

CCP-TP-101

Revision 4

CCP Off-Site Source Recovery Project Sealed Source Radiological Characterization

EFFECTIVE DATE: 11/02/2007

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PRINTED NAME

APPROVED FOR USE

RECORD OF REVISION

Revision Number	Date Approved	Description of Revision
0	03/17/2005	Initial issue.
1	06/09/2005	Incorporated Carlsbad Field Office (CBFO) Document Review Record (DRR) adequacy review comments.
2	11/16/2006	Revised to implement changes to the Waste Isolation Pilot Plant Hazardous Waste Facility Permit requirements resulting from the Section 311/RH PMR.
3	03/15/2007	Revised to remove verification that Technical Supervisor Checklist and Facility Quality Assurance Office Review Checklist is included in the Batch Data Report (BDR) from Attachment 4, Radiological Characterization Independent Technical Reviewer Review Checklist.
4	11/02/2007	Revised to add the file naming and saving steps. Inserted Cs-137 characterization methodology for Am-241/Be/Cs-137 combination sources. Added requirement to comment in the Notes section of the version of Windows® and Access® and if combination sources are being characterized.

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1.0 PURPOSE

This procedure addresses the characterization of defense-related transuranic (TRU) sealed sources recovered by the Los Alamos National Laboratory (LANL) Off-Site Source Recovery Project (OSRP) for disposal at the Waste Isolation Pilot Plant (WIPP). Due to sealed source construction and packaging in special form capsules and pipe components for transportation, the use of WIPP-approved nondestructive assay (NDA) techniques for determining the radionuclide content of waste packages is unreliable and ineffective. As a result, the contents of the waste containers are characterized using acceptable knowledge (AK) documentation and calculations in lieu of NDA. The types of AK documentation used for model input have been deemed adequate by a peer review panel in accordance with NUREG-1297, *Peer Review for High Level Waste Repositories*.

1.1 Scope

This procedure documents the radiological characterization methodology for complying with the requirements outlined in CCP-PO-002, *CCP Transuranic Waste Certification Plan*. It describes the use of AK documentation in combination with computer software to determine the radionuclide content of containers.

Personnel following this procedure will generate a Container Characterization Report (CCR) (for an example, see Attachment 1, Container Characterization Report) and a Radiological Characterization Batch Data Report (BDR). This procedure also provides for data generation level review and verification.

2.0 REQUIREMENTS

2.1 References

Baseline Documents

- *Characterization Database User Documentation*
- *Sealed Sources Peer Review Report* (J. Booth, 12/5/2003)
- ASTM C1490-01, *Standard Guide for Selection, Training, and Qualification of Nondestructive Assay (NDA) Personnel*

- CCP-AK-LANL-008, *Central Characterization Project Acceptable Knowledge Summary Report for Los Alamos National Laboratory Off-Site Source Recovery Project Sealed Sources Waste Streams LA-OS-00-01.001 and LA-OS-00-03*
- CCP-PO-003, *CCP Transuranic Authorized Methods for Payload Control (CCP CH-TRAMPAC)*
- CCP-QP-022, *CCP TRU Software Quality Assurance*
- CCP-TP-005, *CCP Acceptable Knowledge Documentation*

Referenced Documents

- 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-TP-005, *CCP Acceptable Knowledge Documentation*
- CCP-TP-069, *CCP Sealed Source Visual Examination and Packaging*
- NUREG-1297, *Peer Review for High Level Waste Repositories*

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 OSRCharacterizationDatabase.mdb

2.4 Precautions and Limitations

2.4.1 Facility Requirements

- [A] This procedure augments, but does not supersede, applicable requirements of the facilities in which the activities are conducted. Work performed at LANL facilities will be conducted in accordance with facility requirements.
-

NOTE

This procedure DOES **NOT** address radiological protection requirements. All activities described SHALL be conducted in accordance with work plans, procedures, or other process controls generated by the facility where the work is performed.

2.4.2 Conditions Adverse to Quality

- [A] If workers identify a condition that will or could potentially result in the work producing results of unacceptable quality for WIPP-related activities, they must STOP WORK, and prepare a Nonconformance Report (NCR) in accordance with CCP-QP-005, *CCP TRU Nonconforming Item Reporting and Control*.

2.5 Definitions

NOTE

See Attachment 5, Regulatory Definitions, for regulatory definitions.

2.5.1 **Sealed source** – Any radioactive material that is physically encased in a capsule, rod, element, etc. that prevents the leakage or escape of the radioactive material and that prevents its removal without penetration of the casing. For this waste stream, the casing is metal and the special nuclear materials are actinides.

2.5.2 **Sufficient AK** – Documentation that includes at least one of the following sources that specify the primary radionuclide, appropriate activity or gram content (i.e., isotopic for Americium [Am]-241 and Plutonium [Pu]-238 and elemental for Pu-239), and manufacture date:

- Nuclear Materials Management and Safeguards System (NMMSS)

- Source certificates issued by the source manufacturer
- Fabrication or shipping documents specific to the materials or sources being recovered
- Source shipping records produced by the source manufacturer

Alternatively, a combination of other documents that provide either the primary radionuclide content or activity/gram content can be used. These documents include:

- U.S. Nuclear Regulatory Commission (NRC) Radioactive Sealed Sources and Devices Registry
- Manufacturer's sales catalogues
- Manufacturer's source drawings
- NRC or agreement state regulatory licensing information
- Physical markings on the outer casing of the source (e.g., isotope, activity, model number)
- Name plate or labels from the device where the source was housed
- Unique physical description attributed to a specific source model
- Source manufacturer's databases

3.0 RESPONSIBILITIES

3.1 Radiological Characterization Team Leader

- 3.1.1 Compiles and maintains AK source documentation with radiological information received from source owner or other sources, **AND** provides this information to the Acceptable Knowledge Expert (AKE).
- 3.1.2 Assembles Radiological Characterization BDR and submits for required reviews.
- 3.1.3 Reviews CCRs to ensure that Fissile Gram Equivalent (FGE), decay heat, and Plutonium-Equivalent Curie (PE-Ci) limits are **NOT** exceeded and that TRU alpha activity concentration exceeds 100 nanocuries per gram (nCi/g).
- 3.1.4 Completes Attachment 2, Radiological Characterization Batch Data Report Cover Sheet.
- 3.1.5 Initiates NCRs, when necessary.

3.2 Radiological Characterization Operator

- 3.2.1 Verifies Sufficient AK as defined in Section 2.5.
- 3.2.2 Uses Off-Site Source Recovery (OSR) Characterization database to characterize containers, generating a CCR.
- 3.2.3 Verifies CCRs completed by other Radiological Characterization Operators.
- 3.2.4 Prepares and submits NCRs, as necessary.
- 3.2.5 Ensures containers to be characterized are listed on the AK Tracking Spreadsheet.
- 3.2.6 Paginates the Radiological Characterization BDR.
- 3.2.7 Completes Attachment 3, Radiological Characterization Batch Data Report Table of Contents.

3.3 Independent Technical Reviewer (ITR)

3.3.1 Reviews the Radiological Characterization BDR in accordance with the criteria provided by this procedure, **AND** completes Attachment 4, Radiological Characterization Independent Technical Reviewer Review Checklist.

3.3.2 Prepares and submits NCRs, as necessary.

3.4 Facility Records Custodian

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

4.0 PROCEDURE

Radiological Characterization Operator

4.1 Ensure that containers are listed on the AK Tracking Spreadsheet.

4.2 Container Characterization

NOTE

If sufficient AK CAN **NOT** be collected, the container will **NOT** be offered for WIPP disposal.

4.2.1 Verify that sufficient AK has been collected for radiological characterization, as defined in Section 2.5.

[A] **IF** sufficient AK CAN **NOT** be collected,
THEN write an NCR in accordance with CCP-QP-005.

4.2.2 Verify consistency between multiple sufficient AK documents.

[A] **IF** discrepancies between sufficient AK documents are identified,
THEN contact the Radiological Characterization Team Leader to resolve any discrepancies with the CCP AKE in accordance with CCP-TP-005, *CCP Acceptable Knowledge Documentation*.

NOTE

The Characterization database performs all calculations. The operator performs only required data entry.

4.2.3 Use the Characterization database to determine the radiological content of a container as follows:

[A] Enter the software Characterization menu, **AND** click on the "Characterization" button.

[B] Enter your name.

[C] Select a container from the drop-down list, **AND** click the "Add Container" button.

- [D] In the notes section indicate the version of Windows® and Microsoft Access® used **AND** note “Am-241/Be/Cs-137”, if there are combination sources in the drum.

NOTE

The last day of the current month will be default displayed as the “Run Date,” which is the characterization date.

NOTE

The characterization date will display.

- [E] **IF** both the Curies (Ci) and grams (g) are listed, **THEN** select the “Clear Curie” button for Pu sources **OR** “Clear Grams” button for Am sources.
- [F] **IF** grams are **NOT** displayed for Pu **OR** curies for Am, **THEN** enter the known information specified in AK documents.
- [G] **IF** the existing source data listed in the AK does **NOT** subsequently appear on the screen, **THEN** contact the Radiological Characterization Team Leader.
- [H] Enter or confirm the source content(s) in Ci or g, the source manufacture date, the isotope, and the weight of each source, in grams, if **NOT** packaged in a special form capsule (SFC), from available AK documents.
- [H.1] **IF** a manufacture date is **NOT** available, **THEN** select a date based on AK information that will provide the most conservative results (i.e., greatest TRU activity or mass).
- [H.2] **IF** the sources are packaged in an SFC, **THEN** enter the SFC weight in grams in the “WEIGHT of SFCs” field.
- [H.3] Confirm weights against Container Packaging and VE Data Records generated in CCP-TP-069, *CCP Sealed Source Visual Examination and Packaging*.

- [I] Repeat step 4.2.3[H] for each source packaged in the container.
- [J] Click the “View Report” button, **AND** on the “OSR Characterization database – [Source Characterization Report]” page, click on the “Publish it with Microsoft Office Word” bar.
- [K] Save the file to the “CH-BDR” subfolder in the Batch Data Reports folder on the “e-osrp on osrweb” server with the syntax – LAyy-OSR-CH-XXXX.rtf) –
Where: yy = year
XXXX = LA drum number
rtf = file format
- [L] Click the “Export Excel File” button, on the “OSR Characterization database – [Source Characterization Report]” page to create the CCR (For an example, see Attachment 1 – Container Characterization Report).
- [M] Save the file to the “CH-BDR” folder on the “e-osrp on osrweb” server with the syntax – LAyy-OSR-CH-XXXX.xls –
Where: yy = year
XXXX = LA drum number
xls = file format
- [N] **IF** the drum contains Am-241/Be/Cs-137 combination sources,
THEN perform the following:
- [N.1] Add the additional Cs-137 shown on the AK documentation and Sr-90 activity (equal to current Sr value + [D9 * 1.80581E-4]) to the activity column (3) of the spreadsheet.
- [N.2] Copy and paste yellow highlighted cell from the protected “Combie_Templet_Rev1.xls” spreadsheet onto the corresponding cell of the CCR.
- [N.3] Select all the data cells **AND** click “Edit”, and then “Copy”.
- [N.4] Without changing the selected cells, Click “Edit”, and then “Paste Special” **AND** on the “Paste Special” screen, select “values” and click “OK”.

[N.5] Resave Excel[®] file to the appropriate CH-BDR subfolder.

[O] Initial and date pages as required, **AND** sign and date the CCR in the "Performed By" field on the second and last page.

[P] Forward the CCR and supporting AK data to another Radiological Characterization Operator for data entry verification.

Second Radiological Characterization Operator

[Q] Review the CCR and supporting AK data for accuracy, **AND** resolve data error(s) with the originating Radiological Characterization Operator.

[R] Initiate NCRs in accordance with CCP-QP-005, if appropriate.

[S] Initial and date pages as required, **AND** print name, sign and date the CCR in the "Reviewed By" field on the second and last page.

[T] Forward the CCR and supporting AK data to the Radiological Characterization Team Leader.

4.3 Post-Packaging Review

Radiological Characterization Team Leader

4.3.1 Review the CCR table, "Total Container Content With Uncertainty Applied – All Sources," to ensure that:

[A] FGE plus two times the associated error reported in the "Totals" row is **NOT** greater than 200 FGE.

[B] The decay heat plus the associated error reported in the "Totals" row does **NOT** exceed 40 watts (W).

[C] PE-Ci total does **NOT** exceed 1,800 PE-Ci.

[D] TRU alpha activity concentration reported on the "Decay Corrected Data" table of the CCR (without error applied) as "TRU Alpha Activity Concentration" exceeds 100 nCi/g.

4.3.2 Initiate NCRs in accordance with CCP-QP-005, if appropriate.

4.3.3 Print name, sign and date in the "Approved By" field on the second and last page, **OR** return the CCR to the Radiological Characterization Operator for correction.

4.4 Radiological Characterization Batch Data Report (BDR) Preparation

Radiological Characterization Team Leader

4.4.1 Obtain a copy of Attachment 2, Radiological Characterization Batch Data Report Cover Sheet, **AND** obtain a BDR number using the format LAyy-OSR-CH nnn, where yy are the last two numbers of the current year (e.g., 00 for 2000) and nnn is a sequential number starting at 001 for the first BDR of each year.

4.4.2 Record the Batch Number on Attachment 2.

NOTE

Information required for report compilation includes the CCR, the AK Information, any NCRs, Container Packaging and VE Data Records from CCP-TP-069, and any electronic data input files.

4.4.3 Compile information for no more than 20 pipe overpack containers (POCs).

4.4.4 Record the Batch Date on Attachment 2.

4.4.5 Record the waste container identification numbers for each container included in the batch on Attachment 2.

NOTE

Attachment 3 will **NOT** be completed until the data generation level reviews are complete.

4.4.6 Attach the blank Attachment 3 as page 2 of the Radiological Characterization BDR.

4.4.7 Attach the blank Attachment 4.

4.4.8 Attach the CCRs and associated AK information.

4.4.9 Attach NCRs, if applicable.

4.4.10 Prepare the electronic data input files.

4.4.11 Provide the Radiological Characterization BDR and electronic data input files to the ITR for review.

4.5 Independent Technical Review

NOTE

The ITR is an individual other than the original Radiological Characterization Operator who is qualified to have performed the original work. The second Radiological Characterization Operator can **NOT** be the ITR Reviewer.

Independent Technical Reviewer (ITR)

4.5.1 Review BDR and document review by completing Attachment 4, **AND** print name, sign, and date.

4.5.2 **IF** nonconformances are identified, **THEN** generate an NCR in accordance with CCP-QP-005.

4.5.3 Accept the Radiological Characterization BDR by printing name, signing, and dating Attachment 2.

4.5.4 Forward the Radiological Characterization BDR and the electronic data input files to the Radiological Characterization Operator.

Radiological Characterization Operator

4.5.5 Paginate the Radiological Characterization BDR.

4.5.6 Complete Attachment 3, Radiological Characterization Batch Data Report Table of Contents

4.5.7 Print name, sign, and date the CCR.

4.5.8 Submit the Radiological Characterization BDR to the Facility Records Custodian.

Facility Records Custodian

4.5.9 Receive, process, and transmit records in accordance with CCP-QP-008.

5.0 RECORDS

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

5.1.1 QA/Lifetime

[A] Radiological Characterization BDR:

[A.1] Container Characterization Report

[A.2] Attachment 2, Radiological Characterization Batch Data Report Cover Sheet

[A.3] Attachment 3, Radiological Characterization Batch Data Report Table of Contents

[A.4] Attachment 4, Radiological Characterization Independent Technical Reviewer Review Checklist

[A.5] Copies of NCRs, if applicable

5.1.2 QA/Nonpermanent

[A] Electronic Data Input Files (primary and backup)

Attachment 1 – Container Characterization Report (Example)

Characterization Data Sheets

Run Date: _____

Software Version Number: _____

Container Number: _____

¹Source ID:

Manufacture Date:

Nuclide	Initial Content (g)	Initial Activity (Ci)	Decayed Content (g)	Decayed Activity (Ci)	Source FGE	Source PE-Ci	Source Watts (W)	Source % Type A Limit
137Cs								
233U								
234U								
235U								
238Pu								
238U								
239Pu								
240Pu								
241Am								
241Pu								
242Pu								
90Sr								
Other (specify)								
Totals								

¹ This table is repeated for each source packaged in the container

Performed by: _____
(Initial)

Date: _____

Reviewed by: _____
(Initial)

Date: _____

Attachment 1 – Container Characterization Report (Continued) (Example)

Total Container Content With Uncertainty Applied – All Sources

Nuclide	Adjusted Content (g)	Adjusted Activity (Ci)	Adjusted Activity (TBq)	FGE	PE-Ci	W	TRU α Activity (nCi)	% Type A Limit
137Cs								
233U								
234U								
235U								
238Pu								
238U								
239Pu								
240Pu								
241Am								
241Pu								
242Pu								
90Sr								
Others (specify)								
Totals								

Performed by: _____
 | _____
 | Print Name/Signature

Date: _____

Reviewed by: _____
 | _____
 | Print Name/Signature

Date: _____

Approved by: _____
 | _____
 | Print Name/Signature

Date: _____

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Attachment 1 – Container Characterization Report (Continued) (Example)

NDA / Radiological Characterization BDR# _____

Container: LA00000058502

Waste Weight (kg) 0.500

Run Date: 3/31/2005

Decay Corrected Data

Nuclide	Mass (grams)	Mass 1.00 Sigma Error (grams)	Activity (Ci)	Activity 1.00 Sigma Error (Ci)	FGE	PE-CI	Decay Heat (W)	% Type A Limit	TRU Alpha Activity (Ci)
Cs-137	3.12E-07	1.14E-07	2.75E-05	1.00E-05	0.00E+00	0.00E+00	3.04E-08	5.08E-07	0.00E+00
U-233	1.11E-09	0.00E+00	1.08E-11	0.00E+00	1.00E-09	3.39E-12	3.16E-13	4.02E-14	0.00E+00
U-234	3.78E-01	8.69E-02	2.39E-03	5.49E-04	0.00E+00	0.00E+00	6.88E-05	8.85E-06	0.00E+00
U-235	3.07E-04	7.05E-05	6.71E-10	1.54E-10	1.97E-04	0.00E+00	1.85E-11	0.00E+00	0.00E+00
Pu-238	1.62E+00	1.06E-02	2.81E+01	1.83E-01	1.84E-01	2.55E+01	9.31E-01	5.19E-01	2.81E+01
U-238	4.25E-04	9.76E-05	1.44E-10	3.32E-11	0.00E+00	0.00E+00	3.66E-12	0.00E+00	0.00E+00
Pu-239	4.01E-01	5.78E-03	2.52E-02	3.63E-04	4.01E-01	2.52E-02	7.82E-04	4.66E-04	2.52E-02
Pu-240	6.56E-02	1.09E-03	1.51E-02	2.50E-04	1.48E-03	1.51E-02	4.70E-04	2.79E-04	1.51E-02
Am-241	1.29E-02	5.53E-03	4.46E-02	1.92E-02	2.40E-04	4.46E-02	1.49E-03	8.25E-04	4.46E-02
Pu-241	4.72E-03	4.85E-04	4.91E-01	5.05E-02	1.06E-02	9.62E-03	1.56E-05	4.54E-04	0.00E+00
Pu-242	5.82E-03	1.41E-03	2.31E-05	5.62E-06	4.37E-05	2.10E-05	6.81E-07	4.27E-07	2.31E-05
Sr-90	1.50E-07	5.47E-08	2.07E-05	7.55E-06	0.00E+00	0.00E+00	2.40E-08	3.83E-06	0.00E+00
Other Isotopes	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total*	2.49E+00	8.79E-02	2.87E+01	1.91E-01	5.97E-01	2.56E+01	9.33E-01	5.21E-01	2.82E+01
*RMS for errors									

		(1.00 Sigma Error)	
Tru Alpha Activity Concentration	5.64E+07	3.69E+05	nCi/g
Tru Alpha Activity	2.82E+01	1.84E-01	Ci
Total Pu-239 Equiv Activity	2.56E+01	1.68E-01	Ci
Total Pu-239 Fissile Gram Equiv	5.97E-01	6.00E-03	g
Total Decay Heat	9.33E-01	6.11E-03	W

	Printed Name	Signature	Date
RC Operator Review	_____	_____	_____
2nd RC Operator Review	_____	_____	_____
RC Team Leader Review	_____	_____	_____

Attachment 2 – Radiological Characterization Batch Data Report Cover Sheet

CCP Los Alamos National Laboratory	BDR Number:
	BDR Date:
Waste Containers	
(Insert list of waste containers in the batch here)	
Independent Technical Reviewer (ITR) Approval	
ITR Printed Name:	
Approval Signature and Date: _____ / _____	

Attachment 3 – Radiological Characterization Batch Data Report Table of Contents

Batch Data Report Number: _____

Table Of Contents	
Description	Page No.
Radiological Characterization Batch Data Report Cover Sheet	
Radiological Characterization Batch Data Report Table of Contents	
Radiological Characterization Independent Technical Reviewer Review Checklist	
Container Characterization Reports (CCRs) and AK Information	
Copies of NCR(s), if applicable	

Attachment 4 – Radiological Characterization Independent Technical Reviewer Review Checklist

CCP Los Alamos National Laboratory		
Batch Number:		
ITR Review Checklist	YES/NO/NA	Comments/Qualifiers
Data generation and reduction were conducted in a technically correct manner in accordance with this procedure.		
Data are reported in the proper units.		
Data entry was verified by an independent Radiological Characterization Operator.		
“Sufficient” AK documentation and the Container Characterization Reports are attached to the Radiological Characterization BDR.		
Inputs to Characterization Software are correct and consistent with AK documentation.		
Correct revision of procedure used.		
Is container on the AK Tracking Spreadsheet?		
Container Characterization Reports (CCRs) show that FGE, PE-Ci, and Decay heat (wattage) limits were not exceeded for any container and that waste is TRU (>100 nCi/g).		
Radiological Characterization BDR includes: <ul style="list-style-type: none"> • Radiological Characterization Batch Data Report Cover Sheet • Radiological Characterization Batch Data Report Table of Contents • Radiological Characterization Independent Technical Reviewer Review Checklist • Container Characterization Reports (CCRs) and AK Information 		
Radiological Characterization Independent Technical Reviewer Approval		
ITR Printed Name:		

Signature	Date	

Attachment 5 – Regulatory Definitions

10 CFR § 30.4 (1-1-04 Edition): Sealed source means any byproduct material that is encased in a capsule designed to prevent leakage or escape of the byproduct material.

10 CFR § 835.2 (1-1-04 Edition): Sealed radioactive source means a radioactive source manufactured, obtained, or retained for the purpose of utilizing the emitted radiation. The sealed radioactive source consists of a known or estimated quantity of radioactive material contained within a sealed capsule, sealed between layers of non-radioactive material, or firmly fixed to a non-radioactive surface by electroplating or other means intended to prevent leakage or escape of the radioactive material. Sealed radioactive sources do not include reactor fuel elements, nuclear explosive devices, and radioisotope thermoelectric generators.