DOCKET NO: A-98-49; II-A4-250
EPA AIR E-DOCKET NO: EPA-HQ-OAR-2023-0226

WASTE CHARACTERIZATION INSPECTION REPORT

APPROVAL

U.S. ENVIRONMENTAL PROTECTION AGENCY BASELINE INSPECTION OF THE CENTRAL CHARACTERIZATION PROGRAM CONTACT-HANDLED TRANSURANIC WASTE CHARACTERIZATION PROGRAM FOR

ARGONNE NATIONAL LABORATORY

November 15–17, 2022

U.S. Environmental Protection Agency
Radiation Protection Division
Center for Waste Management and Regulations
1200 Pennsylvania Avenue, NW
Washington, DC 20460

August 2023

CONTENTS

TABLES

ATTACHMENTS

ACRONYMS, INITIALIZATIONS AND ABBREVIATIONS

AK	acceptable knowledge
AKSR	Acceptable Knowledge Summary Report
Am	americium
ANL	Argonne National Laboratory
BEGe	broad energy germanium
BoK	Basis of Knowledge
CBFO	Carlsbad Field Office
CCE	chemical compatibility evaluation
CCP	Central Characterization Program
CFR	Code of Federal Regulations
CH	contact-handled
Ci	curie
Cs	cesium
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
Eu	europium
FR	Federal Register
FRAM	Fixed-Energy, Response-Function Analysis with Multiple Efficiencies
FWHM	full-width-at-half-maximum
g	gram
g/cm^3	grams per cubic centimeter
HLW	high-level waste
ISOCS	In Situ Object Counting System
keV	kiloelectron volt
LANL	Los Alamos National Laboratory
LLD	lower limit of detection
LOQI	list of qualified individuals
M&TE	measurement and test equipment
MGA	multi-group analysis
MILCC5	Mobile ISOCS Large Container Counter No. 5
N/A	not applicable

nCi/g	nanocuries per gram
NCR	nonconformance report
NDA	nondestructive assay
NIST	National Institute of Standards and Technology
Np	neptunium
PDP	performance demonstration program
Pu	plutonium
RTR	real-time radiography
SNF	spent nuclear fuel
Sr	strontium
SWB	standard waste box
T1	Tier 1
T2	Tier 2
TMU	total measurement uncertainty
TRU	transuranic
U	uranium
VE	visual examination
WIPP	Waste Isolation Pilot Plant

1.0 EXECUTIVE SUMMARY

This report supports the U.S. Environmental Protection Agency's (EPA's) baseline approval of the contact-handled (CH) transuranic (TRU) debris waste characterization program implemented by the Central Characterization Program (CCP) at the U.S. Department of Energy's (DOE's) Argonne National Laboratory (ANL), in Lemont, Illinois, consistent with the limitations described in this report. In accordance with Title 40 of the Code of Federal Regulations [40 CFR 194.8(b)], EPA conducted Baseline Inspection No. ANL-CCP-CH-Baseline-2022 of ANL-CCP's CH TRU waste characterization program on November 15–17, 2022, remotely and at ANL. With EPA's final approval, DOE may emplace ANL-CCP CH TRU waste in the Waste Isolation Pilot Plant (WIPP).

The scope of the baseline inspection included:

- The acceptable knowledge (AK) process for CH TRU waste.
- The nondestructive assay (NDA) processes for CH TRU waste as performed on the Mobile In-Situ Object Counting System (ISOCS) Large Container Counter No. 5 (MILCC5).
- The visual examination (VE) process for CH TRU waste.

This baseline inspection evaluated ANL-CCP's CH waste characterization program for technical adequacy and, with this approval, ANL-CCP is allowed to use the program components to characterize CH waste in accordance with the conditions and restrictions discussed in this report. EPA is approving the ANL-CCP waste characterization program implemented to characterize CH TRU waste as documented in this report. Specifically, the approval includes:

(1) The AK process for characterizing ANL CH TRU waste.

(2) The MILCC5 NDA system for quantifying radionuclides in ANL CH TRU waste.

(3) The VE nondestructive examination process to identify waste material parameters and the physical form of ANL CH TRU waste.

Any changes to the waste characterization activities after the date of the baseline inspection must be reported to and, if applicable, approved by EPA according to Table 1. All Tier 1 (T1) changes must be submitted for approval before their implementation and will be evaluated by EPA. Upon approval, EPA will post the results of the evaluations in EPA's docket at regulations.gov (Docket No: EPA-HQ-OAR-2001-0012). ANL-CCP must submit Tier 2 (T2) changes at the end of the fiscal year quarter in which they were implemented.

As discussed in section 10.0, there were no public comments in response to the proposed approval. EPA's final approval of the ANL-CCP CH waste characterization program will be conveyed to DOE separately by letter. This information will be provided through the Agency's docket at regulations.gov.

Table 1. Tiering of Contact-Handled Transuranic Waste Characterization Processes Implemented by ANL-CCP (Based on November 15–17, 2022, Baseline Inspection ANL-CCP-CH-Baseline-2022)

Process Elements	ANL-CCP CH Waste Characterization Process – T1 Changes	ANL-CCP CH Waste Characterization Process – T2 Changes*
Acceptable Knowledge	Implementation of payload management	Submission of a list of active ANL-CCP CH AK experts and site project managers Notification to EPA upon availability of or substantive modification** to: • AK summary reports (e.g., CCP-AK-ANLE-002) • AK accuracy reports (annually, at a minimum) • Waste stream profile forms and any associated change notices • Add container memoranda • Site AK procedures requiring CBFO approval*** • Enhanced AK documents such as CCP-TP-005, Attachment 9 forms and AK Assessment, CCE and Basis of Knowledge memoranda (including addition of new figures or attachments)
Nondestructive Assay	New equipment or substantive physical modifications** to approved equipment Extension of or changes to approved calibration ranges for approved equipment Measurement geometries other than 55-gallon drums	Submission of a list of ANL-CCP NDA operators, expert analysts and independent technical reviewers that performed work during the previous quarter Notification to EPA upon substantive modification** to: • Software for approved equipment • Operating ranges upon CBFO approval • Site NDA procedures requiring CBFO approval***
Visual Examination	VE for non-debris waste VE by any process other than ANL-CCP VE operators observing ANL waste handlers package the waste in a glovebox, as demonstrated during the 2022 baseline inspection	Submission of a list of ANL-CCP VE operators, VE experts and independent technical reviewers that performed work during the previous quarter Notification to EPA upon substantive modification** to site VE procedures requiring CBFO approval***
Real-time Radiography	Implementation of RTR	

* ANL-CCP will report all T2 changes to EPA every three months.

** "Substantive modification" refers to a change with the potential to affect ANL-CCP's CH waste characterization processes or documentation of them, excluding changes that are solely related to the environment, safety and health; nuclear safety; or the Resource Conservation and Recovery Act; or that are editorial in nature or are required to address administrative concerns. EPA may request copies of new references that DOE adds during a document revision.

*** Site procedures include any procedures used by ANL-CCP personnel that require Carlsbad Field Office (CBFO) approval. This includes ANL-CCP-specific procedures as well as applicable CCP-wide procedures.

2.0 PURPOSE OF BASELINE INSPECTIONS

On May 18, 1998, EPA certified that the WIPP would comply with the radioactive waste disposal regulations in 40 CFR Parts 191 and 194. In that certification, EPA included Condition 3, which states that "the Secretary shall not allow shipment of any waste from…any waste generator site other than [Los Alamos National Laboratory (LANL)] 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 in 40 CFR 194.8 requires DOE to (1) provide EPA with information on AK for waste streams proposed for disposal at the 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 most recent WIPP Compliance Certification Application.

The rule applying to this baseline inspection can be found in the Federal Register (FR) (Vol. 69, No. 136, pp. 42571–42583, July 16, 2004). Under the changes to 40 CFR 194.8 promulgated in the July 16, 2004, FR notice, EPA must perform a baseline inspection of a TRU waste generator site's waste characterization program. The purpose of the baseline inspection is to review the site's waste characterization program. This review is based on the demonstration that the program's components, with applicable conditions and limitations, can adequately characterize TRU wastes and comply with the regulatory requirements imposed on TRU wastes destined for disposal at the WIPP. An EPA inspection team conducts an onsite inspection to verify that the site's system of controls is technically adequate and properly implemented. Specifically, EPA's inspection team verifies compliance with 40 CFR 194.24(c)(4), which states the following:

> *Any compliance application shall: . . . Provide information which demonstrates that a system of controls has been and will continue to be implemented to confirm that the total amount of each waste component that will be emplaced in the disposal system will not exceed the upper limiting value or fall below the lower limiting value described in the introductory text of paragraph (c) of this section.[[1]] 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 the baseline inspection is to evaluate the implementation of 40 CFR Part 194 requirements by assessing whether DOE sites that characterize TRU waste prior to disposal at the WIPP are capable of adequately doing so. EPA may also conduct follow-up inspections to address issues remaining from the baseline inspection or to seek further clarification/discussion related to waste characterization processes evaluated during a baseline inspection. By approving the CCP-implemented waste characterization systems and processes at ANL-CCP for CH TRU waste, EPA confirms that it has evaluated the capabilities of systems and processes implemented by the site to accomplish two tasks: (1) identification and measurement

[1] The introductory text of 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."

of waste components, such as plutonium (Pu), that must be tracked for compliance,[2] and (2) confirmation that the waste in any given container has been properly identified as belonging to the group of approved waste streams.

3.0 PURPOSE OF THIS REPORT

This report documents the basis for EPA's approval of the ANL-CCP waste characterization program for CH TRU wastes. Specifically, this report:

- Describes the ANL-CCP CH TRU waste characterization systems for approval.
- Provides objective evidence supporting the approval basis for all CH TRU waste characterization systems.
- Identifies all relevant system limitations and/or conditions for each waste characterization system and/or waste containers that are subject to this approval.

4.0 SCOPE AND PURPOSE OF THE BASELINE INSPECTION

The scope of EPA Baseline Inspection No. ANL-CCP-CH-Baseline-2022 included the technical adequacy of the waste characterization systems used by ANL-CCP to characterize CH TRU waste. EPA conducted the NDA and VE portions of EPA Baseline Inspection No. ANL-CCP-CH-Baseline-2022 at ANL in Lemont, Illinois, and the AK portion remotely, both conducted November 15–17, 2022.

The purpose of this inspection was to determine the site's compliance with 40 CFR 194.24. The EPA inspection team evaluated the ANL-CCP waste characterization systems with respect to AK, NDA, which in this case was the MILCC5 NDA system, and nondestructive examination, which in this case was the VE process.

EPA performed this inspection by executing the following:

(1) Obtaining and reviewing site procedures, reports, and other technical information used to characterize CH TRU waste.

(2) Interacting with Carlsbad Field Office (CBFO) and ANL-CCP personnel to arrange inspection logistics.

(3) Preparing technical questions prior to the inspection based on the information cited in (1) above.

(4) Observing NDA and VE characterization activities on site at ANL.

[2] The potential contents of a single waste stream or group of waste streams determine which processes can adequately characterize the waste. For example, if AK suggests that the waste form is heterogeneous, the site should select the matrix-appropriate radiological characterization technique to obtain adequate radionuclide measurements. VE serves to confirm and quantify waste components, such as metals and cellulosic, rubber, and plastic materials. Once the nature of the waste has been confirmed, characterization techniques quantify selected radionuclides in the waste. In some cases, a TRU waste generator site may be able to characterize a range of heterogeneous waste streams or only a few. A site's stated limits on the applicability of proposed waste characterization processes govern the scope of EPA's inspection.

(5) Evaluating ANL-CCP's implementation of waste characterization processes for adequacy and demonstrating compliance with 40 CFR 194.24 requirements.

(6) Conducting the baseline inspection to verify the technical adequacy and/or qualifications of CH waste characterization personnel, procedures, processes, and equipment, as documented in ANL-CCP records.

(7) Evaluating the correlations of containers for the purpose of identifying common attributes.

(8) Communicating all pertinent information to CBFO and ANL-CCP personnel.

(9) Conducting entrance, exit, and daily briefings for CBFO and ANL-CCP management personnel as needed for all segments of the inspection.

(10) Obtaining and reviewing ANL-CCP documents that were revised and/or created in response to the inspection.

(11) Issuing the inspection report and approval.

During an inspection, EPA does not approve characterization data; that function is the sole responsibility of the entity being evaluated, in this case, ANL-CCP. EPA evaluates the site's waste characterization processes to characterize CH TRU waste. The ANL-CCP evaluation consisted of reviewing training records and interviewing waste characterization personnel to assess their understanding of: (1) EPA's waste characterization and WIPP waste disposal requirements; (2) waste characterization processes implemented and available as alternatives; and (3) ANL-CCP's documentation and record-keeping procedures.

In addition, EPA's evaluation focused on observing equipment operations and waste characterization practices at ANL controlled by site procedures and inspecting records related to each of the waste characterization processes within the inspection's scope. An important aspect of this evaluation is the objective evidence documenting the effectiveness of the waste characterization processes. Objective evidence typically takes the form of AK, NDA and VE records, including batch data reports. During this inspection, EPA selected samples of each of these items, based on the number and variety of items each waste characterization process produced, consistent with standard auditing techniques. Based on an evaluation of the waste characterization processes in conjunction with the objective evidence, EPA determined the technical adequacy of these processes and associated records within the inspection's scope.

DOE documents that EPA reviewed for this evaluation are cited throughout the report and are listed in Attachment E. Any of these documents can be requested from the following address:

Eletha Trujillo
Eletha.Trujillo@cbfo.doe.gov
Public Affairs Specialist
Office of the Manager
4021 National Parks Highway
Carlsbad, NM 88220

5.0 EVALUATION PERSONNEL

EPA and its support personnel conducted interviews with ANL-CCP personnel in several disciplines during the site visit to ANL and through teleconferences to conduct the AK evaluation. The members of EPA's inspection team and personnel contacted are listed in Attachment A.

6.0 ARGONNE NATIONAL LABORATORY BACKGROUND

ANL is located in Lemont, Illinois, approximately 25 miles southwest of downtown Chicago. Originally founded in 1946 as the first national laboratory, ANL grew from initial experiments performed at the University of Chicago to produce plutonium for nuclear weapons. Since then, ANL has supported research and development of nuclear reactors and related systems, materials, and components for civilian and national defense programs. This work historically included development of essentially all domestic reactor systems in use today for isotope production, power generation and naval submarine propulsion, as well as applications for weapons destruction, defense waste management, defense safeguards and security and space propulsion. Currently, ANL is a multi-disciplinary research laboratory that performs basic and applied work in engineering, chemistry, physics, materials and environmental studies. Transuranic waste-generating activities at ANL consist mainly of cleaning out buildings or other areas previously used for a variety of research activities.

EPA has not previously approved a CH waste characterization program at ANL under the current baseline inspection process. EPA approved a CH TRU waste characterization program at ANL in 2004, prior to the implementation of the baseline inspection process (refer to Docket No. A-98-49, Item A4-45, August 2004). The CH TRU waste characterization program that EPA approved operated briefly in 2004 until the baseline inspection process was established. Since 2004, ANL shipped CH TRU waste to Idaho National Laboratory for characterization by an EPA-approved waste characterization program as Idaho National Laboratory or Advanced Mixed Waste Treatment Project waste streams, which were characterized and emplaced at the WIPP. On October 4, 2022, the DOE Carlsbad Field Office requested a baseline inspection for ANL-CCP CH TRU waste characterization operations and take steps to certify its CH TRU waste characterization program.

7.0 TECHNICAL EVALUATION – ACCEPTABLE KNOWLEDGE PROCESS

7.1 Waste Characterization Element Description

EPA evaluated ANL-CCP's AK waste characterization program for CH TRU waste characterization. EPA conducted this inspection by reviewing documents and records associated with one waste stream (AECHDM.01) and interviewing ANL-CCP personnel. Inspection details and specific documents and records evaluated for each element summarized below are recorded in the AK checklist that is included in Attachment B.

7.2 Technical Evaluation

7.2.1 Personnel Training and Qualifications

ANL-CCP provided qualification cards for all AK experts and site project managers that actively work with the ANL-CCP waste characterization program. EPA reviewed the qualification cards provided, as well as documentation showing familiarity of the AK experts and site project managers with current revisions of relevant procedures and program documents. EPA also interviewed a portion of the listed AK experts and site project managers. EPA has no issues or concerns with ANL-CCP personnel qualifications for AK experts and site project managers.

Submission to EPA of a list of AK experts and site project managers who performed work in these roles for the ANL-CCP waste characterization program in the previous quarter is a T2 change (refer to Table 1).

7.2.2 Nonconformance and Discrepancy Resolution Documentation

ANL-CCP has not generated any discrepancy resolution reports for Waste Stream AECHDM.01 but cited several discrepancy resolution reports from characterization of the related waste streams. ANL-CCP referenced them in CCP-AK-ANLE-002 as necessary to support the AK summary.

7.2.3 Documentation of Waste Stream Descriptions and Waste Traceability

EPA evaluated waste stream descriptions for three waste streams documented in one Acceptable Knowledge Summary Report (AKSR) and supported by various source documents and CCP-TP-005 forms (i.e., Attachment 6, Attachment 7). During this evaluation, EPA verified:

- The waste stream generating processes are adequately described.
- The expected physical parameters are adequately described.
- The expected radiological parameters are adequately documented.
- Use of AK in NDA and associated limitations are clearly documented and communicated between AK and NDA personnel.
- Waste containers assigned to specific waste streams are traceable from generation through characterization and have documentation supporting inclusion in the waste stream.

Notification to EPA upon completion of or substantive modification to AK summary reports is a T2 change (refer to Table 1).

7.2.4 Implementation of the Enhanced Acceptable Knowledge Process

The enhanced AK process is intended to document (1) evaluation of container-specific AK to provide reasonable assurance that the waste container management and packaging activities are bounded by the applicable AK; (2) evaluation of waste stream-specific AK to provide reasonable assurance that all potential chemical incompatibilities have been identified and evaluated for

impact to long-term isolation of TRU waste; and (3) evaluation of containers against the specified criteria of CBFO's Basis of Knowledge (BoK) document for the treatment and management of oxidizing materials.

Based on interviews with the AK experts and site project managers, ANL-CCP has processes in place to complete the enhanced AK evaluations.

The following are T2 changes (refer to Table 1):

- Notification to EPA upon completion of or substantive modification to CCP-TP-005, Attachment 9 forms; AK Assessment memoranda (including addition of new figures).
- Chemical compatibility evaluation (CCE) memoranda and/or other documentation of waste handling and CCEs.
- BoK memoranda.

Note that this T2 requirement applies to all substantive modifications of these documents, not just those modifications that are considered revisions.

7.2.5 Waste Stream Certification Process

EPA interviewed site project managers regarding the certification of the waste streams, including characterization checklists, characterization information summaries, waste stream profile forms and AK accuracy reports. EPA found that ANL-CCP's certification process is adequate.

The following are T2 changes (refer to Table 1):

- Notification to EPA upon completion of or substantive modification to all waste stream profile forms and any associated change notices.
- Notification to EPA upon completion of or substantive modification to AK accuracy reports (annually, at a minimum).

7.2.6 Overall System of Controls for Acceptable Knowledge

EPA evaluated the completeness of the sampled AK summary reports and general compliance with the AK procedure as evidenced by successful completion of the required forms and found the documents to be complete. ANL-CCP is not overpacking any waste containers for the purposes of payload management.

The WIPP Land Withdrawal Act (Public Law 102-579) as amended by Public Law 104-201 specifies that waste identified for emplacement at WIPP must be defense in origin, must not be spent nuclear fuel (SNF) and must not be high-level waste (HLW). EPA reviewed the AK summary report and supporting source documents relating to the issue of whether the waste is defense in origin, is not SNF and is not HLW (refer to Attachment B). In these documents, DOE states that the waste has a valid defense origin and is not SNF or HLW.

Any implementation of payload management by ANL-CCP is a T1 change (refer to Table 1).

7.3 Acceptable Knowledge Conclusion

7.3.1 Summary of Acceptable Knowledge Findings or Concerns

EPA did not identify any findings or concerns related to the AK and waste certification processes.

7.3.2 Acceptable Knowledge Baseline Approval

EPA approves the AK and waste certification processes as observed during this inspection to characterize CH TRU waste, consistent with the limitations described in this report. Refer to Table 1 for all applicable ANL-CCP CH AK T1 and T2 changes.

7.3.3 Tiering

EPA identified several T1 and T2 changes, as described throughout section 7.2 and summarized in Table 1. Implementation of payload management is the only T1 change.

The T2 changes for AK are:

- Submission of a list of active ANL-CCP AK experts and site project managers that performed work during the previous quarter.
- Notification to EPA upon substantive modification to:
  - AK summary reports (e.g., CCP-AK-ANLE-002)
  - AK accuracy reports (annually, at a minimum)
  - Waste stream profile forms and any associated change notices
  - Add container memoranda
  - Site AK procedures requiring CBFO approval
  - Enhanced AK documents such as CCP-TP-005, Attachment 9, forms and AK Assessment, CCE and BoK memoranda (including addition of new figures or attachments)

8.0 TECHNICAL EVALUATION – NONDESTRUCTIVE ASSAY

8.1 Waste Characterization Element Description

EPA evaluated the use of the ANL-CCP MILCC5 NDA system to characterize CH TRU wastes. The evaluation consisted of assessing the following elements of each NDA system:

- Capability of the measurement hardware and software to perform the required analyses.
- Technical adequacy of the NDA documents and procedures to support the systems' operation.
- Knowledge and understanding of the NDA personnel supporting the systems' operation.

EPA used an NDA checklist (Attachment C) to evaluate the MILCC5 system, as described in section 8.2, which includes the inspection details and the specific documents and records evaluated for each element summarized below.

8.2 Technical Evaluation – Mobile ISOCS Large Container Counter No. 5 (MILCC5) Nondestructive Assay System

8.2.1 Design and Essential Functions

The MILCC5 NDA system is a mobile assay system currently housed in a container located in the Building 331 yard at ANL. ANL-CCP personnel did not express interest in relocating this system, but due to its mobile nature, it could be set up in another location on site at ANL. The MILCC5 began formal operations of CH TRU waste at ANL-CCP on September 19, 2022, and the system had completed assays of six containers that were documented in three MILCC5 batch data reports.

The MILCC5 NDA system consists of two ISOCS-characterized[3] broad energy germanium (BEGe) gamma detectors mounted on specialized moveable carts. The detectors are placed at a specified distance equidistant from and on opposite sides of the container to be measured, i.e., 180° apart, and the vertical height of the detector is the center of the container being assayed. Both detectors are connected to a computer with the ISOCS user interface software. ANL-CCP personnel stated that they maintain at least one spare ISOCS BEGe detector that is the equivalent of those in current use on the MILCC5 to allow for continuity of operations in the event of a detector related issue.

The MILCC5 NDA system uses a drum rotator that provides continuous rotation of approximately two revolutions per minute for assays of 55-gallon drums, the only container type currently approved for assay on the MILCC5 (Reference: MILCC5 Calibration Confirmation Report).

In general, MILCC NDA systems are adjustable to a variety of container types and measurement conditions, and placement of the detectors relative to the item being measured is largely determined by the item's dead time. For the MILCC5 NDA system, there are two discrete measurement geometries, the NEAR and FAR positions. The NEAR position provides the maximum sensitivity for low activity containers while the FAR position allows measurements of higher activity drums so that measurement dead times are reduced. The drum-to-detector distances for the NEAR and FAR positions are 35.5 inches and 72 inches, respectively.[4]

The BEGe detectors directly quantify plutonium-238, -239 and -240 (^{238}Pu, ^{239}Pu, ^{240}Pu), americium-241 and -243 (^{241}Am, ^{243}Am), uranium-233, -235 and -238 (^{233}U, ^{235}U, ^{238}U), cesium-137 (^{137}Cs), neptunium-237 (^{237}Np) and other gamma-emitting radionuclides. The detectors also provide data for the isotopic determination for Pu and other TRU radionuclides as supported by two commonly used gamma radionuclide identification programs, Multi-Group Analysis (MGA)

[3] *ISOCS-characterized* means that the operating attributes of the germanium detectors were determined at the factory in Meriden, CT, prior to receipt at ANL.

[4] All stated distances are measured from the detector end cap to the surface of the container being assayed.

and Fixed-Energy, Response-Function Analysis with Multiple Efficiencies (FRAM). ANL-CCP did not have any isotopic profiles based on approved AK for use at the time of this baseline inspection. Both detectors are cooled mechanically and were not fitted with filters when EPA observed them. A Lynx digital signal processor provides dead time determinations. A multi-curve efficiency calibration compensates for variations in matrix density, from 0.001 to 2.5 grams per cubic centimeter (g/cm^3) (Reference: ISOCS/LabSOCS Detector Characterization Report, MILCC5 Calibration Confirmation Report). Formal ANL-CCP procedures address calibration, operation and data review of the MILCC5 NDA system (Reference: CCP-TP-076, CCP-TP-077, CCP-TP-048). EPA observed that ANL-CCP NDA personnel had access to the current revision of the system's operating procedure in the MILCC5 trailer. ANL-CCP personnel recorded MILCC5 NDA system operations in the logbook that was located with the system, and the logbook adequately documented the calibration, calibration checks and routine operation of the MILCC5 NDA system, including daily performance tests and off-normal conditions such as elevated backgrounds (Reference: MILCC5 Logbook).

EPA found that all observable design and essential functions of the MILCC5 NDA system were technically adequate and appropriately documented for assaying ANL S5000 CH TRU waste in 55-gallon drums.

New equipment or substantive physical modifications to approved equipment is a T1 change. Assaying any container other than a 55-gallon drum is a T1 change. Notification to EPA upon substantive modification to software for approved NDA equipment is a T2 change. Addition of default isotopic values based on AK is a T2 change.

8.2.2 Operational Range

The operating range for the MILCC5 NDA system is limited by matrix density, spectral parameters, dead time and the required lower limit of detection (LLD), discussed in section 8.2.4. As stated in section 8.2.1, the MILCC5 NDA system can assay wastes with densities ranging from 0.001 to 2.5 g/cm^3, a range that exceeds the expected densities of the wastes that ANL-CCP expects to assay with the MILCC5 (Reference: MILCC5 Calibration Confirmation Report, MILCC5 TMU Report). Because the MILCC5 calibration is based on energy, essentially any radionuclide with a gamma emission between 59 and 1408 kiloelectron volts (keV) is within the system's operational range and assays are limited by system dead time or spectral criteria (Reference: ISOCS/LabSOCS Detector Characterization Report, MILCC5 Calibration Confirmation Report). This operational range is adequate for assays of radionuclides anticipated in ANL TRU wastes.

EPA confirmed that the operational range of the MILCC5 NDA system was adequate for the wastes that ANL-CCP currently assays in terms of the waste's physical attributes (matrix) and radionuclide content (activity).

Notification to EPA upon substantive modification to operating ranges or site NDA procedures requiring CBFO approval is a T2 change.

8.2.3 Calibration and Calibration Confirmation

The Canberra factory initially characterized the MILCC5 gamma detectors prior to their receipt at ANL. When setting the system up in its current location, ANL-CCP performed calibrations for energy, efficiency and resolution (Full-Width-at-Half-Maximum) using National Institute of Standards and Technology (NIST)-traceable ^{241}Am and europium-152 (^{152}Eu) line sources that provided a range of gamma emissions from approximately 59 to 1408 keV (Reference: CCP-TP-077, MILCC5 Calibration Confirmation Report).

ANL-CCP performed confirmation measurements by assaying a different set of NIST-traceable ^{241}Am and ^{152}Eu line sources in four 55-gallon drums each using a separate matrix to represent a range of densities, i.e., foam (0.024 g/cm^3), Homasote (0.0422 g/cm^3), medium density fiberboard or MDF (0.686 g/cm^3) and sand (1.47 g/cm^3). All four drums were assayed in both the NEAR and FAR positions and ANL-CCP evaluated the results relative to the bias effect that results from using line sources in a surrogate container. These ISOCS-derived self-attenuation correction factors are energy-dependent and are specific to a 55-gallon drum, and ANL-CCP applied them to the NDA 2000 values to provide the formal calibration confirmation results (Reference: MILCC5 Calibration Confirmation Report, D. Remington ISOCS Modeling Report). The results for all four matrices were evaluated relative to the acceptance criteria for accuracy and precision from DOE's Waste Acceptance Criteria (Reference: WIPP WAC). Results for the four matrices met all acceptance criteria and confirmed that the MILCC5's operational ranges for density (0.001–2.5 g/cm^3) and for energy (59–1408 keV) are adequate for all TRU radionuclides. All mixed gamma radionuclide standards that ANL-CCP used were traceable to the national standards base and all measurements were technically adequate and were appropriately documented (Reference: MILCC5 Calibration Confirmation Report).

Extension of, or changes to, the approved calibration ranges for approved NDA equipment is a T1 change. Notification to EPA of any change to the MILCC5 NDA system that does not directly impact EPA-approved calibration, including relocation of the system at ANL, is a T2 change.

8.2.4 Determination and Documentation of the Lower Limit of Detection, Including the Minimum Detectable Concentration

Instruments performing TRU/non-TRU waste discrimination must have a minimum detectable concentration of less than 100 nanocuries per gram (nCi/g)[5] for TRU radionuclides. Minimum detectable activities are assay event-specific and depend on measurement conditions such as background, matrix and other measurement details.

ANL-CCP documented the MILCC5 NDA system's ability to discriminate TRU and non-TRU waste at the 100 nCi/g criterion for all matrices in the 55-gallon drum in the NEAR position. ANL-CCP staff stated that they can extend counting times for assays in the FAR position as needed (Reference: MILCC5 Calibration Confirmation Report). However, as discussed in section 8.2.1, the purpose of the FAR position is to assay containers with higher activity where the ability to discriminate TRU and non-TRU wastes would not be critical.

[5] The DOE Waste Acceptance Criteria refers to this as the TRU Alpha Activity Concentration or TAAC.

8.2.5 Total Measurement Uncertainty

ANL-CCP documented the determination of the total measurement uncertainty (TMU) for the MILCC5 NDA system (Reference: MILCC5 TMU Report). This includes the contributions of the following, all of which are assumed to be independent and are added in quadrature[6]:

- matrix variations
- matrix density variations
- counting statistics
- calibration uncertainties
- count rate loss corrections
- matrix inhomogeneity
- non-uniform source distribution
- detector positioning
- background
- self-attenuation due to lumps
- isotopic uncertainty
- radionuclide interferences

ANL-CCP stated that the systematic uncertainties of the source and matrix non-uniformities dominate the TMU determination. The MILCC5 TMU Report presents the 1-sigma TMU value for a 55-gallon drum[7] in the NEAR position based on the 129, 414 and 722 keV lines of ^{239}Pu, with the understanding the NDA 2000 software generates an event-specific TMU value for each assay. These values are consistent with TMU values that EPA has evaluated for similar systems and are an adequate demonstration of the MILCC5's ability to provide TMU determinations for assays of CH TRU waste.

EPA verified that this determination of TMU was technically adequate and appropriately documented for the NEAR measurement distance for 55-gallon drums. EPA reviewed the TMU values documented in the MILCC5 batch data reports cited in Attachment C.

8.2.6 Documentation of Measurements

ANL-CCP documents the results of MILCC5 NDA system assays in batch data reports (Reference: CCP-TP-076, CCP-TP-048). For the purposes of EPA's inspection, ANL-CCP prepared three batch data reports that had been processed through Project Level Review which documented the six 55-gallons drums that ANL-CCP assayed to date. EPA reviewed the MILCC5 batch data reports and found they adequately demonstrated ANL-CCP's ability to

[6] ANL-CCP combined all the contributors to uncertainty in quadrature, assuming they are independent. Adding in quadrature is a standard statistical technique that allows one to combine the square root of the sum of each contributor to uncertainty squared, resulting in a lower value than what would be obtained if the values were simply added. For example, the TMU for a 55-gallon drum is derived by taking the square root of the sum of $(5.00\%)^2$ plus $(4.4\%)^2$ plus $(13.6\%)^2$ plus $(7.2\%)^2$ plus $(2.3\%)^2$, which equals 16.9% when added in quadrature, which is less than 32.5%, the value that is obtained by simply summing the individual uncertainty values (Reference: MILCC5 TMU Report).

[7] The MILCC5 TMU Report addresses uncertainty for a Standard Waste Box (SWB), but the MILCC5 is not currently approved for assaying SWBs.

compile all information required to support the characterization of CH TRU wastes (Reference: MILCC5 Batch Data Reports). The batch data reports contained all relevant information, including a statement about the status of each container as TRU or not TRU. The batch data reports included containers that were marked with ANL-CCP nonconformance reports (NCRs) due to their assay values being less than 100 nCi/g or "indeterminate", meaning that the assay could not definitely determine the container's TRU status (Reference: MILCC5 NCR).

EPA confirmed that the ANL-CCP MILCC5 batch data reports adequately documented the characterization of 55-gallon CH drums from the standpoint of determining the activity of the 10 WIPP-tracked radionuclides and their associated uncertainty and their status as TRU waste.

8.2.7 Contact-Handled Determination

ANL-CCP determines that all TRU waste containers are CH, i.e., have a CH dose equivalent rate less than 200 millirem per hour, in accordance with the CCP Transuranic Waste Certification Plan, CCP-PO-002. Measurement of a container's contact dose rate is the responsibility of ANL radiological control technicians who perform surveys using ANL site-specific procedures.[8] ANL generated the current waste streams and manages them as CH, which is verified by radiological control technicians during drum movement around the site including specific hold points when ANL personnel confirm that each container's contact dose rate is less than 200 millirem/hour (Reference: Radiological Survey Reports, ANL Survey Procedure). ANL-CCP would reject and segregate any container found to exceed the CH criteria for contact dose rate.

EPA confirmed that ANL-CCP performs and documents the CH determination for containers that are assayed on the MILCC5 NDA system.

8.2.8 Participation in the Carlsbad Field Office-Sponsored Performance Demonstration Program

At the time of this inspection, the MILCC5 NDA system had not participated in the CBFO-sponsored performance demonstration program (PDP). While ANL-CCP had initially registered to participate in supplemental cycle 29B in 2022, DOE was unable to ship the PDP standards to ANL. The PDP matrix drums are at ANL, but the PDP standards are not. ANL-CCP stated that it expects this issue to be resolved such that it can receive the PDP standards and participate in Cycle 30 in May 2023. The MILCC5 NDA system is scheduled to participate in the PDP annually.

8.2.9 Personnel Training

ANL-CCP stated that it had three qualified operators and one qualified expert analyst to support the MILCC5. The list of qualified individuals (LOQIs) dated November 15, 2022, which ANL-CCP provided during the inspection, documented that all three MILCC5 operators and the expert analyst associated with the system's calibration, operation, data review and approval had current training (Reference: LOQI). ANL-CCP trained all MILCC5 personnel to the current revisions of

[8] There are other attributes of a container related to its radionuclide content that ANL also measures, i.e., fissile gram equivalent, decay heat and ^{239}Pu equivalent activity, all of which ANL personnel assess relative to specific acceptance criteria.

the MILCC calibration (CCP-TP-077), operational (CCP-TP-076) and data review (CCP-TP-048) procedures, as evidenced by the qualification cards that EPA reviewed for all MILCC5 personnel.

Submission to EPA of a list of all NDA personnel who performed work during the previous quarter is an NDA T2 change. Specifically, the list must include all operators, expert analysts and independent technical reviewers.

8.2.10 Environmental Protection Agency Replicate Testing Protocol[9]

As part of this inspection, EPA requested that ANL-CCP reassay three containers that EPA selected from a list of drums previously assayed on the MILCC5. ANL-CCP subjected their results to two statistical tests that EPA requested: a chi-squared (χ^2) test and a *t* test.

The χ^2 test, which is also known as the goodness-of-fit test or the chi-squared test for independence, is used to show how observed data compare with what is expected according to a specific hypothesis. EPA uses this test to show whether the replicate measurements differed from the expected original measurement. The *t* test is a statistical tool that is used to tell if two sets of data are statistically different; EPA uses this test to provide an independent means to verify that the MILCC5 can provide reproducible results for the determination of the quantity of 10 WIPP-tracked radionuclides.

ANL-CCP reassayed Drum Nos. 2108161010, 2108161011, and 2108161012 five times each and compared the average of these results to the drum's original assay data using the two statistical tests described above. EPA reviewed the data and results of these tests, which are included in Attachment C, and discussed below.

The *t-test* for container Nos. 2108161010, 2108161011 and 2108161012 showed no statistically significant differences between the original assay and the average of the five replicate measurements. For container Nos. 2108161011 and 2108161012, the χ^2 test showed that the observed variances in the replicate measurements are less than or equal to the reported uncertainties within the statistical limits of the test. For container No. 2108161010 the χ^2 test showed a *Highly Significant* flag for the ^{241}Am value. Upon closer examination, one of the replicate assays did not detect the 125 keV ^{241}Am peak, which increased the variability of the assays of the replicates and caused the χ^2 test to fail. The container's ^{241}Am content was low and the *Highly Significant* flag is a function of the constraints of the χ^2 test and not a true indication of a measurement problem with the MILCC5 NDA system.

There are no technical issues associated with the performance of replicate testing of the ANL-CCP MILCC5 NDA system.

[9] EPA Replicate Testing for WIPP Nondestructive Assay (NDA) Systems, Revision 2, June 2002.

8.3 Nondestructive Assay Conclusion

8.3.1 Summary of Nondestructive Assay Findings or Concerns

EPA did not identify any findings or concerns related to use of the MILCC5 NDA system.

8.3.2 Nondestructive Assay Baseline Approval

EPA approves the MILCC5 NDA system at ANL in the configurations observed during this inspection to characterize CH TRU waste, consistent with the limitations described in this report. Refer to Table 1 for all applicable ANL-CCP CH NDA T1 and T2 changes.

8.3.3 Tiering

EPA identified several T1 and T2 changes, as described throughout section 8.0 and summarized in Table 1; the T1 changes are:

- New equipment or substantive physical modification to approved equipment.
- Extension of or changes to approved calibration ranges for approved equipment.
- Use of measurement geometries other than 55-gallon drums.

The T2 changes for NDA are:

- Submission of a list of active ANL-CCP NDA operators, expert analysts and independent technical reviewers that performed work during the previous quarter.
- Notification to EPA upon substantive modification to:
  - Software for approved equipment
  - Operating ranges upon CBFO approval
  - Site NDA procedures requiring CBFO approval

9.0 TECHNICAL EVALUATION – VISUAL EXAMINATION PROCESS

9.1 Waste Characterization Element Description

ANL-CCP conducts VE using CCP procedure CCP-TP-113, the same procedure that is used for CH TRU wastes at other DOE TRU generator sites. This involves ANL-CCP VE operators observing ANL site waste handlers package waste. This procedure is designed to be used in conjunction with host site (i.e., ANL) facility operating procedures that conduct operations within the glovebox enclosure where VE is performed. There were four ANL-CCP VE operators and one VE expert, all with up-to-date qualification cards at the time of the site visit.

Logistically, the ANL waste handlers and a health physics technician wearing protective clothing and respirators were inside Building 306, Room A160 that contained a large glovebox enclosure into which they loaded waste items they removed from interim storage containers. The VE process occurs as ANL waste handlers sort and examine the waste items and load them from the glovebox enclosure into the empty 55-gallon output drum that will be the actual CH TRU waste

container. The ANL-CCP VE operators and VE expert were outside Room A160 and were not wearing protective clothing. The ANL waste handlers and ANL-CCP VE operators and VE expert communicated using hand signals and radio communications, and the ANL waste handlers displayed each item before placing it in the waste drum such that the ANL VE operators were able to note the item and record it electronically. Similarly, the ANL waste handlers provided information to the ANL-CCP VE operators, specifically, the scale number and calibration status, tare weight of the output drum, and other pertinent details required to document the ANL-CCP VE process.

The cooperation between the ANL and ANL-CCP personnel was extensive and reflected considerable experience working together to execute a complex process in an efficient manner. The ANL-CCP VE procedure contains complete and detailed instructions for performing VE and requires the operators to document the waste material parameters, the presence or absence of prohibited items and to verify the waste matrix code and item description code. ANL-CCP VE operators recorded these and other required information electronically.

EPA evaluated the documentation that ANL-CCP prepared to support the VE process to characterize CH TRU wastes. This baseline inspection began with a review of technical records and batch data reports and EPA prepared a VE inspection checklist (refer to Attachment D) that includes the aspects described below. EPA then performed an onsite inspection of ANL-CCP personnel conducting VE, focusing on the following:

- Capability of the VE process to confirm the waste's waste material parameters, waste matrix code and item description code and documenting the presence or absence of prohibited items.
- Technical adequacy of ANL-CCP documents and procedures to support VE operations to characterize CH TRU wastes.
- Knowledge, understanding and training of ANL-CCP personnel performing VE for CH TRU wastes.

This baseline inspection included the aspects listed below.

9.2 Technical Evaluation

9.2.1 Onsite Demonstration of Contact-Handled Visual Examination

During the onsite visit, EPA observed the VE event in Building 306 at ANL on November 16, 2022. The VE event consisted of ANL waste handlers unloading bulk materials from several 55-gallon drums into a glovebox enclosure in which they were sorted for inclusion in a new 55-gallon output drum, No. 2108161003. The bulk materials had been collected in 55-gallon drums at various work locations at ANL and staged in the area outside the room where VE took place. The waste materials consisted of miscellaneous debris items, predominantly what appeared to be routine laboratory trash such as protective clothing, rags, filter media, metal, plastic bags, tape and other small items. ANL routinely monitors all containers in this area (Reference: ANL Procedure 1, ANL Procedure 2) and documents the surveys' results (Reference: ANL Survey Results).

The VE event occurred within Room A160, which contained a multi-port glovebox enclosure that covered one wall of the room, allowing two waste handlers to sort waste simultaneously. All ANL personnel inside the room were wearing protective clothing since the entire room was posted as a radiation area and communications were performed using a combination of manual signals and electronic communication. The ANL waste handlers were Lucas Mountain, James Abderhalden, and Health Physics Technician Chris Robert, who were supported by Health Physics Technician Justin Maxwell, who remained outside the room. The ANL-CCP VE operators were Tommy Mojica and Pat Beallis, while Wes Root functioned as the VE expert; all three ANL-CCP personnel remained outside the room. The EPA inspection team observed an ANL health physics technician screening all waste containers and materials during the course of the VE event (Reference: ANL Procedure 1, ANL Procedure 2).

Before the VE event began, the VE expert confirmed the current revision of the VE procedure, the waste's summary category group (S5400), the approved list of measurement and test equipment for the scale and torque wrench (Reference: measurement and test equipment (M&TE) list), waste stream identification, AK summary and LOQI. As discussed previously, the ANL-CCP VE operators worked closely with the ANL waste handlers who displayed all items and facilitated the identification, weighing and recording of all waste items, which the ANL-CCP VE operators recorded electronically in the VE Logbook (Reference: VE Logbook). The ANL waste handlers noted the scale number (000030849) and calibration status (Calibration Due 2-3-2023) and checked the scale's calibration with a 20 kilogram (kg) certified weight. The output drum's net weight was 39.0 kg. ANL waste handlers confirmed that the output drum was empty, had a tare weight of 32.5 kg and that it contained a fiberboard liner which constituted one layer of confinement. ANL-CCP VE operators verified that ANL personnel did not load any prohibited items into the receiving container, and they noted the identity of all waste items placed in the drum. The ANL waste handlers affixed a new ANL tamper indicating device on the output drum (No. 102382) once the drum loading was complete.

ANL waste handlers worked closely with ANL-CCP VE personnel to ensure that the ANL-CCP VE operators identified waste material parameters and all pertinent VE information and recorded them electronically; this information was used to populate the formal ANL-CCP VE batch data report that documented this VE event (Reference: VE Batch Data Report, Observed). EPA determined that the ANL-CCP VE process for CH TRU waste was technically adequate and appropriately documented.

VE for any non-debris waste and VE by any process other than ANL-CCP VE operators observing ANL waste handlers package the waste from a glovebox to a designated output drum, as demonstrated during this inspection, are T1 changes. Notification to EPA upon availability of or modification to the VE procedure requiring CBFO approval is a T2 change (refer to Table 1).

9.2.2 Visual Examination Characterization Records

At the time of the inspection, ANL-CCP had completed five CH VE batch data reports, all of which ANL-CCP had promoted through project level review and determined that these batch data reports were complete, contained all required elements and had been properly processed. ANL-CCP provided the VE batch data report that documented the VE event that EPA observed during this inspection (Reference: VE Batch Data Report, Observed). EPA verified that ANL-

CCP generated and recorded VE data appropriately. VE operators verified the waste matrix code and waste stream identification and the other pertinent details related to the VE event, as discussed in the previous section. Two VE operators signed all data sheets, and EPA found all VE records to be complete.

EPA had no concerns regarding the adequacy of the characterization records to support VE of CH TRU wastes at ANL. The ANL-CCP data validation processes are adequate to capture and correct errors in the documentation of the VE event.

9.2.3 Training of Visual Examination Personnel

EPA inspectors reviewed training records for ANL-CCP VE operators, including the VE expert. The qualification cards were complete and available for review, and the VE expert had an appropriate appointment letter.

EPA determined that ANL-CCP CH VE personnel are appropriately trained and that all training records are up to date and available for review.

Submission to EPA of a list of ANL-CCP VE operators, VE experts and independent technical reviewers that performed work during the previous quarter is a T2 change (refer to Table 1).

9.3 Visual Examination Conclusion

9.3.1 Summary of Visual Examination Findings and Concerns

EPA did not identify any findings or concerns related to VE as a result of this baseline inspection. There are no open issues related to VE from this baseline inspection.

9.3.2 Visual Examination Baseline Approval

EPA approves the ANL-CCP VE process for characterizing CH TRU waste as described in this report. Refer to Table 1 for ANL-CCP CH VE T1 and T2 changes as a result of this baseline inspection.

9.3.3 Tiering

EPA identified several T1 and T2 changes for VE, as described throughout section 9.2 and summarized in Table 1; the T1 changes are:

- VE for non-debris waste.
- VE by any process other than ANL-CCP VE operators observing ANL waste handlers package the waste in a glovebox, as demonstrated during the November 2022 baseline inspection.

The T2 changes are:

- Notification to EPA upon substantive modification to site procedures requiring CBFO approval.

- Submission of a list of ANL VE operators, VE experts and independent technical reviewers that performed work during the previous quarter.

10.0 RESPONSE TO COMMENTS

On June 21, 2023, EPA published a Federal Register notice to take comments on the proposed approval of the ANL-CCP CH waste characterization program. The 45-day comment period ended on August 7, 2023, and there were no comments received from the public.

11.0 SUMMARY OF RESULTS

11.1 Environmental Protection Agency Findings and Concerns

EPA did not identify any findings or concerns during this baseline inspection.

11.2 Conclusions

This approval is based on EPA's baseline inspection ANL-CCP-CH-Baseline-2022 conducted on November 15–17, 2022, remotely and at ANL in Lemont, Illinois. EPA evaluated ANL-CCP's CH TRU waste characterization program and determined it to be technically adequate; the approval includes:

(1) The AK process for ANL CH TRU waste.

(2) The MILCC5 NDA system and processes for characterizing CH TRU waste.

(3) The VE process to identify waste material parameters and the physical form of CH TRU waste.

Any changes to the waste characterization activities from the date of the baseline inspection must be reported to and, if applicable, approved by EPA according to Table 1. All T1 changes must be submitted for approval before their implementation and will be evaluated by EPA. Upon approval, EPA will post the results of the evaluations through EPA's docket at regulations.gov (Docket No: EPA-HQ-OAR-2001-0012). ANL-CCP must submit T2 changes at the end of the fiscal year quarter in which they were implemented.

As discussed in section 10.0, there were no public comments in response to the proposed approval. EPA's final approval of the ANL-CCP CH waste characterization program will be conveyed to DOE separately by letter. This information will be provided through the Agency's docket at regulations.gov.

ATTACHMENT A: BASELINE INSPECTION PERSONNEL LIST

Table A-1. EPA Inspection Team and Personnel Interviewed during Baseline Inspection

Personnel Name	Affiliation	Inspection Function	Entrance Meeting	Interviewed	Exit Meeting
Jerry Ellis	U.S. EPA ORIA	Inspection Lead	NA	NA	NA
Ed Feltcorn	U.S. EPA ORIA	Inspector	NA	NA	NA
Kira Darlow*	SC&A	Technical Inspector, AK	NA	NA	NA
Patrick Kelly	SC&A	Technical Inspector, NDA & NDE	NA	NA	NA
Daniel Bamper	DOE/CBFO	WIPP Liaison	X	Y	X
Noreen Brachmann	DOE/ASO	Observer	X	N	N
Jo Cooney	Argonne	Radiation Protection	X	N	N
Dan Dilday	Argonne	NWM	X	N	N
Jeff Graymajlo	Argonne	NWM	X	N	N
Kevin Haar	WWP/CCP	NDA Cognizant Engineer	X	Y	X
Joe Jacoboski	Argonne	NWM	X	N	N
Carl Jenks	Mirion/LANL/CCP	Expert Analyst MILCC5	X	Y	N
Bob Leppink	Argonne	NWM Deploy Division		N	X
Dan McGann	Argonne	NWM	X	N	
Tommy Mohica	CCP	CH, RH, VE	X	Y	X
William Mussman	Mirion	NDA Subject Matter Expert	X	Y	X
Nick Oudin	ANL	Radiological OPS Manager	Y	N	X
Dan Pancake	ANL	TRU PM	X	Y	X
Spencer Troy Pattee	CCP	VE, CH/RH DTC	X	Y	X
F. Wesley Root	CCP	VE, DTC, VPM	X	Y	X
Craig Simmons	NWP/CCP	PM	X	Y	X
Jonathan Zarndt	Argonne	NWM	X	N	X

*Participated remotely

Note: ASO – Argonne Site Office; DTC – dose-to-curie; NDE – nondestructive examination; NWM – Nuclear Waste Management; NWP – Nuclear Waste Partnership; OPS – Operations; PM – Project Management; VPM - Vendor Project Manager

ATTACHMENT B: ACCEPTABLE KNOWLEDGE CHECKLIST, BASELINE INSPECTION

EPA Inspection No.: ANL-CCP-CH-Baseline-2022 **Inspection Date: November 15–17, 2022**

Table B-1. Personnel

No.	Technical Element/Aspect	Yes, No, N/A	Objective Evidence and Comments
1	Do the AK and waste certification systems of controls require all personnel to be trained and qualified?	Yes	CCP-TP-002, Revision 29; CCP-TP-200, Revision 7; CCP-TP-005, Revision 32
2	Are all AK experts and site project managers performing work for ANL-CCP trained and qualified?	Yes	AK Expert Qualification Cards: Hannah Fredericks, 7-6-2021; Trey Greenwood, 7-11-2016; Elizabeth Lickliter, 10-6-2016; Kevin Peters, 10-26-2016; Scott Smith, 10-25-2016 Site Project Manager Qualification Cards for Jorge Gonzalez, 4-24-2018; Rich Kantrowitz, 2-19-2015 AK Expert and Site Project Manager Acknowledgment of: CCP-TP-002, Revision 29; CCP-TP-005, Revision 32 Interviews with AK experts and site project managers during inspection indicate personnel are qualified.

Table B-2. Acceptable Knowledge Nonconformances and Discrepancies

No.	Technical Element/Aspect	Yes, No, N/A	Objective Evidence and Comments
1	Does the AK system of controls include a process for identifying, documenting and resolving AK-affecting nonconformances prior to continued container characterization and/or shipment?	Yes	CCP-QP-005, Revision 28; CCP-TP-005, Revision 32 ANL-CCP has not identified any AK-affecting nonconformances.
2	When appropriate, does the AK system of controls include a process to re-evaluate AK and document the re-evaluation? This may be documented on a CCP-TP-005, Attachment 10, Acceptable Knowledge Re-evaluation Checklist.	Yes	CCP-TP-005, Revision 32 ANL-CCP has not conducted an AK re-evaluation. This is reasonable – ANL-CCP has only characterized seven containers and the AK experts wrote the AK Summary Report to cover all potential CH waste generation instead of focusing it on the specific known containers.
3	Does the AK system of controls include a process for identifying, documenting and resolving discrepancies between AK source documents and/or between AK and characterization data? This may be documented on a CCP-TP-005, Attachment 11, Acceptable Knowledge Source Document Discrepancy Resolution.	Yes	CCP-TP-005, Revision 32; DR025, DR3001, DR3002, DR3003, DR3004 ANL-CCP has not generated any discrepancy resolution reports for Waste Stream AECHDM.01 but cited several discrepancy resolution reports from characterization of the related waste streams. ANL-CCP referenced them in CCP-AK-ANLE-002 as necessary to support the AK summary.

Table B-3. Waste Stream Description and Waste Identification

No.	Technical Element/Aspect	Yes, No, NA	Objective Evidence and Comments
1	Does the ANL-CCP AK process include describing the waste generating processes?	Yes	CCP-TP-005, Revision 32; CCP-AK-ANLE-002, Revision 0; C9000, C9003, P6004, P6010, P8002, U3003, U6002, U6003 ANL generated the waste during facility maintenance and laboratory operations and followed standard waste management and packaging practices.
2	Does the ANL-CCP AK process include describing the physical composition of the waste for current waste containers and any planned future generation? The expected physical parameters may be documented on a CCP-TP-005, Attachment 6, Waste Form, Waste Material Parameters, Prohibited Items, and Packaging, and/or the associated memorandum.	Yes	CCP-TP-005, Revision 32; CCP-AK-ANLE-002, Revision 0 Attachment 6, 10-22-2021, Memorandum 8-26-2021 ANL-CCP reviews and re-signs the Attachment 6s with each AKSR revision to ensure changes are captured as necessary. Memoranda are reissued only when changes are necessary.
3	Does the ANL-CCP AK process include describing the radiological composition of the waste for current waste containers and any planned future generation? Are the limitations of AK for use in radiological characterization or assay communicated? For CH waste, the radiological characteristics and AK limitations may be documented on a CCP-TP-005, Attachment 7, Radionuclides, and/or the associated AK-NDA memorandum.	Yes	CCP-TP-005, Revision 32; CCP-AK-ANLE-002, Revision 0 Attachment 7, 7-13-2022, Memorandum 7-12-2022 ANL-CCP reviews and re-signs the Attachment 7s with each AKSR revision to ensure changes are captured as necessary. Memoranda are reissued when changes are necessary.
4	Does the ANL-CCP AK process ensure that waste containers are traceable from retrieval or generation through ANL-CCP's characterization process? Traceability records may include add-container memoranda (may include CCP-TP-005, Attachment 8, Waste Containers List), drum-specific paperwork from the generator site, Interface Waste Management Documents List, characterization batch data reports, WIPP Waste Data System screenshots or demonstrations.	Yes	CCP-TP-005, Revision 32; ANL-CCP CH AK Tracking Spreadsheet, 10-19-2022; CCP-AK-ANLE-002, Revision 0 Attachment 8, 7-6-2022; C9003, U6002, U6003 The contents of container Nos. 2108161010, 2108161011, 2108161012, 2112131035 are traceable from original generation and packaging through repackaging (sometimes multiple) and consolidation.

Table B-4. Enhanced Acceptable Knowledge

No.	Technical Element/Aspect	Yes, No, N/A	Objective Evidence and Comments
1	Does the ANL-CCP AK process include reviewing the AK associated with certifiable payload containers generated since August 25, 2016? Does the process provide reasonable assurance that management and packaging of the containers is bounded by the applicable AKSRs? This may be documented on a CCP-TP-005, Attachment 9, Interface Waste Management Documents List, on the CCP-TP-005, Attachment 3, Acceptable Knowledge Source Document Summary for each document listed on the Attachment 9 and/or in a new revision of the AKSR.	Yes	CCP-TP-005, Revision 32; ANL-CCP CH AK Tracking Spreadsheet, 10-19-2022 Attachment 9, 12-14-2021; C9003, P6004, P6010, P8006, P9000 ANL-CCP is maintaining the Interface Waste Management Documents List to track the container management and packaging processes at ANL. ANL-CCP documents verification of the container management and packaging processes in the associated Attachment 3, Acceptable Knowledge Source Document Summary forms. The date of the Attachment 9 form that bounds container management is recorded in the AK Tracking Spreadsheet and Add Container Memoranda as appropriate.
2	Does the ANL-CCP AK process include reviewing the AK associated with certifiable payload containers generated prior to August 25, 2016? Does the process provide reasonable assurance that management and packaging of the containers is bounded by the applicable AK Summary Reports? This may be documented in an AK assessment memorandum; there may be more than one AK assessment memorandum per waste stream.	Yes	CCP-TP-005, Revision 32; Summary of Enhanced AK Status, provided 11-16-2022 ANL-CCP was in the process of completing the AK assessment memorandum at the time of EPA's baseline inspection. EPA has evaluated CCP's enhanced AK process several times at other sites and previously confirmed that the WIPP waste acceptance process will not allow containers to ship prior to completion of the AK Assessment memorandum. Notification to EPA of completion of AK assessment memoranda is a T2 change.
3	Does the ANL-CCP AK process include evaluating the chemical compatibilities within each waste stream and clearly documenting the technical assumptions? Is the process sufficient to identify any potential impacts to the long-term isolation of TRU waste?	Yes	CCP-TP-005, Revision 32; Summary of Enhanced AK Status, provided 11-16-2022 ANL-CCP was implementing the CCP enhanced AK process for CCEs during the baseline inspection. EPA has evaluated CCP's enhanced AK process several times at other sites and previously confirmed that the WIPP waste acceptance process will not allow containers to ship prior to CBFO approval of the CCE memorandum. Notification to EPA of completion of CCE memoranda is a T2 change.
4	Does the ANL-CCP AK process include evaluating the subject containers against the specified criteria of the Basis of Knowledge for the treatment and management of oxidizing materials?	Yes	CCP-TP-005, Revision 32; Summary of Enhanced AK Status, provided 11-16-2022 ANL-CCP was in the process of evaluating the oxidizing chemicals against the Basis of Knowledge at the time of EPA's baseline inspection.

Table B-5. Waste Stream Certification

No.	Technical Element/Aspect	Yes, No, N/A	Objective Evidence and Comments
1	Does ANL-CCP have a process to complete the waste stream profile package and update it as necessary?	Yes	CCP-TP-002, Revision 29 According to conversations with the site project managers listed in Table C-1, the waste stream profile form is not drafted until after at least five containers are fully characterized. CBFO does not approve the waste stream profile package until after all EPA approvals are in place.
2	Does ANL-CCP have a process to certify the characterization data, including validation, verification and reconciliation against the data quality objectives? This may be documented on CCP-TP-005, Attachment 13, CCP Waste Stream Characterization Checklist; CCP-TP-002, Attachment 1, CCP Reconciliation with Data Quality Objective; Characterization Information Summary.	Yes	CCP-TP-002, Revision 29; CCP-TP-005, Revision 32 According to conversations with the site project managers listed in Table C-1, certification of the characterization data does not occur until after at least five containers are fully characterized and all EPA and CBFO characterization approvals are in place. During the process, site project managers confirm that characterization is complete and meets all data quality objectives, that the characterization results are consistent with the AK waste description, and that there are no prohibited items in the containers.
3	Does ANL-CCP have a process to assess AK accuracy for each active waste stream at least annually? This may be documented on a CCP-TP-005, Attachment 14, CCP Acceptable Knowledge Accuracy Report, with an associated narrative.	Yes	CCP-TP-005, Revision 32 According to conversations with the site project managers listed in Table C-1, AK accuracy is assessed once a year, approximately on the anniversary of the CBFO certification audit.

Table B-6. System of Controls

No.	Technical Element/Aspect	Yes, No, N/A	Objective Evidence and Comments
1	Is the AK collection process adequately documented? Documentation may include CCP-TP-005 attachments: Attachment 1, Acceptable Knowledge Documentation Checklist; Attachment 2, Record of Communication; Attachment 3, Acceptable Knowledge Source Document Summary; Attachment 4, Acceptable Knowledge Information List.	Yes	Attachment 1, 6-22-2022; Attachment 4, 6-22-2022 EPA reviewed completed Attachment 3 forms for source documents listed in this checklist.
2	If applicable, are the data and information shared between related waste streams adequately documented?	Yes	CCP-AK-ANLE-002, Revision 0
3	Is the DOE defense determination for all WIPP-bound waste documented?	Yes	CCP-AK-ANLE-002, Revision 0; AE-I-188, C001, C006, C068, P599, U001
4	Is the DOE determination that none of the waste in the waste stream is HLW or SNF documented?	Yes	CCP-AK-ANLE-002, Revision 0; C9003, U6002, U6003
5	If payload management of TRU alpha activity concentration of waste containers selected for overpacking is being conducted for any ANL-CCP waste stream, does the applicable AKSR include an estimate of the total waste volume and the percentage of the waste volume that is above and below 100 nCi/g?	N/A	ANL-CCP is not overpacking any waste containers for the purposes of payload management.

ATTACHMENT C: NONDESTRUCTIVE ASSAY CHECKLIST: MOBILE ISOCS LARGE CONTAINER COUNTER 5 (MILCC5), BASELINE INSPECTION

EPA Inspection No.: ANL-CCP-CH-Baseline-2022 **Inspection Date: November 15–17, 2022**

Table C-1. General System Attributes

No.	Technical Element/Aspect	Yes, No, N/A	Comments and Objective Evidence
1	Is the MILCC5 NDA system correctly identified, including its location at ANL and the official beginning of formal CH TRU assays?	Yes	The MILCC5 is a portable gamma spectrometry system currently housed in a Sealand-type container that is located in the Building 331 Yard at ANL. It consists of two equivalent ISOCS-characterized BEGe gamma detectors placed equidistant from the container being measured on opposite sides (180° apart). It is currently configured to measure only 55-gallon drums at two measurement distances, a NEAR position (17" from the detector faces) and a FAR position (69" from the detector faces). The 55-gallon drum is rotated continuously during assay. Formal MILCC5-CH TRU certification assays began on September 19, 2022. Observation of MILCC5 on site at ANL during inspection; MILCC5 Calibration Conformation Report; CCP-TP-076; CCP-TP-077
2	Do ANL-CCP documents adequately describe the MILCC5?	Yes	ANL-CCP documents adequately describe the MILCC5 and its operations. MILCC5 Calibration Confirmation Report; MILCC5 TMU Report; CCP-TP-076; CCP-TP-077

Table C-2. System Performance

No.	Technical Element/Aspect	Yes, No, N/A	Comments and Objective Evidence
1	Are the container types, types of TRU waste, and the operational parameters for the MILCC5 defined and reasonable?	Yes	TRU wastes eligible for assay on the MILCC5 are 55-gallon drums, no other measurement geometries are approved. There is one ANL CH TRU waste stream AECHDM.01 (heterogeneous debris) and ANL expects all wastes from this waste stream to be within the MILCC5's operating range density ranges for density and other parameters. MILCC5 Calibration Confirmation Report; NDA Memo
2	Are there specific limitations on the MILCC5's use for ANL TRU waste?	No	There are no limits for the MILCC5's operation outside of those described in the calibration confirmation report. MILCC5 Calibration Confirmation Report
3	Did ANL provide documentation regarding how many waste containers and approved MILCC5 NDA system batch data reports were assayed by ANL-CCP at risk pending EPA approval?	Yes	ANL-CCP provided a comprehensive list of all six containers that have been assayed on the MILCC's NDA system since it began formal operations.

No.	Technical Element/Aspect	Yes, No, N/A	Comments and Objective Evidence
4	Is the MILCC5 able to report quantitative values and uncertainties for the WIPP-tracked radionuclides?	Yes	The MILCC5 NDA system quantifies $^{238, 239, 240}$Pu, $^{241, 243}$Am, $^{233, 235, 238}$U, ^{137}Cs, ^{237}Np and other radionuclides and their uncertainty directly. ^{242}Pu, ^{90}Sr and ^{234}U are derived by scaling to measured radionuclides. MILCC5 Calibration Confirmation Report; NDA Waste Stream Memo
5	Have background measurements been taken each operational day? Have any instances of problematic background radiation been documented?	Yes	The MILCC5 NDA system operational logbook and batch data reports indicate the performance of daily background measurements readings, and no instances of problematic backgrounds. MILCC5 Operational Logbook; MILCC5 batch data reports; CCP-TP-076
6	Have system gamma performance checks been completed at least once per operational day? Are the procedures for the performance checks technically adequate for the MILCC5 NDA system including gamma matrix correction, peak position and resolution?	Yes	The MILCC5 NDA system operational logbook and batch data reports indicate the performance of daily performance checks, as required by the MILCC5 operating procedure. MILCC5 Operational Logbook; MILCC5 batch data reports; CCP-TP-076

Table C-3. System Calibration & Calibration Verifications

No.	Technical Element/Aspect	Yes, No, N/A	Comments and Objective Evidence
1	Does the MILCC5 NDA system have a calibration of record? Were consensus standards used in the initial calibration? If so, which standards?	Yes	The MILCC5 NDA system calibration of record is based on ANSI Standard N42.14-1999, ASTM Standards C-1030, C-1133 and C-1726 that was performed at Canberra Industries in Meriden, CT, for each BEGe detector. MILCC5 Calibration Confirmation report; ISOCS/LabSOCS Detector Characterization Reports; CCP-TP-077
2	Are the calibration, execution of performance checks and operation of the MILCC5 NDA system, the calculation of radionuclide values and the review/validation of MILCC5 NDA system data governed by controlled-copy (formal) procedures?	Yes	The MILCC5 NDA system calibration procedure details system calibration checks that ANL-CCP NDA personnel perform on site as well as the selection and loading of established efficiency parameters for specific measurement geometries that were performed at the factory (refer to previous entry). The MILCC5 NDA system operating logbook and batch data reports document these as well. CCP-TP-076; CCP-TP-077; CCP-TP-048; MILCC5 Operational Logbook; MILCC5 batch data reports
3	Are the current revisions of procedures in use for the MILCC5 NDA system?	Yes	EPA observed that the MILCC5 operator had the current revision of the operating procedure at the instrument and referred to it during the assay routine that EPA observed. All MILCC5 batch data reports referenced the current revisions of the appropriate CCP procedures. CCP-TP-076; CCP-TP-077; CCP-TP-048; MILCC5 batch data reports
4	Are the isotopic contributions of unmeasured radionuclides derived using a certain method?	Yes	The MILCC5 NDA system uses MGA and FRAM, at the discretion of the EA. There are no approved AK-based isotopics to use with MILCC5 assays at the time of this inspection. MILCC5 Calibration Confirmation Report; CCP-AK-ANLE-002; NDA Waste Stream Memo

No.	Technical Element/Aspect	Yes, No, N/A	Comments and Objective Evidence
5	Were traceable radionuclide sources used for calibration confirmation and/or verifications? If so, list or reference all standards used.	Yes	The initial detector calibration was performed using ^{241}Am, ^{137}Cs and ^{152}Eu line sources at the Canberra facility in Meriden, CT, and was confirmed at ANL using different ^{241}Am and ^{152}Eu line sources. ANL-CCP performed additional validation measurements using LANL weapons grade Pu sources at 1.1, 36 and 104 g total Pu. All sources were corrected for self-absorption and were traceable to the national standards base. Refer to row 8 in Table C-3, below. MILCC5 Calibration Confirmation Report; ISOCS/LabSOCS Detector Characterization Reports
6	Have the operational ranges with respect to matrix (density) and activity been determined for the MILCC5 NDA system?	Yes	The MILCC5 NDA system can assay weapons grade and heat source debris and solids with a density between 0.01 and 2.5 g/cm^3. ANL-CCP expects this range will cover the wastes from the one ANL waste stream (refer to row 1 in Table C-2, above). MILCC5 Calibration Confirmation Report; NDA Waste Stream Memo; U-234 Ingrowth Memo
7	Has a calibration confirmation been completed for the MILCC5 NDA system?	Yes	Confirmation of the MILCC5 NDA system's factory calibration was performed at ANL using ^{241}Am and ^{152}Eu line sources for three measurement geometries over a range of conditions. ANL performed additional verification measurements using weapons grade Pu sources. Refer to row 5 in Table C-3, above. MILCC5 Calibration Confirmation Report
8	Does the MILCC5 NDA system meet the requirements for accuracy and precision as specified in DOE/WIPP-02-3122, Appendix A, Table A-2 for calibration verifications?	Yes	All MILCC5 NDA system calibration confirmation and validation measurements met the requirements for accuracy and precision. MILCC5 Calibration Confirmation Report
9	Have any NCRs related to the MILCC5 NDA system been issued since the system's initial assay of CH TRU wastes?	Yes	All MILCC5 NCRs have been due to assays indicating containers with less than 100 nCi/g TRU radionuclides or the values being "indeterminate", meaning that the assay could not definitely establish the container's status as TRU. MILCC5 batch data reports; MILCC5 NCR
10	Have any calibration verifications been performed for the MILCC5 NDA system since beginning operations? If so, how many and are they documented?	No	Not Applicable

Table C-4. Lower Limit of Detection

No.	Technical Element/Aspect	Yes, No, NA	Comments and Objective Evidence
1	Has the LLD for the MILCC5 NDA system been determined? Is the LLD determination appropriate for the types of TRU waste ANL expects to assay on the MILCC5 NDA system? Is the technical basis for the LLD determination documented?	Yes	LLDs have been determined for 55-gallon drums in the NEAR and FAR positions for directedly measured and scaled radionuclides. ANL-CCP plans to use only the NEAR position to sort TRU/Non-TRU at the 100 nCi/g criterion. MILCC5 TMU Report; MILCC5 batch data reports
2	Is the MILCC5 NDA system used to discriminate TRU/Non-TRU wastes at the 100 nCi/g criterion? If so, does the MILCC5 have the required sensitivity?	Yes	ANL-CCP expects to use only the NEAR position for 55-gallon drums to make TRU/Non-TRU decision. MILCC5 Calibration Confirmation Report
3	Are there any instances where an LLD value for a non-measured radionuclide is not provided based on a lack of technical feasibility?	No	ANL-CCP has determined "reporting thresholds" for non-measured WIPP-tracked radionuclides, i.e., ^{242}Pu, ^{234}U and ^{90}Sr that are quantified based on decay kinetics and/or scaling to other measured radionuclides. MILCC5 Calibration Confirmation Report; U-234 Ingrowth Memo

Table C-5. Total Measurement Uncertainty

No.	Technical Element/Aspect	Yes, No, N/A	Comments and Objective Evidence
1	Is the TMU for the MILCC5 NDA system technically adequate and appropriately documented?	Yes	ANL-CCP has addressed the TMU determination using the ISOCS Uncertainty Estimator for all three measurement geometries for all appropriate sources of uncertainty. The TMU determination is technically adequate and appropriately documented. MILCC5 TMU Report
2	Is the magnitude of the TMU values observed in the MILCC5 NDA system batch data reports examined during the inspection within the expected range?	Yes	The magnitude of the TMU values is within the expected range. MILCC5 TMU Report; MILCC5 batch data reports

Table C-6. Batch Data Reports and TRU Determination

No.	Technical Element/Aspect	Yes, No, N/A	Comments and Objective Evidence
1	Do the MILCC5 batch data reports contain: • Testing facility name, testing batch number, container numbers, and signature of the site project manager or designee? • Table of contents? • Background and performance check data or control charts for the relevant time period? • Separate testing report sheets for each container?	Yes	All MILCC5 NDA system batch data reports contained the required information. MILCC5 batch data reports
2	Do the Radioassay Data 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 and reviewer signatures?	Yes	All MILCC5 NDA system Radioassay Data Sheets in MILCC5 batch data reports contained the required information. MILCC5 batch data reports
3	Does ANL have a formal method to ensure that all TRU wastes are correctly classified, i.e., > 100 nCi/g TRU alpha activity concentration?	Yes	MILCC5 NDA system batch data reports indicate the TRU alpha activity concentration for each assay. MILCC5 TMU Report; MILCC5 batch data reports

Table C-7. CH Determination

No.	Technical Element/Aspect	Yes, No, N/A	Comments and Objective Evidence
1	Does ANL have a formal program to determine that all TRU waste containers are CH, i.e., < 200 millirem per hour on contact?	Yes	Process knowledge of containers from ANL waste streams indicates that all containers will have a contact dose (equivalent) rate of less than 200 millirem per hour. ANL radiation control technicians monitor the external exposure and neutron dose rates of containers as part of routine operations throughout the site. Surveys are signed by all participants and are achieved as part of the formal record for that container. CCP-PO-002; ANL Survey Procedure; Radiological Survey Reports
2	Identify the ANL organization responsible for CH determination of record for TRU waste containers.	Yes	The responsibility for the CH determination rests with the ANL Waste Certification Official, Rodney Hollister. The formal survey to determine a container's CH status is initiated when the waste generator indicates that a container is full; waste containers from the current ANL CH waste streams are generated in Building 332 and are surveyed in Building 625. Prior to shipping containers to WIPP, ANL personnel perform a radiation survey which will be the survey of record regarding the container's CH status. CCP-PO-002; ANL Survey Procedure; Radiological Survey Reports
3	Are all instruments used for the CH determination of record controlled under a formal program?	Yes	All ANL portable radiation detection equipment used to survey waste containers is controlled by the ANL Radioactive and Hazardous Waste Management Group. CCP-PO-002

Table C-8. Performance Demonstration Program Participation

No.	Technical Element/Aspect	Yes, No, N/A	Comments and Objective Evidence
1	Has the MILCC5 NDA system participated successfully in the CBFO NDA PDP? If so, identify the cycle. If not, identify the scheduled participation cycle.	No	The MILCC5 has not yet participated in the CBFO NDA PDP due to logistical issues with the PDP standards. ANL-CCP is currently scheduled to participate in Cycle 30A in May 2022.

Table C-9. Training

No.	Technical Element/Aspect	Yes, No, N/A	Comments and Objective Evidence
1	Do all MILCC5 NDA system operators, independent technical reviewers and expert analysts have current training as verified on an LOQI?	Yes	All MILCC5 NDA system operators, independent technical reviewers and expert analysts have current training as verified on an LOQI. LOQI; MILCC5 batch data reports
2	Are MILCC5 NDA system data reviewed and approved by qualified personnel? If so, identify the names of the individuals performing technical review and approval of MILCC5 NDA system batch data reports.	Yes	Qualification cards were available and acceptable for Greg Somerville, Martin Garcia, William Mussman, Carl Jenks and William Searcy Qualification cards; MILCC5 batch data reports; CCP-TP-076; CCP-TP-077; CCP-TP-048

Table C-10. Replicate Testing

No.	Technical Element/Aspect	Yes, No, N/A	Comments and Objective Evidence
1	Has replicate testing of the MILCC5 NDA system been performed, and does it meet EPA's Replicate Testing Protocol?	Yes	ANL-CCP assayed Drum Nos. 2108161010, 2108161011 and 2108161012 as replicates (results are documented in Attachments C.1–C.3). All results were acceptable.

ATTACHMENT C.1 REPLICATE TESTING DATA FOR DRUMS ASSAYED ON MILCC5 NDA SYSTEM: CONTAINER NO. 2108161010

Table C.1-1. MILCC5 Replicate Data for Container No. 2108161010, Part 1

Quantity of Interest	Original Measurement Reported Value	Original Measurement Absolute Uncertainty	Original Measurement Relative Uncertainty	Replicate No. 1 Reported Value	Replicate No. 1 Absolute Uncertainty	Replicate No. 1 Relative Uncertainty	Replicate No. 2 Reported Value	Replicate No. 2 Absolute Uncertainty	Replicate No. 2 Relative Uncertainty
^{90}Sr Activity (Ci)	8.21E-07	1.28E-07	15.6%	8.61E-07	1.34E-07	15.6%	8.51E-07	1.33E-07	15.6%
^{137}Cs Activity (Ci)	8.21E-07	1.28E-07	15.6%	8.61E-07	1.34E-07	15.6%	8.51E-07	1.33E-07	15.6%
^{233}U Activity (Ci)	0	0.00E+00	N/A	0	0.00E+00	N/A	0	0.00E+00	N/A
^{234}U Activity (Ci)	0	0.00E+00	N/A	0	0.00E+00	N/A	0	0.00E+00	N/A
^{235}U Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{237}Np Activity (Ci)	7.87E-06	1.21E-06	15.4%	7.82E-06	1.21E-06	15.4%	7.86E-06	1.21E-06	15.4%
^{238}Pu Activity (Ci)	0	0.00E+00	N/A	0	0.00E+00	N/A	0	0.00E+00	N/A
^{238}U Activity (Ci)	0	0.00E+00	N/A	0	0.00E+00	N/A	0	0.00E+00	N/A
^{239}Pu Activity (Ci)	2.07E-03	3.84E-04	18.5%	2.71E-03	5.97E-04	22.0%	3.05E-03	6.59E-04	21.6%
^{240}Pu Activity (Ci)	0	0.00E+00	N/A	0	0.00E+00	N/A	0	0.00E+00	N/A
^{241}Am Activity (Ci)	7.67E-04	1.80E-04	23.4%	7.63E-04	1.76E-04	23.1%	5.11E-04	2.01E-04	39.4%
^{241}Pu Activity (Ci)	1.87E-01	3.04E-02	16.2%	1.64E-01	2.65E-02	16.2%	1.58E-01	2.56E-02	16.2%
TRU Alpha Conc. (nCi/g)	356	5.30E+01	14.9%	435	78	17.9%	446	86	19.3%

Table C.1-2. MILCC5 Replicate Data for Container No. 2108161010, Part 2

Quantity of Interest	Replicate No. 3 Reported Value	Replicate No. 3 Absolute Uncertainty	Replicate No. 3 Relative Uncertainty	Replicate No. 4 Reported Value	Replicate No. 4 Absolute Uncertainty	Replicate No. 4 Relative Uncertainty	Replicate No. 5 Reported Value	Replicate No. 5 Absolute Uncertainty	Replicate No. 5 Relative Uncertainty
^{90}Sr Activity (Ci)	9.99E-07	1.55E-07	15.5%	1.03E-06	1.60E-07	15.5%	1.03E-06	1.60E-07	15.5%
^{137}Cs Activity (Ci)	9.99E-07	1.55E-07	15.5%	1.03E-06	1.60E-07	15.5%	1.03E-06	1.60E-07	15.5%
^{233}U Activity (Ci)	0	0.00E+00	N/A	0	0.00E+00	N/A	0	0.00E+00	N/A
^{234}U Activity (Ci)	0	0.00E+00	N/A	0	0.00E+00	N/A	0	0.00E+00	N/A
^{235}U Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{237}Np Activity (Ci)	7.82E-06	1.21E-06	15.4%	7.82E-06	1.21E-06	15.4%	7.79E-06	1.20E-06	15.4%
^{238}Pu Activity (Ci)	0	0.00E+00	N/A	0	0.00E+00	N/A	0	0.00E+00	N/A
^{238}U Activity (Ci)	0	0.00E+00	N/A	0	0.00E+00	N/A	0	0.00E+00	N/A
^{239}Pu Activity (Ci)	2.86E-03	6.17E-04	21.6%	2.58E-03	5.66E-04	21.9%	2.25E-03	5.13E-04	22.9%
^{240}Pu Activity (Ci)	0	0.00E+00	N/A	0	0.00E+00	N/A	0	0.00E+00	N/A
^{241}Am Activity (Ci)	6.46E-04	1.60E-04	24.7%	6.55E-04	2.35E-04	35.9%	7.28E-04	1.73E-04	23.8%
^{241}Pu Activity (Ci)	1.80E-01	2.92E-02	16.2%	1.81E-01	2.93E-02	16.2%	1.80E-01	2.91E-02	16.2%
TRU Alpha Conc. (nCi/g)	439	80	18.2%	406	77	18.9%	373	68	18.2%

Table C.1-3. MILCC5 Replicate Data for Container No. 2108161010, Part 3

Quantity of Interest	Original Measurement Reported Value	Original Measurement Absolute Uncertainty	Sample Mean	Sample Standard Deviation	Sample Relative Deviation	χ^2	Pr($x < \|\chi^2\|$)	t	Pr($x < \|t\|$)
^{90}Sr Activity (Ci)	8.21E-07	1.28E-07	9.55E-07	9.12E-08	9.6%	2.032	0.730	-1.338	0.252
^{137}Cs Activity (Ci)	8.21E-07	1.28E-07	9.55E-07	9.12E-08	9.6%	2.032	0.730	-1.338	0.252
^{233}U Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{234}U Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{235}U Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{237}Np Activity (Ci)	7.87E-06	1.21E-06	7.82E-06	2.75E-08	0.4%	0.002	1.000	1.515	0.204
^{238}Pu Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{238}U Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{239}Pu Activity (Ci)	2.07E-03	3.84E-04	2.69E-03	3.02E-04	11.3%	2.476	0.649	-1.855	0.137
^{240}Pu Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{241}Am Activity (Ci)	7.67E-04	1.80E-04	6.61E-04	9.70E-05	14.7%	1.168	0.883	1.001	0.373
^{241}Pu Activity (Ci)	1.87E-01	3.04E-02	1.72E-01	1.08E-02	6.3%	0.505	0.973	1.267	0.274
TRU Alpha Conc. (nCi/g)	356	53	420	30	7.2%	1.314	0.859	-1.911	0.129

Table C.1-4. MILCC5 Replicate Data for Container No. 2108161010, Part 4

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

ATTACHMENT C.2 REPLICATE TESTING DATA FOR DRUMS ASSAYED ON MILCC5 NDA SYSTEM: CONTAINER NO. 2108161011

Table C.2-1. MILCC5 Replicate Data for Container No. 2108161011, Part 1

Quantity of Interest	Original Measurement Reported Value	Original Measurement Absolute Uncertainty	Original Measurement Relative Uncertainty	Replicate No. 1 Reported Value	Replicate No. 1 Absolute Uncertainty	Replicate No. 1 Relative Uncertainty	Replicate No. 2 Reported Value	Replicate No. 2 Absolute Uncertainty	Replicate No. 2 Relative Uncertainty
^{90}Sr Activity (Ci)	1.20E-06	1.86E-07	15.5%	1.18E-06	1.83E-07	15.5%	1.20E-06	1.85E-07	15.5%
^{137}Cs Activity (Ci)	1.20E-06	1.86E-07	15.5%	1.18E-06	1.83E-07	15.5%	1.20E-06	1.85E-07	15.5%
^{233}U Activity (Ci)	0	0.00E+00	N/A	0	0.00E+00	N/A	0	0.00E+00	N/A
^{234}U Activity (Ci)	0	0.00E+00	N/A	0	0.00E+00	N/A	0	0.00E+00	N/A
^{235}U Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{237}Np Activity (Ci)	1.48E-06	2.29E-07	15.5%	1.43E-06	2.22E-07	15.5%	1.47E-06	2.28E-07	15.5%
^{238}Pu Activity (Ci)	0	0.00E+00	N/A	0	0.00E+00	N/A	0	0.00E+00	N/A
^{238}U Activity (Ci)	0	0.00E+00	N/A	0	0.00E+00	N/A	0	0.00E+00	N/A
^{239}Pu Activity (Ci)	2.07E-03	4.71E-04	22.7%	2.13E-03	4.84E-04	22.7%	2.22E-03	4.98E-04	22.5%
^{240}Pu Activity (Ci)	4.47E-04	1.15E-04	25.7%	0	0.00E+00	N/A	0	0.00E+00	N/A
^{241}Am Activity (Ci)	2.80E-04	5.21E-05	18.6%	0	0.00E+00	N/A	2.55E-04	4.69E-05	18.4%
^{241}Pu Activity (Ci)	0.00E+00	0.00E+00	N/A	3.32E-02	5.66E-03	17.0%	3.67E-02	6.20E-03	16.9%
TRU Alpha Conc. (nCi/g)	295	5.13E+01	17.4%	225	51	22.7%	261	53	20.2%

Table C.2-2. MILCC5 Replicate Data for Container No. 2108161011, Part 2

Quantity of Interest	Replicate No. 3 Reported Value	Replicate No. 3 Absolute Uncertainty	Replicate No. 3 Relative Uncertainty	Replicate No. 4 Reported Value	Replicate No. 4 Absolute Uncertainty	Replicate No. 4 Relative Uncertainty	Replicate No. 5 Reported Value	Replicate No. 5 Absolute Uncertainty	Replicate No. 5 Relative Uncertainty
^{90}Sr Activity (Ci)	1.19E-06	1.85E-07	15.5%	1.16E-06	1.80E-07	15.5%	1.18E-06	1.83E-07	15.5%
^{137}Cs Activity (Ci)	1.19E-06	1.85E-07	15.5%	1.16E-06	1.80E-07	15.5%	1.18E-06	1.83E-07	15.5%
^{233}U Activity (Ci)	0	0.00E+00	N/A	0	0.00E+00	N/A	0	0.00E+00	N/A
^{234}U Activity (Ci)	0	0.00E+00	N/A	0	0.00E+00	N/A	0	0.00E+00	N/A
^{235}U Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{237}Np Activity (Ci)	1.43E-06	2.21E-07	15.5%	1.47E-06	2.27E-07	15.5%	1.46E-06	2.25E-07	15.5%
^{238}Pu Activity (Ci)	0	0.00E+00	N/A	0	0.00E+00	N/A	0	0.00E+00	N/A
^{238}U Activity (Ci)	0	0.00E+00	N/A	0	0.00E+00	N/A	0	0.00E+00	N/A
^{239}Pu Activity (Ci)	1.86E-03	4.33E-04	23.2%	1.69E-03	3.97E-04	23.5%	2.08E-03	4.69E-04	22.6%
^{240}Pu Activity (Ci)	0	0.00E+00	N/A	0	0.00E+00	N/A	0	0.00E+00	N/A
^{241}Am Activity (Ci)	5.30E-04	1.35E-04	25.5%	2.27E-04	1.27E-04	55.7%	3.19E-04	1.29E-04	40.4%
^{241}Pu Activity (Ci)	4.07E-02	6.78E-03	16.6%	0.00E+00	0.00E+00	N/A	3.47E-02	5.83E-03	16.8%
TRU Alpha Conc. (nCi/g)	252	48	18.9%	202	44	21.7%	252	51	20.3%

Table C.2-3. MILCC5 Replicate Data for Container No. 2108161011, Part 3

Quantity of Interest	Original Measurement Reported Value	Original Measurement Absolute Uncertainty	Sample Mean	Sample Standard Deviation	Sample Relative Deviation	χ^2	Pr($x < \|\chi^2\|$)	t	Pr($x < \|t\|$)
^{90}Sr Activity (Ci)	1.20E-06	1.86E-07	1.18E-06	1.39E-08	1.2%	0.022	1.000	1.210	0.293
^{137}Cs Activity (Ci)	1.20E-06	1.86E-07	1.18E-06	1.39E-08	1.2%	0.022	1.000	1.210	0.293
^{233}U Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{234}U Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{235}U Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{237}Np Activity (Ci)	1.48E-06	2.29E-07	1.45E-06	1.95E-08	1.3%	0.029	1.000	1.304	0.262
^{238}Pu Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{238}U Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{239}Pu Activity (Ci)	2.07E-03	4.71E-04	2.00E-03	2.14E-04	10.7%	0.829	0.935	0.324	0.762
^{240}Pu Activity (Ci)	4.47E-04	1.15E-04	0.00E+00	0.00E+00	N/A	0.000	1.000	N/A	N/A
^{241}Am Activity (Ci)	2.80E-04	5.21E-05	2.66E-04	1.90E-04	71.5%	53.356	0.000	0.064	0.952
^{241}Pu Activity (Ci)	0.00E+00	0.00E+00	2.91E-02	1.65E-02	56.7%	N/A	N/A	-1.609	0.183
TRU Alpha Conc. (nCi/g)	295	51	238	24	10.2%	0.900	0.925	2.117	0.102

Table C.2-4. MILCC5 Replicate Data for Container No. 2108161011, Part 4

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

ATTACHMENT C.3 REPLICATE TESTING DATA FOR DRUMS ASSAYED ON MILCC5 NDA SYSTEM: CONTAINER NO. 2108161012

Table C.3-1. MILCC5 Replicate Data for Container No. 2108161012, Part 1

Quantity of Interest	Original Measurement Reported Value	Original Measurement Absolute Uncertainty	Original Measurement Relative Uncertainty	Replicate No. 1 Reported Value	Replicate No. 1 Absolute Uncertainty	Replicate No. 1 Relative Uncertainty	Replicate No. 2 Reported Value	Replicate No. 2 Absolute Uncertainty	Replicate No. 2 Relative Uncertainty
^{90}Sr Activity (Ci)	4.62E-07	7.38E-08	16.0%	4.46E-07	7.14E-08	16.0%	4.63E-07	7.39E-08	16.0%
^{137}Cs Activity (Ci)	4.62E-07	7.38E-08	16.0%	4.46E-07	7.14E-08	16.0%	4.63E-07	7.39E-08	16.0%
^{233}U Activity (Ci)	0	0.00E+00	N/A	0	0.00E+00	N/A		0.00E+00	N/A
^{234}U Activity (Ci)	0	0.00E+00	N/A	0	0.00E+00	N/A		0.00E+00	N/A
^{235}U Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{237}Np Activity (Ci)	7.55E-08	2.03E-08	26.9%	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{238}Pu Activity (Ci)	0	0.00E+00	N/A	0	0.00E+00	N/A		0.00E+00	N/A
^{238}U Activity (Ci)	0	0.00E+00	N/A	0	0.00E+00	N/A		0.00E+00	N/A
^{239}Pu Activity (Ci)	1.13E-03	6.63E-04	58.6%	7.68E-04	5.55E-04	72.4%	1.15E-03	7.92E-04	69.1%
^{240}Pu Activity (Ci)	0	0.00E+00	N/A	0	0.00E+00	N/A		0.00E+00	N/A
^{241}Am Activity (Ci)	5.68E-04	1.70E-04	29.9%	2.29E-04	9.79E-05	42.8%	5.77E-04	2.10E-04	36.5%
^{241}Pu Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
TRU Alpha Conc. (nCi/g)	113	4.56E+01	40.3%	66	38	56.6%	115	55	47.6%

Table C.3-2. MILCC5 Replicate Data for Container No. 2108161012, Part 2

Quantity of Interest	Replicate No. 3 Reported Value	Replicate No. 3 Absolute Uncertainty	Replicate No. 3 Relative Uncertainty	Replicate No. 4 Reported Value	Replicate No. 4 Absolute Uncertainty	Replicate No. 4 Relative Uncertainty	Replicate No. 5 Reported Value	Replicate No. 5 Absolute Uncertainty	Replicate No. 5 Relative Uncertainty
^{90}Sr Activity (Ci)	4.48E-07	7.16E-08	16.0%	4.28E-07	6.86E-08	16.0%	4.38E-07	7.02E-08	16.0%
^{137}Cs Activity (Ci)	4.48E-07	7.16E-08	16.0%	4.28E-07	6.86E-08	16.0%	4.38E-07	7.02E-08	16.0%
^{233}U Activity (Ci)	0	0.00E+00	N/A	0	0.00E+00	N/A	0	0.00E+00	N/A
^{234}U Activity (Ci)	0	0.00E+00	N/A	0	0.00E+00	N/A	0	0.00E+00	N/A
^{235}U Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{237}Np Activity (Ci)	5.98E-08	1.31E-08	21.9%	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{238}Pu Activity (Ci)	0	0.00E+00	N/A	0	0.00E+00	N/A	0	0.00E+00	N/A
^{238}U Activity (Ci)	0	0.00E+00	N/A	0	0.00E+00	N/A	0	0.00E+00	N/A
^{239}Pu Activity (Ci)	1.32E-03	7.06E-04	53.4%	7.87E-04	6.42E-04	81.6%	0	0.00E+00	N/A
^{240}Pu Activity (Ci)	0	0.00E+00	N/A	0	0.00E+00	N/A	0	0.00E+00	N/A
^{241}Am Activity (Ci)	6.73E-04	2.29E-04	34.1%	7.39E-04	2.00E-04	27.1%	5.63E-04	2.90E-04	51.4%
^{241}Pu Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
TRU Alpha Conc. (nCi/g)	133	50	37.2%	102	45	44.1%	38	21	56.6%

Table C.3-3. MILCC5 Replicate Data for Container No. 2108161012, Part 3

Quantity of Interest	Original Measurement Reported Value	Original Measurement Absolute Uncertainty	Sample Mean	Sample Standard Deviation	Sample Relative Deviation	χ^2	Pr($x < \|\chi^2\|$)	t	Pr($x < \|t\|$)
^{90}Sr Activity (Ci)	4.62E-07	7.38E-08	4.45E-07	1.30E-08	2.9%	0.125	0.998	1.190	0.300
^{137}Cs Activity (Ci)	4.62E-07	7.38E-08	4.45E-07	1.30E-08	2.9%	0.125	0.998	1.190	0.300
^{233}U Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{234}U Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{235}U Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{237}Np Activity (Ci)	7.55E-08	2.03E-08	1.20E-08	2.68E-08	223.6%	6.926	0.140	2.167	0.096
^{238}Pu Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{238}U Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{239}Pu Activity (Ci)	1.13E-03	6.63E-04	8.04E-04	5.08E-04	63.2%	2.351	0.672	0.586	0.589
^{240}Pu Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{241}Am Activity (Ci)	5.68E-04	1.70E-04	5.56E-04	1.97E-04	35.4%	5.378	0.251	0.055	0.959
^{241}Pu Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
TRU Alpha Conc. (nCi/g)	113	46	91	38	42.4%	2.840	0.585	0.536	0.620

Table C.3-4. MILCC5 Replicate Data for Container No. 2108161012, Part 4

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

ATTACHMENT D: VISUAL EXAMINATION CHECKLIST, BASELINE INSPECTION

EPA Inspection No.: ANL-CCP-CH-Baseline-2022 **Inspection Date: November 15-17, 2022**

Table D-1. Visual Examination Process

No.	Technical Element or Aspect	Yes, No, N/A	Objective Evidence and Comments
1	Do ANL-CCP procedures and technical guidance documents provide complete instructions for performing VE?	Yes	EPA observed a VE event in a glovebox enclosure in Room A160 of Building 306 at ANL on November 16, 2022. Two ANL-CCP operators performed VE in accordance with CCP-TP-113, and recorded all required data, verified the waste stream description, waste matrix code and waste summary category group, used a scale and torque wrench that were on the list of approved M&TE, confirmed the presence/absence of prohibited items and that the output drum was empty prior to conducting the VE event. The ANL waste handlers unpacked the bulk waste from the glovebox directly and worked closely with the ANL-CCP VE operators who recorded all required information electronically for container No. 2108161003. CCP-TP-113, Qualification Cards for VE Operators, Appointment Letter for VE Expert, LOQI, VE Operating Logbook, ANL Procedure 1, ANL Procedure 2
2	Are corrective actions taken and appropriately documented and closed when necessary?	Yes	There were no VE-related NCRs in the reviewed VE batch data reports. During interviews, the ANL-CCP CH VE operators were able to describe what constitutes a nonconformance, when an NCR is required and how to initiate and document a corrective action. CCP-QP-005, CCP-TP-002, CCP-TP-113, VE batch data reports
3	Do ANL-CCP procedure(s) require data-generation and project-level reviews of batch data reports?	Yes	EPA verified that ANL-CCP performed reviews for VE batch data reports. Project Level Data Validation and Verification Checklist and Summary (Attachment 1), the independent technical review (Attachment 3) and site project manager (Attachment 1) reviews had been completed and signed appropriately. CCP-TP-113, VE batch data reports

Table D-2. Visual Examination Records

No.	Technical Element or Aspect	Yes, No, N/A	Objective Evidence and Comments
1	Are all appropriate CH VE records available for review?	Yes	All VE-related records were available for review, i.e., records for VE personnel training and qualification, approved measurement and test equipment, waste stream attributes and AK. CCP-QP-002, CCP-TP-113, Qualification Cards for VE Operators, Appointment Letter for VE Expert, LOQI, VE Operating Logbook; VE batch data reports

Table D-3. Personnel Training

No.	Technical Element or Aspect	Yes, No, N/A	Objective Evidence and Comments
1	Do ANL-CCP procedures identify required training and qualifications for CH VE personnel?	Yes	ANL-CCP VE personnel have specific procedures and/or technical guidance in Container Management, Nonconformance Reporting, Conduct of Operations, AK Documents and TRUCON Codes. All ANL-CCP procedures identify the required training and qualifications for VE personnel. Qualification Cards for VE Operators, CCP-TP-113, CCP-QP-002, CCP-QP-005, CCP-TP-068
2	Are the VE operators' qualification and requalification requirements described?	Yes	EPA reviewed the qualification cards for VE operators and determined that they were appropriately trained and that their training records were complete. To become qualified, a VE operator must pass a comprehensive written test with an 80% or better grade; test includes VE operations, documentation, characterization, formal training elements and procedural elements. VE operators must demonstrate capability in the presence of the VE expert during on-the-job training. Qualification Cards for VE Operators, Appointment letter for VE Expert, LOQI, CCP-TP-113, CCP-QP-002
3	Does ANL-CCP have a designated VE expert for VE?	Yes	VE expert designations are documented by letter. A VE expert must be knowledgeable regarding the VE processes, the waste streams examined and the TRU waste being characterized on site in general, and the VE expert is responsible for overall direction and implementation of VE at ANL. The CCP Certification Plan specifies the selection, qualification and training requirements of VE experts. Qualification Cards for VE Operators, Appointment Letter for VE Expert, LOQI, CCP-TP-113, CCP-QP-002

ATTACHMENT E:
LIST OF DOCUMENTS REVIEWED DURING THE BASELINE INSPECTION

E.1 AK

AE-I-188, Determination of Waste Generated in Buildings 108, 202, 203, 206, 223, 306, 315 and 331, Not Dated

AK Expert and Site Project Manager Acknowledgement of Receipt of CCP-TP-002, Revision 29, provided August 6, 2019, and CCP-TP-005, Revision 32, provided November 16, 2022

AK Expert Qualification Card for Elizabeth Lickliter, October 6, 2016

AK Expert Qualification Card for Hannah Fredericks, July 6, 2021

AK Expert Qualification Card for Kevin Peters, October 26, 2016

AK Expert Qualification Card for Scott Smith, October 25, 2016

AK Expert Qualification Card for Trey Greenwood, July 11, 2016

ANL-CCP CH AK Tracking Spreadsheet, October 19, 2022

C001, Fax to Larry Neimark re: Defense versus Non-Defense Waste, Gary Marshall, January 21, 1997

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

C068, Correspondence to Craig R. Tyler, Lockheed Martin Idaho Technologies Co. re: ANL Transuranic Waste - Definition as Defense Waste, D. S. Kirschner, April 16, 1997

C9000, Waste Stream AECHDM.01 Packaging Configuration and Miscellaneous Clarifications, Kevin J. Peters, September 13, 2021, through October 25, 2021

C9003, Waste Stream Container Evaluation Memorandum for Waste Stream AECHDM.01, Scott Smith, Various Dates

CCP-AK-ANLE-002, Central Characterization Program Acceptable Knowledge Summary Report for Argonne National Laboratory Contact-Handled Transuranic Waste from Facility Maintenance and Laboratory Operations, Waste Stream: AECHDM.01, Revision 0, November 10, 2021

CCP-QP-005, CCP TRU Nonconforming Item Reporting and Control, Revision 28, September 27, 2021

CCP-TP-002, CCP Reconciliation of DQOs and Reporting Characterization Data, Revision 29, May 1, 2019

CCP-TP-005, CCP Acceptable Knowledge Documentation, Revision 32, June 9, 2020

CCP-TP-005, Revision 32, CCP Acceptable Knowledge Documentation, Attachment 1 – Acceptable Knowledge Documentation Checklist, AECHDM.01, June 22, 2022

CCP-TP-005, Revision 32, CCP Acceptable Knowledge Documentation, Attachment 4 – Acceptable Knowledge Source Document Information List, AECHDM.01, June 22, 2022

CCP-TP-005, Revision 32, CCP Acceptable Knowledge Documentation, Attachment 6 – Waste Form, Waste Material Parameters, Prohibited Items, and Packaging, AECHDM.01, October 22, 2021, with Memorandum August 26, 2021

CCP-TP-005, Revision 32, CCP Acceptable Knowledge Documentation, Attachment 7 – Radionuclides, AECHDM.01, July 13, 2022, with Memorandum, Revision 0, July 12, 2022

CCP-TP-005, Revision 32, CCP Acceptable Knowledge Documentation, Attachment 8 – Waste Containers List, AECHDM.01, July 6, 2022

CCP-TP-005, Revision 32, CCP Acceptable Knowledge Documentation, Attachment 9 – Interface Waste Management Documents List, AECHDM.01, December 14, 2021

CCP-TP-200, Enhanced Acceptable Knowledge Review, Revision 7, July 14, 2020

DR025, Discrepancy Resolution of the Identification of Acid Bond N940, Steve Schafer, Revision 1, October 7, 2014

DR3001, Resolution of Discrepancies Associated with the Assignment of EPA HWNs to Waste Streams AECHDM-PK and AECHHM-PK, Kevin Peters, March 23, 2011

DR3002, CCP Discrepancy Resolution: Resolution of Discrepancies Associated with the Assignment of Containers RW48078 and RW48190 to Waste Stream AECHDM-PK, K. Peters, June 20, 2011

DR3003, Resolution of Discrepancies Associated with Beryllium Oxide Crucible Pieces in Container RW48192, K. J. Peters, September 14, 2011

DR3004, Resolution of Discrepancies Associated with Beryllium Oxide in Container RW48190, K. J. Peters, November 4, 2011

P599, The Defense Programs Origin of Transuranic waste at Argonne National Laboratory-West, H. F. McFarlane, ANL-NT-192, November 2001

P6004, Review and Approval of Radioactive Waste Requisitions, WMO-PROC-58, Revision 0, 1, 4 thru 12, September 2, 2010–October 27, 2021

P6010, Radioactive Waste Disposal: Containerization, Segregation, and Characterization, LMS, LMS-PROC-310, Revision 0, 1, 2, August 28, 2015–June 25, 2020

P8002, Waste Determination Document, W. Naumann, NWM-606, Revision 0, May 23, 2018

P8006, Waste Management Department Transuranic Waste Program Plan, J. Jacoboski, WM-PP-05, Revisions 0 and 1, August 29, 2019, and December 19, 2019

P9000, Intermediate Sorting, Segregation, Visual Inspection, and Packaging CM TRU Waste, R.E. McGinn, WCD-WMO-51034, Revision 1, September 21, 2021

Site Project Manager Qualification Card for Jorge Gonzalez, April 24, 2018

Site Project Manager Qualification Card for Rich Kantrowitz, February 19, 2015

Summary of Enhanced AK Status, provided November 16, 2022

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

U3003, Historic WMO-195 Waste Requisitions for Containers Repackaged into Waste Streams AEGHDM-PK and AEGHHM-PK, WMO, Various Dates

U6002, Historic Container Documentation for Containers Repackaged into Waste Stream AECHDM.01, Argonne WMO, Various Dates

U6003, Waste Stream AECHDM.01 Waste Container Packaging Forms and Supporting Documentation, Argonne WMO, Various Dates

E.2 NDA – MILCC5

ANL Survey Procedure, ANL Procedure HPP 3.0, Performing Radiological Surveys

ANSI Standard N42.14-1999, Calibration and Use of Germanium Spectrometers for Measuring Gamma-Ray Emissions of Radionuclides

ASTM C-1030, Standard Test Method of the Determination of Plutonium Isotopic Composition by Gamma Ray Spectrometry, April 23, 2018

ASTM C-1133, Standard Test Method for Non-Destructive Assay of Special Nuclear Material in Low Density Scrap and Waste by Segmented Passive Gamma Ray Scanning, April 1, 2018

ASTM C-1726, Standard Guide for Use of Modeling for Passive Gamma Ray Measurements

Batch Data Report Nos. ANLE-MILCC5-0002, ANLE-MILCC5-0003

CCP-PO-002, CCP Transuranic Waste Certification Plan, Revision 31,

CCP-QP-002, CCP Training and Qualification Plan, Revision 45, September 26, 2018

CCP-QP-005, CCP TRU Nonconforming Item Reporting and Control, Revision 26, December 5, 2018

CCP-TP-048, CCP NDA System Data Reviewing, Validating and Reporting Procedure, Revision 18, May 22, 2019

CCP-TP-068, Container Management, Revision 12, December 8, 2015

CCP-TP-076, CCP Operating the Mobile ISOCS Large Container Counter Using NDA 2000, Revision 6, July 20, 2021

CCP-TP-077, CCP Calibrating the Mobile ISOCS Large Container Counter Using NDA 2000, Revision 4, March 18, 2019

D. Remington ISOCS Modeling Report, ISOCS Modeling of ^{152}Eu – ^{241}Am Line Source Standards Utilized for Calibration of NDA Gamma Systems, D. Remington, 2015

EPA Replicate Testing for WIPP Nondestructive Assay (NDA) Systems, Revision 2, June 2002

ISOCS/LabSOCS Detector Characterization Report for Model BE5030 S/N b20011, Canberra Industries, 2021

ISOCS/LabSOCS Detector Characterization Report for Model BE5030 S/N b20039, Canberra Industries, 2021

LOQI, CCP Argonne National Laboratory East (ANLE) List of Qualified Individuals, 10-31-2022, 3:00 AM

MILCC5 Calibration Confirmation Report, Calibration Confirmation Report for the Mobile ISOCS Large Container Counter (MILCC5) at Argonne National Laboratory, CI-MILCC5-NDA-1001 Revision 0, September 13, 2022

MILCC5 NDA Operational Logbook, MILCC5 NDA Operational Logbook, CCP-CH-ANL-NDA-MILCC5-CI, Calendar Year 2022; ANL 331 Yard

MILCC5 Operational Logbook, MILCC5 NDA Operational Logbook, CCP-CH-ANL-NDA-MILCC5-OL, Calendar Year 2022, ANL 331 Yard

MILCC5 Qualification Cards for William Mussman, Greg Somerville, Carl Jenks, Martin Garcia and William Searcy

MILCC5 TMU Report, Central Characterization Program Mobile ISOCS Large Container Counter 5 (MILCC5) Total Measurement Uncertainty Report, CI-MILCC5-TMU-1001, Revision 0, July 18, 2022

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E.3 VE

ANL Procedure 1, WCD-51034.3, Task #2, Sorting, Segregating, Surveying, Visual Examination, and Packaging of CH-TRU Waste, Undated, provided during the inspection

ANL Procedure 2, WCD WMO-766141.1 - Task #2, Intermediate Sorting, Segregating, Surveying and Packaging of Contact Handled Transuranic Waste (CH TRU) in Building 306, A160 Fume Hood, Undated, provided during inspection

ANL Survey Results, Argonne Radiation Work Permit (RWP) 2022-306-020, Approved 10-11-2022

CCP-QP-005, CCP TRU Nonconforming Item Reporting and Control, Standardized Container Management, Revision 28, September 27, 2021

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CCP-TP-113, CCP Standard Contact-Handled Waste Visual Examination, Revision 24, December 17, 2020

LOQI, ANLE NDE Personnel Waste Streams Qualified List, 10-31-2022, 3:00 AM

LOQI, CCP-Argonne National Laboratory East (ANLE) List of Qualified Individuals, 10-31-2022, 3:00 AM

M&TE List, Approved MTE List, Nov-16-2022, 04:30 AM

Qualification cards for VE Operators Pat Beallis, Tommy Mojica, Spencer Troy Pattee, William Riley and VE Expert Wes Root

VE Batch Data Reports, Batch Data Report Nos. AEVECH0001, AEVECH0002, AEVECH0003, AEVECH0004 and AEVECH0005

VE Batch Data Report (Observed), VE Batch Data Report AEVECH0007, record of VE event observed during inspection

VE Expert Appointment Letter for Wes Root

VE Logbook, Operational Log Book (OLB) CCP-CH-ANL-VE-02, 2022 Visual Examination, Building 306 ANL