DRAFT

Department of Energy

PDC PROJECT

F/H LABORATORY WASTE MANAGEMENT STUDY

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STUDY SIGN-OFF PAGE

DEPARTMENT OF ENERGY

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1.0 PURPOSE

The purpose of this study is to identify a path forward for the management of F/H Laboratory wastes and sample returns generated while supporting the Pit Disassembly and Conversion (PDC) Project. The study should assist in the identification of design requirements and unit operations required to develop design documents in support of the development of a cost estimate for the PDC Project. This study will also attempt to identify risk associated with PDC path forward discussed in this study.

2.0 INTRODUCTION

Laboratory support for the PDC Project will be provided by the F/H Laboratory. The primary mission of the analytical laboratory is to support the PDCF mission with respect to compliance with product specifications, process control, and material releases. This includes verification that the plutonium oxide product is in compliance with MOX feed specifications. The laboratory will also analyze samples of HEU oxide and other process streams.

A large portion of the sample will not be modified in the analytical laboratory. Sample portions not modified (e.g. sample used for density testing, moisture content, and hydrogen-to-fissile ratio) will be returned to the process and blended into the products. Samples that can not be returned to the process and other waste generated PDC F/H Laboratory activities will be addressed in this study.

3.0 WASTE TYPES/SAMPLE RETURNS

3.1 The solid waste types that are to be reviewed in this study are TRU, MTRU, LLW, and Green is Clean, and are defined as follows:

Transuranic (TRU) Waste – Solid waste that is contaminated with alpha-emitting transuranic radionuclides (atomic number > 92) with half lives > 20 years, and concentrations > 100 nCi/g of waste matrix at time of assay.

Mixed TRU (MTRU) Waste – TRU waste that is also hazardous, as defined by RCRA.

Low Level Waste (LLW) – Radioactive solid waste, which does not result from direct processing of spent nuclear fuel or byproducts material from uranium or thorium tailings, with a tranuranic concentration of less than 100 nCi/g.

Green is Clean Waste – Non-hazardous waste as defined under the provisions of RCRA and is not radioactive.

Mixed TRU waste, mixed LLW, hazardous waste, and PCB waste are not expected to be generated by the PDC F/H Laboratory activities, and therefore are considered non-routine generated waste. These wastes will not be evaluated in this study.

Solid high level waste will not be generated from the PDC F/H Laboratory.

PDC solid waste may be Be contaminated. Concentrations of Be are expected to be trace to less than 1 gram, therefore no additional characterization is required. Solid waste will require Be labeling.

3.2 The liquid waste and sample return types that are to be reviewed in this study are High Activity Drain (HAD), Low Activity Drain (LAD), and concentrated liquid waste, and are defined as follows:

HAD – Radioactive liquid sample returns, which does not result from direct processing of spent nuclear fuel or byproduct material from uranium or thorium tailings, with an activity level greater than 1000 d/m/mL and less than 1 g/L and less than 0.65 weight percent U-235.

LAD – Radioactive liquid waste with an activity level less than 1000 d/m/mL. These liquids may be considered potentially contaminated liquids or Low Activity Waste (LAW) liquids.

Concentrated Liquid Waste – Radioactive liquid waste with greater than 1 g/L Pu and less than 0.65 weight percent U-235.

4.0 ASSUMPTIONS/REQUIREMENTS

Following are assumptions/requirements for the PDC F/H Laboratory Waste Management System:

- F/H Laboratory TRU waste management activities for the PDC Project are identical to on-going F/H Laboratory TRU waste management activities and for that reason are covered under existing scope as detailed in M&O-FHO-2008-00061, Rev. 1, dated 9/2009, F/H Area Laboratory Transuranic (TRU) Waste Certification/Characterization Plan. Therefore, PDC F/H Laboratory TRU waste management will only have a cursory discussion in this study.
- F/H Laboratory LLW waste management activities for the PDC Project are identical to on-going F/H Laboratory LLW waste management activities and for that reason are covered under existing scope as detailed in CBU-FHO-2003-00051, Rev. 5, dated 7/2009, F/H Area Laboratory Low Level Waste/Mixed Waste Certification/Characterization Plan. Therefore, PDC F/H Laboratory LLW waste management will only have a cursory discussion in this study.
- F/H Laboratory Green is Clean waste management activities for the PDC Project are identical to on-going F/H Laboratory Green is Clean waste management activities and for that reason are covered under existing scope as detailed in L2-1-00096051, Rev. 2, dated 7/2009, Packaging and Handling Low-Level Radioactive and Green Is Clean RBA Waste. Therefore, PDC F/H Laboratory Green is Clean waste management will only have a cursory discussion in this study.

- F/H Laboratory HAD liquid is generated while supporting the PDC Project but HAD liquid is not considered the same as currently gnerated F/H Laboratory HAD liquid sample returns. Currently, F/H Laboratory HAD liquids are drained to the HAD Tank F. HAD Tank F accumulates high activity material and then transfers the high level radioactive liquid via a LR 56S Transport Trailer to the H-Canyon for disposition. F/H Laboratory high level radioactive liquids or HAD liquids generated while supporting the PDC Project will be considered sample returns in the F/H Laboratory and waste when disposed of at the Waste Solidification Building (WSB).
- F/H Laboratory LAD management activities for the PDC Project are similar to on-going F/H Laboratory LAD management activities but will be discussed in this study.
- Concentrated liquid waste would not be accepted by the WSB, therefore concentrated liquid waste will be grouted and once cured, will be handled as TRU waste.

5.0 WASTE SOURCES

The PDC F/H Laboratory TRU solid waste will mainly be contact-handled waste. Due to infrequent generation and low-volume, remote handled TRU waste will be handled on a case-by-case basis. The types of TRU waste generated from the PDC F/H Laboratory include: job control waste, HEPA filter waste, sources and standards, and potentially contaminated beryllium waste. Job control waste includes plastic bottles, plastic vials and caps, glass vials, plastic items, paper items, various metal items, plastic bags, small HEPA filters, from normal facility operation, maintenance, and decontamination efforts.

Concentrated liquids generated by the PDC F/H Laboratory are processed in the Grouting Glovebox to produce a solid waste form and will be disposed of as TRU waste.

The types of LLW solid waste generated from the PDC F/H Laboratory include: job control waste, legacy sources and standards, potentially contaminated beryllium waste, and non-routine low-level radioactive waste streams. Job control waste includes pipet tips, vials, caps, bottles, gloves, swipes, Kimwipes from Lab modules, service floor and support areas. The amount of Beryllium expected to be found in the F/H Laboratory LLW is less than 1 gram per package, therefore it is not required to be reported. Non-routine low-level radioactive waste includes spills, one time waste streams, major decontamination and decommissioning wastes.

The PDC F/H Laboratory Green is Clean waste is solid waste that the user believes is not contaminated and is not required to evaluated or surveyed per Procedure Manual 5Q1.1, Procedure 517. This consists of personal items or items carried through an RBA, equipment/material sorted or used only in an RBA with no potential for contamination (Ref. 5).

The PDC F/H Laboratory HAD liquids are high level radioactive liquid sample returns that are collected in a HAD tank.

The PDC F/H Laboratory LAD liquids are waste from the analytical laboratory sinks, mop water, and other non-routine sources. These liquids are collected in the LAD tank.

6.0 WASTE ASSAY EQUIPMENT

All TRU waste will be assayed using the In-Situ Object Counting System (ISOCS).

LLW may be assayed for accountability values but in most cases the curie content will be determined by either Dose-To-Curie or Smear-To-Curie. If the LLW is assayed, the ISOCS will be used.

HAD and LAD will not be assayed.

The following assay instruments will be utilized in the PDC F/H Laboratory Waste Management System:

- Scale
  - 0-500 lb scale to weigh drumliners/drums
  - 0-6000 lb scale to weigh B-25s
- ISOCS
  - Assay TRU waste in TRU 55-gallon drumliners or 55-gallon drums for accountability values.

7.0 PDC F/H LABORATORY WASTE MANAGEMENT SYSTEM AREA DESCRIPTION

The PDC F/H Laboratory Waste Management System consists of a Waste Management Area, a Waste NDA Area, a HAD Tank, a LAD Tank, and a Grouting Glovebox.

- Waste Management Area – This area is to be used to stage TRU/MTRU waste shipping drums for shipment to the E-Area. The Waste Management Area will also be used to stage B-25 containers, and load LLW waste packages into B-25s. In addition, Green is Clean waste will be staged in this area for shipment to a sanitary landfill.
- Waste NDA Area - The Waste NDA area contains the ISOCS and scales for assaying and weighing TRU waste. LLW may be assayed here if required.
- HAD Tank - The HAD will drain HAD liquid generated from the PDC F/H Laboratory activities into the HAD tank and collect HAD until ready for transport to the WSB. It is currently housed in the basement level of the F/H Laboratory.
- LAD Tank – The LAD Tank will collect LAD liquid generated from the PDC F/H Laboratory activities until ready to be pumped to the ETP. It is housed outside of the F/H Laboratory building in the courtyard.
- Grouting Glovebox - Concentrated liquids generated by the PDC F/H Laboratory are processed in the Grouting Glovebox to produce a solid waste form. Grout powder will be bagged into the glovebox and mixed with the concentrated liquid

to produce a solidified waste form. The solidified waste will then be removed from the glovebox through the bagout port, placed in a 55 gallon drum, and transported to the Waste Management Area for disposal as TRU waste.

8.0 INVENTORY CONTROL

For TRU waste, the mass present in each waste package is quantified by the ISOCS. Other waste types will not require inventory control.

9.0 CHARACTERIZATION OF WASTE

Characterization of solid waste from PDC will involve many techniques. These include, but are not limited to, process knowledge, sample & analysis, smear-to-curie, and non-destructive assay.

10.0 WASTE MANAGEMENT ACTIVITY DESCRIPTION

TRU, LLW, and Green is Clean waste will not be discussed in this section because these waste types are covered under existing scope for the F/H Laboratory. The only exception will be a discussion of concentrated liquids which after grouting will be considered TRU waste. Discussions in this section will include HAD, LAD, and Concentrated Liquids.

Below are the activities required for the management of waste generated by the PDC F/H Laboratory. Figure 1 provides a block diagram of the same steps described below for PDC F/H Laboratory waste management activities. In general, Steps 1 through 6 cover HAD management, steps 7 through 12 cover LAD management, and steps 13 through 20 cover concentrated liquid waste management.

10.1 Description of HAD Management Process

HAD sample returns are generated and drained to the HAD tank. The HAD tank collects liquid until the mix-level is reached, then the tank is mixed and a sample is taken. Once the HAD Tank liquid meets acceptable criteria for WSB, the HAD liquid is transferred to a LR-56, then shipped to the WSB for disposal.

Step 1 – HAD sample return liquid is generated in the PDC F/H Laboratory.

Step 2 – HAD sample return liquid is drained through the HAD to the HAD Tank F.

Step 3 – The HAD Tank F accumulates HAD liquid until the mix-level is reached.

Step 4 – HAD tank F is mixed and then a sample is taken and submitted to the F/H Laboratory for analysis.

Step 5 - HAD liquid is transferred to a LR-56S Transport Trailer when permission is received.

Step 6 - The LR-56S Transport Trailer ships the HAD liquid to the WSB for disposal.

10.2 Description of LAD Waste Management Process

LAD liquids are generated and drained to the LAD tank. The LAD tank collects liquid until the mix-level is reached, then the tank is mixed and a sample is taken. Once the LAD Tank liquid meets acceptable criteria for ETP, the LAD liquid is pumped to the ETP for disposal.

Step 7) – LAD liquid is generated in the PDC F/H Laboratory.

Step 8) – LAD liquid is drained to the LAD tank, located outside the F/H Laboratory in the courtyard.

Step 9) – LAD tank accumulates LAD liquid until mix-level is reached.

Step 10) – LAD tank is mixed, and then a sample is taken and submitted to the F/H Laboratory for analysis.

Step 11) – Operator requests permission to transfer the LAD liquid to the ETF based on analytical results.

Step 12) – LAD liquid is pumped from the LAD tank to ETP for disposal.

10.3 Description of Concentrated Liquids Waste Management Process

Concentrated liquid laboratory waste is generated and collect in 1-liter bottles. A bottle is transferred to the grouting glovebox via a pass-through. A container of grout is posted into the glovebox. The concentrated liquid is added to the grout and mixed, and if required, the mixture is neutralized by adding a caustic. The mixture is allowed to cure and then weighed. The cured mixture is removed from the glovebox via the pass-through or bagout port. The waste is packaged into a drum and the waste is now considered TRU waste. Further waste management activities of the grouted concentrated liquids are covered under existing TRU waste management procedures.

Step 13 – Concentrated liquid waste is generated in the F/H Laboratory

Step 14 - Collect concentrated liquid laboratory waste in a one-liter bottle.

Step 15 - Transfer the concentrated liquid waste bottle to the Grouting Glovebox via pass-throughs.

Step 16 - Post in a 1-gallon paint can containing sufficient amount of grout.

Step 17 - Add concentrated liquid into grout and mix. As needed, neutralize the mixture using with a caustic.

Step 18 - Allow concentrated liquid/grout mixture to cure. Weigh cured mixture on a scale.

Step 19 - Remove the cured mixture from Grouting Glovebox via pass-through or bagout port. Containment is vented/filtered.

Step 20 - Transport to Waste NDA Area/Waste Management Area for NDA and for staging for disposal as TRU waste.

11.0 ISSUES/RISKS REQUIRING FURTHER INVESTIGATION/SOLUTION

As part of this study, a summary review of issues/risks that would be applicable to PDC F/H Laboratory waste management was performed. The following issues/risks were identified and may be important to decision makers in the design of the PDC Project. The significance of the risk identified was not discussed, only that the risk may have some impact on the project.

- The process is still maturing. The layout of the F/H Laboratory for the PDC Project is still in progress. The flow of sample returns/waste through the process discussed in this study is preliminary and subject to change.

- No changes are expected of the F/H Laboratory due to the addition of Stabilization and Packaging Project scope.

- With the addition of PDC Project scope, the F/H Laboratory may require an additional LF-56S and an additional HAD tank to increase capacity and reduce F/H Laboratory downtime. Currently, when the HAD tank reaches operating capacity, all flow of HAD sample returns is stopped and drains are tagged out for up to 2 weeks to complete the process of transferring of sample returns to the H-Canyon. This would occur every couple of months. The PDC Project is expected to add 1000 gallons per month or more of HAD sample returns, and this addition would be expected to decrease productivity of the F/H Laboratory significantly.

  Currently, there is limited room for an additional HAD tank to be located near the existing HAD tank in the basement of the F/H Laboratory. The additional HAD tank may be required to be located outside of the F/H Laboratory. Safeguard and security concerns would need to be addressed.

A separate drain system for the HAD sample returns generated by the F/H Laboratory supporting the PDC Project may need to be reviewed. Current schedules and acceptance criteria for the F/H Laboratory support for the H-Canyon and the PDC Project may conflict with each other unless additional capacity is made available once the PDC Project is online.

Direct piping of HAD liquids to the WSB should be considered and determined if feasible or not. Extra tanks may not be needed if HAD liquids could be pumped through piping to the WSB.

The WSB was designed to have a stub out which was intended to support PDCF pipe connections. This stub out could be used for a pipe connection from the F/H Laboratory. It also may be used for a connection for a new truck unloading station to support the HAD liquids from the PDC F/H Laboratory sample analysis.

12.0 SUMMARY

The PDC F/H Laboratory TRU solid waste will mainly be contact-handled waste. Due to infrequent generation and low-volume, remote handled TRU waste will be handled on a case-by-case basis. F/H Laboratory TRU waste management activities for the PDC Project are identical to on-going F/H Laboratory TRU waste management activities and for that reason are covered under existing scope.

The types of LLW solid waste generated from the PDC F/H Laboratory include: job control waste, legacy sources and standards, potentially contaminated beryllium waste, and non-routine low-level radioactive waste streams. F/H Laboratory LLW waste management activities for the PDC Project are identical to on-going F/H Laboratory LLW waste management activities and for that reason are covered under existing scope.

The PDC F/H Laboratory Green is Clean waste is solid waste that the user believes is not contaminated and is not required to evaluated or surveyed. F/H Laboratory Green is Clean waste management activities for the PDC Project are identical to on-going F/H Laboratory Green is Clean waste management activities and for that reason are covered under existing scope.

HAD sample returns are generated and drained to the HAD tank. The HAD tank collects liquid until the mix-level is reached, then the tank is mixed and a sample is taken. Once the HAD Tank liquid meets acceptable criteria for WSB, the HAD liquid is transferred to a LR-56, then shipped to the WSB for disposal

LAD liquids are generated and drained to the LAD tank. The LAD tank collects liquid until the mix-level is reached, then the tank is mixed and a sample is taken. Once the LAD Tank liquid meets acceptable criteria for ETP, the LAD liquid is pumped to the ETP for disposal.

Concentrated liquid laboratory waste is generated and collect in 1-liter bottles. A bottle is transferred to the grouting glovebox via a pass-through. A container of grout is posted into the glovebox. The concentrated liquid is added to the grout and mixed, and if required, the mixture is neutralized by adding a caustic. The mixture is allowed to cure and then weighed. The cured mixture is removed from the glovebox via the pass-through or bagout port. The waste is packaged into a drum and the waste is now considered TRU waste. Concentrated liquids generated by the PDC F/H Laboratory are processed in the Grouting Glovebox to produce a solid waste form and will be disposed of as TRU waste. Further waste management activities of the grouted concentrated liquids are covered under existing TRU waste management procedures.

13.0 REFERENCES

1) M&O-FHO-2008-00061, Rev. 1, dated 9/2009, F/H Area Laboratory Transuranic (TRU) Waste Certification/Characterization Plan
2) CBU-FHO-2003-00051, Rev. 5, dated 7/2009, F/H Area Laboratory Low Level Waste/Mixed Waste Certification/Characterization Plan
3) L2-1-00096051, Rev. 2, dated 7/2009, Packaging and Handling Low-Level Radioactive and Green Is Clean RBA Waste
4) G-TC-F-00020, Rev. H, dated 1/9/2009, Task Requirements and Criteria, Refurbish Laboratory 174 in Building 772-F for Plutonium Preparation Project (U)
5) 1S, Savannah River Site Waste Acceptance Criteria Manual
6) SRR-354-99-001, Rev.0, dated 2/2002, Pit Disassembly & Conversion Facility, Waste Management Study
7) Y-AES-K-00002, Rev. 0, NNSA, Refinement Study of the K-Area (KAC) Combination Project which provides Pit Disassembly and Conversion Capability and Plutonium Preparation Project Capability, 9/29/09 (UCNI)
8) Y-AES-K-00002, Rev. 0, NNSA, Refinement Study of the K-Area (KAC) Combination Project which provides Pit Disassembly and Conversion Capability and Plutonium Preparation Project Capability, 9/29/09 (UCNI)
9) G-SYD-F-00018, Rev. F Draft, Pit Disassembly And Conversion Facility System Design Description For Analytical Laboratory System (U)
10) G-SYD-F-00044, Rev. F Draft, Pit Disassembly And Conversion Facility System Design Description For Waste Management System (U)

PDC F/H Laboratory Waste Management
Block Flow Diagram - Figure 1