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Acceptable Knowledge Summary Report for REMOTE-HANDLED DEPLETED URANIUM INGOTS FROM MATERIALS AND FUELS COMPLEX

Scott Smith

October 2020

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Idaho National Laboratory
Idaho Falls, Idaho 83415

http://www.inl.gov

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Central Characterization Program
Acceptable Knowledge Summary Report
For

REMOTE-HANDLED DEPLETED URANIUM INGOTS FROM MATERIALS AND FUELS COMPLEX AT THE IDAHO NATIONAL LABORATORY

Waste Stream:
ID-MFC-DU-INGOT

Revision 0

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APPROVED FOR USE

RECORD OF REVISION

Revision Number	Date Approved	Description of Revision
0	10/20/2020	Initial issue.

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LIST OF ACRONYMS AND ABBREVIATIONS

AFCI	Advanced Fuel Cycle Initiative
AK	Acceptable Knowledge
ANL-W	Argonne National Laboratory – West
BAPL	Bettis Atomic Power Laboratory
BC	blanket chopper
CCE	Chemical Compatibility Evaluation
CCP	Central Characterization Program
CFR	Code of Federal Regulations
CH	contact-handled
CF	casting furnace
CP	cathode processor
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DQO	data quality objective
DU	depleted uranium
EBR	Experimental Breeder Reactor
EPA	U.S. Environmental Protection Agency
ER	electrorefiner
FCF	Fuel Conditioning Facility
FDP	Fluorinel Dissolution Process
FFTF	Fast Flux Test Facility
FMF	Fuel Manufacturing Facility
HFEF	Hot Fuel Examination Facility
HWN	Hazardous Waste Number
HUP	high-throughput uranium product
ICP	Idaho Completion Project
ID	identification
IFR	Integral Fast Reactor
INL	Idaho National Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
ISC	Interim Storage Container
IWC	Inner Waste Container
IWTS	Integrated Waste Tracking System
L&O	Laboratory and Office
LANL	Los Alamos National Laboratory
LLNL	Lawrence Livermore National Laboratory
LMFBR	Liquid Metal Fast Breeder Reactor
LWA	*The Waste Isolation Pilot Plant Land Withdrawal Act*

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

m^3	cubic meters
MFC	Materials and Fuels Complex
MFP	mixed fission products
Mk-V	Mark-V
mrem/hr	millirem per hour
MSCF	Material Security and Consolidation Facility
MSDS	Material Safety Data Sheets
NNPP	Naval Nuclear Propulsion Program
nCi/g	nanocuries per gram
NWCF	New Waste Calcining Facility
NWPA	*Nuclear Waste Policy Act of 1982*
OWC	Outer Waste Container
PCB	polychlorinated biphenyl
PIE	post irradiation examinations
PVC	polyvinyl chloride
QA	quality assurance
QAO	quality assurance objective
RCRA	Resource Conservation and Recovery Act
rem/hr	rem per hour
RH	remote-handled
RH TRUCON	RH TRU Waste Content Code
RTR	real-time radiography
SDIO	Strategic Defense Initiative Organization
TREAT	Transient Reactor Test Facility
TRU	transuranic
VE	visual examination
WAC	Waste Acceptance Criteria
WGS	Waste Generator Services
WCPIP	*Remote-Handled TRU Waste Characterization Program Implementation Plan*
WIPP	Waste Isolation Pilot Plant
WIPP-WAC	*Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant*
WIPP-WAP	*Waste Isolation Pilot Plant Hazardous Waste Facility Permit*, *Waste Analysis Plan*
WMP	Waste Material Parameter
ZPPR	Zero Power Physics Reactor (originally named Zero Power Plutonium Reactor)

1.0 EXECUTIVE SUMMARY

This Acceptable Knowledge (AK) Summary Report has been prepared for the Central Characterization Program (CCP) for remote-handled (RH) transuranic (TRU) waste generated and managed by the Materials and Fuels Complex (MFC), formerly Argonne National Laboratory-West (ANL-W) and part of the Idaho National Laboratory (INL). The waste described in this report was historically generated in Building 765, the Fuel Conditioning Facility (FCF), formerly, Hot Fuel Examination Facility (HFEF)-South. The materials are stored at the Idaho Nuclear Technology and Engineering Center (INTEC) Material Security and Consolidation Facility (MSCF), CPP-651. This report was prepared in accordance with CCP-TP-005, *CCP Acceptable Knowledge Documentation* (Reference 1), to implement the AK requirements of DOE/WIPP-02-3214, *Remote-Handled TRU Waste Characterization Program Implementation Plan* (WCPIP) (Reference 2); *Waste Isolation Pilot Plant Hazardous Waste Facility Permit*, *Waste Analysis Plan* (WIPP-WAP) (Reference 3); and DOE/WIPP-02-3122, *Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant* (WIPP-WAC) (Reference 4).

The WIPP-WAP AK requirements are addressed in CCP-PO-001, *CCP Transuranic Waste Characterization Quality Assurance Project Plan* (Reference 5). The WIPP-WAC AK requirements are addressed in CCP-PO-002, *CCP Transuranic Waste Certification Plan* (Reference 6). Additionally, this report provides the AK information required by CCP-PO-505, *CCP Remote-Handled Transuranic Waste Authorized Methods for Payload Control (CCP RH-TRAMPAC)* (Reference 7).

The CCP is tasked with certification of TRU waste for transportation to and disposal at the Waste Isolation Pilot Plant (WIPP). This report was developed in accordance with CCP-TP-005 (Reference 1), which describes how AK is collected, reviewed, and managed by the CCP. The CCP is responsible for collection, review, and management of AK documentation in accordance with CCP-TP-005 and reviews and approves this AK Summary Report. CCP maintains responsibility for this AK Summary Report and all CCP-TP-005 generated forms and records as quality assurance (QA) records. In addition, CCP maintains a copy of the “historical source documents” as non-QA records.

Waste stream ID-MFC-DU-INGOT currently consists of 116 depleted uranium (DU) ingots generated from electrometallurgical refining of uranium blanket material in the MFC FCF, Building 765. The ingots are currently packaged in high-throughput uranium product (HUP) canisters, contained in 37 HFEF-5 canisters (approximately three HUPs to HFEF-5 canister. The blanket material was irradiated in the Experimental Breeder Reactor (EBR)-II and treated to separate and neutralize the bond sodium from the depleted uranium element, and recover the uranium. The ingots were generated as a product material from the process and following evaluation determined to be excess to U.S. Department of Energy (DOE) needs and disposed as RH-TRU waste. The waste will be repackaged into 55-gallon drums in INTEC Buildings CPP-651, CPP-666, and/or CPP-659.

This AK Summary Report, along with the referenced supporting documents, provides a defensible and auditable record of AK for the designated waste stream from the FCF electrorefining process. The references and AK source documents used to prepare this report are listed in Sections 8.0 and 9.0 respectively. The source documents cited throughout this report are identified by alphanumeric designations corresponding to a unique Source Document Tracking Number (e.g., AKA01, C001, CCE01, DR001, M001, P001, and U001).

This AK report includes information relating to the FCF history, mission, process operations, waste identification, characterization, and waste management practices. Information contained in this report was obtained from numerous sources, including facility safety basis documentation, historical document archives, generator and storage facility waste records and documents, and interviews with cognizant personnel.

This report and supporting source documentation provide the mandatory waste program and waste stream-specific information required by the WIPP-WAP (Reference 3). This report also compiles data relevant to applicable U.S. Environmental Protection Agency (EPA) requirements and presents the documentation necessary to satisfy each WCPIP data quality objective (DQO) and quality assurance objective (QAO) for RH-TRU waste stream ID-MFC-DU-INGOT (Reference 2).

2.0 WASTE STREAM IDENTIFICATION SUMMARY

Site Where TRU Waste Is Generated and Stored:

Generation Location:
Idaho National Laboratory
Materials and Fuels Complex
Fuel Conditioning Facility
Scoville, Idaho 83415

Storage Location:
Idaho Nuclear Technology and Engineering Center
Building CPP-651 Material Security and Consolidation Facility
EPA Identification (ID) No. ID4890008952

Characterization and Certification Location:
Idaho Nuclear Technology and Engineering Center
Buildings CPP-651, CPP-659, and CPP-666
EPA ID No. ID4890008952

Facility Where TRU Waste Was Generated:

This waste was generated from electrometallurgical processing of EBR-II DU blanket material conducted at the INL MFC Building 765, FCF hot cell facility. The waste is stored at INTEC MSCF, Building CPP-651. RH-TRU waste repackaging will be conducted in INTEC Building CPP-651, Building CPP-666, the Fluorinel Dissolution Process (FDP) and Fuel Storage Facility, and/or Building CPP-659, the New Waste Calcining Facility (NWCF).

Facility Mission:

The MFC mission is to lead the development of advanced, sustainable nuclear power systems, and is the primary center in the United States for testing and demonstrating nuclear energy technology and experiments. This work centers on the Liquid Metal Fast Breeder Reactor (LMFBR) program of the 1970s, the Integral Fast Reactor (IFR) program of the 1980s, with continued operation to the present under the Advanced Fuel Cycle Initiative (AFCI) program, as well as the Generation IV Nuclear Reactor Program and Space Nuclear Program initiatives.

The MFC EBR-II reactor was utilized for ongoing defense experiments conducted throughout the 30-year operating life (1964-1994). Even though the primary mission of DOE test and research reactors was focused on the development of commercial energy technology, the reactors had an underlying defense mission and ongoing defense research and development experiments were conducted in these facilities. In addition to supporting the LMFBR Program, numerous experiments were conducted for defense applications, including support of the Bettis Atomic Power Laboratory (BAPL) dedicated to supporting the Naval Nuclear Propulsion Program (NNPP), Los Alamos National Laboratory (LANL) and Lawrence Livermore National Laboratory (LLNL) related to weapons plutonium, and the Centaurus program for the Strategic Defense Initiative Organization (SDIO) or “Star Wars” program.

FCF was activated in 1963 with the original mission of demonstrating a fuel reprocessing and prefabrication facility for EBR-II. By the late 1960s, the mission changed to provide the Breeder Reactor Program with a centralized remote-examination complex in support of EBR-II experimental irradiation program, the Transient Reactor Test Facility (TREAT) and Fast Flux Test Facility (FFTF) programs, and other programs designated by the DOE. Beginning in the 1990s the EBR-II Spent Nuclear Fuel Treatment Demonstration Project was conducted to evaluate electrometallurgical treatment of DOE spent fuel. EBR-II irradiated metallic blanket material was processed in FCF producing the DU ingots in waste stream ID-MFC-DU-INGOT.

Summary Category Group: S5000 – Debris Waste

Waste Matrix Code Group: Uncategorized Metals

Waste Matrix Code: S5110

RH-TRU Waste Content Code (RH-TRUCON): ID321, ID322, and ID325

Waste Stream Description:

Waste stream ID-MFC-DU-INGOT contains DU ingots generated in the FCF hot cell facilities in support of electrometallurgical processing of EBR-II irradiated DU blanket material. The only materials included in the HFEF-5 canisters are the HUPs containing the DU ingots. Other debris waste items may be added at the time of repackaging at INTEC. The original canisters are not the final waste package and they will be repackaged into 55-gallon drums (refer to Section 5.4.1).

Following repackaging waste stream ID-MFC-DU-INGOT consists predominantly of inorganic debris waste and contains the following materials:

Other Inorganic Materials items include Grafoil (graphite gaskets from HUPs).

Iron-based Metal/Alloys items include HUPs, and drum cribbing. Metal debris items are primarily composed of, or contaminated with, carbon steel, and stainless-steel.

Aluminum-based Metal/Alloys items may include: aluminum cribbing used in the final packaging configuration.

Other Metal/Alloys items include DU ingots.

The waste consists of DU ingots contaminated with mixed fission products (MFP). A discussion relating to the radiological characterization of this waste stream is provided in Section 5.4.2.

The waste stream was determined not to contain Resource Conservation and Recovery Act (RCRA)-related constituents and is not assigned EPA hazardous waste numbers (HWNs) (refer to Section 5.4.3).

No potential prohibited items are identified for waste stream ID-MFC-DU-INGOT. The material was originally generated and managed as product material and includes only the DU ingots and packaging (refer to Section 5.4.5).

The original canister packaging configuration consists of HFEF-5 cans. The HFEF-5 cans consist of two concentric cylindrical canisters. The DU ingots, contained in HUPs, were placed in the inner carbon steel canister or inner waste container (IWC), which was then placed inside the outer stainless-steel canister or outer waste container (OWC). An 8-inch steel plug was placed on top of the inner canister and then the lid of the outer canister was welded or locked shut.

The original waste containers are repackaged prior to shipment to WIPP. The HUPs from the cans are removed and placed unopened into a prepared - U.S. Department of Transportation (DOT) 7A, Type A 55-gallon steel drum. The drum is prepared with carbon steel and aluminum cribbing designed to securely hold up to two HUPs. The standard 55-gallon steel drum is constructed of 16-gauge materials and has a removable head with a drum head gasket. The 55-gallon drums include a NucFil-certified carbon composite filter. The 55-gallon drum may be loaded into the removable lid canister using a 55-gallon drum lifting bag. The drum lifting bag will remain in the canister with the drum. Up to three drums will be loaded into the removable lid canister (refer to Section 5.5).

Waste stream ID-MFC-DU-INGOT meets the WIPP-WAP and the WCPIP waste stream definitions. The waste is similar in material, physical form, hazardous constituents, and radiological properties (DU ingots) and generated from a single process or activity (electrometallurgical processing of EBR-II blanket material).

3.0 ACCEPTABLE KNOWLEDGE DATA AND INFORMATION

TRU waste destined for disposal at the WIPP must be characterized prior to shipment. Development of knowledge of the waste materials and processes that generate and control the waste is required to provide a clear and convincing argument about the characteristics of each waste stream. The AK characterization documented herein complies with the requirements of the WIPP-WAP (Reference 3) and the WCPIP (Reference 2) and was developed in accordance with CCP-PO-001 (Reference 5), and CCP-TP-005 (Reference 1). The WCPIP identifies waste characterization requirements and methods to satisfy requirements in:

- 40 Code of Federal Regulations (CFR) Part 191, *Environmental Radiation Protection Standards For Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes* (Reference 8)
- 40 CFR Part 194, *Criteria for the Certification and Re-Certification of the Waste Isolation Pilot Plant's Compliance with the 40 CFR Part 191 Disposal Regulations* (Reference 9)
- *Criteria for the Certification and Re-Certification of the Waste Isolation Pilot Plant's Compliance with the 40 CFR Part 191 Disposal Regulations: Certification Decision* (Reference 10)
- Public Law 102-579, *The Waste Isolation Pilot Plant Land Withdrawal Act* (LWA) (Reference 11)

This report presents information obtained from review of more than 80 AK sources relating to the INL, MFC, FCF, INTEC, and Analytical Laboratory history, process operations, and waste management practices. Examples of source documents include facility safety basis documentation, historical document archives, process work sheets, procedures for waste generation activities, interviews with cognizant MFC personnel, results of waste characterization programs, waste container information, and site mission descriptions identifying defense and non-defense operations.

The references and AK sources used to prepare this report are listed in Sections 8.0 and 9.0, respectively. The AK sources referenced within this report by alphanumeric designations (e.g., AKA01, C001, CCE01, DR001, M001, P001, and U001) correspond to the Source Document Tracking Number using the following convention:

- AKA – Acceptable Knowledge Assessment
- C – Correspondence (i.e., memoranda, letters, e-mail, interviews)
- CCE- Chemical Compatibility Evaluation
- DR – AK Discrepancy Resolution
- M - Miscellaneous
- P – Published Documents (i.e., reports, controlled procedures)
- U – Unpublished Data (i.e., databases, analytical data, draft reports)

4.0 REQUIRED PROGRAM INFORMATION

This section presents the mandatory TRU waste program information required by the WIPP-WAP and the WCPIP for waste stream ID-MFC-DU-INGOT (References 2 and 3). This section provides a description of the facility and operations associated with the generation and repackaging of DU ingot waste. Included are descriptions of the MFC FCF, INTEC, and Laboratory and Office (L&O) buildings and operations, summary of the mission, defense determination, and descriptions of operations associated with the generation of the waste stream.

4.1 Facility Location

4.1.1 INL

The INL encompasses approximately 2,300 square kilometers on the Eastern Snake River Plain in Southeastern Idaho (References P051 and P089). Located approximately 34 miles west of Idaho Falls, Idaho, the INL was established in 1949 as a site where the DOE could safely build, test, and operate various types of nuclear facilities (References P042 and P051). The INL has also served as a storage facility for TRU, low-level, and high-level waste since 1952 (References P051 and P102). Strict security is maintained for all INL facilities in accordance with the INL's nuclear and defense missions (Reference P051). At present, the INL supports the engineering and operations efforts of DOE and other federal agencies in areas of nuclear safety research, reactor development, reactor operations and training, nuclear defense materials production, waste management technology development, and energy technology and conservation programs (References P042, P049, P051, and P102).

4.1.2 MFC

The MFC (formerly ANL-W) encompasses an area on the southeastern portion of the INL reservation about three miles north of U.S. Highway 20 and approximately 35 miles west of Idaho Falls, Idaho. The MFC includes several facilities for processing, examining, characterizing, and analyzing radioactive materials. The seven major facilities that comprise the MFC site and their operational status are listed as follows (References P001, P042, P049, P051, P141, P145, P4053, and U025):

- EBR-II (1961 – 1994)
- TREAT (1959 – presently in standby)
- Zero Power Physics Reactor (ZPPR) (1969 – dismantled in 2009), originally named Zero Power Plutonium Reactor
- HFEF (1972 – present), originally named HFEF-North
- FCF (1964 – present), originally named Fuel Cycle Facility, then HFEF-South

- Fuel Manufacturing Facility (FMF) (1986 – currently operating)

- L&O Building (1962 – currently operating)

The DU ingots described in this report were generated from electrorefining EBR-II irradiated DU blanket material in the FCF, Building 765 (References P5002, P5003, and U5000). The ingots are stored in the INTEC MSCF (Building CPP-651) (References C5000, P5003, and U5007). The ingots were sampled upon casting, and the samples analyzied in the L&O Building Analytical Laboratory, Building 752 (References P001, P042, P4024, and P5001). The ingots will be repackaged at INTEC into WIPP compliant containers (References P5003, U5000, and U5007).

4.1.3 INTEC

INTEC is located in the southcentral portion of the INL, three miles north of the Central Facilities Area (References P089 and P102). The original mission of INTEC was to reprocess government-owned spent nuclear fuel from research and defense-related reactors. Reprocessing of nuclear fuel is no longer occurring at INTEC. Current activities involve nuclear fuel storage and radioactive liquid waste processing and storage (Reference P5015). The DU ingots are currently stored in the MSCF (Building CPP-651), and may be repackaged in this same facility. However, if repackaging is conducted at the Idaho Completion Project (ICP) INTEC facilities (operated by Fluor Idaho), the RH-TRU waste canisters will be stored in modified Interim Storage Containers (ISCs) in CPP-1617, the Radioactive Mixed Waste Storage Facility. The canisters are opened and waste repackaging operations are conducted in CPP-651; the FDP Cell in Building CPP-666, and the Steam Spray Booth and Decon Cell, Cell 308 in Building CPP-659 (References P089, P102, P115, P993, P4123, P4126, and U5007). The resulting drums may be stored in ISCs pending final characterization, certification, and transportation activities. CPP-651 is located on the west side; CPP-659 is located in the northeast quadrant; and the CPP-666 is located in the center of the INTEC facility (References P100, P101, P102, P103, P4122, and P5015).

Maps showing the location of the INL, MFC, and INTEC facilities are provided in Figure 1, Location of the INL and INL Facilities, and Figure 2, Map of the Materials and Fuels Complex (Formerly ANL-W). A map of the INTEC facilities is maintained in the AK record (References C5000, P049, P077, P100, P102, P103, and P5015).

4.2 Facility Description

The MFC has been serving the INL and the DOE complex for more than 50 years. The site was established in 1958 with the construction of the TREAT facility. The MFC includes several facilities for processing, examining, characterizing, and analyzing radioactive materials. The waste in this waste stream was generated from processing EBR-II blanket material in the FCF. Samples of the DU ingots produced from processing the material were analyzed in the Analytical Laboratory located in the L&O

Building (References P5002, P5003, U5000, U5002, U5004, and U5007). DU ingots are stored in the INTEC MSCF pending repackaging for characterization and shipment to WIPP (References C5000, P5003, and U5007). MSCF supports the current DOE mission by serving as a safe and secure facility for the storage of spent fuel treatment product (SFTP) and unirradiated uranium (metals and oxides) (Reference P5015).

4.2.1 EBR-II

The EBR-II was designed to demonstrate a complete operational breeder reactor power plant with onsite reprocessing of metallic fuel; demonstrations were successfully carried out from 1964 to 1969. EBR-II achieved initial criticality on September 30, 1961 (i.e., without sodium), and "wet" criticality (i.e., with the core submerged in liquid sodium coolant) on November 11, 1963. EBR-II went to power (12 megawatt electric) on August 13, 1964. The EBR-II facility had: 1) a sodium-cooled reactor with a maximum thermal power rating of 62.5 megawatt, 2) an intermediate closed loop of secondary sodium, and 3) a steam plant that produced 20 megawatt (gross) or 16.5 megawatt (net) electrical power through a conventional turbine generator (References P042, P049, P071, P073, P145, and U025).

From 1969, the emphasis at EBR-II shifted to an irradiation facility that tested fuels and materials for future, larger, liquid metal cooled reactors. The EBR-II facility also provided electrical power for ANL-W and INL sites. EBR-II was officially shut down on September 30, 1994. Since then, EBR-II has been prepared for decontamination and decommissioning. During its lifetime (August 1, 1964, until September 30, 1994), EBR-II generated 366,780 megawatt-day of thermal energy (References P042, P049, P071, P073, and P145).

4.2.2 FCF

This facility first became operational in 1963 as the Fuel Cycle Facility, then renamed HFEF-South in 1972 when HFEF-North was built. The facility demonstrated pyrometallurgical reprocessing of EBR-II fuel during its first few years of operation. A remotely-operated production line was used to reprocess spent EBR-II fuel and return it to the reactor. That mission was discontinued after successful demonstration of the process. In the late 1960s, the facility was stripped of fuel-reprocessing equipment and refitted for examination of EBR-II irradiation experiments in support of the fast reactor program. In 1996, HFEF-South was renamed FCF (References P047, P049, P051, P146, P187, and U025).

From 1969 to 1976, the FCF was used to examine irradiated fuels and material experiments from EBR-II and TREAT, and to provide other reactor support services (e.g., transfer of spent fuel to the INTEC). The FCF consists of two hot cells, one with an air atmosphere and the other with an inert argon gas atmosphere. A layout of the facilities is included as Figure 3, FCF Operating Floor Layout. A total of 23 hot cell workstations surround the outer perimeter of the FCF hot cells. HFEF was activated in

1975 and soon thereafter took over the bulk of the examination activities. The FCF continued conducting some examinations, including processing and packaging spent EBR-II driver fuel for shipment to INTEC for reprocessing. The air cell was refurbished in 1976-1977 and returned to service for these operations. The argon cell was shut down in 1977 for decontamination and refurbishment, and was completed in 1981. The FCF is currently operational (References P042, P047, P049, P060, P063, P146, P187, and U025).

4.2.3 L&O Building

The L&O Building was designed and built in the late 1950s and was operational in the early 1960s. Facilities in the building include the Analytical Laboratory, composed of hot cells, chemistry labs, analytical gloveboxes, the Casting Laboratory, and the Non-Destructive Assay Laboratory. One activity of the Analytical Laboratory is the performance of chemical analyses and experiments on analytical samples of highly irradiated nuclear fuels and materials. The safe and efficient performance of this activity requires this work to be carried out in the Analytical Laboratory hot cells (References C002, P001, P018, P036, P042, P049, P055, P067, P086, and U190). The DU ingots were sampled upon casting, and the samples analyzied in the L&O Building Analytical Laboratory (References P001, P042, P4024, P4025, and P5001).

4.3 Facility Mission

The MFC mission is to lead the development of advanced, sustainable nuclear power systems, and is the primary center in the United States for testing and demonstrating nuclear energy technology and experiments. This mission emphasizes technologies associated with nuclear fuel, including advanced methods for fuel reprocessing, improving fuel efficiency, testing fuel performance, technologies for characterizing nuclear material and restoring the environment, and technologies and processes requiring remote handling of nuclear fuel. This work centers on the LMFBR program of the 1970s, the IFR program of the 1980s, with continued operation to the present under the AFCI program, as well as the Generation IV Nuclear Reactor Program and Space Nuclear Program initiatives. The MFC capabilities encompass the entire nuclear fuel cycle and include nuclear fuel development, spent fuel disposition technology development, liquid metal technology, post-irradiation examinations (PIE), waste and nuclear material characterization, nuclear waste stabilization development, and development of dry, interim storage for spent fuel and other highly-radioactive materials. MFC has a unique suite of nuclear, radiological, and industrial facilities, and operations support organizations that support these activities. These facilities are among the most active and modern of their respective types within the DOE complex. They receive materials from a variety of programs, both defense and civilian, across the complex (References C004, P036, P042, P049, P071, P144, P145, P186, and P187).

FCF was activated in 1963 with the original mission of demonstrating a fuel reprocessing and refabrication facility for EBR-II. This demonstration was successfully carried out through 1964-1968. By the late 1960s, the mission changed in conjunction with the EBR-II mission change, to provide the Breeder Reactor Program with a centralized remote-examination complex in support of EBR-II experimental irradiation program, the TREAT and FFTF programs, and other programs designated by DOE (References P001, P047, P146, and P187). Beginning in the 1990s the EBR-II Spent Nuclear Fuel Treatment Demonstration Project was conducted to evaluate electrometallurgical treatment of DOE spent fuel. EBR-II irradiated metallic blanket material was processed in FCF producing the DU ingots in waste stream ID-MFC-DU-INGOT (References P4024, P4025, P5001, P5002, P5003, and U5000).

4.4 Defense Waste Assessment

The WIPP requires generator sites to use AK to determine that TRU waste streams to be disposed of at the WIPP meet the definition of TRU defense waste. TRU waste is eligible for disposal at the WIPP if it has been generated in whole or part by one of the atomic energy defense activities listed in Section 10101(3) of the *Nuclear Waste Policy Act of 1982* (NWPA) (Reference 12). Based on the review of AK, there is sufficient evidence to demonstrate that TRU wastes generated by MFC FCF electrometallurgical refining operations are contaminated with materials from atomic energy defense activities associated with naval reactors development, defense nuclear materials productions, defense nuclear waste and materials by-products management, and defense research and development activities (References P001, P146, and P187).

EBR-II supported ongoing defense experiments conducted throughout the 30-year operating life of the reactor (1964-1994). In 1968-1969, the reactor was converted to a fast-reactor irradiation test facility. Test fuels and materials were placed in the core assemblies identical to those holding the driver fuel assemblies. The objectives of the LMFBR program include testing of alloy fuel materials; demonstrating transmutation of a variety of actinide materials as reactor fuel; developing more efficient and environmentally sound fuels; and enhancing nuclear non-proliferation. In addition to supporting the LMFBR Program, numerous experiments were conducted for defense applications, including support of the BAPL dedicated to supporting the NNPP. Other defense program experiments conducted at EBR-II included radiation of thermionic elements and tritium production test materials. During its final year, experiments included a cooperative effort between LANL and LLNL to demonstrate disposition of weapons plutonium in a fast reactor (References P001, P071, P145, and P146).

The EBR-II and TREAT reactors also supported the Centaurus program in the 1980s for the SDIO. The SDIO (better known as the “Star Wars” program) was established to pursue technology in the development of a viable and comprehensive ballistic missile defense program. Even though the primary mission of the DOE test and research reactors was focused on the development of commercial energy technology, the reactors had an underlying defense mission and ongoing defense research and development experiments were conducted in these facilities (References C265 and P001).

Waste stream ID-MFC-DU-INGOT was generated from FCF electrometallurgical refining operations. The EBR-II blanket material processed to produce the DU ingots were utilized in the EBR-II core during irradiation of both civilian reactor program and defense program experiments as described above over the 30-year operating life of the reactor (References P001, P071, P145, P146, P187, and U5003). Many of the blanket material assemblies resided in-core for the entire reactor operating history (References P4025 and P5000). Thirty nine EBR-II experiments have been positively identified as defense experiments, and another 20 have been identified as possibly being defense related (References P001 and P5003). Defense program irradiated experiments include the LMFBR Program, NNPP (BAPL), SDIO, as well as experiments for LANL and LLNL. These programs and experiments are atomic energy defense activities associated with naval reactors development, defense nuclear materials productions, defense nuclear waste and materials by-products management, and defense research and development activities (References P001, P071, P145, P146, P187, P4025, P5000, and P5003).

4.5 High-Level Waste and Spent Nuclear Fuel Assessment

The WIPP LWA (Reference 11) prohibits the disposal of spent nuclear fuel and high-level waste as defined by the NWPA (Reference 12) at the WIPP. According to the NWPA, spent nuclear fuel is “fuel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated by reprocessing.” DOE M 435.1-1, *Radioactive Waste Management Manual* (Reference 13), expands on this definition to clarify that “Test specimens of fissionable material irradiated for research and development only, and not production of power or plutonium, may be classified as waste, and managed in accordance with the requirements of this Order when it is technically infeasible, cost prohibitive, or would increase worker exposure to separate the remaining test specimens from other contaminated material.” High-level waste is defined by the NWPA as “the highly radioactive material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations, and other highly radioactive material that the Commission, consistent with existing law, determines by rule requires permanent isolation.” Waste stream ID-MFC-DU-INGOT consists of DU ingots generated from electrometallurgical refining of EBR-II blanket material. While the generating operations involved the processing of spent nuclear fuel, the DU ingots were generated as a “product” material from the process (References P001, P5000, P5001, P5002, P5003, and U5000). However, after further evaluation, the DU ingots were found to be excess to national needs and disposed as TRU waste based on the plutionium ingrowth determined from ingot samples (References P5003, U5000, and U5004). Therefore, the waste is not a spent nuclear fuel, not high-level waste, nor a waste historically managed as high-level waste, and is eligible for disposal at the WIPP as RH-TRU waste.

4.6 TRU Waste Management

The elements of RH-TRU waste management discussed in this section include descriptions of the MFC, FCF, and INTEC facilities operations; and waste identification, segregation, and characterization, as well as organizational and administrative controls that are in place to ensure proper management of RH-TRU waste at INTEC. It should be noted, as the material in waste stream ID-MFC-DU-INGOT has recently been declared waste, it was generated in FCF as a product material and will be repackaged at INTEC as waste (References P5003, U5000, and U5007). MFC waste management criteria are included in this discussion for completeness.

Waste Acceptance Criteria (WAC) have been implemented for the INL since the 1970s requiring some level of waste generator documentation and certification. These requirements have been modified to incorporate DOE/WIPP-02-3122 (Reference 4), requirements as they have been developed for the disposal of TRU waste. TRU waste was defined as radioactive waste contaminated with alpha-emitting TRU radionuclides with half-lives greater than 20 years in concentrations greater than 10 nanocuries per gram (nCi/g). The concentration threshold limit was increased to100 nCi/g in the early

1980s. RH is defined as waste materials packaged so the dose rate at the surface of the waste package is 200 millirem per hour (mrem/hr) or greater and is acceptable at the WIPP if less than 1,000 rem per hour (rem/hr). Items prohibited from receipt and storage include pressurized containers, pyrophoric materials, liquid metals, low pH immobilized acidic waste, explosives, high-level fuel assemblies or first stage raffinates, flammable liquids or solids, and free liquids. Dry powders, ashes, and similar particulate are not accepted unless they are immobilized (References C096, P035, P037, P060, P063, and P091).

Waste program documentation developed by MFC includes: the *TRU-RH Waste Handling Plan for Waste Management Operations*; the *Waste Preparation Procedure for Analytical Laboratory Waste Disposal*; and the *ANL-West Remote-Handled Transuranic Waste Certification Plan*. These documents describe the implementation of the INL WAC including the development of waste stream information, including content code; waste description; generating process; physical, chemical, and radiological compositions; and waste packaging (References C021, C129, P060, P088, P259, and P262).

Wastes generated in the FCF are segregated as TRU and Low-Level Waste and by handling type at the point of generation based on the nature of the material, time in the hot cells, and/or the measured dose rates. Out-of-cell waste is managed as contact-handled (CH). In-cell waste generated from processing or handling non-irradiated materials is managed as CH unless the waste package dose rate exceeds specified limits. Waste generated from processing or handling irradiated materials is managed as RH. RH is segregated as sodium and sodium free waste. Sodium free waste is material where the sodium had been removed or reacted while sodium waste is material contaminated with or containing elemental sodium or NaK (References P256, P259, P260, P262, P263, and P266).

RH-TRU waste items, including materials collected in small plastic bags or small metal cans, are collected in 24-inch tall by 8-inch diameter or 32-inch tall by 9-inch diameter waste receptacles or “convenience cans.” These cans are equipped with slip on caps and staged at or near individual work stations in the FCF Argon and Air Cells. Waste from the convenience cans is packaged into the inner canister of HFEF-5 cans which consist of two concentric cylindrical canisters. The inner HFEF-5 canisters or IWCs are staged in loading pits or storage stands in the FCF cells. When the convenience cans are full, they are capped and staged at the work station until an IWC is available, or transferred to the IWC loading station and the contents emptied. Occasionally, the waste receptacles, without lid, are also discarded. The inner HFEF-5 can is then transferred and/or packaged into the outer HFEF-5 can or OWC from the FCF air cell (References P256, P266, and P4102).

Waste container log sheets are completed during packaging, containing item number, date, description, waste origin, nuclear material (grams), and analyst initials. However, since the ingots were generated as a product, this documentation was not compiled. The ingots were each placed in a HUP, with up to three HUPs placed in an HFEF-5

IWC (References P5003, U5000, and U5007). See Figure 4, HUP Assembly, and Figure 5, Inner and Outer Waste Canister Assembly, to view the original packaging configuration for the waste stream (Reference U5000). The canisters in the waste stream are stored at the INTEC MSCFpending repackaging and characterization for WIPP (References P5003, U5000, and U5007).

INL Waste Generator Services (WGS) waste specialists work with INL waste generators to identify and package wastes to meet the appropriate WAC. WGS manages the certification, storage, treatment, and disposal of waste generated by the ICP at the INL Site in accordance with MCP-1390, *Waste Generator Services Waste Management* (Reference P4140). WGS personnel use this procedure for the management of TRU wastes in coordination with WGS management and applicable departments to ensure that requirements and acceptance criteria, specific to the waste type managed, are adequately considered. This document mandates the input of container and waste stream-specific information into the Integrated Waste Management System (IWTS) for the formulation of container and material profiles. Waste generator data is entered into the INL IWTS database. The IWTS Material Profiles and IWTS Container Profiles are compiled from waste packaging logs, process knowledge, and assay information based on material balance, smear analysis, and/or destructive or non-destructive assay data (Reference P4140).

Waste handling and repackaging procedures for Batelle Energy Alliance (BEA) managed facilities at INTEC are to be developed and descriptions thereof will be incorporated into this document in the future as necessary.

When HFEF-5 canisters are transferred to INTEC ICP/FluorIdaho facilities as RH-TRU waste, it is stored in CPP-1617, Radioactive Mixed Waste Storage Facility. Waste handling in this facility is conducted in accordance with TPR-7318, *CPP-1617 Waste Handling and Operations* (Reference P101). This document includes compatibility information and steps for receiving different types of waste. The IWTS is verified prior to container receipt and is updated after receipt and when containers are moved to approved storage locations (References P101 and P4140).

The *RH TRU Container Repackaging Datasheet (General)* (FRM-880G) is completed during ICP/FluorIdaho INTEC repackaging operations for each original waste container as well as for subsequent repackaging of daughter containers (References P115, P4123, and U5005). This form is used to document the absence of prohibited items, and describes the final packaging configuration of the waste. The repackaging operations are conducted in CPP-659 according to TPR-7298, *Decontamination Cell Operations in CPP-659* (Reference P115). Repackaging operations are conducted in CPP-666 according to TPR-7857, *HFEF Repackaging at the FDPA* (Reference P4123). Procedure TPR-7631, *RH TRU – Container Handling* (specifies container handling for Building CPP-659) (Reference P101) is a general waste management procedure that is also maintained in the AK record as a companion to TPR-7298.

The procedures specify completion of the FRM-880G to document the repackaging evolutions. The FRM-880G documents the absence of prohibited items including pressured containers such as aerosol cans, sealed containers greater than 4-liters, impenetrable items, liquids, and includes instructions for the remediation of these items or conditions. Immobilization of liquids is conducted with Nochar N965 (References P115, P4123, and U5005).

4.6.1 Types and Quantity of TRU Waste Generated

Waste stream ID-MFC-DU-INGOT is characterized under the RCRA as non-hazardous waste. The ingots were generated from processing irradiated depleted uranium, contain plutonium from ingrowth based on sampling data, and are handled as RH-TRU (References P5003, U5000, and U5007). The physical, radiological, and chemical characteristics of this waste are presented in Section 5.4.

This stream currently consists of 116 DU ingots. The ingots are packaged in 4.7-liter HUPs, typically one DU ingot per HUP; however, some HUPs contain more than one ingot. Up to three HUPs may be packaged in an HFEF-5 canister (References P5003, U5000, U5007, and U5008). The specific containers that have been evaluated and included in this waste stream are provided in the AK Containers List (refer to Section 7.0).

4.6.2 Correlation of Waste Streams Generated from the Same Building and Process

The container-specific information has been reviewed for each container to verify the composition and origin of the waste stream inventory. Every container in waste stream ID-MFC-DU-INGOT contains DU ingots generated from FCF electrometallurgical operations (References P5003, U5000, U5001, U5007, and U5008).

Debris waste generated incidental to the electometallurgical operations conducted in FCF are included in waste stream ID-HFEF-S5400-RH described in CCP-AK-INL-580, *Central Characterization Program Acceptable Knowledge Summary Report For Remote-Handled Transuranic Debris Waste From Materials and Fuels Complex Hot Fuel Examination Facility At The Idaho National Laboratory, Waste Stream: ID-HFEF-S5400-RH* (Reference 14). Both waste streams were generated from processing uranium blanket material in the FCF hot cell; however, the canisters in waste stream ID-MFC-DU-INGOT contain only the DU ingots from the process. Waste stream ID-HFEF-S5400-RH includes a variety of waste materials from FCF including items from other hot cell operations (References 14, P4024, P5001, P5002, P5003, and U5000).

Waste stream ID-MFC-DU-INGOT is new and not yet included in the DOE/TRU-19-3425, *Annual Transuranic Waste Inventory Report – 2019* (Reference 15).

4.6.3 Waste Stream Identification, Categorization, and Delineation

The WIPP-WAP defines a waste stream as waste materials that have common physical form, that contain similar hazardous constituents, and that are generated from a single process or activity. The WCPIP definition also includes that the materials in a waste stream must have similar radiological properties (References 2 and 3). The container specific information has been reviewed for each container to verify the composition and origin of the waste stream inventory. The canisters in waste stream ID-MFC-DU-INGOT contain DU ingots generated from FCF electrometurligical processing of EBR-II irradiated DU blanket material (References P5003, U5000, and U5001).

4.7 Description of Waste Generating Process

The DU ingots were generated in the FCF hot cell facilities from electrometallurgical processing of EBR-II irradiated DU blanket material. A process flow diagram is presented in Figure 6, Blanket Treatment Material Flow (References P4024, P4025, and P5001). The ingots will be repackaged at INTEC in the MSCF, Building CPP-651; NWCF, Building CPP-659; or the FDP and Fuel Storage Facility, Building CPP-666. No process flow diagrams are provided for these facilities because the TRU waste generating processes are not a linear progression of activities (References P101, P115, and P4123).

4.7.1 FCF Operations

The FCF consists primarily of adjoining argon and air atmosphere cells surrounded by an operating corridor and auxiliary laboratories. A shielded out-of-cell area for utility and service equipment is located below the argon cell, and a service area and a repair area for contaminated equipment are located below the operating area. A passageway between the EBR-II reactor building and FCF provides access for transferring fuel subassemblies in shielded casks (References P047, P060, P063, P146, P187, and P286).

The air cell has window work stations, some equipped with manipulators. In addition, overhead-handling equipment consists of a 5-ton bridge crane and two bridge mounted electromechanical manipulators. The cell provides a radiation-shielded area with an air atmosphere in which the following operations can be performed (References C4118, P047, P146, P187, P225, P227, P253, P257, P258, and U4033):

- Loading and unloading of casks
- Disassembly of EBR-II subassemblies
- Storage of up to 36 EBR-II subassemblies with forced air cooling

The air cell also serves as a terminal for the transfer locks into the argon cell, a transfer route for equipment and materials to and from the argon cell, and the facility for packaging waste from both the argon and air cells (References P146, P187, P254, and P255).

The primary purpose of the argon cell is to provide a radiation-shielded area where unclad fuel and sodium can be safely handled in an inert atmosphere of argon gas. Although approximately doughnut-shaped, the argon cell actually has the outline of a 16-sided regular polygon. In the early 1980s fourteen sides were provided with shielding windows, one side adjoined the air cell, and one side was blank. Some of these workstations were equipped with manipulators. Currently, fifteen sides are provided with shielding windows and one side adjoins the air cell. All of these workstations are now equipped with manipulators. At the center of the argon cell is an operating area, also in the shape of a 16-sided regular polygon. Originally provided with eight windows (one in every other face), the center operating area now has four. The other four window penetrations could be activated by replacing the window tank section from the operating side of the window. The cell is equipped with two 5-ton overhead cranes and four electromechanical manipulators (References P047, P146, and P187).

Currently, the Argon Cell contains an electrochemical process for treating sodium-bonded spent nuclear fuel. The electrometallurgical treatment process consists of several distinct steps: chopping the fuel elements, electrorefining the fuel, removing entrained salt from uranium electrodeposits and consolidating dendritic deposits in a cathode processor, casting separately into ingots the uranium metal from the cathode and the metal residue from the anode, and, finally, mixing, heating, and pressing the salt electrolyte with zeolite to form a ceramic waste (References P4024, P4025, and P5001). This process is different for driver fuel and blanket material. Processing of driver fuel produces an enriched uranium product, while processing of blanket material produces a DU product (References P4024, P4025, P5001, P5002, P5003, and U5000).

This description of the process is specifically for the blanket material. The spent blanket material is transferred from the Air Cell and mechanically chopped into small segments in the blanket chopper (BC) (References P4024, P4025, P4113, P5001, and P5002). The BC is a pneumatic punch press modified with blades for shearing blanket elements into segments for loading into stainless-steel baskets forming the anode of the electrorefiner (References P4024, P4025, P4106, P4113, P5001, P5002, and P5008). The blanket segments are then electrorefined in molten lithium chloride and potassium chloride salts in the Mark-V (Mk-V) electrorefiner (ER). The metal blanket material ionizes in the reaction producing DU cathodes, hulls (in the anode basket), and spent salt (References P4024, P4025, P5001, P5002, and P5008). The spent salt and anodes from the ER are processed separately, not included in the waste stream, and are therefore not discussed further. Third, the DU cathodes from the ER contain approximately 20 percent salt. The salt is distilled by heating the cathode in the cathode processor (CP) producing a DU uranium ingot (References P4024, P4025, P4107, P5001, and P5002). Fourth, the DU ingot is then heated in the casting furnace (CF) to produce an ingot and corresponding sample (References P4024, P4025, P4105, P4111, P5001, and P5002). Some of the DU ingots produced in the CP were not recast in the CF and these were drill sampled for characterization (References P4024 and U5007). The DU ingots were placed in HUPs for storage, and the HUPs packaged in HFEF-5 cans (References P5003, U5000, and U5007).

4.7.2 Waste Repackaging

RH-TRU waste repackaging will be performed at INTEC in either the MSCF, Buiding CPP-651; Cell 308 in Building CPP-659; or in the FDP Cell in Building CPP-666. As the DU ingots were produced as product material, rather than waste, and the HUPs do not contain any matrials other than the DU ingots, the HUPs are removed from the HFEF-5 canisters and canister liners, and packaged directly into prepared 55-gallon drums. Each drum is equipped with cribbing to securely contain and transport up to two HUPs (References P101, P115, P4123, U5005, U5007, U5008, and U5010).

4.8 Waste Certification Procedures

In the CCP under which the subject waste stream is certified for shipment to WIPP, CCP-TP-005 (Reference 1) directs compilation of AK. CCP certifies TRU waste under the program described in CCP-PO-002 (Reference 6).

5.0 REQUIRED WASTE STREAM INFORMATION:

This section presents the mandatory TRU waste stream specific information required by the WIPP-WAP and the WCPIP for waste stream ID-MFC-DU-INGOT (References 2 and 3). The area of generation, waste stream volume, period of generation, prohibited items, waste packaging, and the physical, chemical, and radiological composition of the waste stream are described.

5.1 Area and Building of Generation

Waste stream ID-MFC-DU-INGOT consists of DU ingots generated in the FCF hot cell facilities from electrometallurgical processing of EBR-II DU blanket material. Every canister in the waste stream is repackaged in INTEC Building 651, the MSCF, Building CPP-659, the NWCF, or Building CPP-666, the FDP and Fuel Storage Facility. It has been determined that every container included in waste stream ID-MFC-DU-INGOT meets the WCPIP and WIPP-WAP waste stream definitions (References P5003, U5000, U5001, and U5005).

5.2 Waste Stream Volume and Period of Generation

Waste stream ID-MFC-DU-INGOT consists of 116 DU ingots. The ingots are packaged approximately one to each HUP for a total of 102 HUPs. However, several HUPs each contain up to three ingots. Up to three HUPs may be packaged in an HFEF-5 canister for a total of 37 HFEF-5 canisters (References P5003, U5000, U5007, and U5008). The DU ingots were produced from May 1998 to August 2010 based on ER processing dates of the DU blanket elements (Reference U5003). The original packaging configurations are not the final waste package and the ingots are repackaged prior to shipment to WIPP. Based on the projected build list, it is estimated that, with two exceptions, two HUPs will be repackaged into one 55-gallon drum. No additional HUPs or ingots are projected for this waste stream (References P5003, U5000, U5007, and U5008). The repackaged waste volume listed in Table 1, Waste Stream ID-MFC-DU-INGOT Containers and Volume, is based on these estimates.

Table 1. Waste Stream ID-MFC-DU-INGOT Containers and Volume

Current Inventory	Repackaged Waste	Volume Cubic Meters (m^3)
116 DU Ingots in, 102 HUPs in, 37 HFEF-5 canisters	52 55-gallon drums	10.8

5.3 Waste Generating Activities

Waste stream ID-MFC-DU-INGOT consists of DU ingots generated in the FCF hot cell facilities from electrometallurgical processing of EBR-II irradiated DU blanket material as described in Section 4.7.1. The waste is repackaged at INTEC as described in Section 4.7.2.

5.4 Types of Waste Generated

This section describes the process inputs, Waste Matrix Code assignment, Waste Material Parameter (WMP) weight estimates, radionuclide contaminants, and RCRA hazardous waste determinations for DU ingots waste stream ID-MFC-DU-INGOT. The waste stream is characterized based on knowledge of the materials, knowledge of the processes generating the waste, and physical descriptions of the waste.

5.4.1 Material Input Related to Physical Form

Waste stream ID-MFC-DU-INGOT contains DU ingots generated in the FCF hot cell facilities in support of electrometallurgical processing of EBR-II irradiated DU blanket material as described in Section 4.7. The only materials included in the HFEF-5 canisters are the HUPs containing the DU ingots. Each HUP, containing at least one ingot with some containing three ingots will be repackaged into new 55-gallon drums (References C5140, U5007, and U5008). The HUPs will not be opened, but will be placed with cribbing into 55-gallon drums, up to two HUPs per drum. No other secondary waste materials are expected to be included in the drums (References C5140, U5007, and U5008).

Waste stream ID-MFC-DU-INGOT consists predominantly of inorganic debris waste and contains the following materials:

Other Inorganic Materials items include Grafoil (graphite gaskets in the HUPs) (References C5140, P006, U5000, and U5007).

Iron-based Metal/Alloys items include HUPs, and drum cribbing. Metal debris items are primarily composed of, or contaminated with, carbon steel, and stainless-steel (References C5140, P5003, U5000, U5005, U5007, and U5010).

Aluminum-based Metal/Alloys items may include: aluminum cribbing used in the final packaging configuration (Reference C5140).

Other Metal/Alloys items include DU ingots (References P5003, U5000, U5001, U5004, U5006, U5007, and U5009).

5.4.1.1 Waste Matrix Code

Based on the evaluation of the materials contained in this waste stream and MFC waste management practices, the waste stream is comprised of greater than 80 volume percent metal debris. Therefore, Waste Matrix Code S5110, Metal Debris, is assigned to waste stream ID-MFC-DU-INGOT (References P5003 and U5000).

5.4.1.2 Waste Material Parameters

The WMP weight percentages for this waste stream were estimated based on the average WMP percentages calculated for five ingot, HUP, and drum combination scenarios as present in the load list ranging from: one ingot in one HUP per drum to three ingots in one HUP per drum. The average ingot and HUP weights are determined from source documentation (U5006, U5007, U5008, and U5009). The weight of the Grafoil gasket is estimated based on the area of the gasket material determined from the HUP drawings in the source documents; assuming a gasket thickness of 0.625 inches; and the relative density provided on the material safety data sheet (MSDS) for the gasket material (References P006, U5000, and U5007). The total weight of the cribbing assembly, consisting of an aluminum top plate and carbon steel tubing, is 185 pounds (Reference C5140). It is assumed approximately one third of this material is the aluminum plate. Since organic waste materials are not expected, the total inorganic waste weight percentage is 100 percent and the organic is zero. The results of the assessment are presented in Table 2, Waste Stream ID-MFC-DU-INGOT Waste Material Parameter Estimates. The analysis of the data is documented in a memorandum (included with Attachment 6 of CCP-TP-005) as required by procedure (Reference 1).

Table 2. Waste Stream ID-MFC-DU-INGOT Waste Material Parameter Estimates

Waste Material Parameter	Average Weight Percent	Weight Percent Range
Iron-based Metals/Alloys	44%	35% - 53%
Aluminum-based Metals/Alloys	13%	10% - 17%
Other Metal/Alloys	43%	33% - 55%
Other Inorganic Materials	<1%	<1%
Cellulosics	0%	N/A
Rubber	0%	N/A
Plastics (waste materials)	0%	N/A
Organic Matrix	0%	N/A
Inorganic Matrix	0%	N/A
Soil/Gravel	0%	N/A
Total Inorganic Waste Avg.	**100%**	
Total Organic Waste Avg.	**0%**	

5.4.2 Radiological Characterization

As described in Section 5.2, waste stream ID-MFC-DU-INGOT consists of DU ingots generated in the FCF hot cell facilities from eletrometallurgical processing of irradiated EBR-II DU blanket material (References P5003 and U5000). The ingots were generated as a product material from the process and following evaluation determined to be excess to DOE needs (Reference P5003).

Based on MFC ingot sample data and dose rate data, the ingots have surface dose rates exceeding 200 mrem/hr and contain more than 100 nCi/g of alpha-emitting TRU isotopes with half lives greater than 20 years. The DU ingot contact dose rates range from 500 to 6000 mrem/hr. Ingot TRU content ranges from 430 to 21000 nCi/g (References P5003 and U5000). The approach implemented by CCP to fully characterize this waste stream is documented in CCP-RC-INL-761, *Central Characterization Program Remote-Handled Transuranic Radiological Characterization Technical Report For Remote-Handled Transuranic Waste Depleted Uranium Ingots From Materials And Fuels Complex At The Idaho National Laboratory Waste Stream: ID-MFC-DU-INGOT* (References 16, P5003, and U5000).

Approximately 1500 EBR-II irradiated blanket elements were processed in the Mk-V ER producing DU ingots. All of the fuel elements were DU with a U-235 enrichment range from 0.18 percent to 0.22 percent. The plutonium content ranges were 0 to 45.7 grams (Reference U5003). A direct correlation between the original blanket elements processed in the ER and the resulting DU ingots is not possible. While the elements were chopped and introduced into the ER in batches, the molten salts used in the process were not replaced after each process run (P4024, P4025, P5001, P5002, P5003, and U5000). Destructive assay samples were cast concurrently with the ingots to allow for MFC radiological characterization (References P4024, P4105, P4111, P5003, U5000, and U5001).

5.4.2.1 Radiological Data Evaluation

The WCPIP requires that, as a minimum, the masses and activities of the following 10 WIPP-tracked radionuclides (if present) be reported (Reference 2):

Am-241	U-233
Pu-238	U-234
Pu-239	U-238
Pu-240	Sr-90
Pu-242	Cs-137

In addition to the above 10 radionuclides, other radionuclides are required to be reported that, in aggregate, constitute 95 percent of the total radiological hazard. For criticality purposes, U-235 is also included in the list of radionuclides to be reported.

Table 3, Summary of Radionuclides in Waste Stream ID-MFC-DU-INGOT, identifies the isotopes present based the distribution of generator reported radionuclides for 102 HUPs included in the waste stream (References C5138 and U5001). This is based on the original sample data and has not been modified to account for decay. It should be noted that many of the “Additional Radionuclides” identified are mixed fission products with short half lives which may only contribute insignificant activity to the ingots when accounting for their age. The radiological distribution used for the waste stream radiological characterization is described in CCP-RC-INL-761 (Reference 16).

Table 3. Summary of Radionuclides in Waste Stream ID-MFC-DU-INGOT

Radionuclide	Expected in Waste Stream
WIPP Required Radionuclides	
Am-241	Yes
Pu-238	Yes
Pu-239	Yes
Pu-240	Yes
Pu-242	Yes
U-233	Yes
U-234	Yes
U-238	Yes
Sr-90	Yes
Cs-137	Yes
Additional Radionuclides	
Ag108	Yes
Ag109m	Yes
Ag110	Yes
Bi211	Yes
In114	Yes
Pb211	Yes
Po210	Yes
Po216	Yes
Rh103m	Yes
Rh106	Yes
Sb126m	Yes
U235	Yes

5.4.3 Chemical Content Identification – Hazardous Constituents

The following sections describe the characterization rationale for assignment of EPA HWNs to waste stream ID-MFC-DU-INGOT. The waste described in this report has was originally generated as a product material and recently declared waste (References P5003 and U5000). It is managed in accordance with INL waste management practices in compliance with the requirements imposed by the Idaho Department of Environment Quality. Based on waste characterization, certification, and management operations conducted by INL, and in compliance with the RCRA, the containers in this waste stream are managed as non-hazardous waste. Review of AK resulted in the assignment of no EPA HWNs to this waste stream (References CCE01, P187, P4024, P4025, P4105, P4106, P4107, P4111, P4113, P4140, P5001, P5002, P5003, P5008, and U5000).

This determination is based on a review of the available AK documentation assessing chemical inputs to the FCF electrometallurgical operations and INTEC repackaging operations. In addition, MSDSs and other manufacturer information was obtained for the commercial products identified to determine the presence of RCRA regulated constituents (References CCE01, P006, P101, P115, P187, P993, P4024, P4025, P4105, P4106, P4107, P4111, P4113, P4123, P5001, P5002, P5003, P5008, U5000, and U5005).

5.4.3.1 F-Listed Constituents

Based on review of AK relative to process inputs, waste stream ID-MFC-DU-INGOT does not contain or is not mixed with F-listed hazardous wastes from nonspecific sources listed in 40 CFR 261.31, *Identification and Listing of Hazardous Waste* (Reference 17). No F-listed hazard constituents have been identified for this waste stream. Therefore no F-listed EPA HWNs are assigned to waste stream ID-MFC-DU-INGOT (References CCE01, P006, P101, P115, P187, P993, P4024, P4025, P4105, P4106, P4107, P4111, P4113, P4123, P5001, P5002, P5003, P5008, U5000, and U5005).

5.4.3.2 Toxicity Characteristic Constituents

Based on review of AK relative to chemicals and materials used during the FCF eletrometallurgical refining process, waste stream ID-MFC-DU-INGOT is not contaminated with toxicity characteristic compounds as defined in 40 CFR 261.24 (Reference 17). None of the toxicity characteristic metals and organic hazardous constituents have been identified for FCF ER operations, INTEC waste repackaging operations, or present in the DU ingots. Therefore no toxicity characteristic EPA HWNs are assigned to waste stream ID-MFC-DU-INGOT (References CCE01, P006, P101, P115, P187, P993, P4024, P4025, P4105, P4106, P4107, P4111, P4113, P4123, P5001, P5002, P5003, P5008, U5000, and U5005).

5.4.3.3 P- and U-Listed Waste

Based on review of AK relative to chemicals and materials used during the FCF eletrometallurgical refining process, waste stream ID-MFC-DU-INGOT does not contain and is not mixed with a discarded commercial chemical product, an off-specification commercial chemical product, or a container residue or spill residue thereof as defined in 40 CFR 261.33 (Reference 17). P- and U-listed reagents, including beryllium powder (P015) and hydrofluoric acid (U134), were not identified as being used or present in FCF eletrometallurgical refining operations. No listed chemicals were identified in the DU ingot container-specific information and no record of a significant spill of listed chemicals was located (e.g., incident report). Waste stream ID-MFC-DU-INGOT is, therefore, not assigned a P- or U-listed HWN (References CCE01, P006, P101, P115, P187, P993, P4024, P4025, P4105, P4106, P4107, P4111, P4113, P4123, P5001, P5002, P5003, P5008, U5000, and U5005).

As described above and in the Chemical Compatibility Evaluation (CCE) for the waste stream, beryllium is not identified as a constituent present in DU ingots. Beryllium is therefore not expected to exceed one percent in any payload container (References CCE01, P006, P101, P115, P187, P993, P4024, P4025, P4105, P4106, P4107, P4111, P4113, P4123, P5001, P5002, P5003, P5008, U5000, and U5005).

5.4.3.4 K-Listed Constituents

The material in this waste stream is not a hazardous waste from any of the sources specified in 40 CFR 261.32 (Reference 17).

5.4.3.5 Ignitables, Corrosives, and Reactives

Ignitability

The materials in this waste stream do not meet the definition of ignitability as defined in 40 CFR 261.21 (Reference 17). The materials are not liquid and ignitable liquids were not used in the electrometallugical or waste repackaging operations (References P4024, P4025, P4105, P4106, P4107, P4111, P5001, P5002, and P5008). The materials are not contaminated with oxidizers and do not meet the definition of an oxidizer; and is not or does not contain constituents capable, under standard temperature and pressure, of causing fire through friction, absorption of moisture, or spontaneous chemical change. This material is not a compressed gas.

Sodium was present as bond material in the DU fuel element segments sent to the MK-V ER. However, the electrometallurgical process was developed to neutralize sodium while producing the uranium product. The sodium is neutralized in the ER process, forming sodium chloride and remaining in the salt matrix which is not included in the waste stream (References P4024, P4025, P5001, P5002, P5003, and P5008). The materials in this waste stream are, therefore, not ignitable wastes (References P115, P4024, P4025, P4105, P4106, P4107, P4111, P4123, P5001, P5002, P5003, P5008, and U5005).

Corrosivity

The materials in this waste stream do not meet the definition of corrosivity as defined in 40 CFR 261.22 (Reference 17). The materials are not liquid and corrosive liquids were not used in the electrometallugical or waste repackaging operations (References P4024, P4025, P4105, P4106, P4107, P4111, P5001, P5002, and P5008). The materials in this waste stream are, therefore, not corrosive wastes (References P115, P4024, P4025, P4105, P4106, P4107, P4111, P4123, P5001, P5002, P5008, and U5005).

Reactivity

The materials in this waste stream do not meet the definition of reactivity as defined in 40 CFR 261.23 (Reference 17). The materials are stable and will not undergo violent chemical change. The materials will not react violently with water, form potentially explosive mixtures with water, or generate toxic gases, vapors, or fumes when mixed with water. The materials do not contain cyanides or sulfides, and are not capable of detonation or explosive reaction. Sodium was present as bond material in the DU fuel element segments sent the MK-V ER. However, the electrometallurgical process was developed to neutralize sodium while producing the uranium product. The sodium is neutralized in the ER process, forming sodium chloride and remaining in the salt matrix which is not included in the waste stream (References P4024, P4025, P5001, P5002, P5003, and P5008). The materials in the waste stream are not capable of detonation or explosive reaction. The materials are not explosive, nor does the material contain any explosives. The materials are not liquid and liquids were not added to containers during repackaging. The materials in this waste stream are, therefore, not reactive wastes (References P115, P4024, P4025, P4123, P5001, P5002, P5003, P5008, and U5005).

Based on FCF electrometallurgical operations and MFC and INTEC material and waste management practices and waste repackaging operations, the materials contained in waste stream ID-MFC-DU-INGOT will not exhibit the characteristics of ignitability (D001), corrosivity (D002), or reactivity (D003) as defined in 40 CFR 261.21, 261.22, and 261.23, respectively (Reference 17).

5.4.4 Polychlorinated Biphenyls (PCBs)

The materials in waste stream ID-MFC-DU-INGOT do not contain polychlorinated biphenyls (PCBs) per 40 CFR, Part 761, *Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and use Prohibitions* (Reference 18). No sources of PCBs were identified as inputs into the waste stream. The waste consists of DU ingots and all other items that may be included are attributed to INTEC waste repackaging operations. PCB items, such as light ballasts, are not identified as being included in the FCF electrometallurgical operations or included with the DU ingots (References CCE01, P006, P101, P115, P187, P993, P4024, P4025, P4105, P4106, P4107, P4111, P4113, P4123, P5001, P5002, P5003, P5008, U5000, and U5005).

5.4.5 Prohibited Items

Based on the review of container documentation and documented waste management practices, no prohibited items are identified for the waste stream. The DU ingots are packaged in HUPs, a 4.7-liter capacity vessel designed to provide criticality spacing. The HUPs are closed with a six bolt gasketed lid (References P5003 and U5000). As there is no other material included in the HUP, and the ingots are an inorganic material (waste material Type II.2 packaged in a metal container), the greater than 4-liter container is an allowable condition (References 4, 6, and U5007). In addition, the HUPs are packaged in HFEF-5 canisters which are also not vented. However, the ingots will be repackaged and removed from the HFEF-5 canisters.

Liquids are not expected in this waste stream. FCF Electrometallugical operations utilized molten salts in the ER; however, any remaining salt was driven off of the DU cathodes produced by further processing in the CP, and the DU ingots in the CF (References P4024, P4025, P4105, P4106, P4107, P4111, P5001, P5002, P5003, P5008, and U5000). In addition, any liquids present would also be driven off in these operations. The ingots were packaged into the HUPs as product material with no other items present (References P5003, U5000, and U5007).

Sodium, ignitable and reactive (EPA HWNs D001 and D003), was present as bond material in the DU fuel element segments sent to the MK-V ER. However, the electrometallurgical process was developed to neutralize sodium while producing the uranium product. The sodium is neutralized in the ER process, forming sodium chloride and remaining in the salt matrix and not in the waste stream (References P4024, P4025, P5001, P5002, P5003, and P5008).

5.5 Waste Packaging

Waste stream ID-MFC-DU-INGOT consists of DU ingots originally stored in HFEF-5 cans. The HFEF-5 cans consist of two concentric cylindrical canisters. The inner canister or IWC, which is approximately 11.6-inches in diameter by 63-inches in length, is composed of carbon steel. The ingots, contained in HUPs, 4.7-liter bolt and gasketed cans configured with “top hats” to create criticality safe spacing, were placed in the inner canister. Up to three HUPs may be included in each IWC. An 8-inch steel plug was placed on top of the IWC and then the lid of the inner canister and then the lid of the outer canister, or OWC was welded or locked shut. The outer stainless-steel canister is approximately 12.75-inches in diameter by 66-inches in length (References P254, P5003, and U5000).

The original canisters will be repackaged prior to shipment to WIPP. The HUPs from the cans are removed and placed unopened into a prepared standard DOT 7A, Type A 55-gallon steel drum. The drum is prepared with carbon steel and aluminum cribbing designed to securely hold up to two HUPs. The standard 55-gallon drum is constructed of 16-gauge materials and has a removable head with a drum head gasket. The 55-gallon drums include a NucFil-certified carbon composite filter. The 55-gallon drum is loaded into the removable lid canister using a 55-gallon drum lifting bag. The drum lifting bag will remain in the canister with the drum. Up to three drums will be loaded into the removable lid canister (References C5140, P101, P115, P4122, P4123, U5005, U5007, and U5010).

6.0 QUALIFICATION OF AK INFORMATION

Document CCP-CP-INL-762, *Central Characterization Program RH-TRU Waste Certification Plan for 40 CFR 194 Compliance For Remote-Handled Depleted Uranium Ingots From Materials and Fuels Complex at the Idaho National Laboratory Waste Stream: ID-MFC-DU-INGOT* (Reference 19, to be developed), describes how each DQO and QAO will be met along with the rationale for selection of the AK qualification methods used. The description of the confirmatory testing process, the percentage of containers that will be subjected to the process, a discussion of why the process is considered representative of the waste stream, and quantitative acceptance criteria are to be determined and will be presented in CCP-CP-INL-762 (Reference 19).

Table 4, Waste Stream ID-MFC-DU-INGOT DQO Determination Summary, lists the DQOs to be addressed using AK associated with waste stream ID-MFC-DU-INGOT relating to the defense waste, radiological, and physical waste stream determinations.

Table 4. Waste Stream ID-MFC-DU-INGOT DQO Determination Summary

DQO Determinations	Summary of Characterization/Qualification Method	AK Sources
Defense Waste	As described in the defense waste justification in Section 4.4, there is sufficient evidence to demonstrate that TRU wastes generated by MFC FCF electrometallurgical operations are contaminated with materials from atomic energy defense activities associated with naval reactors development, defense nuclear materials productions, defense nuclear waste and materials by-products management, and defense research and development activities. **Characterization/Qualification Method**: Not Applicable	C265, P001, P071, P145, P146, P187, P4025, P5000, P5003, U5003
TRU Waste	Evaluation of generator radionuclides demonstrates that this is a TRU waste stream. The concentration of TRU isotopes documented in CCP-RC-INL-761 (Reference 16) will be quantified for each container based on the method described in CCP-CP-INL-762 (Reference 19). **Characterization/Qualification Method**: Method described in CCP-CP-INL-762 (Reference 19).	C5138, P4024, P4105, P4111, P5001, P5002, P5003, U5000, U5001, U5003, U5008, U5009, and CCP-RC-INL-761 (Reference 16)
RH Waste	Generator reported surface dose rates for the containers in waste stream ID-MFC-DU-INGOT indicate the surface dose rates exceed 200 mrem/hr. **Characterization/Qualification Method**: Method described in CCP-CP-INL-762 (Reference 19).	P5003, U5000, and CCP-RC-INL-761 (Reference 16)

Table 4. Waste Stream ID-MFC-DU-INGOT DQO Determination Summary (Continued)

DQO Determinations	Summary of Characterization/Qualification Method	AK Sources
Activity	This DQO is specific to payload containers and will not be assessed until the final payload configuration has been established.	Not Assessed
WIPP 10 Required Radionuclides	The relative activity of the WIPP 10 required radionuclides for this waste stream is documented in CCP-RC-INL-761. **Characterization/Qualification Method**: Method described in CCP-CP-INL-762 (Reference 19).	C5138, U5001, U5008, U5009, and CCP-RC-INL-761 (Reference 16)
Physical Form	As described in Section 5.4.1, waste stream ID-MFC-DU-INGOT consists of debris meeting the WCPIP definition for Summary Category Group S5000. Section 5.4.1.2 identifies the WMPs, including the estimated amount of each in the waste stream. **Characterization/Qualification Method**: AK Sufficiency (TBD) as described in CCP-CP-INL-762.	C5140, P006, P5003, U5000, U5001, U5004, U5005, U5007, U5010
Residual Liquids	As described in Section 5.4.5, residual liquids are not expected and are prohibited during the repackaging of waste stream ID-MFC-DU-INGOT. **Characterization/Qualification Method**: AK Sufficiency (TBD) as described in CCP-CP-INL-762.	P4024, P4025, P4105, P4106, P4107, P4111, P5001, P5002, P5003, P5008, U5000, U5007

7.0 CONTAINER SPECIFIC INFORMATION

Canister container documentation is limited since the DU ingots were originally produced and managed as a product material. Available information consists of AK source documents U5001, U5004, U5008, and U5009. These sources are spreadsheets and reports containing the HUP numbers, the associated isotopic data for the HUP, and the correlation of HUPs to HFEF-5 canisters with a rollup of the isotopic data by canister. Waste handling and repackaing procedures for BEA managed facilities at INTEC are to be developed and descriptions thereof will be incorporated into this document in the future as necessary. For ICP/Fluor Idaho facilities RH-TRU Container Repackaging Datasheets (FRM-880) are completed during INTEC repackaging operations for each original waste canister as well as for subsequent repackaging of daughter containers as described in TPR-7857, *HFEF Repackaging at the FDPA* (Reference P4123); and TPR-7298, *Decontamination Cell Operations in CPP-659* (Reference P115). These forms are maintained as AK source document U5005.

Container specific information for each drum in waste stream ID-MFC-DU-INGOT will be maintained in the most current Container Tracking Spreadsheet. The Container Tracking Spreadsheet, at a minimum, will identify the waste stream, container identification number, original canister number, vent date, and closure date for each drum, based on AK and the most current information from AK characterization activities, as applicable.

In accordance with the procedure CCP-TP-005 (Reference 1), a CCP Waste Containers List (Attachment 8 of the procedure) is completed and maintained as a QA record for each waste stream for waste tracking purposes. Information tracked includes container identification number, waste stream number, and the closure date for each container.

8.0 REFERENCES

1. CCP-TP-005, *CCP Acceptable Knowledge Documentation*, Carlsbad, New Mexico, Nuclear Waste Partnership, LLC.

2. DOE/WIPP-02-3214, *Remote-Handled TRU Waste Characterization Program Implementation Plan*, Carlsbad, New Mexico, U.S. DOE Carlsbad Field Office

3. *Waste Isolation Pilot Plant Hazardous Waste Facility Permit*, *Waste Analysis Plan*, New Mexico Environment Department, Santa Fe, New Mexico

4. DOE/WIPP-02-3122, *Transuranic Waste Acceptance Criteria For The Waste Isolation Pilot Plant,* Carlsbad, New Mexico, U.S. DOE Carlsbad Field Office

5. CCP-PO-001, *CCP Transuranic Waste Characterization Quality Assurance Project Plan*, Carlsbad, New Mexico, Nuclear Waste Partnership, LLC.

6. CCP-PO-002, *CCP Transuranic Waste Certification Plan*, Carlsbad, New Mexico, Nuclear Waste Partnership, LLC.

7. CCP-PO-505, *CCP Remote-Handled Transuranic Waste Authorized Methods for Payload Control (CCP RH-TRAMPAC)*, Carlsbad, New Mexico, Nuclear Waste Partnership, LLC.

8. 40 CFR Part 191, *Environmental Radiation Protection Standards For Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes*, Washington, D.C., U.S. EPA

9. 40 CFR Part 194, *Criteria for the Certification and Re-Certification of the Waste Isolation Pilot Plant's Compliance with the 40 CFR Part 191 Disposal Regulations*, Washington, D.C., U.S. EPA

10. *Criteria for the Certification and Re-Certification of the Waste Isolation Pilot Plant's Compliance with the 40 CFR Part 191 Disposal Regulations: Certification Decision*, Washington, D.C., U.S. EPA

11. Public Law 102-579, *The Waste Isolation Pilot Plant Land Withdrawal Act*, October 30, 1992, as amended by Public Law 104-201

12. 42 U.S.C. 10101, *Nuclear Waste Policy Act of 1982*, U.S. Congress

13. DOE M 435.1-1, *Radioactive Waste Management Manual*

14. CCP-AK-INL-580, *Central Characterization Program Acceptable Knowledge Summary Report For Remote-Handled Transuranic Debris Waste From Materials And Fuels Complex Hot Fuel Examination Facility At The Idaho National Laboratory Waste Stream: ID-HFEF-S5400-RH*, Carlsbad, New Mexico, Nuclear Waste Partnership, LLC.

15. DOE/TRU-19-3425, *Annual Transuranic Waste Inventory Report – 2019*, Carlsbad, New Mexico, U.S. DOE Carlsbad Field Office

16. CCP-RC-INL-761, *Central Characterization Program Remote-Handled Transuranic Radiological Characterization Technical Report For Remote-Handled Transuranic Waste Depleted Uranium Ingots From Materials And Fuels Complex At The Idaho National Laboratory Waste Stream: ID-MFC-DU-INGOT*

17. 40 CFR Part 261, *Identification and Listing of Hazardous Waste*, U.S. EPA

18. 40 CFR, Part 761, *Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and use Prohibitions*, U.S. EPA

19. CCP-CP-INL-762, *Central Characterization Program RH-TRU Waste Certification Plan for 40 CFR 194 Compliance For Remote-Handled Depleted Uranium Ingots From Material and Fuels Complex at the Idaho National Laboratory Waste Stream: ID-MFC-DU-INGOT* (TBD)

9.0 AK SOURCE DOCUMENTS

Source Document Tracking Number	Title
C002	Interview of Pam Crane, Analytical Laboratory, re: Analytical Laboratory Mission and Objectives
C004	Interview of Steve Hayes, Materials and Fuel Complex Project Manager, Advanced Fuel Cycle Initiative, re: Advanced Fuel Cycle Initiative Program Related to Casting Laboratory Operations
C021	United States Government Memorandum to Distribution, re: Receipt of Contact-Handled (CH) and Remote-Handled (RH) Transuranic (TRU) Waste at the INEL
C096	Letter to Distribution re: Changes to Internal Technical Report PR-W-78-014, Rev2
C129	Argonne National Laboratory Intra-Laboratory Memo to Distribution, re: TRU Waste Profile Sheets
C265	Argonne National Laboratory Letter to Mr. Hilary Rauch, Manager, U.S. Department of Energy, re: “TREAT Experiment Program”
C4118	Evaluation and Summary of the Fuel Conditioning Facility (FCF) Process Work Sheets (PWS)
C5000	Recommendation for Approval of DSA-001-SW, ANL-W Standardized Documented Safety Analysis (DSA) and DSA-002-TREAT-WH, TREAT Warehouse (Bldg. 723) DSA
C5138	Calculation of Individual and Total Radionuclide Masses and Activities for Depleted Uranium Ingots Contained in High-Throughput Uranium Product Cans
C5140	Email from Michael Patterson to Scott Smith, re: INL EBR-II DU Ingot AK Info
CCE01	Memorandum to Daniel Wade, CCP Site Project Manager, re: Chemical Compatibility Evaluation for Waste Stream ID-MFC-DU-INGOT
P001	The Defense Programs Origin of Transuranic Waste at Argonne National Laboratory – West
P006	Packet of Material Safety Data Sheets
P018	Nuclear Technology Division, Analytical Laboratory Procedure: Quality Assurance Plan
P035	Idaho National Engineering and Environmental Laboratory Waste Acceptance Criteria
P036	Pollution Prevention/Waste Minimization Plan
P037	Nuclear Fuel Cycle Division, Idaho Operations Office: INEL Transuranic Waste Acceptance Criteria
P042	Analytical Laboratory Safety Analysis Report
P047	Argonne National Laboratory Description and Proposed Operation of the Fuel Cycle Facility for the Second Experimental Breeder Reactor (EBR-II)
P049	Estimated radiological Inventory Sent from Argonne National Laboratory-West to the Subsurface Disposal Area from 1952 through 1993
P051	A Survey of NRTS Waste Management Practices, Volume II
P055	Argonne-West Criticality Hazards Control Statement
P060	ANL-West Remote-Handled Transuranic Waste Certification Plan
P063	ANL-West Remote-Handled Transuranic Waste Certification Plan

Source Document Tracking Number	Title
P067	Safeguards and Security Plan for IFR – EFL
P071	Plant Description, Administration and General Policy
P073	Performance of Metallic Fuels and Blankets in Liquid-Metal Fast Breeder Reactors
P077	ANL-W RCRA Part B Permit Application, General Information
P086	ANL-W Division, Nuclear Materials Control Procedures, Appendix C, Analytical Chemistry Laboratory
P088	TRU-RH Waste Handling Plan for Waste Management Operations
P089	AK Summary Documentation AK TRU Packaging
P091	INEL Transuranic Waste Acceptance Criteria, Criteria for Packaging Transuranic Waste for Receipt at the Idaho National Engineering Laboratory Radioactive Waste Management Complex, Offsite Generated Waste
P100	Engineering Design File, CPP-1617 Fire Area Evaluation
P101	Technical Procedure, CPP-1617 Waste Handling and Operations
P102	Estimated Radiological Inventory Sent from the Idaho Nuclear Technology and Engineering Center to the Subsurface Disposal Area from 1952 through 1993
P103	Safety Analysis Report for the INTEC Waste Management Facility (IWMF)
P115	Decontamination Cell Operations in CPP-659
P141	INEL Waste Management Plan For FY-1978, Idaho National Engineering Laboratory
P144	Hot Fuel Examination Facility/North Facility Safety Report
P145	EBR-II Reactor Review
P146	Hot Fuel Examination Facility South Final Safety Analysis Report
P186	HFEF Safety Analysis Report
P187	FCF Safety Analysis Report
P225	Operation and Maintenance Manual: Vertical Assembler-Dismantler (VAD)
P227	Operation and Maintenance Manual: Spent Fuel Dismantling and Canning – North & South
P253	Operation and Maintenance Manual: InterBuilding Casks (IBC-1 and IBC-2)
P254	Operation and Maintenance Manual: Waste Cask – HFEF-5
P255	Operation and Maintenance Manual: Materials Transport Cask (HFEF-6)
P256	Operation and Maintenance Manual: Contact Handled Solid Waste Handling – HFEF/S

Source Document Tracking Number	Title
P257	Operation and Maintenance Manual: Off-Site Shipping Casks (T2-1 and T2-2)
P258	Operation and Maintenance Manual: Shipping Tubes and Containers (Off-Site)
P259	Operation and Maintenance Manual: Solid Waste Handling and Disposal
P260	Operation and Maintenance Manual: Out-of-Cell Solid Waste Handling
P262	Operation and Maintenance Manual: Out-of-Cell Waste Handling – HFEF/S
P263	Operation and Maintenance Manual: In-Cell Solid Waste Handling
P266	Operation and Maintenance Manual: Remote Handled Solid Waste Handling – HFEF/S
P286	Operation and Maintenance Manual: IBC Washstations Operation and Maintenance
P993	RH-TRU Container Handling
P4024	Analysis of Spent Fuel Treatment Demonstration Operations
P4025	Environmental Assessment, Electrometallurgical Treatment Research and Demonstration Project in the Fuel Conditioning Facility at Argonne National Laboratory-West
P4053	Engineering Evaluation/Cost Analysis for the EBR-II Final End State
P4102	Fuel Conditioning Facility Operating Instructions, Small Transfer Lock System
P4105	Fuel Conditioning Facility Operating Instructions, Injection Casting Furnace
P4106	Fuel Conditioning Facility Operating Instructions, Electrode Assembly/Disassembly Machine
P4107	Fuel Conditioning Facility Operating Instructions, Cathode Processor
P4111	Fuel Conditioning Facility Operating Instructions: Station P-7 – Casting Support; Cathode Processor Support
P4113	Fuel Conditioning Facility Operating Instructions, Element Chopper
P4122	Packaging Configuration for Repacked HFEF-5 Canisters
P4123	HFEF Repackaging at the FDPA
P4126	Combination Fire Hazards Analysis and Fire Safety Assessment for CPP-666, Fluorinel Dissolution Process Area (FDPA)
P4140	Waste Generator Services Waste Management
P5000	Comparison of Measured and Calculated Composition of Irradiated EBR-II Blanket Assemblies
P5001	Electrometallurgical Techniques for DOE Spent Fuel Treatment
P5002	Electrometallurgical Treatment of EBR-II Spent Fuel
P5003	Disposition of Depleted Uranium Ingots

Source Document Tracking Number	Title
P5008	MK-V Electrorefiner
P5009	Configuration of Repackaged Lot 5 (MFC and EBR-I) Remote-Handled Transuranic Waste
P5015	Safety Analysis Report for the Material Security and Consolidation Facility (MSCF) Excerpts
U025	DRAFT Facility Waste Descriptions Argonne – West
U190	Argonne National Laboratory, Argonne-West Analytical Chemistry Laboratory, Criticality Hazards Control Statement
U4033	Collection of FCF Process Work Sheets
U5000	Disposition Initiative - DU Ingots
U5001	DU Ingot ISOZ (HUPs)
U5002	DU Ingot Sampling Pin Samples Vs. Drill Fines (Excerpt from ENT-PE-BRW-009-01)
U5003	Disposition of Depleted Uranium Ingots
U5004	U-Pu totals in DU Ingots
U5005	FRM-880 (RH TRU) Container Repackaging Data Sheet
U5006	HUP Tare Information
U5007	DU Ingot Product Packaging Equivalency to WIPP WAC Waste Packaging
U5008	DU Ingot Repackaging Build List
U5009	Draft Chemical and Radiological Data Reduction from MFC Analytical Laboratory Reports for Depleted Uranium Ingots
U5010	Sketches of HUP Drum Configuration

Figure 1 – Location of the INL and INL Facilities

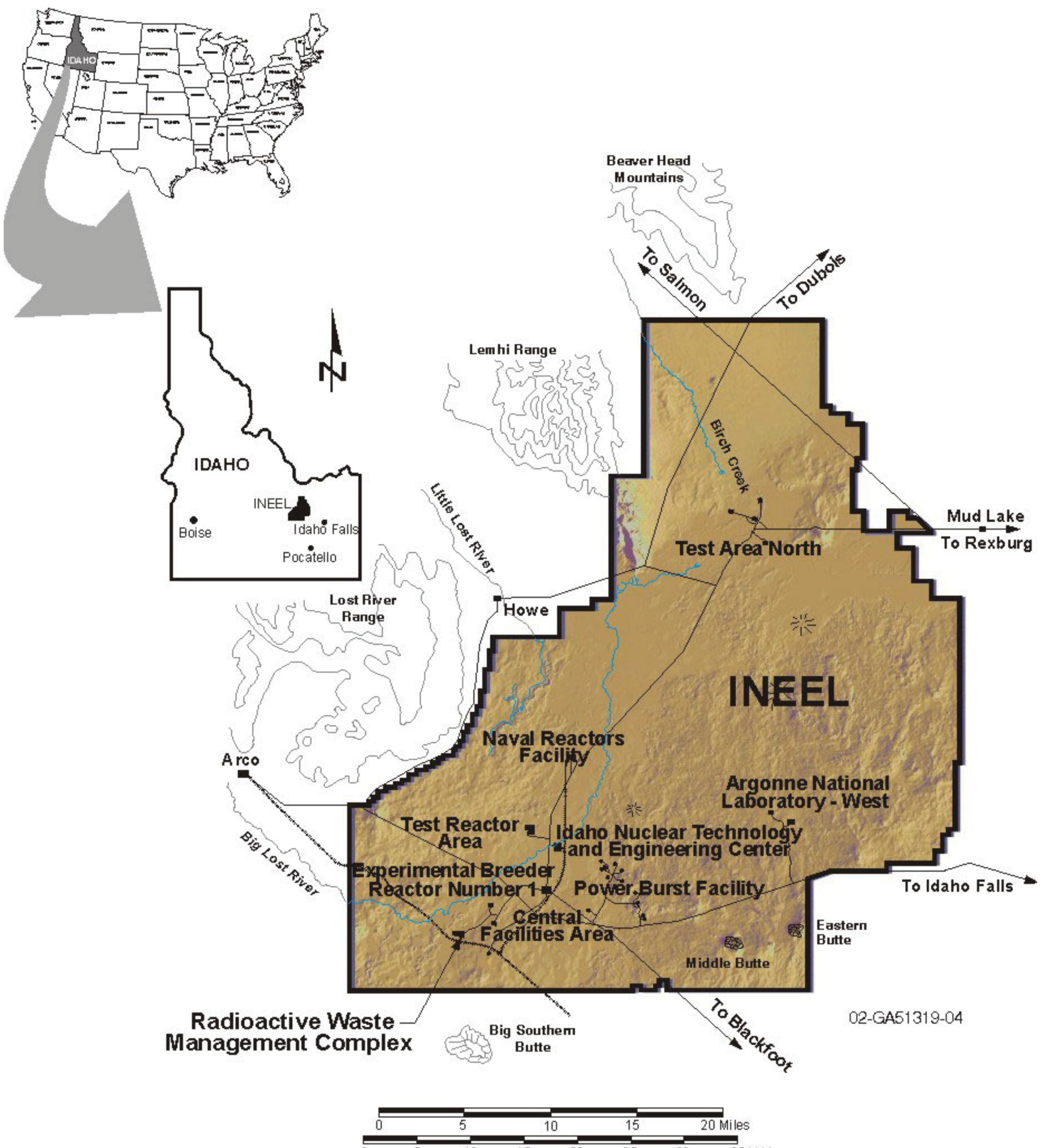

Figure 2 – Map of the Materials and Fuels Complex (Formerly ANL-W)

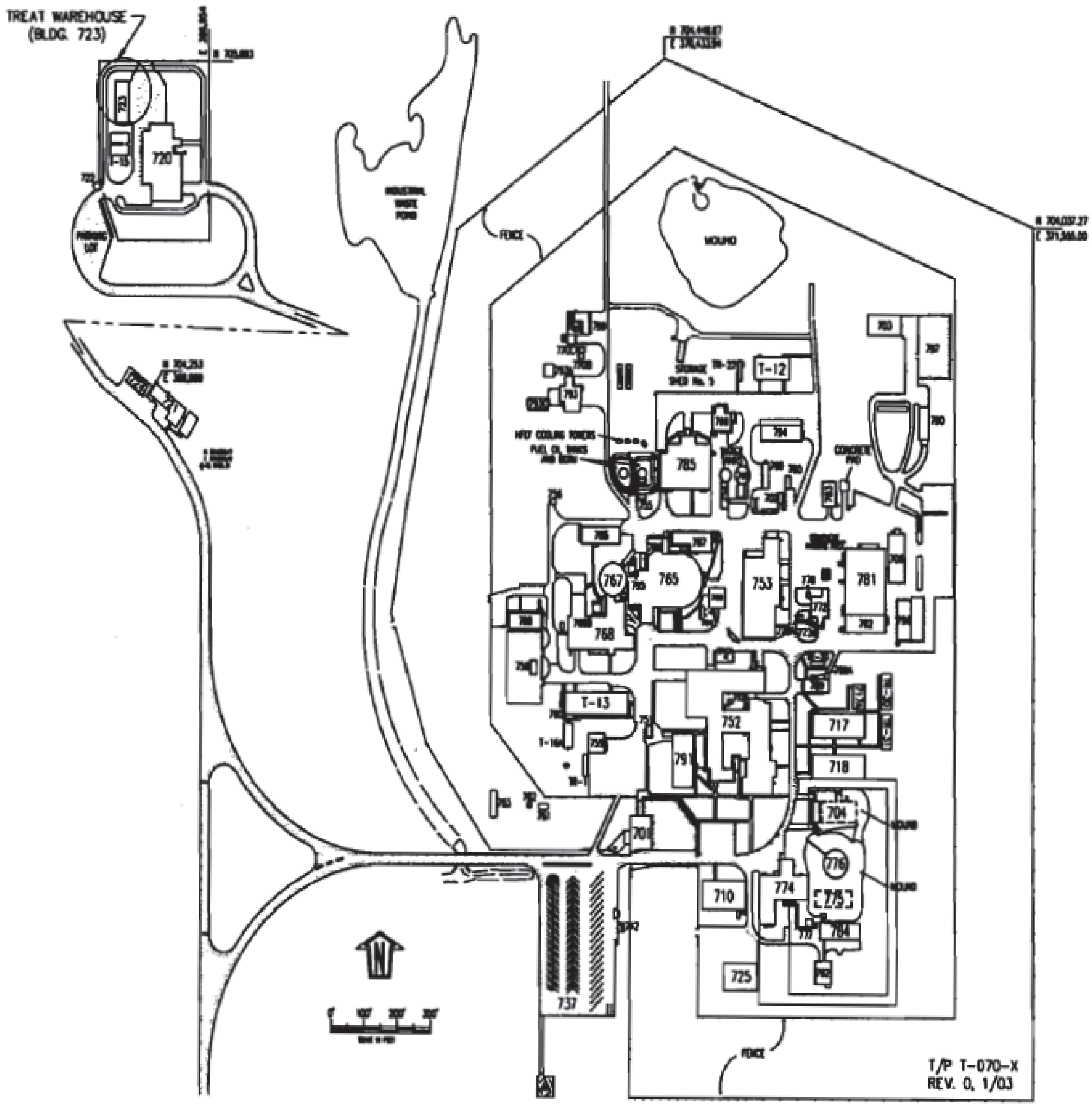

Figure 3 – FCF Operating Floor Layout

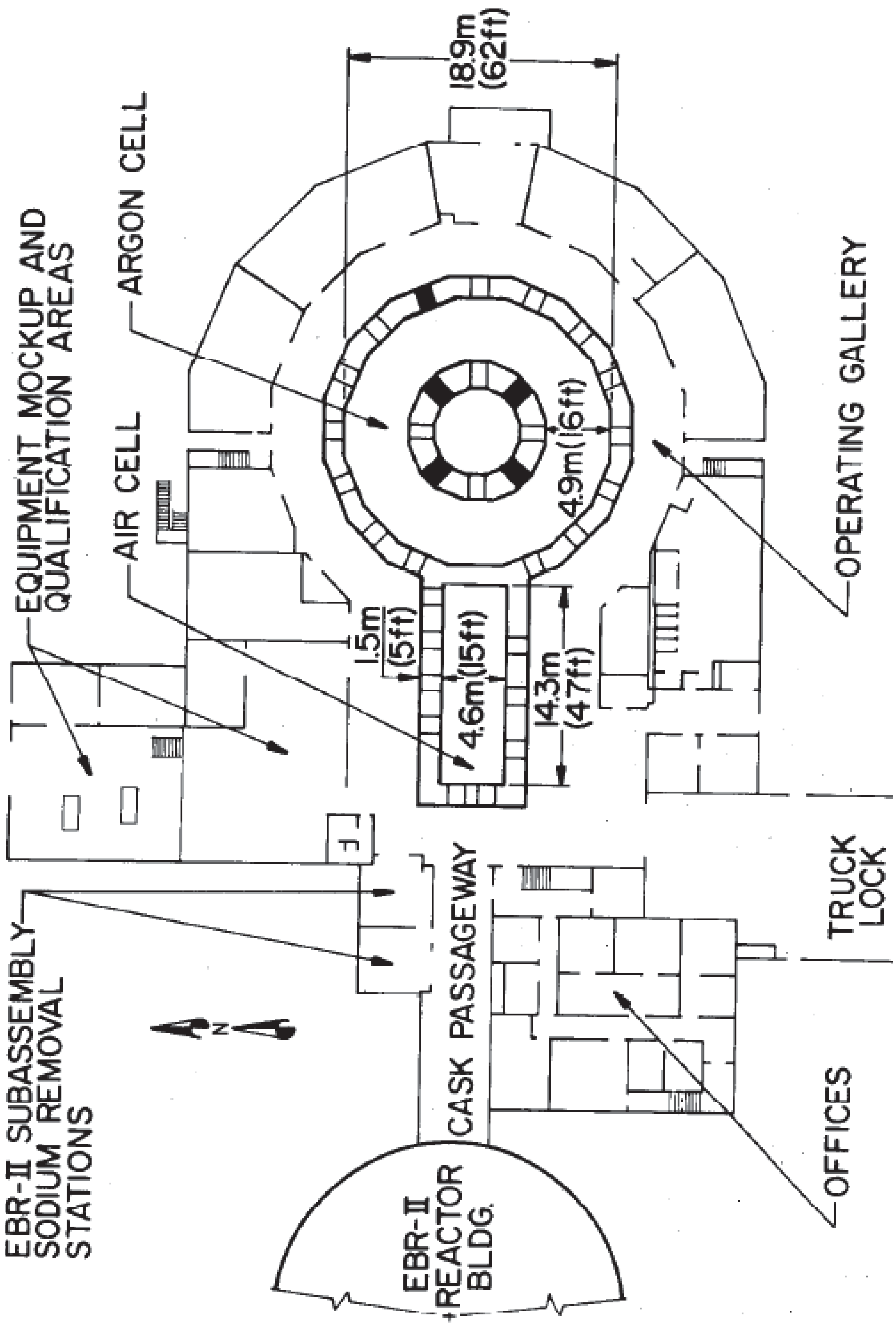

Figure 4 – HUP Assembly

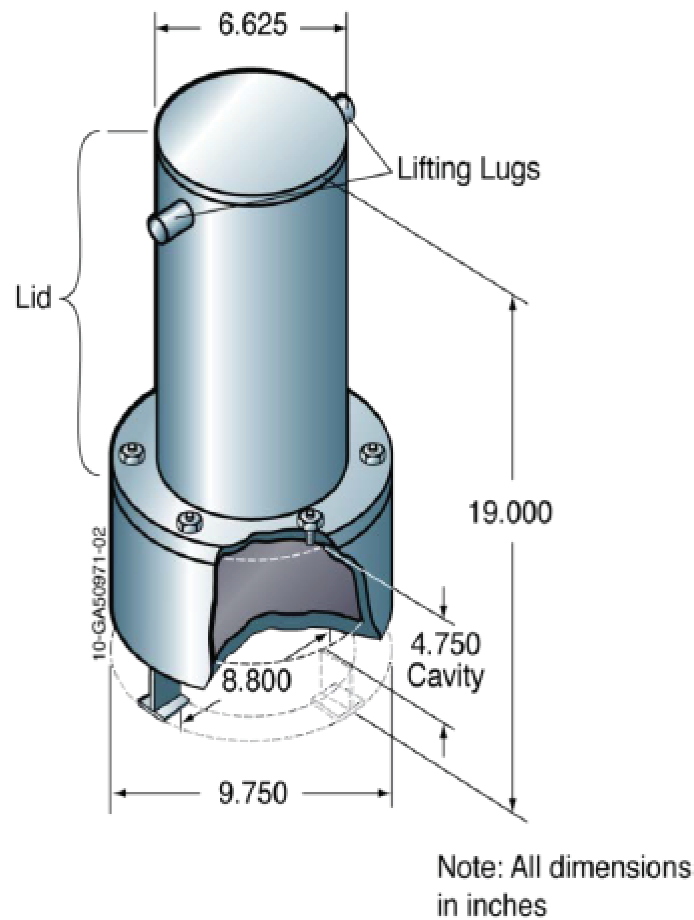

Figure 5 – Inner and Outer Waste Canister Assembly

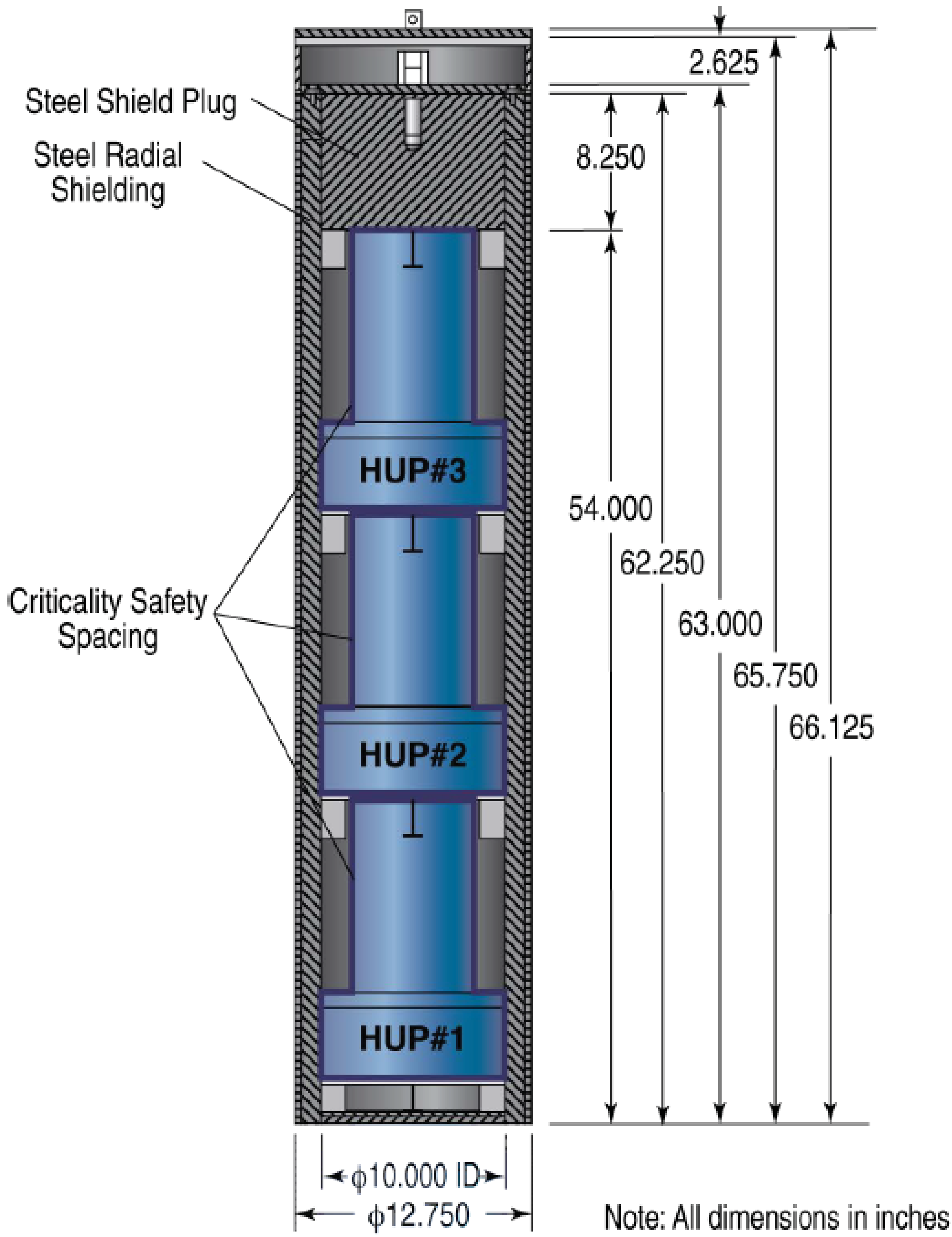

Figure 6 – Blanket Treatment Material Flow