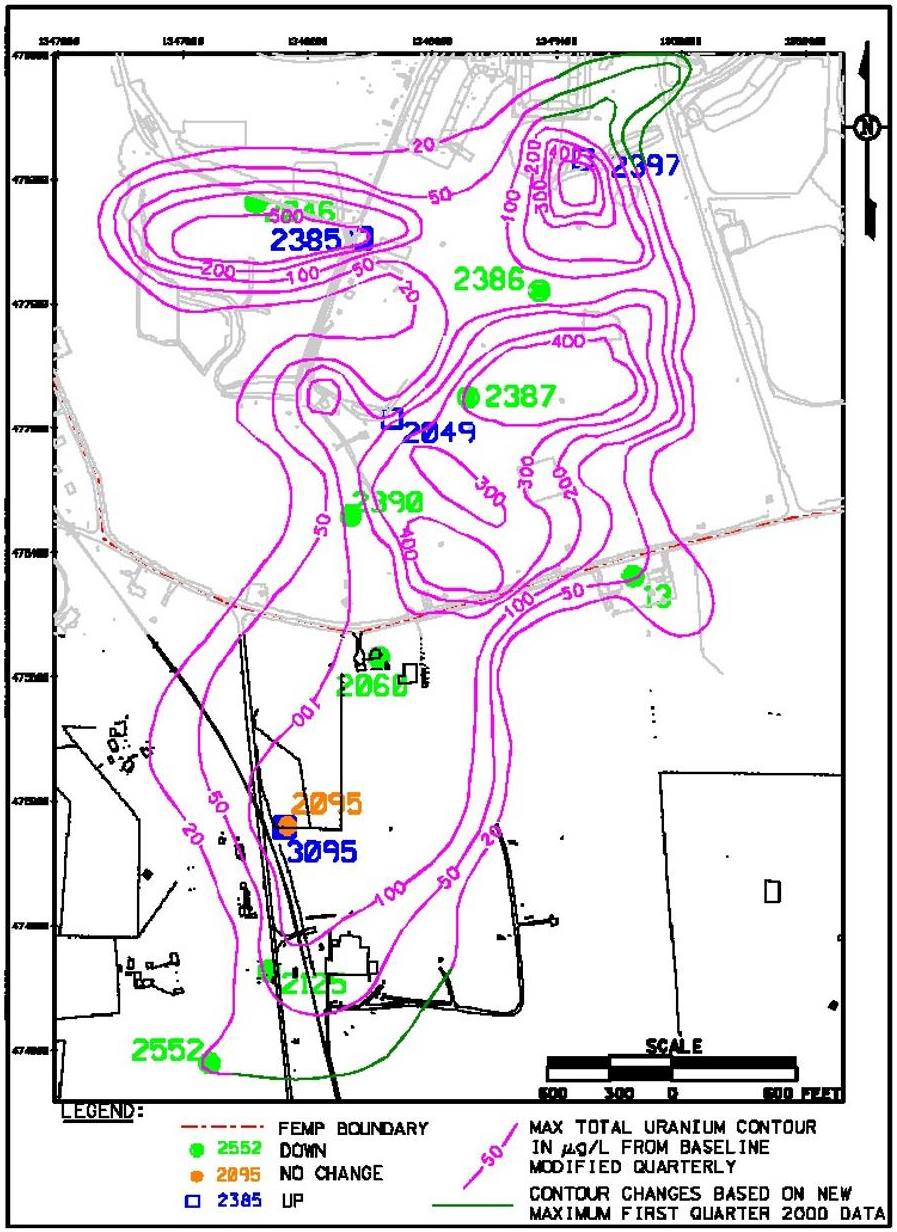


Figure 3: Uranium Groundwater Concentrations: May 2001

Source: http://www.fernald.gov/newsupdate/5yrReview/Sec-6.pdf

Citizen Engagement at Fernald

Fernald Citizens Task Force and Advisory Board (Source: [top] Fernald Citizens Advisory Board; [bottom] U.S. DOE)

Interpretive exhibits in the atrium of the Fernald Preserve Visitors Center. (Source: U.S. DOE)

Observations

Three observations can be drawn from the Fernald case study:

- The degree to which the Fernald clean-up operations were successful relied on several critical factors, including and particularly that the remediation activities followed closure, rather than running concurrent with continued waste generating and contaminating activities co-located on the site.
- Citizen engagement was a priority, and citizens occupied a central role in decision- making, communicating with the public, priority setting.
- Perpetual care was embedded as a project expectation, and the oversight agencies have a known and seemingly reliable plan for long term record keeping and retention of institutional memory.

Alignment of the NSDF Project with IAEA Guidelines

- The 2021 EIS states that, “To meet the requirements of IAEA’s SSR-5, CNL has defined the near surface disposal within its Integrated Waste Strategy as the primary disposal path for LLW that meet the Waste Acceptance Criteria.”
- However, a fundamental issue with the NSDF is continued uncertainties with respect to the radioactive waste inventory and the characterization of the radioactive wastes which CNL may deposit in the NSDF. Until such issues are resolved, there can be no reliable determination made as to whether the wastes being placed in the NSDF meet IAEA guidance.

Conclusions of the Comparative Sites Study

- Each of these facilities and their operating experience was unique, but each provided insights and observations which were relevant to CNL's proposed Near Surface Disposal Facility at Chalk River.
- Some observations were common across the three sites:
  - All three sites operate under the GOCO model, and two of the three have contractors which are partners in the Canadian Nuclear Energy Alliance (operator of CNL).
  - All three examples appear to be effectively reducing the footprint or the extent of radio-contaminants but none are successfully isolating the radio-contaminants from the environment.
  - All three are facilities whose operations were part of the nuclear weapons complex; similarly, the origins of the Chalk River nuclear laboratory site are with the Canadian contribution to nuclear weapons development.

Observations Unique to Each Site – Oakridge

The Oakridge National Laboratories Environmental Management Waste Management Facility illustrated:

- A lack of oversight and/or commitment to operational safety can result in violations of operating protocol and subsequently, environmental violations.
- The environmental violations resulted from a combination of design and operational failures in that there was insufficient water storage capacity as part of the facility design and there were operational decisions made which resulted in environmental harm as a result of those design limitations.
- The responsibility chain went from site owner to contractor to sub-contractor and was broken.

Observations Unique to Each Site – Hanford

The Hanford Environmental Restoration Disposal Facility demonstrated:

- In the GOCO model a lack of oversight from both the contractor and the site allowed key equipment failures to continue undetected for seven months and a falsification of documents to be carried out over a period of years.
- Government agency oversight reports failed to note even such significant failures as those noted immediately above.
- A form of " authorization creep" emerged, with the initial authorization for the facility changing significantly over even the first decade of operation, including broadening the categories of waste and the size of the facility

Observations Unique to Each Site – Fernald

The Fernald On-site Disposal Facility provides an example of several elements which do not appear to be in place in the case of CNL's proposed NSDF, but were important to the Fernald project, including:

- the remediation activities followed closure, rather than running concurrent with continued waste generating and contaminating activities co-located on the site.
- Citizen engagement was a priority, and citizens occupied a central role in decision-making, communicating with the public, and priority setting.
- perpetual care was embedded as a project expectation, and the oversight agencies have a known and seemingly reliable plan for long term record keeping and retention of institutional memory.

Overall Conclusion

Rather than providing examples of success, the observations from the Oakridge National Laboratories Environmental Management Waste Management Facility, Hanford Environmental Restoration Disposal Facility and Fernald On-site Disposal Facility operating experience provide caution warnings.