

# CCP-TP-072

Revision 1

## CCP

### Gamma Energy Assay (GEA) Data Review, Validation, and Reporting Procedure

EFFECTIVE DATE: 01/28/2011

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PRINTED NAME

APPROVED FOR USE

RECORD OF REVISION

Revision Number	Date Approved	Description of Revision
0	01/12/2010	Initial issue.
1	01/28/2011	Minor revision to correct reference after revision to CCP-PO-002, <i>CCP Transuranic Waste Certification Plan</i> .

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## 1.0 PURPOSE

This procedure describes the methods and techniques to review, validate, and report data from Nondestructive Assay (NDA) instruments used to measure transuranic (TRU) waste for the Central Characterization Project (CCP) at the Hanford Site.

### 1.1 Scope

This procedure provides specific instructions for the review, validation, and reporting of measurement data from NDA determination of the radionuclide content in contact-handled (CH) TRU waste. Instructions within this procedure are specific to the CANBERRA NDA2000 software.

## 2.0 REQUIREMENTS

### 2.1 References

- *Methods and Algorithms Used in MGA*, by Ray Gunnink, 1999
- CCP-PO-002, *CCP Transuranic Waste Certification Plan*
- CCP-QP-002, *CCP Training and Qualification Plan*
- CCP-QP-005, *CCP TRU Nonconforming Item Reporting and Control*
- CCP-QP-008, *CCP Records Management*
- CCP-QP-022, *CCP Software Quality Assurance Plan*
- CCP-TP-071, *CCP Gamma Energy Assay (GEA) Operating Procedure*

### 2.2 Training Requirements

2.2.1 Personnel performing this procedure will be trained and qualified in accordance with CCP-QP-002, *CCP Training and Qualification Plan*, prior to performing this procedure.

### 2.3 Equipment List

#### 2.3.1 Software:

- NDA2000, Waste Assay
- Genie 2000, Gamma Acquisition and Analysis

### 2.4 Precautions and Limitations

2.4.1 None

### 2.5 Prerequisite Actions

2.5.1 None

### 2.6 Definitions

2.6.1 None

### 3.0 RESPONSIBILITIES

#### 3.1 NDA Operator

3.1.1 Provides NDA data to the NDA Expert Analyst (EA).

#### 3.2 NDA Expert Analyst (EA)

3.2.1 Reviews assay data and selects appropriate analysis mode, if applicable.

3.2.2 Resolves discrepancies in assay data and documents resolutions.

3.2.3 Generates final Radioassay Data Sheets, if necessary.

3.2.4 Prepares electronic files for submission to the Facility Records Custodian.

3.2.5 Evaluates quality control (QC) measurement trends and bias.

3.2.6 Evaluates the quality of the data produced from the NDA instrumentation.

3.2.7 Ensures the NDA Batch Data Report (BDR) is assembled.

#### 3.3 NDA Independent Technical Reviewer (ITR)

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#### **NOTE**

The NDA Independent Technical Reviewer (ITR) is an individual other than the data generator who is qualified to have performed the initial work.

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3.3.1 Ensures that proper data reduction has been performed and the assembled BDR documentation is complete and accurate.

3.3.2 Ensures Attachment 1, NDA Batch Data Report Cover Sheet, is complete.

3.3.3 Ensures Attachment 2, NDA Batch Data Report Table of Contents, is completed and BDR is paginated.

3.3.4 Ensures Attachment 3, NDA Batch Data Report Narrative Summary, is completed.

3.3.5 Completes Attachment 4, NDA ITR Checklist.

3.4 Facility Records Custodian

- 3.4.1 Receives, processes, and transmits all records generated by this procedure in accordance with CCP-QP-008, *CCP Records Management*.

#### 4.0 PROCEDURE

##### 4.1 NDA Operator

4.1.1 Forward all data to the NDA EA for technical review.

##### 4.2 NDA EA Review

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#### NOTE

All comments on the NDA Technical Review Comment Sheet(s) (see Attachment 5, NDA Technical Review Comment Sheet – EXAMPLE, for an example) shall be resolved by the NDA EA and documented in the disposition field. This includes information reported on the 10 Waste Isolation Pilot Plant (WIPP) tracked radionuclides (Americium [Am]- 241, Plutonium [Pu]-238, Pu-239, Pu-240, Pu-242, Uranium [U]-233, U-234, U-238, Cesium [Cs]-137, and Strontium [Sr]- 90) and U-235 for determining Fissile Gram Equivalent (FGE), and any other radionuclides identified in the analysis.

The NDA EA must maintain expertise in performing waste container assay analysis. The NDA EA must be knowledgeable of the data acquisition process for the type of NDA (e.g., neutron, gamma) reviewed.

Nuclides that are not directly measured are derived as described in Appendix 1, Activity Quantification for Pu-242, Sr-90, and U-234. The ratio of peaks from Am-241 is used to determine the presence of Cs-137. If detected, the Cs-137 concentration can be used to calculate the Sr-90 by applying an appropriate scaling factor. The scaling factor used and how it was derived comes from the site Acceptable Knowledge (AK) documentation.

For Pu-239 waste stream campaigns, the self-absorption peak correction is performed by applying a correction for the Pu-239 result based on gamma-ray attenuation as a function of energy.

Measured and/or default isotopic fractions are used as described in the site AK documentation.

Multi-Group Analysis (MGA) is the main analytical software tool for isotopic calculation. Fixed-energy Response function Analysis with Multiple efficiencies (FRAM) may be used to supplement isotopic analyses that are difficult for MGA to analyze.

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4.2.1 Perform the following:

- [A] Review the spectra to determine if other corrections need to be made to the data.
- [B] Review MGA results, if available.
  - [B.1] **IF** NO MGA results are available, **THEN** evaluate whether any of the default isotopic fractions associated with the waste stream are appropriate for the measurement, **OR** report only directly measured radionuclides.
- [C] Identify and resolve problems flagged, **AND** document on the NDA Technical Review Comment Sheet.
- [D] Review the spectrum and nuclide identification report for additional unknown or identified radionuclides, as appropriate.

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**NOTE**

The nuclide libraries installed on the instrument computer are controlled by the NDA EA, and will only be modified in accordance with CCP-QP-022, *CCP Software Quality Assurance Plan*. A controlled library will be used for all analyses unless the NDA EA determines that a different library is needed for an individual measurement.

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**NOTE**

If the automated data selection is overridden by the NDA EA, the basis for the new selection must be documented on the NDA Technical Review Comment Sheet.

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- [E] Evaluate the Radioassay Data Sheets with the following criteria and select the best set of results to include in the NDA BDR.
  - [E.1] Measurement uncertainty
  - [E.2] Interfering nuclides
  - [E.3] Density and moderation properties of the matrix
  - [E.4] Other parameters deemed appropriate by the NDA EA

- [F] Ensure that only measured radionuclides are reported for waste matrices with no default or measure isotopic fractions.
- [G] Regenerate the data, when applicable.
- [H] Review any regenerated Radioassay Data Sheets, **AND** correct data, if necessary.
- [I] Complete the NDA Technical Review Comments Sheet for each waste assay.
- [J] Print, sign, and date the NDA Technical Review Comment Sheet(s).
- [K] Prepare raw data electronic files (primary and backup) for submission to the Facility Records Custodian.
- [L] Forward the Radioassay Data Sheets to the NDA Operator for signature, as applicable.

**NDA Operator**

- [M] Sign and date the following, as applicable:
  - [M.1] Radioassay Data Sheet(s)
  - [M.2] QA Last Results Report(s) (Background or Background/Transmission, Daily Performance Check, and Weekly Performance Check)
- [N] Forward the signed Radioassay Data Sheets and QA Last Results to the NDA ITR.

#### 4.3 NDA Independent Technical Reviewer (ITR)

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##### **NOTE**

The NDA ITR is someone other than the data generator that is technically qualified to have performed the initial work.

The NDA ITR reviews 100 percent of the data after the NDA EA review. The NDA ITR ensures that the 10 WIPP-tracked radionuclides, and U-235, for determining FGE, are listed on every NDA Radioassay Data Sheet. Any radionuclides identified in the analysis that contribute to 95 percent of the Radiological Hazard are reported on the NDA Radioassay Data Sheet.

The NDA ITR reviews and completes the NDA Radioassay Data Sheet and Attachment 4.

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##### 4.3.1 Ensure BDR is assembled to include:

- [A] Attachment 1, NDA Batch Data Report Cover Sheet
- [B] Attachment 2, NDA Batch Data Report Table of Contents
- [C] Attachment 3, NDA Batch Data Report Narrative Summary
- [D] Copy of Nonconformance Report(s) (NCRs), if applicable
- [E] Attachment 4, NDA ITR Review Checklist
- [F] NDA Radioassay Data Sheets
- [G] NDA Technical Review Comment Sheet(s)
- [H] Quality Assurance (QA) Last Results Report(s) (Background or Background/Transmission, Daily Performance Check, and Weekly Performance Check) covering the time period during which the assay data were acquired.
- [I] Supplemental data (if applicable)

##### 4.3.2 Perform the following:

- [A] Review the NDA BDRs and ensure all documentation is accurate and complete in accordance with step 4.3.1[A].
- [B] Ensure the following are completed, signed, and dated, OR complete as necessary:

- [B.1] Attachment 1, NDA Batch Data Report Cover Sheet
- [B.2] NDA Radioassay Data Sheet(s)
- [C] Review the following on the NDA Radioassay Data Sheet for completeness and conformity to CCP-PO-002, *CCP Transuranic Waste Certification Plan*, requirements:
  - Total Pu-239 FGE and Total Measurement Uncertainty (TMU) reported in grams (g)
  - TRU alpha activity concentration and TMU reported in nanocuries per gram (nCi/g)
  - Listing of individual radioisotopes present and TMU reported in Curies (Ci) and g
  - Decay Heat and TMU reported in watts (W)
  - Pu-239 equivalent activity and TMU reported in Plutonium Equivalent-Curies (PE-Ci)
- [D] Verify the Pu-239 FGE value plus two times the TMU is less than 200 g.
  - [D.1] **IF** Pu-239 FGE value plus two times the TMU is greater than or equal to 200 g,  
**THEN** identify container number and value in the NDA ITR comments section of Attachment 3.
- [E] If necessary, generate an NCR in accordance with CCP-QP-005, *CCP TRU Nonconforming Item Reporting and Control*, **AND** include a copy of NCR(s) in the BDR.
- [F] Complete Attachment 4, NDA ITR Review Checklist
- [G] Complete Attachment 3, NDA Batch Data Report Narrative Summary
- [H] Ensure Attachment 2 is complete and BDR is paginated.
- [I] Submit the NDA BDR and raw data electronic files (primary and backup) to the Facility Records Custodian.

#### 4.4 Facility Records Custodian

- 4.4.1 Receive, process, and transmit records generated by this procedure in accordance with CCP-QP-008.

## 5.0 RECORDS

5.1 Records generated during the performance of this procedure are maintained as QA records in accordance with CCP-QP-008. The records are the following:

### 5.1.1 QA/Lifetime Nonpermanent

[A] Batch Data Report, including:

[A.1] Attachment 1, NDA Batch Data Report Cover Sheet

[A.2] Attachment 2, NDA Batch Data Report Table of Contents

[A.3] Attachment 3, NDA Batch Data Report Narrative Summary

[A.4] Copy of NCR(s) (If applicable)

[A.5] Attachment 4, NDA ITR Checklist

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#### **NOTE**

Radioassay Data Sheets are generated in the following NDA operating procedure:

- CCP-TP-071, *CCP Gamma Energy Assay (GEA) Operating Procedure*

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[A.6] NDA Radioassay Data Sheet(s)

[A.7] NDA Technical Review Comment Sheet

[A.8] QA Last Results Reports (Background or Background/Transmission, Daily Performance Check, and Weekly Performance Check)

### 5.1.2 QA/Nonpermanent

[A] Raw data electronic files – compact disks (CDs) Primary and Backup

#### Appendix 1 – Activity Quantification for Pu-242, Sr-90, and U-234

CCP-PO-002 requires the quantification of the 10 WIPP-tracked radionuclides, Am-241, Pu-238, Pu-239, Pu-240, Pu-242, U-233, U-234, U-238, Sr-90, and Cs-137. Pu-242, Sr-90, and U-234 are derived values.

The isotopic analysis software, MGA, accomplishes the relative quantification of the Pu-242 concentration via an isotopic correlation technique.

A detailed discussion of the MGA Pu-242 correlation algorithm can be found in *Methods and Algorithms Used in MGA*, by Ray Gunnink, 1999.

The quantification of Sr-90 and U-234 activities is accomplished through the use of scaling factors that are obtained from site AK, and specified by memorandum.



Attachment 2 – NDA Batch Data Report Table of Contents

NDA Batch Number: \_\_\_\_\_

Testing Facility: \_\_\_\_\_

SECTION	PAGE NUMBER
Attachment 1, NDA Batch Data Report Cover Sheet	
Attachment 2, NDA Batch Data Report Table of Contents	
Attachment 3, NDA Batch Data Report Narrative Summary	
Copy of NCR(s), if applicable	
Attachment 4, NDA ITR Checklist	
NDA Radioassay Data (Includes Radioassay Data Sheets and NDA Technical Review Comment Sheets)	
QA Last Results Reports Background or Background/Transmission Daily Performance Checks Weekly Performance Checks	
Supplemental Data, if applicable	

Attachment 3 – NDA Batch Data Report Narrative Summary

**Batch #:** \_\_\_\_\_

**Date:** \_\_\_\_\_

**Quality Control Summary:** \_\_\_\_\_

\_\_\_\_\_

**Nonconformance:** \_\_\_\_\_

\_\_\_\_\_

**NDA ITR Comments:** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Printed Name:** \_\_\_\_\_

**Signature and Date:** \_\_\_\_\_ / \_\_\_\_\_

<b>Site ID:</b>	<b>NDA Batch Number:</b>
<b>Procedure/Rev Number:</b>	<b>NDA Counter ID:</b>
<b>NDA Independent Technical Reviewer Checklist</b>	
<b>Description of Criteria Reviewed</b>	<b>Criteria Met (Circle)</b>
Data generation and reduction were conducted in a technically correct manner in accordance with the standard operating procedures for the NDA methods used.	Yes No
Data is reported in the proper units.	Yes No N/A
Have calculations been verified and validated by a software test plan, and/or 100 percent check of all hand calculations?	Yes No
The testing QA documentation is complete and includes QC sample results made at the beginning and ending of the counting session(s) for the batch.	Yes No
QC measurement results are within established control limits per standard operating procedures (Reference Table A-3, Range of Applicability, CCP-PO-002).	Yes No
Were QC criteria that were not met documented with a NCR?	Yes No N/A
Weekly Interfering Matrix Measurements were properly performed and have been used to assess the long-term stability of the NDA instruments matrix correction?	Yes No
The activities and masses (including TMU expressed in 1-sigma) are reported for the ten WIPP-tracked radionuclides. <b>Note:</b> Less than Lower Limit of Detection (LLD) or zero shall be reported in accordance with CCP-PO-002, Section 3.3.1[A.1].	Yes No
Is the reported data for each container in the batch from the same system?	Yes No
Are all radionuclides that contribute to 95 percent of the radioactive hazard reported on the Radioassay Data Sheet?	Yes No
Was U-235 identified greater than the LLD in any waste container?	Yes No
If YES, is it reported?	Yes No N/A

Attachment 4 – NDA ITR Checklist (Continued)

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<b>Site ID:</b>	<b>NDA Batch Number:</b>
<b>Procedure/Rev Number:</b>	<b>NDA Counter ID:</b>
<b>NDA Independent Technical Reviewer Checklist</b>	
<b>Description of Criteria Reviewed</b>	<b>Criteria Met (Circle)</b>
Testing batch data correctly lists the testing facility name, batch number, waste container numbers, and Operator's and Reviewer's signatures and dates.	Yes    No
<b>NDA Independent Technical Reviewer Approval</b>	
Printed Name: _____	
Signature: _____	
Date: _____	

Attachment 5 – NDA Technical Review Comment Sheet – EXAMPLE

Automated ITR for Container #1                      11/4/2009    8:44:38 AM                      Page 15

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Automated Independent Technical Review  
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Counter ID:                      GEA                      Count Type: Assay - Debris  
Container ID:                      Container #1                      Assay Date: 11/4/2009  
Waste Matrix Code: S5000  
Sequence Number: 14511

-----  
MGA Analysis:  
-----  
DISPOSITION:

-----  
Gamma Analysis:  
Analysis Status: No errors.  
Pu-239/Am-241 ratio is less than the lower limit of 200.00  
Pu-239/Np-237 ratio is less than the lower limit of 125.00  
-----  
DISPOSITION:

-----  
Miscellaneous:  
-----  
DISPOSITION:

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Expert Review by: \_\_\_\_\_ Date: \_\_\_\_\_