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

MAY 12 2005

OFFICE OF
AIR AND RADIATION

Dr. Ines Triay, Acting Manager
Carlsbad Field Office
U.S. Department of Energy
P.O. Box 3090
Carlsbad, NM 88221-3090

COPY

Dear Dr. Triay:

This letter provides the results of the U.S. Environmental Protection Agency's (EPA or we) Inspection Number EPA-INL-AMWTP-03.05-08 of the Advanced Mixed Waste Treatment Project (AMWTP) at the Idaho National Laboratory (INL). EPA conducted this inspection to ensure that the transuranic (TRU) waste characterization activities implemented at the AMWTP for characterizing debris waste are in compliance with our regulations (40 CFR 194.8(b)(3), 40 CFR 194.8(c) and 40 CFR 194.24). This inspection was conducted from February 28-March 4, 2005. The AMWTP plans to super-compact (or compress) a portion of this debris waste. The super-compacted waste will be packed in 100-gallon payload containers for disposal at WIPP.

Background

In March 2004, EPA approved, for disposal at WIPP, retrievably-stored, contact-handled (CH) solid waste characterized using approved systems and processes of the AMWTP (Air Docket No. A-98-49, Item II-A4-42). This original approval did not apply to CH debris waste (S5000) or any super-compacted waste from the AMWTP.

Also in March 2004, EPA informed DOE of its decision to allow the disposal of super-compacted waste at WIPP (Air Docket No. A-98-49, Item II-B3-68). This approval was given following an analysis that concluded that the characteristics of the super-compacted waste are adequately represented by the current performance assessment methodology and that the disposal of super-compacted waste from INL was not a significant change to EPA's 1998 Certification Decision. This approval also stated that quality assurance and waste characterization inspections by EPA were required prior to the disposal of super-compacted waste from INL AMWTP. EPA determined that the primary issue with the super-compacted waste is the inventory of cellulosics, plastics, and rubber and its potential to generate additional gas. For this reason, EPA is requiring DOE to maintain the current 1.67 magnesium oxide (MgO) safety factor of 1.67. To maintain this safety factor, it may be necessary to add extra MgO backfill with super-compacted waste.

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Prior to the emplacement of super-compacted waste in the repository, EPA must inspect and approve DOE's MgO emplacement plan, procedures and tracking system (Air Docket No. A-98-49, Item II-B3-79). EPA plans to inspect DOE's MgO emplacement program the week of May 16, 2005. If EPA finds the emplacement activities to be adequate, EPA will approve the emplacement of super-compacted waste at WIPP.

March 2005 Inspection

During our March 2005 site inspection we examined the AMWTP's ability to characterize retrievably-stored and newly-generated CH TRU debris (S5000) waste and super-compacted debris waste. EPA inspectors examined the entire system of controls, which includes, acceptable knowledge (AK), nondestructive assay (NDA), nondestructive examination (NDE) and the WIPP Waste Information System (WWIS).

We understand that INL AMWTP plans to dispose of retrievably-stored and newly-generated debris drums directly or in ten drum overpacks. Newly-generated debris waste will be super-compacted, load managed waste in 100-gallon drums at the WIPP.

Our inspection identified three (3) findings and seven (7) concerns. Subsequent to our inspection, DOE provided responses to all three of our findings. EPA reviewed DOE's responses and has determined that our findings have been adequately addressed. EPA will evaluate DOE's response to the concerns at subsequent EPA inspections.

EPA therefore approves the use of waste characterization processes at INL AMWTP for characterization of newly-generated and retrievably-stored CH TRU debris waste with the following exception:

- TRU waste from the Bettis Laboratory cannot be disposed of at WIPP until improvements are made to the requisite AK packages and approved by EPA.

Approval Summary

With this letter, the AMWTP at INL is now approved to characterize and dispose of CH TRU retrievably-stored and newly-generated, including super-compacted, debris waste (S5000) using approved systems and processes at WIPP. (EPA inspection and approval of the MgO emplacement is required prior to the emplacement of 100-gallon drums containing super-compacted debris waste from AMWTP.) The Table below provides a summary of EPA's complete waste characterization approvals for AMWTP at INL.

Summary of EPA Approvals

Waste Characterization Element	Retrievably-stored solid S-3000 Waste	Retrievably-stored debris S-5000 Waste	Newly Generated debris S-5000 Waste*
Acceptable Knowledge	Approved - February 2004	Approved**- May 2005	Approved - May 2005
Non Destructive Assay	Approved - February 2004 - Z-211-102 (IWAS) - Z-211-103 (IWAS)	Approved - May 2005 - Z-211-102 (IWAS) - Z-211-103 (IWAS) - Z-390-100 (IWAS) - Z-390-101 (IWAS)	Approved - May 2005 - Z-211-102 (IWAS) - Z-211-103 (IWAS) - Z-390-100 (IWAS) - Z-390-101 (IWAS)
Non Destructive Examination	Approved - February 2004 - Visual Examination - Real Time Radiography	Approved - May 2005 - Visual Examination - Real Time Radiography	Approved - May 2005 - Visual Examination - Real Time Radiography
WIPP Waste Information System	Approved - February 2004	Approved - May 2005	Approved - May 2005
Load Management	Not approved	Approved - May 2005	Approved - May 2005

* - This approval also applies to the super-compacted debris waste
** - Does not include TRU Bettis debris waste.

If you have any questions, please contact Ed Feltcorn at (202) 343-9422.

Sincerely,

Bonnie C. Gitlin, Acting Director
Radiation Protection Division

Enclosure

cc: Kerry Watson, CBFO
Ava Holland, CBFO
Frank Marcinowski, DOE/EM (w/o enclosure)
Lynne Smith, DOE/EM (w/o enclosure)

DOCKET NO: A-98-49, Item II-A4-53

WASTE CHARACTERIZATION REPORT

EPA INSPECTION NO. EPA-INL-AMWTP-03.05-8
OF THE ADVANCED MIXED WASTE TREATMENT PROJECT (AMWTP) FACILITY
(INL)
FEBRUARY 28 – MARCH 4, 2005

U.S. Environmental Protection Agency
Office of Radiation and Indoor Air
Center for Federal Regulations
1200 Pennsylvania Ave, NW
Washington, DC 20460

May 2005

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ATTACHMENTS

1.0 EXECUTIVE SUMMARY

In accordance with 40 CFR 194.8, from February 28 through March 4, 2005, the U.S. Environmental Protection Agency (EPA or the Agency) conducted EPA Inspection Number EPA-INL-AMWTP-03.05-8 of the Advanced Mixed Waste Treatment Project (AMWTP) located at the Idaho National Laboratory (INL). The purpose of the inspection is to verify that this site is able to characterize all wastes proposed for disposal in the Waste Isolation Pilot Plant (WIPP) as required by 40 CFR 194.24(c)(4).

EPA must verify compliance with 40 CFR 194.24 before waste may be disposed of at WIPP, as specified in Condition 3 of the Agency's certification of the WIPP's compliance with disposal regulations for transuranic (TRU) radioactive waste (63 *Federal Register* 27354, 27405, May 18, 1998).

EPA previously evaluated and approved waste characterization systems at AMWTP for contact-handled (CH), retrievably-stored solid wastes (S3000) during Inspection No. EPA-INL-AMWTP-08.03-08 conducted in August 2003 and Inspection No. EPA-INL-AMWTP-10.03-24 in October 2003. As a part of Inspection No. EPA-INL-AMWTP-08.04.08, EPA inspectors verified if AMWTP had addressed the EPA Findings outstanding from the August and October 2003 inspections. The waste characterization systems approved for solids in February 2004 were AK, Non Destructive Assay (NDA), and data transfer using the WIPP Waste Information Tracking System (WWIS).

The focus of EPA Inspection No. EPA-INL-AMWTP-03.05-8 was characterization of contact-handled (CH), newly-generated and retrievably-stored debris waste (S5000) using AK, NDA, and WWIS, as well as Real-Time Radiography (RTR) and Visual Examination (VE): two characterization techniques that EPA had evaluated and approved previously. This debris waste is a mixture of TRU debris waste from different DOE sites that has been in storage at INL.

At AMWTP, retrievably-stored CH TRU debris in standard waste boxes (i.e., Rocky Flats waste) or damaged 55-gallon drums are to be repackaged in 55-gallon drums. As an alternative pathway this waste and other retrievably-stored CH TRU debris will be combined and repackaged in new 55-gallon drums as the newly-generated debris. Upon full characterization according to the WIPP waste acceptance criteria (WAC), the newly-generated debris drums are processed at the supercompactor facility, where they are reduced in size. Depending on the weight of individual drums and TRU alpha contents, up to nine (9) super-compacted (compressed) 55-gallon drums of debris waste can be loaded into 100-gallon payload containers for disposal at WIPP. All drums loaded in 100-gallon payload containers must comply with the load management requirements of Appendix E of the CH WAC.

Two NDA systems, Nos. Z-390-100 (IWAS) and Z-390-101 (IWAS), were evaluated for characterizing only S5000 debris wastes; these systems will not be used to assay S3000 solids. Additionally, EPA evaluated the characterization of S5000 debris wastes for the two NDA systems that were previously approved for S3000 solids, Nos. Z-211-102 (IWAS) and Z-211-103 (IWAS).

EPA's inspection team determined that INL's AMWTP waste characterization activities using AK, NDA using two Integrated Waste Assay Systems (IWASs) Nos. Z-390-100 and Z-390-101, and the WWIS, as inspected, are adequate for the characterization of S5000 debris waste and are approved. Additionally, the IWASs Nos. Z-211-102 and Z-211-103 are approved for the characterization of debris waste (S5000), in addition to solids (S3000) based on EPA's previous approval.

EPA's inspection team identified three (3) findings and seven (7) concerns as a result of its inspection; all findings require a response. Since the inspection DOE provided responses to the EPA findings. EPA evaluated the responses for adequacy and completeness and concluded that they have been resolved satisfactorily. The table below summarizes the waste characterization processes that EPA has approved at AMWTP.

Summary of EPA Approvals

Waste Characterization Element	Retrievably-stored solid S-3000 Waste	Retrievably-stored debris S-5000 Waste	Newly Generated debris S-5000 Waste*
Acceptable Knowledge	Approved – February 2004	Approved**– May 2005	Approved – May 2005
Non Destructive Assay	Approved – February 2004 – Z-211-102 (IWAS) – Z-211-103 (IWAS)	Approved – May 2005 – Z-211-102 (IWAS) – Z-211-103 (IWAS) – Z-390-100 (IWAS) – Z-390-101 (IWAS)	Approved – May 2005 – Z-211-102 (IWAS) – Z-211-103 (IWAS) – Z-390-100 (IWAS) – Z-390-101 (IWAS)
Non Destructive Examination	Approved – February 2004 - Visual Examination - Real Time Radiography	Approved – May 2005 - Visual Examination - Real Time Radiography	Approved – May 2005 - Visual Examination - Real Time Radiography
WIPP Waste Information System	Approved – February 2004	Approved – May 2005	Approved – May 2005
Load Management	Not approved	Approved – May 2005	Approved – May 2005

* - This approval also applies to the supercompacted debris waste
** - Does not include TRU Bettis debris waste.

2.0 PURPOSE OF INSPECTIONS

On May 18, 1998, the U.S. Environmental Protection Agency (EPA or Agency) certified that the Waste Isolation Pilot Plant (WIPP) will comply with the radioactive waste disposal regulations at 40 CFR 191. In this certification, EPA also included Condition No. 3, which states that "the Secretary shall not allow shipment of any waste from . . . any waste generator site other than LANL [Los Alamos National Laboratory] for disposal at the WIPP until the Agency has approved the processes for characterizing those waste streams for shipment using the process set forth in §194.8." The approval process described at 40 CFR 194.8 requires the Department of Energy (DOE or Department) to (1) provide EPA with information on process knowledge[1] for waste streams proposed for disposal at WIPP, and (2) implement a system of controls used to confirm that the total amount of each waste component that will be emplaced in the WIPP will not exceed limits identified in the WIPP Compliance Certification Application (CCA). An EPA inspection team visits the site to verify through a demonstration that process knowledge and other elements of the system of controls are technically adequate and are being implemented properly. Specifically, EPA's inspection team verifies compliance with 40 CFR 194.24(c)(4), which states the following:

> *** Any compliance application shall: *** Provide information which demonstrates that a system of controls has been and will continue to be implemented to confirm that the total amount of each waste component that will be emplaced in the disposal system will not exceed the upper limiting value or fall below the lower limiting value described in the introductory text of paragraph of this section.[2] The system of controls shall include, but shall not be limited to: measurement; sampling; chain of custody records; record keeping systems; waste loading schemes used; and other documentation.

In other words, the purpose of inspections is to verify that the DOE waste generator sites, which characterize TRU waste prior to shipment to WIPP, are characterizing and tracking the waste in such a manner that EPA is confident that the waste will not exceed the approved limits. By approving waste characterization (WC) systems and processes at INL AMWTP, EPA has evaluated capabilities of those systems and processes to accomplish two tasks: (1) they can identify and measure the waste components (such as plutonium) that must be tracked for

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[1] *Process knowledge* refers to knowledge of waste characteristics derived from information on the materials or processes used to generate the waste. This information may include administrative, procurement, and quality control documentation associated with the generating process, or past sampling and analytic data. Usually, the major elements of process knowledge include information about the process used to generate the waste, material inputs to the process, and the time period during which the waste was generated. In the context of these reports specifically and waste characterization generally, EPA uses the term "acceptable knowledge" synonymously with "process knowledge."

[2] The introductory text of paragraph 40 CFR 194.24(c) states: "For each waste component identified and assessed pursuant to [40 CFR 194.24(b)], the Department shall specify the limiting value (expressed as an upper or lower limit of mass, volume, curies, concentration, etc.), and the associated uncertainty (i.e., margin of error) for each limiting value, of the total inventory of such waste proposed for disposal in the disposal system."

compliance;[3] and (2) they can confirm that the waste in any given container has been properly identified as belonging to the group of approved waste streams. Under 40 CFR 194.8(b)(4), EPA is authorized to perform follow-up inspections to verify that a TRU waste site is properly characterizing the relevant waste streams and that it is shipping waste that belongs only to those waste streams or groups of waste streams that have been characterized by the approved WC processes.

3.0 PURPOSE OF THIS REPORT

This inspection report documents the basis for EPA's approval decision and explains the results of Inspection No. EPA-INL-AMWTP-03.05-8 in terms of findings or concerns. The report, if applicable, provides objective evidence of outstanding findings (non-conformances) in the form of documentation. The report also describes any tests or demonstrations completed during the course of the inspection. The completed checklists attached to the report reference the documents, principally AMWTP procedures that EPA's inspection team reviewed. If you wish to see any items identified in the attached checklists, please contact:

Quality Assurance Manager
USDOE/Carlsbad Field Office
P.O. Box 3090
Carlsbad, NM 88221

EPA's decision to approve or disapprove the system of controls (processes) used to characterize one or more waste streams at a site is conveyed to DOE separately by letter, in accordance with 40 CFR 194.8(b)(3). This report identifies and explains the basis for EPA's decision as contained in the letter. EPA's approval or disapproval extends only to the processes reviewed during the inspection, and identified in this report and its attachments. Only waste that can be adequately characterized using processes verified by EPA through inspections may be shipped to WIPP for disposal.

4.0 SCOPE

The scope of Inspection No. EPA-INL-AMWTP-03.05-8 incorporated the technical adequacy of the system of controls used to achieve the following:

- Identify and quantify the activities of the 10 WIPP-tracked radionuclides (^{241}Am, ^{137}Cs, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{90}Sr, ^{233}U, ^{234}U, and ^{238}U), with an emphasis on AK and NDA using the two (2) in-plant IWASs in Building 674 for S5000 debris, as well as the two (2)

[3] The potential contents of a waste stream or group of waste streams determine which processes can adequately characterize the waste. For example, if acceptable knowledge information suggests that the waste form is heterogeneous, the site should select a nondestructive assay technique that suits such waste in order for adequate measurements to be obtained. Radiography and visual examination help both to confirm and quantify waste components, such as cellulosics, rubbers, plastics, and metals. Once the nature of the waste has been confirmed, the assay techniques then quantify selected radionuclides in the waste. In some cases, a TRU waste generator site may be able to characterize a wide range of heterogeneous waste streams or only a few. EPA's inspection scope is governed by a site's stated limits on the applicability of proposed waste characterization processes.

IWASs located in Building 634 (previously approved by EPA for S3000 solids) for the analysis of S5000 debris waste

- Assign Waste Material Parameters (WMPs) correctly using Real-Time Radiography (RTR) and Visual Examination (VE)
- Perform effective waste information transfer using the WIPP Waste Information System (WWIS)

As stated previously, waste characterization procedures and activities in use at AMWTP had been approved by EPA to characterize contact-handled (CH), retrievably-stored solid waste (S3000) during EPA Inspection No. EPA-INL-AMWTP-08.04-8 and Inspection No. EPA-INL-AMWTP-10.03-24 in August and October 2003, respectively. The scope of the inspection detailed in this report covered the processes used to characterize CH newly generated and retrievably-stored debris waste (S5000). Specifically, the scope of this audit included AK, NDA, RTR, VE, and data transfer using WWIS.

5.0 DEFINITIONS

Finding: A determination that a specific item or activity does not conform to 40 CFR 194.24(c)(4). A finding requires a response from the Carlsbad Field Office (CBFO).

Concern: A judgment that a specific item or activity may or may not have a negative effect on compliance and, depending on the magnitude of the issue, may or may not require a response.

6.0 INSPECTION TEAM

The members of the EPA waste characterization inspection team are identified below.

Inspection Team Member	Position	Affiliation
Mr. Ed Feltcorn	Inspection Team Leader	U.S. EPA
Ms. Rajani Joglekar	Inspector	U.S. EPA
Ms. Connie Walker	Inspector	S. Cohen & Associates
Ms. Dorothy Gill	Inspector	S. Cohen & Associates
Mr. Patrick Kelly	Inspector	S. Cohen & Associates

CBFO-QA performed a separate and independent quality assurance audit of the same AMWTP processes that EPA evaluated for regulatory compliance, CBFO Audit A-05-08. Mr. Charlie Riggs, the CBFO-QA Audit Team Leader, served as DOE's primary point of contact with EPA's inspection team. Ms. Ava Holland and Mr. Martin Navarette from CBFO-QA were also present. The quality assurance auditors and technical specialists from CBFO Technical Assistance Contractor (CTAC) supported the CBFO-QA audit team.

The INL is located in southeastern Idaho, about 80 miles from Idaho Falls, Idaho. The site encompasses approximately 890 square miles. The U.S. government established INL in 1949 as the National Reactor Testing Station. Its original mission was the design, construction, and testing of prototype nuclear reactors. Over the years, emphasis has shifted from reactor development to multi-program research, hazardous and radioactive waste management and cleanup, and the development of environmental technologies. In January 1997, the laboratory, then known as the Idaho National Engineering Laboratory, changed its name to the Idaho National Engineering and Environmental Laboratory (INEEL) to highlight its role in developing waste cleanup and other environmental technologies. In February 2005, the site's name was changed to the Idaho National Laboratory (INL) to better reflect its role in the development of nuclear-related technologies.

INL has approximately 65,000 m^3 of TRU waste in inventory. Of this, approximately 8,000 m^3 of waste (6,000 m^3 from the Rocky Flats Environmental Technology Site (RFETS)) is currently in storage at the Subsurface Disposal area of the Radioactive Waste Management Complex. In accordance with state agreements, INL was required to ship 3,100 m^3 of TRU waste to WIPP by the end of the year 2002, a commitment that was met. Approximately six thousand 55-gallon drums of CH retrievably-stored homogenous solids generated at RFETS were shipped to INL. British Nuclear Fuel Limited (BNFL) took over TRU waste characterization responsibilities from Bechtel, who had shipped the required 3,100 m^3 to the WIPP under a separate activity. BNFL has built a waste treatment facility under the AMWTP, and is currently using this facility to supercompact and otherwise treat TRU waste prior to shipment to WIPP. This facility was operational at the time of this inspection, and EPA examined their WC capabilities to characterize debris TRU waste (S5000) using the standard techniques common to programs at other facilities.

7.0 PERFORMANCE OF THE INSPECTION

EPA Inspection Number EPA-INL-AMWTP-03.05-8 took place from February 28 through March 4, 2005. The inspection involved the following elements of AMWTP's TRU characterization program: AK; NDA using four separate assay systems;[4] non-destructive examination (VE/RTR), and data transfer using the WWIS. These elements constitute a sampling of the "system of controls" for waste characterization that is identified in 40 CFR 194.24(c)(4).

EPA examined all of the above processes to determine whether AMWTP demonstrated compliance with 40 CFR 194.24 for the waste streams within the audit's scope. The checklists used by EPA inspectors for AK, NDA, RTR, VE, and WWIS evaluations are included in Attachments A.1 through A.5. The checklists identify the objective evidence reviewed by EPA.

[4] NDA systems Z-211-102 and Z-211-103 were previously evaluated and approved by EPA for analyzing solids (S3000), and were evaluated during this audit for the analysis of debris (S5000). As discussed in this report, the evaluation of Z-211-103 was indeterminate at the time of the inspection due to its operational status, but this system was evaluated completely following the submission of additional materials post-inspection. NDA systems Z-390-100 and Z-390-101 were evaluated for the first time by EPA during this audit and, pending approval, will be used only for the analysis of debris waste at this time. BNFL personnel stated that the use of the Z-390 in-plant systems for S3000 solids is expressly prohibited.

The inspection was conducted in the following steps:

(1) Preparation of draft checklists prior to the inspection

(2) Reviewing the results of EPA's and CBFO's recent audits of INL AMWTP, including findings and concerns identified by EPA and corrective actions required by CBFO to identify potential areas of inquiry during inspection interviews

(3) Reviewing site procedures and other information, and modifying EPA checklists as appropriate to incorporate site-specific information

(4) Onsite verification of the technical adequacy or qualifications of personnel, procedures, and equipment by means of interviews and demonstrations.

The following sections present the results of EPA's inquiries into each technical area. The checklists in Attachments A.1 through A.5 identify key documents that the EPA inspection team reviewed, AMWTP and support contractor personnel who were interviewed, and systems demonstrations that were performed, as applicable. Key personnel interviewed are as follows:

Personnel Contacted During the Audit

Personnel	Organization	Area of Expertise
Joan Connolly	Northwind Inc.	Acceptable Knowledge Expert
Betty Tolman	Northwind Inc.	Acceptable Knowledge Expert
Steve Carpenter	Weston	Acceptable Knowledge Expert
Kathy Sbryk	Washington TRU Solutions	Acceptable Knowledge Expert
Vivian Sendelweck	Wastren	Acceptable Knowledge Expert
Carolyn Abbott	Northwind Inc.	Acceptable Knowledge Expert
Bill Erhardt	BNFL	Acceptable Knowledge Expert
Gary Buss	BNFL	Process Engineer/POS
Stella Martinez	BNFL	WWIS
Martin Clapham	BNFL	NDA Subject Matter Expert
Darrin Hovis	TRU Programs BNFL (Stoller)	WWIS
Christina Winterbottom	TRU Programs BNFL (Stoller)	WWIS
Nichole Wartchow	TRU Programs BNFL (Stoller)	WWIS
Vincent Medina	TRU Programs	VE, RTR
Michael Loftus	Operations	VE
Jason Bottles	Operations	VE
Brad Scholes	Operations	VE
Jeff Martinez	Operations	VE
Fred Pearson	Operations	VE
Scott Baguley	Operations	VE
Richard Steffens	Operations	RTR
Benny Burnside	Data Validation	RTR
Mark Sorenson	Operations	RTR
Kathy Birch	Operations	RTR

Personnel Contacted During the Audit

Personnel	Organization	Area of Expertise
Judy Petersen-Campbell	Data Validation	RTR
Reed Walker	Data Validation	RTR
Joe Poirier	Data Validation	RTR
Kevin Lundquist	Data Validation	RTR
Florian Wernette	Data Validation	RTR

7.1 Acceptable Knowledge (AK)

EPA examined the AK process and associated information to determine whether AMWTP demonstrated compliance with §194.8 requirements for their CH newly generated and retrievably-stored TRU debris waste (S5000). A large number of drums or containers have been or will be repackaged into new drums prior to characterization, while other drums will be characterized as "direct load", i.e. without repackaging. Once fully characterized, **only** the repackaged and direct-loaded drums meeting the requirements of Appendix E of the CH Waste Acceptance Criteria (WAC) can be super-compacted and loaded in 100-gallon payload containers approved for the disposal at WIPP. As part of the inspection, EPA reviewed the elements of the AK process listed below. Attachment A.1 identifies the objective evidence reviewed by EPA:

- Overall procedural technical sufficiency and scope, and ability to follow the AK waste characterization process for containers and waste streams
- Waste-generating procedures, processes, and documentation
- Characterization of required waste material parameters and radionuclides
- AK information assembly and compilation
- AK confirmation and associated discrepancy resolution
- Sufficiency of AK characterization results
- Assembly of required information and use of supplemental information
- AK Summary preparation
- Reassignment of waste stream due to AK and discrepancy analysis
- AK Accuracy

Acceptable knowledge is used to determine several aspects of TRU wastes at AMWTP, including but not limited to the following:

- Defense waste status
- Material parameters
- Waste stream
- Radionuclide information

- Waste matrix codes

During the inspection, EPA inspectors examined several procedures and documents, including the following:

- Acceptable Knowledge Ledger, February 28, 2005
- AK List of BN510 feedstock by IDC AK Accuracy Assessment, SH-007-2004, August 16, 2004
- AK Document Reference Inventory Form 1084, February 28, 2005
- AKR-03-8, AK Resolution, Radionuclide (^{137}Np) inconsistent with AK documentation, May 12, 2003
- AKR-03-09, AK Resolution, Radionuclides (^{137}Cs and ^{90}Sr) inconsistent with AK documentation, May 23, 2003
- AKR-03-10, AK Resolution, Radionuclide (^{40}K) inconsistent with AK Documentation
- AKR-03-34, Form 1070, AK Resolution, Drum contains greater than 50% IDC 371 Fire Brick, December 15, 2003
- AKR-04-74, Unexpected packaging configurations — fiber packs, March 7, 2004
- AKR-04-99, Form 1070, AK Resolution, Drum contains primarily plastic — waste not metals, June 21, 2004
- AMWTP Form 1066, Advanced Mixed Waste Treatment Facility, Battelle Columbus Laboratories, Mound Laboratory, Rocky Flats Environmental Technology Site, Bettis Laboratory, Super-compacted Debris, March, 2005
- BNFL-5232-RPT-TRUW-03, Revision 4, Drum Assay Technical Review Report, July 8, 2004
- BNFL-5232-RPT-TRUW-04, Acceptable Knowledge Document for the Battelle Columbus Laboratories Building JN-4 Plutonium Laboratory, October 1, 2003
- BNFL-5232-RPT-TRUW-06, Revision 2a, Reference P400A, R1, AMWTP TRU Waste Management Acceptable Knowledge Elements, March 3, 2005
- BNFL-5232-RPT-TRUW-07, Determination of Radioisotopic Content in TRU Waste Based on Acceptable Knowledge, Revision 5 dated December 16, 2004.
- BNFL-5232-RPT-TRUW-12, AMWTP Waste Stream Designations, Revision 2a, March 3, 2005
- BNFL-5232-RPT-TRUW-13, INL AMWTP AK Document for INL Stored Transuranic Waste-Mound Plant Waste, Revisions 0 and 1, September 3, 2004, and March 3, 2005
- BNFL-5232-RPT-TRUW-30, Acceptable Knowledge Summary for Super-compacted Debris Waste, Revisions 0A and 0B, January 26, 2005, and February 2005

- C251A, Group Interview Record of Eugene Sands, Larry Stickel, Harley Toyu, Jax Berchtold, Mike Failey, and George Kirsch, BCL, documented by Kevin Peters/Jeff Harrison, WASTREN, Inc., May 13, 1998
- C273A, Interview with Vince Medina conducted by Betty Tolman, RE: Packaging/Waste Configuration for First/Second Stage Sludge, March 15, 2004
- Draft Waste Stream Profile Form for BN510 (incomplete), February 28, 2005
- Individual Training Manual for Acceptable Knowledge Expert Vivian Sendelweck, October 7, 2004
- Individual Training Manual for Acceptable Knowledge Expert and Site Project Manager Designee Steve Carpenter, June 22, 2004
- Individual Training Manual for Acceptable Knowledge Expert and Site Project Manager Designee Betty Tolman, June 22, 2004
- INEL-96/0280, Revision 03, Acceptable Knowledge Document for INL Stored Transuranic Waste — Rocky Flats Plant Waste, May 29, 2003
- Memorandum, from Elvin Dumas to Eric Schweinsberg, RE: BNFL Advanced Mixed Waste Treatment Project Quality Assurance Independent Assessment QA-2004-004, ED-041-2004
- Memorandum, from Eric Schweinsberg to Patricia Utley, RE: Establishment of Summary Waste Category Miscertification Rate for S5000 EPS-061-2004 and SPC-016-2005, August 12, 2004, and February 28, 2005
- MP-TRUW-8.11, Revision 9, Idaho National Engineering and Environmental Laboratory Advanced Mixed Waste Treatment Project Data Reconciliation, January 6, 2005
- MP-TRUW-8.13, Revision 10, Idaho National Engineering and Environmental Laboratory, Advanced Mixed Waste Treatment Project, Collection, Review, Confirmation, and Management of Acceptable Knowledge Documentation, BNFL Inc.
- NCR #12613, Insufficient AK for Bettis Laboratory
- P012A TRUPACT II Content Codes, TRUCON, 89-04 Revision 6, 1994
- P015A TRU Waste Sampling Program, Volume 1—Waste Characterization EEG WM 6503, Clements and Kudera, September 1985
- P024A, Content Code Assessments for INEL contact-handled stored Transuranic Wastes, Tom Clements, WM-F1-82-021, October 1982.
- P057A, Operations Safety Analysis (OSA), Raschig Ring Inspection, Removal, and Replacement, 771.037, July 31, 1989
- P072A, EG&G Rocky Flats Plant Waste Operations Procedures, Nuclear Safety Related Category 3, TRU Organic Sampling and Transferring, Buildings 707 and 777, WO-2010, Revision 0, 1991
- P206A, U234 Activity with Respect to Total Alpha Activity, INL/INT-98-01268, EDF-RWMC-1045, Revision 1, August 12, 1998

- P227A, R2, Plutonium Mass Fractions derived for SGRS Data, Bechtel BWXT Idaho, LLC EDF-1609, June 29, 2000
- P227A, R1, Engineering Design File for the TRU Waste Characterization – SWEPP Assay Systems, Plutonium Mass Fractions derived from SGRS Data, Bechtel BWXT Idaho LLC EDF-1609, June 11, 2003
- P269A, SWEPP Absolute Analysis Package (SAP) Software Test Plan and Report, C.R. Hoffman, INEL/INT-01-01368, Revision 2 – February 2002, Revision 3 – April 02, 2002
- P322A, Radioassay Data Collected During the 3100 Cubic Meter Project, EDF-3374, Revision 0, January, 2003
- P323A, Course 7: Metals for Nuclear Power, Lesson Ten, Structural Materials, D.W. Lillie et al., GE Research Laboratory, Copyright 1958
- P359A, Summary HSG Data Collected During 3,100 m^3 Project, EDF-3396, Revision 0, February 03, 2003
- P364A, INEL 95/194, RWMC EDF-837, Estimated Earthen and Geofabric-Covered TRU Waste Inventory in the TSA for RWMC, August 24, 1995
- P384A, Technical Manual MD-20734, Plutonium Processing—Material Control, September 15, 1973
- P387A, R2, VE Operating Procedures and Date Reporting, multiple text revisions, Revision 10, February 12, 2005
- P388A R2, Waste Packaging Rev. 5, BNFL Inc., INST-01-24, Revision 9, June 26, 2005
- P393A, R1, Advanced Mixed Waste Treatment Project Waste Stream Designations, AMWTP-EDF-199, Revision 0, February 19, 2003, and BNFL-5232-PT-TRUW-12, Revision 0, August 27, 2003
- P397A, Aqueous and Oil/Organic Liquid TRU Waste Solidification Method Test Plan and Report, PRO-1582-PQP/PQR, Revision 0, September 12, 2002
- P423A, Mound Site Radionuclides by Location, Technical Manual, MD-22143, Issue 3, March 22, 2001
- P425A, Material Safety Data Sheets for Oakite 360L (May 18, 1992); Oakite Aluminum Cleaner 164 (January 4, 1990); Oakite Dynadet (March 27, 1992); Oakite Super Ruststripper (October 1, 1999); collection date December 21, 2004
- U118A, Fissile Distribution by Content Code, Query Date November 8, 1995
- U127A, BBWI-Generated Drum Data, including Data from the Transuranic Waste Management Information System (TWMIS), date unknown.

The following puck drum/100-gallon payload container data packages were also examined:

Puck Drum ID Number	RTR Batch ID	VE Boxline Batch ID	Assay Batch ID	100-gallon Payload Container ID
10003621	RTR04-00395	N/A	ASY04-00698	10026898

Puck Drum ID Number	RTR Batch ID	VE Boxline Batch ID	Assay Batch ID	100-gallon Payload Container ID
10015651	RTR04-00395	N/A	ASY04-00698	
10034020	N/A	VEB05-00081	ASY05-00082	100334193
10034021	N/A	VEB05-00101	ASY05-00082	
10034022	N/A	VEB05-00061	ASY05-00025	
10034792	N/A	VEB05-00081	ASY05-00082	
10034791	N/A	VEB05-00081	ASY05-00082	
10033623	N/A	VEB05-00081	ASY05-00025	
10005989	RTR04-00394	N/A	ASY04-0098	10034212
10003760	RTR04-00396	N/A	ASY04-0098	
10003795	RTR04-00396	N/A	ASY04-0098	
10033829	N/A	VEB05-00061	ASY05-00025	10034192
10030207	N/A	VEB05-00061	ASY05-00025	
10030190	N/A	VEB05-00041	ASY05-00025	
10033837	N/A	VEB05-00041	ASY05-00025	
10033833	N/A	VEB05-00041	ASY05-00025	
10033826	N/A	VEB05-00041	ASY05-00025	
10034024	N/A	VEB05-00081	ASY05-00025	
10033832	N/A	VEB05-00041	ASY05-00025	
10003670	RTR04-00395	N/A	ASY04-00698	10026899
10000370	RTR04-00394	N/A	ASY04-00670	

The inspection team evaluated adequacy of AK information specific to the CH TRU retrievably-stored and newly-generated debris waste.

(1) The AK Summary for Super-compacted Waste (BN510) was insufficient.

The INL Super-compacted Waste Stream, BN510, is a newly generated waste stream composed of feedstock from approximately 50 waste streams generated at sites such as Mound, Rocky Flats, and Battelle. The AK Summary BNFL-5232-RPT-TRUW-30, *Acceptable Knowledge Summary for Super-compacted Debris Waste* (TRUW-30), for this composite waste stream was very brief, as much of the expected AK data for the feed components had been included in AK Documents for each site contributing waste to BN510. As a result, however, TRUW-30 lacked some of the necessary detail to ensure that the document is a "stand-alone" summary. For example, the document must be of sufficient detail to convey the radiological content of the waste, including isotopic distributions, radionuclide contribution by at least feed site, and identification of the two most prevalent isotopes, as well as other relevant radiological information presented in Appendix A of the CH WAC. TRUW-30 did not contain adequate summaries of the radiological information, instead referencing a document (BNFL-5232-RPT-TRUW-07, *Determination of Radioisotopic Content in TRU Waste Based on Acceptable Knowledge,* TRUW-07) that may in turn then reference other documents for information (e.g., INEL-96/0280). The ability of the AK Summary to serve as a stand-alone document would be improved by making the following revisions:

- Add brief summaries of the mandatory information, including brief feed-specific process summary discussions (by feed site)
- Include a more thorough discussion of the site-generated debris wastes, including anticipated volumes, waste material parameters, etc.

- If the AK data could not explicitly rule out the presence of prohibited items, this should be stated
- Revise the entire document to ensure that all of the data presented therein are adequately referenced and that any referencing errors are corrected
- Add waste generation dates and TWBIR references, and revise TRUW-30, Figure 2, to include RTR/NDA

During the inspection, the site revised TRUW-30 to identify the two most prevalent radioisotopes by feed site and general types of plutonium present in the waste (e.g., weapons grade or heat source). The revision substantiated the radiological content information given in TRUW-30, however, future versions of TRUW-30 could be improved by the addition of specific isotopic distributions listed by feed site. Also, many of the above issues were reflected in CBFO's CAR 05-011. EPA's review of the resulting Corrective Action Report showed that the site revised TRUW-30 post-inspection to include most of the items in the above bulleted list.

(2) AK data assembled for the Bettis Laboratory component was incomplete.

TRUW-30 indicated that debris waste from Bettis Laboratory is intended to feed the BN510 waste stream. However, TRUW-30 also indicates that currently, little AK data are available for Bettis wastes. No Bettis Laboratory-specific AK Document, like those written for other feed sites (i.e., Rocky Flats, Mound, Battelle), was available for review during the inspection. The site recognized this deficiency and issued NCR addressing the problem (NCR #12613). EPA agrees that this action was appropriate, and that Bettis waste must not be included in the BN510 waste stream until adequate AK has been assembled.

(3) The audit scope did not include all waste generated from the supercompaction process, and did not include "direct load" debris waste to be sent directly to WIPP without undergoing supercompaction.

During review of the BN510 AK information, creation of a newly generated solid waste from the supercompaction process was identified. The scope of this inspection did **not** include this solid waste (S3000 "squeezant"). Approval of this additional newly generated waste created by supercompaction will be addressed at a later inspection, because EPA currently authorizes this site for CH TRU retrievably-stored solid waste only. Also, site representatives had not prepared waste stream profile forms for retrievably-stored debris waste, and indicated during interviews that direct shipment of wastes to WIPP as contact-handled, retrievably-stored debris waste (i.e., direct shipment without supercompaction) was not within the scope of the audit.

A large body of supporting AK information for retrievably-stored debris waste was examined during the inspection because these are also feed material to the newly generated debris (super-compacted) waste stream, even though no WSPFs with attached AK Summaries for retrievably-stored debris wastes had been prepared. Because of the time-critical nature related to initiation of AMWTP waste shipment, and because a large

body of AK information was examined for retrievably-stored debris waste, EPA shall approve shipment of retrievably-stored debris waste in this instance. However, it is expected that the complete scope of all audits and inspections will be adequately defined in the future, and that completed WSPFs, AK Summaries, and other documents required for shipment of CH retrievably-stored debris waste will be ready for EPA review at the next inspection.

(4) AK and NDA personnel communication was assessed, and should be improved.

TRUW-07 indicates that the weapons-grade plutonium isotopic distribution will be expected for all waste from RFETS. It further stated that this waste may also contain enriched/depleted uranium (EU/DU), and that the distribution used is dependent on whether the EU/DU content was based on measurement data. The site also provided a mathematical approach to determine the ^{234}U content based upon various ^{235}U and ^{238}U values. Heat source plutonium and related isotopic distributions are expected at Mound. Apparently, there are no direct measurements or analytical data to confirm the distributions present at Battelle, so BNFL assumed that the Mound and Rocky Flats distributions would apply to Battelle waste if heat source and/or weapons-grade plutonium isotopes were detected. Mr. Martin Clapham, BNFL's NDA expert, was asked how AK data were used in NDA, and he indicated that the use of measurement vs. default isotopic values would essentially be determined on a case-by-case basis. INL has repeatedly had issues with respect to AK-NDA data sharing and agreed uses of data. Therefore, implementation of a system similar to that currently in place in the CCP program (see Section 4.4.17 of procedure CCP-TP-005, Revision.13 or later) would ensure full communication and agreement among all parties regarding the use of AK-derived radionuclide information.

(5) AK data assembly, compilation, and discrepancy resolution were adequate, including identification of mandatory and supplemental information.

The site has implemented a good data management system, whereby all AK data sources are identified and presented in AK Form 1084, which serves as the AK "roadmap." Figure 1 in TRUW-30 shows the document hierarchy applicable to BN510, with each of these documents containing its own reference list. Mandatory/supplemental information on a feed site- and AMWTP-basis is identified by requirements on Forms 1066 and 1067. A random sample of suggested supplemental data was requested, and the site provided several examples of supplemental information collected to support mandatory data. Many documents were provided to inspectors the first day of the inspection. As a result, it was clear that information in some supporting documents (e.g., BNFL-5232-RPT-TRUW-06, TRUW-07, TRUW-12, TRUW-13, TRU-04, and INEL-96/0280, Revision 03) was assembled, but had not completed the review and approval process prior to the inspection. These documents require additional editorial work, including appropriate referencing of assumptions, removing irrelevant text from previous versions, and including appropriate AK information (i.e., RFETS boxed waste, which was omitted from some AK documentation). Many of these documents were revised during the inspection to address errors, but other documents, including those requiring addition of

RFETS box data, were not. However, the RFETS boxed waste exclusion was reflected in CBFO's CAR No. 05-012, and was addressed in the related Corrective Action Report dated April 4, 2005. EPA has reviewed the CAR and found it to be adequate. Further, the site had implemented an AK Resolution Ledger, which documents each discrepancy and related resolution and status. This concept helps track all issues associated with a waste/waste stream, and is a good practice.

(6) AK Procedure MP-TRIW-8.13, Revision 9, was adequate, but should be revised to address waste material parameter identification.

During the inspection, EPA inspectors noted that MP-TRUW-8.13, Revision 9, did not include the required identification of the two most prevalent isotopes. Revisions were made to this procedure during the audit to address this issue. While the procedure, in general, is sufficiently adequate, two issues identified during previous inspections had yet to be addressed. MP-TRUW-8.13, Revision 10, still did not require collection of AK data for materials important to performance assessment, including ferrous metals, cellulosics, plastic, rubber (CPR), and nonferrous metals. Similarly, the procedure did not explicitly call for identification of unexpected radionuclides, although this information is typically included in supporting AK documents. DOE provided a revision of MP-TRUW-8.13 that included the required identification of the waste material parameters and radionuclides, so the issue has been adequately addressed.

(7) Data/drum tracking was examined and found to be improved relative to the previous inspections. However, the Virtual Puck Drum (VPD) systems did allow the compositing of pucks within 100-gallon drums in a manner that violated requirements of Appendix E of DOE-WIPP-02-3122 (CH WAC).

During previous inspections, the EPA inspectors noted issues with respect to tracking and management of waste containers. For example, the inspectors made the following notation: "When the Shipping Module is added to the WTS, this field ensures that container status is tracked; this Module could also include the inventory of containers that were characterized by Bechtel, but were shipped by BNFL, to ensure that the system tracks all waste ultimately managed by BNFL." EPA observed during this current inspection that progress had been made with regard to the WTS system. WTS is a source of information to the Process Optimization System (POS) that assembles and calculates specific virtual puck drums to ensure that no CH WAC requirements have been overlooked with respect to Load Management. AK shows that waste feed to BN510 will be composed of approximately 50% of drums containing >100nCi/g TRU alpha activity and 50% of drums containing <100 nCi/g TRU alpha activity, as well as some wastes/containers that may not have any measurable TRU alpha radionuclides. The POS is used to track and preferentially assemble pucks within 100-gallon payloads to ensure that the payload meets EPA and CH WAC requirements. That is, the POS selects drums from both the direct feed and box (repackaged) areas, and identifies combinations of containers that, upon compaction and placement within a 100-gallon drum, will still be compliant with EPA, CH WAC, and other requirements. As part of this calculation, the drum container weight from each of the compacted drums is incorporated in the total

nCi/g calculation for the 100-gallon container, since this material is now technically part of the waste.

AK data indicated that individual drums from different sites that are pucked and used to create the BN510 waste stream may be composed only of non-TRU alpha components (e.g., EU/DU). The CH WAC, Appendix E, requires each container within a payload to have measurable quantities of at least one TRU isotope. Therefore, each of the pucks within a 100-gallon payload container must contain measurable TRU isotopes. EPA determined that the site did not correctly implement the requirements of Appendix E, because the site did not consider the activity performed to be Load Management and thus intended to include non-TRU pucks in payload containers. However, EPA determined and DOE concurred that Load Management is being implemented, and therefore waste-tracking systems and creation of 100-gallon payload container overpacks must comply with requirements set forth in Appendix E of the CH WAC. Management of waste input using the POS is imperative to ensure that all 100-gallon drums containing pucked material meet the CH WAC, Appendix E requirements. As such, the site must consider the Load Management requirements of the CH WAC, Appendix E, and manage VPDs accordingly. CBFO issued CAR No. 05-018 regarding this issue and the Corrective Action Report was prepared and provided to EPA. Although not indicated in this CAR, the site did modify TRU-30 (AK Summary for BN510) to state that load management would take place. The revision, together with the information presented in the Corrective Action Report, appears to have adequately addressed EPA's concern.

(8) Drum characterization status must be accurately tracked and readily available.

A list of containers that had undergone the entire characterization process was requested at the beginning of the inspection to facilitate traceability analysis from the drum to supporting AK documents. However, site personnel had difficulty producing this listing during the first day of the inspection, although the list was eventually provided. The source of this delay could not be ascertained during the inspection, but the site (when preparing for inspection) must ensure that the status of each drum with respect to all characterization elements is readily known and retrievable to ensure that all characterization requirements are met. This is also necessary prior to shipment of waste drums.

(9) AK Accuracy was examined.

Sites are not required by the CH WAC to specifically identify radionuclide measurement-AK accuracy (as is mandated for waste matrix codes and hazardous waste codes), but sites are required to address and compare AK and NDA data in a more generic sense. An AK Accuracy memorandum (Memorandum from Sheila Hailey to Eric Schweinsberg, AK Accuracy Assessment, SH-007-2004, dated August 16, 2004) was prepared to document this comparison, but the comparisons therein are confusing. For example, Table 2 of the AK Accuracy Memorandum includes a field entitled "Number of Containers Flagged with 'Y'," but it is unclear what events or observations would precipitate a "Y" designation. Criteria for "Y" designations should be provided because

this parameter controls or strongly influences the accuracy calculations, and the memo thus implies relatively low AK accuracy values with respect to radionuclides (86% for first/second stage sludges, and only 61% for 374 sludges). The origin of this "Y" value must be described so that the apparent 86% and 61% accuracy values can be put into context. It should be noted that an AK Assessment was not available for debris waste. Also note that upon examination of the AK Accuracy Report and related AK Resolution forms, EPA inspectors determined that AK Accuracy, when calculated for BN510, will not measure adequacy of AK data because of the diverse nature of the waste stream. Therefore, no value or meaning can be imparted to these calculations, and therefore EPA requires that they be performed on a feed waste stream basis.

(10) AK data limitations must be improved for Battelle waste.

AK data limitations were documented on Form 1068, and were appropriately thorough for most documents examined. However, AK isotopic distribution limitations for Battelle waste must be specifically identified in TRUW-07. The Acceptable Knowledge Expert (AKE) indicated that certain assumptions were made when assigning the isotopic distributions presented in TRUW-07, but these assumptions and analysis were lacking and must be identified in TRUW-07, and must be supported by memos to file or other documents in the AK Record. Also, site representatives indicated that a chapter should be added to this document explicitly related to the BN510 waste stream; addition of this chapter will improve AK for a diverse BN510 waste stream and EPA agrees that it is a good idea.

(11) The BN510 waste stream was appropriately designated.

The document BNFL-5232-RPT-TRUW-12, *Waste Stream Designations*, summarizes proposed waste subdivisions and designations for the site. Based on information presented in this and other supporting documents, the definition of BN510 as a newly generated debris waste stream was appropriate. While the document is a good source of information to understand the general waste components that will eventually be managed through the AMWTP and elsewhere at the site, caution must be exercised when assuming that the "waste stream" designations actually meet the definition of waste stream as specified in the CH WAC and WAP. The document was examined as a source of supporting objective evidence for the process, but this action does not constitute approval of document contents by EPA.

(12) The AK Record should include characterization information from other sites with ongoing characterization to ensure adequate communication of new AK data to INL.

(13) EPA examined the communication of information between sites. When AMWTP/INL is managing wastes generated at other facilities, communication between generator sites and AMWTP/INL is imperative to ensure that appropriate AK data assembly and interpretation occur. For example, analogous WSPFs from RFETS are included in the AK record and are examined on a regular basis to ensure that ongoing AK is examined and integrated into AK documents, as appropriate. Communication is particularly

important since sites such as RFETS are closing and INL is beginning to ship waste sourced from this closing site, so the AK data and other information from RFETS might not be readily available to INL personnel when needed. Also, differences between INL and other site data obtained as part of ongoing site characterization should be identified and resolved.

Findings

The EPA inspection team identified three (3) AK findings during the inspection. However, as noted below, all of the findings were resolved either by subsequent CAR resolution or through post-inspection modification of documents, so no response to any of these findings is required.

AK Finding No. 1. The document BNFL-5232-RPT-TRUW-30, *Acceptable Knowledge Summary for Super-compacted Debris Waste* (TRUW-30), that was reviewed during the inspection lacked necessary details to enable it to function as a "stand-alone" AK Summary. This is required to ensure that the AK basis for the waste characterization system of controls is adequately maintained. Listed below are the document deficiencies that were identified during the inspection:

(1) TRUW-30 must be of sufficient detail to convey the radiological content, including isotopic distributions, radionuclide contribution by at least feed site, and identification of the two most prevalent isotopes, as well as other relevant radiological information presented in Appendix A of the CH WAC.

(2) TRUW-30 should include, not just reference, all mandatory information, including very brief feed-specific process summary discussions (by feed site). Physical parameters with respect to the expected waste material parameters (in whole or by feed) should be included.

(3) TRUW-30 must also include a more thorough discussion of the site-generated debris waste, including anticipated volumes, waste material parameters, etc. If the AK data cannot explicitly rule out the presence of prohibited items, state this.

(4) Inclusion of waste generation dates, addition of TWBIR references, correction of inaccurate references, and revision of Figure 2 to include RTR/NDA is required.

(5) The entire document should be revisited to ensure that all of the data presented therein is adequately referenced.

CAR 05-011 resolution information was provided to EPA subsequent to the inspection and was reviewed by EPA AK personnel. Upon review, it was determined that items 1 and 4, and most of Item 2 were addressed through CAR resolution. Remaining items 3 and 5 were re-evaluated by EPA and are now considered to be a concern rather than a finding (see AK Concern No. 6, below).

AK Finding No. 2. MP-TRUW-8.13, Revision 10, *Idaho National Engineering and Environmental Laboratory, Advanced Mixed Waste Treatment Project, Collection, Review, Confirmation and Management of Acceptable Knowledge Documentation*, still does not require

collection of AK data for materials important to performance assessment, including ferrous metals, cellulosics, plastic, rubber (CPR), and nonferrous metals. Similarly, the procedure did not explicitly call for identification of unexpected radionuclides, although this information is typically included in supporting AK documents. Subsequent to the inspection, the site revised Procedure 8.13 (now Rev. 11) to include this information, and the finding has therefore been adequately resolved.

AK Finding No. 3. Waste Stream BN510 is to be composed of several individual waste streams generated at different sites. During the inspection, EPA determined that the site does not correctly implement the requirements of Appendix E of CH WAC, because the site did not consider the supercompaction activity performed to be Load Management. However, EPA determined, and DOE concurred, that Load Management is being implemented, and therefore waste-tracking systems must ensure compliance with requirements set forth in Appendix E of the CH WAC. Revision of site controls to recognize this compliance issue was required. Subsequent to the inspection and in response to DOE CAR No. 05-018, the site performed CAR resolution activities and revisions that adequately address EPA's concerns, so the finding has therefore been adequately resolved.

Concerns

The EPA inspection team identified seven (7) AK concerns, one of which was addressed adequately by the submission of additional information post-inspection. The other six (6) concerns do not require a response at this time. However, EPA will verify the site's response to these remaining concerns at the subsequent inspection. Also, reconsideration of an EPA finding identified during the inspection based on post-inspection information has resulted in the removal of a finding and addition of a concern. EPA will evaluate the AK Summary with respect to these concerns during subsequent inspections.

AK Concern No. 1. Currently, few AK data are available for Bettis wastes. The site recognized this deficiency and issued an NCR addressing the problem (NCR #12613). EPA agrees that this action was appropriate, and that Bettis waste must not be included in the BN510 waste stream until adequate AK has been assembled.

AK Concern No. 2. INL has repeatedly had issues with respect to sharing data between the AK and NDA groups. This communication is important to ensure appropriate use of AK data. Therefore, implementation of a system similar to that currently in place in the CCP program (i.e., see Section 4.4.17 of procedure CCP-TP-005, Revision 13, or latest version) would appear in order to ensure full communication and agreement regarding the use of AK-derived radionuclide information.

AK Concern No. 3. RFETS box waste was not included in the related AK documentation available during this inspection. During the inspection, EPA personnel made the point that this information should be included in relevant documents to ensure complete understanding of waste feed stream composition being included in the supercompaction process. To accomplish this, the AK documents require revision to include data from the RFETS box waste. Subsequent to the inspection, additional information was provided which demonstrated that the appropriate AK

documents had been revised to include the RFETS box data. Upon examination of the newly provided information, EPA considers this concern to be closed. No response to this concern is required.

AK Concern No. 4. An AK Accuracy memorandum (Memorandum from Sheila Hailey to Eric Schweinsberg, AK Accuracy Assessment, SH-007-2004, dated August 16, 2004) was prepared to document this comparison, but the comparisons therein are confusing. For example, Table 2 of the AK Accuracy Memorandum includes a field entitled "Number of Containers Flagged with 'Y,'" but it is unclear what events or observations would precipitate a "Y" designation. Criteria for "Y" designations should be provided, because it appears to control the accuracy calculations, and the memo thus implies relatively low AK accuracy values with respect to radionuclides (86% for first/second stage sludges, and only 61% for 374 sludges). The origin of this "Y" value must be elicited, so that the apparent 86% and 61% accuracy values can be put into context.

AK Concern No. 5. The AKE indicated that certain assumptions were made when assigning the isotopic distributions presented in BNFL-5232-RPT-TRUW-07, *Determination of Radioisotopic Content in TRU Waste Based on Acceptable Knowledge*, but these assumptions and analysis must be presented in summary within TRUW-07, and must be supported by memos to file or other documents in the AK Record.

AK Concern No. 6. The document BNFL-5232-RPT-TRUW-30, *Acceptable Knowledge Summary for Super-compacted Debris Waste* (TRUW-30), should serve as a stand-alone summary, and therefore should be revised as follows:

- TRUW-30 should include, not just reference, all mandatory information, including very brief feed-specific process summary discussions (by feed site).
- TRUW-30 must also include a more thorough discussion of the site-generated debris waste, including anticipated volumes, waste material parameters, etc. If the AK data cannot explicitly rule out the presence of prohibited items, state this.
- The entire document should be revisited to ensure that all of the data presented therein is adequately referenced.

AK Concern No. 7. A large body of supporting AK information for retrievably-stored debris waste was examined during the inspection because these are also feed material to the newly-generated debris (super-compacted) waste stream, even though no WSPFs with attached AK Summaries for retrievably-stored debris wastes had been prepared. Because of the time-critical nature related to initiation of AMWTP waste shipment, and because a large body of AK information was examined for retrievably-stored debris waste, EPA shall approve shipment of retrievably-stored debris waste in this instance. However, it is expected that the complete scope of all audits and inspections will be adequately defined in the future, and that completed WSPFs, AK Summaries, and other documents required for shipment of CH retrievably-stored debris waste will be ready for EPA review at the next inspection.

7.2 Non Destructive Assay (NDA)

During Inspection No. EPA-INL-AMWTP-03.05-8, EPA inspected two essentially identical IWASs that are designated Z-390-100 and Z-390-101, both located in Building WMF-674 of the AMWTP. These are referred to as the *in-plant* systems and according to the current AMWTP plans, these systems will be used to assay 55-gallon containers prior to their being compacted in the facility supercompactor. These systems are the functional equivalent of the two NDA systems EPA evaluated previously, Z-211-102 and Z-211-103, both of which are located in Building WMF-634 of the AMWTP. The Z-211 systems were previously evaluated and approved by EPA for assaying S3000 solids (see *Waste Characterization Report EPA INSPECTION NO. EPA INL-AMWTP-08.04-8 of the Advanced Mixed Waste Treatment (AMWTP) Facility, Idaho National Engineering and Environmental Laboratory (INL), August 16 – August 20, 2004*).

The scope of the inspection detailed in this report included a reevaluation of the two Z-211 NDA systems for S5000 debris, as well as the initial evaluation of the two Z-390 systems for debris only. BNFL has stated that the Z-390 systems will not be used to assay solids at this time. One of the Z-211 systems, Z-211-103, was not operational at the time of this inspection due to a broken germanium detector, and the EPA Inspection Team was not able to evaluate this system's performance of replicate analyses since equipment was being repaired. However, AMWTP personnel provided replicate data at a later date and these data were subsequently evaluated. The evaluation of the procedures, records, and other documentation conducted during this inspection did include Z-211-103, but its operational status at the time prevented the EPA Inspection Team from making a definitive determination regarding its acceptability for use with S5000 debris. Upon obtaining the replicate data, EPA technical personnel were able to evaluate all aspects of this system.

As part of this inspection, EPA reviewed the following elements of the NDA process:

- Capability of the measurement hardware and software to perform the required analyses, including the systems' sensitivity and uncertainty
- Technical adequacy of the assay program's documents and procedures
- Knowledge and understanding of the personnel involved in the NDA program

The checklist presented in Attachment A.2 identifies the objective evidence that was examined for both the two Z-390 IWASs, as well as the two Z-211 IWASs. The following documents were among those examined to assess whether NDA is being adequately performed:

- MP-TRUW-8.1, Certification Plan for INL Contact-Handled Transuranic Waste, Revision 5, August 18, 2004
- BNFL 5232-INST-OI-14, Drum Assay Operations, Revision 14, November 22, 2004
- BNFL-5232-INST-OI-11, Drum Assay Operations, Revision 19, FC-1, August 17, 2004
- MP-TRUW-8.8, Level I Data Validation, Revision 11, January 13, 2005

- MP-TRUW-8.16, WWIS Data Transfer, Revision 10, July 13, 2004
- MP-8.1.1, Drum Assay Post-Maintenance Calibration & Verification, Revision 6, November 22, 2004
- Retrieval 1 (Z-211-102), Calibration Reports, Lifetime Quality Records, Volume #1 of 1, AMWTP Drum Assay Systems, BNFL PO# 5232-00-001, Canberra # 69785
- Retrieval 2 (Z-211-103), Calibration Reports, Lifetime Quality Records, Volume #1 of 1, AMWTP Drum Assay Systems, BNFL PO# 5232-00-001, Canberra # 69785
- BNFL-5232-RPT-TRUW-03, Drum Assay Technical Review Report, Revision 4, July 8, 2004
- BNFL-5232-RPT-TRUW-06, Determination of Radioisotopic Content in TRU Waste Based on Acceptable Knowledge, Revision 1, November 20, 2003
- BNFL-5232-RPT-TRUW-07, Determination of Radioisotopic Content in TRU Waste Based on Acceptable Knowledge, Revision 4, February 2004
- CI-IDA-NDA-0035, Calibration Verification & Confirmation Procedure for the Integrated Waste Assay System (IWAS) at AMWTP, Revision 3, May 29, 2003
- CI-IDA-NDA-0053, Site Acceptance Test Report (SATR) for the Integrated Waste Assay System (IWAS) at AMWTP, System Z-390-100, Revision 4, March 29, 2003
- CI-IDA-NDA-0052, Site Acceptance Test Report (SATR) for the Integrated Waste Assay System (IWAS) at AMWTP, System Z-390-101, Revision 3, March 29, 2003
- CI-IDA-NDA-0055, Total Measurement Uncertainty for the AMWTP Integrated Waste Assay Systems, Revision 1, July 30, 2003

During this inspection, EPA assessed several technical elements of INL's NDA process (see Attachment A.2), as discussed below.

(1) The design and operational history of the Z-390-100 and Z-390-101 Integrated Waste Assay Systems (IWASs) were assessed.

The Z-390-100 and Z-390-101 systems are identically designed NDA systems that combine passive-active neutron assay techniques with gamma spectrometry in a single system. These systems are designed to quantify the radiological components of TRU waste in 55-gallon drums and 55-gallon/83-gallon over-packs, with a variety of waste matrices, including, but not limited to, combustibles, glass, organic and inorganic sludge, and metals. Because of the multi-modal system design and the ability to correct for matrix effects on both the gamma and neutron measurement elements independently, the system is essentially matrix-independent within the range of demonstrated applicability for each measurement technique.

In the passive neutron mode, each IWAS uses over 100 ^{3}He proportional counters, arranged in a 4Π geometry to detect the neutrons emitted when ^{240}Pu or some other radionuclide spontaneously fissions. The IWAS estimates the quantity of ^{240}Pu (referred

to as the ^{240}Pu effective, Pu-240$_{EFF}$) based on the measured neutron flux. The quantity of individual radionuclides can be estimated by combining the measured Pu-240$_{EFF}$ with ratios of the quantities of other individual radionuclides measured using two broad-energy germanium (BEGe) detectors described in more detail below. An Add-A-Source (AAS) matrix-correction technique is used to estimate and correct for the effect of the waste matrix on the neutrons emitted from within the matrix. During the AAS measurement, a ^{252}Cf source is introduced into the drum measurement chamber. The response of the system to the ^{252}Cf source with the waste matrix present is compared with the recorded response of the system to the same source when no waste matrix is present, and a correction factor is derived from that ratio.

In the active neutron mode, a pulsed source of 14 MeV neutrons is thermalized by the high-density polyethylene walls of the drum measurement chamber, and potentially the waste matrix itself, and used to induce fission in ^{239}Pu and other fissile and fissionable nuclides. The IWAS detects the fission-induced neutrons in one of four Fast Neutron Detector Packs (FNDP) located in each of the four drum measurement chamber walls. Each FNDP consists of several ^{3}He proportional counters surrounded by high-density polyethylene and wrapped in a thin layer of cadmium. Using a differential die-away analysis, the quantity of ^{239}Pu that would result in the observed signal is estimated. This quantity is referred to as the ^{239}Pu effective or Pu-239$_{EFF}$. In a manner very similar to that for the passive neutron mode, the quantity of other individual radionuclides can be estimated by combining the measured Pu-239$_{EFF}$ with radionuclide ratios (isotopics) measured on the BEGe detectors.

In the gamma-ray assay mode, the two BEGe detectors located in one of the walls of the chamber are used to not only estimate the radionuclide ratios, but also to determine the absolute quantity of one or more of the gamma-emitting radionuclides present. The two detectors are withdrawn from the chamber in the event that the system is being operated in active neutron mode to minimize damage to the germanium crystals from neutron irradiation. When not in active-neutron mode, the detectors are reinserted into the drum measurement chamber. Spectra from the BEGe detectors are analyzed using Canberra's NDA-2000 software package and Multi-Group Analysis (MGA), which estimates the ratio of radionuclides based on the relative height of specific measured gamma energy peaks. When MGA fails to provide a valid result, the NDA-2000 software uses either a default set of isotopic ratios based on previous assays of waste drums containing primarily weapons grade plutonium if ^{239}Pu is detected as the dominant plutonium isotope, or an isotopic mix consistent with heat source material if ^{238}Pu is detected as the dominant plutonium isotope. In some cases, no TRU isotopes are detected in the waste, though there may be significant quantities of depleted Uranium (DU). The addition of Multi-Group Analysis – Uranium (MGA-U), a software package that is used to analyze predominantly Uranium wastes, has helped to address these drums. Of course, these wastes are currently not eligible for shipment to WIPP due to their lack of measurable TRU radionuclides. The decision to use measured isotopic ratios or a set of default isotopic ratios is an automated function of the NDA software system. There are no operator inputs or selections, and the NDA system does not use information directly from AK or the Waste Tracking System (WTS) in making this determination.

Data on completed assays for all four (4) IWASs were compiled. The two 390 IWASs went operational in August 2004, and the values presented represent the period from August 2004 until February 28, 2005. For the 390-100 system, 122 waste containers have been assayed and these have been compiled into 6 Radioassay Batch Data Reports (BDRs), 3 of which have gone through Project Level Review onsite. The 390-100 system had completed assays for 57 drums and these data had been compiled into 14 BDRs, 2 of which have gone through Project Level Review. For the two Z-211 systems, the operational time period is from May 2003 until February 28, 2005. For the Z-211-102 system, 6,534 waste containers have been assayed since May 2003, and these have been complied into 509 BDRs, 452 of which have been through Project Level Review. Assay cycles have been completed for a total on both units of 8,572. These numbers of assays translate into 541 and 504 batch data reports generated for the Z-211-102 and Z-211-103, respectively. Of these BDRs, 330 and 347, respectively, have been through the entire review process, including Project Level Validation and Verification.

(2) System calibrations for the Z-390-100 and Z-390-101 IWASs have been performed as required.

Both the Z-390-100 and Z-390-101 IWASs were calibrated by Canberra Industries prior to their shipment to the AMWTP. The calibration of each system was verified and documented in the site acceptance reports CI-IDA-NDA-0053 and CI-IDA-NDA-0054 for Z-390-100 and Z-390-101, respectively.

The calibration is appropriate for a variety of waste matrices, including glass, sludge, metals, and combustibles. The applicable waste matrices include the following waste matrix codes: sludge waste codes 001, 002, 003, and 004; and debris waste codes 320, 330, 336, 339, 371, 374, 393, 432, 440, 441, 442, 480, and 481. The active and passive calibrations are valid for neutron absorption correction factors between 1.0 and 2.7, and for neutron moderation correction factors between 1.0 and 3.0. The system does have an upper limit on the ^{240}Pu mass of 12g, which correlates to ~200g WGPu. Because of an administrative control limit placed on the overall matrix correction factor, it must be less than 6.0. The gamma calibration is applicable for low Z materials ($Z < 15$) with densities as high as about 1.6 g/cm3. The gamma system uses a matrix correction factor that is generated by using a multi-energy matrix correction factor curve. To determine whether a drum falls within the appropriate measurement range to use the gamma measurement technique, the system weighs the drum and generates a bulk density based upon the assumption that the drum is 100% full. The BEGe detectors are calibrated for gamma-ray energies between 59 and 1,408 keV.

The operating range of the instruments is defined as 0.010 to 200 g of weapons-grade plutonium (WGPu), although it is not a mass calibration in the strict sense. In theory, there is no mass limit, provided that the photon energy is between 59 and 1,480 keV and all operational parameters are met. The mode, i.e., gamma, passive, or active neutron, that is reported for each assay event is selected automatically by the software based on the results that have the smallest measurement uncertainty. Conceptually, the active

neutron mode is typically selected for lower plutonium mass loadings between 0.010 and 0.250 g WGPu, while the passive neutron measurement is used for higher plutonium mass loadings between 0.100 and 200 g WGPu. However, the active neutron mode is seldom used. Initially, the system was configured to perform the active neutron assay first, but operational experience has shown that this mode was rarely used as the assay of record. BNFL personnel (M. Clapham) stated that out of the approximately 7,000 assay events to date, the active mode results were used as the assay of record no more than 40 times. Considering the maintenance-intensive nature of the active neutron mode and the fact that, according to M. Clapham, the passive gamma mode provides data of equal or greater value, the active neutron mode has been disabled through the initiation of a software change. It can still be used, although it no longer fires for each assay event automatically as the first part of the assay sequence. To use this mode, the operator must initiate it deliberately, which would typically happen if the passive neutron and gamma data indicated the need for this assay mode. The gamma-ray mode is most likely to be chosen to assay waste matrices with low Z materials or drums with small quantities of fissile material.

(3) The total measurement uncertainty (TMU) of assays performed on the Z-390-100 and Z-390-101 IWASs has been determined and documented.

The determination of TMU for the Z-390-100 and Z-390-101 is documented in CI-IDA-NDA-0055, *Total Measurement Uncertainty for the AMWTP Integrated Waste Assay Systems*, Revision 1, dated July 30, 2003. This document addresses TMU for all four (4) of the IWASs, Z-390-100 & 101, and Z-211-102 & 103, and was evaluated in detail during the previous EPA Inspection in August 2004. It has not been changed or modified in any way since that time. The evaluation of TMU addresses all major components of TMU. Uncertainties for the passive neutron mode included uncertainties due to calibration, counting statistics, matrix/source distribution effects, and elevated backgrounds due to high Z matrices. For the active neutron mode, uncertainties due to calibration, counting statistics, matrix/source distribution effects, neutron multiplication, and self-shielding were also included. Uncertainties for the gamma-ray mode included those due to calibration, counting statistics, self-absorption, matrix heterogeneity, and source heterogeneity. Uncertainties due to the measurement of isotopic or radionuclide ratios were also included.

CBFO identified one Condition Adverse to Quality for which CBFO CAR-05-019 was issued. Specifically, the condition was the fact that the net weight of a container is not included in the calculation of uncertainty. This may seem minor, but in those cases where the waste matrix itself is very light, this produces an incorrect and technically unjustifiable estimate of uncertainty.

(4) The lower limit of detection (LLD), including the minimum detectable concentration (MDC) of the Z-390-100 and Z-390-101 IWASs, has been determined and documented.

The LLD, defined as that level of radioactivity that, if present, yields a measured value greater than the critical level with a 95% probability, where the critical level is defined as

that value which measurements of the background will exceed with 5% probability. The LLD is a strong function of both the background and the efficiency of the system. The NDA-2000 software calculates the LLD and the MDC for each assay based on the background and efficiency associated with that particular measurement.

Nominal LLDs and MDCs were determined for a variety of matrices for the active neutron, passive neutron, and gamma modes by assaying surrogate drums of those matrices with no radioactive sources present. Matrices used for the active and passive neutron modes included combustibles, metals, glass, and inorganic and organic sludge. For the gamma mode, the LLD and MDC were estimated for four matrices, varying in density from 0.0284 to 1.58 g/cm^3. The nominal values were reported in the site acceptance reports CI-IDA-NDA-0053 and CI-IDA-NDA-0054 for Z-390-100 and Z-390-101, respectively.

It was observed that AMWTP had been reporting results for containers where the concentrations of all TRU radionuclides were less than or equal to the LLD. This required the generation of an AMWTP Non Conformance Report (NCR) according to an AMWTP procedure (MP-TRUW-8.8), which apparently had not been done. Additionally, these containers were destined for WIPP in 100-gallon puck overpacks, based on AMWTP's assumption that this process was considered making newly generated waste and was not Load Management. CBFO determined, with EPA concurrence, that this process was in fact Load Management, and therefore was subject to the requirements of DOE-WIPP-02-3122, Appendix E. According to CBFO, the AMWTP process was clearly in violation and CBFO issued CAR 05-019 to address this.

(5) Several NDA batch data reports (BDR) and Radioassay Data Sheets (RDSs) of assay results generated by the Z-211 and Z-309 systems were reviewed.

The data sheets were generally found to contain all of the necessary information in radionuclide content, measurement uncertainty, total TRU alpha activity, and other calculated quantities, as well as proper identification of measurement machine, measurement technique, and the use of measured isotopic ratios or the selection of default isotopic ratios. Three of the BDRs were found to contain narratives with the incorrect procedural references, i.e., they incorrectly referenced INST-OI-14, rather than correctly referencing INST-FOI-01. CBFO issued CAR 05-015 in response.

(6) EPA replicate testing of the Z-390-100 and Z-390-101, and Z-211-102 and Z-390-103 was performed and evaluated.

The purpose of the replicate testing performed as part of this inspection is to provide EPA with an independent means to verify that the IWASs can provide consistent, reproducible results for the determination of the quantity of 10 WIPP-tracked radionuclides (^{241}Am, ^{137}Cs, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{90}Sr, ^{233}U, ^{234}U, and ^{238}U) and the TRU alpha concentration. This is accomplished by reassaying drums previously characterized on the same system in order to demonstrate the following:

- The system produces results consistent with the reported total measurement uncertainty (TMU) by comparing the sample standard deviation for a number of replicate measurements taken over several hours or days to the reported TMU
- The system provides reproducible results over longer periods of time, such as weeks or months, by comparing the results of the replicate measurement(s) to the original reported values

As part of this inspection, EPA requested that INL reassay previously assayed drums. The drums chosen for each assay system were selected from a list provided by INL. The drums included containers 1000659 and 10004600 assayed on Z-211-102; containers 10033835 and 10034784 assayed on Z-390-100; and, containers 10028237 and 10033618 assayed on Z-390-101. Each of the drums was reassayed five (5) times and the results compared with the original assay values. As stated previously, replicate assays were not performed on the Z-211-103 system due to its non-operational status at the time of the inspection. However, following completion of system repairs, replicate assays were performed on the Z-211-103 system for containers 10000393 and 10004052. These results were provided to EPA at a later date and are included in this evaluation.

The replicate analyses occurred during and directly following the inspection, although the EPA Inspection Team did not observe the assay events directly due to logistical considerations. Assay operations were conducted in accordance with Revision 14 of INST-OI-14 and Revision 6 of INST-FOI-01 for the Z-211 and Z-390 systems, respectively. As specified by EPA protocol, the replicate test drums must be fed through the system manually and, in actuality, in reverse order than normal assay drums. This change is necessary to accommodate several of the automated features of the AMWTP, such as bar code readers and a data management system that will take the most recent assay of a drum and replace the previous measurement (in the case of EPA replicates resulting in the deletion of the data behind the Project Level V&V and the data collected from any of the previous replicates as well).

Two statistical tests, a *Chi Squared ($\chi 2$) Test* and a *t Test* were performed for each container measured on Z-211-102, Z-211-103, Z-390-100 and Z-390-101. Data and results of the statistical analysis are included in Attachments B.1-B.16.

Z-211-102 System

The two (2) containers assayed on Z-211-102 were 10000659 and 10004600. The *($\chi 2$) Test* for containers 10000659 and 10004600 showed that the observed variances in the replicate measurements were less than or equal to the reported uncertainties. The *t Test* for 10004600 showed no statistical differences between the observed variances in the replicate measurements, the original assay values, and the average of the five replicate assays. However for container 10000659, the *t Test* indicated *highly significant* differences between the original assay values and the average of the five replicate assays for the four plutonium isotopes and ^{241}Am. The five replicates are grouped tightly (RSD of 0.6% for ^{239}Pu), but are far enough away from the original measurement to cause a *t Test* failure at the criterion of a 0.01 level of significance, as defined in *EPA Replicate Testing for WIPP Nondestructive Assay (NDA) Systems, Rev. 2, June 2002.* The exact reason for this is unclear. It appears to indicate that assay results likely exhibit greater variation over long periods than short periods, which, due to the expected fluctuations in

environmental background, is not entirely unexpected. Whether it indicates an actual measurement problem is questionable, since the magnitude of the difference between the original and replicates in curies (6.89 versus 5.52) is not great in absolute terms. Since all results are linked to the ^{239}Pu value, this difference occurs in all plutonium isotopes, ^{241}Am, and TRU Alpha Activity, since these six (6) radionuclides comprise 100% of the container's TRU activity. Additionally, the conditions encountered for this container approach one of the limiting conditions of the replicate testing protocol, i.e., the precision of the replicates is very good and causes the numerical criterion to be violated. Post-measurement discussions with site NDA personnel do not indicate any measurement-related problem that bears further investigation at this time.

Z-211-103 System

The two (2) containers assayed on Z-211-103 were 10000393 and 10004052. The *(χ2) Test* for containers 10000659 and 10004600 showed that the observed variances in the replicate measurements were less than or equal to the reported uncertainties. The *t Test* for 10004600 showed no statistical differences between the observed variances in the replicate measurements, the original assay values, and the average of the five replicate assays.

Z-390-100 System

The two (2) containers assayed on Z-390-100 were 10033835 and 10034784. For container 10033835, the *(χ2) Test* indicates a highly significant difference with respect to ^{238}Pu. This may have been caused by the manner in which this value was derived, i.e., the measured ^{239}Pu value was used to generate a ^{238}Pu value by the application of isotopics from MGA. This amplifies the uncertainty due to combining the empirical (^{239}Pu) and MGA uncertainties, and the ^{238}Pu RSD for the five replicates is 48%. Additionally, four (4) of the six (6) assays are passive neutron measurements and the remaining two (2) are gamma results; this results in a greater variability than would be expected for results from a single modality.

For container 10033835, the *(χ2) Test* showed that the observed variances in the replicate measurements were less than or equal to the reported uncertainties. The *t Test* for 10033835 showed no statistical differences between the observed variances in the replicate measurements, the original assay values, and the average of the five replicate assays. However for container 10034784, the *t Test* indicated *highly significant* differences between the original assay values and the average of the five replicate assays for the five plutonium isotopes. As discussed above, all results are linked to the ^{239}Pu value, so this difference occurs in all plutonium isotopes and will be reflected in the TRU Alpha Activity, since these five (5) radionuclides comprise one hundred percent of the container's TRU activity. As discussed above, it is unclear if this indicates an actual measurement problem, since the magnitude of the difference between the original and replicates in curies (1.78 E-03 versus 1.53 E-03) is not great in absolute terms, and the conditions encountered for this container approach one of the limiting conditions of the replicate testing protocol, i.e., the precision of the replicates is very good and causes the numerical criterion to be violated. Post-measurement discussions with site NDA personnel do not indicate any measurement-related problem that bears further investigation at this time.

Z-390-101 System
The two (2) containers assayed on Z-390-101 were 10033618 and 10028237. The *(χ2) Test* for both containers showed that the observed variances in the replicate measurements were less than or equal to the reported uncertainties. The *t Test* for both containers showed no statistical differences between the observed variances in the replicate measurements, the original assay values, and the average of the five replicate assays.

Findings

The EPA inspection team did not identify any NDA findings.

Concerns

The EPA inspection team did not identify any NDA concerns.

7.3 Real-Time Radiography (RTR)

As part of the inspection of the RTR activities, the team reviewed the elements of the RTR process listed below. Emphasis was placed on overall procedural technical adequacy and implementation, and identification of waste material parameters and prohibited items:

- Documentation of RTR activities through use of an approved procedure
- Proper execution of RTR activities
- Management oversight and independent review of RTR activities
- Statistical verification of RTR activities through VE (see Section 7.4)
- Training of RTR personnel

The RTR facility uses radiography to help determine the following aspects of TRU waste characterization:

- Types and amounts of waste material parameters (WMP)
- Presence or absence of prohibited items
- Testing for new operators on the RTR system using specifically placed items

The procedure revision, provided to the inspection team prior to the inspection, was Revision 20. However the current RTR procedure revision used by the site is Revision 21. The minor differences between these two revisions did not negatively impact the inspection process. The following documents were among those examined to assess whether all RTR operations follow the appropriate approved procedures:

- INST-OI-12, Revision 20, *Real-Time Radiography Operations,* January 20, 2005
- RTR Analysis Reports for containers numbers 10005612, 10006165, 10021323, 10016184, 10016182, and 10002936
- RTR Batch Data Report, RTR04-00335

- Image Quality Verification Form for RTR (Form 1578)
- RTR Status Log (Form 1374)
- Daily RTR Technical Safety Requirements Surveillance Checks (Form 1218)
- Container Location Report
- Training records for operators and RTR TS/QA

A complete listing of all objective evidence that was evaluated during the inspection is provided below.

- Procedure INST-OI-12, Revisions 20 & 21
- RTR Analysis Report for container 10005612
- RTR Analysis Report for container 10006165
- RTR Analysis Report for container 10021323
- RTR Analysis Report for container 10016184
- RTR Analysis Report for container 10016182
- RTR Analysis Report for container 10002936
- Batch Data Report RTR04-00335
- Container Location Report, Temperature Chart for Building 634, dated March 2, 2005
- Calibration report for temperature transmitter TT-232-063-B
- Calibration report for temperature transmitter TT-232-063-A
- Daily RTR Technical Safety Requirements Surveillance Checks (Form 1218), dated March 2, 3005
- Imaging Quality Indicator Verification Form for RTR, dated February 27, 2005
- Imaging Quality Indicator Verification Form for RTR, dated March 1, 2005
- Imaging Quality Indicator Verification Form for RTR, dated March 2, 2005
- RTR Status Log, dated February 27, 2005
- RTR Status Log, dated February 28, 2005
- RTR Status Log, dated March 1, 2005
- RTR Status Log, dated March 2, 2005j
- AMWTP training Roster, dated August 4, 2004

During the inspection, the following elements of the RTR process were investigated (see Attachment A.3):

(1) Overall procedural technical adequacy and implementation.

The RTR procedure, documented in INST-OI-12, Revision 20, *Real-Time Radiography Operations*, contained specific information on performing non-intrusive radiography, including operational set-up and check-out, identification of prohibited items, assignment of waste material parameters and estimation of weights and volumes, confirmation of waste matrix codes, input of data, issuance of non-conformance reports, and technical review of radiography results.

The procedure requires that drums be preheated for 72 hours prior to RTR examination. This ensures that any liquids present are not frozen and will be detected during the RTR event.

(2) Characterization of WMPs and prohibited items.

Procedure INST-OI-12, Revision 20, required that radiography calibration be conducted at the beginning of every shift in which drums are subject to examination. Adherence to calibration requirements were confirmed through interviews with RTR operators, the RTR TS/QA (Vince Medina), observation of the RTR event for drum number BN10031697, and review of RTR video/audio tapes for drums BN10002936, BN10021668, and BN10004014.

At the beginning of a shift and prior to examining any waste containers, the operator runs a scan on the lines-pair resolution test gauge to determine that images are clearly visible. The procedure requires an image resolution of 16 lines per inch and the image test is documented on Form 1578, Imaging Quality Indicator Verification Form for RTR.

For each container undergoing examination, an audio/video recording of the RTR event is made. The first notations made on the audio/video recording by the operator are the drum number and the date and time on the audio/video recording before beginning the radiography process. The examination of the drum begins at the top drum lid, where the operator identifies the seal and vent. The drum is rotated through at least 360 degrees, so that all objects can be viewed from all sides. The operator has the ability to zoom both in and out and increase or decrease the scan energy in order to compensate for varying densities in the material examined. During examination, the operator also "rocks" the drum to determine the presence of free liquids. Procedure INST-OI-12 requires that drums be preheated before the RTR event to ensure that free liquids are not frozen.

The WTS system is used to electronically enter data. The WTS form requires entries ("Yes" or "No") for all prohibited items. Standardized weight tables for WMPs in the WTS system automatically calculate weights based on the number of each item entered by the operator. Additional items can be added, if necessary, and AK personnel are informed of any additions, so that the AK record can be updated. The IDC is verified and the number of layers of confinement documented.

As part of the inspection, EPA observed the examination of one (1) waste container—drum number BN10031697. EPA also reviewed videotapes of RTR examinations for containers BN10002936, BN10021668, and BN10004014.

For drums BN10002936 and BN10004014, the operator did not call out the items found in the drums. Drum BN10004014 contained a sealed metal pipe that appeared to be over 4 liters, which was not identified as such by the operator. The CTAC Auditor, with concurrence by the EPA Inspector, documented these RTR failures as DOE CAR 05-013.

(3) Documentation of radiography activities was examined.

Simultaneous audio descriptions and video recordings are made as the waste is examined. This was observed by EPA Inspectors during the examination of one (1) waste container and further verified by review of RTR videotapes for the above-referenced waste containers. The operator inputs the data into an electronic RTR waste container data form in the WTS system concurrently with the examination.

(4) Adequate documentation of radiography procedures was ascertained.

Radiography procedures are well defined and the documents are controlled. During the inspection, EPA reviewed the adequacy and implementation of all radiography-related procedures. Required QC examinations were performed as required. In batch RTR04-00335, the replicate scan was performed on container BN10022785 and an independent observation was performed on container BN10022802. NCRs are generated as needed. NCR number 4509 was initiated on container BN1006165 (incorrect IDC, operator training and AK resolution) and NCR number 7675 was initiated for container number 1005612 (prohibited item).

(5) Training of radiography personnel was adequate.

During the inspection, EPA reviewed documentation of the capability demonstration for all radiography personnel. The training drum for operator Richard Steffens was viewed during the inspection. The training records reviewed indicate that only trained personnel were operating the RTR equipment and verification of qualification for RTR operators is a checklist item for the ITR at data level generation data review. RTR operators are required to review the results of the RTR/VE comparison examinations, and they did receive "lessons learned" training. Training documentation was complete and filed correctly for viewing and reference. The documents reviewed include:

- Training records for RTR operators
- Training manual for RTR TS/QA
- Training roster for "RTR/VE Feedback," dated August 4, 2004

EPA also viewed the following RTR test drum videotape and verified that the operator identified all prohibited items.

- Test drum QAPjP001 for Richard Steffens

Findings

The EPA inspection team did not identify any findings in RTR. The issues identified by the CTAC Technical Specialist(s) will be tracked by monitoring the CBFO process for CAR closure.

Concerns

The EPA inspection team did not identify any concerns related to RTR.

7.4 Visual Examination (VE)

As part of the inspection of the VE activities, the team reviewed the elements of the VE process listed below. Emphasis was placed on overall procedural technical adequacy and implementation, and on identification of WMPs, IDCs, and prohibited items:

- Characterization of WMPs, IDCs, and prohibited items
- Documentation of VE activities
- Adequate documentation of VE procedures
- Training of VE personnel

The Waste VE facility uses manual examination to determine the following aspects of TRU Waste Characterization at the AMWTP facility:

- Confirmation of WMPs and IDCs
- Confirm presence or absence of prohibited items
- Removal of prohibited items from waste stream
- Confirmation of RTR analysis
- Training for new operators on the VE system using on-job training
- Generation of data for calculation of miscertification rates

The following documents were among those reviewed to assess whether VE operations follow the appropriate approved procedures and meet VE requirements:

- INST-OI-17, Revision 3, Facility Visual Examination Operations, December 20, 2004
- INST-OI-34, Revision 10, Visual Examination Operating Procedures and Data Reporting, January 12, 2005
- Employees by Qualifications/Certifications list
- Qualification Packages for VE operators
- Training Manual for VEE
- VE Batch Data Report VVE05-00201
- VE Batch Data Report VEB05-00081
- Special Case Waste/Drum Repack Station (Form 1565)

- Turnover Checklists for box line operations
- Memoranda, Establishment of Summary Category Miscertification Rate for S5000

In addition, the documents listed below were reviewed as objective evidence.

- Certification Plan for INL Contact-Handled Transuranic Wastes, MP-TRUW-8.1, Revision 7
- AMWTP QAPjP, MP-TRUW-8.2, Revision 3
- INST-OI-34, Revision 10, Visual Examination Operating Procedure and Data Reporting
- Facility Visual Examination Operations, INST-FOI-17, Revision 3
- Memo, Establishment of Summary Category Miscertification rate for S5000, Addendum, dated February 28, 2005
- Memo, Establishment of Summary Category Miscertification rate for S5000, dated August 12, 2004
- Memo, Establishment of Summary Category Miscertification rate for S3000, dated August 11, 2004
- Batch Report VVE05-00201
- Batch report VEB05-00081
- Training Manual for (TS/QA)(RTR, Coring, VE)(VEE), Vince Medina
- Qualification Package for Michael Loftus
- Qualification Package for Jason Bates
- Employees by Qualifications/Certifications list
- Special Case Waste/Drum Repack Station, Form 1565
- Turnover Checklist, dated February 28, 2005

During the inspection, the technical elements of AMWTP's VE process were evaluated (see Attachment A.4).

(1) Overall procedural technical adequacy and implementation, and identification of WMPs and IDCs were examined.

The VE system procedure, documented in INST-OI-17, Revision 3, *Facility Visual Examination Operations*, contains specific instructions for performing visual examinations, including operational set-up and check-out, identification of prohibited items, assignment of waste material parameters and estimation of weights and volumes, confirmation of waste matrix codes and IDCs, input of data, issuance of non-conformance reports, and technical review of visual examination results.

(2) Characterization of WMPs as required by 40 CFR 194.24 was assessed.

During the audit, the inspection team observed two (2) VE evolutions. The first evolution was on the box line, where waste is repackaged into drums after the VE event (source box 10027424). This type of examination is not required to be captured on video.

The second evolution was of a drum examined as a VE QC check for RTR (drum number 10002936). The VE procedure requires that at the beginning of every drum examination, video and audio checks be performed to ensure high-quality results. This was confirmed during an interview with VE operators and observation of equipment setup during the VE (QC for RTR) examination.

For each container undergoing examination, an audio/video recording of the event is made. The first notations made on the audio/video recording by the operator before beginning the visual examination are the drum number and the date and time. The VE examination of the drum begins with the removal of the drum lid. Liner presence and venting are verified and the liner is removed, if present. The Volume Utilization Percentage (VUP) of the drum is also estimated. The drum is emptied of interior liner bags and closure methods are recorded. All packages are opened to the lowest layer of confinement and sorted by Waste Material Parameter (WMP) category. The waste is weighed, after a scale check, and finally repacked into a new drum. Results of the VE are recorded electronically, and a DVD and VHS made from the recording. Data entries are made via the Waste Tracking System software, concurrently with the examination.

The video/audio tape for the above VE event was viewed as part of the RTR inspection. Although weights were recorded in the WTS and were announced on the audio portion of the tape, the scale readout could not be seen on the video portion of the tape. The DOE/CTAC auditor, with concurrence from the EPA Inspector, documented this failure as DOE CAR 05-010. AMWTP initiated a Batch NCR for this failure.

(3) Documentation of VE activities was examined.

Simultaneous audio descriptions and video recordings are made as the waste is examined. This was observed by the EPA Inspector during the examination of one waste container (drum number BN10002936), and further verified by review of the VE videotape for that container. Several operators worked with the drum in a glove box, extracting, identifying, and weighing the waste, and another operator controlled the video/audio recording and entering of data into the WTS system.

(4) Calculation of miscertification rates.

An initial miscertification rate of 11% was used for S5000 waste. The site-specific rate was established in August 2004 and documented in a memorandum, calculating the miscertification rate at 1%. This memorandum included all candidate drum numbers and the drums randomly selected for VE examination. Replacement drums were selected as needed from the original list of candidate drums. The process used to establish and

calculate site miscertification rates was compliant with the requirements contained in WIPP HWP, Attachment B.2.

(5) Documentation of VE procedures is adequate.

VE procedures were well defined and the documents are controlled. During the inspection, EPA reviewed the documentation and adequacy of the VE procedure and related documents. Operators consistently used the procedure as a working guide during the RTR operations.

(6) Training of VE personnel was evaluated.

Procedures MP-RTQP-14.1, MP-RTQP-14.6, MP-RTQP-14.19, and MP-RTQP-14.20 are associated with the training of VE personnel, and include all the requirements for qualifying personnel for VE responsibilities. The training records reviewed indicate that only trained personnel are performing VE, and verification of operator certification is a review item in the ITR data generation level review checklist. Training documentation was complete and filed correctly for viewing and reference. During the inspection, EPA reviewed training documentation for the Visual Examination Expert (VEE) and two (2) operators. The Employees by Qualifications/Certifications lists all personnel qualified for VE.

- Qualification Package, Visual Examination, for Michael Loftus
- Qualification Package, Visual Examination, for Jason Bottles
- Training Manual for VEE, qualified as TS/QA (RTR, Coring, VE) and VEE
- Employee by Qualifications/Certifications, FQPOT10A – Visual Examination

Findings

The EPA inspection team did not identify any findings related to VE. The issues identified by the CTAC Technical Specialist(s) will be tracked by monitoring the CBFO process for CAR closure.

Concerns

The EPA inspection team did not identify any concerns related to VE.

7.5 WIPP Waste Information System (WWIS)

Personnel entering data into WWIS can only do so after being granted access by the WWIS Administrator, and access to the required forms in the Waste Tracking System (WTS) system is access controlled. After the data has been through every level of review and approval, it is compiled into a drum file and entered into an approved spreadsheet (Form 1221, WWIS Characterization and Certification Data) in the WTS by the Waste Certification Assistant (WCA). The WCA then reviews the entered data and signs the form. Form 1384 (CH TRU Waste Certification Statement) is then automatically populated from the data entered into Form 1221. These data are reviewed to ensure that they are WIPP-compliant and accepted by the

WCA. Data are then converted into ASCII format and transmitted to WWIS. E-mail notification of WWIS status for each entry is received and maintained in the drum file. The information container in the drum file is subsequently used for transportation activities. For the purpose of demonstration, the inspection team observed data entry for drum number BN10010973.

The following documents were reviewed prior to or during the inspection to guide investigation and questions during the inspection:

- MP-TRUW-8.16, Revision 14, *WWIS Data Transfer,* December 29, 2004
- Management Assessment Report, *WWIS Data Entry (Final Review) for Container BN10010973*, dated February 21, 2005.

At the time of EPA's inspection, AMWTP had successfully certified over 1,300 drums into the WWIS.

The objective evidence reviewed during the inspection contained the following documents.

- MP-TRUW-8.16, Revision 14
- Memo, QA Review of Lot BNINW 216.15 for Data Reconciliation, dated February 15, 2005
- Training record for WCO, Christy Winterbottom
- Training record for WCA, Nikki Wartchow
- Completed Form 1221 for drum # BN10010973
- CH TRU Waste Certification Statement for drum # BN10010973
- Training Equivalency Verification Form for Darrin Hovis, WCO/TCO
- HGS report for drum # BN10010973
- NDA report for drum # BN10010973
- RTR report for drum # BN10010973
- Characterization Information Summary Report, dated February 14, 2005
- E-mail from WISS concerning container status (BN10000194) dated June 2, 2004
- E-mail from WISS concerning container status (BN10005832) dated December 21, 2004
- E-mail from WISS concerning container status (BN10002878), dated June 2, 2004
- Management Assessment Report for container BN10010973, dated February 21, 2005
- WIPPnet Remote Access Request Form
- Characterization Methods by Site, dated March 3, 2005

During the inspection, the technical elements of AMWTP's WWIS process were evaluated (see Attachment A.5).

(1) Overall procedural technical adequacy and implementation.

The WWIS procedure, documented in MP-TRUW-8.16, Revision 14, *WWIS Data Transfer,* contained complete instructions for entering, reviewing, and transmitting data, as well as issuance of non-conformance reports and technical review of data. There are adequate reviews incorporated into the WWIS entry procedure to minimize transmittal of non-compliant or incorrect data. Based on the review of the procedure and actual WWIS practices, the overall WWIS data entry process implemented by AMWTP was adequate. The required WWIS elements are presented in the WWIS Data Requirements listing on page WWIS-9.

(2) Documentation of WWIS activities was examined.

During the inspection, AMWTP personnel demonstrated WWIS data entry for drum number BN10010973. This demonstration conformed to the requirements in the governing procedure. Because the drum data used for demonstration had previously been submitted to WWIS for certification, the inspectors were not able to observe transfer of actual AMWTP characterization data.

Data storage and retrieval was demonstrated. AMWTP personnel were able to retrieve and print the certification data contained in the Waste Container Data Report for the demonstration drum (BN10010973). The file contained characterization data, completed WWIS Characterization and Certification data (Form 1221), and the CH TRU Waste Certification Statement (Form 1384).

(3) Adequate documentation of WWIS procedure was ascertained.

The WWIS procedure was well defined and was controlled. The forms used for data entry, Forms 1221 and 1384, were also adequate and were controlled.

(4) Training of WWIS personnel was evaluated.

Actual job performance was observed to verify training and qualifications of the WWIS personnel. Training and qualifications packages were reviewed for the WCA and WCO, who performed the data entry demonstration. Required training included use of the WIPP Waste Information System User's Manual, and the required reading list included the WIPP WAP and DOE/CBFO QAPD.

- Qualification Package for WCO
- Qualification Package for WCA

Findings

The EPA inspection team did not identify any findings related to WWIS.

Concerns

The EPA inspection team did not identify any concerns related to WWIS.

8.0 RESPONSE TO COMMENTS

EPA did not receive comments in Docket A-98-49 related to this inspection.

9.0 SUMMARY OF RESULTS

The EPA inspection team determined that the processes that were inspected were capable of characterizing TRU debris waste in accordance with 40 CFR 194.24(c)(4) as follows:

(1) The AK process was technically adequate.

(2) The NDA systems were technically adequate to characterize S5000 debris wastes.

(3) The WWIS process was satisfactory.

(4) The VE systems were technically adequate.

(5) The NDE system was technically adequate.

EPA's inspection team identified three (3) findings and seven (7) concerns as a result of its inspection; all findings require a response; the concerns do not require a response.

9.1 Findings

The EPA inspection team identified three (3) AK findings during the inspection. However, as noted below, all of the findings were resolved either by subsequent CAR resolution or through post-inspection modification of documents, so no further response to any of these findings is required.

AK Finding No. 1. The document BNFL-5232-RPT-TRUW-30, *Acceptable Knowledge Summary for Super-compacted Debris Waste* (TRUW-30), that was reviewed during the inspection lacked necessary details to enable it to function as a "stand-alone" AK Summary. This is required to ensure that the AK basis for the waste characterization system of controls is adequately maintained. Listed below are the document deficiencies that were identified during the inspection:

(1) TRUW-30 must be of sufficient detail to convey the radiological content, including isotopic distributions, radionuclide contribution by at least feed site, and identification of the two most prevalent isotopes, as well as other relevant radiological information presented in Appendix A of the CH WAC.

(2) TRUW-30 should include, not just reference, all mandatory information, including very brief feed-specific process summary discussions (by feed site). Physical parameters with respect to the expected waste material parameters (in whole or by feed) should be included.

(3) TRUW-30 must also include a more thorough discussion of the site-generated debris waste, including anticipated volumes, waste material parameters, etc. If the AK data cannot explicitly rule out the presence of prohibited items, state this.

(4) Inclusion of waste generation dates, addition of TWBIR references, correction of inaccurate references, and revision of Figure 2 to include RTR/NDA is required.

(5) The entire document should be revisited to ensure that all of the data presented therein is adequately referenced.

CAR 05-011 resolution information was provided to EPA subsequent to the inspection and was reviewed by EPA AK personnel. Upon review, it was determined that items 1 and 4, and most of Item 2 were addressed through CAR resolution. Remaining items 3 and 5 were re-evaluated by EPA and are now considered to be a concern rather than a finding (see AK Concern No. 6, below).

AK Finding No. 2. MP-TRUW-8.13, Revision 10, *Idaho National Engineering and Environmental Laboratory, Advanced Mixed Waste Treatment Project, Collection, Review, Confirmation and Management of Acceptable Knowledge Documentation*, still does not require collection of AK data for materials important to performance assessment, including ferrous metals, cellulosics, plastic, rubber (CPR), and nonferrous metals. Similarly, the procedure did not explicitly call for identification of unexpected radionuclides, although this information is typically included in supporting AK documents. Subsequent to the inspection, the site revised Procedure 8.13 (now Rev. 11) to include this information, and the finding has therefore been adequately resolved.

AK Finding No. 3. Waste Stream BN510 is to be composed of several individual waste streams generated at different sites. During the inspection, EPA determined that the site does not correctly implement the requirements of Appendix E of CH WAC, because the site did not consider the supercompaction activity performed to be Load Management. However, EPA determined, and DOE concurred, that Load Management is being implemented, and therefore waste-tracking systems must ensure compliance with requirements set forth in Appendix E of the CH WAC. Revision of site controls to recognize this compliance issue was required. Subsequent to the inspection and in response to DOE CAR No. 05-018, the site performed CAR resolution activities and revisions that adequately address EPA's concerns, so the finding has therefore been adequately resolved.

Concerns

The EPA inspection team identified seven (7) AK concerns, one of which was addressed adequately by the submission of additional information post-inspection. The other six (6) concerns do not require a response at this time. However, EPA will verify the site's response to these remaining concerns at the subsequent inspection. Also, reconsideration of an EPA finding

identified during the inspection based on post-inspection information has resulted in the removal of a finding and addition of a concern. EPA will evaluate the AK Summary with respect to these concerns during subsequent inspections.

AK Concern No. 1. Currently, few AK data are available for Bettis wastes. The site recognized this deficiency and issued an NCR addressing the problem (NCR #12613). EPA agrees that this action was appropriate, and that Bettis waste must not be included in the BN510 waste stream until adequate AK has been assembled.

AK Concern No. 2. INL has repeatedly had issues with respect to sharing data between the AK and NDA groups. This communication is important to ensure appropriate use of AK data. Therefore, implementation of a system similar to that currently in place in the CCP program (i.e., see Section 4.4.17 of procedure CCP-TP-005, Revision 13, or latest version) would appear in order to ensure full communication and agreement regarding the use of AK-derived radionuclide information.

AK Concern No. 3. RFETS box waste was not included in the related AK documentation available during this inspection. During the inspection, EPA personnel made the point that this information should be included in relevant documents to ensure complete understanding of waste feed stream composition being included in the supercompaction process. To accomplish this, the AK documents require revision to include data from the RFETS box waste. Subsequent to the inspection, additional information was provided which demonstrated that the appropriate AK documents had been revised to include the RFETS box data. Upon examination of the newly provided information, EPA considers this concern to be closed. No response to this concern is required.

AK Concern No. 4. An AK Accuracy memorandum (Memorandum from Sheila Hailey to Eric Schweinsberg, AK Accuracy Assessment, SH-007-2004, dated August 16, 2004) was prepared to document this comparison, but the comparisons therein are confusing. For example, Table 2 of the AK Accuracy Memorandum includes a field entitled "Number of Containers Flagged with 'Y,'" but it is unclear what events or observations would precipitate a "Y" designation. Criteria for "Y" designations should be provided, because it appears to control the accuracy calculations, and the memo thus implies relatively low AK accuracy values with respect to radionuclides (86% for first/second stage sludges, and only 61% for 374 sludges). The origin of this "Y" value must be elicited, so that the apparent 86% and 61% accuracy values can be put into context.

AK Concern No. 5. The AKE indicated that certain assumptions were made when assigning the isotopic distributions presented in BNFL-5232-RPT-TRUW-07, *Determination of Radioisotopic Content in TRU Waste Based on Acceptable Knowledge*, but these assumptions and analysis must be presented in summary within TRUW-07, and must be supported by memos to file or other documents in the AK Record.

AK Concern No. 6. The document BNFL-5232-RPT-TRUW-30, *Acceptable Knowledge Summary for Super-compacted Debris Waste* (TRUW-30), should serve as a stand-alone summary, and therefore should be revised as follows:

- TRUW-30 should include, not just reference, all mandatory information, including very brief feed-specific process summary discussions (by feed site).
- TRUW-30 must also include a more thorough discussion of the site-generated debris waste, including anticipated volumes, waste material parameters, etc. If the AK data cannot explicitly rule out the presence of prohibited items, state this.
- The entire document should be revisited to ensure that all of the data presented therein is adequately referenced.

AK Concern No. 7. A large body of supporting AK information for retrievably-stored debris waste was examined during the inspection because these are also feed material to the newly generated debris (super-compacted) waste stream, even though no WSPFs with attached AK Summaries for retrievably-stored debris wastes had been prepared. Because of the time-critical nature related to initiation of AMWTP waste shipment, and because a large body of AK information was examined for retrievably-stored debris waste, EPA shall approve shipment of retrievably-stored debris waste in this instance. However, it is expected that the complete scope of all audits and inspections will be adequately defined in the future, and that completed WSPFs, AK Summaries, and other documents required for shipment of CH retrievably-stored debris waste will be ready for EPA review at the next inspection.

9.2 Conclusions

EPA's independent inspection of personnel, procedures, and equipment at AMWTP has led EPA to conclude that the INL AMWTP waste characterization program meets the technical requirements of §194.24(c) regarding the characterization systems and processes at AMWTP as listed below:

Acceptable Knowledge (AK) — EPA concluded that the elements of the AMWTP AK waste characterization processes that the inspection team examined, as identified in Attachment A.1, are technically adequate. However, open issues remain from a previous EPA inspection regarding S3000 solid wastes.

Non Destructive Assay (NDA) — EPA concluded that the elements of the AMWTP NDA program examined during the inspection were technically adequate with respect to the identification of required radionuclides, instrument calibration and detection limit, personnel training, and Total Measurement Uncertainty for the instruments and matrices as listed in the table below.

Real-Time Radiography (RTR) — EPA concluded that the elements of the AMWTP RTR program examined during the inspection were technically adequate with respect to the assignment of Waste Material Parameters.

Visual Examination (VE) — EPA concluded that the elements of the AMWTP VE program examined during the inspection were technically adequate with respect to the assignment of Waste Material Parameters.

WIPP Waste Information System (WWIS) — EPA concluded that the elements of the AMWTP WWIS data transfer program that were examined during the inspection were adequate.

The EPA inspection team determined that the AMWTP's waste characterization processes of AK, NDA, RTR, VE, and WWIS that were evaluated during this inspection can adequately characterize CH retrievably-stored and newly generated transuranic debris waste (S5000) in accordance with 40 CFR 194.24(c)(4), and that AMWTP continues to be able to characterize retrievably-stored S3000 solid wastes consistent with the EPA approval previously granted. The approval of waste characterization elements that resulted from this inspection are summarized in the table below in conjunction with those approvals EPA previously granted AWMTP.

Summary of EPA Approvals

Waste Characterization Element	Retrievably-stored solid S-3000 Waste	Retrievably-stored debris S-5000 Waste	Newly Generated debris S-5000 Waste*
Acceptable Knowledge	Approved – February 2004	Approved**– May 2005	Approved – May 2005
Non Destructive Assay	Approved – February 2004 – Z-211-102 (IWAS) – Z-211-103 (IWAS)	Approved – May 2005 – Z-211-102 (IWAS) – Z-211-103 (IWAS) – Z-390-100 (IWAS) – Z-390-101 (IWAS)	Approved – May 2005 – Z-211-102 (IWAS) – Z-211-103 (IWAS) – Z-390-100 (IWAS) – Z-390-101 (IWAS)
Non Destructive Examination	Approved – February 2004 - Visual Examination - Real Time Radiography	Approved – May 2005 - Visual Examination - Real Time Radiography	Approved – May 2005 - Visual Examination - Real Time Radiography
WIPP Waste Information System	Approved – February 2004	Approved – May 2005	Approved – May 2005
Load Management	Not approved	Approved – May 2005	Approved – May 2005

* - This approval also applies to the supercompacted debris waste
** - Does not include TRU Bettis debris waste.

Attachments A.1 through A.5

Attachment A.1: Acceptable Knowledge (AK) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/Comment
Procedures require staff to be: • Familiar with applicable technical procedures • Familiar with QAOs • Qualified to assemble, compile, and confirm AK data	MP-TRUW-8.13, Rev. 10	Employee's explanation of job duties was consistent with applicable procedures Employee could identify the mandatory AK items for assembly Employee's identification of applicable procedures was correct Employee adequately explained how to assemble, compile, and confirm data Employees responsible for AK documentation were trained and qualified in accordance with applicable procedures	Y	Examined training records for Betty Tolmen, Vivian Sendelweck, and Steve Carpenter. All appeared to have appropriate training. All three attended the audit, including Ms. Joan Connelly, and all appeared to understand their roles and responsibilities, as well as the requirements for performing Acceptable Knowledge data assembly acquisition, compilation, examination, and reconciliation.
Procedures demonstrate a logical progression from general facility information to more detailed waste stream-specific information	MP-TRUW-8.13, Rev. 10, MP-TRUW-8.11 Rev. 9	This logical sequence can be demonstrated through traceability analysis. (Traceability analysis and linkages may include but need not be limited to individual container data for radionuclides and waste material parameters, IDCs, and waste streams.) AK documentation is traceable to the drum level	Y, in part	Performed traceability analysis for drums 10026898, 100334193, 100334212, 10034192, 10026899. Examined related batch data reports, draft WSPF for BN510, and several reports and references, including, but not limited to, BNFL-5232-RPT-TRUW-03, Rev 4; BNFL-5232-RPT-TRUW-04; BNFL-5232-RPT-TRUW-06; BNFL-5232-RPT-TRUW-07; BNFL-5232-RPT-TRUW-12 Rev. 2a; BNFL-5232-RPT-TRUW-13; BNFL-5232-RPT-TRUW-30 Revs. 0A and 0B, INEL-96/0280, Rev. 03., U127A. Documentation is traceable to the drum level. Traceability was hindered by the site's inability to develop a complete drum list with respect to 100-gallon payload containers that have undergone complete characterization. This inability to develop detailed listings should be remedied, as it could prove problematic in the future.
Procedures for AK processes are consistent with each other	MP-TRUW-8.13, Rev. 10, MP-TRUW-8.11 Rev. 9	Procedures for AK processes are implemented consistently	Y in part	Single procedure for AK assembly; data reconciliation also presented. MP-TRUW-8.13, Rev. 10 still does not require collection AK data for materials important to performance assessment, including ferrous metals,

Attachment A.1: Acceptable Knowledge (AK) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/Comment
				cellulosics, plastic, rubber (CPR), and nonferrous metals. It also does not call for identification of unexpected radionuclides
The site's TRU waste management program has procedures to determine: • Waste categorization schemes (e.g., consistent definitions of waste streams) and terminology • Breakdown of the types and quantities of TRU waste generated/stored at the site • How waste is tracked and managed at the generator site (including historical and current operations)	MP-TRUW-8.13, Rev. 10, MP-TRUW-8.11 Rev. 9		N	BNFL-5232-RPT-TRUW-03, Rev 4; BNFL-5232-RPT-TRUW-04; BNFL-5232-RPT-TRUW-06; BNFL-5232-RPT-TRUW-07; BNFL-5232-RPT-TRUW-12 Rev. 2a; BNFL-5232-RPT-TRUW-13; BNFL-5232-RPT-TRUW-30 Revs. 0A and 0B INEL-96/0280, Rev. 03. Acceptable Knowledge Ledger, INEL-96/0280, Rev. 03, P388A, U127A. Waste Stream BN510 is to be composed of several individual waste streams generated at different sites. DOE recognized, and EPA agrees, that the site does not correctly implement the requirements of Appendix E because the site did not consider the supercompaction activity performed to be Load Management. However, both DOE and EPA believe that Load Management is being implemented, and therefore waste tracking systems must ensure compliance with requirements set forth in Appendix E of the CH WAC. Revision of site controls to recognize this compliance issue is required.
Procedures call for AK information to be collected for: ^{241}Am, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{233}U, ^{234}U, ^{238}U, ^{90}Sr, ^{137}Cs + unexpected radionuclides ferrous metals (in containers) cellulosics, plastics, rubber nonferrous metals (in containers)	MP-TRUW-8.13, Rev. 10	AK information is collected for: ^{241}Am, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{233}U, ^{234}U, ^{238}U, ^{90}Sr, ^{137}Cs + unexpected radionuclides ferrous metals (in containers) cellulosics, plastics, rubber nonferrous metals (in containers)	N	BNFL-5232-RPT-TRUW-03, Rev 4; BNFL-5232-RPT-TRUW-04; BNFL-5232-RPT-TRUW-06; BNFL-5232-RPT-TRUW-07; BNFL-5232-RPT-TRUW-12 Rev. 2a; BNFL-5232-RPT-TRUW-13; BNFL-5232-RPT-TRUW-30 Revs. 0A and 0B, INEL-96/0280, Rev. 03

Attachment A.1: Acceptable Knowledge (AK) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/Comment
		Specify isotopes/quantities defined by AK • Must be appropriate and result in unbiased values for cumulative activity and mass of radionuclides Is AK information collected for isotopes?		Procedure does not mandate the collection of waste material parameters important to PA. Also, AK Summary is not stand-alone with respect to nuclide data, as TRUW-7 includes almost all radionuclide information. The AK Summaries should be stand-alone, in that the general radionuclide content and waste material content can be ascertained. Also, the summary for super-compacted waste does not identify the two most prevalent radionuclides, as specified in the CH WAC, although the TRUW-8.13 now includes this requirement. Further, isotopic data for the Battelle component of the super-compacted waste was not well justified, as it was simply assured that RFETS and Mound WG and HS plutonium isotopics would apply.
Procedures require documentation of radionuclide process origin	MP-TRUW-8.13, Rev. 10	Identified radionuclides and their isotopic distributions are consistent and accurate See AK Confirmation	Y, in part	BNFL-5232-RPT-TRUW-07. BNFL-5232-RPT-TRUW-03, P206A, P227A, P269A, P322A, P423A, U118A Battelle isotopic data was not well justified or documented. However, AK process data from RFETS source material shows good RFETS to INL linkage.
		Radionuclides identified by AK and isotopic distributions are provided to NDA/Radioassay personnel. If AK data are provided to NDA personnel, data are available to operators prior to determination of isotopic quantities. Data use and limitations are well defined (refer to NDA checklist).	Y, in part	AK data are apparently shared with NDA personnel, but the AK-NDA communication line is not as rigorous as with other programs. Recommend that this site initiate an AK-NDA memo program comparable to that under the CCP as presented in CCP-TP-005, Section 4.4.17.

Attachment A.1: Acceptable Knowledge (AK) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/Comment
Procedures require: Assembling AK information Compiling AK documentation into an auditable record (the process should include review of AK information to determine the waste material parameters and radionuclides present, as well as source info discrepancy resolution) Assigning waste streams/waste matrix codes Identifying physical forms, waste material parameters, and radionuclides (including, if possible, isotopic ratios) Resolving data discrepancies Identifying management controls for discrepant items/containers/waste streams. Confirming AK information with other analytical results (done by comparing AK characterization data with that obtained through NDE and/or visual examination, including discrepancy resolution)	MP-TRUW-8.13, Rev. 10, MP-TRUW-8.11 Rev. 9	Compilation of AK documentation is adequately demonstrated From CH WAC If AK data discrepancy is identified, site will evaluate the source of the discrepancy to determine if discrepant information is credible. Information that is not credible will be identified as such and reasons for dismissing will be justified in writing. Limitations concerning information will be documented in the AK record and summarized in the AK report. If a discrepancy cannot be resolved, the site will perform direct measurements for the impacted population. Discrepancies are adequately resolved	Y, in part	BNFL-5232-RPT-TRUW-03, Rev 4; BNFL-5232-RPT-TRUW-04; BNFL-5232-RPT-TRUW-06; BNFL-5232-RPT-TRUW-07; BNFL-5232-RPT-TRUW-12 Rev. 2a; BNFL-5232-RPT-TRUW-13; BNFL-5232-RPT-TRUW-30 Revs. 0A and 0B, INEL-96/0280, Rev. 03; WSPF for BN510; AMWTF Forms 1066 and 1067 (for each feed stream to the supercompated waste); AMWTP Form 1084; Reference examples P206A, P227A, P269A, P322A, P423A, U118A, AKR-03-8, AKR-03-09, AKR-03-10, AKR-03-34, AKR-04-74, AKR-04-99, C251A C273A P015A P072A P384A, P388A.; AK Resolution Ledger; Form 1084, AK Accuracy Report. In general, the data assembly and compilation process appeared adequate, although the AK Summary requires revision to be more stand-alone and to include radionuclide summary data; identification of the two most prevalent radionuclides; additional information pertaining to the physical parameters important to PA; and adequate supporting references. Currently, little AK data are available for Bettis wastes. The site recognized this deficiency and issued an NCR addressing the problem (NCR #12613). Also, RFETS box waste was not included in related AK documentation. This information should be included in relevant documents to ensure complete understanding of waste feed stream composition being included in the supercompaction process. Site does a very good job of tracking all AK

Attachment A.1: Acceptable Knowledge (AK) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/Comment
				discrepancies, placing both AK-AK and AK-Confirmation discrepancies on the AK Discrepancy Ledger. This appears to be a very valuable tool, and could be initiated at other sites. The AK Accuracy report has not been updated to reflect any supercompated waste. It is assumed that the report will be prepared in the same manner as done for solid waste, which requires revision to specifically state the criteria for a "Y" designation in terms of problems/ discrepancies, because the result is an AK Accuracy as low as 61% for 374 sludge, which is a troublesome value if the origin of the value is not completely understood. Also note that the AK accuracy for the super-compacted waste stream is meaningless because the stream incorporates individual feeds of varying physical/chemical/radiological composition.
From CH WAC 1. If AK was used (i.e., data collected prior to QA program), what method was employed to qualify the information? Approved methods or peer review, corroborating data, confirmatory testing, and QA program equivalency? 2. At a minimum, to confirm existing AK data, it is necessary to compare ratios of the two most prevalent radionuclides in the isotopic mix	MP-TRUW-8.13, Rev. 10	AK confirmation based on NDE and/or visual examination is adequately demonstrated 1. ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Pu, ^{242}Pu and ^{241}Am: - Confirmation can be accomplished via comparison of measured and AK values for ^{239}Pu/ ^{240}Pu for weapons grade plutonium; ^{238}Pu/ ^{239}Pu for heat source - Measured ^{241}Am can be used to calculate ^{241}Pu (for subsequent AK comparison) if time of chemical separation is known (no ^{241}Am at time of separation assumed) - ^{241}Pu can be compared (by ratio) to confirm AK of any Pu isotope associated with WG/RG (i.e., ^{239}Pu or ^{240}Pu)	N	BNFL-5232-RPT-TRUW-07, BNFL-5232-RPT-TRUW-03, BNLF-5232-RTP-TRUW-30, P368A, P206A, P227A, P269A, P322A, P423A, U118A, AK Accuracy Report Note that the site includes literally no AK radionuclide information with the WSPF sent to Carlsbad. Therefore, it is unclear how CBFO checks WSPF- WWIS information for comparability. Sites use a default WG isotopic distribution for the entire WS as derived from RFETS and a default HG isotopic distribution based upon Mound information. However, applicability of

Attachment A.1: Acceptable Knowledge (AK) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/Comment
		- ^{238}Pu from AK for wg/rg Pu is assumed to be valid if the AK values of ^{239}Pu and ^{240}Pu have been confirmed by measurement - ^{242}Pu calculated by correlation techniques, since it can't be measured 2. ^{235}U, ^{233}U, ^{238}U, ^{234}U - Were they tracked or measured in AK information? - If no valid AK exists, data generated can only be used to detect or calculate, or confirm absence - ratios for ^{234}U calculated from ^{235}U enrichment - If valid AK exists can confirm with certified systems - ^{234}U calculated by ^{235}U enrichment, because ^{234}U can't be measured 3. ^{137}Cs and ^{90}Sr - Confirmed by WIPP-certified system (direct measurement or comparison of ^{241}Am peak at 662 keV to other ^{241}Am peaks (disproportionate ^{241}Am peak at 662 keV could mean presence of ^{137}Cs) - ^{90}Sr calculated from ^{137}Cs using scaling factors 4. Other radionuclides – must identify via NDA and should identify via AK		the distribution to Battelle and Bettis is questionable. Feed waste streams can contain variations of depleted and enriched uranium. A mathematical comparison chart was prepared for determining ^{234}U based on the EU-DU proportionality. Correlation techniques apparently used as appropriate for ^{242}Pu. Site does not identify the two most prevalent radionuclides in the isotopic mix, or at least does not present the information in an understandable fashion. Cs-Sr determined by scaling factors. Recommend preparation of the AK-NDA memo as performed by CCP to document the use of AK and concur on this use.
Procedures require that: AK information must be compiled in an auditable record, including a road map for all applicable information. A reference list must be provided that	MP-TRUW-8.13, Rev. 10, MP-TRUW-8.11, Rev. 9	AK information is compiled in an auditable record, including a road map for all applicable information. A reference list is provided that identifies documents, databases, Quality Assurance protocols, and other sources of	Y	Form 1084, Forms 1066 and 1067, BNFL-5232-RPT-TRUW-06; BNFL-5232-RPT-TRUW-03, Rev 4; BNFL-5232-RPT-TRUW-04; BNFL-5232-RPT-TRUW-06; BNFL-5232-RPT-TRUW-07; BNFL-5232-RPT-TRUW-12 Rev. 2a; BNFL-5232-RPT-TRUW-13; BNFL-

Attachment A.1: Acceptable Knowledge (AK) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/Comment
identifies documents, databases, Quality Assurance protocols, and other sources of information that support AK information. The overview of the facility and TRU waste management operations in the context of the facility's mission must be correlated to specific waste stream information. Correlations between waste streams, with regard to time of generation, waste generating processes, and site-specific facilities be clearly described. For newly generated wastes, the rate and quantity of waste to be generated shall be defined. Nonconforming waste must be segregated.		information that support AK information. The overview of the facility and TRU waste management operations in the context of the facility's mission is correlated to specific waste stream information. Correlations between waste streams, with regard to time of generation, waste generating processes, and site-specific facilities are clearly described. For newly generated wastes, the rate and quantity of waste to be generated are defined. Nonconforming waste is segregated.		5232-RPT-TRUW-30 Revs. 0A and 0B, INEL-96/0280. Adequate AK information is available with respect to process and facility missions for the feed streams from RFETS, Mound and Battelle; Bettis, however, has inadequate AK at this time for inclusion in the feed stream to the super-compacted waste. The AK Ledger and Nonconformance Reports show disposition of wastes; wastes that require solidification/removal of liquids are segregated and treated prior to shipment. Note that while the super-compacted waste stream definition appears justified, other waste streams defined in TRUW-12 do not appear to be well justified or follow the definition as presented in the WAP or CH WAC.
Procedures require that the following information will be included in the AK record: Map of the site that identifies the areas and facilities involved in TRU waste generation, treatment, and storage Facility mission description related to TRU waste generation and management Description of the operations that generate TRU waste at the site and process information, including: – Area(s) or building(s) from which the waste stream was or is generated – Estimated waste stream volume and time period of generation – Waste generating process description for each building or area	MP-TRUW-8.13, Rev. 10	The following information is in the AK record: Map of the site that identifies the areas and facilities involved in TRU waste generation, treatment, and storage Facility mission description related to TRU waste generation and management Description of the operations that generate TRU waste at the site and process information, including: Area(s) or building(s) from which the waste stream was or is generated Estimated waste stream volume and time period of generation Waste-generating process description for each building or area	Y	BNFL-5232-RPT-TRUW-03, Rev 4; BNFL-5232-RPT-TRUW-04; BNFL-5232-RPT-TRUW-06; BNFL-5232-RPT-TRUW-07; BNFL-5232-RPT-TRUW-12 Rev. 2a; BNFL-5232-RPT-TRUW-13; BNFL-5232-RPT-TRUW-30 Revs. 0A and 0B, INEL-96/0280. AK information was well-assembled and addressed all of the required elements; see above comments, however, regarding presentation of this information in the AK Summary for BN510. It must be revised to enable it to be a stand-alone document. Specific examples include the lack of references, inclusion of radionuclide data, identification of the two most prevalent isotopes, and better physical parameter

Attachment A.1: Acceptable Knowledge (AK) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/Comment
– Process flow diagrams, if appropriate – Generalized material inputs or other information that identifies the radionuclide content of the waste stream and the physical waste form – Types and quantities of TRU waste generated, including historical generation through future projections		Process flow diagrams, if appropriate Generalized material inputs or other information that identifies the radionuclide content of the waste stream and the physical waste form Types and quantities of TRU waste generated, including historical generation through future projections		identification. The AK procedure must also be improved to require collection and presentation of WMP data in the AK Summaries, as well as to require the presentation of unexpected radionuclides, and to include more thorough and complete references to all material presented therein..
From CH WAC • Waste identification/categorization schemes relevant to the isotopic composition of waste and description of isotopic composition of each waste stream • Physical/chemical waste composition that could affect isotopic distribution (i.e., processes to remove ingrown ^{241}Am) • Statement of all numerical adjustments applied to derive the material's isotopic distribution, e.g., scaling factors, decay/ingrowth corrections and secular equilibrium considerations • specification of isotopic ratios for the 10 WIPP-tracked radionuclides and, if applicable, the radionuclides that comprise 95% of the hazard		From CH WAC • Waste identification/categorization schemes relevant to the isotopic composition of waste and description of isotopic composition of each waste stream • Physical/chemical waste composition that could affect isotopic distribution (i.e., processes to remove ingrown ^{241}Am) • Statement of all numerical adjustments applied to derive the material's isotopic distribution, e.g., scaling factors, decay/ingrowth corrections, and secular equilibrium considerations • Specification of isotopic ratios for the 10 WIPP-tracked radionuclides and, if applicable, the radionuclides that comprise 95% of the hazard	Y, in part	See above. Two most prevalent radionuclides need to be addressed in AK documentation. Also, use of isotopic distributions from RFETS and Mound for all waste feeds must be better justified.
The site has procedures for the collection of supplemental information.	MP-TRUW-8.13, Rev. 10	Samples of supplemental information are sufficiently detailed and are appropriate to the waste being characterized. From CH WAC Examples of supplemental information include:	Y	Examples: C251A C273A P015A, P072A P384A, P388A, P057A, P269A, P227A, U118A, U127A Site has collected and documented numerous AK supplemental data sources, including MSDS sheets, site-specific process information,

Attachment A.1: Acceptable Knowledge (AK) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/Comment
		• Safeguards and security and other material control systems/programs • Reports of nuclear safety or criticality • Accidents involving SNM waste packaging, and waste disposal • Building or nuclear material management area logs or inventory records • Site databases that provide SNM or nuclear material information test plans • Research project reports, or laboratory notebooks that describe the radionuclide content of materials used in experiments • Information from site personnel • Historical analytical data relevant to isotopic distribution in the waste stream		etc. Site databases can be queried (although access to the historic database TRIPS is more difficult than in previous versions), etc. However, site must ensure that ongoing characterization data, as well as WSPFs and related CIS from analogous waste streams at other sites (RFETS, etc.), be collected and included in the auditable record. This information represents a good source of AK data and should be collected.
Site documents/procedures require the facility prepare an AK summary document that summarizes all information collected, including the basis for all waste stream designations.	MP-TRUW-8.13, Rev. 10	The AK summary is available for EPA review and contains the required information, including the basis for all waste stream designations.	N	BNFL-5232-RPT-TRUW-03, Rev 4; BNFL-5232-RPT-TRUW-04; BNFL-5232-RPT-TRUW-06; BNFL-5232-RPT-TRUW-07; BNFL-5232-RPT-TRUW-12 Rev. 2a; BNFL-5232-RPT-TRUW-13; BNFL-5232-RPT-TRUW-30 Revs. 0A and 0B, INEL-96/0280. See comments above. AK Summary should be revised to address issues to make it a stand-alone document, as well as lack of references, need to add radionuclide data, identification of the two most prevalent isotopes, and physical parameter identification.
Site procedures require that additional information be collected before waste may be shipped if the required AK information is not available for a waste stream.	MP-TRUW-8.13, Rev. 10	Additional information is collected before waste may be shipped if the required AK information is not available for a waste stream.	Y	Site has issued an NCR for Bettis Waste because not all required AK data are available. Therefore, this waste in ineligible as a feed to the super-compacted waste stream.

Attachment A.1: Acceptable Knowledge (AK) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/Comment
The site has a written procedure for the confirmation of AK information using analytical data, including NDA/NDE and/or VE. This procedure applies to both retrievably-stored and newly generated waste. This procedure requires a reevaluation of AK if NDE/NDA or VE identify it to be a different waste matrix code. This procedure describes how the waste must be reassigned, based on the AK reevaluation.	MP-TRUW-8.13, Rev. 10, MP-TRUW-8.11, Rev. 9	AK information is confirmed using analytical data, including NDA/NDE and/or VE. Has the acceptable knowledge expert calculated the percent changes in matrix parameter categories (MPCs) based on AK and NDE/VE? Were accuracy evaluations assigned? Are these acceptable?	Y, in part	AK Accuracy Report; AK Ledger Sites track discrepant containers and calculate AK Accuracy based on WMC and hazardous constituent identification changes. Actual "confirmation" of AK radionuclide content via NDA is not presented in the AK Accuracy calculations or the CIS attached to the WSPF (as is done for VE, RTR, and chemical analysis results). Note that there are issues, as previously discussed, with the AK accuracy calculations, as they are essentially meaningless for the super-compacted waste stream as a whole.

Attachment A.1: Acceptable Knowledge (AK) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/Comment
Procedures require the following steps to be followed if wastes are reassigned to a different waste matrix code based on NDA/NDE or VE: Review existing information based on the container identification number and document all differences Reassess and document all analytical data associated with the waste Reevaluate waste material parameter determinations and document any changes Reevaluate the radionuclide content and document any changes Verify and document that the reassigned waste matrix code was generated within the specified time period, area and buildings, waste generating process, and that the process material inputs are consistent with the waste material parameters identified during radiography or visual examination Record all changes to acceptable knowledge records If discrepancies exist in the acceptable knowledge information for the reassigned waste matrix code, complete a nonconformance report, document the segregation of this container, and define the corrective actions necessary to fully characterize the waste	MP-TRUW-8.13, Rev. 10	The following steps are followed if wastes are reassigned to a different waste matrix code: Review existing information based on the container identification number and document all differences Reassess and document all analytical data associated with the waste Reevaluate waste material parameter determinations and document any changes Reevaluate the radionuclide content and document any changes Verify and document that the reassigned waste matrix code was generated within the specified time period, area and buildings, waste generating process, and that the process material inputs are consistent with the waste material parameters identified during radiography or visual examination Record all changes to acceptable knowledge records If discrepancies exist in the acceptable knowledge information for the reassigned waste matrix code, complete a nonconformance report, document the segregation of this container, and define the corrective actions necessary to fully characterize the waste	Y	AMWTP Form 1070; AKR-03-8, AKR-03-09, AKR-03-10, AKR-03-34, AKR-04-74, AKR-04-99, AK Ledger. Site tracks all wastes on Form 1070, which asks the questions on this checklist. Discrepant containers are tracked on the AK ledger. Note that while significant IDC changes have been identified, because the supercompated waste stream is so broad and the waste matrix code so general, it is unlikely that significant problems will be identified under this checklist element, even though the IDC changes identified could be significant.
Does the site have procedures for shipment revocation and procedures for notification of CBFO when a container is revoked?	MP-TRUW-8.13, Rev. 10	Has a waste stream been revoked based either on AK information or reassessment as part of reconfirmation? If so, was the procedure(s) followed?	Y	Site has not "self" revoked, but site has in the past not allowed shipment because of errors identifying the specific containers in allowable waste stream shipment lots. This error has not resulted in shipment of containers with no assay or RTR/VE; the issue pertains to shipment of

Attachment A.1: Acceptable Knowledge (AK) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/Comment
				containers out of compliance with RCRA.
Until discrepancies are resolved, shipment of the waste stream to the WIPP is prohibited	MP-TRUW-8.13, Rev. 10	If data consistently indicate discrepancies with acceptable knowledge information, the site increases sampling, reassesses the materials and processes that generate the waste, and resubmits waste stream profile information.	Y	See above.

Attachment A.2: Non Destructive Assay (NDA) Checklist for AMWTP

Establishment of Required Elements in Procedures	Y/N	Location	Execution of Procedures or Verification of Activity	Y/N	Objective Evidence or Comment
General Reporting Requirements					
Procedures require assay systems to report quantitative values and uncertainties for ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{241}Am, ^{233}U, ^{234}U, ^{238}U, ^{90}Sr, and ^{137}Cs.	Y	MP-TRUW-8.1, Rave. 5, Section A.1, Page A-2	Quantitative values and uncertainties for ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{241}Am, ^{233}U, ^{234}U, ^{238}U, ^{90}Sr, and ^{137}Cs are reported.	Y	All required radionuclides are reported in the radio assay data sheets, the BDRs, and AMTP Form 1221/1384
Procedures require that each container disposed of at WIPP contains TRU waste.	Y	MP-TRUW-8.1, Rev. 5, Section A.1, Page A-2	Containers to be disposed of at WIPP meet the definition of TRU waste.	Y	All waste shipped from AMWTP to date have met the definition of TRU waste with TRU alpha concentration >100 nCi/g.
NDA instruments and procedures are appropriate for the waste streams and/or waste content codes being assayed.	Y	MP-TRUW-8.1, Rev. 5, Section A.1, Page A-2	NDA instruments and procedures are appropriate for the waste streams and/or waste content codes being assayed.	Y	All four IWASs are equivalent; all are multi-modal systems (gamma, passive, and active neutron) with AAS matrix correction for each assay. Systems are waste stream-independent within the defined operating range.
NDA instruments and procedures result in unbiased values for the cumulative activity of the WIPP radionuclide inventory.	Y	MP-TRUW-8.1, Rev. 5, Section A.1, Page A-2	NDA instruments and procedures result in unbiased values for the cumulative activity of the WIPP radionuclide inventory.	Y	IWAS measurement system and associated TMU correct for all appropriate factors in accordance with DOE/WIPP-02-3122.
Acceptable Knowledge (AK)					
Isotopic ratios for use in qualifying radionuclides are performed by direct measurement or, when AK is used, are qualified by confirmatory testing.	Y	MP-TRUW-8.1, Rev. 5, Section A.2, Page A-3	Isotopic ratios for use in quantifying radionuclides are performed by direct measurement or, when AK is used, are qualified by confirmatory testing.	Y	NDA-2000 software uses WGPu or HS Pu default isotopic ratios when MGA fails
Lower Level of Detection					
Procedures require that the LLD for each NDA system is determined.	Y	MP-TRUW-8.1, Rev. 5, Section A.3, Page A-8	The LLD for each NDA system has been determined.	Y	LLDs are determined for each measurement. Nominal values are reported in the site acceptance reports CI-IDA-NDA-0051 through CI-IDA-NDA-0054 for Z-211-102, Z-211-103, Z-390-100 & Z-390-101, respectively.

Attachment A.2: Non Destructive Assay (NDA) Checklist for AMWTP

Establishment of Required Elements in Procedures	Y/N	Location	Execution of Procedures or Verification of Activity	Y/N	Objective Evidence or Comment
Procedures require that site specific environmental backgrounds and container specific interferences must be accounted for in LLD determinations.	Y	MP-TRUW-8.1, Rev. 5, Section A.3, Page A-8	Site-specific environmental backgrounds and container-specific interferences are accounted for in LLD determinations.	Y	Site Acceptance Test Reports (SATRs) CI-IDA-NDA-0051 through CI-IDA-NDA-0054 address this.
NDA instruments performing TRU/low-level waste discrimination measurements are required to have a LLD no greater than 100 nCi/g.	Y	MP-TRUW-8.1, Rev. 5, Section A.3, Page A-8	NDA instruments performing TRU/low-level waste discrimination measurements are required to have a LLD no greater than 100 nCi/g.	Y	LLDs are reported for each measurement based on the background at the time of the assay.
Total Measurement Uncertainty (TMU)					
The method used to calculate the total measurement uncertainty (TMU) for all required quantities must be documented and technically justified.	Y	MP-TRUW-8.1, Rev. 5, Section A.3, Page A-8	The method used to calculate the TMU for all required quantities are documented and technically justified.	Y	Confirmed TMU determination is the same for all 4 IWASs in one document, CI-IDA-NDA-0055, TMU for the AMWTP IWAS, Rev. 1, July 30, 2003.
Methods to determine TMU must be reviewed and approved by CBFO for each NDA instrument.	Y	MP-TRUW-8.1, Rev. 5, Section A.3, Page A-8	Methods to determine TMU have been reviewed and approved by CBFO for each NDA instrument.	Y	Participated in review and approval of TMU during inspection with CBFO Technical Specialist and AMWTP personnel.
Calibration					
Procedures require that each NDA instrument is calibrated before its initial use.	Y	MP-TRUW-8.1, Rev. 5, Section A.3, Page A-9	The NDA instrument has been calibrated before its initial use.	Y	All IWASs were calibrated at the factory (Meriden, CT) prior to their shipment to AMWTP. Upon receipt/installation at AMWTP, calibrations were verified as documented in CI-IDA-NDA-0051 through CI-IDA-NDA-0054. Calibration activities for all 4 IWASs were done in accordance with CI-IDA-NDA-0031.

Attachment A.2: Non Destructive Assay (NDA) Checklist for AMWTP

Establishment of Required Elements in Procedures	Y/N	Location	Execution of Procedures or Verification of Activity	Y/N	Objective Evidence or Comment
Site procedures must specify the range of applicability of system calibrations.			The range of applicability of system calibrations has been specified.		Operating range specified in SATRs CI-IDA-NDA-0051 through CI-IDA-NDA-0054. System calibrations are not *mass calibrations* in a strict sense, although the operating range is expressed as 0.010 g – 200 g WGPu. Any assay within energy range for γ or AAS range for PN that meets measurement criteria is acceptable, in theory.
Procedures require that any matrix/source surrogate waste combinations are representative of the activity ranges and relevant waste matrix characteristics (i.e., densities, effective atomic number, neutron absorber and moderator content) planned for measurement by the system.	Y	MP-TRUW-8.1, Rev. 5, Section A.3, Page A-9	Matrix/source surrogate waste combinations used are representative of the activity ranges and relevant waste matrix characteristics planned for measurement by the system.	Y	Matrices used for active and passive neutron calibration include combustibles, glass, metals, and organic and inorganic sludges. For gamma mode, matrices with densities up to 1.6 g/cm^3 were used.
Procedures require the use of consensus standards, when such standards exist. If consensus standards do not exist, the calibration technique must be approved by CBFO.	Y	MP-TRUW-8.1, Rev. 5, Section A.3, Page A-9	Consensus standards have been used, when such standards exist. If consensus standards do not exist, the calibration technique has been approved by CBFO.	Y	Calibrations performed using ^{241}Am/^{152}Eu gamma sources, ^{252}Cf sources, and ^{235}U, ^{239}Pu. Certificates were available for all sources.
Procedures require that primary standards be obtained from suppliers maintaining a nationally accredited measurement program.	Y	MP-TRUW-8.1, Rev. 5, Section A.3, Page A-9	Primary standards have been obtained from suppliers maintaining a nationally accredited measurement program	Y	Reviewed source copies of source certifications.
Calibration Verification					
Procedures require that verification of an NDA instrument's calibration is performed after any of the following occurrences: major system repairs and/or modifications,	Y	MP-TRUW-8.1, Rev. 5, Section A.3, Page A-9	Verification of an NDA instrument's calibration has been performed when required.	Y	Calibration of Z-211-102 verified on August 12, 2004, when one of the BEGe detectors was reinstalled. A-211-103 had calibration verification on July 28, 2004, following work on the neutron generator.

Attachment A.2: Non Destructive Assay (NDA) Checklist for AMWTP

Establishment of Required Elements in Procedures	Y/N	Location	Execution of Procedures or Verification of Activity	Y/N	Objective Evidence or Comment
replacement of the system's components, significant changes to the system's software, and relocation of the system.					
Procedures require recalibration of the system if the calibration verification demonstrates that the system's response has significantly changed.	Y	MP-TRUW-8.1, Rev. 5, Section A.3, Page A-9	Recalibration of the system has been performed if the calibration verification demonstrates that the system's response has significantly changed.	Y	At the time of the inspection, no recalibration had been required for any of the 4 IWASs.
Calibration Confirmation					
Procedures require confirmation of the calibration of a system by performing replicate measurements of a non-interfering matrix.	Y	MP-TRUW-8.1, Rev. 5, Section A.3, Page A-10	The calibration of a system has been confirmed by performing replicate measurements of a non-interfering matrix.	Y	Calibration confirmation has been performed for all 4 IWASs and documented in SATRs CI-IDA-NDA-0051 through CI-IDA-NDA-0054.
Procedures require that replicate measurements be performed with containers of the same nominal size as those used for actual waste assays.	Y	MP-TRUW-8.1, Rev. 5, Section A.3, Page A-10	Replicate measurements have been performed with containers of the same nominal size as those used for actual waste assays.	Y	PDP-type drums with non-interfering matrices used for replicate testing.
Procedures require that replicate measurements be performed according to the same procedures used for actual waste assays.	Y	MP-TRUW-8.1, Rev. 5, Section A.3, Page A-10 (procedure is INST-OI-14, Rev. 13)	Replicate measurements have been performed according to the same procedures used for actual waste assays.	Y	Replicate testing is performed in the same manner as normal assay.
Procedures require that replicate measurements be performed using nationally recognized standards or standards derived from nationally recognized standards that span the range of use of the instrument.	Y	MP-TRUW-8.1, Rev. 5, Section A.3, Page A-10	Replicate measurements have been performed using nationally recognized standards or standards derived from nationally recognized standards that span the range of use of the instrument.	Y	Combinations of different PDP WGPu sources have been used.
Procedures require that the standards used for calibration confirmation are not the same sources for the most recent calibration.	Y	MP-TRUW-8.1, Rev. 5, Section A.3, Page A-10	The standards used for calibration confirmation are not the same sources for the most recent calibration.	Y	PDP standards used for calibration confirmation are not the same sources used for calibration.

Attachment A.2: Non Destructive Assay (NDA) Checklist for AMWTP

Establishment of Required Elements in Procedures	Y/N	Location	Execution of Procedures or Verification of Activity	Y/N	Objective Evidence or Comment
Requirements for accuracy, expressed as %R, and precision, expressed as %RSD, must be met.	Y	MP-TRUW-8.1, Rev. 5, Section A.3, Page A-10 (%R required is to be 100±30%)	Requirements for accuracy and precision have been met.	Y	Results of calibration confirmation for all 4 IWASs are included in SATRs CI-IDA-NDA-0051 through and CI-IDA-NDA-0054.
General Quality Control					
Procedures require that all radioassay and data validation be performed by appropriately trained and qualified personnel.	Y	MP-TRUW-8.1, Rev. 5, Section A.4.1, Page A-11	All radioassay and data validation has been performed by appropriately trained and qualified personnel.	Y	Reviewed personnel training records for NDA operators.
Procedures require that requalification of personnel be based on evidence of continued satisfactory performance and is performed at least every 2 years.	Y	MP-TRUW-8.1, Rev. 5, Section A.4.1, Page A-11	Requalification of personnel be based on evidence of continued satisfactory performance has been performed at least every two years.	Y	Reviewed personnel training records for NDA operators.
Procedures require that all computer programs, including spreadsheets used for data reduction or analysis, meet the applicable requirements in the QAPD.	Y	MP-TRUW-8.1, Rev. 5, Section A.4.1, Page A-11	All computer programs, including spreadsheets used for data reduction or analysis, meet the applicable requirements in the QAPD.	Y	NDA 2000 V3.2 is the primary software used and it was reviewed.
Procedures require that site participate in any relevant measurement comparison programs sponsored or approved by CBFO, including the Performance Demonstration Program (PDP).	Y	MP-TRUW-8.1, Rev. 5, Section A.4.1, Page A-11	The site has participated in relevant measurement comparison programs sponsored or approved by CBFO.	Y	Z-211-102 and Z-211-103 participated and passed PDP Cycle 11A for Non Interfering Matrix, Metals and Sludge. Z-390-100 and Z-390-101 participated and passed Cycle 11A for Non Interfering Matrix and Metals. All results are documented in the November 2004 CBFO PDP Scoring Report.
Background and Performance Checks					
Procedures require daily background measurements, unless otherwise approved by CBFO. Contributions to backgrounds from nearby	Y	MP-TRUW-8.1, Rev. 5, Section A.4.2, Page A-11	Daily background measurements have been taken, unless otherwise approved by CBFO. Contributions to backgrounds from nearby	Y	Reviewed background control charts contained in Radioassay BDRs.

Attachment A.2: Non Destructive Assay (NDA) Checklist for AMWTP

Establishment of Required Elements in Procedures	Y/N	Location	Execution of Procedures or Verification of Activity	Y/N	Objective Evidence or Comment
radiation sources must be carefully controlled, or more frequent backgrounds must be measured.			radiation sources have been carefully controlled.		
Procedures require that system performance checks be performed at least once per operational day.	Y	MP-TRUW-8.1, Rev. 5, Section A.4.2, Page A-11	Performance checks have been performed at least once per operational day.	Y	Reviewed performance checks control charts contained in Radioassay BDRs. Daily performance check performed using 11 g WGPu source in a combustibles matrix
System performance checks must include, as applicable, efficiency and matrix correction checks, and peak position and resolution checks for spectrometry systems.	Y	MP-TRUW-8.1, Rev. 5, Section A.4.2, Page A-11	Performance checks include, as applicable, efficiency, and matrix correction checks, and peak position and resolution checks for spectrometry systems.	Y	Performance check limits for all 4 IWASs are documented in SATRs CI-IDA-NDA-0051 through CI-IDA-NDA-0054. Y Checks include centroid, FWHM and area of 662 keV peak.
Procedures require that at least once per operational week, an interfering matrix is used to assess the long-term stability of the NDA instrument and its matrix corrections.	Y	MP-TRUW-8.1, Rev. 5, Section A.4.2, Page A-12	An interfering matrix is used to assess the long-term stability of the NDA instrument and its matrix corrections at least once per operational week.	Y	Weekly interfering matrix check uses a variety of matrices, including combustibles, mixed metals, glass, and inorganic sludge.
Procedures require that interfering surrogate waste matrices be constructed in a way that the matrix characteristics do not change over time.	Y	MP-TRUW-8.1, Rev. 5, Section A.4.2, Page A-12	Interfering surrogate waste matrices have been constructed in a way that the matrix characteristics do not change over time.	Y	Discussion with site personnel.
Procedures require that sources used for performance checks either be long-lived or decay-corrected.	Y	MP-TRUW-8.1, Rev. 5, Section A.4.2, Page A-12	Sources used for performance checks either are long-lived or decay-corrected.	Y	PDP WGPu sources used for weekly interference checks.
Procedures require that performance checks be quantitative and based on 2 and 3 sigma limits.	Y	MP-TRUW-8.1, Rev. 5, Section A.4.2, Page A-13	Performance checks are quantitative and based on 2 and 3 sigma limits.	Y	Quantitative limits are documented in SATRs CI-IDA-NDA-0051 through CI-IDA-NDA-0054 and are plotted on control charts for all 4 IWASs.
Data Management					
Procedures require that all radioassay data be reviewed and	Y	MP-TRUW-8.1, Rev. 5, Section A.5.1,	All radioassay data has been reviewed and approved by qualified	Y	Review checklists for both data generation level and project level review were

Attachment A.2: Non Destructive Assay (NDA) Checklist for AMWTP

Establishment of Required Elements in Procedures	Y/N	Location	Execution of Procedures or Verification of Activity	Y/N	Objective Evidence or Comment
approved by qualified personnel before being reported to WWIS.		Page A-14	personnel before being reported to WWIS.		examined and found satisfactory.
Procedures require that radioassay testing batch reports consist of the following: • Testing facility name, testing batch number, container numbers, and signature of the Site Project Officer (SPO) or designee(s) • Table of Contents • Background and performance check data or control charts for the relevant time period. • Data validation per the QAPD and site procedures • Separate testing report sheets for each container.	Y	MP-TRUW-8.1, Rev. 5, Section A.5.2, Page A-14	Radioassay testing batch reports consist of the following: • Testing facility name, testing batch number, container numbers, and signature of the Site Project Officer (SPO) or designee(s) • Table of Contents • Background and performance check data or control charts for the relevant time period. • Data validation per the QAPD and site procedures • Separate testing report sheets for each container.	Y	Multiple BDRs were reviewed and found to contain the requisite information.
Procedures require that testing report sheets include: • Title "Radioassay Data Sheet" • Method/procedure used • Date of radioassay • Activities and associated TMU for individual radionuclides • TRU alpha concentration and its associated TMU • Operator signature • Reviewer signature	Y	MP-TRUW-8.1, Rev. 5, Section A.5.2, Page A-14	Testing report sheets include: • Title "Radioassay Data Sheet" • Method/procedure used • Date of radioassay • Activities and associated TMU for individual radionuclides • TRU alpha concentration and its associated TMU • Operator signature • Reviewer signature	Y	Numerous Radioassay Data Sheets were reviewed and found to contain all of the requisite information.
Procedures require that the following nonpermanent records be maintained at the radioassay-testing facility or	Y	MP-TRUW-8.1, Rev. 5, Section A.5.3, Page A-15	The following nonpermanent records must be maintained at the radioassay-testing facility or	Y	AMWTP now keeps all of their permanent records in paper form. These records are collected, reviewed, and maintained as

Attachment A.2: Non Destructive Assay (NDA) Checklist for AMWTP

Establishment of Required Elements in Procedures	Y/N	Location	Execution of Procedures or Verification of Activity	Y/N	Objective Evidence or Comment
forwarded to the site project office: • Testing batch reports • All raw data, including instrument readouts, calculation records, and radioassay QC results • All applicable instrument calibration reports			forwarded to the site project office: • Testing batch reports • All raw data, including instrument readouts, calculation records, and radioassay QC results • All applicable instrument calibration reports		permanent QA records.

Attachment A.3: Real-Time Radiography (RTR) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
Site procedures identify required training and qualifications for RTR personnel • RTR operators are instructed in the specific waste generating practices and typical packaging configurations expected to be found in each matrix parameter category at the site.	INST-OI-12, Rev. 20	• Employees explanation of job duties was consistent with applicable procedures • Operator could name prohibited items • Operator's explanation of required actions if prohibited items were encountered was consistent with procedure • Operator could identify applicable policies and procedures governing the operation of RTR equipment • Operator adequately explained the consequences of misidentifying prohibited items • RTR operators passed a training drum test that includes items common to the waste streams generated/stored at the site. • RTR operators identify the limitations of their system and explain what the process of identifying and managing drums with prohibited items.	Y	Observed RTR of drum number BN10031967 during the audit. Reviewed the training drum audio/video recording for operator Richard Steffens, dated 2/15/05. Interviewed the RTR operator and RTR TS (Vince Medina) who were able to describe the set-up procedure, image quality check, and identification of prohibited items. The WTS system requires data entry with regard to the presence or absence of prohibited items. Objective evidence reviewed: (1) Form 1374, RTR Status Log, dated 3/1/05 (2) Form 1374, RTR Status Log, dated 2/27/05 (3) Form 1374, RTR Status Log, dated 2/28/05 (4) Form 1218, Daily RTR Technical Safety Requirements Surveillance Checks, dated 3/2/05 (5) RTR Analysis Report for container number BN10016182 (6) RTR Analysis Report for container number BN10016184 (7) Batch Data Report for batch number RTR04-00335
		• Operators training was consistent with applicable procedures • Operators certification is current	Y	Operator certification verification is contained in the ITR, TS, and QAO data generation level review checklists. Objective evidence reviewed: (1) Training Manual for Technical Supervisor/Quality Assurance (TS/QA)(RTR, Coring, VE) & Visual Examination Expert (VEE) Vince Medina

Attachment A.3: Real-Time Radiography (RTR) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
There is a procedure for determining if the resolution of the RTR equipment is sufficient to image the types of waste and waste containers likely to be encountered at this site. The procedure allows the operator to adjust RTR to accommodate the physical properties of the waste and waste containers likely to be encountered at this site	INST-OI-12, Rev. 20	• Operator adequately explained how to adjust the system to image the range of wastes likely to be encountered at this specific site • The RTR system could be adjusted • Operator adequately explained how the presence of free liquids is determined • Operator adequately explained how the acceptability of an image is determined • Operator adequately explained what is done if an image is unacceptable (e.g., the waste is solidified or the container is lead-lined) • The x-ray producing device has controls that allow the operator to vary voltage, thereby controlling image quality • High-density material was examined with the x-ray device set on the maximum voltage • Low-density material was examined at lower voltage settings to improve contrast and image definition	Y	Interviewed the RTR operator and RTR TS (Vince Medina) who were able to describe the set-up procedure and image quality check. During the RTR demonstration, the operator changed the Kv setting to more clearly view denser items. How the Image quality is assessed was also demonstrated by the operator. Form 1578, Imaging Quality Indicator Verification Form for RTR, is completed prior to the examination of drums. Image Resolution is documented on Form 1374, RTR Status Log. Procedure INST-OI-12, S. 4.2.14 requires that drums are preheated at 18°C for a minimum of 72 hours to ensure that liquids are not frozen. The Container Location Report documents when the drums arrive in Building 634 so that drums do not undergo RTR examination until the preheating criterion has been met. Objective evidence reviewed: (1) Imaging Quality Indicator Verification Form for RTR, dated 3/1/05 (2) Form 1374, RTR Status Log, dated 3/1/05 (3) Form 1374, RTR Status Log, dated 2/27/05 (4) Form 1374, RTR Status Log, dated 2/28/05 (5) Image Quality Indicator Verification Form for RTR (Form 1578) (6) RTR Status Log (Form 1374) (7) Form 1218, Daily RTR Technical Safety Requirements Surveillance Checks, dated 3/2/05 (8) Temperature printout for Building 634, where preheating occurs, from 2/24/05 to

Attachment A.3: Real-Time Radiography (RTR) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
				3/2/05 (9) Annual calibration reports for temperature sensors in Building 634. (10) Container Location Report, dated 3/2/05
		• RTR tape is high quality, the sound track is audible, and the required information is contained on the audible portion of the tape. The RTR tape is consistent with the data package for the same drum.	Y	Reviewed audio/video recording for drum numbers BN10002936, BN10021668, BN10016215, BN10004014, and Richard Steffen's training drum QAPjP001. Reviewed RTR Analysis Report and the RTR tape for container number 10002936 Objective evidence reviewed: (1) RTR Analysis Report for drum number BN10002936
Procedures require that RTR operators receive the results of the VE/RTR comparison	INST-OI-12, Rev 20	• RTR operators receive the results of the VE/RTR comparison	Y	Reviewed Batch Report VVE05-00201, drum number 10002936, which was examined as a VE QC check of RTR. The report contained the RTR/VE Comparison Report. The SPQAO performs the comparison to determine if there is a miscertification. If a miscertification is determined, an NCR is issued. Operators are required to review the VE/RTR comparison reports after it is generated. Training is performed by the AMWTP VEE, Vince Medina, to ensure that RTR operators receive the lessons learned from the VE/RTR comparison. Objective evidence reviewed: (1) Training roster for "RTR/VE Feedback," dated 8/4/04 (2) Batch Report for VVE05-00201, container BN10002936

Attachment A.3: Real-Time Radiography (RTR) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
There is a procedure for determining whether the waste stream assignment, hazardous waste codes, and weights were correctly assigned	INST-OI-12, Rev 20	• The procedure is adequately implemented • Corrective actions are taken when necessary • Does the RTR operator use a standard weight lookup table to provide an estimate of WMP weights? If so, has the table been updated to reflect additional information gained through previous RTR/VE exams or updated AK information?	Y	Weight tables are contained in the WTS system that automatically calculates weights based on the number of items present. The RTR TS (Vince Medina) decides if any new items need to be added by monitoring how frequently these new items are encountered. If a new item is to be entered into the weight tables, a certified weight is obtained for that item. Personnel responsible for AK are informed of the addition to the weight tables so that the AK record can be updated. A software design change request is initiated to enable the change to be made. The RTR Analysis Report, generated for each container, includes the Waste Material Parameters, IDC, and weights. NCRs are generated as needed. RTR Analysis Report for container 10005612 has NCR number 7675 associated with it, and RTR Analysis Report for container BN10006165 has NCR number 4509 associated with it. <u>Objective evidence reviewed:</u> (1) RTR Analysis Report for container BN10005612 with NCR number 7675 attached (2) RTR Analysis Report for container BN10006165 with NCR number 4509 attached
		The site evaluates the accuracy and reproducibility of data, for example: • Independent replicate scans and replicate observations of the RTR recording are performed	Y	Independent observations and replicate scans are performed as required. The software used does not allow the operator to close a batch until the replicate examination and independent observation are completed.

Attachment A.3: Real-Time Radiography (RTR) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
		• Independent replicate examinations are performed on one waste container per day per testing (whichever is less frequent) • Independent observations of one examination (not the replicate) are performed once per day per testing, whichever is less frequent, by a qualified RTR operator (anyone but the initial RTR operator) • Qualified radiography personnel other than the operator perform oversight functions, including periodic audio/videotape reviews of accepted waste containers.		Reviewed RTR Analysis Reports for container number 10016182 that was subject to an independent observation. The original Analysis ID was 0000015093 and the independent observation was Analysis ID was 0000015099. Reviewed RTR Analysis Reports for container number 10016184 that was subject to a replicate scan. The original Analysis ID was 0000015094 and the replicate scan was Analysis ID was 0000015097. In batch RTR04-00335, the replicate was performed on container number BN10022785 and the independent observation was performed on drum number BN10022802. These QC checks were performed by independent operators. Interviewed RTR ITRs Judy Petersen-Campbell, Reed Walker and Joe Poirier. Verification of operator qualification is performed at the data generation level by the ITR. Verification that the replicate scan and independent observation are performed is made by the ITR, TS, and QAO in their respective review checklists. <u>Objective evidence reviewed:</u> (1) RTR Analysis Report for container number BN10016182 (2) RTR Analysis Report for container number BN10016184 (3) Batch Data Report for batch number RTR04-00335
		• Site implemented an automated RTR data entry system to facilitate data entry to the WWIS.	Y	The WTS system is utilized to enter RTR data. Observed the RTR evolution for drum number BN10031967 during the audit. The RTR operator

Attachment A.3: Real-Time Radiography (RTR) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
		• Direct data entry into an electronic form is done by the RTR operator using a computer while the operator is still in the RTR booth. • The electronic data file undergoes the same quality control (QC) checks used for hand-written data entries		entered the data into the electronic form concurrently with the examination. Data is reviewed, at data generation level, by the ITR, TS, and QAO. Project level reviews are performed by the SQAO and SPM. Objective evidence reviewed: (1) Batch Report No. RTR04-00335 (2) RTR Analysis Report for containers BN10002936, BN10006165, BN10005612, BN10016182, BN10016184, and BN10021323
		• RTR operator has received lessons-learned information based on the comparison of RTR and VE data.	Y	Reviewed Batch Report VVE05-00201, drum number BN10002936, which was examined as a VE QC check of RTR. The report contained the RTR/VE Comparison Report. Training is performed by the AMWTP VEE, Vince Medina, to ensure that RTR operators receive the lessons learned from the VE/RTR comparison. Objective evidence reviewed: (1) Training roster for "RTR/VE Feedback," dated 8/4/04 (2) Batch Report for VVE05-00201, container BN10002936
		• RTR operator adequately explained the process followed for examining a drum and entering data into data forms (whether hard copy or electronic data entry is used).	Y	The RTR evolution for drum number BN10031967 was observed during the audit. Data entry was performed electronically into the WTS system. Reviewed audio/video recording for drum numbers BN10002936, BN10021668, BN10016215, BN10004014, and Richard Steffens training drum QAPjP001. For drum numbers BN10002936 and BN10004014, the operator did not call out the items found in the

Attachment A.3: Real-Time Radiography (RTR) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
				drum during the scan. Drum number 10021668 contained a sealed metal pipe. The pipe had a welded bottom with a threaded cap at the top. The volume of the sealed pipe appeared to be above 4 liters. The DOE auditor, with concurrence by the EPA inspector, documented these concerns as DOE CAR 05-013.

Attachment A.4: Visual Examination (VE) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/Comment
Site procedures identify required training and qualifications for VE personnel	MP-RTQP-14.19, MP-RTQP-14.20, MP-RTQP-14.6	• VE expert's explanation of job duties was consistent with applicable procedures • VE expert could name prohibited items • VE expert's explanation of required actions if prohibited items were encountered was consistent with procedure • VE expert could identify applicable policies and procedures governing the operation of VE equipment • VE expert adequately explained the consequences of misidentifying prohibited items	Y	The Visual Examination Expert (VEE), Vincent Medina, was interviewed during the audit and he explained the VE evolution procedure for both the box line operations and VE as a QC check for RTR. The VE processing of container number BN10002936 was observed during the audit. Training for Mr. Medina was reviewed and was current. The box line VE process was observed during the audit (source container 10027424). During this operation the boxes are delivered to the facility after RTR (note: this RTR event is not WIPP-compliant). Prohibited items are removed and if the prohibited item cannot be treated, it is returned to M&O. The drums that the waste is loaded into after the visual examination are non-vented as they are "pucked" at a later date. A video tape is not made of this VE evolution. The evolution for VE as a QC check for RTR is both video and audio recorded. The procedures and policies governing this operation are the Certification Plan, QAPjP, and INST-FOI-17. Note: the DOE/CTAC checklist for VE stated that the controlling document was INST-FOI-34. INST-FOI-34 was written for VE of S3000 waste. <u>Objective evidence reviewed:</u> (1) Certification Plan for INL Contact-Handled Transuranic Waste, MP-TRUW-8.1, R.7 (2) Quality Assurance Project Plan (QAPjP), MP-TRUW8.2, R.3 (3) Facility Visual Examination Operations, INST-FOI-17, R.3 (4) Batch Report for VVE05-00201, container 10002936 (5) Employees by Qualifications/Certifications, FQPOT10A – Visual Examination (6) Training Manual for Technical Supervisor/Quality Assurance (TS/QA)(RTR, Coring, VE) & Visual Examination Expert (VEE) Vince Medina

Attachment A.4: Visual Examination (VE) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/Comment
		• VE expert's training was consistent with applicable procedures • VE expert's certification is current	Y	The training file for the VEE (Vince Medina) was reviewed and found to be current. Objective evidence reviewed: (1) Training Manual for Technical Supervisor/Quality Assurance (TS/QA)(RTR, Coring, VE) & Visual Examination Expert (VEE) Vince Medina, dated 8/5/04
		• VE expert identified the types of waste matrices, parameters, and specific items likely to be encountered at this specific site • Operator identified typical items • Operator identified the various waste container packaging configurations and liners • VE expert had been tested on examining waste containers with items common to the waste streams generated/stored at the site	Y	Two of the operators (Jason Bottles and Michael Loftus) were interviewed and observed during the VE evolution for the box line. Operators Brad Scholes, Jeff Martinez, Fred Pearson, and Scott Baguley were interviewed during VE as a QC check for RTR evolution. All operators were found to be adequately trained and could identify prohibited items and various items contained within the drum. Item identification is based on experience rather than testing (there is no VE test drum). Before becoming qualified to work independently, operators are required to work beside an experienced operator and completion of their training is documented in their training file. Mr. Medina (VEE) was interviewed and was able to describe all VE operations. The training files for the VEE and the above operators were reviewed and found to current. Objective evidence reviewed: (1) Qualification Package for Jason Bottles, dated 4/10/04 (2) Qualification Package for Michael Loftus, dated 4/14/04 (3) Employees by Qualifications/Certifications, FQPOT10A – Visual Examination (4) Training Manual for Technical Supervisor/Quality Assurance (TS/QA)(RTR, Coring, VE) & Visual Examination Expert (VEE) Vince Medina, dated 8/5/04
		• VE expert/reader's explanation of how to operate the data recording system was consistent with applicable procedures	Y	The WTS system is utilized to electronically record the VE evolution data. Two qualified (Jason Bottles and Michael Loftus) VE operators performed the box line operations. One operator manipulated the waste

Attachment A.4: Visual Examination (VE) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/Comment
		• The video camera was focused prior to the start of VE • VE experts verbal description of the inner bag/packages inventory was recorded • If an automated data entry system is used, the VE expert could navigate through the various screens		and the other input the data into the WTS system. Both operators concurred on data to be entered into the data file and both signed to accept the data. During the demonstration the VE process was paused so that consultation with the VEE could take place. For the evolution of VE as a QC of RTR, both video and audio recording takes place (record on four channels concurrently). A DVD is made and then a VHS recording is made. The VEE is required to be present while this examination is performed, and he is also required to accept the data by signing the electronic form. Both VE events observed were performed in accordance with procedure instructions and the prerequisite checks were completed. It was noted that all operators (except for those working in the glove box) used the procedure as a working document and the procedural steps were continually reviewed during operations. Objective evidence reviewed: (1) Batch report number VVE05-00201, 1 container, Waste Matrix Code S5126 (2) Form 1564, Turnover Checklist for box line operations, dated 2/28/05 (3) Special Case Waste/Drum Repack Station, Form 1565, dated 3/1/05 (log for VE as a QC check for RTR drum evolution observed).
Current versions of all relevant procedures and technical guidance documents were located in the VE room	INST-FOI-17, R.3	VE procedures: • Instruct employees on how to conduct a VE from start to finish • Are sufficiently detailed to enable the operator to determine if a waste container meets the criteria of §194.24 with regard to identifying applicable parameters with waste limits	Y	Observed demonstration of VE of container 10002936 (QC check for RTR) from setup of equipment to end of examination. Prohibited items are segregated and documented in the WTS in box line operations. WTS contains a standard list of wastes, including material and waste parameter with associated weights. WTS automatically calculates weights of items found based on those lists. All bags are opened during the VE as a QC check of RTR evolution. This examination is performed in a glove box. Note: Procedure INST-FOI-34 was written for VE of S3000 waste and

Attachment A.4: Visual Examination (VE) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/Comment
		• Outline the steps to be taken by the examiner if a prohibited item is identified • Establish standard nomenclature, based on current site practice, so that all staff recognize waste by the same descriptors		procedure INST-FOI-17 for S5000. Although there are only a few differences between procedures 17 and 34, the DOE/CTAC checklist was written for INST-FOI-34, while the audit was for S5000 waste only. Objective evidence reviewed: (1) Batch report number VVE05-00201, 1 container, Waste Matrix Code S5126 (VE evolution observed during the audit) (2) Special Case Waste/Drum Repack Station, Form 1565, dated 3/1/05 (log for VE as a QC check for RTR drum evolution observed).
		• If the bags are not opened, a brief written description of the contents of the bags is prepared with estimates of the amount of each waste type in the bags • The site uses AK to identify the matrix parameter category and to estimate waste material parameters present	Y	The operators have the AK records available for reference in the VE areas. The WTS includes waste parameters and their associated weights. For both the box line and RTR QC check VE events, all bags are opened. Objective evidence reviewed: (1) Batch report number VVE05-00201, 1 container, Waste Matrix Code S5126 (2) Batch report number VEB05-00081, 10 containers, with Waste Matrix Codes of S5330 or S5112.
There is a procedure for handling instances when the VE Expert is unable to see through the inner plastic bags/packages/containers of waste	IST-FOI-17, R.3, S.4.6 & 4.9	• The VE expert has decision-making criteria for assessing the need to open the bags/packages in order to identify all of their contents	Y	For both the box line and RTR QC check VE events, all bags are opened. Objective evidence reviewed: (1) Batch report number VVE05-00201, 1 container, Waste Matrix Code S5126 (2) Batch report number VEB05-00081, 10 containers, with Waste Matrix Codes of S5330 or S5112.
		Prior to starting the VE, the VE expert reviewed all documented data related to the waste container and its contents • If the VE expert determined in advance to open all bags/packages in a waste container of a particular TRUCON code,	Y	For both the box line and RTR QC check VE events, all bags are opened. Objective evidence reviewed: (1) Batch report number VVE05-00201, 1 container, Waste Matrix Code S5126 (2) Batch report number VEB05-00081, 10 containers, with Waste Matrix Codes of S5330 or S5112.

Attachment A.4: Visual Examination (VE) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/Comment
		matrix parameter category, and/or IDC, this decision was based on AK or data from previous examinations of the waste • The VE expert documented the basis for these decisions		
		VE Staff have access to standardized charts or tables to aid in the consistent estimation/assignment of weights, waste material parameters, and waste matrix codes • The estimated WMP weights are determined by compiling an inventory of waste items, residual materials and packing materials • The items on the inventory are sorted by WMP and combined with a standard weight look-up table to provide an estimate of WMP weights • Reference tables are updated as the site gains information from VE	Y	The WTS contains standard tables that are used during data entry. Weights are automatically calculated from the number of entries for each item and the standard weights. Reviewed reports VEB05-00041, VEB05-00051, VEB05-00081, VEB05-00101, VEC05-00083 and VVE05-0021 during the audit. Objective Evidence reviewed: (1) Batch report number VVE05-00201, 1 container, Waste Matrix Code S5126. (2) Batch report number VEB-05-00081, 10 containers, Waste Matrix Code S5330 or S5112.
		The VE expert's description of the contents of the waste container include: • Height and shape of the waste in the container, so that the volume of the container and the volume utilization percentage can be determined • Estimation of the utilized waste container volume percentage using the highest point and shape of waste in a waste container	Y	During the box line operation demonstration, the operators documented in the WTS the estimated percentage the drum fill factor (55-gallon drum used for repackaging). Reviewed batch reports VEB05-00041, VEB05-00061, VEB05-00081, VEB05-00101, VEC05-00083, and VVE05-00201 during the audit, Objective evidence reviewed: (1) Batch report number VVE05-00201, 1 container, Waste Matrix Code S5126 (2) Batch report number VEB05-00081, 10 containers, with Waste Matrix Codes of S5330 or S5112.

Attachment A.4: Visual Examination (VE) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/Comment
		The VE expert describes the location, container, and estimated volume (as a percent of the container volume and depth of liquid within the container) of any liquids detected		
		VE staff record the VE image and observations • A VE data form is used to document the matrix parameter category and estimated WMP weights of the waste • An audio/videotape is made of the waste container exam and maintained as a nonpermanent record	Y	The WTS system is utilized to electronically record the VE evolution data. For the evolution of VE as a QC of RTR, both video and audio recording takes place (recorded on four channels concurrently). A VHS recording is subsequently made from the digitally recorded data. The VEE is required to be present while this type of examination is performed, and he is required to accept the data by signing the electronic form. The WTS contains tables correlating waste items to standard weights or volumes and a Waste Parameter table that calculates weight based as percentage of the container contents. Objective evidence reviewed: (1) Batch report number VVE05-00201, 1 container, Waste Matrix Code S5126 (2) Form 1564, Turnover Checklist for box line operations, dated 2/28/05 (3) Special Case Waste/Drum Repack Station, Form 1565, dated 3/1/05 (log for VE as a QC check for RTR drum evolution observed).
		The number of liners and types of liners present in the waste container is documented • Individual inner bags/packages, if present, are removed from the poly liner(s) • All inner bag/packages are labeled and weighed using a calibrated mass balance	Y	NA for box line operations. The operator performed a calibration check on the scale used for weighing of bags, packaging, and waste. During the review of the audio/video tape of this VE event, it was observed that the position of the scale readout was such that it was not recorded by the cameras. The DOE auditor, with concurrence by the EPA inspector, documented this concern as DOE CAR 05-010.

Attachment A.4: Visual Examination (VE) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/Comment
				Objective evidence reviewed: (1) Batch report number VVE05-00201, 1 container, Waste Matrix Code S5126
		The inventory includes a description of all waste items, residual materials, packaging materials, and/or waste material parameters contained both in and outside of the inner bag/package • Estimates of the weights of the waste items, residual materials, packaging materials and/or waste material parameters are recorded on both audiotape and the VE data form • The weight of the empty container and its rigid poly liner, if present, is recorded and documented • The gross weight of the waste container (container plus contents) is recorded on the VE data form • The total number of bags/packages is recorded on the data form	Y	During the glove box VE demonstration, the weight of the 90 mil liner, plastic bagging waste, breached plastic bags, partial fiberboard liner, and filtered bag were determined and documented in the WTS. The number of each item was recorded and the weights calculated by the WTS system. Weights for the drum are documented on the Analysis Report page for each drum ("VE Weight" and "Net Weight ") Objective evidence reviewed: (1) Batch report number VVE05-00201, 1 container, Waste Matrix Code S5126 (2) Batch report number VEB05-00081, 10 containers, with Waste Matrix Codes of S5330 or S5112.
		VE testing data reports: • Provide batch/sample identification number • Identify the appropriate matrix parameter categories listed in the BIR that contain information sufficient to estimate weights of waste material parameters	Y	The following VE data packages were reviewed during the onsite audit: VEB05-00041, VEB05-00061, VEB05-00081, VEB05-00101,VEC05-00083, and VVE05-00201. No problems were identified during review of the data packages. The batch and container numbers are provided on the Batch Report Coversheet. Batch report number VEB05-00081 included ITR, TS, and QA generation level checklists. The SQAO and SPM checklists were also contained in the report. These checklists were completed and signed

Attachment A.4: Visual Examination (VE) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/Comment
		• Contain data review checklists for each test verifying that the data generation level review, validation, and verification took place		as required. Objective evidence reviewed: (1) Batch report number VVE05-00201, 1 container, Waste Matrix Code S5126 (2) Batch report number VEB05-00081, 10 containers, with Waste Matrix Codes of S5330 or S5112.
There is a procedure for determining whether the waste stream assignment, hazardous waste codes, and weights were correctly assigned	INST-FOI-17, R.3	• The procedure is adequately implemented • Corrective actions are taken when necessary	Y	Observed VE of box line operations and VE as a QC check of RTR. Operators consistently referenced procedure INST-FOI-17 during performance of the VE activities. Actions required when prohibited are contained in Sections 4.6.14 and 4.812-4.8.15 of this procedure. The presence or absence of prohibited items is documented in the WTS. The following VE data packages were reviewed during the onsite audit: VEB05-00041, VEB05-00061, VEB05-00081, VEB05-00101,VEC05-00083, and VVE05-00201. No problems were identified during review of the data packages. EPA codes are included as part of the VE Analysis Report. Objective evidence reviewed: (1) Batch report number VVE05-00201, 1 container, Waste Matrix Code S5126 (2) Batch report number VEB05-00081, 10 containers, with Waste Matrix Codes of S5330 or S5112
		The site evaluates the accuracy and reproducibility of data, for example: • Independent replicate weighing of 1/20 items and replicate observations of the VE	Y	The WTS software requires that one (1) in ten (10) items is reweighed and must meet the acceptance criterion (INST-FOI-17, R.3, S.4.6.31.4). Independent checks are not required for the box line operations. The following VE data packages were reviewed during the onsite audit:

Attachment A.4: Visual Examination (VE) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/Comment
		video are performed • Independent replicate exams are performed on one waste container per day per testing (whichever is less frequent) • Independent observations of one exam (not the replicate exam) are performed once per day per testing, whichever is less frequent, by a qualified VE expert (anyone but the initial VE expert)		VEB05-00041, VEB05-00061, VEB05-00081, VEB05-00101,VEC05-00083, and VVE05-00201. No problems were identified during review of the data packages. Objective evidence reviewed: (1) Batch report number VVE05-00201, 1 container, Waste Matrix Code S5126 (2) Batch report number VEB05-00081, 10 containers, with Waste Matrix Codes of S5330 or S5112.
		• The VE expert assesses the accuracy of the TRUCON code, matrix parameter category, and/or IDC • The VE expert recommends and documents changes	Y	The VEE is required to sign the WTS forms accepting the information contained within the WTS. Data generation level checklists verify that the waste material parameters are documented correctly and the IDC, WMC, and waste stream description match the physical form of the waste. Changes are documented in the WTS system. The VE Analysis Report indicated any changes in IDC or verification of the original IDC. The VEE has access to the Waste Matrix Code Reference Manual, BNFL-5332-RPT-TRUW-05, if necessary. The following VE data packages were reviewed onsite: VEB05-00041, VEB05-00061, VEB05-00081, VEB05-00101, and VEC05-00083. Objective evidence reviewed: (1) Batch report number VVE05-00201, 1 container, Waste Matrix Code S5126 (2) Batch report number VEB05-00081, 10 containers, with Waste Matrix Codes of S5330 or S5112.
		Prior to videotaping/recording a VE, operational checks are conducted at the beginning of each work shift • These checks include observation of a test	Y	For both box line operations and VE as a QC check of RTR, daily checks are performed. Reviewed batch reports VEB05-00041, VEB05-00061, VEB05-00081, VEB05-00101, VEC05-00083, and VVE05-00201 during the audit.

Attachment A.4: Visual Examination (VE) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/Comment
		pattern to ensure that the VE system has adequate video quality		Objective evidence reviewed: (1) Form 1564, Turnover Checklist for box line operations, dated 2/28/05 (2) Special Case Waste/Drum Repack Station, Form 1565, dated 3/1/05 (log for VE as a QC check for RTR drum evolution observed).
The site has a procedure for using the data obtained from VE to determine the percentage of miscertified waste containers • The site uses a historical miscertification rate of 2% to calculate the number of waste containers that must be visually examined in the first year • The site established a site-specific miscertification rate • The sites revised miscertification rate is based on the last 12 (or more) months of certification activities • The facility has a procedure for randomly selecting waste containers	MP-TRUW-8.19, R.6	• The annual number of waste containers undergoing characterization is appropriately calculated • The miscertification rate is within the range presented in Table 5-1, p. 19 of the QAPP (1% to 6%); if not, alternative calculations are provided for review • Only waste containers certified for compliance with WIPP-WAC and TRAMPAC were randomly selected	Y	The annual number of waste containers undergoing characterization is calculated by the SPM. Memorandum dated 8/12/04, Establishment of Summary Category Miscertification Rate for S5000, contains a list of the candidate drums and the drums selected. Memorandum dated 8/12/04, Establishment of Initial Rate (includes calculation worksheet), identifies replacement drums. No S5000 drums were miscertified and the miscertification rate was set at 1%. The calculation worksheet is contained in the initial rate memorandum (objective evidence number 1). The initial miscertification was 11%, resulting in 50 drums undergoing VE. Objective evidence reviewed: (1) Memorandum, dated 8/12/04, Establishment of Initial Rate (includes calculation worksheet). (2) Memorandum, dated 8/12/04, Establishment of Summary Category Miscertification Rate for S5000. (3) Memorandum, dated 2/28/05, Establishment of Summary Category Miscertification Rate for S5000 - Addendum. (4) Memorandum, dated 8/11/04, Establishment of Summary Category Miscertification Rate for S3000.

Attachment A.4: Visual Examination (VE) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/Comment
The facility has a replacement strategy for selecting waste containers • The replacement strategy is restricted to a waste stream or waste stream lot that, through the random selection process, happens to have container(s) identified for VE	MP-TRUW-8.19, R.6	• Replacement VE is performed on the sampled containers • If fewer containers were visually examined than were sampled, the replacements were selected randomly from the population of sampled containers • The replacement containers were from a different lot	Y	Replacement containers are from the same lot and have been characterized. Memorandum dated 8/12/04, Establishment of Summary Category Miscertification Rate for S5000, contains a list of the candidate drums and the drums selected. Memorandum dated 8/12/04, Establishment of Initial Rate (includes calculation worksheet), identifies replacement drums. Objective evidence reviewed: (1) Memorandum, dated 8/12/04, Establishment of Initial Rate (includes calculation worksheet). (2) Memorandum, dated 8/12/04, Establishment of Summary Category Miscertification Rate for S5000.
		• Once containers have been visually examined, the UCL_{90} for the proportion miscertified is calculated • The site adequately demonstrated that corrective actions taken after VE of containers to improve certification accuracy are not used to adjust the visual examination results and the UCL_{90} • The site has used the appropriate distribution for the UCL_{90} calculation to determine N.	Y	No S5000 drums were miscertified and the miscertification rate was set at 1%. The calculation worksheet is contained in the initial rate memorandum (objective evidence number1). Replacement drums were selected as needed from the original list of candidate drums. Objective evidence reviewed: (1) Memorandum, dated 8/12/04, Establishment of Initial Rate (includes calculation worksheet). (2) Memorandum, dated 8/12/04, Establishment of Summary Category Miscertification Rate for S5000. (3) Memorandum, dated 2/28/05, Establishment of Summary Category Miscertification Rate for S5000 - Addendum.

Attachment A.5: WIPP Waste Information System (WWIS) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/Comments
Procedures require WWIS and Data Expert/Staff to be trained to assess data and properly enter transfer data in the WWIS.	MP-TRUW-8.16, s. 4.1.1.6	• Employees explanation of job duties was consistent with applicable procedures	Y	Personnel are trained to Advanced Mixed Waste Treatment Project (AMWTP) procedure MP-TRUW-8.16, Rev. 14, effective date 12/30/04. During the audit, Cristy Winterbottom (Waste Certification Official, WCO) and Nikki Wartchow (Waste Certification Assistant, WCA) entered data into the required forms prior to submittal to WWIS for drum number BN10010973. Because the data for this drum had already been transmitted to WWIS, the data was entered into a temporary file that could be deleted. Characterization data must be approved by WIPP before the drum can be processed for certification in WWIS. All NCRs must be closed prior to data entry. Successful NCR closure is reported as a memorandum from the PLV&V QA Manager to the TRU Program Manager. <u>Objective evidence reviewed:</u> (1) AMWTP procedure MP-TRUW-8.16, Rev 14 (2) Training record for WCO, Christy Winerbottom (3) Training record for WCA, Nikki Wartchow (4) Completed Form 1221 for drum number BN10010973 (dated 2/21/05) (5) Data Reconciliation memorandum, dated 2/14/05.
		• WWIS and Data Expert/Staff are trained to assess data and properly enter and transfer all data in the WWIS	Y	The data were entered into Form 1221 (WWIS Characterization and Certification Data form) in the WTS by the WCA. The data were reviewed by the WCA; the WCO then performs an independent review of the data and signs this form. Form 1384 (CH TRU Waste Certification Statement) is automatically

Attachment A.5: WIPP Waste Information System (WWIS) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/Comments
		• Data entry personnel and data reviewers/verifiers are trained on the WWIS system using the WIPP Waste Information System User's Manual and the appropriate site procedures?		populated from the information contained in Form 1221. The training records for the WCO and WCA were reviewed. The WIPP Waste Information System User's Manual is required training for personnel. For example, the WIPP Waste Information System User's Manual is item 2.15 on the Skill Set training requirement for the WCA. Objective evidence: (1) CH TRU Waste Certification Statement for drum number BN10010973 (2) Training equivalency Verification Form, Darrin Hovis, WCO/TCO.
		• WWIS and Data Expert/Staff adequately explained how data are assessed, input, and transferred into the WWIS.	Y	The data entry for drum number BN10010973 was observed during the audit. Objective evidence reviewed: (1) AMWTP procedure MP-TRUW-8.16, Rev 14 (2) Training record for WCO, Christy Winerbottom (3) Training record for WCA, Nikki Wartchow (4) Completed Form 1221 for drum number BN10010973 (dated 2/21/05) (5) CH TRU Waste Certification Statement for drum number BN10010973
		• For those sites entering data into WWIS using electronic methods, data entry personnel and data reviewers/verifiers are trained on the site's data system using appropriate site procedures	Y	Personnel are trained to Advanced Mixed Waste Treatment Project (AMWTP) procedure MP-TRUW-8.16, Rev. 14, effective date 12/30/04. During the audit, Cristy Winterbottom (Waste Certification Official, WCO) and Nikki Wartchow (Waste Certification Assistant, WCA) entered data into the WWIS for drum number BN10010973, IDC 001. Because this drum information had already been transmitted to WWIS, the data were entered into a

Attachment A.5: WIPP Waste Information System (WWIS) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/Comments
				temporary file. If certification is required for the drum, the temporary file is printed and the data reviewed against the 1221 form. Only after this review are the data submitted to WWIS (in the pre-submittal file). Prior to tramsmittal to WWIS, project level reconciliation of data must be completed. <u>Objective evidence reviewed:</u> (1) AMWTP procedure MP-TRUW-8.16, Rev 14 (2) Training record for WCO, Christy Winerbottom (3) Training record for WCA, Nikki Wartchow (4) Completed Form 1221 for drum number BN10010973 (dated 2/21/05) (5) CH TRU Waste Certification Statement for drum number BN10010973 (6) Data Reconciliation memorandum, dated 2/14/05
		• Generation level data review checklists and reports are complete and have been verified by SPO and SQAO review for each waste container.	Y	Drum file contains all information required for WWIS entry. The HSG, RTR, and NDA information contain the SQAO and SPM review checklists. These checklists include verification that all data generation checklists have been completed. <u>Objective evidence reviewed:</u> (1) Headspace Gas, NDA, and RTR Batch Data Reports for drum number BN10010973
		• Generation level data packages contain the following information: – Sampling, testing, and batch analytical data reports – Data review checklists	Y	Drum file contains all information required for WWIS entry. The HSG, RTR, and NDA information contain the SQAO and SPM review checklists. These checklists include verification that all data generation checklists have been completed.

Attachment A.5: WIPP Waste Information System (WWIS) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/Comments
		• Reviews and verification of generation level data packages are complete		Objective evidence reviewed: (1) Headspace Gas, NDA, and RTR Batch Data Reports for drum number BN10010973
		• Project level data packages contain the following information for each waste container: – Data validation summary – Analytical results • Reviews of project level data packages are complete	Y	The data validation summary is contained in the Characterization Information Summary Report that correlates container identification number and the corresponding data package numbers (Form 1598). Drum file contains analytical data for HSG, RTR, and NDA, which are reviewed by the SQAO and SPM. Objective evidence reviewed: (1) Characterization Information Summary Report, dated 2/14/05 (2) Headspace Gas, NDA, and RTR Batch Data Reports for drum number BN10010973
There are adequate procedures for treatment of nonconforming data	MP-TRUW-8.16, s. 4.4.2.18-20	• Procedures for nonconforming data are adequately implemented	Y	If nonconforming data are identified, these data can be pulled out of the WWIS. These changes can only be processed by the WWIS Administrator at the request of the Idaho DOE. The WWIS Administrator can either reject the subject data or return it to the pre-submittal status. The site is informed of any actions by e-mail. AMWTP Form 1021 (Management Assessment Report) is completed to document final review of data entry. Objective evidence reviewed: (1) E-mail, dated 6/2/04, stating that container BN10000194 was approved for certification (2) E-mail, dated, 12/21/04, returning container BN10005832 to pre-submittal status (3) E-mail, dated,1/19/05, rejecting container BN10002878 for certification (4) Management Assessment Report, dated 2/21/05, for container BN10010973

Attachment A.5: WIPP Waste Information System (WWIS) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/Comments
Security measures for ensuring data integrity and accessing WWIS are sufficient • System access • Access log review	MP-TRUW-8.16, s. 4.1 & 4.2		Y	All personnel requiring access to the system must be granted access by completing a WIPPnet Remote Access Request Form. The completed forms are maintained in Carlsbad and copies were not available at the site. The forms used for data entry (1221 and 1384) are located on the Intranet and require a password for log on. WWIS data entry has a double password access requirement. Objective evidence reviewed: (1) WIPPnet Remote Access Request Form (blank)
There are adequate procedures for entering data into the WWIS	MP-TRUW-8.16, R.14	• Procedures for entering data into the WWIS are adequately implemented	Y	For the purpose of demonstration, data for drum number BN10010973 was entered into the required AMWTP forms (1221 and 1384), converted to an ACSII file and submitted to the temporary file in WWIS (the drum had previously been successfully entered into the WWIS). If certification was required for the drum, the temporary file is printed and the data reviewed against the 1221 form. Only after this review is the data submitted to the WWIS. Personnel are trained to Advanced Mixed Waste Treatment Project (AMWTP) procedure MP-TRUW-8.16, Rev. 14, effective date 12/30/04. During the audit, Cristy Winterbottom (Waste Certification Official, WCO) and Nikki Wartchow (Waste Certification Assistant, WCA) entered data into the WWIS for drum number BN10010973, IDC 001. Objective evidence reviewed: (1) AMWTP procedure MP-TRUW-8.16, Rev 14 (2) Training record for WCO, Christy Winerbottom (3) Training record for WCA, Nikki Wartchow

Attachment A.5: WIPP Waste Information System (WWIS) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/Comments
				(4) Completed Form 1221 for drum number BN10010973 (dated 2/21/05) (5) CH TRU Waste Certification Statement for drum number BN10010973
	MP-TRUW-8.16, S. 4.4.1, 4.4.2.6	• Data entered into the WWIS consistent with WIPP requirements, i.e., data fields are populated [See Attachment 1 for list of required data fields]	Y	The drum file data for container number BN10010973 were reviewed during the audit, and the items required by Attachment 1, except for packaging number and assembly ID, were verified. Packaging number and assembly ID are associated with transportation and were not present in the drum file. The WCO reviews Forms 1221 and 1384 to verify that the data are correct and WIPP compliant. <u>Objective evidence reviewed:</u> (1) Completed Form 1221 for drum number BN10010973 (dated 2/21/05) (2) Characterization Information Summary Report, dated 2/14/05 (3) Headspace Gas, NDA and RTR Batch Data Reports for drum number BN10010973 (4) CH TRU Waste Certification Statement for drum number BN10010973
The edit/limit checks contained in the WWIS system are appropriate for the site • Approved radioassay methods • Approved characterization methods • Approved analyte detection methods	MP-TRUW-8.16, S. 4.4.2.6, Note above	• The edit/limit checks are appropriate.	Y	The site has successfully submitted over 1300 drums to the WWIS to date. The site utilizes the WIPP Waste Information System Characterization Methods by Site report to ensure that only approved methods are used for characterization. The characterization methods used are contained in this report. The radionuclide data are processed in a separate spreadsheet that calculates if the data are WWIS-

Attachment A.5: WIPP Waste Information System (WWIS) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/Comments
				compliant. The calculation used is the same as that used by WWIS. Objective evidence reviewed: (1) Headspace Gas, NDA, and RTR Batch Data Reports for drum number BN10010973 (2) Characterization Methods by Site, dated 3/3/05
		• The site adequately demonstrated its ability to transmit waste container characterization data to the WIPP using the WWIS	Y	The site has successfully submitted over 1300 drums to the WWIS to-date. The characterization data must be approved by WIPP before the drum can be processed for certification in WWIS (MP-TRUW-8.16, S. 4.4.1). Objective evidence reviewed: (1) E-mail, dated 6/2/04, stating that container BN10000194 was approved for certification
		• The site adequately demonstrated its ability to receive information from the WIPP via the WWIS, including e-mail notifications	Y	E-mail notifications of container status are received by the site. Three e-mails, showing different container dispositions, were reviewed during the audit. Objective evidence reviewed: (1) E-mail, dated 6/2/04, stating that container BN10000194 was approved for certification (2) E-mail, dated, 12/21/04, returning container BN10005832 to pre-submittal status (3) E-mail, dated,1/19/05, rejecting container BN10002878 for certification
		• The site adequately demonstrated its ability to print the appropriate waste container characterization data reports for data submitted to	Y	Waste characterization data are contained in the drum file, which is used to complete the necessary data entry. Data reports (RTR, HSG, NDA) for drum BN10010973 were reviewed during the audit.

Attachment A.5: WIPP Waste Information System (WWIS) Checklist

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/Comments
		WIPP using the WWIS		Objective evidence reviewed: (1) Headspace Gas, NDA, and RTR Batch Data Reports for drum number BN10010973
The site has adequate procedures that require verification of the accuracy of waste container characterization data submitted to and received by WIPP using the WWIS Waste container data reports are required to be reconciled with site data	MP-TRUW-8.16, S. 1.0, 4.4.1	• Waste container characterization data submitted to and received by WIPP are verified • Waste container data reports are reconciled with site data	Y	Data are entered into WWIS characterization module and must be approved before WWIS entry for drum certification can take place Objective evidence reviewed: (1) CH TRU Waste Certification Statement for drum number BN10010973 (2) Data Reconciliation memorandum, dated 2/14/05 (3) Characterization Information Summary Report, dated 2/14/05 (4) Headspace Gas, NDA and RTR Batch Data Reports for drum number BN10010973
Procedures for waste container characterization data submitted to WIPP using the WWIS require that the following records be kept: • WWIS access requests • WWIS access logs • Waste container data input reports • WWIS waste container data reports	MP-TRUW-8.16, S. 5.0	The following records are kept: • WWIS access requests • WWIS access logs • Waste container data input reports • WWIS waste container data reports	Y	WWIS access requests and access logs are maintained in Carlsbad and no copies are kept at the site. As part of the procedure, the waste container data are entered into Form 1221. Data entry for container BN10010973 was observed during the audit. The drum file for drum BN10010973 was reviewed during the audit; this file contains the RTR, HSG, and NDA data reports. After completion of WWIS submission, the drum file is stored and used by transportation personnel. Objective evidence reviewed: (1) Headspace Gas, NDA, and RTR Batch Data Reports for drum number BN10010973 (2) WIPPnet Remote Access Request Form (blank)

WWIS Data Requirements

Container number - present	Radionuclide name - present
Site ID - present	Radionuclide activity - present
Waste stream profile number - present	Radionuclide activity uncertainty - present
Matrix code - present	Radionuclide mass - present
Trucon Code - present	Radionuclide mass uncertainty - present
Decay heat - present	Waste material parameter weight - present
Decay heat uncertainty - present	Radioassay method - present
Shipment number - present	Assay date - present
Packaging number - NA (transportation)	Characterization method - present
Assembly ID - NA (transportation)	Characterization method date - present
TRU alpha activity - present	Packaging layers - present
TRU alpha activity uncertainty - present	Alpha surface concentration - present
TRU alpha activity concentration - present	Dose rate - present
TRU alpha activity concentration uncertainty - present	Sample ID - present
Pu 239 equivalent activity - present	Sample type - present
Pu 239 fissile gram equivalent - present	Sample date - present
Pu 239 FGE uncertainty - present	Analyte - present
Handling code – present	Analyte concentration - present
Waste Type code – present	Analyte detection method - present

Attachments B.1 through B.12

Attachment B.1: Replicate Testing Data for Container 10000659, Z-211-102 System

Quantity of Interest	Original Measurement			Replicate #1			Replicate #2		
	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty
^{90}Sr Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{137}Cs Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{233}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{234}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{235}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{237}Np Activity (Ci)	1.39E-05	2.96E-06	21.3%	1.22E-05	2.55E-06	20.9%	1.26E-05	2.63E-06	20.9%
^{238}Pu Activity (Ci)	1.87E-01	4.43E-02	23.7%	1.73E-01	3.93E-02	22.7%	1.80E-01	4.07E-02	22.6%
^{238}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{239}Pu Activity (Ci)	6.89E+00	1.39E+00	20.2%	5.49E+00	1.10E+00	20.1%	5.56E+00	1.12E+00	20.1%
^{240}Pu Activity (Ci)	1.58E+00	3.21E-01	20.3%	1.28E+00	2.57E-01	20.1%	1.31E+00	2.63E-01	20.1%
^{241}Am Activity (Ci)	1.19E+00	2.42E-01	20.3%	1.34E+00	2.69E-01	20.1%	1.39E+00	2.79E-01	20.1%
^{241}Pu Activity (Ci)	1.24E+01	2.52E+00	20.3%	9.05E+00	1.83E+00	20.2%	9.39E+00	1.90E+00	20.2%
^{242}Pu Activity (Ci)	1.29E-04	2.92E-05	22.6%	1.03E-04	2.31E-05	22.4%	1.05E-04	2.35E-05	22.4%
TRU Alpha Conc. (nCi/g)	137,000	20,200	14.7%	117,000	16,500	14.1%	119,000	16,600	13.9%

Quantity of Interest	Replicate #3			Replicate #4			Replicate #5		
	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty
^{90}Sr Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{137}Cs Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{233}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{234}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{235}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{237}Np Activity (Ci)	1.17E-05	2.46E-06	21.0%	1.28E-05	2.68E-06	20.9%	1.21E-05	2.53E-06	20.9%
^{238}Pu Activity (Ci)	1.82E-01	4.10E-02	22.5%	2.07E-01	4.57E-02	22.1%	1.68E-01	3.88E-02	23.1%
^{238}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{239}Pu Activity (Ci)	5.50E+00	1.11E+00	20.1%	5.51E+00	1.11E+00	20.1%	5.56E+00	1.12E+00	20.1%
^{240}Pu Activity (Ci)	1.25E+00	2.51E-01	20.1%	1.26E+00	2.53E-01	20.1%	1.30E+00	2.61E-01	20.1%
^{241}Am Activity (Ci)	1.40E+00	2.83E-01	20.2%	1.35E+00	2.71E-01	20.1%	1.36E+00	2.73E-01	20.1%
^{241}Pu Activity (Ci)	9.41E+00	1.90E+00	20.2%	9.52E+00	1.92E+00	20.2%	9.20E+00	1.86E+00	20.2%
^{242}Pu Activity (Ci)	1.01E-04	2.26E-05	22.4%	1.02E-04	2.28E-05	22.4%	1.05E-04	2.35E-05	22.4%
TRU Alpha Conc. (nCi/g)	117,000	16,400	14.0%	117,000	16,400	14.0%	118,000	16,600	14.1%

Attachment B.2: Replicate Testing Results for Container 10000659, Z-211-102 System

Quantity of Interest	Original Measurement		Sample Mean	Sample Standard Deviation	Relative Standard Deviation	χ^2	Pr($x < \|\chi^2\|$)	t	Pr($x < \|t\|$)
	Reported Value	Absolute Uncertainty							
^{90}Sr Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{137}Cs Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{233}U Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{234}U Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{235}U Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{237}Np Activity (Ci)	1.39E-05	2.96E-06	1.23E-05	4.32E-07	3.5%	0.085	0.999	3.420	0.027
^{238}Pu Activity (Ci)	1.87E-01	4.43E-02	1.82E-01	1.50E-02	8.3%	0.461	0.977	0.303	0.777
^{238}U Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{239}Pu Activity (Ci)	6.89E+00	1.39E+00	5.52E+00	3.36E-02	0.6%	0.002	1.000	37.095	0.000
^{240}Pu Activity (Ci)	1.58E+00	3.21E-01	1.28E+00	2.55E-02	2.0%	0.025	1.000	10.742	0.000
^{241}Am Activity (Ci)	1.19E+00	2.42E-01	1.37E+00	2.59E-02	1.9%	0.046	1.000	-6.278	0.003
^{241}Pu Activity (Ci)	1.24E+01	2.52E+00	9.31E+00	1.87E-01	2.0%	0.022	1.000	15.052	0.000
^{242}Pu Activity (Ci)	1.29E-04	2.92E-05	1.03E-04	1.79E-06	1.7%	0.015	1.000	13.166	0.000
TRU Alpha Conc. (nCi/g)	137,000	20,200	117,600	894	0.8%	0.008	1.000	17.710	0.000

Quantity of Interest	χ^2 Test	t Test
^{90}Sr Activity (Ci)	#VALUE!	Not Applicable
^{137}Cs Activity (Ci)	#VALUE!	Not Applicable
^{233}U Activity (Ci)	#VALUE!	Not Applicable
^{234}U Activity (Ci)	#VALUE!	Not Applicable
^{235}U Activity (Ci)	#VALUE!	Not Applicable
^{237}Np Activity (Ci)	Not Significant	Significant
^{238}Pu Activity (Ci)	Not Significant	Not Significant
^{238}U Activity (Ci)	#VALUE!	Not Applicable
^{239}Pu Activity (Ci)	Not Significant	Highly Significant
^{240}Pu Activity (Ci)	Not Significant	Highly Significant
^{241}Am Activity (Ci)	Not Significant	Highly Significant
^{241}Pu Activity (Ci)	Not Significant	Highly Significant
^{242}Pu Activity (Ci)	Not Significant	Highly Significant
TRU Alpha Conc. (nCi/g)	Not Significant	Highly Significant

Attachment B.3: Replicate Testing Data for Container 10004600, Z-211-102 System

Quantity of Interest	Original Measurement			Replicate #1			Replicate #2		
	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty
^{90}Sr Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{137}Cs Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{233}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{234}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{235}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{237}Np Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{238}Pu Activity (Ci)	6.84E-05	3.06E-05	44.8%	5.31E-05	2.36E-05	44.5%	4.69E-05	2.12E-05	45.3%
^{238}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{239}Pu Activity (Ci)	2.30E-03	5.06E-04	22.0%	1.81E-03	3.87E-04	21.4%	1.60E-03	3.68E-04	23.0%
^{240}Pu Activity (Ci)	5.12E-04	1.21E-04	23.6%	4.02E-04	9.25E-05	23.0%	3.55E-04	8.66E-05	24.4%
^{241}Am Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{241}Pu Activity (Ci)	3.65E-03	1.05E-03	28.8%	4.20E-03	1.19E-03	28.3%	3.71E-03	1.09E-03	29.5%
^{242}Pu Activity (Ci)	6.72E-08	3.74E-08	55.7%	5.22E-08	2.90E-08	55.5%	4.61E-08	2.59E-08	56.1%
TRU Alpha Conc. (nCi/g)	72	13	18.0%	57	10	17.7%	50	9	18.0%

Quantity of Interest	Replicate #3			Replicate #4			Replicate #5		
	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty
^{90}Sr Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{137}Cs Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{233}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{234}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{235}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{237}Np Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{238}Pu Activity (Ci)	6.02E-05	2.66E-05	44.2%	5.97E-05	2.64E-05	44.3%	4.41E-05	2.06E-05	46.8%
^{238}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{239}Pu Activity (Ci)	2.05E-03	4.24E-04	20.7%	2.03E-03	4.24E-04	20.9%	1.50E-03	3.86E-04	25.7%
^{240}Pu Activity (Ci)	4.55E-04	1.02E-04	22.4%	4.52E-04	1.02E-04	22.6%	3.33E-04	9.02E-05	27.1%
^{241}Am Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{241}Pu Activity (Ci)	4.76E-03	1.32E-03	27.8%	4.72E-03	1.32E-03	27.9%	3.48E-03	1.10E-03	31.7%
^{242}Pu Activity (Ci)	5.91E-08	3.26E-08	55.2%	5.87E-08	3.25E-08	55.3%	4.33E-08	2.48E-08	57.3%
TRU Alpha Conc. (nCi/g)	64	11	17.2%	64	11	17.3%	47	10	21.3%

Attachment B.4: Replicate Testing Results for Container 10004600, Z-211-102 System

Quantity of Interest	Original Measurement		Sample Mean	Sample Standard Deviation	Relative Standard Deviation	χ^2	Pr($x < \lvert\chi^2\rvert$)	t	Pr($x < \lvert t \rvert$)
	Reported Value	Absolute Uncertainty							
^{90}Sr Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{137}Cs Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{233}U Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{234}U Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{235}U Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{237}Np Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{238}Pu Activity (Ci)	6.84E-05	3.06E-05	5.28E-05	7.30E-06	13.8%	0.227	0.994	1.952	0.123
^{238}U Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{239}Pu Activity (Ci)	2.30E-03	5.06E-04	1.80E-03	2.48E-04	13.8%	0.959	0.916	1.850	0.138
^{240}Pu Activity (Ci)	5.12E-04	1.21E-04	3.99E-04	5.53E-05	13.9%	0.839	0.933	1.858	0.137
^{241}Am Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{241}Pu Activity (Ci)	3.65E-03	1.05E-03	4.17E-03	5.79E-04	13.9%	1.212	0.876	-0.827	0.455
^{242}Pu Activity (Ci)	6.72E-08	3.74E-08	5.19E-08	7.17E-09	13.8%	0.147	0.997	1.950	0.123
TRU Alpha Conc. (nCi/g)	72	13	56	8	13.9%	1.441	0.837	1.662	0.172

Quantity of Interest	χ^2 Test	t Test
^{90}Sr Activity (Ci)	#VALUE!	Not Applicable
^{137}Cs Activity (Ci)	#VALUE!	Not Applicable
^{233}U Activity (Ci)	#VALUE!	Not Applicable
^{234}U Activity (Ci)	#VALUE!	Not Applicable
^{235}U Activity (Ci)	#VALUE!	Not Applicable
^{237}Np Activity (Ci)	#VALUE!	Not Applicable
^{238}Pu Activity (Ci)	Not Significant	Not Significant
^{238}U Activity (Ci)	#VALUE!	Not Applicable
^{239}Pu Activity (Ci)	Not Significant	Not Significant
^{240}Pu Activity (Ci)	Not Significant	Not Significant
^{241}Am Activity (Ci)	#VALUE!	Not Applicable
^{241}Pu Activity (Ci)	Not Significant	Not Significant
^{242}Pu Activity (Ci)	Not Significant	Not Significant
TRU Alpha Conc. (nCi/g)	Not Significant	Not Significant

Attachment B.5: Replicate Testing Data for Container 10033835, Z-390-100 System

Quantity of Interest	Original Measurement			Replicate #1			Replicate #2		
	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty
^{90}Sr Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{137}Cs Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{233}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{234}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{235}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{237}Np Activity (Ci)	2.45E-07	5.93E-08	24.2%	2.87E-07	5.74E-08	20.0%	1.61E-07	4.85E-08	30.1%
^{238}Pu Activity (Ci)	2.61E-03	2.66E-04	10.2%	4.61E-03	4.79E-04	10.4%	1.09E-03	1.26E-04	11.6%
^{238}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{239}Pu Activity (Ci)	5.69E-02	5.80E-03	10.2%	4.90E-02	5.10E-03	10.4%	4.52E-02	5.92E-03	13.1%
^{240}Pu Activity (Ci)	1.22E-02	1.24E-03	10.2%	1.09E-02	1.13E-03	10.4%	9.02E-03	1.40E-03	15.5%
^{241}Am Activity (Ci)	3.01E-02	3.07E-03	10.2%	2.91E-02	3.03E-03	10.4%	1.79E-02	3.19E-03	17.8%
^{241}Pu Activity (Ci)	1.42E-01	1.45E-02	10.2%	1.40E-01	1.46E-02	10.4%	9.68E-02	1.52E-02	15.7%
^{242}Pu Activity (Ci)	1.49E-06	1.52E-07	10.2%	1.42E-06	1.48E-07	10.4%	1.03E-06	1.90E-07	18.4%
TRU Alpha Conc. (nCi/g)	2,082	137	6.6%	1,910	124	6.5%	1,494	141	9.4%
Quantity of Interest	**Replicate #3**			**Replicate #4**			**Replicate #5**		
	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty
^{90}Sr Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{137}Cs Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{233}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{234}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{235}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{237}Np Activity (Ci)	2.33E-07	5.73E-08	24.6%	1.79E-07	4.96E-08	27.7%	1.73E-07	9.46E-08	54.7%
^{238}Pu Activity (Ci)	2.28E-03	2.35E-04	10.3%	2.66E-03	2.79E-04	10.5%	2.56E-03	8.68E-04	33.9%
^{238}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{239}Pu Activity (Ci)	5.60E-02	5.77E-03	10.3%	4.95E-02	5.20E-03	10.5%	4.63E-02	6.07E-03	13.1%
^{240}Pu Activity (Ci)	1.12E-02	1.15E-03	10.3%	1.09E-02	1.14E-03	10.5%	8.94E-03	1.41E-03	15.8%
^{241}Am Activity (Ci)	2.99E-02	3.08E-03	10.3%	2.69E-02	2.82E-03	10.5%	2.24E-02	3.58E-03	16.0%
^{241}Pu Activity (Ci)	1.14E-01	1.17E-02	10.3%	1.23E-01	1.29E-02	10.5%	1.01E-01	1.55E-02	15.3%
^{242}Pu Activity (Ci)	1.39E-06	1.43E-07	10.3%	1.34E-06	1.41E-07	10.5%	1.04E-06	2.00E-07	19.2%
TRU Alpha Conc. (nCi/g)	2,027	135	6.7%	1,837	123	6.7%	1,637	147	9.0%

Attachment B.6: Replicate Testing Results for Container 10033835, Z-390-100 System

Quantity of Interest	Original Measurement		Sample Mean	Sample Standard Deviation	Relative Standard Deviation	χ^2	Pr($x < \lvert\chi^2\rvert$)	t	Pr($x < \lvert t \rvert$)
	Reported Value	Absolute Uncertainty							
^{90}Sr Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{137}Cs Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{233}U Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{234}U Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{235}U Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{237}Np Activity (Ci)	2.45E-07	5.93E-08	2.07E-07	5.28E-08	25.5%	3.166	0.530	0.665	0.543
^{238}Pu Activity (Ci)	2.61E-03	2.66E-04	2.64E-03	1.27E-03	48.0%	90.582	0.000	-0.022	0.984
^{238}U Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{239}Pu Activity (Ci)	5.69E-02	5.80E-03	4.92E-02	4.21E-03	8.5%	2.101	0.717	1.671	0.170
^{240}Pu Activity (Ci)	1.22E-02	1.24E-03	1.02E-02	1.11E-03	10.9%	3.203	0.524	1.646	0.175
^{241}Am Activity (Ci)	3.01E-02	3.07E-03	2.52E-02	5.03E-03	19.9%	10.748	0.030	0.882	0.428
^{241}Pu Activity (Ci)	1.42E-01	1.45E-02	1.15E-01	1.74E-02	15.2%	5.802	0.214	1.415	0.230
^{242}Pu Activity (Ci)	1.49E-06	1.52E-07	1.24E-06	1.93E-07	15.5%	6.447	0.168	1.164	0.309
TRU Alpha Conc. (nCi/g)	2,082	137	1,781	214	12.0%	9.748	0.045	1.147	0.315

Quantity of Interest	χ^2 Test	t Test
^{90}Sr Activity (Ci)	#VALUE!	Not Applicable
^{137}Cs Activity (Ci)	#VALUE!	Not Applicable
^{233}U Activity (Ci)	#VALUE!	Not Applicable
^{234}U Activity (Ci)	#VALUE!	Not Applicable
^{235}U Activity (Ci)	#VALUE!	Not Applicable
^{237}Np Activity (Ci)	Not Significant	Not Significant
^{238}Pu Activity (Ci)	Highly Significant	Not Significant
^{238}U Activity (Ci)	#VALUE!	Not Applicable
^{239}Pu Activity (Ci)	Not Significant	Not Significant
^{240}Pu Activity (Ci)	Not Significant	Not Significant
^{241}Am Activity (Ci)	Significant	Not Significant
^{241}Pu Activity (Ci)	Not Significant	Not Significant
^{242}Pu Activity (Ci)	Not Significant	Not Significant
TRU Alpha Conc. (nCi/g)	Significant	Not Significant

Attachment B.7: Replicate Testing Data for Container 10034784, Z-390-100 System

Quantity of Interest	Original Measurement			Replicate #1			Replicate #2		
	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty
^{90}Sr Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{137}Cs Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{233}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{234}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{235}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{237}Np Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{238}Pu Activity (Ci)	5.07E-05	2.04E-05	40.3%	4.44E-05	1.80E-05	40.6%	4.19E-05	1.71E-05	40.7%
^{238}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{239}Pu Activity (Ci)	1.78E-03	2.37E-04	13.3%	1.56E-03	2.20E-04	14.1%	1.47E-03	2.10E-04	14.3%
^{240}Pu Activity (Ci)	3.96E-04	6.22E-05	15.7%	3.46E-04	5.67E-05	16.4%	3.27E-04	5.43E-05	16.6%
^{241}Am Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{241}Pu Activity (Ci)	3.40E-03	7.75E-04	22.8%	2.97E-03	6.92E-04	23.3%	2.81E-03	6.58E-04	23.4%
^{242}Pu Activity (Ci)	5.14E-08	2.72E-08	52.9%	4.50E-08	2.39E-08	53.1%	4.25E-08	2.26E-08	53.1%
TRU Alpha Conc. (nCi/g)	59	6	11.0%	51	6	11.7%	48	6	11.8%
Quantity of Interest	**Replicate #3**			**Replicate #4**			**Replicate #5**		
	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty
^{90}Sr Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{137}Cs Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{233}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{234}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{235}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{237}Np Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{238}Pu Activity (Ci)	4.48E-05	1.81E-05	40.5%	4.45E-05	1.81E-05	40.7%	4.23E-05	1.73E-05	40.8%
^{238}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{239}Pu Activity (Ci)	1.57E-03	2.17E-04	13.8%	1.56E-03	2.25E-04	14.4%	1.49E-03	2.18E-04	14.6%
^{240}Pu Activity (Ci)	3.50E-04	5.67E-05	16.2%	3.47E-04	5.79E-05	16.7%	3.30E-04	5.54E-05	16.8%
^{241}Am Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{241}Pu Activity (Ci)	3.00E-03	6.93E-04	23.1%	2.98E-03	6.97E-04	23.4%	2.83E-03	6.68E-04	23.6%
^{242}Pu Activity (Ci)	4.54E-08	2.41E-08	53.0%	4.51E-08	2.39E-08	53.1%	4.29E-08	2.28E-08	53.2%
TRU Alpha Conc. (nCi/g)	52	6	11.4%	51	6	11.9%	49	6	12.1%

Attachment B.8: Replicate Testing Results for Container 10034784, Z-390-100 System

Quantity of Interest	Original Measurement		Sample Mean	Sample Standard Deviation	Relative Standard Deviation	χ^2	Pr($x < \lvert\chi^2\rvert$)	t	Pr($x < \lvert t \rvert$)
	Reported Value	Absolute Uncertainty							
^{90}Sr Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{137}Cs Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{233}U Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{234}U Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{235}U Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{237}Np Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{238}Pu Activity (Ci)	5.07E-05	2.04E-05	4.36E-05	1.37E-06	3.1%	0.018	1.000	4.757	0.009
^{238}U Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{239}Pu Activity (Ci)	1.78E-03	2.37E-04	1.53E-03	4.64E-05	3.0%	0.153	0.997	4.922	0.008
^{240}Pu Activity (Ci)	3.96E-04	6.22E-05	3.40E-04	1.07E-05	3.1%	0.117	0.998	4.798	0.009
^{241}Am Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{241}Pu Activity (Ci)	3.40E-03	7.75E-04	2.92E-03	9.04E-05	3.1%	0.054	1.000	4.868	0.008
^{242}Pu Activity (Ci)	5.14E-08	2.72E-08	4.42E-08	1.37E-09	3.1%	0.010	1.000	4.824	0.009
TRU Alpha Conc. (nCi/g)	59	6	50	2	3.1%	0.233	0.994	4.343	0.012

Quantity of Interest	χ^2 Test	t Test
^{90}Sr Activity (Ci)	#VALUE!	Not Applicable
^{137}Cs Activity (Ci)	#VALUE!	Not Applicable
^{233}U Activity (Ci)	#VALUE!	Not Applicable
^{234}U Activity (Ci)	#VALUE!	Not Applicable
^{235}U Activity (Ci)	#VALUE!	Not Applicable
^{237}Np Activity (Ci)	#VALUE!	Not Applicable
^{238}Pu Activity (Ci)	Not Significant	Highly Significant
^{238}U Activity (Ci)	#VALUE!	Not Applicable
^{239}Pu Activity (Ci)	Not Significant	Highly Significant
^{240}Pu Activity (Ci)	Not Significant	Highly Significant
^{241}Am Activity (Ci)	#VALUE!	Not Applicable
^{241}Pu Activity (Ci)	Not Significant	Highly Significant
^{242}Pu Activity (Ci)	Not Significant	Highly Significant
TRU Alpha Conc. (nCi/g)	Not Significant	Significant

Attachment B.9: Replicate Testing Data for Container 10028237, Z-390-101 System

Quantity of Interest	Original Measurement			Replicate #1			Replicate #2		
	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty
^{90}Sr Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{137}Cs Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{233}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{234}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{235}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{237}Np Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{238}Pu Activity (Ci)	7.88E-06	3.78E-06	48.0%	1.09E-05	4.67E-06	42.8%	1.19E-05	5.11E-06	42.9%
^{238}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{239}Pu Activity (Ci)	2.77E-04	8.06E-05	29.1%	3.84E-04	7.53E-05	19.6%	4.19E-04	8.25E-05	19.7%
^{240}Pu Activity (Ci)	6.15E-05	1.86E-05	30.3%	8.54E-05	1.82E-05	21.3%	9.30E-05	1.99E-05	21.4%
^{241}Am Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{241}Pu Activity (Ci)	5.28E-04	1.82E-04	34.5%	7.33E-04	1.97E-04	26.9%	7.98E-04	2.15E-04	27.0%
^{242}Pu Activity (Ci)	7.98E-09	4.70E-09	58.9%	1.11E-08	6.08E-09	54.8%	1.21E-08	6.63E-09	54.8%
TRU Alpha Conc. (nCi/g)	22	5	23.9%	30	5	16.1%	33	5	16.2%

Quantity of Interest	Replicate #3			Replicate #4			Replicate #5		
	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty
^{90}Sr Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{137}Cs Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{233}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{234}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{235}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{237}Np Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{238}Pu Activity (Ci)	1.07E-05	4.64E-06	43.4%	1.14E-05	4.78E-06	41.9%	8.55E-06	3.82E-06	44.7%
^{238}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{239}Pu Activity (Ci)	3.75E-04	7.76E-05	20.7%	4.01E-04	6.98E-05	17.4%	3.00E-04	6.99E-05	23.3%
^{240}Pu Activity (Ci)	8.33E-05	1.87E-05	22.4%	8.90E-05	1.73E-05	19.4%	6.68E-05	1.66E-05	24.8%
^{241}Am Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{241}Pu Activity (Ci)	7.15E-04	1.99E-04	27.8%	7.64E-04	1.94E-04	25.4%	5.73E-04	1.71E-04	29.8%
^{242}Pu Activity (Ci)	1.08E-08	5.96E-09	55.2%	1.16E-08	6.28E-09	54.1%	8.67E-09	4.87E-09	56.2%
TRU Alpha Conc. (nCi/g)	29	5	17.1%	31	5	14.4%	24	5	19.2%

Attachment B.10: Replicate Testing Results for Container 10028237, Z-390-101 System

Quantity of Interest	Original Measurement		Sample Mean	Sample Standard Deviation	Relative Standard Deviation	χ^2	Pr($x < \lvert\chi^2\rvert$)	t	Pr($x < \lvert t \rvert$)
	Reported Value	Absolute Uncertainty							
^{90}Sr Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{137}Cs Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{233}U Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{234}U Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{235}U Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{237}Np Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{238}Pu Activity (Ci)	7.88E-06	3.78E-06	1.07E-05	1.28E-06	12.0%	0.461	0.977	-1.998	0.116
^{238}U Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{239}Pu Activity (Ci)	2.77E-04	8.06E-05	3.76E-04	4.56E-05	12.1%	1.280	0.865	-1.978	0.119
^{240}Pu Activity (Ci)	6.15E-05	1.86E-05	8.35E-05	1.00E-05	12.0%	1.161	0.885	-2.001	0.116
^{241}Am Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{241}Pu Activity (Ci)	5.28E-04	1.82E-04	7.17E-04	8.63E-05	12.0%	0.897	0.925	-1.996	0.117
^{242}Pu Activity (Ci)	7.98E-09	4.70E-09	1.09E-08	1.32E-09	12.1%	0.314	0.989	-1.991	0.117
TRU Alpha Conc. (nCi/g)	22	5	29	4	12.0%	1.868	0.760	-1.789	0.148

Quantity of Interest	χ^2 Test	t Test
^{90}Sr Activity (Ci)	#VALUE!	Not Applicable
^{137}Cs Activity (Ci)	#VALUE!	Not Applicable
^{233}U Activity (Ci)	#VALUE!	Not Applicable
^{234}U Activity (Ci)	#VALUE!	Not Applicable
^{235}U Activity (Ci)	#VALUE!	Not Applicable
^{237}Np Activity (Ci)	#VALUE!	Not Applicable
^{238}Pu Activity (Ci)	Not Significant	Not Significant
^{238}U Activity (Ci)	#VALUE!	Not Applicable
^{239}Pu Activity (Ci)	Not Significant	Not Significant
^{240}Pu Activity (Ci)	Not Significant	Not Significant
^{241}Am Activity (Ci)	#VALUE!	Not Applicable
^{241}Pu Activity (Ci)	Not Significant	Not Significant
^{242}Pu Activity (Ci)	Not Significant	Not Significant
TRU Alpha Conc. (nCi/g)	Not Significant	Not Significant

Attachment B.11: Replicate Testing Data for Container 10033618, Z-390-101 System

Quantity of Interest	Original Measurement			Replicate #1			Replicate #2		
	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty
^{90}Sr Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{137}Cs Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{233}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{234}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{235}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{237}Np Activity (Ci)	7.59E-08	1.61E-07	212.0%	1.68E-07	6.74E-08	40.1%	6.35E-08	7.81E-08	123.0%
^{238}Pu Activity (Ci)	7.12E-04	6.49E-04	91.2%	2.69E-04	3.01E-04	112.0%	1.32E-04	3.33E-04	252.0%
^{238}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{239}Pu Activity (Ci)	1.40E-02	1.82E-03	13.0%	1.33E-02	1.73E-03	13.0%	1.34E-02	1.74E-03	13.0%
^{240}Pu Activity (Ci)	1.68E-03	6.18E-04	36.8%	2.14E-03	4.00E-04	18.7%	2.11E-03	4.60E-04	21.8%
^{241}Am Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{241}Pu Activity (Ci)	2.75E-02	7.48E-03	27.2%	2.00E-02	4.52E-03	22.6%	1.57E-02	4.13E-03	26.3%
^{242}Pu Activity (Ci)	1.28E-07	6.12E-08	47.8%	1.50E-07	3.96E-08	26.4%	1.40E-07	4.33E-08	30.9%
TRU Alpha Conc. (nCi/g)	348	43	12.4%	333	38	11.5%	333	39	11.7%

Quantity of Interest	Replicate #3			Replicate #4			Replicate #5		
	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty
^{90}Sr Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{137}Cs Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{233}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{234}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{235}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{237}Np Activity (Ci)	1.10E-07	6.90E-08	62.7%	7.79E-08	8.34E-08	107.0%	1.16E-07	6.35E-08	54.7%
^{238}Pu Activity (Ci)	1.06E-03	3.96E-04	37.4%	4.08E-06	3.31E-04	8120.0%	1.04E-03	3.53E-04	33.9%
^{238}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{239}Pu Activity (Ci)	1.32E-02	1.74E-03	13.2%	1.40E-02	2.03E-03	14.5%	1.35E-02	1.76E-03	13.0%
^{240}Pu Activity (Ci)	2.76E-03	5.19E-04	18.8%	2.54E-03	5.26E-04	20.7%	2.80E-03	5.01E-04	17.9%
^{241}Am Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{241}Pu Activity (Ci)	3.68E-02	6.22E-03	16.9%	3.19E-02	6.16E-03	19.3%	3.48E-02	6.82E-03	19.6%
^{242}Pu Activity (Ci)	2.27E-07	5.63E-08	24.8%	1.94E-07	5.43E-08	28.0%	2.11E-07	5.04E-08	23.9%
TRU Alpha Conc. (nCi/g)	361	39	10.9%	350	45	12.8%	367	39	10.7%

Attachment B.12: Replicate Testing Results for Container 10033618, Z-390-101 System

Quantity of Interest	Original Measurement		Sample Mean	Sample Standard Deviation	Relative Standard Deviation	χ^2	Pr($x < \|\chi^2\|$)	t	Pr($x < \|t\|$)
	Reported Value	Absolute Uncertainty							
^{90}Sr Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{137}Cs Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{233}U Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{234}U Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{235}U Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{237}Np Activity (Ci)	7.59E-08	1.61E-07	1.07E-07	4.05E-08	37.8%	0.253	0.993	-0.703	0.521
^{238}Pu Activity (Ci)	7.12E-04	6.49E-04	5.01E-04	5.10E-04	101.8%	2.466	0.651	0.378	0.725
^{238}U Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{239}Pu Activity (Ci)	1.40E-02	1.82E-03	1.35E-02	3.11E-04	2.3%	0.117	0.998	1.524	0.202
^{240}Pu Activity (Ci)	1.68E-03	6.18E-04	2.47E-03	3.30E-04	13.4%	1.142	0.888	-2.183	0.094
^{241}Am Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{241}Pu Activity (Ci)	2.75E-02	7.48E-03	2.78E-02	9.41E-03	33.8%	6.328	0.176	-0.033	0.975
^{242}Pu Activity (Ci)	1.28E-07	6.12E-08	1.84E-07	3.80E-08	20.6%	1.541	0.819	-1.356	0.247
TRU Alpha Conc. (nCi/g)	348	43	349	16	4.5%	0.522	0.971	-0.044	0.967

Quantity of Interest	χ^2 Test	t Test
^{90}Sr Activity (Ci)	#VALUE!	Not Applicable
^{137}Cs Activity (Ci)	#VALUE!	Not Applicable
^{233}U Activity (Ci)	#VALUE!	Not Applicable
^{234}U Activity (Ci)	#VALUE!	Not Applicable
^{235}U Activity (Ci)	#VALUE!	Not Applicable
^{237}Np Activity (Ci)	Not Significant	Not Significant
^{238}Pu Activity (Ci)	Not Significant	Not Significant
^{238}U Activity (Ci)	#VALUE!	Not Applicable
^{239}Pu Activity (Ci)	Not Significant	Not Significant
^{240}Pu Activity (Ci)	Not Significant	Not Significant
^{241}Am Activity (Ci)	#VALUE!	Not Applicable
^{241}Pu Activity (Ci)	Not Significant	Not Significant
^{242}Pu Activity (Ci)	Not Significant	Not Significant
TRU Alpha Conc. (nCi/g)	Not Significant	Not Significant

Attachment B.13: Replicate Testing Data for Container 10000393, Z-211-103 System

Quantity of Interest	Original Measurement			Replicate #1			Replicate #2		
	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty
^{90}Sr Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{137}Cs Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{233}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{234}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{235}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{237}Np Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{238}Pu Activity (Ci)	3.04E-05	1.42E-05	46.7%	3.97E-05	1.79E-05	45.0%	2.38E-05	1.13E-05	47.6%
^{238}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{239}Pu Activity (Ci)	1.05E-03	2.68E-04	25.5%	1.35E-03	3.02E-04	22.4%	8.12E-04	2.22E-04	27.3%
^{240}Pu Activity (Ci)	2.34E-04	6.29E-05	26.9%	3.01E-04	7.19E-05	23.9%	1.80E-04	5.13E-05	28.5%
^{241}Am Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{241}Pu Activity (Ci)	2.19E-03	6.90E-04	31.5%	3.12E-03	9.05E-04	29.0%	1.87E-03	6.17E-04	33.0%
^{242}Pu Activity (Ci)	3.07E-08	1.76E-08	57.2%	3.90E-08	2.18E-08	55.8%	2.34E-08	1.36E-08	58.0%
TRU Alpha Conc. (nCi/g)	54	11	20.9%	69	13	18.4%	42	9	22.4%

Quantity of Interest	Replicate #3			Replicate #4			Replicate #5		
	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty
^{90}Sr Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{137}Cs Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{233}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{234}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{235}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{237}Np Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{238}Pu Activity (Ci)	2.82E-05	1.27E-05	45.0%	3.20E-05	1.42E-05	44.4%	3.61E-05	1.61E-05	44.7%
^{238}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{239}Pu Activity (Ci)	9.60E-04	2.14E-04	22.3%	1.09E-03	2.30E-04	21.1%	1.23E-03	2.68E-04	21.8%
^{240}Pu Activity (Ci)	2.13E-04	5.07E-05	23.8%	2.42E-04	5.49E-05	22.7%	2.74E-04	6.41E-05	23.4%
^{241}Am Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{241}Pu Activity (Ci)	2.21E-03	6.41E-04	29.0%	2.51E-03	7.05E-04	28.1%	2.84E-03	8.12E-04	28.6%
^{242}Pu Activity (Ci)	2.77E-08	1.55E-08	55.8%	3.15E-08	1.74E-08	55.3%	3.55E-08	1.97E-08	55.6%
TRU Alpha Conc. (nCi/g)	49	9	18.3%	55	10	17.4%	63	11	17.9%

Attachment B.14: Replicate Testing Results for Container 10000393, Z-211-103 System

Quantity of Interest	Original Measurement		Sample Mean	Sample Standard Deviation	Relative Standard Deviation	χ^2	Pr(x <|χ^2|)	t	Pr(x <|t|)
	Reported Value	Absolute Uncertainty							
^{90}Sr Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{137}Cs Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{233}U Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{234}U Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{235}U Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{237}Np Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{238}Pu Activity (Ci)	3.04E-05	1.42E-05	3.20E-05	6.28E-06	19.7%	0.783	0.941	-0.227	0.832
^{238}U Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{239}Pu Activity (Ci)	1.05E-03	2.68E-04	1.09E-03	2.13E-04	19.6%	2.530	0.639	-0.165	0.877
^{240}Pu Activity (Ci)	2.34E-04	6.29E-05	2.42E-04	4.79E-05	19.8%	2.319	0.677	-0.152	0.886
^{241}Am Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{241}Pu Activity (Ci)	2.19E-03	6.90E-04	2.51E-03	4.95E-04	19.7%	2.061	0.725	-0.590	0.587
^{242}Pu Activity (Ci)	3.07E-08	1.76E-08	3.14E-08	6.17E-09	19.6%	0.494	0.974	-0.107	0.920
TRU Alpha Conc. (nCi/g)	54	11	56	11	19.5%	3.708	0.447	-0.129	0.904

Quantity of Interest	χ^2 Test	t Test
^{90}Sr Activity (Ci)	#VALUE!	Not Applicable
^{137}Cs Activity (Ci)	#VALUE!	Not Applicable
^{233}U Activity (Ci)	#VALUE!	Not Applicable
^{234}U Activity (Ci)	#VALUE!	Not Applicable
^{235}U Activity (Ci)	#VALUE!	Not Applicable
^{237}Np Activity (Ci)	#VALUE!	Not Applicable
^{238}Pu Activity (Ci)	Not Significant	Not Significant
^{238}U Activity (Ci)	#VALUE!	Not Applicable
^{239}Pu Activity (Ci)	Not Significant	Not Significant
^{240}Pu Activity (Ci)	Not Significant	Not Significant
^{241}Am Activity (Ci)	#VALUE!	Not Applicable
^{241}Pu Activity (Ci)	Not Significant	Not Significant
^{242}Pu Activity (Ci)	Not Significant	Not Significant
TRU Alpha Conc. (nCi/g)	Not Significant	Not Significant

Attachment B.15: Replicate Testing Data for Container 10004052, Z-211-103 System

Quantity of Interest	Original Measurement			Replicate #1			Replicate #2		
	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty
^{90}Sr Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{137}Cs Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{233}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{234}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{235}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{237}Np Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{238}Pu Activity (Ci)	1.04E-04	4.51E-05	43.4%	9.94E-05	4.29E-05	43.2%	1.18E-04	5.09E-05	43.1%
^{238}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{239}Pu Activity (Ci)	3.51E-03	6.63E-04	18.9%	3.38E-03	6.25E-04	18.5%	4.02E-03	7.32E-04	18.2%
^{240}Pu Activity (Ci)	7.81E-04	1.62E-04	20.7%	7.52E-04	1.53E-04	20.3%	8.93E-04	1.79E-04	20.1%
^{241}Am Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{241}Pu Activity (Ci)	8.61E-03	2.27E-03	26.4%	7.81E-03	2.05E-03	26.2%	9.26E-03	2.41E-03	26.0%
^{242}Pu Activity (Ci)	1.02E-07	5.56E-08	54.5%	9.77E-08	5.31E-08	54.4%	1.16E-07	6.30E-08	54.3%
TRU Alpha Conc. (nCi/g)	117	18	15.6%	113	17	15.2%	134	20	15.0%

Quantity of Interest	Replicate #3			Replicate #4			Replicate #5		
	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty
^{90}Sr Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{137}Cs Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{233}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{234}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{235}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{237}Np Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{238}Pu Activity (Ci)	1.10E-04	4.74E-05	43.1%	1.22E-04	5.26E-05	43.1%	1.08E-04	4.67E-05	43.2%
^{238}U Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{239}Pu Activity (Ci)	3.75E-03	6.83E-04	18.2%	4.16E-03	7.61E-04	18.3%	3.69E-03	6.86E-04	18.6%
^{240}Pu Activity (Ci)	8.32E-04	1.67E-04	20.1%	9.24E-04	1.87E-04	20.2%	8.20E-04	1.67E-04	20.4%
^{241}Am Activity (Ci)	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%	0.00E+00	N/A	0.0%
^{241}Pu Activity (Ci)	8.64E-03	2.25E-03	26.0%	9.58E-03	2.50E-03	26.1%	8.50E-03	2.23E-03	26.2%
^{242}Pu Activity (Ci)	1.08E-07	5.86E-08	54.3%	1.20E-07	6.53E-08	54.4%	1.06E-07	5.77E-08	54.4%
TRU Alpha Conc. (nCi/g)	125	24	19.1%	139	27	19.2%	123	24	19.5%

Attachment B.16: Replicate Testing Results for Container 10004052, Z-211-103 System

Quantity of Interest	Original Measurement		Sample Mean	Sample Standard Deviation	Relative Standard Deviation	χ^2	Pr($x < \lvert\chi^2\rvert$)	t	Pr($x < \lvert t \rvert$)
	Reported Value	Absolute Uncertainty							
^{90}Sr Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{137}Cs Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{233}U Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{234}U Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{235}U Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{237}Np Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{238}Pu Activity (Ci)	1.04E-04	4.51E-05	1.11E-04	8.85E-06	7.9%	0.154	0.997	-0.771	0.484
^{238}U Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{239}Pu Activity (Ci)	3.51E-03	6.63E-04	3.80E-03	3.04E-04	8.0%	0.838	0.933	-0.872	0.433
^{240}Pu Activity (Ci)	7.81E-04	1.62E-04	8.44E-04	6.71E-05	7.9%	0.688	0.953	-0.860	0.438
^{241}Am Activity (Ci)	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	#VALUE!	#VALUE!	N/A	N/A
^{241}Pu Activity (Ci)	8.61E-03	2.27E-03	8.76E-03	6.90E-04	7.9%	0.369	0.985	-0.196	0.854
^{242}Pu Activity (Ci)	1.02E-07	5.56E-08	1.10E-07	8.75E-09	8.0%	0.099	0.999	-0.787	0.475
TRU Alpha Conc. (nCi/g)	117	18	127	10	7.9%	1.208	0.877	-0.776	0.481

Quantity of Interest	χ^2 Test	t Test
^{90}Sr Activity (Ci)	#VALUE!	Not Applicable
^{137}Cs Activity (Ci)	#VALUE!	Not Applicable
^{233}U Activity (Ci)	#VALUE!	Not Applicable
^{234}U Activity (Ci)	#VALUE!	Not Applicable
^{235}U Activity (Ci)	#VALUE!	Not Applicable
^{237}Np Activity (Ci)	#VALUE!	Not Applicable
^{238}Pu Activity (Ci)	Not Significant	Not Significant
^{238}U Activity (Ci)	#VALUE!	Not Applicable
^{239}Pu Activity (Ci)	Not Significant	Not Significant
^{240}Pu Activity (Ci)	Not Significant	Not Significant
^{241}Am Activity (Ci)	#VALUE!	Not Applicable
^{241}Pu Activity (Ci)	Not Significant	Not Significant
^{242}Pu Activity (Ci)	Not Significant	Not Significant
TRU Alpha Conc. (nCi/g)	Not Significant	Not Significant