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

AUG 19 2004

OFFICE OF
AIR AND RADIATION

R. Paul Detwiler, Acting Manager
Carlsbad Field Office
U.S. Department of Energy
P.O. Box 3009
Carlsbad, NM 88221-3090

COPY

Dear Dr. Detwiler:

This letter provides the results of the U.S. Environmental Protection Agency's (EPA or we) Inspection Number EPA-LLNL-CCP-5.04-8. The EPA inspected the waste characterization activities of the Central Characterization Project (CCP) implemented at the Lawrence Livermore National Laboratory (LLNL) from May 4-7 2004. This report is issued in accordance with our regulations at 40 CFR 194.8(b)(3) and 40 CFR 194.24.

We determine that the transuranic (TRU) waste characterization systems and processes implemented by the CCP at LLNL, examined during the inspection and discussed in the enclosed report were adequate. During the course of the inspection, we evaluated CCP's capabilities to characterize retrievably-stored contact-handled TRU debris (S5000) and solid (S3000) waste. EPA identified two findings and five concerns; none of the concerns require a response from Department of Energy (DOE) at this time. We will verify steps taken to address these concerns during a future inspection.

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

cc (w/o enclosure):
Lynne Smith, DOE-EM

UNIQUE #	DOE UFC	DATE REC'VD	ADDRESSEES
0404525	5486.02	AUG 2 6 2004	R. Detwiler K. Watson K. Holland T. Pietz R. Nelson D. Galbraith A. Pangle J. Zwick R. Chavez

DOCKET NO: A-98-49, Item II-A4-45

WASTE CHARACTERIZATION INSPECTION REPORT

EPA INSPECTION NO. EPA-LLNL-CCP-05.04-8
of the
CENTRAL CHARACTERIZATION PROJECT (CCP)
as implemented at the
LAWRENCE LIVERMORE NATIONAL LABORATORY (LLNL) SITE
May 4-7, 2004

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Radiation and Indoor Air
Center for Federal Regulations
1200 Pennsylvania Ave, NW
Washington, DC 20460

August 2004

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Attachments

1.0 EXECUTIVE SUMMARY

In accordance with 40 CFR 194.8, from May 4-7, 2004, the U.S. Environmental Protection Agency (EPA or Agency) conducted EPA inspection number EPA-LLNL-CCP-05.04-8 of the Central Characterization Project (CCP) as implemented at the Lawrence Livermore National Laboratory (LLNL) in California to verify that waste proposed for disposal in the Waste Isolation Pilot Plant (WIPP) could be characterized as required at 40 CFR 194.24(c)(4). EPA must verify compliance with 40 CFR 194.24 before waste may be shipped to the WIPP for disposal, as specified in Condition 3 of the Agency's certification of the WIPP's compliance with disposal regulations for transuranic (TRU) radioactive waste (63 Fed. Reg. 27354, 27405, May 18, 1998). The waste characterization (WC) systems and processes that EPA inspected were Acceptable Knowledge (AK); Non Destructive Assay (NDA); Non-Destructive examination (NDE) including Visual Examination (VE) and Radiography (RTR); and data transfer using the WIPP Waste Information System (WWIS) all used to characterize or track contact handled (CH) retrievably stored debris (S5000) waste.

The EPA inspection team determined that LLNL CCP's WC activities using AK, NDA using a High Efficiency Neutron Counter (HENC), VE, RTR, and the WWIS as inspected could adequately characterize CH retrievably stored debris (S5000) waste. EPA identified two (2) findings and five (5) concerns. None of the concerns requires a response from the Department of Energy (DOE) at this time. EPA will verify steps taken to address these concerns during a future inspection.

2.0 PURPOSE OF INSPECTION

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:

> *** 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 transuranic (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 the Lawrence Livermore National Laboratory (LLNL) as implemented by the Central Characterization Project (CCP), EPA has evaluated capabilities of those systems, and processes can accomplish two tasks: (1) they can identify and measure the waste components (such as plutonium) that must be

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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."

tracked for 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 WC inspection report documents the basis for EPA's decision and explains the results of inspection number EPA-LLNL-CCP-05.04-8 in terms of findings or concerns. The report, if applicable, provides objective evidence of outstanding findings (nonconformances) 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 show the documents (principally procedures) that the EPA 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 inspection or surveillance may be disposed of at WIPP.

4.0 SCOPE

The scope of inspection number EPA-LLNL-CCP-05.04-8 incorporated the technical adequacy of the system of controls used to characterize waste material parameters (WMPs) and the activities of the ten 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 acceptable knowledge (AK) nondestructive assay (NDA), real-time radiography (RTR), Visual Examination (VE), and waste information transfer through the WIPP Waste Information System (WWIS).

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[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 the radioactive isotopes in the waste. In the given example, a TRU waste 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

At the time of inspection number EPA-LLNL-CCP-5.04-8, the procedures and activities reviewed by EPA were being used to characterize contact handled (CH) retrievably stored debris (S5000) TRU waste using AK, NDA, and Non Destructive Examination (NDE [VE and RTR]). Data transfer using the WWIS was also assessed.

5.0 DEFINITIONS

Finding: A determination that a specific item or activity does not conform with 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 surveillance team are identified below

Inspection Team Member	Position	Affiliation
Mr. Ed Feltcorn	Inspector	EPA
Ms. Rajani Joglekar	Inspector	EPA
Ms. June Dreith	Inspector	EPA Contractor
Dr. Dave Stuenkel	Inspector	EPA Contractor
Mr. Jerry Rossman	Inspector	EPA Contractor
Mr. Robert Thielke	Inspector	EPA Contractor

Numerous DOE CBFO and LLNL CCP personnel, including both DOE staff and support contractors, participated in EPA's inspection, in addition to performing a separate DOE audit of the same processes. Mr. Tom Putnam, a CTAC employee, served as the CBFO Audit Team Leader and was DOE's primary point of contact with the EPA inspection team. The CBFO audit was supported by the Carlsbad Technical Assistance Contractor (CTAC).

LLNL, located in Livermore, California, is a one square mile DOE facility that is currently operated by the University of California. LLNL was established in 1952 as a second national laboratory to augment the nuclear weapons research and development work being performed at LANL. The primary mission of LLNL has been nuclear weapons research and development. However, LLNL has been extensively involved in several other nuclear and non-nuclear research and development programs. Among the other nuclear related research programs undertaken by LLNL since 1952 include magnetic and inertial fusion, isotope separation, positron research, reactor research, and the Plowshare[4] program. Environmental Restoration became a laboratory directorate in the 1990s and environmental management and restoration of the site has become

[4] Plowshare was a program undertaken by the AEC to determine the possible peaceful uses for atomic detonations. LLNL participated in this program from the 1960s until the program was disbanded during the 1970s.

one of the priorities of the laboratory. The CCP has assumed CH TRU waste certification activities at the LLNL site, and the purpose of this inspection was to assess LNLL CCP's characterization program

7.0 PERFORMANCE OF THE INSPECTION

EPA inspection number EPA-LLNL-CCP-05.04-8 took place May 4-7, 2004. The inspection focused on the following elements of the LLNL's TRU WC program: AK; NDA using the High Efficiency Neutron Counter (HENC); NDE using VE and RTR, and data transfer using the WWIS. This element constitutes 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 LLNL demonstrated compliance with 40 CFR§194.24 for the waste streams being examined. The checklists used by EPA inspectors for the AK, NDA, NDE, and WWIS evaluations are included in Attachments A.1 through A.5. The checklists identify the objective evidence reviewed by EPA.

The inspection was conducted in the following steps:

1) preparation of draft checklists prior to the inspection;
2) review of the results of CBFO's recent audits of CCP sites and corrective actions requested by CBFO (this background information suggests potential areas of inquiry during interviews);
3) review of site procedures and other information, and modification of EPA checklists, if necessary, to incorporate site-specific information; and
4) on-site verification of the technical adequacy or qualifications of personnel, procedures, and equipment by means of interviews and demonstrations.

The following subsections address the results of EPA's inquiries into each technical area in turn. The checklists attached to this report (Attachments A.1 - A.5) identify, as appropriate, key documents that the EPA inspection team reviewed, key site personnel who were interviewed, and key demonstrations that were performed. Key personnel interviewed are as follows:

Personnel	Organization	Area of Expertise
Jeff Harrison	Wastren, Inc.	Acceptable Knowledge
Billy Kirkes	LLNL Technical Specialist	Acceptable Knowledge
Rodney Hollister	LLNL RHWM Project Manager	Acceptable Knowledge
Bruce Gillespie	Mobile Characterization Services (MCS)	Nondestructive Assay
Richard Machado	Mobile Characterization Services (MCS)	Nondestructive Assay
Joshua Chiulli	Mobile Characterization Services (MCS)	Nondestructive Assay
Thomas Donohoue	Central Characterization Project (CCP)	Nondestructive Assay
James Behanna	Central Characterization Project (CCP)	Nondestructive Assay
Steve Ewing	LLNL/CCP	Radiography
Larry Lamb	LLNL/CCP	Radiography

Greg Lamb	LLNL/CCP	Radiography
Abraham Romo	LLNL/CCP	Visual Examination
Favian Romo	LLNL/CCP	Visual Examination
Doyle Durham	LLNL/CCP	Visual Examination
J. R. Stroble	LLNL/CCP	WWIS
Shelley Jensen	LLNL/CCP	WWIS

7.1 Acceptable Knowledge (AK)

EPA examined the AK process and associated information to determine whether LLNL CCP demonstrated compliance with §194.8 requirements for LLNL's CH retrievably stored TRU debris (S5000) waste. As part of the inspection, EPA reviewed the elements of the AK process listed below. The checklist at Attachment A.1 identifies the objective evidence reviewed by EPA:

- Overall procedural technical sufficiency and scope, with emphasis on tracking of the AK WC process for individual containers and waste streams;
- Characterization of WMPs and radionuclides as required by 40 CFR 194.24, the revised CH-WAC, and attachments to the CCA;
- Compilation of AK information and use of supplemental information;
- Confirmation of AK and resolution of discrepancies;
- Technical adequacy of AK characterization results;
- Preparation of the AK summary;
- Technical adequacy of required procedures (e.g., a consistent definition of waste streams);
- Reassignment of any waste based on an analysis of AK and discrepancies; and
- Appropriate determination of AK accuracy.

AK is used to determine several aspects of TRU wastes at LLNL, including but not limited to:

- General WMP content of waste;
- Radionuclide content of waste with respect to identifiable isotopic ratios of the EPA 10 radionuclides and other radionuclides, and nature of waste with respect to TRU vs. non-TRU content and related waste management issues;
- Waste processes that generated waste, including but not limited to location of waste generation, programmatic considerations, and buildings in which wastes were generated;
- Waste stream determination; and
- Defense waste status.

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

- Waste Stream Profile Form: LL-M001-S5400, CIS Correlation of Container ID, HSG, UCL to Evaluation Form, HSG Summary Data, RTR/VE Summary of Prohibited Items Reconciliation with DQO, WSPF – AH1, Draft – HSG Summary Data Report, Lot1, HSG- Tentatively Identified Compounds – LL0M001-S5400, Lot 1
- Management Assessment Report, MA-CCP-0009-03, 10/18/03
- C111 Memorandum: Radiological Evaluation of LLNL Waste, JLH-005-2003, 5/4/04
- Attachment 1, AK Documentation Checklist, LL-T002-S5400
- Attachment 1, AK Documentation Checklist, LL-M001-S5400
- Attachment 4, AK Source Document Reference List, LL-T002-S5400
- Attachment 4, AK Source Document Reference List, LL-M001-S5400
- Attachment 5, Hazardous Constituents, LL-M001-S5400
- Attachment 5, Hazardous Constituents, LL-T002-S5400
- Attachment 6, Waste Form, Waste Material Parameters Prohibited Items, and Packaging LL-M001-S5400
- Attachment 6, Waste Form, Waste Material Parameters Prohibited Items, and Packaging LL-T002-S5400
- Attachment 7, Radionuclides, LL-T002-S5400
- Attachment 7, Radionuclides, LL-M001-S5400
- Attachment 8, Waste Containers, LL-T002-S5400
- Attachment 8, Waste Containers, LL-M001-S5400
- D001, Waste Stream Delineation, AK Source Document Summary, LL-M001-S5400 – LL-T002-S5400
- D002, Metals, AK Source Document Summary, LL-M001-S5400
- D003, Hazardous Waste, AK Source Document Summary, LL-M001-S5400
- D004, Bulbs and Circuit Boards, AK Source Document Summary, LL-M001-S5400
- D005, Organic, AK Source Document Summary, LL-M001-S5400
- D006, F007 and F009 on Building 419 Waste AK Source Document Summary, LL-M001-S5400
- Memo, AK Accuracy Report, LL-M001-S5400
- AK Confirmation Checklist, LL-M001-S5400, Lot 1
- BDR, LL-M001-S5400, NDE LL04-NDE-0001, LL04-NDE-002, LL04-NDE-007

- VE, LL04-VE-0002, LL04-VE-0003, LL04-VE-0004, LL04-VE-0005, LL04-VE-0008
- HSG, LL04-HSG-0004, LL04-HSG-0001
- NDA, LL04-NDA-0002, LL04-NDA-0003 LL04-NDA-0004
- Randomly Selected Containers for VE, 4/29/04
- CCP, Miscertification Rate Calculations, LL01-M001-S5400
- U002 Travelers, 5 Traceable Drums, 1 newer – LL85700959TRU, 1 Older – LL85000284
- U005 PKE, Process Knowledge Evaluation #0227, 0231, 0499
- C103, Waste Matrix Code & Waste Material Parameter Determination for LLNL Transuranic Waste
- D007, Waste Matrix Code
- TWBIR P001, Transuranic Waste Baseline Inventory Report Database
- P022 PKE, Process Knowledge Evaluation (Describing the creation of PKE's)
- P024, Management of TRU Waste by TRU Waste Generators
- P003, Safety Analysis Report for Building 332
- TWBIR, Transuranic Waste Baseline Inventory Report (Rw2), 12/95
- U010, Waste Characterization Summaries of Heavy Element Facility Experiment Request Forms 1974-1990
- U007, Chem Trac Database, Building 251, 332, 419 Chemical Inventory Queries Output to Excel Spreadsheets
- P010, TRU Waste Program Certification and Quality Assurance Plan
- P009, Quality Assurance Manual LLNL TRU Waste Certification Program TRU Waste Certification Plan
- C079, TRU Waste Generator Interview Sheet No. 91-4-1-3. Interview J. Lewis conducted by K. Hainebach and D. Hoyt, LLNL
- C029, Interview: Between J. Harrison & J. Schmitz, D. Hanson, T. Harter, and J. Magana, LLNL
- C016, Memo From J. Harrison to file: WAP Interpretation In the Creation of Process How Diagrams.
- C015, AK Interview Notes of Jerry Landrum, LLNL, by Jeff Harrison
- C011, Misc. Correspondence Regarding remedial actions at LLNL Following Shipment of mixed waste to NTS in 1990
- Livermore Approval for the AK Summary Report
- NCR, LLNL-0093-04, Homogenous is greater than 50% of the waste volume

- CCP-TP-102, RTR #2 Radiography Inspection Operating Procedure, Rev. 1, 2/25/04
- CCP-TP-114, CCP Waste Visual Examination , Rev. 2, 3/22/04
- C086L, AK Source Document Summary Facsimile Transmission to Jeff Harrison Removal of F004 & D027 From WS
- P034, AK Source Document Summary Material Safety Data Sheets and Technical Data (MSDS Sheets)

The following drums and associated data packages were also examined:

Drum	Radioassay Data Package	VE Data Package	RTR Data Package
LL85101184TRU	LL04-NDA-0003	LL04-VE-0005	LL04-NDE-0002
LL85000571TRU	LL04-NDA-0002	LL04-VE-0008	LL04-NDE-0007
LL5200499TRU	LL04-NDA-0004	LL04-VE-0003	LL04-NDE-0002
LL8500581TRU	LL04-NDA-0004	LL04-VE-0002	LL04-NDE-0001
LL85900722TRU	LL04-NDA-0004	LL04-VE-0004	LL04-NDE-0002

The inspection team also reached the conclusions listed below.

1) The AK process was adequate with respect to collection of mandatory information, and supplemental data collection.

The collection of mandatory and supplemental data was acceptable. Supplemental information was provided regarding the waste based on the location and generation of the waste from specific buildings (151,235,251,332,419). The AK Summary Report (AKS) contained a significant amount of information and showed effort in its assembly and interpretation. However, additional information should have been included in the AKS to address information to be reported in accordance with the Waste Acceptance Plan (WAP), and the reports would benefit from refinement to ensure correct interpretation of data presented. For example, clearer estimates of waste volumes (drum) produced to date (between 1985 and August 2002), and the anticipated volume of waste to be produced would be beneficial to improve the quality of the AK record. Also, the AK summaries included, at the time of inspection, only information on the greater than 100 nCi/g component of the waste. That is, waste below 100 nCi/g was not addressed with respect to management practice, storage volume, to be generated volume, etc. within the AKS. The AK Expert (AKE) stated during the audit that load management would not be performed in the near term. If this practice will be implemented at a later time, the AKS must be revised prior to implementation to include this waste population and the requisite information pertinent to this population.

Also, LLNL CCP has a site wide data base tracking system which assists in the internal tracking of containers to be disposed of at WIPP. According to Mr. Jeff Harrison, the tracking database is referred to as the HAZTRACK database. Procedures for the use of this internal database were not documented nor was it clear that the software had been tested and

validated for use in accordance with software quality assurance (QA) protocols outlined in 194.22.

2) AK-NDA communication was extensive and well documented.

There have been numerous examples of NDA-AK miscommunication at other sites that directly impacted how information was presented in the AK summary and how AK data were used by NDA personnel. LLNL CCP had clearly taken the initiative to resolve this issue by modifying CCP-TP-005 to include section 4.4.17, which mandates AK-NDA communication, documentation, and agreement of AK use in NDA via a joint AK-NDA memorandum. During the inspection, we observed that AKE and NDA personnel had met and drafted a memo (included as an AK Source Document) which clearly laid out allowable use of AK with respect to NDA. The EPA inspector observed this meeting, and suggestions made by EPA were incorporated into the memo. The memorandum states:

> *"If measured values are not used to calculate individual Pu isotope masses, NDA will compare the available measurement to the AK isotopic ratios to one of the six grades of plutonium. One of those ratios will be used to calculate the individual Pu isotope masses. If the measurement does not correspond to one of the ratios, NDA performs expert review. NDA personnel may assess the isotopic information contained in the Waste Disposal Requisition (WDR) package (e.g. Parcel Cards) as a guide for scaling the other isotopes. If there are no Pu isotopics, only measured values will be used to categorize the drum as TRU....If a given drum contains a mixture of plutonium grades, the weapons-grade composition will be used to scale Pu-242. This will provide a conservatively low result so as not to overestimate the amount of Pu-242...If U-235 is measured, the U-235 activity will be multiplied by a conservative factor of 30 to calculate U-234 activity. If U-238 is measured and U-235 is not measured, NDA performs expert review. NDA personnel may assess the isotopic information contained in the WDR package to determine if DU or NU is present. If information in the WDR does not specify this information, NU will be conservatively assumed. This will provide a conservatively high U-234 estimate...NDA will use the conservative activity ration of 1.0 to calculate Sr-90 based on the Cs-137 measurement..."*

This paragraph well documented the proposed approach, but EPA expects that measurement data must be used, unless technical justification for their exclusion are well documented and placed in the record for review upon audit. Also, if measured data are not used, all resolution and justifications for use of AK and default isotopics shall be documented and placed in the AK record. Further, criteria for "expert review" and determinations thereof must also be well documented and placed in the auditable record. Additionally, mandatory examination of Waste Data Report would appear appropriate rather than stating the NDA personnel "may" examine this information source when there are no measured data and information must be obtained. Finally, data limitations or issues that might arise that could impact the quality of information imported into the measurement system must be documented.

It should be noted that at this time the drafted NDA/AK memo applies to both mixed and non-mixed waste streams.

3) The AK Summaries should have better addressed and justified waste stream determinations

The WAP and Waste Acceptance Criteria (WAC) define waste stream as:

> *"A waste stream is waste material generated from a single process or from an activity which is similar in material, physical form, and hazardous constituents."*

The AKS for debris waste should have clearly indicated how the waste streams met the required definition. For example, it was unclear how the definition addressed generation through a single process since activities were quite varied. It was also unclear how the "similar material" designation was achieved, since the isotopic signature of the waste was highly variable; similarly, similar "physical form" designation was questionable because the site originally included S3000 drums in the waste stream (thereby bringing into question this waste stream category designator). It did appear that the site had divided waste by hazardous vs.non hazardous components. Available data appeared to indicate that these relatively small retrievably stored waste stream(s) couldn't necessarily be better segregated to better meet the definition of waste stream. However, EPA will examine the definition of waste stream and the maintenance of this definition for any newly generated components of this waste stream for which approval may be sought in the future, unless wastes with the recognized disparate material and physical forms can be clearly demonstrated to have been generated from a distinct, single waste generating process.

4) Assignment of Waste Matrix Code (WMC) were inadequately addressed and justified.

The AKS Report for LLNL, CCP-AK-LLNL-001, Revision 0 indicated that the mixed debris stream also contained distinct drums comprised entirely of solidified liquid organic and inorganic waste (i.e. S3000 wastes), which were solidified using a variety of solidification reagents. Based upon interviews with Mr. Jeff Harrison and Mr. Mark Doherty as well as an indication in the AKS Report that "some of the drums contain greater than 50% solids but that the waste stream as a whole is debris waste," it was determined that some drums in the mixed debris waste stream should not have been included in the debris waste stream. According to Mr. Harrison, twenty-five 55-gallon drums had been identified to the date of inspection in the inventory for LLNL that contained greater than 50% solids. Those twenty-five waste drums contained salts, solidified material, and boxed HEPA type filters. These waste containers should therefore have been classified as homogenous solids, WMC S3000, and appropriately segregated into a separate waste stream. The WIPP WAP (which was an attachment to the CCA) makes no allowance for combining drums of S3000 homogenous solid waste into the debris waste matrix code S5000, particularly if these drums can be readily identified and segregated. Consequently, these waste streams should have been separated into one or more waste streams, accordingly. All waste discussed above was generated from LLNL CCP's on-site including Buildings 332, 251, and 419.

The WAP requires assignment of a WMC for each waste stream. However, the S5400 code assigned to the waste is a broader waste matrix group code, not a waste matrix code. AK

personnel indicated that assignment of a detailed waste matrix code was not justified by the quality of AK data, in that significant variability was expected, but it is unclear whether this complexity was inherent or was imparted by the waste stream combination process. Also, drum-specific AK data were present which would have allowed the assignment of a waste matrix code to individual drums, but LLNL CCP's AK personnel indicated that the data had inherent problems and did not want to use the data. Other sites have displayed AK physical form data on spreadsheets and demonstrated, through mathematical averaging or other manipulation of the data, that the WMC (or WMC group) designator was appropriate. However, no spreadsheet, memos, or other data were shown the EPA inspector to justify the combination of these waste streams. If the waste stream designation assigned at the time of inspection is retained, the AKS should then be revised to clearly support and justify why a WMC cannot be determined even if such a determination can be made on a drum level. Further, the AK Accuracy calculation is required on a WMC, not WMC group basis, so this decision would render the AK Accuracy calculations invalid.

5) AK Accuracy determinations for the CCP program were not valuable with respect to radionuclides.

AK accuracy, as cited in the WAC, requires comparison of radionuclide AK and measurement data, but is non-specific with respect to how this accomplished. In cases where AK data are used specifically as part of, in lieu of, or to directly support NDA measurements, the AK accuracy calculations should provide meaningful assessments of AK data use to these ends. If, however, sites believe AK data do not provide this type of support, then the AK accuracy assessment should reflect this level of AK use. The CCP procedure should be revised to recognize this distinction. The AK Memorandum (Item 2, above) indicates that AK-measurement data comparisons will be important, so it is expected that future AK Accuracy calculations will be somewhat robust.

Findings:

The EPA inspection team identified the following one (1) AK finding:

AK Finding No. 1: LLNL CCP must segregate all S3000 containers from the mixed debris waste stream, and recategorize these segregated containers into a new waste stream. Waste streams identified as containing drums that are greater than 50% solids (S3000) clearly do not belong in a debris waste stream, as they are generated by a separate process and have a different physical form.

Concerns:

The EPA inspection team identified the following five (5) AK Concerns:

AK Concern Number 1: LLNL has a site wide data base tracking system which assists in the internal tracking of containers to be shipped to WIPP. According to Mr. Jeff Harrison, the tracking database was referred to as the HAZTRACK database. Procedures for the use of this internal database were not documented in the AK record, nor was it clear that the software had

been tested and validated for use in accordance with software quality assurance protocols outlined in 194.22. While no response to this concern is required at this time, EPA shall inspect and assess this data transfer mechanism under a separate inspection, and it will be of particular scrutiny if it is ever used to directly import data into the WWIS at some future date.

AK Concern Number 2: CCP-TP-005 was revised to include a new section 4.4.17 mandating AK-NDA personnel communication and concurrence with regard to the use of AK by NDA. Language was included in a memorandum (reference C111) which specified how AK was to be used by NDA. This language well documents the proposed approach, but EPA expects that measured data will be used if at all possible. If for some reason measured data cannot be used, all resolution and justifications for use of AK and default isotopics shall be documented and placed in the AK record. Further, criteria for "expert review" and determinations thereof must also be well documented and placed in the auditable record. Additionally, mandatory examination of WDR would appear appropriate rather than stating the NDA personnel "may" examine this information source when there are no measured data and information must be obtained. Data limitations or issues that might arise that could impact the quality of information imported into the measurement system must be documented. Finally, updating of the memo could be required if additional NDA data indicate that different use of AK information. No response to this concern is required, and EPA shall assess the adequacy of waste stream AK-NDA resolution memorandum during our recertification inspection

AK Concern Number 3: The WAP and WAC define waste stream as:

> *"A waste stream is waste material generated from a single process or from an activity which is similar in material, physical form, and hazardous constituents."*

The AKS for the debris should clearly indicate how the waste streams meet the required definition; this is of particular concern for the mixed debris waste stream which is comprised, apparently of very different materials and physical forms of wastes, and it is of question whether the wastes were indeed generated from a single process. Available data appear to indicate that these relatively small retrievably stored waste stream(s) cannot necessarily be better segregated to better meet the definition of waste stream, therefore no response to this concern is required at this time. However, EPA shall examine the definition of waste stream and maintenance of this definition for any newly generated components of this waste stream for which approval may be sought in the future, unless wastes with the recognized disparate material and physical forms can be clearly demonstrated to have been generated from a distinct, single waste generating process.

AK Concern No 4: The assignment of a WMC group is not well justified, particularly since detailed data are available for each drum (or drum parcel). EPA expects that the WMC or code group assignment shall be well described and documented in the AK record to ensure that appropriate waste stream designations are made and supported. No response to this concern is required at this time, but EPA shall evaluate whether the AK record includes adequate justification at its recertification inspection.

AK Concern No 5: AK accuracy, as cited in the WAC, requires comparison of radionuclide AK and measurement data, but is non-specific with respect to how this accomplished. In cases

where AK data are used specifically as part of, in lieu of, or to directly support NDA measurements, then the AK accuracy calculations should provide meaningful assessments of AK data use to these ends. If, however, sites believe AK data do not provide this type of support, then the AK accuracy assessment should reflect this level of AK use. The LLNL CCP procedure should be revised to recognize this distinction. No response to this concern is required at this time, as EPA shall assess AK Accuracy during its next recertification inspection.

7.2. Nondestructive Assay (NDA)

EPA inspected one system, the CCP HENC to be used as part of the CCP at LLNL. As part of the inspection, EPA reviewed the following elements of the NDA process:

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

The checklist in Attachments A.2 identifies the objective evidence that we examined for the CCP HENC. The following documents were examined to assess whether NDA is being adequately performed:

- CCP-PO-002, CCP Waste Certification Plan, Revision 9, 03/15/04
- CCP-AK-LLNL-001,Central Characterization Project Acceptable Knowledge Summary Report For Lawrence Livermore National Laboratory Waste Streams: LL-T002-S5400 LL-M001-S5400, Revision 0, 02/09/04
- CCP-TP-107, Operating the CCP High Efficiency Neutron Counter Using NDA 2000, Revision 2, 04/02/04
- CCP-TP-108, Calibrating the CCP High Efficiency Neutron Counter Using NDA 2000, Revision 1, 04/02/04
- CCP-TP-109, Data Reviewing, Validating, and Reporting Procedure for the CCP High Efficiency Neutron Counter Using NDA 2000, Revision 0, 03/31/04
- CCP-LLNL-NDA-001, CCP HENC Calibration and Validation Plan and Report, Revision 2, 05/04/04
- CI-LLNL-NDA-0424, Total Measurement Uncertainty for the CCP High Efficiency Neutron Counter (HENC) for the Characterization of TRU Drums at LLNL, Revision 2, 05/03/04
- Batch Data Report LL04-NDA-0003
- Batch Data Report LL04-NDA-0004

During the inspection, EPA assessed several technical elements of CCP's NDA process at LLNL (see Attachments A.2), as discussed below.

1) The design of the CCP HENC was assessed.

The CCP HENC, located in the yard near Building #695 at LLNL, is a combination (or hybrid) NDA system incorporating both a passive neutron counter and an integral gamma-ray spectrometer. The passive neutron counter uses ^{3}He proportional counters, along with a multiplicity shift register and an Add-a-Source (AaS) matrix correction, to provide an estimate of the amount of spontaneously fissioning material inside the drum. This quantity, referred to as the ^{240}Pu effective, is the amount of ^{240}Pu that would produce the observed true coincidence rate, after correcting for the neutron moderation properties of the waste matrix. The quantity of individual radionuclides can be related to the ^{240}Pu effective if the relative ratios of the quantities of the radionuclides, including all spontaneously fissioning radionuclides, is measured or otherwise known. In the CCP HENC, these radionuclide (or isotopic) ratios are normally determined by Multi-Group Analysis (MGA) of the gamma-ray spectrum, measured by the integral gamma-ray spectrometer, described in following paragraph.

The integral gamma-ray spectrometer is a high purity germanium (HPGe) detector used to acquire the gamma-ray spectrum to be analyzed by MGA, and to provide direct quantification of a number of radionuclides, including ^{238}Pu, ^{239}Pu, ^{241}Pu, ^{241}Am, ^{233}U, ^{235}U, ^{238}U, ^{137}Cs, and ^{237}Np. The spectrometer uses a multi-curve efficiency calibration, based on the density of the waste matrix, to correct for the attenuation of gamma-rays inside the drum.

2) System calibration the LLNL CCP's HENC had been performed as required.

The calibration of the CCP HENC is documented in *CCP HENC Calibration and Validation Plan and Report*, CCP-LLNL-NDA-001, Revision 2, dated May 4, 2004. The calibration was applicable to S5400 heterogeneous debris waste packaged in 55-gallon (208 liter) drums. The passive neutron calibration was performed in March 2004 using combinations of weapons grade plutonium (WGPu) sources totaling 0.10, 1.0,10, 35, 65, 90, 132, 167 and 200 grams in a non-interfering matrix. The confirmation of the passive neutron calibration was performed by assaying surrogate drums containing 0.9, 24, and 132 g WGPu in non-interfering and combustibles matrices. The operating range of the passive neutron system is from the lower limit of detection (LLD) to 11.5 g ^{240}Pu-effective (the equivalent of 200 g WGPu).

The integral gamma-ray spectrometer was calibrated in February 2004 using six (6) ^{241}Am/^{152}Eu line sources in four (4) surrogate waste drums with waste matrix densities of 0.0187, 0.440, 0.660, and 1.589 g/cm^{3}. For each of the surrogate waste drums, the efficiency of the detector was measured as a function of gamma-ray energy between 59 and 1,408 kiloelectron-volts (keV). The calibration of the integral gamma-ray spectrometer was confirmed using the same WGPu sources used to confirm the passive neutron calibration.

3) The TMU of assays performed on the CCP HENC had been determined and documented.

The determination of the TMU of assays performed on the CCP HENC was documented in *Total Measurement Uncertainty for the CCP High Efficiency Neutron Counter (HENC) for*

the Characterization of TRU Drums at LLNL, CI-HENC-TMU-0424, Revision 2, dated May 3, 2004. Among the components of uncertainty included in the TMU determination for the passive neutron measurement were contributions from the calibration uncertainty, neutron counting statistics, matrix and source distribution effects, background effects for high Z waste matrices, and uncertainties due to isotopics, chemical forms, and neutron multiplication.

For the integral gamma-ray spectrometer, components of uncertainty included in the TMU determination included Calibration source uncertainties, counting statistics, self-absorption effects, matrix non-homogeneities, non-uniform source distributions, and isotopic measurement uncertainties. For absolute gamma spectrometry measurements on LLNL's CCP-HENC, the energy dependent efficiency curve for a waste drum was estimated by interpolation, using the energy dependent efficiency curves of surrogate calibration drums with the next lower and higher densities. The density is calculating by dividing the net weight (or mass) of the drum by the volume of waste, based on the fill percentage typically estimated by radiography. The uncertainty in the density of the waste matrix was not explicitly included in the TMU determination, or otherwise addressed in the TMU report.

4) The lower limits of detection LLD, including the minimum detectable concentration MDC of the LLNL CCP's HENC had been determined and documented.

The LLD was defined in the *CCP Transuranic Waste Certification Plan*, CCP-PO-002, Revision 9, dated March 15, 2004, as "that level of radioactivity which, 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 of any given NDA measurement is likely to depend on the type of measurement (i.e. passive neutron vs. gamma spectrometry), the properties of the waste matrix being assayed, and the environmental background. For this reason, the LLD will vary from drum to drum and may even vary between measurements of the same drum. The NDA2000 software estimates and reports the LLD of each of the ten (10) WIPP-tracked radionuclides for each measurement. Only measured values that exceed the reported LLD for that measurement will be reported and used in calculations of derived quantities, such as total TRU alpha activity and TRU alpha activity concentration.

The average LLD for each of the WIPP-tracked radionuclides estimated for a surrogate drum containing 130 kg of particle board using the absolute gamma modality. The MDC was also estimated using the passive neutron modality for a surrogate drum containing 73 kg of metals. The average MDC of six replicate measurements of the metals drums with no added activity was 47.09 nCi/g. The results for the absolute gamma and passive neutron modalities are documented in Sections 5.6 and 6.6 of the *CCP HENC Calibration and Validation Plan and Report*, CCP-LLNL-NDA-001, Revision 2, dated May 4, 2004, respectively.

5) EPA replicate testing of the CCP HENC was performed and evaluated.

The purpose of the replicate testing performed as part of this inspection is to provide the EPA with an independent means to verify that the CCP HENC can provide consistent,

reproducible results for the determination of the quantity of ten 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 or instrument in order to:

- show that the instrument produces results consistent with the reported TMU, by comparing the sample standard deviation for a number of replicate measurements taken over several hours or days to the reported TMU; and to
- show that the instrument 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 the inspection to certify the LLNL CCP HENC, EPA requested that LLNL reassay three (3) drums that EPA randomly selected from a list of drums previously assayed on the HENC. The drums included containers LL85100561TRU, LL85200674TRU, and LL85701176TRU. Each of the drums was reassayed five (5) times. Two statistical tests, a chi-squared (χ^2) test and *t* test were performed for each container. Data and results of the statistical analysis are included in Attachments B.1-B.6.

For Container LL85100561TRU, the χ^2 test showed that, within the statistical limits of the test, the observed variances in the replicate measurements are less than or equal to the reported uncertainties. The *t* test showed statistically significant differences between the original measurement assay values and the average of the five replicate measurements for the activities of ^{239}Pu and ^{242}Pu, and the TRU alpha activity concentration. The average activity of ^{239}Pu for the replicate measurements is 13% less than that of the original measurement, while the average activity of ^{242}Pu for the replicate measurements is 15% greater than that of the original measurement. For the replicate measurements, the average TRU alpha activity concentration is 6% less than that of the original measurements. The deviations in the above mentioned replicate data suggest that assay results are likely to vary more over long periods than over much shorter periods. This not entirely unexpected since environmental backgrounds are likely to change more from day-to-day or over the course of an entire day than from hour-to-hour. The observed deviations which are somewhat greater than the reported TMU also suggest that the TMU may be somewhat underestimated.

The χ^2 test for Container LL85200674TRU showed that, within the statistical limits of the test, the observed variances in the replicate measurements are less than or equal to the reported uncertainties. The *t* test for showed only statistically significant differences between the original measurement assay values and the average of the five replicate measurements for the activity of ^{241}Am. The averages of the reported assay values for ^{241}Am are only 5% less than the original assay values, a difference not inconsistent with the reported uncertainty and quite likely due simply to chance. According to the *t* test the probability of observing such a difference due to chance is 4.8%, a probability only slightly smaller the 5% probability used to identify statistically significant differences.

The *t* test for Container LL85701176TRU showed no statistically significant differences between the original measurement assay values and the average of the five replicate

measurements. The χ^2 test showed that for all but one radionuclide, within the statistical limits of the test, the observed variances in the replicate measurements are less than or equal to the reported uncertainties. The relative sample standard deviation for the activity of ^{238}Pu reported for the five replicate measurements was 25%, a value about two and a half times as large as the reported relative uncertainty of 9% for the original measurement. The probability of a difference arising from chance is about 0.08%. The relative sample standard deviation for the activity of ^{238}Pu reported for Containers LL85100561TRU and LL85200674TRU was 7%. The χ^2 test results are consistent with the results for LL85100561TRU that suggest the TMU for the CCP HENC may be underestimated and underreported.

Findings:

The EPA inspection team identified one (1) NDA finding.

NDA Finding Number 1: The determination of the TMU using the absolute gamma modality of the CCP HENC did not adequately address all contributions of uncertainty. For absolute gamma spectrometry measurements, the energy dependent efficiency curve for a waste drum was estimated by interpolation, using the energy dependent efficiency curves of surrogate calibration drums with lower and higher densities. The density was calculated by dividing the net weight (or mass) of the drum by the volume of waste, based on the fill percentage, typically estimated by radiography. The uncertainty in the density of the waste matrix was not explicitly included in the TMU determination, or otherwise addressed in the TMU report. This issue was also reflected in a Corrective Action Report (CAR) issued by CBFO. Additionally, replicate testing data suggested that the TMU for the CCP HENC may be underestimated and underreported. EPA will review the estimation of the TMU as part of its review of DOE's response to this finding.

Concerns:

The EPA inspection team identified no 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 sufficiency and scope and on quantitative and qualitative identification of waste material parameters. Quantification of WMPs was required according to 40 CFR 194.24:

- Documentation of RTR activities through procedures, operating instructions, and operator aids;
- Proper execution of RTR activities;
- Management oversight and independent review of RTR activities;
- Statistical verification of RTR activities through VE (see Section 7.4); and
- Training of RTR personnel.

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

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

The following documents were among those examined to assess whether all RTR operations follow the appropriate approved procedures:

- CCP-TP-102, Revision 1, *CCP RTR #2 Radiography Inspection Operating Procedure, 02/24/2004*
- CCP-TP-028, Revision 2, *CCP Radiographic Test and Training Drum Requirements, 02/24/2004*
- RTR Batch Data Report LL04-NDE-0001 (container numbers LL85000514TRU*, LL85000528TRU*, LL85900581TRU*, LL85400499TRU, LL85000514TRU IO and LL85900581TRU R*)
- RTR Batch Data Report LL04-NDE-0002 (container numbers LL85900722TRU*, LL85101184TRU*, LL85800746TRU*, LL85900760TRU*, LL85900722TRU IO and LL85801184TRU R*)
- RTR Batch Data Report LL04-NDE-0007 (container numbers LL85000571TRU*, LL85200527TRU*, LL85200787TRU*, LL85100561TRU*, LL85500601TRU*, LL85600530TRU, LL85000726TRU, LL85800483TRU, LL85600530TRU IO and LL85100561TRU R*)

**For each of the above containers, the associated videotape record was also reviewed as part of the inspection.*

During the inspection, we assessed several technical elements of CCP's RTR process at LLNL (see Attachment A.3), as discussed below.

1) Overall procedural technical sufficiency and scope, with emphasis on quantitative and qualitative identification of waste material parameters

The Mobile RTR system procedure, documented in *CCP-TP-102, Revision 1, CCP RTR #2 Radiography Inspection Operating Procedure*, 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.

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

Procedure *CCP-TP-102, Revision 1* required that radiography calibration be conducted at the beginning of every shift in which drums are subject to examination. LLNL CCP adherence

to calibration requirements were confirmed through: a May 5, 2004 interview with RTR specialists, Greg Lamb and Steve Ewing; EPA examination of RTR for two waste containers during the inspection; and review of RTR videotapes for 15 waste containers in three batch data reports.

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 Lines-Pair Test acceptance criteria, as prescribed in *CCP-TP-102, S. 4.5* is that a minimum of five (5) line pairs per cm (lp/cm) are clearly visible on the calibration scale.

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 (if present), and the gauge markings that are attached magnetically to the outside of the drum. 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.

As part of the inspection, EPA observed the examination of two waste containers, drum number LL85100434TRU and drum number LL85900524TRU. EPA also reviewed videotaped scans of containers from Batch Data Reports LL04-NDE-0001, LL04-NDE-0002 and LL04-NDE-0007 as noted with an asterisk in the fore mentioned document list. Examination was conducted in accordance with established site procedures and the requirements for characterization contained in 40 CFR 194.24.

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 two waste containers and further verified by review of RTR videotapes for the above referenced waste containers. A second operator inputs the data into an electronic RTR waste container data form.

4) Adequate documentation of radiography procedures was ascertained.

Radiography procedures are well defined and the documents are controlled. During the inspection, EPA reviewed the documentation and adequacy of all radiography-related procedures.

5) Training of radiography personnel was adequate.

Procedure *CCP-TP-028, Revision 2, CCP Radiographic Test and Training Drum Requirements*, includes all the requirements for content and set-up of the radiography test drum. Mr. Steve Ewing prepared the test drum. The test drum contained the requisite items

specified in the regulations. During the inspection, EPA reviewed documentation of the capability demonstration for all radiography personnel. Training records reviewed indicate that only trained personnel were operating the RTR equipment. Training documentation was complete and filed correctly for viewing and reference. The documents reviewed include:

- CCP Qualification Cards for Steve Ewing, NDE-03, Rev. 0
- CCP Qualification Cards for Larry Lamb, NDE-03, Rev. 0
- CCP Qualification Cards for Greg Lamb, NDE-03, Rev. 0

EPA also reviewed the following RTR test drum videotapes and verified that all prohibited items were identified by the operator.

- RTR Tape LL-NDE-TEST-01B, Operator – Greg Lamb
- RTR Tape LL-NDE-TEST-03D, Operator – Larry Lamb

The test drums are prepared by the technical supervisor in accordance with Procedure *CCP-TP-028, Revision 2, CCP Radiographic Test and Training Drum Requirements.*

Findings:

The EPA inspection team identified no RTR findings.

Concerns:

The EPA inspection team identified no RTR concerns.

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 sufficiency and scope and on quantitative and qualitative identification of WMPs:

- Characterization of WMPs as required by 40 CFR 194.24,
- Documentation of VE activities,
- Adequate documentation of VE procedures, and
- Training of VE personnel.

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

- Types and amounts of WMPs,
- Confirm presence or absence of items prohibited from disposal,
- Removal of prohibited items from waste stream,

- Confirmation of RTR analysis, and
- Training for new operators on the VE system using on-job training.

The following documents were among those examined to assess whether all VE operations follow the appropriate approved procedures:

- CCP-TP-114, Revision 2, *CCP Waste Visual Examination, 03/24/2004*
- CCP-QP-002, Revision 15, *CCP Training and Qualification Plan, 03/10/2004*
- VE Batch Data Report LL04-VE-0001TRU (container number LL85000514TRU*)
- VE Batch Data Report LL04-VE-0002TRU (container number LL85900581TRU)
- VE Batch Data Report LL04-VE-0003TRU (container number LL85400499TRU*)
- VE Batch Data Report LL04-VE-0004TRU (container number LL85900722TRU)
- VE Batch Data Report LL04-VE-0005TRU (container number LL85101184TRU)
- VE Batch Data Report LL04-VE-0006TRU (container number LL85800746TRU)
- VE Batch Data Report LL04-VE-0007TRU (container number LL85300621TRU*)
- VE Batch Data Report LL04-VE-0008TRU (container number LL85000571TRU)

**For each of the above containers, the associated videotape record was also reviewed as part of the inspection.*

During the inspection, EPA assessed several technical elements of CCP's VE process at LLNL (see Attachment A.4), as discussed below.

1) Overall procedural technical sufficiency and scope, with emphasis on quantitative and qualitative identification of WMPs, were examined.

The VE system procedure, documented in *CCP-TP-114, Revision 2, CCP Waste Visual Examination*, contained specific information on performing visual examination 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 visual examination results.

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

The VE procedure required that at the beginning of every drum examination or prohibited item removal, video and audio checks are performed to ensure high-quality results. This was confirmed during an interview with Abraham Romo on May 4, 2004, and EPA's examination of VE on two waste containers during the inspection and subsequent review of VE videotapes. A test image and narrative were recorded, the tape is stopped, rewound and played back to verify high quality audio and video. The tape is stopped at the end of the test and VE is recorded from that point on, thereby saving the test portion on the tape.

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 are the drum number and the date and time on the audio/video recording before beginning the visual examination. 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. Dosages are recorded for individual packages within the drum. Packages are opened to the lowest layer of confinement and sorted by Waste Material Parameter (WMP) category. The waste is recorded for weight and volume estimated, then repacked into a new drum with liner. Results of the VE are recorded electronically on the *CCP Waste VE Data Form, CCP-TP-114, Attachment 9.* In the event a prohibited item is removed, the item is segregated from the remaining waste and then processed into the output drum. The prohibited item's weight is recorded on the *CCP Waste VE Prohibited Item Removal Form, CCP-TP-114, Attachment 10.*

As part of the inspection, EPA observed the VE of one waste container, drum number LL85800039TRU. EPA also reviewed videotaped scans of containers from Batch Data Reports LL04-VE-0001, LL04-VE-0003 and LL04-VE-0007 as noted with an asterisk in the fore mentioned document list. Examination was conducted in accordance with established site procedures and the requirements for characterization contained in 40 CFR 194.24.

3) Documentation of VE 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 waste container and further verified by review of VE videotapes for the above referenced waste containers. A second operator inputs the data into an electronic VE waste container data form.

4) Documentation of VE procedures appeared adequate.

VE procedures were well defined and the documents are controlled. During the inspection, EPA reviewed the documentation and adequacy of all VE related procedures.

5) Training of VE personnel was evaluated.

Procedure *CCP-QP-002, Revision 15, CCP Training and Qualification Plan*, includes all the requirements for qualifying personnel for VE responsibility. During the inspection, EPA reviewed documentation of the capability demonstration for all visual examination personnel. Training records reviewed indicate that only trained personnel are performing VE. Training documentation was complete and filed correctly for viewing and reference. The documents reviewed include:

- CCP Qualification Cards for Abraham Romo, VEO-03, Rev. 1
- CCP Qualification Cards for Favian Romo, VEO-03, Rev. 1
- CCP Qualification Cards for Doyle Durham, VEO-03, Rev. 1

Findings:

The EPA inspection team identified no VE findings.

Concerns:

The EPA inspection team identified no VE concerns.

7.5 WIPP Waste Information System (WWIS)

WC data at LLNL was acquired from the various sources (AK, RTR, VE, and NDA) and subsequently compiled into BDRs. Once the waste had been through every level of review and approval, it would be certified by a Waste Certification Official (WCO) for entry into the WWIS and transmittal to the WIPP. The CCP program used an excel spreadsheet and the WWIS system to perform basic data checks, transmit data, and receive confirmation, approval, or denial of waste data at the LLNL facility.

The following documents were reviewed prior to or during the audit to inform the development of checklists and guide investigation and questions during the inspection:

- CCP-TP-030, Revision 11, *CCP TRU Waste Certification and WWIS Data Entry,* 03/29/04
- Instructions for WWIS Data Entry Personnel for CCP at LLNL [Waste Stream LL001.01], Revision 0, April 30, 2004.

At the time of EPA's inspection, LLNL had not been approved for any waste streams and no waste stream profiles had been submitted for initiating WWIS entry. Therefore, the recent date on the baseline WWIS data entry instruction document is not problematic.

During the inspection, we assessed several technical elements of CCP's WWIS process at LLNL (see Attachment A.5), as discussed below.

1) Overall procedural technical sufficiency and scope were assessed.

The WWIS procedure, documented in *CCP-TP-030, Revision 11, CCP TRU Waste Certification and WWIS Data Entry*, contained information on entering, reviewing and transmitting data, as well as issuance of non-conformance reports and technical review of data. The procedures for gathering LLNL information for entry into the WWIS was consistent with the procedure employed for the other CCP sites. Based upon the review of the procedure and the actual WWIS practices, the overall WWIS LLNL data entry process was adequate.

2) Documentation of WWIS activities was examined.

Waste data was entered into an Excel spreadsheet (LLNL Template.xls) which was the same template originally developed for the Nevada Test Site (reviewed and approved by EPA) with

modifications and updates to incorporate the TRUCON codes likely to be encountered at LLNL, updated decay codes, and updated shipping codes for LLNL. Ms. Shelley Jensen (LLNL based Data Entry Person) and Mr. J.R. Stroble demonstrated the data entry process, the QC checks performed by the spreadsheet template, and the WWIS import, storage, and transmittal processes. The demonstration conformed to the requirements in the governing procedure.

Data storage was demonstrated. The file structure included folders that were named for the particular waste stream and which contained individual files named by the batch number. Each waste stream (file folder) could also be broken down into data "lots", which contained batch data reports. The LL001.01waste stream had a large waste container population and was to be processed by "lots" rather than by batch. For the purposes of the inspection, surrogate data was entered to simulate actual data entry and review. At the time of the inspection, LLNL did not have approval to transmit real characterization data to WWIS. Consequently, the inspectors were not able to observe the transfer of actual LLNL characterization results into the WWIS. However, an identical system had been successfully implemented at other CCP sites.

3) Adequate documentation of WWIS procedures was ascertained.

WWIS procedures were well defined and the documents were controlled. During the inspection, EPA reviewed the documentation and adequacy of all WWIS-related procedures.

4) Training of WWIS personnel was evaluated.

Actual job performance was observed to verify training and qualification of the WWIS personnel. A qual card system is used to document WWIS training that typically consisted of procedure review and required reading including the WIPP WAC.

Findings:

The EPA inspection team identified no WWIS findings

Concerns:

The EPA inspection team identified no WWIS concerns.

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 characterize the following wastes in accordance with 40 CFR 194.24(c)(4) as follows:

1) The AK process appeared technically adequate and are adequately implemented.
2) The NDA systems are technically adequate and related processes are adequately implemented
3) The NDE system is technically adequate and related processes are adequately implemented
4) The WWIS process was adequately implemented

The EPA inspection team identified two (2) findings and (5) concerns, but none of the concerns requires a response.

9.1 Findings

AK Finding No. 1: LLNL CCP must segregate all S3000 containers from the mixed debris waste stream, and recategorize these segregated containers into a new waste stream. Waste Streams identified as containing drums that are greater than 50% solids (S3000) clearly do not belong in a debris waste stream, as they are generated by a separate process and have a different physical form.

NDA Finding Number 1: The determination of the TMU using the absolute gamma modality of the CCP HENC does not adequately address all contributions of uncertainty. For absolute gamma spectrometry measurements, the energy dependent efficiency curve for a waste drum is estimated by interpolation, using the energy dependent efficiency curves of surrogate calibration drums with lower and higher densities. The density is calculating by dividing the net weight (or mass) of the drum by the volume of waste, based on the fill percentage, typically estimated by radiography. The uncertainty in the density of the waste matrix is not explicitly included in the TMU determination, or otherwise addressed in the TMU report. Additionally, replicate testing data suggest that the TMU for the CCP HENC may be underestimated and underreported. EPA will review the estimation of the TMU as part of its review of DOE's response to this finding.

9.2 Concerns

AK Concern Number 1: LLNL has a site wide data base tracking system which assists in the internal tracking of containers to be shipped to WIPP. According to Mr. Jeff Harrison, the tracking database is referred to as the HAZTRACK database. Procedures for the use of this internal database are not documented in the AK record, nor is it clear that the software has been tested and validated for use in accordance with software quality assurance protocols outlined in 194.22. While no response to this concern is required at this time, EPA shall inspect and assess this data transfer mechanism under a separate inspection venue, and it will be of particular scrutiny if it is ever used to directly import data into the WWIS at some future date.

AK Concern Number 2: CCP-TP-005 was revised to include a new section 4.4.17 mandating AK-NDA personnel communication and concurrence with regard to the use of AK by NDA. Language was included in a memorandum (reference C111) which specified how AK was to be used by NDA. This language well documents the proposed approach, but EPA expects that measured data will be used if at all possible. If for some reason measured data cannot be used,

all resolution and justifications for use of AK and default isotopics shall be documented and placed in the AK record. Further, criteria for "expert review" and determinations thereof must also be well documented and placed in the auditable record. Additionally, mandatory examination of WDR would appear appropriate rather than stating the NDA personnel "may" examine this information source when there are no measured data and information must be obtained. Data limitations or issues that might arise that could impact the quality of information imported into the measurement system must be documented. Finally, updating of the memo could be required if additional NDA data indicate that different use of AK information. No response to this concern is required, and EPA shall assess the adequacy of waste stream AK-NDA resolution memorandum during our recertification inspection.

AK Concern Number 3: The WAP and WAC define waste stream as:

> *"A waste stream is waste material generated from a single process or from an activity which is similar in material, physical form, and hazardous constituents."*

The AKS for the debris should clearly indicate how the waste streams meet the required definition; this is of particular concern for the mixed debris waste stream which is comprised, apparently of very different materials and physical forms of wastes, and it is of question whether the wastes were indeed generated from a single process. Available data appear to indicate that these relatively small retrievably stored waste stream(s) cannot necessarily be better segregated to better meet the definition of waste stream, therefore no response to this concern is required at this time. However, EPA shall examine the definition of waste stream and maintenance of this definition for any newly generated components of this waste stream for which approval may be sought in the future, unless wastes with the recognized disparate material and physical forms can be clearly demonstrated to have been generated from a distinct, single waste generating process.

AK Concern No 4: The assignment of waste matrix code group is not well justified, particularly since detailed data are available for each drum (or drum parcel). In so doing, the site has rendered AK accuracy calculations invalid, because the choice was made to not use detailed data to assign the lowest level WMC assignment possible. EPA expects that the waste matrix code or code group assignment shall be well described and documented in the AK record to ensure that appropriate waste stream designations are made and supported. No response to this concern is required at this time, but EPA shall evaluate whether the AK record includes adequate justification at its recertification inspection..

AK Concern No 5: AK accuracy, as cited in the WAC, requires comparison of radionuclide AK and measurement data, but is non-specific with respect to how this accomplished. In cases where AK data are used specifically as part of, in lieu of, or to directly support NDA measurements, then the AK accuracy calculations should provide meaningful assessments of AK data use to these ends. If, however, sites believe AK data do not provide this type of support, then the AK accuracy assessment should reflect this level of AK use. The CCP procedure should be revised to recognize this distinction. No response to this concern is required at this time, as EPA shall assess AK Accuracy during its next recertification inspection.

9.3 Conclusion

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

Acceptable Knowledge: — The AK process is adequate for characterizing contact handled retrievably stored debris waste, although several concerns were identified that EPA shall examine and assess for resolution during the recertification inspection.

Nondestructive Assay (NDA) — The CCP HENC NDA system and the process used at LLNL is adequate for characterizing contact handled heterogeneous debris TRU waste.

Nondestructive Examination (NDE) — The NDE processes used at LLNL is adequate for determining the physical components of contact-handled debris TRU waste.

WIPP Waste Information System (WWIS) — The WWIS process used at LLNL under the CCP program is adequate.

The EPA inspection team determined that LLNL's waste characterization processes (specifically AK, NDA, RTR, VE and WWIS) inspected can adequately characterize CH retrievably-stored TRU debris (S5000) waste in accordance with 40 CFR 194.24(c)(4).

Attachment A.1
AK Checklist

Attachment A.2
NDA Checklist

Attachment A.3
Radiography (NDE) Checklist

Attachment A.4
VE Checklist

Attachment A.5
WWIS Checklist

Attachment A.5.1
List of WWIS Items

Attachment B.1
Replicate Testing Data for Container LL85100561TRU

Attachment B.2
Replicate Testing Results for Container LL85100561TRU

Attachment B.3
Replicate Testing Data for Container LL85200674TRU

Attachment B.4
Replicate Testing Results for Container LL85200674TRU

Attachment B.5
Replicate Testing Data for Container LL85701176TRU

Attachment B.6
Replicate Testing Results for Container LL85701176TRU

A.1 Acceptable Knowledge (AK) Checklist for Inspection EPA- LLNL-CCP

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		CCP-QP-002	• 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	Training and Qualification, training records for Mark Doherty, Billy Kirkes, and Shari Nance. Personnel understood job duties and could identify mandatory information needs/procedures. It was noted that periodic retraining is not required for AK personnel, and this should be considered.
Procedures demonstrate a logical progression from general facility information to more detailed waste stream-specific information		CCP-TP-005 Rev 13	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 by use of a drum trailer used at the facility.	Y	CCP-AK-LNL-001, Rev0; P001, P004, Contents Inventory Data Sheet, Containers LL85101184 TRU, LL85400499 TRU, LL85900581 TRU, LL85900722 TRU, LL85000571 TRU traceably appear to be adequate.
Procedures for AK processes are consistent with each other		CCP-TP-005 Rev 13	Procedures for AK processes are implemented consistently	Y	Single procedure deals with AK

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
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)	CCP-TP-005 Rev 13	Procedures are implemented consistently	N	CCP-AK-LLNL-001 Rev.0, Poo1, P004, P002, Attachment 7, C002, U001, U002. A significant quantity of isotopic data are collected, and it appears that this information is adequately presented. Ferrous metals are qualitatively assessed in AK, reference 5.4.1.2 page 64. Waste material parameter quality also, based on parcel cards, Reference C103, a memo to file. Note that individual container/parcel data are available, but the site chose not to use this detailed information to better refine the waste matrix code assignment, and did not adequately justify the waste stream designation because the site combines S3000 and S5000 waste into a waste stream when they can clearly be segregated.
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) From CH WAC: 1. Specify isotopes/quantities defined by AK –Must be appropriate and result in unbiased values for cumulative activity and mass of Radionuclides	CCP-TP-005 Rev 13	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) From CH WAC: Is AK information collected for isotopes?	Y	CCP-AK-LLNL-001 Rev.0, P002, P004, P005, P006, U002. Radionuclides are documented based on the location and building and linked to AK. AK information appears to be collected for WMPs and radionuclides, but in the case of WMPs as part of WMC assignment, no spreadsheet quantifications were presented to inspectors.

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
Procedures require documentation of radionuclide process origin	CCP-TP-005 Rev 13	Identified Radionuclides and their isotopic distributions are consistent and accurate	Y	CCP-AK-LLNL-001 Rev.0, P001, P002, P003, P004, U001, U002 Acceptable Knowledge Source Document Summary reports have been completed which clearly defines and documents the procedures to be followed by NDA to determine AK. Memo documenting AK use by NDA (C111) was generated. Data limitations, uses, etc. should be documented in the AK record.
		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	Se above. Also, note that while the NDA-AK communication and use of AK is agreed upon, measured data should take precedence, al l use of Aks should be well justified, etc.
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) • Auditing of AK records.	CCP-TP-005 Rev 13, CCP-TP-03, Rev 13	Compilation of AK documentation is adequately demonstrated	Y, in part	CCP-AK-LLNL-001 Rev.0, C001, C002, P001, P002, P003, P004, P005, P006, U001, U002., D002, D002 Batch Data Reports; AK Accuracy reports; WSPF for Waste Streams LL-T002-S5400, and LL-M001-S5400. The CCP program personnel assembled what they believed to be adequate documentation to support the intended use of AK (i.e. mandatory information), NDA personnel and AK personnel have now established a process to collect adequate supplemental AK data. Data discrepancies appear to be adequately resolved. As indicated in other checklist elements, however, the waste stream definition is of question, as is the assignment of the WMCG designator rather than WMC. It appears that confirmation takes place, as three containers (or more) had been through the process of confirmation.
		Discrepancies are adequately resolved	Y	

Establishment of Required Technical Elements in Procedures	Y/N	Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
From CH-WAC 1.If AK used (i.e. data collected prior to QA program)- what method was employed to qualify-peer review, corroborating data, confirmatory testing, 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 <u>2, 238, 239, 240, 241, 242 Pu and 241Am:</u> -Confirmation can be accomplished via comparison of measured and AK values for ^{239} Pu/ ^{240} Pu for wgpu; ^{238}Pu/ ^{239}Pu for heat source. - Measured ^{241}Am can be used to calculate 241Pu (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) - ^{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		CCP-TP-005 Rev 13	AK confirmation based on NDE and/or visual examination is adequately demonstrated	N	CCP-AK-LLNL-001 Rev.0, U001, U002, C111. AK Personnel perform adequate supplemental/supporting data acquisition with respect to radionuclide information. The memorandum (C111) describing AK use by NDA indicates that while the CH WAC comparison allowances will be used as applicable, but contrary to memo implications, sites must use measured data if at all possible. The memo states: "If measured values are not used to calculate individual Pu isotope masses, NDA will compare the available measurement to the AK isotopic ratios to one of the six grades of plutonium. One of those radios will be used to calculate the individual Pu isotope masses. If the measurement does not correspond to one of the ratios, NDA performs expert review. NDA personnel may assess the isotopic information contained in the Waste Disposal Requisition (WDR) package (e.g. Parcel Cards) as a guide for scaling the other isotopes. If there are no Pu isotopics, only measured values will be used to categorize the drum as TRU....If a given drum contains a mixture of plutonium grades, the weapons-grade composition will be used to scale Pu-242. This will provide a conservatively low result so as not to overestimate the amount of Pu242". This appears appropriate so long as measured data are used when at all possible, the use of expert review is justified, and all decisions are placed in the AK record.

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
3. 235U, 233U, 238U, 234U 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 4. ^{137}Cs and ^{90}Sr -confirmed by WIPP certified system (direct measurement or comparison of ^{241}Am peak at 662 kv to other ^{241}Am peaks (disproportionate ^{241}Am peak at 662 kv could mean presence of ^{137}Cs) - 90 Sr calculated from ^{137}Cs using scaling factors 5. Other Radionuclides- must identify via NDA and should identify via AK	CCP-TP-005 Rev 13		Y	See above. Also, the memo states: "If U-235 is measured, the U-235 activity will be multiplied by a conservative factor of 30 to calculate U-234 activity. If u-238 is measured and U-235 is not measured, NDA performs expert review. NDA personnel may assess the isotopic information contained in the WDR package to determine if DU or NU is present. If information in the WDR does not specify this information, NU will be conservatively assumed. This will provide a conservatively high U-234 estimate...NDA will use the conservative activity ration of 1.0 to calculate Sr-90 based on the Cs-137 measurement..."
Procedures require that: • AK information be compiled in an auditable record, including a road map for all applicable information. • A reference list be provided that 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 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 be segregated.	CCP-TP-005 Rev 13	• 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 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 is clearly described. For newly generated wastes, the rate and quantity of waste to be generated are defined. • Nonconforming waste is segregated.	Y	CCP-AK-LLNL-001 Rev.0. Attachment 4 is the AK roadmap, and is adequate. The reference list provides adequate supplemental information. The overview of the facility is adequate. The CCP program did adequately document input materials from various building to demonstrate that activities were defense related.

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
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 -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 **From CH-WAC** 1 **waste identification/categorization** schemes relevant to the isotopic composition of waste and description of isotopic composition of each waste stream 2 physical/chemical waste composition that could affect isotopic distribution (i.e. processes to remove ingrown 241am) 3 statement of all numerical adjustments applied to derive the material's isotopic distribution e.g. scaling factors, decay/ingrowth corrections and secular equilibrium considerations 4 specification of isotopic ratios for the 10 WIPP-tracked Radionuclides and, if applicable, the Radionuclides that comprise 95% of the hazard	CCP-TP-005 Rev 13	The following information is 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 -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 From CH-WAC 1 waste identification/categorization schemes relevant to the isotopic composition of waste and description of isotopic composition of each waste stream 2 physical/chemical waste composition that could affect isotopic distribution (i.e. processes to remove ingrown 241am) 3 statement of all numerical adjustments applied to derive the material's isotopic distribution e.g. scaling factors, decay/ingrowth corrections and secular equilibrium considerations 4 specification of isotopic ratios for the 10 WIPP-tracked Radionuclides and, if applicable, the Radionuclides that comprise 95% of the hazard	Y	CCP-AK-LLNL-001 Rev.0, C002, P001, P002, P003, P004, P005, P006, U001, U002., D002, D002 Batch Data Reports; AK Accuracy reports; PKE for Waste Streams. Mandatory/general information was available, and LL-T001-S5400 and LL-M001-S5400 linkages between process material input origin and assumed waste outputs are in the AK record. CCP program has done a progressively better job at including isotopic compositions that could affect distributions, etc.

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
The site has procedures for the collection of supplemental information.	CCP-TP-005 Rev 13	Samples of supplemental information are sufficiently detailed and are appropriate to the waste being characterized. From CH-WAC Examples of supplemental information include: 1 safeguards and security and other material control systems/programs 2 reports of nuclear safety or criticality, accidents involving SNM 3 waste packaging, waste disposal, building or nuclear material management area logs or inventory records, site databases that provide SNM or nuclear material information 4 test plans, research project reports, or laboratory notebooks that describe the radionuclide content of materials used in experiments 5 information from site personnel 6 historical analytical data relevant to isotopic distribution of the waste stream	Y	CCP-AK-LLNL-001 Rev.0, C002, P001, P002, P003, P004, P005, P006, U001, U002., D002, D002 Batch Data Reports; AK Accuracy reports; PKE for Waste Streams LL-T001-S5400, and LL-M001-S5400. Collection of supplemental information was adequate. AKE relied on only higher tier documents for generalized information but also provide acceptable supplemental information. Safeguards/security data, reports of nuclear safety, test plans, information from site personnel, etc were 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.	CCP-TP-005 Rev 13	The AK summary is available for EPA review and contains the required information, including the basis for all waste stream designations.	Y	CCP-AK-LLNL-001 Rev.0. AK Summary was prepared; see comments above for deficiencies associated with the AK Summary
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.	CCP-TP-005 Rev 13	Additional information is collected before waste may be shipped if the required AK information is not available for a waste stream.	Y	CCP-AK-LLNL-001 Rev.0. To date, CCP states that adequate information has been available.

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.	CCP-TP-005 Rev 13	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	CCP-AK-LLNL-001 Rev.0. AK Accuracy Report Attachment 11. Confirmation was completed at the time of the inspection. As with all sites, tracking of WMC outliers to ensure that the preponderance of waste in the waste stream matches the WMC. Is recommended. AK accuracy must be revised to reflect the intended us of the data with respect to radionuclide/isotopic comparisons. Also, AK Accuracy calculations for WMC are rendered invalid by the site's choice of using WMCG rather than WMC, since they could easily assign WMC on a container basis and have chosen not to do so.
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	CCP-TP-005 Rev 13	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	CCP-AK-LLNL-001 Rev.0. Has not been implemented yet, so no objective evidence to this end was available

Establishment of Required Technical Elements in Procedures	Y/N	Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
The site has procedures for shipment revocation and procedures for notification of CAO when a container is revoked?		CCP-TP-005 Rev 13	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	No CCP shipments have been revoked.
Until discrepancies are resolved, shipment of the waste stream to the WIPP is prohibited.		CCP-TP-005 Rev 13	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	Note that the Discrepancy Reports are filled out and the package is re-evaluated and repackaged.

A.2 Nondestructive Assay (NDA) Checklist for Inspection EPA- LLNL-CCP-05.04-8

Establishment of Required Technical Elements in Procedures	Y/N	Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
The method used to calculate the total measurement uncertainty (TMU) for all required quantities must be documented and technically justified.	Y	*CCP Transuranic Waste Plan*, CCP-PO-002, Révision 9, Section A.3 (Page 100)	The method used to calculate the total measurement uncertainty (TMU) for all required quantities are documented and technically justified.	N	The uncertainty in the density of the waste matrix is not explicitly included in the TMU determination, or otherwise addressed in the TMU report.
Methods to determine TMU must be reviewed and approved by CBFO for each NDA instrument.	Y	*CCP Transuranic Waste Plan*, CCP-PO-002, Révision 9, Section A.3 (Page 100)	Methods to determine TMU have been reviewed and approved by CBFO for each NDA instrument.	N	CBFO issued a Corrective Action Report (CAR) because "The CCP report 'Total Measurement Uncertainty for the WIPP High Efficiency Neutron Counter (HENC)' Revision 2 is inadequate. It contains several errors and does not fully represent the contribution of the determination of drum density."
Calibration					
Procedures require that each NDA instrument is calibrated before its initial use.	Y	*CCP Transuranic Waste Plan*, CCP-PO-002, Revision 9, Section A.3 (Page 100)	The NDA instrument has been calibrated before its initial use.	Y	The CCP HENC passive neutron and absolute gamma calibrations were performed in March 2004 and February 2004, respectively.
Site procedures must specify the range of applicability of system calibrations.	Y	*CCP Transuranic Waste Plan*, CCP-PO-002, Revision 9, Section A.3 (Page 100)	The range of applicability of system calibrations has been specified.	Y	The passive calibration range is from 0 to 11.5 g ^{240}Pu effective (200 g WGPu). The gamma energy calibration is from 59 to 1,408 keV. The absolute gamma efficiency is applicable for matrix densities between 0.0187 and 1.589 gcm^3.
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	*CCP Transuranic Waste Plan*, CCP-PO-002, Revision 9, Section A.3 (Page 100)	Matrix/source surrogate waste combinations used are representative of the activity ranges and relevant waste matrix characteristics planned for measurement by the system.	Y	Absolute gamma calibration included surrogate matrices with densities of 0.0187, 0.440, 0.660, and 1.589 g/cm^3. The Add-a-Source passive neutron correction was verified using surrogate drums containing matrices spanning the expected moderator index.

Establishment of Required Technical Elements in Procedures	Y/N	Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
					Matrices included combustibles, metals, glass, and sludge.
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	*CCP Transuranic Waste Plan*, CCP-PO-002, Revision 9, Section A.3 (Page 101)	Consensus standards have been used, when such standards exist. If consensus standards do not exist, the calibration technique has been approved by CBFO.	Y	For gamma calibration, six (6) $^{241}Am/^{152}Eu$ line sources used. For passive neutron calibration, weapons grade plutonium oxide (PuO_2) used.
Procedures require that primary standards be obtained from suppliers maintaining a nationally accredited measurement program.	Y	*CCP Transuranic Waste Plan*, CCP-PO-002, Revision 9, Section A.3 (Page 101)	Primary standards have been obtained from suppliers maintaining a nationally accredited measurement program	Y	Copies of source certificates for $^{241}Am/^{152}Eu$ line sources and PuO_2 sources are included in Appendix 1 of the calibration report.
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, replacement of the system's components, significant changes to the system's software, and relocation of the system.	Y	*CCP Transuranic Waste Plan*, CCP-PO-002, Revision 9, Section A.3 (Page 101)	Verification of an NDA instrument's calibration has been performed when required.	Y	Passive neutron chamber efficiency, originally determined at the factory, was verified using a ^{252}Cf source. (This is an addition to the mass calibration performed independently.
Procedures require recalibration of the system if the calibration verification demonstrates that the system's response has significantly changed.	Y	*CCP Transuranic Waste Plan*, CCP-PO-002, Revision 9, Section A.3 (Page 101)	Recalibration of the system has been performed if the calibration verification demonstrates that the system's response has significantly changed.	Y	Verification of the passive neutron calibration indicated that the system's response had not significantly changed. No recalibration was required.
Calibration Confirmation					
Procedures require confirmation of the calibration of a system by performing replicate measurements of a non-interfering matrix.	Y	*CCP Transuranic Waste Plan*, CCP-PO-002, Revision 9, Section A.3 (Page 101)	The calibration of a system has been confirmed by performing replicate measurements of a non-interfering matrix.	Y	Absolute gamma and passive neutron calibrations have been confirmed by making six (6) replicate measurements for of a combustibles and zero-matrix drum, respectively for each of three different plutonium loadings.
Procedures require that replicate measurements be performed with containers of the same nominal size as those used for actual waste assays.	Y	*CCP Transuranic Waste Plan*, CCP-PO-002, Revision 9, Section A.3 (Page 101)	Replicate measurements have been performed with containers of the same nominal size as those used for actual waste assays.	Y	Replicate measurements were made using 55-gallon drums, like those normally assayed.
Procedures require that replicate measurements be performed according to	Y	*CCP Transuranic Waste Plan*, CCP-PO-002,	Replicate measurements have been performed according to the same	Y	CCP-TP-107, *Operating the CCP High Efficiency Neutron*

Establishment of Required Technical Elements in Procedures	Y/N	Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
the same procedures used for actual waste assays.		Revision 9, Section A.3 (Page 101)	procedures used for actual waste assays.		*Counter Using NDA 2000*, was used for replicate measurements.
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	*CCP Transuranic Waste Plan*, CCP-PO-002, Revision 9, Section A.3 (Pages 101-102)	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	Sources totaling 0.91, 24, and 133 g WGPu were used for calibration confirmation
Procedures require that the standards used for calibration confirmation are not the same sources for the most recent calibration.	Y	*CCP Transuranic Waste Plan*, CCP-PO-002, Revision 9, Section A.3 (Page 102)	The standards used for calibration confirmation are not the same sources for the most recent calibration.	Y	$^{241}Am/^{152}Eu$ line sources used for absolute gamma calibration were not used for calibration confirmation. WGPu sources used for passive neutron calibration were not used for calibration confirmation.
Requirements for accuracy, expressed as %R, and precision, expressed as %RSD, must be met.	Y	*CCP Transuranic Waste Plan*, CCP-PO-002, Revision 9, Section A.3 (Page 102)	Requirements for accuracy and precision have been met.	Y	Requirements for accuracy (70% < %R < 130%) na d precision (%RSD < 14%) have been met for each of the three drums assayed.
General Quality Control					
Procedures require that all radioassay and data validation be performed by appropriately trained and qualified personnel.	Y	*CCP Transuranic Waste Plan*, CCP-PO-002, Revision 9, Section A.4.1 (Page 104)	All radioassay and data validation has been performed by appropriately trained and qualified personnel.	Y	Operators and data reviewers demonstrated the experience and expertise necessary.
Procedures require that requalification of personnel be based on evidence of continued satisfactory performance and is performed at least every two years.	Y	*CCP Transuranic Waste Plan*, CCP-PO-002, Revision 9, Section A.4.1 (Page 104)	Requalification of personnel be based on evidence of continued satisfactory performance has been performed at least every two years.	Y	Interview with CCP and LLNL personnel.
Procedures require that all computer programs, including spreadsheets used for data reduction or analysis, meet the applicable requirements in the QAPD.	Y	*CCP Transuranic Waste Plan*, CCP-PO-002, Revision 9, Section A.4.1 (Page 104)	All computer programs, including spreadsheets used for data reduction or analysis, meet the applicable requirements in the QAPD.	Y	Software used for data acquisition and analysis includes NDA 2000, Genie 2000, and Multi-Group Analysis (MGA).
Procedures require that site participate in any relevant measurement comparison programs sponsored or approved by CBFO, including the Performance Demonstration Program (PDP).	Y	*CCP Transuranic Waste Plan*, CCP-PO-002, Revision 9, Section A.4.1 (Page 104)	The site has participated in relevant measurement comparison programs sponsored or approved by CBFO.	Y	CCP HENC has participated the PDP program, but results are pending.
Background and Performance Checks					
Procedures require daily background	Y	*CCP Transuranic Waste*	Daily background measurements have	Y	Background checks are

Establishment of Required Technical Elements in Procedures	Y/N	Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
measurements, unless otherwise approved by CBFO. Contributions to backgrounds from nearby radiation sources must be carefully controlled, or more frequent backgrounds must be measured.		*Plan*, CCP-PO-002, Revision 9, Section A.4.2 (Page 105)	been taken, unless otherwise approved by CBFO. Contributions to backgrounds from nearby radiation sources have been carefully controlled.		performed daily in accordance with Section 4.3 of CCP-TP-107, *Operating the CCP High Efficiency Neutron Counter Using NDA 2000.* Control charts are include in BDRs.
Procedures require that system performance checks be performed at least once per operational day.	Y	*CCP Transuranic Waste Plan*, CCP-PO-002, Revision 9, Section A.4.2 (Page 105)	Performance checks have been performed at least once per operational day.	Y	Quality Control (QC) calibration checks are performed daily in accordance with Section 4.4 of CCP-TP-107, *Operating the CCP High Efficiency Neutron Counter Using NDA 2000.* Control charts are include in BDRs.
System performance checks must include, as applicable, efficiency, matrix correction checks, and for spectrometry systems peak position and resolution.	Y	*CCP Transuranic Waste Plan*, CCP-PO-002, Revision 9, Section A.4.2 (Page 105)	Performance checks include, as applicable, efficiency, matrix correction checks, and for spectrometry systems peak position and resolution.	Y	For absolute gamma modality, performance checks include the centroid of the 414 keV peak, the full width half-maximum (FWHM) of the 414 keV peak, and ^{239}Pu mass of a 10 g WGPu source. For passive neutron modality, performance checks include ^{240}Pu effective of 10 g WGPu source.
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	*CCP Transuranic Waste Plan*, CCP-PO-002, Revision 9, Section A.4.2 (Page 105)	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 checks are performed daily in accordance with Section 4.5 of CCP-TP-107, *Operating the CCP High Efficiency Neutron Counter Using NDA 2000.*
Procedures require that interfering surrogate waste matrices be constructed in a way that the matrix characteristics do not change over time.	Y	*CCP Transuranic Waste Plan*, CCP-PO-002, Revision 9, Section A.4.2 (Page 105)	Interfering surrogate waste matrices have been constructed in a way that the matrix characteristics do not change over time.	Y	Interview with CCP and LLNL personnel.
Procedures require that sources used for performance checks either be long-lived or decay-corrected.	Y	*CCP Transuranic Waste Plan*, CCP-PO-002, Revision 9, Section A.4.2 (Page 105)	Sources used for performance checks either are long-lived or decay-corrected.	Y	Plutonium sources used for performance checks are long-lived. Short-lived sources (i.e. ^{252}Cf) are decay corrected.
Procedures require that performance checks be quantitative and based on 2 and 3 sigma limits.	Y	*CCP Transuranic Waste Plan*, CCP-PO-002, Revision 9, Section A.4.2 (Page 106)	Performance checks are quantitative and based on 2 and 3 sigma limits.	Y	Limits are based on Student t-test for 95% and 99% confidence intervals.
Data Management					

Establishment of Required Technical Elements of Procedures	Y/N	Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
Procedures require that all radioassay data be reviewed and approved by qualified personnel before being reported to WWIS.	Y	*CCP Transuranic Waste Plan*, CCP-PO-002, Revision 9, Section A.5.1 (Page 109)	All radioassay data has been reviewed and approved by qualified personnel before being reported to WWIS.	Y	Reviewed Batch Data Reports (BDR) LL04-NDA-0003 and LL04-NDA-0004
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	*CCP Transuranic Waste Plan*, CCP-PO-002, Revision 9, Section A.5.2 (Page 110)	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	Reviewed Batch Data Reports (BDR) LANDA0001 LANDA0002, LANDA0003, LANDA0004, and LANDA0005 BDRs included Radioassay Data Sheets (RDS) for each container.
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	*CCP Transuranic Waste Plan*, CCP-PO-002, Revision 9, Section A.4.5.2 (Pages 110-111)	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	Reviewed radioassay data sheets for the following containers in the following NDA batch data reports: BDR LL04-NDA-0003 LL85000420TRU LL85101184TRU LL85800633TRU LL85500757TRU LL85700775TRU LL85701176TRU LL85900835TRU LL85800039TRU LL85800317TRU BDR LL04-NDA-0004 LL85900581TRU LL85000038TRU LL85000496TRU LL85900562TRU LL85900722TRU

Establishment of Required Technical Elements in Procedures	Y/N	Location	Execution of Procedures	Y/N	Objective Evidence/ Comments
					LL85400499TRU LL85400418TRU LL85800628TRU LL85800807TRU
Procedures require that the following nonpermanent records be maintained at the radioassay-testing facility or 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	Y	CCP-PO-002, Revision 6, Section A.4.5.3 (Page 111)	The following nonpermanent records be maintained at the radioassay-testing facility or 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	Y	Operators back-up data to compact discs daily. Raw data are included on compact discs in records sent to site office

A.3 Radiography Checklist for Inspection EPA- LLNL-CCP-05.04-8

Establishment of Required Technical Elements in Procedures	Location	Execution of Procedures	Y/N	Objective Evidence/Comment
Site procedures identify required training and qualifications for Radiography personnel Radiography 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.	Y CCP-TP-028, Revision 2 CCP-TP-102, Revision 1	• Employee's 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 radiography equipment • Operator adequately explained the consequences of misidentifying prohibited items • Operators passed a training drum test that includes items common to the waste streams generated/stored at the site. • Operators identify the limitations of their system and explain the process of identifying and managing drums with prohibited items.	Y Y Y Y Y Y Y	• Reviewed training records of test drum for S. Ewing, G. Lamb, L. Lamb • Interviewed S. Ewing, G. Lamb
		• Operator's training was consistent with applicable procedures • Operator's certification is current	Y Y	• Reviewed training records of test drum for S. Ewing, G. Lamb, L. Lamb • Reviewed Qualification Cards for S. Ewing, L. Lamb, G. Lamb
There is a procedure for determining if the resolution of the Radiography 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 Radiography to accommodate the physical properties of the waste and waste containers likely to be encountered at this site.	Y CCP-TP-102, Revision 1	• Operator adequately explained how to adjust the system to image the range of wastes likely to be encountered at this specific site • The Radiography 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,	Y Y Y Y Y Y	Interviewed S. Ewing, G. Lamb Observed RTR on Drum LL85900524 Examined Batch Data Reports LL04-NDE-001 LL04-NDE-002 LL04-NDE-007 Observed RTR on Drum LL85900524 Reviewed videotapes for Batch Data Reports: LL04-NDE-001 LL04-NDE-002 LL04-NDE-007

Establishment of Required Technical Elements in Procedures	Location	Execution of Procedures	Y/N	Objective Evidence/Comment
		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	
		Radiography tape is typically high quality, the sound track is audible, and the required information is contained on the audible portion of the tape. The Radiography tape is consistent with the data package for the same drum.	Y	Reviewed videotapes for Batch Data Reports: LL04-NDE-001 LL04-NDE-002 LL04-NDE-007
Procedures require that Radiography operators receive the results of the VE/Radiography comparison	ID	Radiography operators receive the results of the VE/Radiography comparison	ID	Indeterminate because study has not occurred.
There is a procedure for determining whether the waste stream assignment, hazardous waste codes, and weights were correctly assigned	Y CCP-TP-102, Revision 1	• The procedure is adequately implemented • Corrective actions are taken when necessary • Does the radiography 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	Interviewed S. Ewing, G. Lamb Examined Batch Data Reports LL04-NDE-001 LL04-NDE-002 LL04-NDE-007
		The site evaluates the accuracy and reproducibility of data, for example: • Independent replicate scans are performed on one waste container per day per testing (whichever is less frequent) • Independent observations of one scan (not the replicate scan) are performed once per day per testing, whichever is less frequent, by a qualified Radiography operator (anyone but the initial Radiography operator) • Oversight functions, including periodic audio/videotape reviews of accepted waste containers are performed by qualified radiography personnel other than the operator	Y	Interviewed S. Ewing, G. Lamb Examined Batch Data Reports LL04-NDE-001 LL04-NDE-002 LL04-NDE-007
		Radiography operator has received "lessons	ID	Indeterminate.

Establishment of Required Technical Elements In Procedures	Facility Location	Execution of Procedures	Y/N	Objective Evidence/Comment
		learned" information based on the comparison of Radiography and VE data.		
		Radiography 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	Interviewed S. Ewing, G. Lamb

A.4 Visual Examination (VE) Checklist for Inspection EPA- LLNL-CCP-05.04-8

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	Y CCP-QP-002, Revision 15 CCP-TP-114, Revision 2	• 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 Y Y Y Y	• Interviewed S A. Romo, F. Romo, D. Durham • Reviewed Qualification Cards for A. Romo, F. Romo, D. Durham
		• VE expert's training was consistent with applicable procedures • VE expert's certification is current	Y Y	• Interviewed S A. Romo, F. Romo, D. Durham • Reviewed Qualification Cards for A. Romo, F. Romo, D. Durham
		• 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 Y Y Y	• Interviewed S A. Romo, F. Romo, D. Durham • Reviewed Qualification Cards for A. Romo, F. Romo, D. Durham • Observation of VE on drum # LL85800039TRU
		• VE expert/reader's explanation of how to operate the data recording system was consistent with applicable procedures • The video camera was focused prior to the start of VE • VE expert's verbal description of the inner	Y Y	• Observation of A/V check of VE on drum # LL85800039TRU • Review of VE Tapes LL04-VE-0001 LL04-VE-0003

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
		bag/package's inventory was recorded • If an automated data entry system is used, the VE expert could navigate through the various screens	Y Y	LL04-VE-0007
Current versions of all relevant procedures and technical guidance documents were located in the VE room	Y CCP-TP-114, Revision 2	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 • 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	Y Y Y Y	• Observation of VE on drum # LL85800039TRU • Interviewed S A. Romo, F. Romo, D. Durham
There is a procedure for handling instances when the VE Expert is unable to see through the inner plastic bags/packages/containers of waste 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 CCP-TP-114, Revision 2	• 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 Y	• Observation of VE on drum # LL85800039TRU • Interviewed S A. Romo, F. Romo, D. Durham • Cross reference with drum traveler
		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, 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	Y Y	• Observation of VE on drum # LL85800039TRU • Interviewed S A. Romo, F. Romo, D. Durham • Cross reference with drum traveler
		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 packaging materials	Y	• Observation of VE on drum # LL85800039TRU • Interviewed S A. Romo, F. Romo, D. Durham

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
		• 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 Y	
		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 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	Y Y	• Observation of VE on drum # LL85800039TRU
		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 Y	• Observation of VE on drum # LL85800039TRU • Review of VE Tapes LL04-VE-0001, LL04-VE-0003, LL04-VE-0007
		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 Y	• Observation of VE on drum # LL85800039TRU • Review of Batch Data Reports LL04-VE-0001, LL04-VE-0002, LL04-VE-0003, LL04-VE-0004, LL04-VE-0005, LL04-VE-0006, LL04-VE-0007, LL04-VE-0008
		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	Y Y	• Observation of VE on drum # LL85800039TRU • Review of VE Tapes LL04-VE-0001, LL04-VE-0003, LL04-VE-0007 • Review of Batch Data Reports LL04-VE-0001, LL04-VE-0002, LL04-VE-0003, LL04-VE-0004, LL04-VE-0005, LL04-VE-0006, LL04-VE-0007, LL04-VE-0008

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
		• 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 Y	
		VE testing data reports: • provide batch/sample identification number • identify the appropriate matrix parameter categories listed in the BIR • contain information sufficient to estimate weights of waste material parameters • contain data review checklists for each test verifying that the data generation level review, validation, and verification took place	Y Y Y Y	• Review of Batch Data Reports LL04-VE-0001, LL04-VE-0002, LL04-VE-0003, LL04-VE-0004, LL04-VE-0005, LL04-VE-0006, LL04-VE-0007, LL04-VE-0008
There is a procedure for determining whether the waste stream assignment, hazardous waste codes, and weights were correctly assigned	Y CCP-TP-114, Section 4.1.2 and CCP Waste VE Data Form, Q. 27	• The procedure is adequately implemented • Corrective actions are taken when necessary	Y Y	• Review of Batch Data Reports LL04-VE-0001, LL04-VE-0002, LL04-VE-0003, LL04-VE-0004, LL04-VE-0005, LL04-VE-0006, LL04-VE-0007, LL04-VE-0008
		The site evaluates the accuracy and reproducibility of data, for example: • Independent replicate weighing of 1/20 items and replicate observations of the VE 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)	Y Y Y	• Review of Batch Data Reports LL04-VE-0001, LL04-VE-0002, LL04-VE-0003, LL04-VE-0004, LL04-VE-0005, LL04-VE-0006, LL04-VE-0007, LL04-VE-0008 • CCP-TP-114, Attch. 11, CCP Waste VE Independent Technical Reviewer Checklist
		• The VE expert assesses the accuracy of the TRUCON code, matrix parameter category, and/or IDC • The VE expert recommends and documents changes	Y Y	• Review of Batch Data Reports LL04-VE-0001, LL04-VE-0002, LL04-VE-0003, LL04-VE-0004, LL04-VE-0005, LL04-VE-0006, LL04-VE-0007, LL04-VE-0008

Establishment of Required Technical Elements in Procedures	Y/N	Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
					• CCP-TP-114, Attch. 11, CCP Waste VE Independent Technical Reviewer Checklist
			Prior to videotaping/recording a VE, operational checks are conducted at the beginning of each work shift • these checks include observation of a test pattern to ensure that the VE system has adequate video quality	N	• Observation of VE on drum # LL85800039TRU – An A/V check is done but a test pattern is not used.

A.5 WIPP Waste Inventory System (WWIS) Checklist for Inspection EPA- LLNL-CCP-05.04-8

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 WWIS11	Y CCP-TP-030 Rev 11, Instructions for WWIS Data Entry Personnel for CCP and LLNL Rev 0	Employee's explanation of job duties was consistent with applicable procedures	Y	Shelly Jensen & JR Stroble demonstrated the entire waste cert and data entry process
	Y CCP-TP-030 Rev 11, Instructions for WWIS Data Entry Personnel for CCP and LLNL Rev 0	WWIS and Data Expert/Staff are trained to assess data and properly enter and transfer all data in the WWIS 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?	Y Y	A demonstration of data assessment and entry was observed A demonstration of observed and a copy of the system manual was presented.
	Y CCP-TP-030 Rev 11, Instructions for WWIS Data Entry Personnel for CCP and LLNL Rev 0	WWIS and Data Expert/Staff adequately explained how data are assessed, input, and transferred into the WWIS?	Y	S. Jensen & J R Stroble adequately demonstrated and explained how data is assessed, input and transferred.
	Y CCP-TP-030 Rev 11, Instructions for WWIS Data Entry Personnel for CCP and LLNL Rev 0	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	The demonstration included the Excel template LLNL_Template.xls which generates an electronic file for importation into the WWIS
	Y CCP-TP-030 Rev 11, Instructions for WWIS Data Entry Personnel for CCP and LLNL Rev 0	Generation level data review checklists and reports are complete and have been verified by SPO and SQAO review for each waste container	ID	Process was adequately explained and demonstrated using surrogate data though at the time of the inspection, no actual data was available.
	Y CCP-TP-030 Rev 11, Instructions for WWIS Data Entry Personnel	Generation level data packages contain the following information: Sampling, testing, and analytical results	Y	The demonstration included each of these elements.

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/ Comments
	for CCP and LLNL Rev 0	Data review checklists Raw data to verify summary information		
	Y CCP-TP-030 Rev 11, Instructions for WWIS Data Entry Personnel for CCP and LLNL Rev 0	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 Y	Sample data was reviewed and verified to contain these elements. Observed.
There are adequate procedures for treatment of nonconforming data	Y CCP-TP-030 Rev 11, Instructions for WWIS Data Entry Personnel for CCP and LLNL Rev 0	Procedures for nonconforming data are adequately implemented	I	No nonconforming data has been encountered at the WWIS level as of the date of this inspection.
Security measures for ensuring data integrity and accessing WWIS are sufficient • System access • Access log review	Y CCP-TP-030 Rev 11, Instructions for WWIS Data Entry Personnel for CCP and LLNL Rev 0			
There are adequate procedures for entering data into the WWIS	Y CCP-TP-030 Rev 11, Instructions for WWIS Data Entry Personnel for CCP and LLNL Rev 0	Procedures for entering data into the WWIS are adequately implemented. Data entered into the WWIS consistent with WIPP requirements, i.e., data fields are populated [See Attachment A.4.1 for list of required data fields]	Y	The data entry simulation adequately demonstrated WWIS data entry procedure implementation. The Excel template, LLNL_Template.xls was adequately demonstrated to include all of the necessary data fields.
The edit/limit checks contained in the WWIS system are appropriate for the site • Approved radioassay methods • Approved characterization methods • Approved analyte detection methods	Y CCP-TP-030 Rev 11, CCP TRU Waste Certification and WWIS Data Entry	The edit limit checks are appropriate.	Y	The demonstration included edit limit checks and were found to be adequate.
		The site adequately demonstrated its ability to transmit waste container characterization data	Y	Simulated Data transmission was demonstrated.

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/ Comments
		to the WIPP using the WWIS		
		The site adequately demonstrated its ability to receive information from the WIPP via the WWIS, including E-mail notifications	Y	An email response was returned from the WIPP site.
		The site adequately demonstrated its ability to print the appropriate waste container characterization data reports for data submitted to WIPP using the WWIS	Y	The demonstration included a printout of the simulated waste characterization data report.
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	Y CCP-TP-030 Rev 11, Instructions for WWIS Data Entry Personnel for CCP and LLNL Rev 0	Waste container characterization data submitted to and received by WIPP are verified Waste container data reports are reconciled with site data	Y	The verification process was part of the demonstration. Data reconciliation was part of the data verification process.
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	Y CCP-TP-030 Rev 11, Instructions for WWIS Data Entry Personnel for CCP and LLNL Rev 0	The following records are kept: • WWIS access requests • WWIS access logs • Waste container data input reports • WWIS waste container data reports	Y	This data is available from the WWIS administrator at the WIPP site.

Attachment A.5.1
WWIS Data Requirements

Container number	Radionuclide name
Site ID	Radionuclide activity
Waste stream profile number	Radionuclide activity uncertainty
Matrix code	Radionuclide mass
Trucon Code	Radionuclide mass uncertainty
Decay heat	Waste material parameter weight
Decay heat uncertainty	Radioassay method
Shipment number	Assay date
Packaging number	Characterization method
Assembly ID	Characterization method date
TRU alpha activity	Packaging layers
TRU alpha activity uncertainty	Alpha surface concentration
TRU alpha activity concentration	Dose rate
TRU alpha activity concentration uncertainty	Sample ID
^{239}Pu equivalent activity	Sample type
^{239}Pu fissile gram equivalent	Sample date
^{239}Pu fissile gram equivalent uncertainty	Analyte
Handling code	Analyte concentration
Waste type code	Analyte detection method

Attachments B.1 through B.6

Attachment B.1	**Replicate Testing Data for Container LL85100561TRU**
Attachment B.2	**Replicate Testing Results for Container LL85100561TRU**
Attachment B.3	**Replicate Testing Data for Container LL85200674TRU**
Attachment B.4	**Replicate Testing Results for Container LL85200674TRU**
Attachment B.5	**Replicate Testing Data for Container LL85701176TRU**
Attachment B.6	**Replicate Testing Results for Container LL85701176TRU**

B.1 Replicate Testing Data for Container LL85100561TRU

Quantity of Interest	Original Measurement			Replicate No. 1			Replicate No. 2		
	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty
^{233}U Activity (Ci)			N/A			N/A			N/A
^{234}U Activity (Ci)			N/A			N/A			N/A
^{235}U Activity (Ci)			N/A			N/A			N/A
^{236}U Activity (Ci)			N/A			N/A			N/A
^{238}Pu Activity (Ci)	6.55E-02	6.02E-03	9.2%	6.96E-02	6.42E-03	9.2%	7.62E-02	6.94E-03	9.1%
^{239}Pu Activity (Ci)	3.31E-01	3.05E-02	9.2%	2.89E-01	2.67E-02	9.2%	2.83E-01	2.58E-02	9.1%
^{240}Pu Activity (Ci)	2.47E-01	2.27E-02	9.2%	2.44E-01	2.25E-02	9.2%	2.43E-01	2.21E-02	9.1%
^{241}Pu Activity (Ci)	3.65E+00	3.36E-01	9.2%	3.49E+00	3.22E-01	9.2%	3.30E+00	3.01E-01	9.1%
^{242}Pu Activity (Ci)	1.25E-04	1.15E-05	9.2%	1.44E-04	1.33E-05	9.2%	1.45E-04	1.32E-05	9.1%
^{241}Am Activity (Ci)	7.14E-01	6.57E-02	9.2%	6.90E-01	6.37E-02	9.2%	6.49E-01	5.91E-02	9.1%
^{90}Sr Activity (Ci)			N/A			N/A			N/A
^{137}Cs Activity (Ci)			N/A			N/A			N/A
^{237}Np Activity (Ci)	4.11E-06	5.53E-07	13.5%	4.39E-06	5.63E-07	12.8%	3.88E-06	5.10E-07	13.1%
TRU Alpha Conc. (nCi/g)	339,407	19,037	5.6%	323,187	18,231	5.6%	312,837	17,130	5.5%

Quantity of Interest	Replicate No. 3			Replicate No. 4			Replicate No. 5		
	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty
^{233}U Activity (Ci)			N/A			N/A			N/A
^{234}U Activity (Ci)			N/A			N/A			N/A
^{235}U Activity (Ci)			N/A			N/A			N/A
^{238}U Activity (Ci)			N/A			N/A			N/A
^{238}Pu Activity (Ci)	7.91E-02	7.21E-03	9.1%	8.53E-02	7.76E-03	9.1%	7.56E-02	7.01E-03	9.3%
^{239}Pu Activity (Ci)	2.88E-01	2.63E-02	9.1%	2.86E-01	2.60E-02	9.1%	2.97E-01	2.76E-02	9.3%
^{240}Pu Activity (Ci)	2.44E-01	2.22E-02	9.1%	2.48E-01	2.26E-02	9.1%	2.39E-01	2.22E-02	9.3%
^{241}Pu Activity (Ci)	3.45E+00	3.14E-01	9.1%	3.33E+00	3.03E-01	9.1%	3.58E+00	3.32E-01	9.3%
^{242}Pu Activity (Ci)	1.45E-04	1.32E-05	9.1%	1.50E-04	1.37E-05	9.1%	1.36E-04	1.26E-05	9.3%
^{241}Am Activity (Ci)	6.63E-01	6.05E-02	9.1%	6.53E-01	5.94E-02	9.1%	6.79E-01	6.29E-02	9.3%
^{90}Sr Activity (Ci)			N/A			N/A			N/A
^{137}Cs Activity (Ci)			N/A			N/A			N/A
^{237}Np Activity (Ci)	4.24E-06	5.42E-07	12.8%	3.61E-06	4.97E-07	13.8%	3.94E-06	5.31E-07	13.5%
TRU Alpha Conc. (nCi/g)	318,562	17,494	5.5%	318,113	17,276	5.4%	322,685	18,132	5.6%

REPLICATE-1

B.2 Replicate Testing Results for Container LL85100561TRU

Quantity of Interest	Original Measurement		Sample Mean	Sample Standard Deviation	Relative Standard Deviation	Relative Difference	χ^2	t
	Reported Value	Absolute Uncertainty						
^{233}U Activity (Ci)								
^{234}U Activity (Ci)								
^{235}U Activity (Ci)								
^{238}U Activity (Ci)								
^{238}Pu Activity (Ci)	6.55E-02	6.02E-03	7.72E-02	5.71E-03	7.40%	-17.80%	3.602	-1.863
^{239}Pu Activity (Ci)	3.31E-01	3.05E-02	2.89E-01	5.22E-03	1.81%	12.81%	0.117	7.408
^{240}Pu Activity (Ci)	2.47E-01	2.27E-02	2.44E-01	3.21E-03	1.32%	1.38%	0.080	0.967
^{241}Pu Activity (Ci)	3.65E+00	3.36E-01	3.43E+00	1.16E-01	3.37%	6.03%	0.473	1.738
^{242}Pu Activity (Ci)	1.25E-04	1.15E-05	1.44E-04	5.05E-06	3.51%	-15.20%	0.771	-3.435
^{241}Am Activity (Ci)	7.14E-01	6.57E-02	6.67E-01	1.74E-02	2.61%	6.61%	0.280	2.479
^{90}Sr Activity (Ci)								
^{137}Cs Activity (Ci)								
^{237}Np Activity (Ci)	4.11E-06	5.53E-07	4.01E-06	3.08E-07	7.67%	2.38%	1.240	0.291
TRU Alpha Conc. (nCi/g)	339,407	19,037	319,077	4,184	1.31%	5.99%	0.193	4.435

Quantity of Interest	Pr($x<\|\chi^2\|$)	χ^2 Test	Pr($x<\|t\|$)	t Test
^{233}U Activity (Ci)		Not Applicable		Not Applicable
^{234}U Activity (Ci)		Not Applicable		Not Applicable
^{235}U Activity (Ci)		Not Applicable		Not Applicable
^{238}U Activity (Ci)		Not Applicable		Not Applicable
^{238}Pu Activity (Ci)	46.26%	Not Significant	13.59%	Not Significant
^{239}Pu Activity (Ci)	99.83%	Not Significant	0.18%	Highly Significant
^{240}Pu Activity (Ci)	99.92%	Not Significant	38.83%	Not Significant
^{241}Pu Activity (Ci)	97.61%	Not Significant	15.72%	Not Significant
^{242}Pu Activity (Ci)	94.23%	Not Significant	2.64%	Significant
^{241}Am Activity (Ci)	99.11%	Not Significant	6.83%	Not Significant
^{90}Sr Activity (Ci)		Not Applicable		Not Applicable
^{137}Cs Activity (Ci)		Not Applicable		Not Applicable
^{237}Np Activity (Ci)	87.15%	Not Significant	78.58%	Not Significant
TRU Alpha Conc. (nCi/g)	99.56%	Not Significant	1.14%	Significant

REPLICATE-2

B.3 Replicate Testing Data for Container LL85200674TRU

Quantity of Interest	Original Measurement			Replicate No. 1			Replicate No. 2		
	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty
^{233}U Activity (Ci)			N/A			N/A			N/A
^{234}U Activity (Ci)			N/A			N/A			N/A
^{235}U Activity (Ci)			N/A			N/A			N/A
^{238}U Activity (Ci)			N/A			N/A			N/A
^{238}Pu Activity (Ci)	4.39E-02	3.91E-03	8.9%	5.28E-02	4.73E-03	9.0%	4.76E-02	4.23E-03	8.9%
^{239}Pu Activity (Ci)	1.03E+00	9.18E-02	8.9%	1.03E+00	9.21E-02	8.9%	9.86E-01	8.75E-02	8.9%
^{240}Pu Activity (Ci)	2.29E-01	2.04E-02	8.9%	2.32E-01	2.07E-02	8.9%	2.27E-01	2.01E-02	8.9%
^{241}Pu Activity (Ci)	3.13E+00	2.79E-01	8.9%	2.95E+00	2.64E-01	8.9%	2.92E+00	2.59E-01	8.9%
^{242}Pu Activity (Ci)	1.92E-05	1.70E-06	8.9%	1.90E-05	1.70E-06	8.9%	1.87E-05	1.66E-06	8.9%
^{241}Am Activity (Ci)	2.08E-01	1.85E-02	8.9%	2.02E-01	1.81E-02	9.0%	1.95E-01	1.73E-02	8.9%
^{90}Sr Activity (Ci)			N/A			N/A			N/A
^{137}Cs Activity (Ci)			N/A			N/A			N/A
^{237}Np Activity (Ci)	2.23E-06	4.31E-07	19.3%	2.12E-06	4.18E-07	19.7%	2.05E-06	4.01E-07	19.6%
TRU Alpha Conc. (nCi/g)	40,077	2,544	6.3%	40,234	2,553	6.3%	38,611	2,428	6.3%

Quantity of Interest	Replicate No. 3			Replicate No. 4			Replicate No. 5		
	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty
^{233}U Activity (Ci)			N/A			N/A			N/A
^{234}U Activity (Ci)			N/A			N/A			N/A
^{235}U Activity (Ci)			N/A			N/A			N/A
^{238}U Activity (Ci)			N/A			N/A			N/A
^{238}Pu Activity (Ci)	4.78E-02	4.25E-03	8.9%	4.40E-02	3.90E-03	8.9%	4.45E-02	3.95E-03	8.9%
^{239}Pu Activity (Ci)	9.76E-01	8.67E-02	8.9%	9.81E-01	8.71E-02	8.9%	9.82E-01	8.72E-02	8.9%
^{240}Pu Activity (Ci)	2.28E-01	2.03E-02	8.9%	2.28E-01	2.02E-02	8.9%	2.25E-01	2.00E-02	8.9%
^{241}Pu Activity (Ci)	2.90E+00	2.57E-01	8.9%	2.74E+00	2.43E-01	8.9%	2.70E+00	2.40E-01	8.9%
^{242}Pu Activity (Ci)	1.89E-05	1.68E-06	8.9%	1.87E-05	1.66E-06	8.9%	1.83E-05	1.62E-06	8.9%
^{241}Am Activity (Ci)	1.95E-01	1.74E-02	8.9%	1.96E-01	1.74E-02	8.9%	1.91E-01	1.69E-02	8.8%
^{90}Sr Activity (Ci)			N/A			N/A			N/A
^{137}Cs Activity (Ci)			N/A			N/A			N/A
^{237}Np Activity (Ci)	1.80E-06	3.91E-07	21.7%	1.91E-06	4.07E-07	21.3%	2.23E-06	4.11E-07	18.4%
TRU Alpha Conc. (nCi/g)	38,377	2,409	6.3%	38,436	2,418	6.3%	38,263	2,417	6.3%

REPLICATE-3

B.4 Replicate Testing Results for Container LL85200674TRU

Quantity of Interest	Original Measurement		Sample Mean	Sample Standard Deviation	Relative Standard Deviation	Relative Difference	χ^2	t
	Reported Value	Absolute Uncertainty						
^{233}U Activity (Ci)								
^{234}U Activity (Ci)								
^{235}U Activity (Ci)								
^{238}U Activity (Ci)								
^{238}Pu Activity (Ci)	4.39E-02	3.91E-03	4.73E-02	3.51E-03	7.42%	-7.84%	3.226	-0.894
^{239}Pu Activity (Ci)	1.03E+00	9.18E-02	9.91E-01	2.21E-02	2.23%	3.79%	0.232	1.612
^{240}Pu Activity (Ci)	2.29E-01	2.04E-02	2.28E-01	2.55E-03	1.12%	0.44%	0.062	0.358
^{241}Pu Activity (Ci)	3.13E+00	2.79E-01	2.84E+00	1.14E-01	4.00%	9.20%	0.664	2.313
^{242}Pu Activity (Ci)	1.92E-05	1.70E-06	1.87E-05	2.68E-07	1.43%	2.50%	0.100	1.633
^{241}Am Activity (Ci)	2.08E-01	1.85E-02	1.96E-01	3.96E-03	2.02%	5.87%	0.183	2.811
^{90}Sr Activity (Ci)								
^{137}Cs Activity (Ci)								
^{237}Np Activity (Ci)	2.23E-06	4.31E-07	2.02E-06	1.70E-07	8.40%	9.33%	0.622	1.118
TRU Alpha Conc. (nCi/g)	40,077	2,544	38,784	820	2.11%	3.23%	0.416	1.440

Quantity of Interest	$Pr(x<\lvert\chi^2\rvert)$	χ^2 Test	$Pr(x<\lvert t\rvert)$	t Test
^{233}U Activity (Ci)		Not Applicable		Not Applicable
^{234}U Activity (Ci)		Not Applicable		Not Applicable
^{235}U Activity (Ci)		Not Applicable		Not Applicable
^{238}U Activity (Ci)		Not Applicable		Not Applicable
^{238}Pu Activity (Ci)	52.08%	Not Significant	42.17%	Not Significant
^{239}Pu Activity (Ci)	99.38%	Not Significant	18.23%	Not Significant
^{240}Pu Activity (Ci)	99.95%	Not Significant	73.84%	Not Significant
^{241}Pu Activity (Ci)	95.57%	Not Significant	8.18%	Not Significant
^{242}Pu Activity (Ci)	99.88%	Not Significant	17.78%	Not Significant
^{241}Am Activity (Ci)	99.60%	Not Significant	4.83%	Significant
^{90}Sr Activity (Ci)		Not Applicable		Not Applicable
^{137}Cs Activity (Ci)		Not Applicable		Not Applicable
^{237}Np Activity (Ci)	96.06%	Not Significant	32.64%	Not Significant
TRU Alpha Conc. (nCi/g)	98.12%	Not Significant	22.34%	Not Significant

REPLICATE-4

B.5 Replicate Testing Data for Container LL85701176TRU

Quantity of Interest	Original Measurement			Replicate No. 1			Replicate No. 2		
	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty
^{233}U Activity (Ci)			N/A			N/A			N/A
^{234}U Activity (Ci)			N/A			N/A			N/A
^{235}U Activity (Ci)			N/A			N/A			N/A
^{238}U Activity (Ci)			N/A			N/A			N/A
^{238}Pu Activity (Ci)	1.23E-02	1.16E-03	9.4%	9.14E-03	8.64E-04	9.5%	6.91E-03	7.16E-04	10.4%
^{239}Pu Activity (Ci)	1.37E-01	1.29E-02	9.4%	1.23E-01	1.16E-02	9.4%	1.23E-01	1.27E-02	10.3%
^{240}Pu Activity (Ci)	4.92E-02	4.64E-03	9.4%	4.91E-02	4.64E-03	9.5%	4.97E-02	5.15E-03	10.4%
^{241}Pu Activity (Ci)	6.11E-01	5.76E-02	9.4%	5.72E-01	5.41E-02	9.5%	5.24E-01	5.43E-02	10.4%
^{242}Pu Activity (Ci)	4.02E-06	3.79E-07	9.4%	4.06E-06	3.84E-07	9.5%	4.15E-06	4.30E-07	10.4%
^{241}Am Activity (Ci)	2.25E-02	2.12E-03	9.4%	2.20E-02	2.08E-03	9.5%	2.52E-02	2.61E-03	10.4%
^{90}Sr Activity (Ci)			N/A			N/A			N/A
^{137}Cs Activity (Ci)			N/A			N/A			N/A
^{237}Np Activity (Ci)	9.03E-07	1.53E-07	16.9%	7.32E-07	1.30E-07	17.8%	7.26E-07	1.39E-07	19.1%
TRU Alpha Conc. (nCi/g)	3,003	189	6.3%	2,761	172	6.2%	2,783	190	6.8%

Quantity of Interest	Replicate No. 3			Replicate No. 4			Replicate No. 5		
	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty
^{233}U Activity (Ci)			N/A			N/A			N/A
^{234}U Activity (Ci)			N/A			N/A			N/A
^{235}U Activity (Ci)			N/A			N/A			N/A
^{238}U Activity (Ci)			N/A			N/A			N/A
^{238}Pu Activity (Ci)	1.01E-02	9.42E-04	9.3%	1.39E-02	1.33E-03	9.6%	9.68E-03	8.99E-04	9.3%
^{239}Pu Activity (Ci)	1.35E-01	1.26E-02	9.3%	1.43E-01	1.37E-02	9.6%	1.22E-01	1.13E-02	9.3%
^{240}Pu Activity (Ci)	5.15E-02	4.82E-03	9.4%	5.00E-02	4.78E-03	9.6%	4.93E-02	4.57E-03	9.3%
^{241}Pu Activity (Ci)	6.41E-01	5.99E-02	9.3%	7.01E-01	6.71E-02	9.6%	6.08E-01	5.64E-02	9.3%
^{242}Pu Activity (Ci)	4.29E-06	4.01E-07	9.3%	4.17E-06	3.98E-07	9.5%	4.12E-06	3.82E-07	9.3%
^{241}Am Activity (Ci)	2.44E-02	2.28E-03	9.3%	2.40E-02	2.29E-03	9.5%	2.23E-02	2.07E-03	9.3%
^{90}Sr Activity (Ci)			N/A			N/A			N/A
^{137}Cs Activity (Ci)			N/A			N/A			N/A
^{237}Np Activity (Ci)	8.71E-07	1.56E-07	17.9%	8.40E-07	1.63E-07	19.4%	8.59E-07	1.41E-07	16.4%
TRU Alpha Conc. (nCi/g)	3,003	186	6.2%	3,137	200	6.4%	2,762	168	6.1%

REPLICATE-5

B.6 Replicate Testing Results for Container LL85701176TRU

Quantity of Interest	Original Measurement		Sample Mean	Sample Standard Deviation	Relative Standard Deviation	Relative Difference	χ^2	t
	Reported Value	Absolute Uncertainty						
^{233}U Activity (Ci)								
^{234}U Activity (Ci)								
^{235}U Activity (Ci)								
^{238}U Activity (Ci)								
^{236}Pu Activity (Ci)	1.23E-02	1.16E-03	9.95E-03	2.53E-03	25.43%	19.14%	19.022	0.850
^{239}Pu Activity (Ci)	1.37E-01	1.29E-02	1.29E-01	9.39E-03	7.27%	5.69%	2.120	0.758
^{240}Pu Activity (Ci)	4.92E-02	4.64E-03	4.99E-02	9.50E-04	1.90%	-1.46%	0.168	-0.692
^{241}Pu Activity (Ci)	6.11E-01	5.76E-02	6.09E-01	6.72E-02	11.04%	0.29%	5.450	0.024
^{242}Pu Activity (Ci)	4.02E-06	3.79E-07	4.16E-06	8.47E-08	2.04%	-3.43%	0.200	-1.488
^{241}Am Activity (Ci)	2.25E-02	2.12E-03	2.36E-02	1.38E-03	5.85%	-4.80%	1.693	-0.715
^{90}Sr Activity (Ci)								
^{137}Cs Activity (Ci)								
^{237}Np Activity (Ci)	9.03E-07	1.53E-07	8.06E-07	7.08E-08	8.79%	10.79%	0.857	1.255
TRU Alpha Conc. (nCi/g)	3,003	189	2,889	172	5.95%	3.78%	3.306	0.603

Quantity of Interest	Pr($x < \|\chi^2\|$)	χ^2 Test	Pr($x < \|t\|$)	t Test
^{233}U Activity (Ci)		Not Applicable		Not Applicable
^{234}U Activity (Ci)		Not Applicable		Not Applicable
^{235}U Activity (Ci)		Not Applicable		Not Applicable
^{238}U Activity (Ci)		Not Applicable		Not Applicable
^{238}Pu Activity (Ci)	0.08%	Highly Significant	44.35%	Not Significant
^{239}Pu Activity (Ci)	71.37%	Not Significant	49.06%	Not Significant
^{240}Pu Activity (Ci)	99.67%	Not Significant	52.70%	Not Significant
^{241}Pu Activity (Ci)	24.41%	Not Significant	98.17%	Not Significant
^{242}Pu Activity (Ci)	99.53%	Not Significant	21.10%	Not Significant
^{241}Am Activity (Ci)	79.20%	Not Significant	51.42%	Not Significant
^{90}Sr Activity (Ci)		Not Applicable		Not Applicable
^{137}Cs Activity (Ci)		Not Applicable		Not Applicable
^{237}Np Activity (Ci)	93.06%	Not Significant	27.77%	Not Significant
TRU Alpha Conc. (nCi/g)	50.80%	Not Significant	57.93%	Not Significant

REPLICATE-6