Complications Associated with Long-Term Disposition of Newly-Generated Transuranic Waste: A National Laboratory Perspective – 9283

B.J. Orchard, L.A. Harvego, T.L. Carlson, R.P. Grant
Idaho National Laboratory
P.O. Box 1625, Idaho Falls, ID 83415

ABSTRACT

The Idaho National Laboratory (INL) is a multipurpose national laboratory delivering specialized science and engineering solutions for the U.S. Department of Energy (DOE). Sponsorship of INL was formally transferred to the DOE Office of Nuclear Energy, Science and Technology (NE) by Secretary Spencer Abraham in July 2002. The move to NE, and designation as the DOE lead nuclear energy laboratory for reactor technology, supports the nation's expanding nuclear energy initiatives, placing INL at the center of work to develop advanced Generation IV nuclear energy systems; nuclear energy/hydrogen coproduction technology; advanced nuclear energy fuel cycle technologies; and providing national security answers to national infrastructure needs.

As a result of the Laboratory's NE mission, INL generates both contact-handled (CH) and remote-handled (RH) transuranic (TRU) waste from ongoing operations. Generation rates are relatively small and fluctuate based on specific programs and project activities being conducted; however, the Laboratory will continue to generate TRU waste well into the future in association with the NE mission. Currently, plans and capabilities are being established to transfer INL's CH TRU waste to the Advanced Mixed Waste Treatment Plant (AMWTP) for certification and disposal to the Waste Isolation Pilot Plant (WIPP). RH TRU waste is currently placed in storage at the Materials and Fuels Complex (MFC).

In an effort to minimize future liabilities associated with the Laboratory's NE mission, INL is evaluating and assessing options for the management and disposition of all its TRU waste on a real-time basis at time of generation. This paper summarizes near-term activities to minimize future re-handling of INL's TRU waste, as well as, potential complications associated with the long-term disposition of newly-generated TRU waste. Potential complications impacting the disposition of INL newly-generated TRU waste include, but are not limited to: 1) required RH TRU packaging configuration(s) vs. current facility capabilities, 2) long-term NE mission activities, 3) WIPP certification requirements, and 4) budget considerations.

INTRODUCTION

The primary focus of recent efforts at the INL to address TRU waste has centered on the Laboratory's legacy waste volume. INL's legacy TRU waste is subject to near-term legal and regulatory milestones and represents a significant liability both in terms of waste management costs and potential impacts to the ongoing NE mission of the Laboratory if established milestones are not met. In addition to this legacy waste, the INL continues to generate TRU waste as part of its ongoing mission. Therefore, efforts were initiated in Fiscal Year 2008 by the Idaho Facilities Management Program at the INL, concurrent with efforts to address INL's legacy waste, to address newly-generated TRU waste. The goals of this effort, which is ongoing, are to:

1. Eliminate the continued generation of "legacy" waste

2. Minimize future re-handling of TRU waste to the maximum extent practical

3. Minimize TRU waste management costs

4. Minimize the impact to ongoing operations.

This paper presents an overview of the INL, its mission, and TRU waste generating activities and provides information relative to the near- and long-term disposal of newly-generated TRU waste resulting from the Laboratory's mission activities.

IDAHO NATIONAL LABORATORY OVERVIEW

The INL is a multipurpose national laboratory delivering specialized science and engineering solutions for DOE. Sponsorship of INL was formally transferred to the NE by Secretary Spencer Abraham in July 2002. The move to NE, and designation as the DOE lead nuclear energy laboratory for reactor technology, supports the nation's expanding nuclear energy initiatives, placing INL at the center of work to develop advanced Generation IV nuclear energy systems; nuclear energy/hydrogen coproduction technology; advanced nuclear energy fuel cycle technologies; and providing national security answers to national infrastructure needs.

Transuranic Waste Generation

As a result of the Laboratory's NE mission, INL generates both CH and RH TRU waste from ongoing operations, primarily at MFC[a]. Generating facilities and an overview of each facility's purpose is presented in Table 1.

Table 1. Overview of INL facilities where the majority of the Laboratory's contact-handled and remote-handled TRU waste is generated and stored.

Facility (Building Number)	Purpose
Analytical Laboratory (AL) (MFC-752)	The AL provides a variety of chemical and radiological services in support of MFC programs. The Casting Laboratory and the Non-Destructive Analysis laboratory are located in the AL. Waste generation includes CH and RH TRU and mixed TRU wastes.
Contaminated Equipment Storage Building (CESB) (MFC-794)	The CESB is a RCRA permitted treatment, storage, and disposal facility and contains storage areas and a tent for operations including characterizing and packaging wastes generated from discarded equipment and CH TRU waste.
Electron Microscopy Laboratory (EML) (MFC-774)	The EML houses two major pieces of equipment, a scanning electron and a transmission electron microscope. The laboratory performs material analyses on stainless steel, irradiated metals, and ceramics, resulting in the generation of CH TRU waste.

[a] Prior to the new INL contract, which was issued in 2005, MFC was referred to as Argonne National Laboratory-West (ANL-W) and was operated by the University of Chicago under the direction of the DOE Chicago Field Office. At the time the INL contract was issued to Battelle Energy Alliance, LLC (BEA), ANL-W was renamed MFC and is operated under the direction of the DOE Idaho Operations Office (DOE-ID).

Table 1. Continued.

Facility (Building Number)	Purpose
Fuel Manufacturing Facility (FMF) (MFC-704)	The FMF was used to fabricate metal fuels for use in Experimental Breeder Reactor (EBR)-II and other reactors. Waste generation includes CH TRU and mixed TRU wastes resulting from research, development, and fabrication of experimental reactor fuels.
Hot Fuel Examination Facility (HFEF) (Building MFC-785)	HFEF is a large hot cell facility equipped for examining irradiated fuels and performing other materials experiments. The Neutron Radiography Reactor and Waste Characterization Area are also located at HFEF. Waste generation includes CH and RH TRU and mixed TRU wastes.
Fuel Conditioning Facility (FCF) (Building MFC-765)	FCF performs treatment of sodium-bonded spent fuel and demonstrates DOE spent fuel treatment technologies. Waste generation includes CH and RH TRU and mixed TRU wastes.
Radioactive Scrap and Waste Facility (RSWF) (MFC-771)	The RSWF is an interim storage facility for spent fuel and RH mixed and radioactive wastes, including RH TRU waste. The facility is located on four acres situated 804 m (½ mile) northeast of the MFC Site. The facility consists of cathodically-protected carbon steel liners set and buried vertically in the ground. A variety of storage configurations have been utilized at the facility, with newly-generated waste placed for storage in double steel containers.

TRU waste generation rates are relatively small and fluctuate based on specific programs and project activities being conducted; however, the Laboratory will continue to generate TRU waste well into the future in association with its' NE mission. Currently, plans and capabilities are being established to transfer INL's CH TRU waste to AMWTP for certification and disposal to WIPP. RH TRU waste is currently placed in storage at MFC. Planning activities have commenced to determine the most cost-effective approach to disposition this waste in the future, while minimizing impacts to ongoing mission activities.

CH TRU waste is generated primarily at the FMF and AL at MFC. The FMF was originally constructed to house all EBR-II fuel manufacturing operations at MFC, including fuel element and core assembly fabrication and secure storage of special nuclear materials. With the termination of the Integral Fast Reactor Program and the shutdown of EBR-II in 1994, the mission of FMF has evolved to focus on new reactor fuel development activities, including the handling of actinide compound powders, pressing and high-temperature sintering of powders into pellets, and placement of these pellets into fuel cladding tubes for irradiation. The AL provides elemental and isotopic analysis of highly radioactive waste samples and irradiated and non-irradiated fuels in support of FMF. In addition, the AL receives a variety of samples from internal BEA customers, Idaho Site contractors, and other DOE and non-DOE contractors for analysis. The AL also supports fuel development work, such as the conversion of oxide to metal fuel and isotopic separations.

RH TRU waste is generated primarily in the HFEF and FCF hot cells, located at MFC, as well as the AL. The HFEF (Figure 1) is a large, heavily shielded hot cell facility designed to perform post-irradiation examination (PIE) of highly irradiated fuel and structural materials, as well as waste form development. It was originally constructed to provide support to the Integral Fast Reactor Program with post- and inter-irradiation examination capabilities. Currently this facility is primarily used for PIE of irradiated fuels and materials, including irradiated experiments from the INL Advanced Test Reactor.

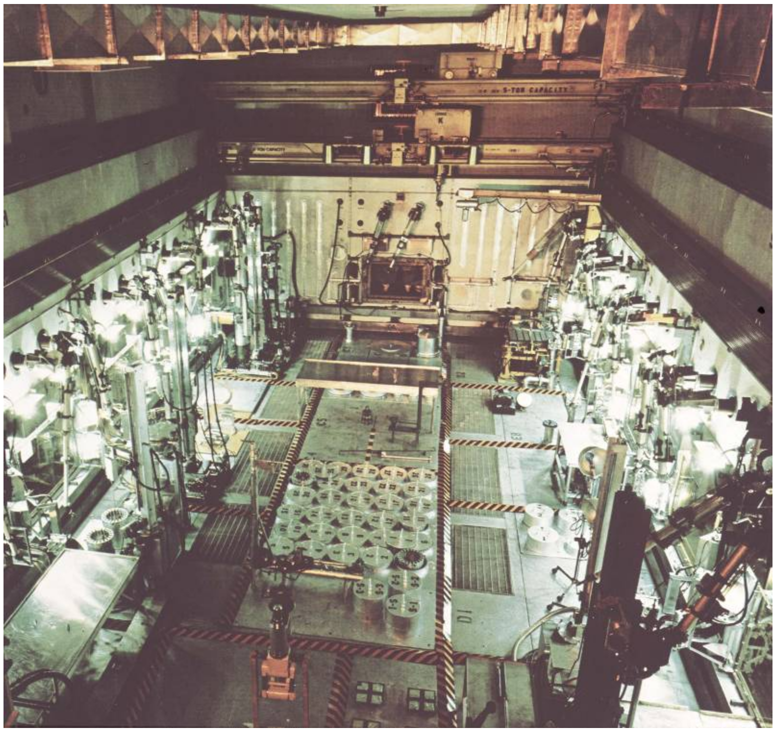

Fig. 1. Photograph of the Hot Fuel Examination Facility Main (Argon) Cell.

The FCF (Figure 2) is also a large, heavily shielded hot cell facility closely coupled with EBR-II that was originally used to demonstrate fuel reprocessing and refabrication using pyrometallurgical processing. It continues to be used to demonstrate the technical feasibility of the electrometallurgical technology for reconditioning spent nuclear fuel. The present emphasis is the treatment of legacy EBR-II spent driver and blanket fuel assemblies. Hot cells in the AL are used to perform radiological, heavy metal, and trace element analysis in support of these activities, generating small quantities of RH TRU in the process.

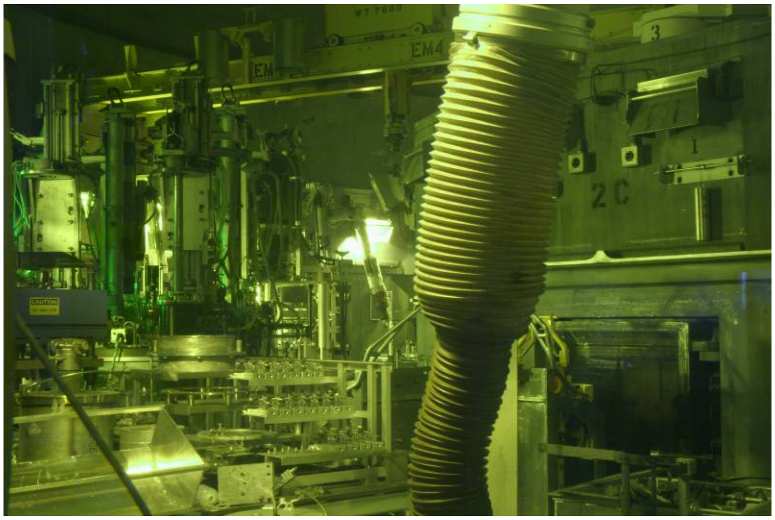

Fig. 2. Photograph of the Fuel Conditioning Facility Argon Cell viewed via Window 1.

Transuranic Waste Characteristics

MFC TRU waste consists of materials resulting from the research and production of nuclear fuels and resulting sample waste from fuel examination. The TRU waste streams consist of rags, clothing, tools and other such items contaminated with radioactive elements, primarily plutonium. Waste consists of glass, metals, ceramics, dissolved fuel samples (neutralized and solidified), personal protective equipment, glovebox equipment, anti-C's, paper, rags, filters and plastic (Figure 3). CH mixed TRU waste is generated from analytical sampling, etching contaminated surfaces, replacement of lead-lined glove-box gloves, and waste characterization. The waste consists primarily of fuel samples, experiment hardware, and glovebox waste that contain cadmium, chromium, lead, or other heavy metals.

Fig. 3. Typical glovebox debris waste generated at MFC.

NEAR-TERM DISPOSAL OF CONTACT-HANDLED TRANSURANIC WASTE

Historically, ANL-W was always considered part of INL in the waste management area; low-level waste was disposed at the INL Radioactive Waste Management Complex (RWMC), mixed waste was part of the INL Site Treatment Plan, and CH TRU waste was sent to RWMC for storage. Although stored ANL-W CH TRU waste was considered as part of the Large Quantity Site WIPP Certification Program for INL, it was separate in management and DOE oversight. CH TRU generated by ANL-W (and the first shipment from MFC) was to disposition in campaigns rather than under an authorized program that could get the waste processed for WIPP receipt. TRU waste historically stored at RWMC is being processed for WIPP shipment at the AMWTP. All CH TRU waste generated at MFC and received by RWMC is still in storage, pending waste stream profile development and acceptance by WIPP.

Contact-Handled Transuranic Waste Generation

Newly-generated CH TRU waste generation rates are dependent on year-to-year program and project activities. The major generation sources are analysis of EBR-II spent fuel conditioning process samples and fuel fabrication samples. The waste is TRU primarily due to plutonium content, but CH TRU wastes may also include americium, neptunium, curium and other TRU isotopes that are being evaluated as part of future reactor experimental fuel performance testing.

Waste is packaged into 0.21 m^3 (55-gal) drums in the generating facility and stored there, or sent to an onsite storage facility for storage pending shipment to AMWTP. CH TRU waste generation for the MFC Complex ranges from 6 to 18 drums per year (1.25 to 3.75 m^3/yr), on average. The last CH TRU shipping campaign was conducted in 2005; therefore, all CH TRU waste generated since 2005 is in storage at MFC.

Contact-Handled TRU Waste Management Program Development

Since the INL contract was issued in 2005, newly-generated TRU waste has been placed in storage. If this waste is not sent for disposal, storage facility radiological limits will be reached, severely impacting ongoing mission activities. To minimize impacts to INL programs, efforts were initiated to ship INL-generated CH TRU waste to AMWTP for processing, certification, and shipment to WIPP.

Two primary documents were written to establish the program. The first, a Laboratory-Wide Procedure, LWP-8300, "Transuranic Waste Handling," defines the requirements and establishes the process associated with the generation, handling, characterization, and storage of TRU waste generated at INL facilities. It is intended to integrate the waste acceptance criteria (WAC) of the receiving facility into the overall process of TRU waste management. Compliance requirements for waste form, waste containers, and waste packages are included in this procedure. The second document, PLN-8300, "MFC TRU Waste Certification Program Plan" is a plan for specifically certifying CH TRU waste generated at MFC to demonstrate compliance with the AMWTP WAC (MP-TRUW-8.40 "Non-AMWTP Mixed Transuranic Waste Acceptance).

A Statement of Work (SOW) was prepared to establish a contract with AMWTP to allow the INL TRU program to be reviewed for acceptance at AMWTP. The objective is to ensure CH TRU waste characterization and management related activities are performed in compliance with all applicable requirements so that the waste can be sent to AMWTP for certification and shipment to WIPP. One of the elements included in the SOW was a clause that allowed AMWTP and INL personnel to discuss alternative (non-routine) packaging and shipping configurations for CH TRU and mixed TRU waste generated by INL facilities, programs, and projects. An example was to provide evaluation, direction and written authorization for INL facilities to package the CH TRU waste to the AMWTP WAC instead of the previously used ANL-W TRUCON codes.

Current Contact-Handled TRU Program Status

CH TRU waste is typically generated in glove boxes and is removed through bagging ports into plastic sleeves. Operational and contamination control procedures resulted in multiple bag layers, thus restricting the amount of TRU waste that can be disposed in an individual container. Waste generated by MFC may contain a wide variety of isotopes used in fuel evaluation experiments, primarily uranium and plutonium but also americium and neptunium.

There are three driving container loading limits for MFC CH TRU waste: Pu-239 Fissile Gram Equivalent (FGE), Pu-239 Curie Equivalent Activity (PE-Ci), and decay heat. When MFC facilities applied the restrictions of the ANL-W TRUCON codes (AW 125), container loading was usually limited by decay heat. This prompted the discussion with AMWTP to determine if MFC could use the less restrictive limits found in the AMWTP WAC, which would allow the wattage limit to be increased from approximately 0.04 watts to approximately 0.08 watts per 0.21 m^3 (55-gal) drum. This discussion lead to the conclusion that MFC did not have to abide by the ANL-W TRUCON code limits as the waste was going to be processed by AMWTP prior to shipment to WIPP. Additionally, because AMWTP is located at the Idaho Site the shipment of waste from MFC to AMWTP is conducted as an out-of-commerce shipment under a transport plan, minimizing the impact of U.S. Department of Transportation limits.

Once the decision was made that the MFC TRU waste did not need to meet ANL-W TRUCON limits, the waste limits were reevaluated to determine what criteria would be set to allow the waste to be accepted by AMWTP. The final acceptance limit decision applied the highest activity levels acceptable in the final waste form produced by AMWTP to maximize the amount of TRU waste allowed in each drum loaded at MFC.

Debris waste processed at AMWTP is sent through a super compactor, which crushes 0.21 m^3 (55-gal) drums for placement in a 0.38 m^3 (100-gal) overpack. A single 0.38 m^3 (100-gal) overpack will contain from two to seven 0.21 m^3 (55-gal) drums. The resulting container exiting the compactor must meet both the limits of the WIPP WAC. Obviously, individual feed drums cannot be at the maximums allowed by the WIPP WAC and still allow the final container to meet the limits. To address this concern, MFC container limits were adjusted to allow this waste to be blended with other CH TRU waste at lower activities. The PE-Ci limit was reduced from the WIPP WAC limit of 80 PE-Ci. The FGE limit was reduced from the WIPP-WAC limit of 200 FGEs. However, the decay heat limit was raised to 0.3 watts, as internal layers of confinement are breached in the compaction process. Because the limiting factor for MFC waste was usually decay heat, this decision allows more activity to be placed in each drum at MFC.

Results of Final Waste Acceptance Decisions

The increase in the decay heat limit allows up to seven (7) times more Pu-equivalent waste to be placed in each drum. This has positive benefits to both MFC and AMWTP. MFC facilities can package waste more efficiently as more individual bags of waste can be put into each drum. Less effort is expended to control waste activity to the stringent criteria of the ANL-W TRUCON codes. Decay heat limits are difficult to determine and control when small amounts of americium are present. The higher limit allows glovebox cleanup and sample waste removal campaigns to be completed without having to split samples to meet final drum characterization. Higher activity loading translates directly to fewer drums being loaded for storage and shipment. Management costs for characterizing, storing and transporting drums at the higher limits can be reduced by up to 75% from the original cost projected by MFC. AMWTP will be able to blend higher MFC activity waste with other sources of lower activity TRU waste and still meet their acceptance limits. This will reduce the number of drums they must process from MFC, resulting in processing cost savings.

Contact-Handled Transuranic Waste Disposal Costs

Currently, AMWTP operations are fully funded by the DOE Environmental Management (EM) Program; therefore, NE must only pay for actual processing costs (i.e., materials), not facility infrastructure associated with the AMWTP. The life-cycle cost (INL and AMWTP) associated with disposition of CH TRU waste borne by INL projects and programs is approximately $10,000 per 55-gal drum.

NEAR-TERM DISPOSAL OF REMOTE-HANDLED TRANSURANIC WASTE

While a specific path has been identified for the disposition of newly-generated CH TRU waste through the AMWTP, a similar path is yet to be defined for INL’s newly-generated RH TRU waste. Prior to establishment of the RH TRU WAC for WIPP, ANL-W defined a packaging configuration that would be compatible with a RH-72B cask. This packaging configuration consists of three (3) vented 0.17 m^3 (45-gal) inner waste cans (drums) placed in a stainless-steel outer waste can (RH TRU outer waste can) configured to fit inside the RH-72B cask’s removable lid canister (RLC). This packaging configuration remains the standard INL configuration for RH TRU waste generated at FCF; a different packaging configuration (referred to as a HFEF-5 can) is currently used at HFEF.

The FCF hot cell is configured such that management of RH TRU waste utilizing this packaging configuration can be conducted without facility modifications or increased labor burden, and consistent with cell insertion and removal procedures and practices. While in-cell storage of RH TRU waste in this packaging configuration is not optimal for the HFEF hot cells, the cells nonetheless are configured to handle this packaging configuration without facility modifications or increased labor burden, and use of this configuration is consistent with cell insertion and removal procedures and practices. Deviation from this packaging configuration will likely require infrastructure and operations modifications, some potentially significant, to the FCF and HFEF hot cells. The goal for newly-generated RH TRU waste is to establish a packaging configuration that minimizes facility modifications, while also minimizing the life-cycle cost to disposition this waste stream to WIPP.

Remote-Handled Transuranic Waste Generation and Characteristics

As with CH TRU waste, waste generation rates for RH TRU waste are highly dependent on program and project activities at MFC. The waste is generated primarily as a result of hot cell operations at HFEF, FCF, and AL including incidental wastes associated with the processing of EBR-II spent fuel. Current generation rates are approximately 1 to 1.5 m^3/yr with radiological dose rates up to 800 R/h. Plans to increase the amount of EBR-II spent fuel processed at MFC could result in RH TRU waste generation rates doubling in the next several years. Radiation readings associated with recently packaged RH TRU waste are shown in Figure 4.

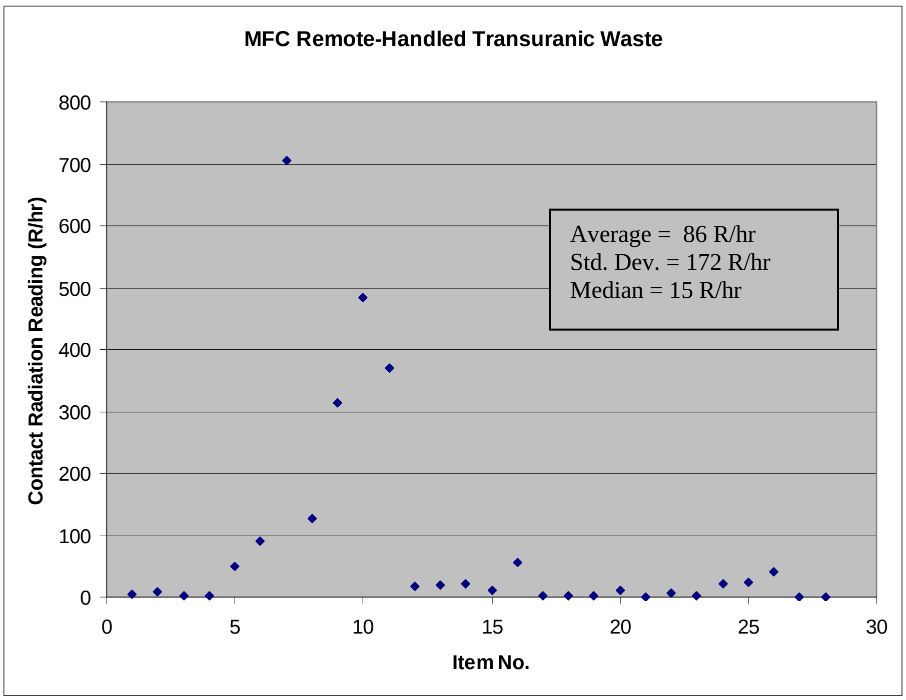

Fig. 4. Radiation readings of 28 newly-generated remote-handled transuranic waste cans.

Newly-generated RH TRU waste is currently packaged in one of two configurations: 1) 0.17 m^3 (45-gal) drums and 2) HFEF-5 cans. Newly-generated RH TRU waste from FCF and AL is packaged in 0.53 m (21-in.) diameter, 0.80-m (31 3/8-in.) tall carbon steel drums with a bolted lid and a nominal capacity of 0.17 m^3 (45-gal). The drums are vented, with three drums placed in a 0.57-m (22 5/8-in.) diameter stainless steel outer waste can (RH TRU outer waste can) that varies in length, depending on series, between 2.65 m (104.5 in.) and 2.71 m (106.8 in.). The outer waste can has a welded lid and shield plug. The HFEF-5 packaging configuration consists of a 0.29-m (11.5-in.) diameter, 1.52-m (5-ft) long carbon steel inner waste can with a bolted lid that is placed in a 0.32-m (12.75-in.) diameter, 1.83-m (6-ft) long stainless steel outer waste can with a welded lid and shield plug. The HFEF-5 cans are not vented and have a waste payload of approximately 0.1 m^3 (26.4 gal). This represents the primary packaging configuration for RH TRU waste generated at HFEF.

Newly-generated RH TRU waste is currently being held in-cell, as feasible, pending clear identification of packaging requirements to disposition the waste to WIPP. The waste is transferred to an onsite storage facility - the RSWF - once interim in-cell storage capacity is exhausted or storage of the waste impacts ongoing hot cell operations (imminent at FCF).

Options for Newly-Generated Remote-Handled Transuranic Waste Packaging

Based on program needs, generation locations, and generation volumes options seven (7) options for packaging INL newly-generated waste have been identified. These options are summarized in Table 2.

Table 2. Options considered for newly-generated remote-handled transuranic waste.

Option/Description	Advantages	Disadvantages/Requirements
Option 1 – Direct placement of HFEF-5 can in RLC for disposal.	• No process changes to HFEF/FCF hot cells	• Inefficient use of disposal volume • Would require venting of the HFEF-5 cans • Require regulatory approval to collect headspace gas samples from HFEF-5 can (55-gal only approved method).
Option 2 – Packaging RH TRU waste in 0.17 m^3 (45-gal) cans and RH TRU outer waste can with no subsequent repack	• Process/procedural changes only to HFEF to implement 0.17 m^3 (45-gal) packaging as standard RH TRU packaging configuration	• Require venting of the RH TRU outer waste can
Option 3 – Packaging in 0.17 m^3 (45-gal) cans and RH TRU outer waste can with subsequent repack	• Process/procedural changes only to HFEF to implement 0.17 m^3 (45-gal) packaging as standard RH TRU packaging configuration	• Temporary storage (i.e., 0.17 m^3 [45-gal] cans would have to be retrieved from RH TRU outer waste can and transferred to 0.21 m^3 [55-gal] drums and RLC for final disposition) would be required
Option 4 – Packaging in 0.17 m^3 (45-gal) cans with subsequent overpack in 0.21 m^3 (55-gal) drums	• Minimize potential downstream handling as waste packaged in established WIPP packaging configuration	• Process and infrastructure changes at both HFEF and FCF required • Require storage/staging area for 021 m^3 (55-gal) overpack drums
Option 5 – Packaging in 0.11 m^3 (30-gal) drums	• Established packaging configuration for RH TRU waste (via 0.21 m^3 [55-gal] overpack)	• Process and infrastructure changes at both HFEF and FCF required • Require storage/staging area for

	• Utilize planned 0.17 m^3 (55-gal) shielded overpack for *portion* of RH TRU waste stream	0.17 m^3 (55-gal) shielded overpack • Would still require use of RH TRU outer waste can/RLC for portion of waste not meeting shielded overpack requirements

Table 2. Continued.

<table>
<tr><th>Option/Description</th><th>Advantages</th><th>Disadvantages/Requirements</th></tr>
<tr><td>Option 6 – Combination of 0.17 m^3 (45-gal) and 0.11 m^3 (30-gal) cans</td><td>• Best utilization of WIPP volume/handling efficiencies</td><td>• Process and infrastructure changes at both HFEF and FCF required
• Would require discrete in-cell segregation capability based on radiation levels and expected shielding efficiency
• Disadvantages/requirements of Options 2 thru 4 also apply</td></tr>
<tr><td>Option 7 – Package in 0.17 m^3 (45-gal) and/or 0.11 m^3 (30-gal) drums and store in RLC and/or shielded overpack</td><td>• Minimize downstream re-handling of waste to get in shipping configuration for WIPP disposal</td><td>• Process and infrastructure changes at both HFEF and FCF required, as well as MFC interim storage facility (RSWF)
• Require evaluation of cask handling ability at both FCF and HFEF
• Disadvantages/requirements of Options 2 thru 5 also apply</td></tr>
<tr><td colspan="3"><u>Items Impacting All Options:</u>
1. A subset of the packaged waste will require headspace gas sampling – requiring ability to extract a specific drum and overpack in 0.17 m^3 (55-gal) drum for equilibration and sampling.
2. All inner containers must be vented.
3. Generation rate estimated at 1 to 1.5 m^3/yr with radiation levels as presented in Figure 4.
4. Long-term management dependent on whether INL must ship to INTEC before shipment to WIPP (and associated limitations at INTEC [e.g., ability to extract 0.17 m^3 (45-gal) can from RH TRU outer wastes can and place in RLC]) or whether INL can conduct campaigns from MFC utilizing one of the WIPP mobile shipping units.</td></tr>
</table>

In determining the preferred packaging configuration, limitations at the generating facilities, mission/program impacts of infrastructure changes, and ongoing mission/program activities must be weighed against WIPP packaging requirements. Based on a review of the options identified, the preferred INL option for packaging newly-generated, RH TRU waste is to obtain concurrence on use of 0.17 m^3 (45-gal) drums. Establishing capability to utilize the ANL-W established outer waste can would be optimal; however, this is not a WIPP approved configuration and necessary reviews and approvals would be required. The Department costs associated with such review and approval must be weighed with impacts to NE program activities to establish the capability to remove the 0.17 m^3 (45-gal) drums from the HFEF and FCF hot cells to allow the drums to be overpacked in 0.21 m^3 (55-gal) drums.

All options identified in Table 2 require development of WIPP certification capabilities at MFC or use of existing capabilities of the RH TRU Program at the Idaho Nuclear Technology and Engineering Center (INTEC). Long-term consideration of the most cost-effective means to package INL RH TRU waste must balance costs for establishing redundant RH TRU certification capabilities at the Idaho Site vs. costs associated with transferring INL newly-generated, RH TRU waste to INTEC for final certification. These costs include transportation costs and infrastructure costs at both MFC and INTEC. Other considerations impacting this analysis include packaging configuration, radiological dose rates, external contamination of the inner waste cans, and ongoing and future RH TRU Program activities at INTEC.

Remote-Handled Transuranic Waste Disposal Costs

Costs for disposition of INL newly-generated RH TRU waste have not yet been defined. However, based on the added complexity of RH waste management versus CH waste management, RH TRU waste disposal is anticipated to cost at least 10X more than CH TRU waste. The ultimate packaging configuration and location for final certification efforts will directly impact the costs associated with RH TRU waste disposition. Because the EM Idaho Cleanup Project contract is a target scope, fixed price contract, the processing of INL newly-generated TRU waste through INTEC is treated as out-of-scope work. As such, INL would be required to fund both actual processing costs (i.e., materials) and facility infrastructure expenses. This structure is significantly different than that of AMWTP and could potentially increase the NE costs to disposition newly-generated TRU waste substantially.

LONG-TERM DISPOSAL OF IDAHO NATIONAL LABORATORY TRANSURANIC WASTE

The objective of evaluating activities associated with the disposition of INL newly-generated TRU wastes include:

1. Minimizing impacts to ongoing and future NE operations and programs

2. Minimizing (and ultimately eliminating) future liabilities associated with disposal of INL's TRU waste

3. Balancing the impacts to NE operations and programs with the requirements for disposition of INL TRU waste to WIPP, including programmatic considerations of the WIPP Program

4. Conducting activities in the most cost-effective and efficient manner considering the various constraints associated with the long-term INL mission.

A number of constraints including programmatic decisions, ongoing activities, and physical constraints impact the disposition of INL newly-generated TRU waste. These constraints are likely to drive different near- and long-term approaches to the management of INL newly-generated CH and RH TRU wastes. Of particular note are the following:

- ***EM Program plans for AMWTP and the Remote-Handled TRU Program at INTEC.*** The duration of activities associated with each program will directly influence the disposition of INL newly-generated TRU waste. The longevity of each of these programs is not well defined. INL will utilize each of these programs to the maximum extent practicable; however, following cessation of these EM program activities at the Idaho Site (assumed approximately Fiscal Year 2015), alternative disposition paths must be defined. To that end, NE must balance the required investment to disposition newly-generated TRU waste through these programs versus the return on investment (i.e., how long disposition path will be available for NE use).

  Also of consideration is the planned acquisition for the AMWTP. As described previously, INL has established a pathway through the current AMWTP contractor for newly-generated, CH TRU waste. The impact of a new contract award on this disposition path for INL newly-generated CH TRU waste is not known at this time.

- ***Availability of WIPP Mobile Shipping Unit.*** The availability of the WIPP mobile shipping unit to prepare INL newly-generated CH and RH TRU waste for final disposal following cessation of EM

TRU Program activities at Idaho Site is not known. The availability of one of the two existing units must be balanced against investment in certification capabilities at MFC considering the relatively low annual generation of CH and RH TRU waste.

- ***WIPP Capacity.*** The capacity and life-expectancy of WIPP to accept CH and RH TRU wastes will influence the disposition of INL newly-generated TRU waste.

- ***WIPP Priority for INL Waste Stream.*** Significant priority is currently being placed on legacy TRU waste from the Idaho Site, including INL legacy TRU waste. However, considering the relative small volume of INL-generated CH and RH TRU waste, the ability to establish necessary priority for waste stream approvals, shipping campaigns, etc. is not known. The ability to arrange shipping campaigns will directly impact required onsite storage capabilities as well as influence the management of INL newly-generated CH and RH TRU waste.

As identified previously, INL newly-generated CH and RH TRU waste volumes are relatively small in comparison to other legacy waste streams in the DOE Complex. Nonetheless, as part of the ongoing and future NE mission of the Laboratory both CH and RH TRU waste will be generated. The volume of waste generated is directly tied to the success of the INL NE mission, with increased waste volumes anticipated if perspective programs and projects develop. Establishing cost-effective and efficient disposition pathways for this waste is critical to the Department's mission at the Idaho Site and must be considered as the INL advances the national, economic, and energy security of the United States as the preeminent nuclear energy laboratory in the DOE Complex.

ACKNOWLEDGMENTS

Work supported by the U.S. Department of Energy, Office of Nuclear Energy, Science, and Technology under DOE Idaho Operations Office Contract DE-AC07-05ID14517.