UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

SEP 9 2010

OFFICE OF
AIR AND RADIATION

Donald C. Gadbury
Manager, National TRU Program
Carlsbad Field Office
U.S. Department of Energy
P.O. Box 3090
Carlsbad, NM 88221-3090

Dear Mr. Gadbury:

On May 20 and 21, 2010, the Carlsbad Field Office (CBFO) requested that the U.S. Environmental Protection Agency (EPA) approve addition of remote-handled (RH) transuranic (TRU) debris waste from Argonne National Laboratory (ANL) K-Wing to a previously approved ANL debris waste stream (AERHDM) at as a Tier 1 change. This letter approves the addition of K-Wing waste containers and as a result, INL may dispose of this waste at the Waste Isolation Pilot Plant (WIPP). The enclosed report (EPA Docket No. A-98-49; II-A4-132) supports EPA's approval decision.

The Central Characterization Project (CCP) characterized this waste using remote-handled (RH) waste characterization processes approved by EPA in January 2007. EPA determined that the procedures and processes used by ANL-CCP staff for characterizing debris waste stream AERHDM were adequate. As a result of our evaluation, EPA has made several changes to the tiering table (See Table 1 of the enclosed report). The revised Tier 1 and Tier 2 changes will apply to all CCP's RH TRU waste characterization activities at ANL.

While previous Tier 1 changes adding RH waste streams have been container limited, this approval is not limited to a specific number of waste containers of K-Wing waste added to AERHDM. ANL-CCP may add K-Wing waste containers to the approved waste streams, if:

- Additional containers have similar pedigree as the approved waste stream; and
- ANL-CCP can demonstrate that the radionuclide scaling factors used for the RH waste stream (AERHDM) are technically appropriate for use in the Dose-to-Curie (DTC) determination of the radiological characterization of the additional containers.

Any addition of new K-Wing waste containers to the approved waste stream must comply with the revised ANL-CCP tiering table (see Table 1 of the enclosed report), including the following:

1. EPA notification: When notifying EPA, an INL-CCP must (a) identify the approximate number of additional containers **and** the approximate additional volume of waste, and (b) provide the timeframe for waste generation, characterization and disposal.

2. Submission of documents: Upon characterizing a sufficient number of containers to generate 1-2 Batch Data Reports, INL-CCP must provide the list of characterized containers and a revised AKSR and supporting source documents, and an updated radiological characterization report. If any of the documents are not changed, CBFO should make that clear to EPA. From this list, EPA may select a few containers for a detailed review to verify that the additional containers belong to the approved waste stream.

EPA expects CBFO to notify us of the addition of containers to this waste stream during our weekly call.

If you have any questions regarding this approval, please contact Rajani Joglekar at (202) 343-9462 or Ed Feltcorn at (202) 343-9422.

Sincerely,

Tom Peake

Tom Peake, Director
Center for Waste Management and Regulations

Enclosure

cc: Electronic Distribution
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DOCKET NO: A-98-49; II-A4-132

WASTE CHARACTERIZATION TIER 1 CHANGE REPORT

ADDITION OF 30 55-GALLON K-WING DEBRIS WASTE CONTAINERS TO THE REMOTE-HANDLED DEBRIS WASTE STREAM (AERHDM) AT THE ARGONNE NATIONAL LABORATORY

U.S. Environmental Protection Agency
Office of Radiation and Indoor Air
Center for Federal Regulations
1200 Pennsylvania Avenue, NW
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September 2010

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ATTACHMENTS

ACRONYMS AND ABBREVIATIONS

ACL	Analytical Chemistry Laboratory
AGHCF	Alpha Gamma Hot Cell Facility
AK	Acceptable Knowledge
AKE	Acceptable Knowledge Expert
AKSR	Acceptable Knowledge Summary Report
Am	americium
ANL	Argonne National Laboratory
Ba	barium
BDR	Batch Data Report
CBFO	Carlsbad Field Office
CCP	Central Characterization Project
CFR	Code of Federal Regulations
CH	Contact-Handled
Ci	Curie
Cm	curium
CMT	Chemical Technology Division
CRR	Characterization Reconciliation Report
Cs	cesium
CSSF	Correlation and Surrogate Summary Form
CTP	Confirmatory Testing Plan
DOE	U.S. Department of Energy
DQO	Data Quality Objective
DR	Discrepancy Resolution
DTC	Dose-to-Curie
EPA	U. S. Environmental Protection Agency
g/cm^3	grams per cubic centimeter
LWR	light water reactor(s)
MCNP5	Monte Carlo N-Particle Transport Code
NCR	Non-Conformance Report

ORIGEN	Oak Ridge Isotopic Generation Computer Program
PTS	Project Tracking System
Pu	plutonium
RERTR	Reduced Enrichment Research and Test Reactor Program
RH	Remote-Handled
RTR	Real-time Radiography
SPM	Site Project Manager
Sr	strontium
T1	Tier 1
T2	Tier 2
TMI	Three Mile Island
TRU	Transuranic
TSFU	Total Scaling Factor Uncertainty
U	uranium
UREX	Uranium Extraction
VE	Visual Examination
WCPIP	Remote-Handled TRU Waste Characterization Program Implementation Plan
WDS	Waste Data System
WIPP	Waste Isolation Pilot Plant
WMP	Waste Material Parameter
WSPF	Waste Stream Profile Form
Y	yttrium

1.0 EXECUTIVE SUMMARY

This report supports the U.S. Environmental Protection Agency's (EPA's) decision to approve the addition of remote-handled (RH) transuranic (TRU) debris waste to the RH debris Waste Stream AERHDM at the U.S. Department of Energy's (DOE's) Argonne National Laboratory (ANL), as characterized by the Central Characterization Project (CCP). Specifically, this approval is for the addition of 30 55-gallon containers[1] of debris waste from the K-Wing in Building 205 to Waste Stream AERHDM.

On January 16, 2007, EPA approved ANL-CCP's waste characterization processes for disposal of Waste Stream AERHDM at the Waste Isolation Pilot Plant (WIPP). This baseline approval applied to 45[2] containers of legacy RH debris waste drums. The ANL Baseline Final Inspection Report (see EPA Docket No. A-98-49; II-A4-73) cited the inclusion of any additional containers of debris wastes as a Tier 1 (T1) change that requires EPA approval prior to implementation. A summary of EPA's approval of the ANL RH TRU waste characterization program is included as Attachment A.

On May 20 and 21, 2010, the Carlsbad Field Office (CBFO) requested EPA approval of a T1 change to include approximately 30 55-gallon containers of K-Wing debris wastes in Waste Stream AERHDM. Because there were no new equipment or processes on site at ANL, EPA conducted a desktop review of this change, concluding that the ANL-CCP has used the EPA-approved systems of controls to characterize the additional 30 RH debris containers from K-Wing to the Waste Stream AERHDM (See Section 5.0 for details). ANL-CCP estimates that there are, however, approximately 75 55-gallon containers that would be generated from the K-Wing activity. The systems of controls evaluated as part of this review continue to be technically adequate, and EPA thus approves the T1 change request. EPA did not identify any findings or concerns during this evaluation.

In the future, when ANL-CCP characterizes the remaining 45+ containers of the K-Wing waste to add to the approved Waste Stream AERHDM, no T1 change request for approval is necessary, if ANL-CCP can demonstrate the following:

- The additional containers have the same pedigree as the approved waste stream; and
- The radionuclide scaling factors used for the RH waste stream are technically appropriate for use in the Dose-to-Curie (DTC) determination of the radiological characterization of the additional containers

In addition, ANL-CCP must:

1. Notify EPA concerning the approximate number of additional containers **and** the approximate additional volume of waste.

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[1] Containers is a generic term which applies to cans, canisters, drums, and any other types of waste packaging units that may be characterized individually for their radiological and physical contents.

[2] The baseline approval was written for 45 containers; however, documentation from ANL-CCP indicates that the original waste stream contained 44 drums. Therefore, throughout this report, the size of Waste Stream AERHDM varies depending on which document is being referenced.

2. Provide the timeframe for waste generation, characterization and disposal.

3. Submit to EPA, upon characterizing a sufficient number of containers to generate 1-2 Batch Data Reports (BDRs), the following:

    a. the list of characterized containers
    b. a revised Acceptable Knowledge Summary Report (AKSR) and supporting source documents
    c. an updated radiological characterization report

4. Inform EPA if any other waste characterization documents have been changed.

From the list mentioned in #3 above, EPA may select a few containers for a detailed review to verify that the additional containers belong to the approved waste stream and are adequately characterized to demonstrate regulatory compliance.

The ANL-CCP's compliance with the above conditions is necessary when adding containers to the approved Waste Stream AERHDM. When adding containers to an approved waste stream, however, if different or new scaling factors are used, the T1 change approval is necessary.

EPA has revised the original tiering table to add the modified T1 change and the above-listed conditions as Tier 2 (T2) changes, as shown in Table 1 in **bold**. Table 1 below now will apply to all RH waste characterization activities occurring at ANL-CCP.

This report serves as EPA's public notification of the results of the proposed T1 changes and their evaluations. This information will be provided through the EPA website and by sending e-mails to the WIPPNEWS list, in accordance with 40 CFR 194.8(b)(3).

Table 1. Tiering of RH TRU Waste Characterization Processes Implemented by ANL-CCP (Based on September 12–14, 2006 Baseline Inspection; Updated August 30, 2010)

RH Waste Characterization Process Elements	ANL-CCP RH Waste Characterization Process – T1 Changes	ANL-CCP RH Waste Characterization Process – T2 Changes
Acceptable Knowledge (AK)	Any new waste streams not approved under this baseline Modification of the approved Waste Stream AERHDM to include additional containers beyond the approximately 45 included in CCP-AK-ANLE-500, Revision 1, **if new or different radionuclide scaling factors are required** Substantive modification(s) that have the potential to affect the characterization process to CCP-AK-ANLE-500, CCP-AK-ANLE-501 or CCP-AK-ANLE-502 Implementation of load management for any RH waste stream	Notification to EPA that the final DTC determination is complete for RH containers in the approved waste stream Notification to EPA when updates are made to AK documentation as a result of WCPIP revisions Notification that updates have been completed to the following documents: • All future revisions of CCP-ANLE-AK-500, CCP-ANLE-AK-501 • Listing of the references that document the assembly of fuel pin data and review process • All future revisions of CCP-ANLE-AK-502 • CCP-AK-ANLE-500 and CCP-AK-ANLE-502 to address freeze file changes Notification to EPA that the data package for this debris waste stream is completed, including any modifications to the WSPF including the CRR and AK Summary Notification to EPA when AK accuracy reports are completed, prepared annually at a minimum **Notification to EPA when additional containers are added to RH TRU Waste Stream AERHDM and the containers were characterized using the same radionuclide scaling factors*** **Notification to EPA of availability of a revised AKSR and source documents supporting the addition of containers to the approved waste stream*** **Notification to EPA when Attachment 4 of CCP-TP-005 is generated to reflect the updated AKSR Source Document Reference List** **Notification to EPA when Attachment 8 of CCP-TP-005 has been formally updated**

Table 1. Tiering of RH TRU Waste Characterization Processes Implemented by ANL-CCP (Based on September 12–14, 2006 Baseline Inspection; Updated August 30, 2010)

RH Waste Characterization Process Elements	ANL-CCP RH Waste Characterization Process – T1 Changes	ANL-CCP RH Waste Characterization Process – T2 Changes
Radiological Characterization, including Dose-To-Curie (DTC)	Use of any alternate radiological characterization procedure other than DTC with established scaling factors as documented in CCP-TP-504 and CCP-AK-ANLE-501, Revision 0, respectively, or substantive modification thereof Any new waste stream not approved under this baseline or addition of containers to Waste Stream AERHDM that require changing the established radionuclide scaling factors Application of new scaling factors for isotopic determination other than those documented in CCP-AK-ANLE-501	Notification to EPA that revisions of CCP-AK-ANLE-501 or CCP-TP-504 that require CBFO approval are complete **Notification to EPA of availability of a revised radiological characterization report, if generated when containers are added to the approved waste stream*** **Radiological content data provided in BDRs for the population of additional containers***
Visual Examination (VE)	VE by reviewing existing audio/visual recordings for summary waste category not covered by this approval VE by any new process for S5000 debris wastes	Notification to EPA that revisions of any VE procedure that require CBFO approval are complete Addition of new S5000 debris waste streams **Physical content data provided in BDRs for the population of additional containers***
Real-time Radiography (RTR)	Any use of RTR requires EPA approval	None
WIPP Waste Data System (WDS)	None	Changes made to WDS procedure(s) that require CBFO approval

Notes:
- This table has been modified by deleting the references to specific sections of the baseline inspection report where each T1 or T2 element is discussed.
- ANL-CCP will report all T2 changes to EPA quarterly.
- Notification to EPA is not necessary when document updates are editorial in nature or are required to address administrative concerns.
- *Substantive modification* refers to a change with the potential to affect ANL-CCP's RH waste characterization process, e.g., the use of an inherently different type of measurement instrument or the use of the high-range probe as described in CCP-TP-504 for radiological characterization.
- Additions to the original tiering table as a result of this T1 evaluation appear in **bold**.

* These marked changes apply when containers are added to Waste Stream AERHDM and are characterized using the same radionucliude scaling factors as were used to characterize the original approved waste stream. EPA notification is required when the site identifies the need to characterize additional containers belonging to the approved waste stream.

2.0 PURPOSE OF INSPECTIONS AND TIER 1 EVALUATIONS

Any changes to the waste characterization activities from the date of the baseline inspection must be reported to, and, if applicable, approved by EPA, according to the tiering requirements set forth in the ANL Baseline Final Report cited above.

Under the changes to 40 CFR 194.8 promulgated in the July 16, 2004, *Federal Register* notice, EPA must perform a single baseline inspection of a TRU waste generator site's waste characterization program. The purpose of a baseline inspection is to approve the site's waste characterization program based on the demonstration that the program's components, with applicable conditions and limitations, can adequately characterize TRU wastes and comply with the regulatory requirements imposed on TRU wastes destined for disposal at the WIPP. An EPA inspection team conducts the baseline inspection to verify that the site's system of controls is technically adequate and properly implemented.

Following the EPA's approval of waste characterization processes evaluated during the baseline inspection, EPA is authorized to evaluate and approve, if necessary, changes to the site's approved waste characterization program by conducting additional inspections under the authority of 40 CFR 194.24(h). Under 40 CFR 194.24, EPA has the authority to conduct continued compliance inspections to verify that the site continues to use only the approved waste characterization processes to characterize the waste and remains in compliance with all the regulatory requirements. Based on the adequacies of the waste characterization processes demonstrated during the baseline inspection, including all conditions and limitations, EPA specified which subsequent waste characterization program changes or modifications must undergo further EPA inspection or approval under 40 CFR 194.24. This was accomplished by assigning a tier level to each aspect of the ANL-CCP's characterization program. T1 activities have more stringent reporting requirements and require that DOE notify EPA, and that EPA provide approval prior to implementation. The rule under which baseline inspections are conducted can be found in the *Federal Register* (Vol. 69, No. 136, pages 42571-42583 of July 16, 2004).

3.0 PURPOSE OF THIS REPORT

This report presents the results of EPA's evaluation of T1 changes to include approximately 30 55-gallon containers of RH TRU debris K-Wing waste (see Section 5.0, below in Waste Stream AERHDM, as described in CCP-AK-ANLE-500, Revision 5 and Discrepancy Resolution (DR) Form DR023. This report presents the technical basis and results of EPA's approval decision. EPA's approval decision regarding the inclusion of the K-Wing wastes has been conveyed to DOE separately by letter. As discussed previously, EPA will also announce the decision on its website at www.epa.gov/radiation/WIPP, in accordance with 40 CFR 194.8(b)(3).

The DOE documents that EPA reviewed for this evaluation are cited in different sections throughout the report and are listed at the end of the report. Any of these documents can be requested from the following:

Carlsbad Field Office
Manager, National TRU Program
U S Department of Energy
P O Box 3090
Carlsbad, NM 88221-3090

4.0 SCOPE OF THE TIER 1 EVALUATION

The scope of this evaluation was the inclusion of approximately 30 55-gallon containers of RH TRU debris K-Wing waste as described in CCP-AK-ANLE-500, Revision 5. The evaluation was performed by comparing elements assessed in the previous EPA approval against information about the new drums that was provided by ANL-CCP/CBFO to ensure that these drums fit within the approval issued by EPA previously. Some elements of the previous report, i.e., the Los Alamos National Laboratory mass spectrometry data, were not evaluated again because the addition of these containers did not affect these elements. Only those elements that were affected by the addition of the approximately 30 containers were re-evaluated. Because this evaluation involved expanding an existing waste stream to incorporate new containers and not the addition of a new Summary Category Group or waste stream, an inspection checklist was not used.

This approval is limited to the addition of approximately 30 55-gallon containers of K-Wing RH TRU debris waste. If the remaining approximately 45 55-gallon K-Wing containers are to be added to the approved RH debris Waste Stream AERHDM, then the T1 change and T2 changes included in the revised tiering table (see Table 1 above) apply. EPA approval is necessary when any other RH waste stream generated at ANL which is not an approved debris waste stream is characterized for the disposal at the WIPP.

EPA examined the acceptable knowledge (AK) and radiological characterization processes and associated information to determine whether ANL-CCP demonstrated compliance with 40 CFR 194.8 for a T1 change to add drums to Waste Stream AERHDM. Personnel who participated in the T1 evaluation are listed in Table 2, along with each person's affiliation and function during the evaluation.

Table 2. T1 Evaluation Participants

Name	Affiliation & Function
Rajani Joglekar	Lead Inspector, U.S. EPA
Ed Feltcorn	Inspector, U.S. EPA
Connie Walker	Technical Evaluator – Acceptable Knowledge, SC&A
Kira Darlow	Technical Evaluator – Acceptable Knowledge, SC&A
Patrick Kelly	Technical Evaluator – Radiological Characterization, SC&A
Amir Mobasheran	Technical Evaluator – Radiological Characterization, SC&A
Kevin Peters	Acceptable Knowledge Expert, ANL-CCP
Irene Quintana	Site Project Manager, ANL-CCP
Jene Vance	Radiological Characterization Subject Matter Expert, ANL-CCP

5.0 TECHNICAL EVALUATION OF THE ADDITION OF 30 DRUMS OF K-WING DEBRIS WASTE

5.1 Acceptable Knowledge

EPA examined the AK process and associated information to determine whether the ANL-CCP waste characterization program demonstrated compliance with the requirements of 40 CFR 194.8 for the addition of approximately 30 K-Wing containers of RH TRU debris waste to ANL Waste Stream AERHDM.

Waste Characterization Element Description

As part of the inspection, EPA reviewed the following with respect to the use of AK for waste characterization as impacted by the addition of new containers:

- Waste stream identification and definition
- Radionuclide content of additional waste
- Physical composition of additional waste
- Sufficiency of modified AKSR to include the additional waste
- Drum data traceability
- Defense origin of additional waste
- Identification of High-Level Waste (HLW), TRU vs. Low-Level Waste (LLW), Spent Nuclear Fuel (SNF)
- AK source document sufficiency
- Modifications to the Confirmatory Testing Plan (CTP)
- Modifications to the Waste Stream Profile Form (WSPF) and Characterization Reconciliation Report (CRR)
- Correlation and Surrogate Summary Form (CSSF) and Contact-Handled (CH)-RH correlation
- Personnel training
- Non-Conformance Reports (NCRs) and AK DRs
- AK accuracy
- Load management
- Identification and attainment of Data Quality Objectives (DQOs)

Documents, Waste Containers and Batch Data Reports Provided

EPA evaluated the documentation that ANL-CCP had prepared to support the inclusion of approximately 30 55-gallon containers of K-Wing waste in Waste Stream AERHDM. Several attachments, source documents, required forms and other data were provided to EPA, and relevant sources were examined as part of this T1 inspection. Revision 5 of the AKSR (provided to EPA at the start of this review) did not satisfactorily support inclusion of K-Wing waste in Waste Stream AERHDM. Therefore, EPA based their evaluation and subsequent approval on the

draft AKSR, Revision 6, as provided by ANL-CCP representatives through Freeze File[3] documentation. The listing of all documentation reviewed is in Attachment B, and the list of BDRs examined is presented in Table 3.

Table 3. Batch Data Reports Examined

Drum Number	VE BDR Number	DTC BDR Number
RW18870	RHANLVE100004	RHANLDTC10005
RW18871	RHANLVE100004	RHANLDTC10005
RW18872	RHANLVE100004	RHANLDTC10005
RW18873	RHANLVE100004	RHANLDTC10005
RW18874	RHANLVE100004	RHANLDTC10005

Technical Evaluation

To assess inclusion of approximately 30 55-gallon RH debris drums from the K-Wing based on their radiological and physical characteristics, EPA determined the following: how these data had been integrated, impacts of the information on the waste stream, changes to the radiological and physical characteristics of the waste and other elements that could affect pertinent characteristics of Waste Stream AERHDM. Results of the analysis are presented below. When information presented in the text is supported directly by one of the AK references, that reference is cited in parentheses.

(1) The definition of Waste Stream AERHDM was examined with respect to the addition of the K-Wing wastes and found to be adequate.

Waste Stream AERHDM is a debris waste stream generated by ANL in two locations – the alpha gamma hot cell facility (AGHCF) and the K-Wing[4]. As part of the baseline, EPA evaluated this waste stream and concluded that the waste stream was adequately defined, but the waste stream did not at that time include K-Wing waste. After reviewing the modified documentation, EPA concluded that inclusion of K-Wing waste in Waste Stream AERHDM is adequately supported.

K-Wing waste created from 1995–2007 as a result of hot cell activities is included in Waste Stream AERHDM, because most of the materials tested in the K-Wing hot cells originated as either samples prepared in the AGHCF or from the same commercial reactors. ANL sampled irradiated target material (corrosion studies and high-burnup characterization) and demonstration of Uranium Extraction (UREX) chemical separation processes in support of advanced nuclear fuel cycles. EPA evaluated an ANL-CCP-provided comparison of the accountable materials identified in the K-Wing inventory and the materials identified in AK source documents collected during the characterization of the original AGHCF waste materials (C2027, P2033), and concluded that adding K-Wing waste to the AERHDM waste stream is technically adequate. Additionally, since fuel pin residue samples generated during processing of samples from

[3] Freeze File: As a result of EPA inspections, if CCP must revise documents to address EPA issues, CCP makes those changes and provides a copy to EPA as objective evidence for the changes made. These revisions are then processed by CCP's document control process to generate an official version as the most current revision.
[4] The AGHFC and the K-Wing Hot Cell Facility are distinct facilities located in the 200 Area of ANL that were used for similar purposes.

various reactors were transferred between the AGHCF and the K-Wing, those samples may have been contaminated/commingled with minor amounts of radiological materials from any fuels ever processed in the same area (P051, P330, P344, P515, P518, P519, P523, P551, P575, P802, P819, C812, C2006, C2027, U303, U304, U802, U1003, U2002, U2004).

Based on the historical information concerning materials handled in the K-Wing and AGHCF, ANL-CCP concluded that the physical form and composition of the K-Wing debris wastes are similar to the AGHCF debris waste, and therefore eligible to be part of Waste Stream AERHDM. ANL-CCP personnel estimated waste material parameters (WMPs) based on documented historical operations and visual estimates of the waste inventory. See Item (3), below, for further discussion regarding physical composition of K-Wing debris waste.

Even though the UREX process significantly impacted the radiological composition of the K-Wing debris, as indicated in CCP-AK-ANLE-501, Revision 2, Attachment A, the transfer of many common materials between the two areas and provision of common support activities between the K-Wing and AGHCF suggest that the debris waste generated from the K-Wing (as identified in CCP-AK-ANLE-501, Revision 2, Attachment A) has common physical and radiological characteristics and was generated by mutually supportive activities. Therefore, the modified AKSR and support documentation, as presented to EPA, as well as other contaminant transfer information, adequately support inclusion of K-Wing waste in Waste Stream AERHDM.

(2) Radiological characteristics of the K-Wing waste were assessed with respect to their similarity to Waste Stream AERHDM and found to be adequate.

The AKSR states that most of the sources and samples were moved into K-Wing following the 1995 cleanout campaign, and these sources and samples are documented in the Chemical Technology Division (CMT) Nuclear Materials Inventory Database. Table 11 in the AKSR provides a list of the significant isotopes calculated in the fuels managed in K-Wing, as well as the total grams of each isotope estimated to be present in the K-Wing portion of the AERHDM waste stream, and provides evidence of the completeness of the AK record.

ANL-CCP determined that the radiological signature imparted by the UREX processes would have a dominant impact on the radiological composition of debris removed from K-Wing. Further, it was determined that while radiological data are available for the various fuels (Table 11 of the AKSR), the actual isotopic signature and related scaling factors for debris within the K-Wing A and B Cells could not be determined using these data and ORIGEN2.2 modeling because of the potential separation of cesium-137 (^{137}Cs) during the UREX process. Therefore, ANL-CCP decided that the radiological composition of the debris must instead be determined through swipe sampling and analysis; Section 5.2 below presents EPA's evaluation of the swipe sampling and analysis. ANL-CCP compared the swipe sample analytical results for plutonium (Pu) isotopes against AK information specific to light water reactor (LWR) fuels (U896). This comparison showed that the swipe sample data and AK information for both the Pu isotopes and the uranium-235/238 ($^{235/238}$U) ratios were in good agreement, thus indicating that the waste composition was dominated by LWR fuels used in the UREX process. Because ^{234}U could not be measured and because the AK LWR data had been verified through sampling and analysis, ANL-CCP then used ^{234}U information from LWR fuel AK data to develop scaling factors for this

isotope. These data indicate that the AK record is very useful and provides a good understanding of the radiological material in the K-Wing, and sampling and analysis verify radiological assumptions based on AK.

(3) Physical characteristics of the K-Wing waste were assessed with respect to the physical characteristics of Waste Stream AERHDM and were found to be adequate.

WMPs identified in the K-Wing waste materials include iron-based metals/alloys, aluminum-based metals/alloys, other metals, other inorganic materials, cellulosics, rubber and plastic (waste materials), which are the same WMPs previously identified for the AGHCF waste. ANL-CCP estimated a preliminary waste inventory for the K-Wing waste based on visual inspection of the K-Wing hot cells. WMP fractions were estimated based on observation and a review of documentation regarding historical operations in the K-Wing, and WMP weights were estimated based on observation and experience with similar debris in other locations. Based on the results of this evaluation, ANL-CCP concluded that the K-Wing debris waste is physically similar to the AGHCF debris waste, and that the WMP parameters published in the AKSR for the AGHCF debris waste are comparable and bounding. Source document C2010 presents the WMP assessment summarized in this section and states that the memo will be included in Attachment 6 – Waste Form, WMPs, Prohibited Items and Packaging to support the physical waste description of Waste Stream AERHDM.

ANL-CCP representatives indicated that all organic liquids presently in the K-Wing will be segregated and not included in Waste Stream AERHDM, and aqueous solutions found in the K-Wing will be neutralized and solidified prior to packaging and inclusion in Waste Stream AERHDM. Visual Examination (VE) will be performed at the time of packaging to confirm the absence of prohibited items.

(4) The AK summary and implementation of AK as required in Attachment A of the Waste Characterization Program Implementation Plan were evaluated and were found to be adequate.

EPA examined Revision 5 of the AKSR and found that the document contained all the necessary pieces prescribed in Attachment A of the WCIP, but the waste stream was not defined well enough to support inclusion of the K-Wing waste. The EPA inspector raised the following two issues.

Issue No. 1: The argument that K-Wing waste should be part of Waste Stream AERHDM needed to have better justification, taking into account the following points:

a) The various components of the waste stream needed to be more clearly explained and supported as belonging to the same waste stream.
b) Commonality of fuel pins and flow of materials between the AGHCF and K-Wing needed to be more clearly demonstrated. That is, the AKSR must show that the underlying radiological composition of the waste (excluding UREX) is common to K-Wing and AGHCF per the waste stream definition.

c) The UREX demonstrations have such a large influence on the radiological characterization of the K-Wing waste that a better counter argument is needed to explain why the K-Wing waste does not need to be its own waste stream.

Issue No. 2: In several places throughout Revision 5 of the AKSR, an explanation is given that both the AGHCF and K-Wing handled fuel samples from the same nuclear reactor (for example, page 23, 2nd paragraph, page 26, 1st and 2nd paragraphs), but source document references are only provided for AGHCF. Additional references and/or a re-write of the sections to better incorporate the K-Wing waste needed to be provided.

ANL-CCP AK personnel provided an additional source document (C2027) to EPA that addresses the majority of the points raised in the above two issues. Now the source document more clearly explained the relationship between AGHCF waste and K-Wing waste through a fuel-by-fuel comparison of the K-Wing inventory and the AK documentation collected for the characterization of the original AGHCF RH debris waste. The document also more clearly describes historic waste management practices in the K-Wing and AGHCF, including mention of historic waste commingling and procedures that had been in place, before being changed for reasons unrelated to the technical aspects of the waste, to transfer all K-Wing waste to the AGHCF for packaging. This information also explains that ANL-CCP considers that the UREX waste belongs in Waste Stream AERHDM because of the historic commingling and common fuel sources between the K-Wing and the AGHCF. See Item (1), above, for a full discussion of the waste stream definition. ANL-CCP also provided to EPA (and the AK record) a copy of the draft Revision 6 of the AKSR (U911) demonstrating how reference C2027 is to be incorporated into the document. This draft addresses both of the above EPA issues and satisfactorily supports inclusion of the K-Wing waste.

EPA finds that the AKSR will be sufficient upon inclusion of the revisions as demonstrated in the draft Revision 6 that EPA reviewed, and expects a formal revision of the AKSR to be completed prior to the ANL-CCP's 2011 1st quarter submission of T2 changes to EPA for review and concurrence.

(5) Data traceability of K-Wing waste was examined and was found to be adequate.

EPA examined traceability of AK data to understand the waste generation, packaging, processing, transfer and characterization processes up to and including that performed by ANL-CCP. Data management in the Project Tracking System (PTS) data system used by ANL-CCP was also assessed, as well as presentation and general contents of the ANL-CCP waste characterization data. Also, availability of the data in the WIPP Waste Data System (WDS) was evaluated.

The K-Wing waste is newly generated, so there are no original data packaging sheets or other generator documentation associated with individual drums. ANL-CCP indicated that prior to the submission of a T1 change request five drums were generated that underwent ANL-CCP's VE and DTC characterization. EPA was provided the following two BDRs:

- A VE BDR (RHANLVE100004) that included five K-Wing drums—RW18870, RW18871, RW18872, RW18873 and RW18874. Examination of these data indicated that the drums contained many different debris items including, but not limited to, plywood disks, open plastic and glass bottles, plastic caps, plastic tubing, tape, stainless steel hardware and steel cans/cable, heating mantles, hose clamps, ceramic funnels, rubber stoppers, stainless steel fittings, plastic bags, glass labware, aluminum, brass, thermocouples, cameras, equipment, copper gaskets and paper. These items are generally consistent with the anticipated waste stream content presented in the AKSR.

- A DTC BDR (ANLRHDTC10005) that included measurements for drums RW18870, RW18871, RW18872, RW18873 and RW18874. Documentation in the BDR included the container data and DTC conversion sheets for each drum. Examination of the BDR indicated that the radionuclide scaling factors presented on the conversion sheets were equivalent to those calculated by ANL-CCP as presented in Section 5.2 of this report, as well as in Table A4-1 of CCP-AK-ANLE-501, Revision 2, Appendix A.

A copy of the Attachment 8 container list was provided; the list was dated 2007 and did not include the K-Wing wastes. However, the March 10, 2009, Add Container Memo that was appended to Attachment 8 requested inclusion of the five K-Wing drums in the waste stream. EPA expects that Attachment 8 will eventually be formally updated to include the K-Wing wastes and has identified a new T2 change to receive notification when the Attachment 8 container list has been formally updated.

ANL-CCP did not originally provide to EPA documentation pertaining to drum data as managed in the ANL-CCP PTS system. ANL-CCP also did not originally provide Site Project Manager (SPM) review documentation, or a CRR that addressed the K-Wing waste. Also, the five K-Wing drums mentioned above had not been entered into the WDS. EPA requested provision of a CRR that addressed the K-Wing waste, as well as modifications (change requests) to the WSPF addressing K-Wing and print-outs of each drum as currently documented in the PTS and AK Tracking Spreadsheet. ANL-CCP provided all of the requested information, except for the revised WSPF which will occur once the waste stream is approved by EPA and subsequently certified by CBFO; the CRR was provided in draft form solely for the purpose of EPA's T1 review. Provision of these data demonstrates that ANL-CCP is able to generate the required documentation for the K-Wing drums.

(6) Defense Origin of K-Wing waste was assessed and found to be adequate.

EPA previously evaluated and approved the defense waste determination of Waste Stream AERHDM for the AGHCF waste during the baseline inspection (No. EPA-ANL-CCP-RH-9.06-8). Defense-related spent fuels managed in K-Wing after 1995 included those obtained from the EBR-II reactor, Hanford N reactor, Shippingport Light Water Breeder Reactor and Reduced Enrichment Research and Test Reactor Program (RERTR), which were also used in Yucca Mountain corrosion studies and high-burnup characterization studies (C006, C2004, C2007, U001). ANL-CCP representatives also indicate that due to the fact that the K-Wing continues to "store, manage, and utilize research materials... accumulated throughout the... operational history" and the impossibility of "separation of contamination from destructively examined

specimens," all RH TRU debris waste from the K-Wing meets the WIPP requirement of defense-related waste (C2027).

(7) Identification of high-level waste, transuranic versus low-level waste, spent nuclear fuel with respect to K-Wing waste was assessed and found to be adequate

According to the *Nuclear Waste Policy Act* (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's M 435.1-1, *DOE Radioactive Waste Management Manual* expands on this definition to clarify that test specimens of fissionable material irradiated for research and development only may be classified as waste. ANL-CCP determined that the wastes generated during deactivation, decommissioning and demolition activities of the K-Wing facility are contaminated with residual radiological contamination from various operations conducted from 1996 until 2007, and do not contain irradiated fuel elements withdrawn from a reactor. EPA inspected the K-Wing inventory documentation and agrees that the radiological materials managed in the K-Wing were primarily fuel samples and swarf, as indicated by the size of the material and the segment/sample ID record (U2004). ANL-CCP also states that the intact irradiated fuel pin test specimens were managed separately and are not included in the waste stream. As a result, the K-Wing waste material is not considered spent nuclear fuel.

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. ANL-CCP determined that the K-Wing waste does not contain spent nuclear fuel, so by definition the waste could not contain high-level waste. Also, while the K-Wing UREX process demonstrations included reprocessing research, by virtue of taking place within a hot cell, these R&D laboratory operations were not production operations involving the separation or reprocessing of constituent elements from reactor fuels; therefore, no high-level waste was generated (P2019, P2023, P2024). ANL-CCP concluded that the waste is not a spent nuclear fuel or high-level waste, and EPA believes the arguments presented are reasonable. Note that ANL-CCP is not including in Waste Stream AERHDM any of the vitrified samples of high-level waste or waste surrogates from West Valley and Savannah River Site used during Yucca Mountain corrosion studies and stored in the K-Wing, pending further evaluation.

(8) Sufficiency of AK support documents and related document tracking with respect to the addition of K-Wing references was evaluated and was found to be adequate.

An AK Source Document Reference List was prepared using unique identifiers for the different document types, following the format typically used by ANL-CCP for RH wastes. The listing is complete, and is easy to understand. ANL-CCP identified several references specific to K-Wing wastes; however, EPA identified several places in the AKSR where statements were made about the K-Wing without associated source documents to support the statements. EPA discussed this with ANL-CCP representatives, and an additional source document (C2027) was provided [see Items (1) and (4), above, for details]. ANL-CCP representatives also provided a draft Revision 6

of the AKSR to demonstrate that references to source document C2027 were added to the text, and the reference list at the back of the AKSR was updated accordingly (U911). Available information supports the overall inclusion of K-Wing waste into the existing AERHDM waste stream. EPA only examined the documentation specific to the technical elements discussed in the AKSR and not the individual source documents used by the AK Expert (AKE) to prepare the AK basis for the waste stream in question (see Attachment B for a list of reviewed references).

(9) Modifications of the Waste Stream Profile Form and related Characterization Reconciliation Report were assessed and were found to be adequate.

ANL-CCP representatives indicated that a revision to the WSPF has not yet been prepared, but did provide a draft revision of the CRR. EPA evaluated the draft CRR and found it to be adequate. As required in EPA's baseline approval, revision of the WSPF and related attachments, including the CRR, is a T2 change, and EPA will receive notification of these changes when they are made.

(10) Evaluation of the Certification Plan and Confirmatory Testing Plan was found to be satisfactory.

RH sites must generate a Certification Plan that explains how RH waste characterization will take place at each site, as well as a CTP when this plan is required as part of AK Qualification. ANL-CCP provided a combined Certification Plan and CTP for EPA review, and EPA reviewed its compatibility with the Waste Characterization Program Implementation Plan (WCPIP) requirements. ANL-CCP's characterization program for the K-Wing waste includes the use of sampling and analysis information in combination with DTC to quantify the WIPP-tracked radionuclides and VE during packaging to identify the physical WMPs. ANL-CCP stated that "[although] there is considerable detailed information on the composition and burnup of the fuel materials examined in all of the hot cells, the potential separation of the ^{137}Cs in the UREX processing relative to the actinides and other insoluble radionuclides would make it virtually impossible to develop scaling factors based on ORIGEN2.2 analyses and modeling for the K-Wing hot cells. Therefore, to develop scaling factors a sampling campaign was performed." Smear samples were collected and analyzed at the ANL Analytical Chemistry Laboratory (ACL). EPA observed the sampling and analysis process at ANL on February 16-17, 2010. Approval of this process is included in EPA Docket No. A-98-49; II-A4-130, dated August 2010.

The sampling data were used, as detailed in Section 5.2 of this report, to develop radionuclide scaling factors applicable to the K-Wing waste. ANL-CCP compared the $^{235/238}U$ ratio and the relative abundance of the Pu isotopes in the sampling results against AK data pertinent to LWR fuels. Both sets of values compared favorably, demonstrating that the LWR AK data can be verified by analytical data. Sampling data did not provide ^{234}U isotopic information; however, the ^{234}U AK data used to quantify this isotope was qualified by confirmatory testing.

The above clarifies the characterization and qualification elements of the radiological characterization process; however, this has not been clearly presented in the CTP. Review of the CTP showed that all of the remaining required radiological characterization elements were adequately addressed. Based on the information above, EPA determined that ANL-CCP

adequately used a combination of approaches to characterize and, as necessary, qualify AK data as required in 40 CFR 194.24/22.

(11) Use of a Correlation and Surrogate Summary Form was evaluated and it was determined to not apply to these wastes.

Completion of a CSSF is required when AK information from a related CH waste stream is used in the RH waste characterization process. During Baseline Inspection No. EPA-ANL-CCP-RH-9.06-8, an ANL-CCP representative indicated that CH data were not used in this manner. Inclusion of K-Wing debris waste in Waste Stream AERHDM also did not require completion of a CSSF.

(12) Personnel training was evaluated and was found to be adequate.

Training records for Kevin Peters (AKE), Steve Schafer (AKE) and Irene Quintana (SPM) were examined. Records were provided on July 21, 2010. It should be noted that the documentation examined did not indicate that ANL-CCP individuals are trained to EPA requirements, nor are they trained with respect to radiological characterization aspects, both of which are required in the WCPIP. Since the WCPIP is currently under revision, EPA will examine future training against the next version of the WCPIP.

(13) Non-Conformance Reports and Discrepancy Resolution Forms were examined and were found to be adequate.

EPA examined NCRs and DRs related to Waste Stream AERHDM during Baseline Inspection No. EPA-ANL-CCP-RH-9.06-8 and found the preparation of these documents to be adequate. No Non-Conformance Report (NCRs) are available for the K-Wing wastes as only five drums have been fully characterized at this time. One DR Form (DR023) addresses the change in the estimated volume of K-Wing debris waste. Based on this single DR, and NCRs and DRs evaluated during previous reviews, EPA expects that the process EPA evaluated in the past would be used to develop these documents when necessary.

(14) AK accuracy was assessed and was found to be adequate.

ANL-CCP revises its AK Accuracy Report annually. The last AK Accuracy Report was completed on May 13, 2010, but does not include evaluation of the AK accuracy for any K-Wing drums. EPA's baseline approval includes changes or updates to the AK Accuracy Report as a T2 change. Therefore, ANL-CCP/CBFO will automatically notify EPA when the next AK Accuracy Report specific to this waste stream is available.

(15) Load Management was evaluated and it was determined to not apply to this waste stream.

ANL-CCP representatives indicated that load management is not intended for Waste Stream AERHDM, and this will not change with inclusion of the K-Wing wastes that comprise this T1 evaluation. EPA's baseline inspection report indicated that the implementation of load management is a T1 change requiring EPA prior approval.

(16) Attainment of Data Quality Objectives was evaluated and found to be adequate.

As a result of the analysis presented in Items 1-14, above, EPA was able to assess how each DQO will be addressed. The following DQOs must be addressed as per the WCPIP:

- Defense determination
- TRU waste determination
- RH waste determination
- Activity determination (total and activity per canister, including quantification and identification of the 10 EPA WIPP-tracked radionuclides)
- Residual liquids
- Physical form, including metals, cellulose, plastic and rubber

As indicated in Item (9), above, the DQOs were addressed primarily through AK, DTC, Solid Sampling/Analysis and VE. When evaluated as a whole, CCP-AK-ANLE-500, Revision 5 and the draft Revision 6 prepared by ANL-CCP in July 2010, CCP-AK-ANLE-501, Revision 2, CCP-AK-ANLE-502, Revision 2, Draft A, and the reviewed supporting source documents, indicate that the DQOs, as specified in the WCPIP, have been met.

Summary of Acceptable Knowledge

Findings or Concerns

The EPA Inspection Team did not identify any findings or concerns relative to the inclusion of approximately 30 55-gallon containers of K-Wing debris waste during this T1 change evaluation.

New Tier 2 AK Changes

Based on the results of this T1 evaluation, there is one change to the AK T1 designations and four AK T2 changes. The T1 change requires EPA approval when containers added to an approved waste stream require different radionuclide scaling factors for radiological characterization. Four new AK T2 changes require the following: (1) EPA notification when additional containers characterized using the same scaling factors are added to the approved waste stream, (2) submission of a revised AKSR addressing addition of containers to the approved waste streams and supporting source documents, (3) submission of Attachment 4 of CCP-TP-005 is revised to include the updated AKSR Source Document Reference List, and (4) submission of Attachment 8 of CCP-TP-005 has been formally updated to reflect the additional containers. Accordingly, the AK portion of the tiering table is revised. Refer to the revised tiering table - Table 1 of the Executive Summary.

5.2 Radiological Characterization

Radiological Characterization Element Description

The nature of RH TRU waste presents difficulties with respect to obtaining meaningful measurement data. RH radiological characterization relies on the development of radionuclide scaling factors that correlate an easily measured parameter like a waste container's external exposure (dose) rate with isotopic distributions for specific TRU radionuclides. The development of radionuclide scaling factors for the ANL K-Wing RH TRU debris waste was based on the collection and analysis of smear samples. The development of the ^{137}Cs-based scaling factors was supported by the following five sources of information:

- Sampling Plan CCP-AK-ANL-505A: This plan was specifically developed for collecting samples from the debris waste in the K-Wing hot cells and describes the number of samples and location to collect the smear samples
- Sampling BDR AERH1001: This BDR includes pertinent sample information, i.e., location, identification and collection dates and times
- BDR 7TRUA50: The report summarizes the results of smear samples analysis (radionuclide measurements) conducted by the ANL ACL
- Calculation package ANL-RH-08, *K-Wing Debris Scaling Factor Development*: The Excel™ spreadsheet calculates the ^{137}Cs-based scaling factors for specific radionuclides in each sample
- Calculation package ANL-RH-13, *Development of U-234 Scaling Factor for K-Wing Debris*: The calculation package provides the scaling factor for ^{234}U

The characterization method used for the ANL K-Wing RH TRU debris waste was evaluated in terms of the technical adequacy as supported by the program's documents, procedures and controls, and the knowledge and understanding of the personnel involved in the RH waste characterization program. During this T1 evaluation, EPA examined the following elements of the ANL-CCP radiological characterization program:

- Development of DTC relationships as a function of waste density using MicroShield™ based on each drum's measured external exposure (dose) rate, assuming the main contributor to the external exposure was ^{137}Cs
- Derivation of radionuclide scaling factors for quantification of the 10 WIPP-tracked radionuclides, as supported by the sampling and the calculation packages

Documents and Batch Data Reports Provided

EPA evaluated the documentation that ANL-CCP prepared to support the approval of the ANL K-Wing RH TRU debris waste. The list of all radiological characterization-related documents reviewed by EPA is included in Attachment B.

Technical Evaluation

The EPA inspection team evaluated the following aspects:

(1) The technical adequacy and documentation supporting the development of scaling factors and identification of the types of fuel and general distribution of contaminants associated with this waste stream were evaluated and found to be adequate.

The nature of the activities and operations conducted in the K-Wing hot cells was such that scaling factors could not be developed based on ORIGEN2.2 because of the UREX processing and the potential separation of ^{137}Cs. ANL-CCP prepared a sampling Plan CCP-AK-ANL-505A for taking swipe samples of the K-Wing waste. EPA reviewed the adequacy of a sampling plan to determine if the sampling method and its implementation could result in the collection of a representative (statistically unbiased) sample from the debris waste suitable for radiochemical analysis. The minimum numbers of samples needed were less than the number of reported values by a factor of between two and three. There were no concerns regarding the technical adequacy of a sampling plan and documentation that EPA reviewed. EPA determined that the sampling plan and its implementation to obtain 19 smear samples from the ANL K-Wing RH TRU debris waste were technically adequate. EPA also reviewed the BDR AERH1001 and determined that the appropriate sample-related information was included. Specifically, the Attachment 1 from CCP-TP-512 contained: sample collection date; sample collection procedure number with current revision; sample identification number; sample matrix and container size; and the specific analyses that were requested.

(2) The technical content and documentation of the resources used to determine the radionuclide contents of the representative samples collected were evaluated and found to be adequate.

EPA evaluated ANL-CCP BDR 7TRUA50, which summarized the results of the analysis performed on the 19 collected samples by the ANL's ACL. There were no concerns regarding the technical adequacy and documentation of the resources used for the identification of the types and general distribution of the contaminants relative to these ANL K-Wing RH TRU debris wastes.

(3) The development of radionuclide scaling factors was evaluated and was found to be technically adequate and appropriately documented.

A radionuclide scaling factor provides a technically sound method of deriving a value for radionuclides that are difficult to measure on the basis of an easily measurable attribute like external dose rate, assuming the measured dose rate can be correlated to a known constituent, i.e., the fission product ^{137}Cs, the dominant contributor to the gamma dose rate for K-Wing RH TRU debris wastes. The measured dose rate in conjunction with the waste density and the DTC correlation leads to the determination of the concentration of ^{137}Cs, and the activities of the reportable radionuclides, using their ^{137}Cs-based scaling factors.

The measurements of the radionuclide concentrations in the samples were used to develop the scaling factors. Except for ^{233}U and ^{234}U, which were treated differently, the scaling factors were

determined by dividing the total activity of each radionuclide by total ^{137}Cs activity. The spreadsheet in the Calculation Package ANL-RH-08, *K-Wing Debris Scaling Factor Development*, was reviewed (U889) for a process followed when generating radionuclide scaling factors and was determined as technically adequate.

The averaging procedure described above and in Calculation Package ANL-RH-08 (U889) could not be applied to ^{233}U and ^{234}U to determine their scaling factors. This was because only one sample had a reported measurement value for ^{233}U and ^{234}U was not measured in any of the samples analyzed. The scaling factor for ^{233}U was determined, as an upper bound (conservative/overestimate) value, using the minimum detectable activity.

The nearly exclusive UREX processing activities in the K-Wing hot cells (from 2003 to 2007) led to a particular method of determining the scaling factor for ^{234}U. The method used was based on the assumption that the extensive UREX processing had resulted in a U distribution in the debris waste similar to what is present in the fuel processed (fuels from the Big Rock Point, Cooper and H.B. Robinson reactors). Based on this assumption, the scaling factor for ^{234}U was determined as follows:

(a) Determine the ratio $^{234/238}U$ from the characterization data for LWR fuels in Calculation Package ANL-RH-13. It is noted again that this ratio was not available from the sample data, as ^{234}U had not been measured in any of the samples collected.

(b) Determine the $^{234}U/^{137}Cs$ scaling factor by multiplying the ratio found in Step (a) by the $^{238}U/^{137}Cs$ ratio derived from the sample data.

The validity of the assumption made above (representativeness of the ratio $^{234/238}U$ obtained from the AK record) was verified via comparing the $^{235/238}U$ ratio from the sample data with the $^{235/238}U$ ratio from the AK record; they were 5.83E-02 and 7.51E-02, respectively. A second comparison involving Pu isotopes was also conducted, and it also confirmed the assumption (see Figure A4-1 in Appendix A, CCP-AK-ANLE-501, Revision 2). The Calculation Package ANL-RH-13, *Development of U-234 Scaling Factor for K-Wing Debris*, was reviewed (U896) for a process followed when generating radionuclide scaling factors and was determined as technically adequate.

Figure 1 below, which is Figure A 2-1 of Appendix A of the Technical Report CCP-AK-ANLE-501, Revision 2, depicts the flow diagram of the characterization process for K-Wing RH TRU debris waste at ANL.

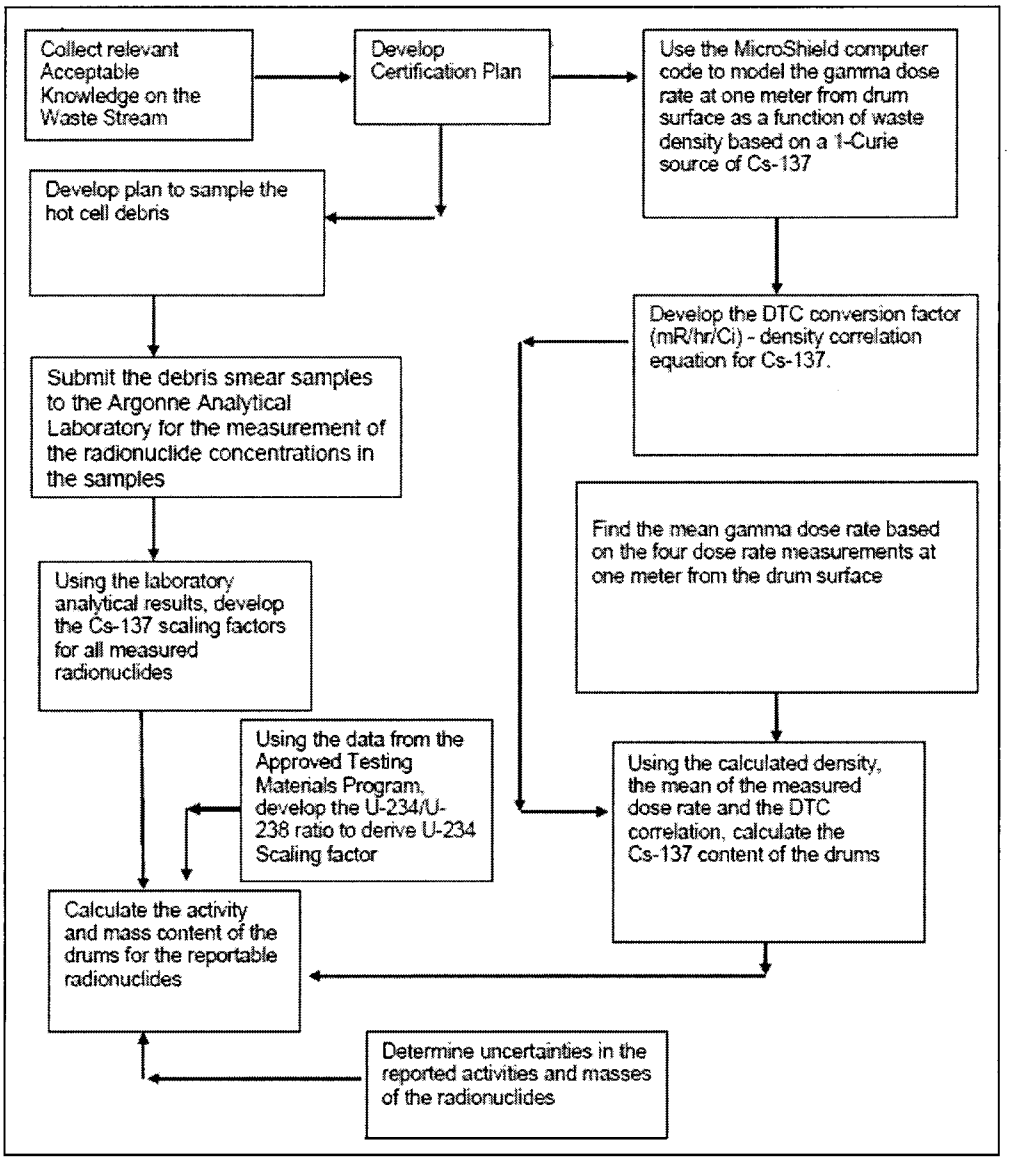

Figure 1. Flow Diagram Depicting the Characterization Process for the K-Wing RH TRU Debris Waste at ANL

A single set of ^{137}Cs-based scaling factors was determined for the characterization of K-Wing RH TRU debris waste at ANL. The scaling factors are shown in Table 4, below.

Table 4. Scaling Factors for the K-Wing RH TRU Debris Waste at ANL in Units of Curies of Specific Radionuclide/Curies ^{137}Cs (Ci/Ci ^{137}Cs)

Radionuclide	^{137}Cs Scaling Factor
^{233}U	5.57E-5
^{234}U	1.45E-05
^{235}U	2.62E-07
^{238}U	4.48E-06
^{238}Pu	5.61E-02
^{239}Pu	5.90E-03
^{240}Pu	8.63E-03
^{241}Pu	4.03E-01
^{242}Pu	3.56E-05
^{241}Am	4.55E-02
^{244}Cm	1.52E-02
^{137}Cs	1.00E+00
^{137m}Ba	9.46E-01
^{90}Sr	8.40E-01
^{90}Y	8.40E-01

EPA evaluated the following aspects:

- Activity values derived from modeling and statistical metrics, namely mean and standard deviation values for each measured radionuclide
- The appropriateness of the choice of physical constants and radionuclide-specific attributes (specific activity, physical half-life, decay heat, neutron cross-sections, photon transition probabilities, etc.) and the technical correctness of the values assigned to each attribute
- Isotopic activity values are correlated to the radionuclide whose physical half-lives possibly contribute to the measured external dose rate, i.e., ^{137}Cs
- Contributions of the short-lived radionuclides to the total measured dose rate
- Appropriate decay correction according to ANL-CCP procedure (CCP-TP-504) of all radionuclide values for purposes of model development and routine assays performed via DTC
- The calculated results used to develop the scaling factors and convert the measured external dose rates obtained via DTC to radionuclide activity levels
- Activity and uncertainty values determined for the ten WIPP-Tracked radionuclides [^{233}U, ^{234}U, ^{238}U, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu, americium-241 (^{241}Am), ^{137}Cs and strontium-90 (^{90}Sr)]

- The determination of the contribution of all radionuclides to the radiological hazard[5]
- Shielding and other calculations supporting the scaling factors performed using MicroShield™ and MCNP5 to derive the appropriate DTC relationships as a function of waste density for the geometry appropriate to the K-Wing RH TRU debris waste at ANL following repackaging (55-gallon drum)[6]

There are no issues related to the technical adequacy or documentation of radionuclide scaling factors for the K-Wing RH TRU debris waste at ANL.

(4) The technical basis of the Dose-To-Curie correlation and its documentation were evaluated and found to be unchanged from what EPA had inspected and approved previously, and both aspects were acceptable.

The DTC correlation was based on the following assumptions:

- The waste drum 100 percent full with waste
- The radionuclides of interest dispersed uniformly throughout the waste
- The waste matrix's density to be unity (one), because photon attenuation is more influenced by material density, as opposed to specific composition or atomic number
- Waste densities range from 0.2 g/cm^3 to 1.8 g/cm^3

Using MicroShield™, ANL-CCP developed a DTC correlation for a 55-gallon drum filled with RH TRU waste in terms of millirem per hour for a 1-Ci source of ^{137}Cs. Figure A5-2 in CCP-AK-ANLE-501, Revision 2 shows a plot of dose rate as a function of waste density at a distance of 1 meter for ^{137}Cs. A DTC spreadsheet similar to the DTC spreadsheet that EPA evaluated during the baseline inspection is used for K-Wing RH TRU debris waste at ANL as well, involving the debris waste scaling factors. The spreadsheet contained the required information, specifically: cask identification number, container gross weight, estimated fill percentage and results of the four dose rate measurements that are obtained via the application of DTC procedure CCP-TP-504. An example Waste Drum DTC Conversion Record (spreadsheet) is included as Figure A5-3 in CCP-AK-ANLE-501, Revision 2. There were no concerns regarding the technical basis of the DTC correlation and its documentation for the K-Wing RH TRU debris waste at ANL.

(5) Technical aspects and documentation of the radiological characterization process were evaluated and found to be acceptable.

Attachment A to CCP-AK-ANLE-501, Revision 2 is the main document that describes the radiological characterization process that ANL-CCP used for the K-Wing RH TRU debris waste at ANL. This attachment is supported by a series of calculation packages that were reviewed in

[5] Although the determination of a waste container's radiological hazard is not an EPA requirement, this information may be useful in understanding other aspects of a container's radiological characterization.
[6] MicroShield™ is a commercial computer code used for shielding analyses. MCNP5 is Monte Carlo N-Particle Transport Code that has been developed by Los Alamos National Laboratory.

the process of evaluating the K-Wing RH TRU debris waste at ANL, listed in Attachment A. These packages had been prepared and reviewed by several ANL-CCP radiological characterization team members who supported the ANL-CCP RH baseline effort. These packages documented the following for the K-Wing RH TRU debris waste at ANL:

- Scaling factor development
- Determination of reportable radionuclide
- DTC correlation for ^{137}Cs
- Uncertainty analysis
- DTC spreadsheet
- Development of ^{234}U scaling factor DTC spreadsheet

The EPA evaluation team reviewed these packages and Appendix A to CCP-AK-ANLE-501, Revision 2 and found that they adequately document the radiological characterization process for K-Wing RH TRU debris waste at ANL. The calculation packages cited above adequately support the activities upon which the radiological characterization of the K-Wing RH TRU debris waste at ANL is based. There were no issues related to the documentation of technical aspects of the radiological characterization approach for the K-Wing RH TRU debris waste at ANL-CCP.

(6) The technical basis and derivation of Total Scaling Factor Uncertainty were evaluated and were found to be adequate.

The development of Total Scaling Factor Uncertainty (TSFU) for the K-Wing RH TRU debris waste at ANL, which belongs to the Waste Stream AERHDM, is based on the propagation of uncertainties present in all aspects of the determination of the radiological constituents of RH TRU waste. These aspects are assumed to be independent, which allows them to be added in quadrature. The TSFU determination included contributions of the following:

- ^{137}Cs activity measurement
  - Measurement uncertainty
  - Dose contribution of other gamma-emitting radionuclides
- ^{137}Cs DTC correlation
  - Waste density determination
  - Drum weight measurement
  - Tare weight determination
  - Estimated fill percentage
  - MicroShield™ modeling uncertainties (function of waste density)
  - MicroShield™ code uncertainties
- Scaling factor uncertainty
  - Sample data measurement uncertainty
  - Uncertainty in the mean scaling factor derived from the sample data
  - Drum-to-drum variations in the scaling factors

The treatment of TSFU is presented in Appendix A to CCP-AK-ANLE-501, Revision 2 and Calculation Package No. ANL-RH-11. The principal contributors to the uncertainty in the total ^{137}Cs-based scaling factors are the uncertainty in mean scaling factors and the drum-to-drum

uncertainty, the latter being the main contributor. The main contributors to the overall (total) uncertainty are ^{137}Cs activity uncertainty and the TSFU, as indicated in Table 5 below.

Table 5. Final Scaling Factor Uncertainty Listed by Radionuclide for K-Wing RH TRU Debris Waste at ANL

Radionuclide	Cs-137 Activity Uncertainty	Drum-to-Drum Uncertainty	Total Uncertainty
^{233}U	34.2%	103.2%	108.7%
^{234}U	34.2%	33.0%	47.5%
^{235}U	34.2%	28.0%	44.2%
^{238}U	34.2%	29.0%	44.8%
^{238}Pu	34.2%	30.3%	45.6%
^{239}Pu	34.2%	20.2%	39.7%
^{240}Pu	34.2%	26.8%	43.4%
^{241}Pu	34.2%	28.0%	44.2%
^{242}Pu	34.2%	45.0%	56.5%
^{241}Am	34.2%	28.6%	44.6%
^{244}Cm	34.2%	26.8%	43.4%
^{90}Sr	34.2%	33.5%	47.8%
^{137}Cs	34.2%	0.0%	34.2%

There were no concerns regarding the technical derivation and documentation of TSFU for the K-Wing RH TRU debris waste at ANL.

(7) RH and TRU determinations were assessed and were found to be adequate.

The determination that the RH containers meet the definition of TRU waste and RH waste was examined during the baseline inspection. Both of these aspects are directly involved with the DTC measurement conducted at ANL, as was observed during the baseline inspection. These were not assessed directly during this T1 evaluation, but EPA did verify that no aspects of these two determinations had changed. There were no technical or documentation-related concerns regarding the TRU and RH determinations for K-Wing RH TRU debris waste at ANL.

Summary of Radiological Characterization

Findings or Concerns

The EPA Inspection Team did not identify any findings or concerns relative to the radiological characterization of approximately 30 55-gallon containers of K-Wing debris waste during this T1 change evaluation.

Tiering Changes

Based on the results of this T1 evaluation, there are no changes to the T1 designations and two T2 changes for radiological characterization. The two T2 changes added to the radiological characterization portion of the tiering table are (1) requiring notification regarding the

availability of a revised radiological characterization technical report associated with the addition of containers of K-Wing waste to the approved waste stream (AERHDM), and (2) providing radiological BDRs for additional containers as discussed below.

If additional containers for this waste stream are generated and will be characterized using the same scaling factors as those used for the containers approved as part of this T1 change request, then the following information for radiological characterization is necessary. Upon characterizing a sufficient number of containers from this population to generate 1-2 BDRs, ANL-CCP must provide the list of characterized containers and an updated radiological characterization report. From this list, EPA may select a few containers for detailed review to verify that the additional containers belong to the approved waste stream. However, if the containers require new or different radionuclide scaling factors, the additional containers will be subjected to EPA's T1 evaluation and approval prior to disposal at WIPP.

6.0 SUMMARY OF RESULTS

Findings and Concerns

The EPA Inspection Team did not identify any findings or concerns relative to the inclusion of approximately 30 55-gallon containers of K-Wing debris waste to Waste Stream AERHDM during this T1 change evaluation.

Tiering Changes

EPA revised the tiering table to modify one T1 change under AK and add four T2 changes under AK, two T2 changes under radiological characterization and one T2 change under VE as follows:

- One AK T1 change is modified pertaining to the addition of containers to an approved waste stream when new scaling factors are used for their characterization
- Four AK T2 changes requiring EPA notification when (1) additional containers characterized using the same scaling factors are added to the approved waste stream, (2) a revised AKSR addressing addition of containers to the approved waste stream and supporting source documents are complete, (3) Attachment 4 of CCP-TP-005 is generated to reflect the updated AKSR Source Document Reference List, and (4) Attachment 8 of CCP-TP-005 is formally updated to reflect the additional containers
- Two radiological characterization T2 changes requiring notification when a revised radiological characterization report associated with the addition of containers to the approved waste stream and providing radiological BDRs for these containers
- One VE T2 change requiring the submission of the appropriate BDRs for the population of waste containers that are being added to the approved waste stream

Addition of containers to the approved waste stream:

In the future, when ANL-CCP characterizes the remaining 45+ containers of the K-Wing waste to add to the approved waste stream AERHDM, no T1 change request for approval is necessary if ANL-CCP can demonstrate the following:

- The additional containers have the same pedigree as the approved waste stream; and
- The radionuclide scaling factors used for the RH waste stream are technically appropriate for use in the DTC determination of the radiological characterization of the additional containers

In addition, ANL-CCP must:

1. Notify EPA concerning the approximate number of additional containers **and** the approximate additional volume of waste.

2. Provide the timeframe for waste generation, characterization and disposal.

3. Submit to EPA, upon characterizing a sufficient number of containers to generate 1-2 BDRs, the following:

    a. the list of characterized containers
    b. a revised AKSR and supporting source documents
    c. an updated radiological characterization report

4. Inform EPA if any other waste characterization documents have been changed.

From the list mentioned in #3 above, EPA may select a few containers for a detailed review to verify that the additional containers belong to the approved waste stream and are adequately characterized to demonstrate regulatory compliance.

The ANL-CCP's compliance with the above conditions is necessary when adding containers to an approved waste stream AERHDM. When adding containers to an approved waste stream, however, if different or new scaling factors are necessary it is a T1 change requiring EPA approval.

7.0 CONCLUSIONS

During this T1 change evaluation, EPA examined the inclusion of approximately 30 55-gallon containers of K-Wing debris wastes to Waste Stream AERHDM. Based on the results of this evaluation, EPA is approving inclusion of approximately 30 55-gallon containers of K-Wing debris wastes to Waste Stream AERHDM with the limitations discussed above.

ATTACHMENT A

APPROVAL SUMMARY FOR ANL RH WASTE CHARACTERIZATION PROGRAM

ANL-CCP RH Approvals	Date	EPA Docket Number
ANL RH Baseline Approval	January 2007	A-98-49; II-A4-73
Tier 1 Change – Approval of WIPP Waste Information System	January 2007	A-98-49; II-A4-74
Tier 1 Change – Approval of Visual Examination for Newly Generated Waste	June 2008	A-98-49; II-A4-102
Approval of 100 additional drums of AGHCF debris waste to Waste Stream AERHDM	October 2008	

ATTACHMENT B

LIST OF DOCUMENTS REVIEWED BY EPA DURING T1 EVALUATION

CCP-AK-ANLE-500 Central Characterization Project Acceptable Knowledge Summary Report For Argonne Remote-Handled Debris Waste, Waste Stream: AERHDM, Revision 5, January 14, 2010

CCP-AK-ANLE-501, Central Characterization Project Remote-Handled Transuranic Radiological Characterization Technical Report for Remote-Handled Transuranic Debris Waste From Argonne National Laboratory-East, Revision 2, May 10, 2010

CCP-AK-ANLE-502, Central Characterization Project RH TRU Waste Certification Plan for 40 CFR Part 194 Compliance and Confirmation Test Plan for ANL RH Waste Stream: AERHDM, Revision 2, Draft A, 2010

CCP-AK-ANL-505A, Central Characterization Project Sampling and Analysis Plan for Argonne Remote Handled Debris Waste, Waste Stream AERHDM, Revision 0, December 9, 2009

CCP-TP-005, *CCP Acceptable Knowledge Documentation*, Carlsbad, New Mexico, Washington TRU Solutions, LLC

CCP-TP-005, Revision 18, CCP Acceptable Knowledge Documentation, Attachment 8 – Waste Containers List, Waste Stream AERHDM, August 8, 2007

CCP-TP-512, Revision 3, Attachment 7, CCP Remote-Handled Waste Sampling Attachment 7 - Site Project Manager Radiochemistry or ICP-MS Analytical Batch Data Report Checklist BDR No. 7, TRUA50, May 14, 2010

Inter-Office Correspondence from I.S. Quintana to CCP Records Custodian, RE: Transmittal of Waste Stream Profile Form, Attachment 4, for Remote-Handled Waste Stream AEHRDM at the Argonne National Laboratory, July 23, 2008

Inter-Office Correspondence, from C.M. Gomez to M. Sensibaugh, Acceptable Knowledge Accuracy Report, Argonne National Laboratory, Waste Stream Number AERHDM, Lots 1-5, May 13, 2010

Memorandum to Hillari Neeley and Irene Quintana, CCP SPMs, from Kevin Peters, CCP AKE, RE: Addition of 10 Containers to Waste Stream AERHDM, March 10, 2009

Memorandum to Hillari Neeley, CCP SPM, from Kevin Peters, CCP AKE, RE: Addition of 2 Containers to Waste Stream AERHDM, March 10, 2010

Memorandum to Hillari Neeley, CCP SPM, from Kevin Peters, CCP AKE, RE: Addition of 5 Containers to Waste Stream AERHDM, March 22, 2010

Memorandum to Hillari Neeley and Irene Quintana, CCP SPMs, from Kevin Peters, CCP AKE RE: Addition of 15 Containers to Waste Stream AERHDM, April 16, 2009

Memorandum to Irene Quintana, CCP SPM, from Kevin Peters, CCP AKE, RE: Addition of 6 Containers to Waste Stream AERHDM, May 20, 2008

Memorandum to Hillari Neeley and Irene Quintana, CCP SPM, from Kevin Peters, CCP AKE, RE: Addition of 2 Containers to Waste Stream AERHDM, Date: June 27, 2008

Memorandum to Hillari Neeley and Irene Quintana, CCP SPMs, from Kevin Peters, CCP AKE, RE: Addition of 9 Containers to Waste Stream AERHDM, September 14, 2009

RH Tiering of TRU Waste Characterization Processes Implemented by CCP at ANL (Based on EPA Baseline Inspection No. EPA-ANL-CCP-RH-9.06-8) DOCKET # A-98-49; II-A4-73, August 2008

C006, Interview with Larry Neimark re: AGHCF samples, applicable programs, defense relationship to materials and commingling of waste, ROC-C6, Cheryl Schultz, July 17, 2001

C812, Memo from T. S. Bray & R. V. Strain to M. Goldberg, Characterization of N-Reactor Fuel Samples, T. S. Bray, R. V. Strain, October 4, 2000.

C2004, Safety Review for Unsaturated Testing of Uranium Metal Spent Fuel in Bldg. 205 Senior Cave and K-116 Facilities, CMT50-0 US-Draft, R.D. Wolson, March 7, 2009

C2006, Work Plan for the Preparation of Unirradiated Al-clad Specimens for CMT, IPS-329-00-00, T.S. Bray, December 2, 1999

C2007, Work Plan for the Preparation of Specimens from the Characterization of Pins UW02010 (A/G 498A) and UW08036 (A/G 498B), IPS-284-00-00, L.A.Neimark, June 17, 1998

C2010, Evaluation of the Physical Waste Composition for K-Wing Waste in Waste Stream AERHDM, C. Chancellor, September 24, 2009

C2027, Waste Stream Delineation Evaluation for Waste Stream AERHDM to Include K-Wing Waste, K. Peters, July 14, 2010

DR023, Waste Stream AERHDM Volume Projection Corrections, K. J. Peters, June 23, 2010.

P051, AGHCF Operations Manual: 11.0 Waste Management, IPS-2-00-00, October 23, 1996.

P330, Work Plan for the Characterization and Sectioning of H. B. Robinson Rod R01 (A/G 615) and Surry Rod H7 (A/G 593) for the Sandia HEDD Project Memo to IPS Document File, IPS-433-00-00, Hanchung Tsai, ET-IPS, October 14, 2003

P344, Analysis of Spent Nuclear Fuel Sample A/G 574B2 (Limerick Reactor) to Determine Selected Isotopes and Estimate Fuel Burnup, N/A, D.G. Graczyk, April 2003

P515, Work Plan for Determining Hydrogen Contents in TMI-1 Cladding Memo to IPS Document File, IPS-331-00-00 and IPS-331-00-01, Hanchung Tsai, IPS-ET, October 20, 1999 and February 3, 2000

P518, Work Plan for the Steam Oxidation Tests at 1200 degrees on Unirradiated Zry-4 and Irradiated TMI-1 Cladding Memo to NRC Program File Several Supplemental Instructions, IPS-335-00-00 and IPS-335-01-00, Y. Yan, February 11, 2000

P523, Work Plan for CMT Samples from TMI Fuel Rod Segments Memo to Distribution, IPS-342-00-00, R. V. Strain, January 31, 2000

P551, Work Plan for the Examination of Fuel Plates from the RERTR-4 Experiment in ATR; Work Plan for Cutting H. B. Robinson Rod Sections and Loading into Shipping Tubes and Supplemental Instruction 153, IPS-375-00-00, -01-00, IPS-376-00-00, R. V. Strain, March 16, 2001, April 12, 2001 and March 26, 2001

P575, Work Plan for the Examination of Fuel Plates from the RERTR-4 Experiment in ATR, Revision 1, IPS-400-01-00, R. V. Strain, February 22, 2002

P802, Extended Burnup Demonstration, Reactor Fuel Program, Pre-Irradiation Characterization and Summary of Pre-Program Poolside Examinations, Big Rock Point Extended Burnup Fuel, XN-NF-80-40; UC-78; DOE/ET/34006-3, C. A. Exarhos, L.F. Van Swam, F.P. Wahlquist, December 1981

P819, IPS-306-00-00, Work Plan for the Characterization of N-Reactor Fuel Specimens (A/G 562), IPS-306-00-00, T. Bray, March 09, 1999

P2019, Test Plan for the Characterization of an Approved Testing Material Mixed Oxide Fuel Source Document Reference Information, Lawrence A. Neimark, SNF-3A-004, Revision 0, April 8, 1998

P2023, Attachment 3: Results of the UREX+2 Spent Fuel Demonstration (OUO), D. Bowers, et.al., February 28, 2005

P2024, Attachment 3: Results of the UREX+1a Spent Fuel Demonstration (OUO), C. Pereira, et.al., March 31, 2006

P2033, Revised Estimate of the Radioactive Inventory in the AGHCF, NOD-155-00-00, R.J. Page, January 7, 2009

U001, AGHCF Position Statement Regarding Defense Versus Non-Defense TRU Waste, April 7, 2000

U303, Notes for Correction of Fissile Ledger Database Regarding H. B. Robinson Fuel Shipment, T. Bray, April 17, 2004

U304, Robinson Report, Unknown Dates

U802, SPM Logbook Information for A/G 249, ANL ID 46232, Various Dates

U889, CCP Calculation Package – Cs-137 Scaling Factor Development, Revision 0, ANLE-RH-08, Jene Vance, April 15, 2010

U890, CCP Calculation Package – Determination of Reportable Radionuclides, Revision 0, ANLE-RH-09, Jene Vance, June 14, 2010

U891, CCP Calculation Package – ANL K-Wing Debris Cs-137 DTC Correlation, Revision 0, ANLE-RH-10, Jene Vance, May 04, 2010

U894, CCP Calculation Package – Uncertainty Analysis for K-Wing Debris, Revision 0, ANLE-RH-11, Jene Vance, May 04, 2010

U895, CCP Calculation Package – DTC Spreadsheet K-Wing Debris, Revision 0, ANLE-RH-12, Jene Vance, April 04, 2010

U896, CCP Calculation Package – Development of U-234 Scaling Factor, ANLE-RH-13, Jene Vance, May 04, 2010

U1003, Argonne Special Material Receipt and Transfer Documentation by A/G Number, Various Authors, 1964–1997

U2002, CMT Nuclear Materials Inventory Database – detail report with ratios and FGEs, L.E. Maggos, July 21, 2009

U2004, Material in K-Wing 07-29-09 Spreadsheet, L.E. Maggos, February 11, 2009

U2010, Contactor Cleaning Procedure, S. Aase, R. Leonard, August 19, 2003