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CP3-WM-0437 FRev. 2A	TITLE: Waste Characterization and Profiling	Page 1 of 72

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REVISION/CHANGE LOG

Revision/Change Letter	Description of Changes	Pages Affected	Date of Revision/Change
FR0	Procedure Bluesheet	ALL	10/19/2017
FR1	Initial Release	ALL	1/10/2018
FR2	Address CA-000697, AI-0001207. Add CP2-SS-3000 and CP3-NM-3007 as Use References. Add Steps 5.1. Address CA-000785, AI-0001267. Revise document based on its usage to define a process, not perform work at the activity level. Also revision of processes to align with current organization and execution strategies. Add statement to CP3-WM-0437-F03.	ALL	5/30/18
FR2A	Changed to incorporate characterization review requirements into Section 6.7 and to include a note identifying potential sources of waste forecasting information as required by CAPA CA-001637 and CAPA CA-001756.	6, 14, 15, 71	4/9/19

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1.0 PURPOSE AND SCOPE

1.1 Purpose

This procedure provides the requirements and methodologies for the characterization of waste streams and containers at the Deactivation and Remediation (D&R) Project. This procedure establishes the basis to ensure that all waste generated is properly characterized for Resource Conservation and Recovery Act (RCRA), Toxic Substances Control Act (TSCA), and Radiological constituents. This procedure also addresses waste profiling including both onsite (for example, C-746-U Landfill) and off-site disposal. **If** characterizing and profiling waste going to the Nevada National Security Site (NNSS) **then** see CP3-WM-0707, *NNSS Specific Waste Characterization, Profiling, Packaging and Shipping* for specific NNSS Waste Acceptance Criteria (WAC) requirements that are in addition to the requirements in this procedure.

1.2 Scope

This procedure applies to solid waste as defined in *KRS* 224.01-010 and 401 *KAR* for newly-generated, newly-discovered, and legacy waste at the U.S. Department of Energy (DOE)-owned Paducah Site. This procedure may also be used to characterize recyclable materials. This procedure provides the processes and guidance to satisfy selected requirements related to waste characterization in:

- 10 Code of Federal Regulations (*CFR) – Nuclear Regulatory Commission*
- 40 *CFR – Protection of the Environment*
- 49 *CFR – Transportation*
- 401 KAR – *Protection of the Environment*
- DOE O 435.1, Chg. 1 – *Radioactive Waste Management*
- DOE M 435.1, Chg. 1 – *Radioactive Waste Management Manual*
- SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*
- EPA QA/G-4, *Guidance for the Systematic Planning Using the Data Quality Objectives Process*
- Applicable Treatment, Storage, and Disposal Facility (TSDF) WAC
- CP2-WM-0011, *Waste Acceptance Criteria for the Treatment, Storage and Disposal Facilities at the Paducah DOE Site*

2.0 REFERENCES

2.1 Use References

- CP2-SS-3000, *Nuclear Materials Control and Accountability Plan for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*
- CP2-WM-0307, *Paducah Waste Characterization Sampling and Analysis Plan*
- CP3-ES-5003, *Quality Assured Data*

- CP3-NM-3007, *Managing and Documenting Termination of Safeguards Nuclear Materials*
- CP3-WM-0707, *NNSS Specific Waste Characterization, Profiling, Packaging and Shipping*
- CP3-WM-3015, *Waste Packaging*
- CP3-WM-3025, *Preparation and Processing of Paducah Landfill Packages*
- EPA QA/G-4 (a.k.a. EPA/600/R-96/055), *Guidance for the Systematic Planning Using the Data Quality Objectives Process*
- SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*

2.2 Source References

- 10 *CFR, Nuclear Regulatory Commission*
- 40 *CFR, Protection of Environment*
- 49 *CFR, Transportation*
- CP2-WM-0011, *Waste Acceptance Criteria for the Treatment, Storage and Disposal Facilities at the Paducah DOE Site*
- CP3-QA-2005, *Nonconformance Control*
- DOE M 435.1-1, Chg. 1, *Radioactive Waste Management Manual*
- DOE O 435.1, Chg. 1, *Radioactive Waste Management*
- TSDF WAC

3.0 COMMITMENTS

None

4.0 RESPONSIBILITIES

Responsibilities are outlined in Section **6.0**.

5.0 GENERAL INFORMATION

5.1 All Nuclear Material Control and Accountability (NMC&A) accountable material will be managed in the appropriate material balance area according to CP2-SS-3000, *Nuclear Materials Control and Accountability Plan for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* and CP3-NM-3007, *Managing and Documenting Termination of Safeguards Nuclear Materials*.

6.0 INSTRUCTIONS

6.1 Project Planning and Waste Identification

Transportation Manager

NOTES:

D&R Project planning may require input from Waste, Materials, and Environmental Services personnel, and/or Waste Certification Official, etc.

Project requiring planning support include projects or activities that are expected to generate regulated wastes (excluding trash or refuse collected by the infrastructure contractor) requiring characterization, containerization, on-site storage, treatment, transportation as hazardous material, or disposition.

Waste characterization requirements may be incorporated into more comprehensive characterization efforts necessary to support project scope execution. In such a case, the Waste Engineer should participate in characterization planning in order to ensure waste characterization needs are addressed.

When available, waste forecasting information provided in project schedules, project specific waste management plans, or other documented sources may be used to identify support requirements. Chg A

6.1.1 **If** project planning or support need is identified, **then** assign a Waste Engineer to support the planning and execution of the project scope.

Waste Engineer

NOTE:

All potential waste streams are evaluated to determine if materials may be diverted for waste minimization or recycle.

6.1.2 Review the project scope for activities that will likely result in the generation of waste streams requiring characterization.

6.1.3 Identify the waste stream and/or population of waste to be characterized.

6.1.4 Determine the purpose for waste characterization, whether it is for disposal, treatment, recycling, and/or transportation.

6.1.5 **If** disposal at Nevada National Security Site (NNSS) is considered, **then** refer to CP3-WM-0707, *NNSS Specific Waste Characterization, Profiling, Packaging and Shipping* for specific waste characterization requirements that are in addition to this procedure.

NOTES:

Contaminants of concern include constituents reasonably expected to be in the waste which may require regulatory determinations. These determinations may include the following:

- RCRA (listed and characteristic)
- TSCA [direct and source, polychlorinated biphenyl (PCB), and asbestos containing material (ACM)]
- Radionuclides

Other constituents may be required by the Transportation Group for U.S. Department of Transportation (DOT) determinations.

Other constituents may be required for profiling by a given TSDF WAC

6.1.6 To the extent practical based on process knowledge and existing data, identify contaminants of concern for waste stream to be characterized.

NOTE:

For efficiency in characterization, wastes are grouped based on anticipated physical or chemical forms and properties, radionuclide contents, and/or knowledge of potential disposition options of anticipated waste streams.

6.1.7 Group the waste for characterization.

NOTE:

For normal statistical characterization, sub-grouping is commonly by source and/or media with an expectation that the subgroups are similar in contamination. **If** the waste is sub-grouped such that there is not an expectation that contamination levels are similar, other statistical methods must be used.

6.1.8 **If** necessary to facilitate appropriate characterization and profiling of the identified wastes, **then** subdivide the waste population into smaller subgroups.

NOTE:

Appendix B, *Process Knowledge*, provides guidance in determining the usefulness of process knowledge (PK) in supporting the characterization of wastes.

6.1.9 For each group or subgroup, collect, review, **and** document PK information related to the sources, contents, and processes of generation for each waste stream.

NOTE:

Prior to obtaining a new Characterization Package Number, a review of existing Characterization Packages may be appropriate to identify an existing characterization that may already be established.

Existing Characterization Packages may be sufficient for new materials if compatible and sufficiently bounding.

6.1.10 Determine the need for a new Characterization Package Number **and** contact the Waste Generator organization Database Administrator for a number.

6.2 Existing Data Review

Waste Engineer

NOTE:

Previously collected data may be identified and utilized when appropriate to support the characterization process. When using existing data, data quality should be evaluated as the usability of the data could be impacted by a number of factors including, but **NOT** limited to, analytical method, previous sampling type, or lab data qualifiers.

The primary sources existing data include project documentation and facility/project characterization data collected by other D&R contractor organizations including Radiological Controls and Environmental Services Characterization.

6.2.1 Identify **and** collect available existing analytical data.

NOTE:

Appendix C, *Historical Data Review and Data Limitations*, provides guidance on the use of historical data elements in support of waste characterization, including limitations.

6.2.2 Review **and** determine the quality and usability of available existing data sources for the characterization of identified waste matrices.

NOTE:

Appendix F, *Statistics Guidance, Documentation and Review*, provides guidance for statistical evaluation of data used for characterization.

6.2.3 Determine the level of statistical evaluation needed for existing data **and** perform any evaluations determined to be appropriate.

NOTE:

Resolution of discrepancies may involve further review of PK information including identifying additional documents or information sources to validate previous information or assumptions. Further review of data relevance and quality may also be required.

6.2.4 Compare existing data to the PK **and** resolve any discrepancies identified.

6.2.5 **If** characterization process is based on PK that is **NOT** sufficient to characterize waste and there is insufficient existing data, **then** proceed to **Section 6.3**.

6.2.6 **If** characterization process is based on sufficient PK to characterize waste **and** existing data confirms PK, **then** proceed to **Section 6.5**.

6.3 Sample and Data Collection Planning and Review

6.3.1 The sampling and analysis decisions are derived by the Data Quality Objectives (DQOs) in accordance with EPA QA/G-4 (a.k.a. EPA/600/R-96/055), *Guidance on Systematic Planning Using the Data Quality Objectives Process*.

Waste Engineer

6.3.2 Determine the analyses and detection limits required to meet the end use requirements of the sampling data.

NOTE:

Appendix D, *Determining Sample Type and Number of Samples*, provides comprehensive guidance regarding number and types of samples required for waste characterization.

6.3.3 Determine the type and number of samples to be taken.

NOTE:

Appendix E, *Determining QA/QC Sample Requirements*, provides guidance for determining Quality Assurance and Quality Control (QA/QC) requirements for waste characterization sampling.

6.3.4 Determine the QA/QC requirements for the samples to be taken.

6.3.5 Determine the sampling requirements as required by CP2-WM-0307, *Paducah Waste Characterization Sampling and Analysis Plan* **and** document in a Sampling and Analysis Event Plan (SAEP).

NOTES:

New analytical data used to make waste determinations or Land Disposal Restrictions (LDR) certification must be from a DOE Consolidated Audit Program (DOECAP) audited laboratory or equivalent.

Waste for disposal at Energy Solutions, Clive Utah must be analyzed at a Utah or National Environmental Laboratory Accreditation Conference (NELAC) certified laboratory.

6.3.6 Request lab contracting from the Sample Management Office.

6.3.7 Coordinate the sampling event with the Sample and Data Management Organization and the appropriate project personnel.

6.3.8 Assess **and** validate (if applicable) the data to determine usability in accordance with CP3-ES-5003, *Quality Assured Data*, and SW-846, Chapter 9, Sampling Plan.

6.3.9 **If** sampling was random, **then** continue the characterization process by going to **Section 6.4**.

6.3.10 **If** sampling was not random, **then** continue the characterization process by going to **Section 6.5**.

6.4 Statistical Evaluation of Data

Waste Engineer

6.4.1 Perform the statistical evaluation of data using the guidance in Appendix F, *Statistics Guidance, Documentation and Review*.

NOTE:

Appendix L, *Calculation Verification Guidance*, provides guidance for determining review and verification of waste characterization calculations.

6.4.2 Document the evaluation and the peer review of calculations.

6.4.3 **If** verification includes independent confirmation of one or more calculations including unit's analysis, and global verification of formulas, **then** document on Form CP3-WM-0437-F06, *Calculation Verification and Validation*.

6.4.4 **If** the statistical evaluation of the data is sufficient to complete the characterization, **then** go to **Section 6.5**.

6.4.5 **If** the statistical evaluation of the data is not sufficient to complete the characterization, **then** return to **Section 6.3** to plan additional sampling and data collection.

6.5 Characterization (Waste Stream)

Waste Engineer

6.5.1 Perform a RCRA determination in accordance with the applicable state and federal regulations using the guidance in Appendix G, *RCRA Determination*.

NOTE:

Regulatory Compliance assistance should be requested if the appropriate RCRA codes are **NOT** evident **or** if the waste characterized is generated in a Solid Waste Management Unit (SWMU) that may require listed waste codes be included.

6.5.2 **If** the waste is determined to be regulated under RCRA, **then** identify any associate SWMUs, assign waste codes, **and** determine appropriate disposal options.

NOTES:

The determination of friable and non-friable asbestos will support determination of packaging requirements to meet the WAC requirements of the selected disposition option.

6.5.3 Perform a TSCA determination in accordance with the applicable state and federal regulations using the guidance in Appendix H, *TSCA Determination - PCBs*, for PCBs, and Appendix I, *TSCA Determination - Asbestos Containing Material*, for Asbestos Containing Material (including friability determination).

NOTE:

Regulatory Compliance assistance should be requested if the appropriate TSCA waste type (Remediation waste, PCB bulk product waste, lab waste, etc.) are not evident.

6.5.4 **If** the waste is determined to be regulated under TSCA, **then** determine the TSCA waste types and appropriate disposal options.

6.5.5 Perform a radiological evaluation using the guidance in Appendix J, *Radiological Evaluation*.

NOTE:

When completing form CP3-WM-0437-F05, *Waste Characterization Verification Form*, the requestor and the reviewer are not the same person.

6.5.6 **If** the waste being characterized meets the applicable criteria of an existing characterization (such as, generation process, RCRA/TSCA determinations, etc.), **then** complete form CP3-WM-0437-F05, obtain the appropriate reviews, **and** provide the form and attachments to applicable project personnel.

NOTE:

Changes to characterization information should be communicated by: Providing a "red-line" version of the characterization documentation showing changes; Providing a "change summary"; and/or, Emailing change documentation to those whose activities or decisions are potentially impacted.

6.5.7 **If** changes are made to an existing characterization, **then** communicate changes to all potentially impacted personnel (project personnel, Transportation Specialists, etc.).

NOTES:

Equivalent forms of characterization documentation cannot be used for NNSS waste.

Equivalent forms of characterization documentation may be approved by the Transportation Manager.

For completion of CP3-WM-0437-F01, the preparer and reviewer are **NOT** the same person.

If equivalent documentation is used, refer to Appendix M for minimum content.

6.5.8 **If** this is a new characterization, **then** complete form CP3-WM-0437-F01, *Waste Characterization Documentation*, or equivalent documentation, obtain the appropriate reviews, and provide the form and attachments to applicable project personnel.

6.5.9 **If** requested to support project decision-making, **then** define **and** provide additional information, such as waste packaging.

NOTE:

Updated database information should be provided on the appropriate form, or using an equivalent method approved by the Waste Generator Manager.

6.5.10 **If** the new characterization determinations are inconsistent with existing waste inventory information or categories (for example, RCRA, TSCA, etc.), **or** other inventory database updates are required, **then** update the waste inventory database by providing the corrected information to the Waste Generator organization Database Administrator.

6.5.11 Provide specific direction to field personnel to make any necessary labeling and storage changes.

6.6 Characterization of Containers as Packaged for Disposition

6.6.1 All containers to be packaged for disposition must be characterized in accordance with this procedure, CP3-WM-0437 and in addition, if waste is being disposed at NNSS, see CP3-WM-0707 for specific NNSSWAC requirements prior to packaging and subsequent submittal of the form CP3-WM-0437-F03, *Final Packaging Container Characterization Form*, or its equivalent to the assigned Transportation Specialist.

Waste Engineer

NOTES:

Weighted average calculations may be required if multiple waste streams or subgroups are co-mingled or when Low-Specific Activity and Surface Contaminated Objects (SCOs) are packaged together. These calculations must be performed and validated per the guidance in Appendix L.

The net weight of the waste (excluding the weight of the container and shielding) must be used to calculate the specific activity of the waste in each container.

Refer to Appendix J, *Radiological Evaluation*, for additional guidance when radiological characterization is based on surface contamination.

6.6.2 Evaluate the radiological contents for each final waste package.

6.6.3 Determine the appropriate combination of waste to be contained in each packaging taking into consideration the following:

- Waste stream characterization from **Section 6.5**
- Nuclear Criticality Safety (NCS) requirements
- TSDF requirements
- 49 *CFR* requirements (Off-site shipments)

NOTES:

Personnel performing waste packaging are trained and certified as required by 49 *CFR* 172 Subpart H to perform the packaging function.

Sufficient direction is provided to packaging personnel to ensure compliance with regulatory and disposition requirement and to preclude packaging of prohibited materials.

6.6.4 Provide waste instruction to waste packaging personnel as required by CP3-WM-3015, *Waste Packaging* and CP3-WM-0707 (for NNSS waste packaging) to ensure compliant packaging and the proper documentation of required package information (weight, volume, dose rates, etc.).

6.6.5 **If** changed conditions are encountered during packaging activities (such as, inspection, sorting, segregation, repackaging, etc.) that could affect characterization, **then** suspend the field work and/or set the item aside for further evaluation by characterization personnel.

6.6.6 Review package documentation to verify volumes, weights, surface area (if applicable), and/or dose rates are recorded for each container during the packaging process **and** resolve any discrepancies in accordance with CP3-WM-3015.

NOTE:

Information may be captured and provided electronically in lieu of form CP3-WM-0437-F03 if sufficient to meet transportation and disposition requirements.

6.6.7 Document the characterization for the final package(s) on form CP3-WM-0437-F03, using the waste stream characterization data from **Section 6.5** and information from **Step 6.6.5.**

NOTE:

Peer reviews are performed by a Waste Engineer or the Transportation Manager.

6.6.8 Obtain a peer review of the final container characterization.

6.6.9 **If** calculations were required, **then** follow the guidance in Appendix L for proper verification.

6.6.10 Provide form CP3-WM-0437-F03, or the information captured electronically, to the Transportation Specialist **and** forward a copy to NMC&A for their information and use.

NOTES:

The specific TSDF WAC may contain a site-specific LDR/Underlying Hazardous Constituent (UHC) form(s).

If the waste has been blended, the LDR form must be written for the waste in its original form.

6.6.11 **If** the waste is characterized as RCRA hazardous, **then** complete form CP3-WM-0437-F04, *Land Disposal Notification and Certification Form* or other TSDF equivalent form(s).

6.7 Risk Assessment/Characterization Review

NOTES:

Risk Assessments are required for waste streams that have not been 100% inspected or waste containers that have been stored outside and have not been repackaged.

Waste streams which have undergone 100% inspection and have been subsequently stored outside in excess of 6 months shall be evaluated to determine if additional assessments are required. A Risk Assessment, if required, must be completed prior to shipment.

Risk Assessments can be performed on a waste stream basis or on smaller sub-groups within a waste stream. If sub-groups have been characterized and a Risk Assessment completed, the sub-group of waste may be shipped without waiting for the overall waste stream Risk Assessment to be completed.

Waste Engineer

6.7.1 Review the waste characterization PK documentation.

6.7.2 Follow the guidance in Appendix K to identify the number of containers to be subject to visual inspection and document the decision using form CP3-WM-0437-F07, *Waste Characterization Risk Assessment*.

NOTE:

Consultation with Subject Matter Experts or Functional Managers may be necessary to support inspection requirement determinations.

6.7.3 Determine the appropriate inspection criteria per waste stream.

6.7.4 **If** it is determined that there is adequate and accurate PK documenting the waste material, **then** document this determination on form CP3-WM-0437-F07, obtain applicable signatures, and the signature from the Transportation Manager.

6.7.5 Verify the appropriate work control documentation is in place to allow for the waste to be visually inspected in accordance with CP3-WM-3015 and in addition CP3-WM-0707 (for NNSS Waste).

6.7.6 Oversee visual inspection processes to ensure results meet the guidance in Appendix L.

6.7.7 Document inspection results on form CP3-WM-0437-F08, *Waste Characterization Risk Assessment Field Observations Checklist* **or** another equivalent manner at the discretion of Characterization personnel and management.

6.7.8 Review the results of the Risk Assessment with the appropriate Subject Matter Expert (SME)/Management to determine whether risk is adequately assessed, or further container inspections are warranted.

6.7.9 **If** further inspections are warranted, **then** go to Step **6.7.3**, if adequate, proceed to Step **6.7.10**.

6.7.10 Consolidate all Risk Assessment Information in the storage files with the related waste stream characterization package.

NOTE:

Characterization Reviews include all characterization packages without regard to risk assessment requirements and are completed prior to forwarding the characterization package to the data base administrator for integration into the waste tracking database.

6.7.11 Forward the completed and peer reviewed waste characterization package, including partially completed form CP3-WM-0437-F07, to the Transportation Management, or a specifically designated Subject Matter Expert (SME), for review.

<u>Transportation Manager or Designated SME</u> Chg A

NOTE:

Characterization reviews are intended to be comprehensive and include review of the characterization package and data utilized in development of the characterization and evaluation of any process knowledge or facility knowledge decision making.

6.7.12 Review the characterization package and associated data to identify any potential risks associated with the characterization that might result in transportation or environmental non-compliance.

6.7.13 Resolve review comments with the Waste Engineer **and** document completion of the characterization review by signing form CP3-WM-0437-F07.

6.7.14 Return the completed form to the WE for incorporation into the final characterization package. Chg A

6.8 Waste Profiling

Waste Engineer

6.8.1 **If** the waste is being profiled for disposal at the C-746-U landfill, **then** complete a landfill package in accordance with CP3-WM-3025, *Preparation and Processing of Paducah Landfill Packages*.

6.8.2 **If** the waste is being profiled for disposal at NNSS, **then** use CP3-WM-0707, for specific profiling steps.

NOTE:

Commercial TSDFs must have a current DOECAP audit or equivalent.

6.8.3 **If** the waste is being profiled for off-site treatment and/or disposal (other than NNSS), **then** obtain the following applicable information:

- Form CP3-WM-3015-F01, *Waste Item Container Log*
- Form CP2-WM-0011-F02, *Request for Disposal (RFD)*
- Form CP3-WM-0437-F01, *Waste Characterization Documentation*
- Form CP3-WM-0437-F05, *PGDP Waste Characterization Verification*
- Form CP3-WM-0437-F03, *Final Packaging Container Characterization*, or electronic equivalent
- Form CP3-WM-0437-F04, *Land Disposal Notification And Certification*, or other TSDF equivalent forms
- PK narrative/Technical Basis Document (NNSS)

6.8.4 **If** the waste fits an existing profile, **then** proceed to **Step 6.8.9**.

6.8.5 **If** the waste does not fit an existing profile, **then** revise the existing profile, **or** write a new profile.

6.8.6 Submit the new or revised profile to the TSDF.

6.8.7 **If** a treatability study sample is required, **then** notify the applicable project personnel to arrange for shipment of the sample.

6.8.8 **If** any technical issues arise, **then** work with TSDF staff and applicable site personnel to resolve the issues.

NOTE:

Funding/Procurement requests are **NOT** required for disposal at NNSS.

6.8.9 Submit a funding/procurement request for waste treatment and/or disposal services to

the applicable cost account manager and to the TSDF.

6.8.10 Notify transportation personnel when the waste profile has been approved by the TSDF.

6.8.11 Notify transportation personnel when the Notice to Transport/Shipment Approval has been received from the TSDF.

7.0 RECORDS

7.1 Records Generated

The following records may be generated by this procedure:

- Form CP3-WM-0437-F01 Part A - D, *Waste Characterization Documentation*
- Form CP3-WM-0437-F02, *Waste Item Information Update*
- Form CP3-WM-0437-F03, *Final Packaging Container Characterization*
- Form CP3-WM-0437-F04, *Land Disposal Notification And Certification*
- Form CP3-WM-0437-F05, *PGDP Waste Characterization Verification*
- Form CP3-WM-0437-F06, *Calculation Verification And Validation*
- Form CP3-WM-0437-F07, *Waste Characterization Risk Assessment*
- Form CP3-WM-0437-F08, *Waste Characterization Risk Assessment Field Observations Checklist*
- Sampling and Analysis Event Plans
- Equivalent forms to those listed above may be used if approved by Waste, Materials, and Environmental Services management or approved by the receiving TSDF.

7.2 Records Disposition

The records are to be maintained in accordance with CP3-RD-0010, *Records Management Process*.

Appendix A – Acronyms/Definitions

ACRONYMS

ACM – asbestos-containing material

CFR – *Code of Federal Regulations*

D&R – Deactivation and Remediation

DOE – U.S. Department of Energy

DOECAP – DOE Consolidated Audit Program

DOT – U.S. Department of Transportation

DQO – data quality objective

LDR – land disposal restrictions

LLW – low-level waste

NNSS – Nevada National Security Site

PCB – polychlorinated biphenyl

PK – process knowledge

QA – Quality Assurance

QC – Quality Control

RCRA – Resource Conservation and Recovery Act

SAEP – Sampling and Analysis Event Plan

SCO – surface contaminated object

SME – subject matter expert

SWMU – Solid Waste Management Unit

TCLP – Toxicity Characteristic Leachate Procedure

TPU – Total Propagated Uncertainty

TSCA – Toxic Substances Control Act

TSDF – Treatment, Storage, and Disposal Facility

UHC – underlying hazardous constituent

WAC – waste acceptance criteria

Appendix A – Acronyms/Definitions (Continued)

WPC – Waste Package Certifier

DEFINITIONS

Characterization Personnel – Refers to any of the following, by title, as directed by management:

- Characterization Lead
- Waste Engineer

Completeness – The comparison between the amount of valid, or usable, data you originally planned to collect, versus how much you collected.

Data Validation – A comprehensive analysis and review of analytical data, conducted against a set of predetermined criteria and leading to the assignment of relative usability (i.e., completely usable, estimated value, unusable) for each analytical result. The validation criteria should be developed using the DQO process and will depend upon the type(s) of data involved and the purpose for which the data are collected. Data should be validated by technically qualified personnel who are independent of those performing the analyses.

Disposal – Emplacement of waste in a manner that ensures protection of the public, workers, and the environment with no intent of retrieval and that requires deliberate action to regain access to the waste.

Hazardous Waste – Waste regulated by RCRA as described in 401 *KAR* 31:040.

Low-Level Waste (LLW) – All radioactive waste that is not high–level waste, spent nuclear fuel, transuranic (TRU) waste, by–product material [as defined in section 11e.(2) of the Atomic Energy Act of 1954, as amended], or naturally–occurring radioactive material.

Mixed Waste – Waste that is both hazardous and Low-Level radioactive.

Nevada National Security Site Waste Acceptance Criteria (NNSS WAC) – The Nevada National Security Site document that establishes the United States Department of Energy Nevada Operations Office waste acceptance criteria and requirements for waste certification and transfer.

Package – The packaging together with its contents as presented for transport (49 *CFR* 173.403).

Packaging – The assembly of components necessary to ensure compliance with the packagirequirements of 49 *CFR* (49 *CFR* 173.403).

Process Knowledge (PK) – Refers to any information that the generator possesses about a waste stream.

Record – A completed document or other medium that provides objective evidence of an item, service, or process.

Appendix A – Acronyms/Definitions (Continued)

Subject Matter Experts (SMEs) – Technical support personnel to review and recommend approval of waste profiles and supporting documents [including work plans, sampling and analysis plans, field–generated records, Technical Basis Documents (TBDs), Process Knowledge File Narratives (PKFNs), etc.], re-review existing profiles and supporting documentation when unacceptable conditions are reported by D&R contractor QA trending reports, and provide recommendations on related technical issues to the Transportation Manager.

Treatment – Any method, technique, or process designed to change the physical or chemical characteristics of the waste to render it: less hazardous, safer to transport, store, or dispose of, or reduce its volume.

Waste Acceptance Criteria – The technical and administrative requirements that a waste must meet in order for it to be accepted at a treatment, storage, or disposal facility.

Waste Certification – A process by which a waste generator affirms that a given waste or waste stream meets the waste acceptance criteria of the facility to which the generator intends to transfer waste for treatment, storage, or disposal.

Waste Certification Official (WCO) – The person who affirms by signature that wastes meet all of the waste acceptance and other applicable criteria for NNSS. Also ensures independent oversight is conducted to verify that quality assurance requirements and waste acceptance criteria are satisfied.

Waste Characterization – The identification of waste composition and properties, by review of acceptable knowledge (which includes process knowledge), or by nondestructive examination, nondestructive assay, or sampling and analysis, to comply with applicable storage, treatment, handling, transportation, and disposal requirements.

Waste Container – A receptacle for waste, including any liner, shielding, or material that is intended to accompany the waste in disposal.

Waste Profile (WP) – A standardized document format used to identify the physical, chemical, and radiological characteristics of a waste stream.

Waste Stream – A waste or group of wastes from a process or a facility with similar physical, chemical, or radiological properties.

Appendix B – Process Knowledge

Introduction

Process Knowledge (PK) is documented knowledge about the waste source, constituents, and generation process that allows a reliable estimation of the contamination components and concentrations. PK may be based on historical data from related waste streams. PK that is not based on historical data is only useful for proving a waste stream to be non-regulated for specific constituents because there was no contamination source. PK is an effective tool for characterization of waste in cases where sampling and analyses are difficult or are not cost effective. Documentation of PK is critical. Collecting and tracking PK is efficient, preventing rework for repeated or ongoing waste streams.

Sources

The following are some examples of the types and sources of information that may be used to support the use of characterization by PK:

- Historical records, including historic analytical data or literature
- Description of the waste generating operations and/or process
- Known relationships between radioactive and hazardous constituents
- Manufacturer/Procurement specifications
- Plans and drawings
- Material Safety Data Sheets
- Procedures, Work Packages, Etc.
- Logbooks and batch records
- Lab analysis and direct assay results
- Material (i.e. mass) balance and concentration calculations
- Personnel interviews (documented and signed by the interviewer and interviewee, if possible)

Traceability

PK must be traceable to the waste being characterized, and the traceability must be documented in writing.

Documentation

The use of PK is documented on Form CP3-WM-0437-F01 “Waste Characterization Documentation”, or Form CP3-WM-0437-F05, “PGDP Waste Characterization Verification Form”, as applicable. Supporting information (i.e., memos, reports, interview records, batch records, traceability rationale, etc.) will be attached.

NOTE 1: For large reports, summary level information or a reference to the report is acceptable.

NOTE 2: Some TSDF WACs specify the method for documentation of PK.

Appendix C – Historical Data Review and Data Limitations

The following elements about the historical data are topics to be considered before using the data to make waste characterization decisions. If the decision is made to use the historical data, then the usability and limitations of the data should be documented on or attached to Form CP3-WM-0437-F01, "Waste Characterization Documentation", or Form CP3-WM-0437-F05, "PGDP Waste Characterization Verification", as applicable.

Elements

The sampled material is directly related to this waste or to the waste generation process.

1. The characterization/sampling strategy is adequate for characterization of the current material.
2. The Sampling and Analysis Event Plan (SAEP) is available.
3. Field Notes are available.
4. The sampling techniques are known.
5. The sample types are known.
6. The project QC and/or QA are known.
7. The laboratory data qualifiers are known.
8. The analytical methods are known.
9. The analytical methods are appropriate for regulatory decisions.
10. The data has been reviewed, assessed, or validated.

NOTE: If the historical data use is limited, then additional sampling may be required to supplement the historical data, or to be used in the place of it.

Appendix D – Determining Sample Type and Number of Samples

General

A sample is a portion of material taken from a larger quantity of material for the purpose of measuring or estimating the properties or the composition of the larger quantity. The following definitions and descriptions of sample types and their applicability to sample collection are guidance for use in planning a sampling event.

NOTE: Sampling should be performed in accordance with an approved procedure and/or an approved SAEP document. These documents typically identify the number and type of samples to be taken.

Volumetric and Surface Contamination Sampling

- **Volumetric Contamination** is measured when a sample is obtained from a material that has contaminants of concern impregnated or dispersed within.

  A volumetric sample of a material such as paint chips or grease may also be obtained from the surface of nonporous materials. The TSDF option will indicate whether the measured contamination is reported over the surface area or applied to the entire mass of the waste.
- **Surface Contamination** is usually measured by wipe or smear sample and direct radiological measurements. This sampling is appropriate for nonporous objects where the contamination has not permeated the item or material. The units for these samples are usually expressed as contaminant mass per area or activity per area. In order to determine total contamination, the total potentially-contaminated surface area of the waste must be estimated.

  NOTE: Refer to Appendix L for guidance.

Representative versus Biased Sampling

- **Representative Sampling** produces results that can be said to exhibit, on average, the properties of a whole population. In certain circumstances where the waste volume is relatively small, the contaminant or contaminants of concern are uniformly distributed, and waste is consistent over time, a single sample may be representative. Representative sampling is the primary sampling strategy for waste characterization and clean-up verification. Representative sampling is usually obtained through random selection of sampling locations from the population.
- **Biased Sampling** occurs when the contaminants of concern are not representatively sampled. Intentional biased sampling is sometimes desirable if “hot spots” are of concern and sampling locations can be selected based on location or observation. If biased sampling is conducted, then statistical evaluation of the waste is not appropriate.

Random Sample Methods

- **Simple Random Sampling** occurs when each unit in the population has an equal chance of being sampled. It is the default random sampling strategy when there is little information about contaminant distribution and rationale for an alternate strategy does not exist.
- **Systematic Random Sampling** involves randomly selecting the first unit from a population to sample and selecting subsequent units at fixed time or space intervals. This approach ensures that samples selected are distributed more evenly across the population and simplifies the process of selecting units to sample. Note: Systematic random sampling can return inaccurate and/or imprecise data when unrecognized trends or cycles exist in the population.

Appendix D – Determining Sample Type and Number of Samples (Continued)

Random Sample Methods (Continued)

- **Stratified Random Sampling** is appropriate when PK or existing data suggests that the waste can be divided into different categories (or strata) which are similar in composition. Stratified random sampling requires random sampling of each strata, which results in a more precise estimate of the mean concentration of a selected constituent. The mean concentration of a constituent is used in statistical calculations, as described in SW-846, to determine if a waste is hazardous. "Stratified" is the same as "layered" or "phase separated" in liquids. This type of sampling is most effective in reducing uncertainty when enough is known about the waste to minimize variability within each strata. Existing analytical data and PK can be used to stratify the waste so that similar materials are grouped together.

Grab Samples, Individual Representative Samples, and Composite Samples

- **Grab Sampling** is appropriate when PK has been established for a particular homogeneous waste stream that it is well mixed or uniformly contaminated. If that is the case, a grab sample from anywhere from the whole population may be obtained.
- **Individual Random Sampling** is appropriate when there is little or no PK that the material in a waste stream is homogeneous. It may be obtained by collecting and consolidation one or more full cores or by consolidating aliquots multiple randomly-selected locations within the container.
- **Composite Sampling** involves consolidation sample material from more than one container in a population. The advantage of composite sampling is analytical cost savings. The disadvantage is that the measurement of variance is lost. The purpose for sampling and the regulatory or TSDF threshold should be considered before composite sampling is selected.

  NOTE: If the container to be sampled includes heterogeneous waste, then multiple aliquots may be required from the same container and consolidated into one sample.

Phased Sampling

- When there is the potential for distinct physical phases in a waste stream, a full core or mixture of the phases can be sampled and mixed to produce one sample. However, if the sample will phase out (e.g., aqueous and oil mixtures) it may be desirable to sample the phases separately and use the relative proportions of the phases to calculate a weighted average of contamination.

Appendix D – Determining Sample Type and Number of Samples (Continued)

Number of Samples (Non-containerized waste)

It may be desirable to sample while the waste is in situ (i.e., before it is removed) or after it is removed and bulked, but prior to containerization (for example, debris or soil piles). The appropriate number of samples may be ascertained by determining the number of container-equivalents for the in-situ or bulked waste, and then following the requirements of Table D.1: Characterization Sampling or Table D.2: Confirmatory Sampling. If this is not feasible because not all the in-situ waste is accessible for sampling or not desirable because the waste is homogeneous, then other sampling strategies may be selected. Following is a list of references that may be helpful. This list is not all inclusive.

1. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846
2. *Multi-Agency Radiation Survey and Site Investigation Manual*, NUREG-1575, EPA 402-R-97-016, DOE/EH-0624
3. *Field Manual for Grid Sampling of PCB Spill Sites to Verify Cleanup*, EPA-560/5-86-017
4. *Statistical Methods for Environmental Pollution Monitoring*, R. O. Gilbert

Number of Samples (Containerized Waste)

Determination for the number of samples per waste stream is ultimately based on the characteristics of the waste and the threshold against which it is measured. Since each waste stream is unique, alternate methods for quantity determination may be justified and documented as necessary by the characterization personnel.

The guidance outlined below is for individual samples. If composite samples are taken, aliquots from additional drums will be required to produce the number of samples shown below:

1. For waste streams requiring samples to initially characterize the waste, FPDP will typically sample approximately 10% of the number of containers in a given waste stream. For statistical evaluation a minimum of two samples is required. The total number of samples required ensuring completeness to account for up to 20% missing or unusable data is the minimum number of samples plus 20% of the minimum number of samples. Always round up to the highest sample number. Below are a few examples using this approach:

Table D.1: Characterization Sampling

Number of Containers	Minimum Number of Samples	Total Number of Samples for Completeness
5	2	3
21	3	4
112	112 x 0.1 = 11.2 = 12	12 + (12 x 0.2) = 14.4 = 15

Appendix D – Determining Sample Type and Number of Samples (Continued)

2. For waste streams characterized by PK, but requiring confirmatory samples, typically the number of samples required equals a minimum of 10% of the number of containers in a sub-waste stream. However, for sub-waste streams containing more than 34 containers, collecting samples for analyses at a rate of 10% may not be economically feasible or practical. Therefore, FPDP intends to use the 10% method for sub-waste streams with ≤ 34 containers and the cube root method for sub-waste streams with > 34 containers. Below are a few examples using this approach:

Table D.2: Confirmatory Sampling		
Number of Containers	Minimum Number of Samples	Total Number of Samples for Completeness
5	2	3
21	3	4
112	5	6
1250	11	14

If there is any potential of non-aqueous liquid in an aqueous waste stream profile, **then** the default sampling plan (Number of Samples) will be 100%.

3. EPA SW-846 Equation 8 (or a comparable method if Type I and Type II decision errors are considered), is the preferred method to determine the number of samples. However, EPA SW-846 Equation 8 (or a comparable method) requires previous analytical data to determine the mean and associated standard deviation for the analyte with the most restrictive regulatory threshold level. EPA SW-846 Equation 8 (or a comparable method) may be used *a posteriori*, in situations where the acceptable upper limit approximates or exceeds the regulatory threshold value for a given analyte, to determine if additional sample collection and analysis is warranted. In addition, in situations where sufficient previous analytical data exists for a sub-waste stream, EPA SW-846 Equation 8 (or a comparable method) may be used in lieu of the sample frequency identified above.

Appendix E – Determining QA/QC Sample Requirements

General

Quality control samples, which are used to document the accuracy and precision of sampling and analyses, are described below. Additional QA and QC procedures are employed by the laboratories as described in their contracts. Procedure CP3-ES-5003 defines the frequency of collection of QC samples.

Trip Blanks

Trip blanks are prepared in the lab, are carried to the field, and opened during the sampling event. Trip blanks should accompany sample containers to and from the field. These samples can be used to detect any contamination or cross-contamination during handling and transportation. Typically trip blanks are associated with volatile organics analyses and are obtained at a frequency of one per sample batch.

Equipment Blanks

Equipment blanks consist of metal-and/or organic-free water that has been brought into contact with sampling equipment. They are used to detect contamination introduced to a sample from improperly decontaminated sampling equipment. **PCB Wipe Equipment Blanks** are produced by wiping the equipment with hexane-soaked gauze pads.

Field Blanks

Field blanks are equipment blanks that are collected in the field. They are used to detect contamination from sampling equipment, cross contamination from previously collected samples, or contamination from conditions during sampling.

Field Duplicates

Field duplicates are replicate samples that are collected at the same time and from the same location as the original sample. Field duplicates can indicate the variability of contamination within the waste, the precision of the sampling technique, and the variability due to the analytical measurement process.

Appendix F – Statistics Guidance, Documentation and Review

General

Statistical inference may be used to support waste characterization decision-making. This decision-making will be based upon confidence limits determined appropriate based upon the end use of the data. The confidence limit is derived from data generated by random sampling processes.

Evaluation of Sample Distributions

The calculations for the confidence limit used is based on the distribution of the parameter of interest in the population. To identify the type of distribution exhibited (e.g. normal, lognormal, etc.), the distribution of sample results may be evaluated by any or all of the following methods:

- Shapiro-Wilk or equivalent test for normality,
- Visual inspection of the data (such as, a graph or plot of the data),
- Use of other software methods (skewness, kurtosis, etc.).

NOTE: The evaluation of a sample distribution will be based on analytical results reported above the detection limit (i.e. no results for non-detects will be used). Additionally, if there are less than three detects for a particular constituent of concern in a data set, the sample distribution will be assumed to be normal.

If the data is not normally distributed, then evaluate the data per the following guidance:

- Evaluate the PK and the analytical documentation to determine if the distribution is a result of sampling and analysis (Additional sampling and analysis may be required).
- If the data correlates to an apparent stratification of the population and PK substantiates this correlation, then the population may be evaluated as a stratified population.
- If the data is determined to meet an alternate distribution profile, a data transformation and a subsequent acceptable confidence limit may be developed.
- If appropriate transformations do not normalize the data, non-parametric approaches may be utilized to form the required confidence limit.
- Alternatively, additional samples may be collected to expand the number of data points representing the population. These additional data provide a broader base with which to evaluate distributions.

Treatment of "Non-Detect" Values

Table F.1: RCRA/TSCA "Non-Detect" Analytical Data

IF	AND	THEN
The non-detected (ND) results are <15% of the data points		Use ½ the Determination Limit (DL) for the NDs
The ND results are >15% of data the points		Use the DL for all of the NDs
The ND results are 100% of the data points (when the DL is > Regulatory/Profile Limit)	PK indicates the contaminant is not present at or above the regulatory threshold	Perform additional analysis, **OR** Assume the waste is not regulated
	PK indicates the contaminant may be present at or above the regulatory threshold	Assume the waste is regulated

Appendix F – Statistics Guidance, Documentation and Review (Continued)

Table F.2: Radiological Analytical Data Treatment		
IF the analytical result for a given radionuclide is:	**AND** Process Knowledge indicates:	
	The nuclide is not present, **THEN**	The nuclide may be present, **THEN**
Reported as zero or a negative value	Assume not present	Assume not present, **OR** Assume reported detection limit
Reported as a positive value, and qualified as a ND	Assume not present	Assume reported value, **OR** Assume reported detection limit
Detected	Assume not present	Assume reported value
Comments: Depending on the requirements of the TSDF WAC and/or the risk level deemed acceptable, the Total Propagated Uncertainty (TPU) may be added to the radionuclide result that is selected for use.		

Treatment of Duplicate Analyses

Sample duplicate analyses are an integral part of SW-846 quality assurance protocol and are used to measure sampling and analytical performance in terms of precision (reproducibility).

A sample and its duplicate are designed to be equivalent, (such as, sampled and analyzed in precisely the same manner) therefore any distinction between a sample and its duplicate is arbitrary. For purposes of statistical treatment of data, the average value of duplicate analyses for each constituent for a given sample may be used for calculating statistics, or the more conservative value may be used, depending on the use of the data.

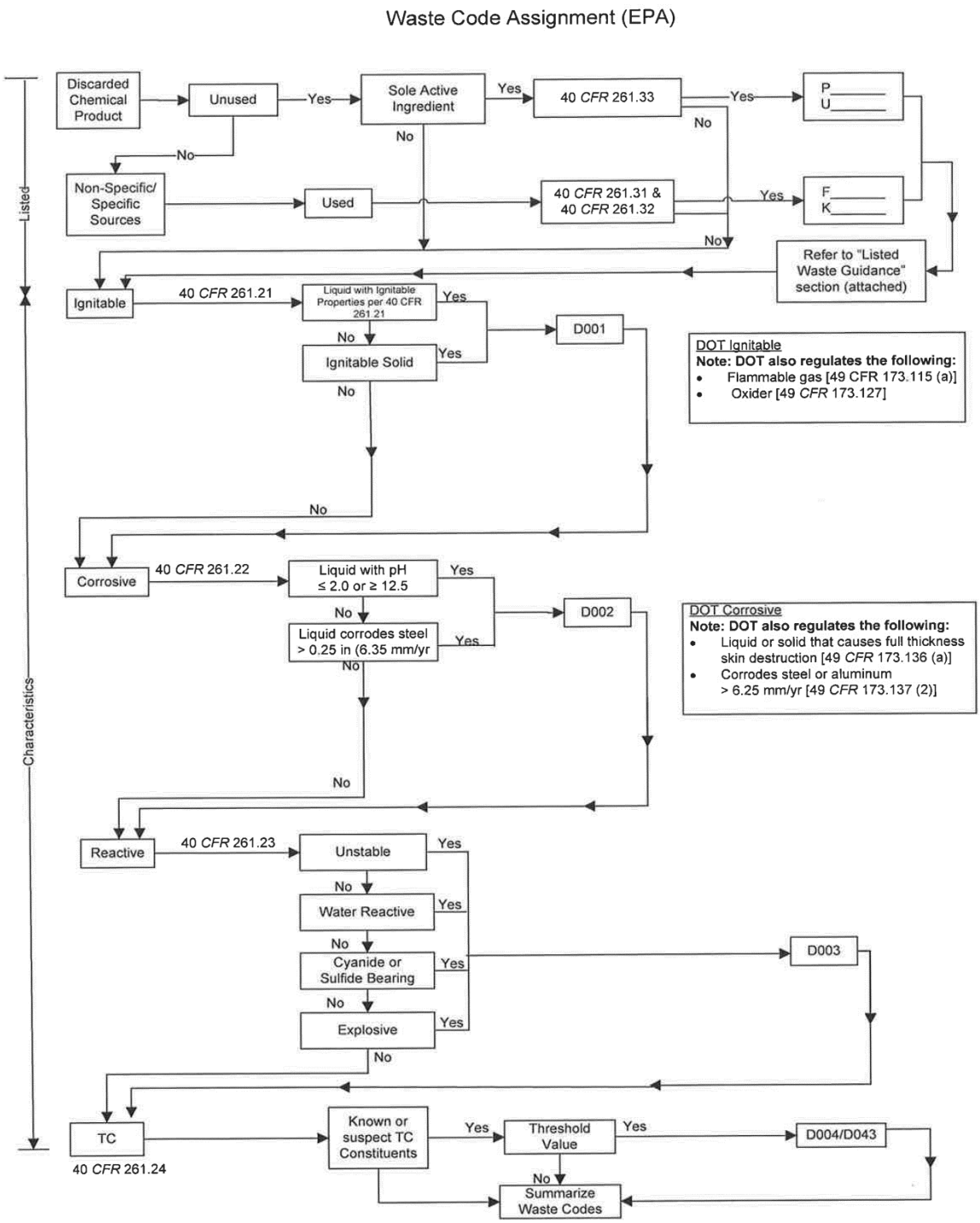
NOTE: For statistical evaluation of a sub-group, a sample and its duplicate are not considered to be two separate samples.

Forming the Acceptable Confidence Limit

Based upon the distribution of the sample results, an appropriate confidence limit may be developed to support decision-making. A minimum of two data points is required in order to compute a confidence limit. All data (including non-detects treated as described above) will be used to compute the confidence limit.

NOTE: Statistical evaluations used are documented on the *Waste Characterization Documentation* Form (CP3-WM-0437-F01), or *PGDP Waste Characterization Verification Form* (CP3-WM-0437-F05) as appropriate.

Appendix G – RCRA Determination



Appendix G – RCRA Determination (Continued)

NOTE: Most states have RCRA characteristic limits that are consistent with the Federal regulations. Specific environmental requirements for each disposal state must be determined.

Listed Waste

Discarded Chemical Products

Discarded chemical products must meet the following criteria:

- Unused
- Sole Active Ingredient (Not mixtures)
- Specifically listed in 401 *KAR* 31:040, Section 4 in one of two categories:
  - "P" Chemical Products: Designated as Dangerous Waste (DW) and Acutely Hazardous Waste (AHW) [Waste Codes: P_ _ _].
  - "U" Chemical Products: Designated as DW [Waste Codes:U _ _ _].

Discarded Chemical Products include:

- Commercial chemical products
- Off-specification chemical products
- Spill cleanup of materials designated as a discarded chemical product
- Residues or inner liners in non-empty containers which held a "P" chemical product

NOTE: If the containers meet the definition of empty in 401 *KAR* 31:010 Section 7(1)(a), the residues are excluded from regulation.

Dangerous Waste Sources

Dangerous waste sources fall into one of two categories:

1. Non-Specific Source: These are generically listed in 401 *KAR* 31:040, Section 2, consist mostly of "spent material" [Waste Codes: F _ _ _].

   Definitions

   Spent Material: Any material that has been used, and as a result of contamination, can no longer serve the purpose for which it was produced without reprocessing.

   Degreasing: The removal of grease, wax, dirt, oil, and other undesirable substances from various materials, through cold cleaning, vapor degreasing (open top), vapor degreasing (conveyorized), and fabric scouring.

2. Specific Sources: These are processes specifically listed in 401 *KAR* 31:040, Section 3 [Waste Code: K _ _ _].

Mixture Rule

- A mixture of a solid waste and one or more listed hazardous wastes is classified as hazardous waste and bears the same EPA hazardous waste number as the one for the listed waste in the mixture.

- A mixture of a solid waste and one or more characteristic hazardous wastes is classified as hazardous waste, unless the mixture does not exhibit any of the hazardous waste characteristics.

Appendix G – RCRA Determination (Continued)

NOTE 1: Intentionally mixing waste to eliminate waste codes is not allowed.

NOTE 2: LDRs and UHCs still apply.

Derived-from Rules

- Residues derived from the treatment of characteristic wastes are hazardous only if they continue to exhibit a characteristic.
- Residues from the treatment of listed wastes remain listed wastes.

Contained-in Policy

- The contained-in policy (codifed in August 1992) allows the EPA to regulate environmental media outside the scope of the Mixture Rule.
  1. If environmental media (i.e., soil, groundwater, sediment, etc.) contains a hazardous waste, then it too must be managed as a hazardous waste.
  2. With a state-approved "no longer contains" determination, wastes subject to the "contained-in" policy cease to be hazardous waste when the hazardous constituents are completely removed, or reduced below a specifically agreed level based on health-risk criteria.

NOTE 1: This "Contained-in Determination" is only applicable in the state or EPA region that grants it. (i.e. If granted by the state of Kentucky, it will not apply at disposal sites outside of Kentucky). Concurrence by the receiving state must be obtained.

NOTE 2: LDR and UHCs still apply.

Listed Waste Guidance (From Flowchart)

Summary of 40 *CFR* 261.31, 32, and 33

- **IF** the waste is environmental media (soil, sediment, water), or debris that contains or is contaminated with a listed waste, **AND** it is from an area or waste stream with an approved "contained-in" or "contaminated with" determination for a specific code, **AND** the waste meets the condition of the determination, **THEN** the listed code would no longer apply.

- **IF** a listed waste code applied, **THEN** perform one of the following:
  - Apply the waste code, issue a listed waste determination memorandum, and distribute
  - Work with Regulatory Compliance Specialist to seek a "contained-in" or "contaminated with" determination or a "Delisting" petition would be appropriate.

- Contact Regulatory Compliance Specialist for additional guidance as necessary.

Appendix G – RCRA Determination (Continued)

Full Radiological and Metal Suites for Waste Characterization

Table G-1: Metal Suites for Waste Characterization

Name	TCLP and/or Bulk Method	TCLP Units	Bulk Units	Purpose for Analysis
Arsenic	EPA SW-846-6010	mg/L	mg/Kg	RCRA Characterization Determination
Barium	EPA SW-846-6010	mg/L	mg/Kg	RCRA Characterization Determination
Cadmium	EPA SW-846-6010	mg/L	mg/Kg	RCRA Characterization Determination
Chromium	EPA SW-846-6010	mg/L	mg/Kg	RCRA Characterization Determination
Lead	EPA SW-846-6010	mg/L	mg/Kg	RCRA Characterization Determination
Mercury	EPA SW-846-7470/7471	mg/L	mg/Kg	RCRA Characterization Determination
Selenium	EPA SW-846-6010	mg/L	mg/Kg	RCRA Characterization Determination
Silver	EPA SW-846-6010	mg/L	mg/Kg	RCRA Characterization Determination
Antimony	EPA SW-846-6010	mg/L	mg/Kg	Relevant UHC
Beryllium	EPA SW-846-6010	mg/L	mg/Kg	Relevant UHC
Nickel	EPA SW-846-6010	mg/L	mg/Kg	Relevant UHC
Thallium	EPA SW-846-6010	mg/L	mg/Kg	Relevant UHC
Zinc	EPA SW-846-6010	mg/L	mg/Kg	Energy*Solutions* WAC Requirement

Notes
RCRA limits for characteristics are in units of mg/L Toxicity Characteristic Leachate Procedure (TCLP).
Universal Treatment Standards for Underlying Hazardous Constituents (UHCs) are in units of mg/L (TCLP)

Appendix H – TSCA Determination – PCBs

PCB Category			Definition	Disposal Options
PCB Articles	**A PCB Article is any manufactured article, other than a PCB Container, that contains PCBs and whose surfaces have been in direct contact with PCBs. "PCB Article" includes capacitors, transformers, electric motors, pumps, pipes and any other manufactured item (1) which is formed to a specific shape or design during manufacture, (2) which has end use functions dependent in whole or in part upon its shape or design during end use, and (3) which has either no change composition during its end use or only those changes of composition which have no commercial purpose separate from that of the PCB Article.**			
	PCB Transformers		Any transformer that contains ≥ 500 ppm PCBs	**40 *CFR* 761.60(b)(1)** **(1) Incinerator, or** **(2) Chemical waste landfill provided that all free-flowing liquid is remove from the transformer, the transformer is filled with a solvent, the transformer is allowed to stand for at least 18 continuous hours, and then the solvent is thoroughly removed.**
	PCB Capacitors (intact and non-leaking)		**Any capacitor that contains ≥ 500 ppm PCBs. Capacitor is a device for accumulating and holding a charge of electricity and consisting of conducting surfaces separated by a dielectric. Assume PCBs ≥ 500 ppm in a capacitor of unknown concentration made prior to July 2, 1979. Assume PCBs < 50 ppm in a capacitor made after July 2, 1979.**	
		PCB Small Capacitors	A capacitor which contains less than 3 lbs of dielectric fluid. A capacitor whose total volume is less than 100 cubic inches may be considered to contain less than 3 lbs of dielectric fluid. Includes fluorescent light ballasts containing intact and non-leaking capacitors and PCB potting material (< 50 ppm).	**40 *CFR* 761.60(b)(2)(ii)** **Municipal landfill**
		PCB Large High or Low Capacitors	A large high voltage capacitor contains 3 lbs or more of dielectric fluid and which operates at or above 2,000 volts. A large low voltage capacitor contains 3 lbs or more of dielectric fluid and which operates below 2,000 volts.	**40 *CFR* 761.60(b)(2)(iii)** **(1) Incinerator, or** **(2) Chemical waste landfill under special circumstances if approved by the EPA.**
	PCB Hydraulic Machines		**Includes die casting machines**	**40 *CFR* 761.60(b)(3)** **Drain all free flowing liquid, and if liquid is > 1,000 ppm, then** **(1) Decontaminate in accordance with 761.79, or** **(2) Flush with a solvent** **(3) Dispose via footnote A below**

Appendix H – TSCA Determination - PCBs (Continued)

PCB Category			Definition	Disposal Options
PCB Articles (Continued)	PCB-Contaminated Electrical Equipment		Any electrical equipment (such as transformers, capacitors, and circuit breakers, including those in railroad locomotives and self-propelled cars) which contain ≥ 50 ppm and < 500 ppm PCBs in the dielectric fluid. In the case of dry electrical equipment, the electrical equipment is PCB-contaminated if it has PCBs > 10 ug/100cm^2 and < 100 ug/100cm^2 as measured by a standard swipe test (40 *CFR* 761.123).	**40 *CFR* 761.60(b)(4)/761.60(b)(6)(ii)(A)** **Drain all free-flowing liquids** **Dispose via footnote A below**
	Other PCB Articles	PCB Articles (≥ 500 ppm PCBs)		**40 *CFR* 761.60 (b)(6)(i)** **(1) Incinerator or** **(2) Chemical waste landfill provided that all free-flowing liquid PCBs have been thoroughly drained from the article.**
		PCB Contaminated Article	Any article which contains ≥ 50 ppm and < 500 ppm PCBs in the dielectric fluid. In the case of dry electrical equipment, the electrical equipment is PCB-contaminated if it has PCBs > 10 ug/100cm^2 and < 100 ug/cm^2 as measured by a standard swipe test per 40 *CFR* 761.123.	**Drain all free-flowing liquid** **Dispose via footnote A below**
PCB Containers	**Any package, can, bottle, bag, barrel, drum, tank, or other device that contains PCBs or PCB articles and whose surfaces have been in direct contact with PCBs.**			
	< 500 ppm PCBs			**40 *CFR* 761.60(c)(2)** **(1) Municipal solid waste landfill provided that all free-flowing liquid PCBs have been thoroughly drained from the container.**
	≥ 500 ppm PCBs			**40 *CFR* 761.60 (c)(1)** **(1) Incinerator, or** **(2) Chemical waste landfill provided that all free-flowing liquid PCBs have been thoroughly drained from the container, or** **(3) Decontaminate the container per 40 *CFR* 761.79** **Note: 40 *CFR* 761.30(u)(1)(ii) allows reuse of the container without decontamination if the standard is met.**

Appendix H – TSCA Determination - PCBs (Continued)

PCB Category		Definition	Disposal Options
PCB Remediation Waste	**PCB Remediation waste is waste containing PCBs as a result of a spill, release, or other unauthorized disposal, at the following concentrations: (1) Materials disposed of prior to April 18, 1978, that are currently at concentrations ≥ 50 ppm PCBs, regardless of the concentration of the original spill; (2) materials which are currently at any volume or concentration where the original source was ≥ 500 ppm PCBs beginning on April 18, 1978, or ≥ 50 ppm PCBs beginning on July 2, 1979; and (3) materials which are currently at any concentration if the PCBs are spilled or released from a source not authorized for use under this part. PCB remediation waste means soil, rags, and other debris generated as a result of any PCB spill cleanup, including, but limited to soil, gravel, dredged materials, such as sediments, settled sediment fines, and aqueous decantate from sediment, sewage sludge containing < 50 ppm PCBs, buildings and other man-made structures (such as concrete floors, or walls) porous surfaces, and non-porous surfaces. Unless sampled and analyzed IAW 761.283, .286, or .292, the waste shall be assumed to contain ≥ 50 ppm PCBs (40 *CFR* 761.61(a)(5)(i)(B)(2)(i).**		
	Non-liquid Cleaning Materials and PPE	Includes non-porous surfaces and other non-liquid materials such as rags, gloves, booties, other disposable PPE, and similar materials resulting from PCB cleanup activities.	**40 *CFR* 761.61(a)(5)(i)(B)(2)(ii) → 761.61(a)(5)(v)(A)** **(1) Decontamination per 761.79** **(2) Municipal solid waste landfill, or** **(3) Non-municipal, non-hazardous waste landfill, or** **(4) Hazardous waste landfill permitted by a State authorized under section 3006 of RCRA, or** **(5) Chemical waste landfill**
	< 50 ppm or < 100 ug/100cm^2		
	≥ 50 ppm or ≥ 100 ug/100 cm^2		**40 *CFR* 761.61(a)(5)(i)(B)(2)(iii)** **(1) Hazardous waste landfill permitted by a State authorized under section 3006 of RCRA, or** **(2) Chemical waste landfill**
PCB Bulk Product Waste	**Waste derived from manufactured products containing non-liquid state, at any concentration where the concentration at the time of designation for disposal was ≥ 50 ppm PCBs. Includes bulk wastes or debris from the demolition of buildings and other man-made structures manufactured, coated, or serviced with PCB.**		
	Presumed or known to leach < 10 ug/L PCBs	Plastics (such as plastic insulation from wire or cable; radio, television, and computer casings; vehicle parts; or furniture laminates); preformed or molded rubber parts and components; applied dried paints, varnishes, waxes, or other similar coatings or sealants; caulking; asbestos; non-liquid building demolition debris; or non-liquid PCB bulk product waste from the shredding of automobiles or household appliances from which PCB small capacitors have been removed (shredder fluff). Other PCB bulk product waste that leaches PCBs < 10 ug/L of water measured using a procedure used to simulate leachate generation.	**40 *CFR* 761.61(b)(1)** **(1) Municipal solid waste landfill, or** **(2) Non-municipal, non-hazardous waste landfill**
	Presumed or known to leach ≥ 10 ug/L PCBs	**Paper or felt gaskets, fluorescent light ballasts with PCBs in the potting materials ≥ 50 ppm.**	**40 *CFR* 761.62(a)(3)** **(1) Municipal solid waste landfill, or** **(2) Non-municipal, non-hazardous waste landfill**

Appendix H – TSCA Determination - PCBs (Continued)

PCB Category	Definition	Disposal Options
PCB Household Waste	PCB waste generated by residents on the premises of a temporary or permanent residence for individuals and is composed primarily of materials found in their homes.	**40 *CFR* 761.63** **(1) Municipal solid waste landfill or** **(2) Non-municipal, non-hazardous waste landfill**
PCB Wastes from Research & Development	Demonstrations for commercial PCB disposal approvals, pre-demonstration tests, test of major modifications to previously approved PCB disposal technologies, treatability studies for PCB disposal technologies which have been approved, development of new disposal technologies, and research on chemical transformation processes including, but not limited to, biodegradation. (non-liquid only)	**40 *CFR* 761.64** **(1) Decontamination per 761.79** **(2) Municipal solid waste landfill or** **(3) Non-municipal, non-hazardous waste landfill**
Footnote A		**(1) Decontamination per 761.79 (not necessary if initial decontamination was performed adequately) or** **(2) Municipal solid waste landfill or** **(3) Non-municipal, non-hazardous waste landfill or** **(4) Scrap metal recovery oven or smelter or** **(5) Incinerator or** **(6) Chemical waste landfill**

Appendix I – TSCA Determination - Asbestos Containing Material

Introduction

Asbestos is regulated by the Environmental Protection Agency under the Toxic Substance Control Act (TSCA) and the Clean Air Act (CAA). Waste water treatment standards for asbestos are regulated under the Clean Water Act.

The regulatory threshold, with the exception of the Clean Water Act, is at 1% by weight friable asbestos. Friable asbestos is defined as asbestos fibers in a matrix that can be "crumbled, pulverized, or reduced to a powder with hand pressure when dry."

The state of Kentucky has primacy for implementing all regulations applicable to asbestos. The federal regulations for asbestos are spelled out in 40 *CFR* 61 and 763.

Definitions

Asbestos Containing Material (ACM): Any material containing more than 1% asbestos. Visual inspection may lead to the suspicion that the material is ACM, but actual determination can only be made by instrument analysis.

NOTE 1: Laboratory reports for asbestos may show a percentage reported for "asbestos," which may indicate a sum of all the individual types of asbestos. Laboratory reports may also show individual asbestos types, as listed below.

Asbestos Mineral Fibers

- Chrysotile (also called white asbestos)
- Tremolite
- Actinolite
- Anthophyllite
- Crocidolite (also called blue asbestos)
- Amosite (also called brown asbestos)

NOTE 2: ACM may be Regulated ACM (RACM) based on its form as outlined below:

Friable Asbestos - Containing Material: Friable asbestos material is defined as asbestos-containing material that when dry, can be crumbled, pulverized, or reduced to a powder with hand pressure.

Nonfriable Asbestos - Containing Material: Nonfriable asbestos-containing material is defined as asbestos-containing material that when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.

Category I Nonfriable Asbestos: Packings, gaskets, resilient floor covering, and asphalt roofing products/mastic/sealants. Per EPA this Category I Nonfriable material if determined to be "in good condition" and "nonfriable" by the Asbestos Inspector may be disposed of as ordinary construction waste instead of ACM waste.

Category II Nonfriable Asbestos: Other nonfriable asbestos not included in Category I.

Appendix I – TSCA Determination - Asbestos Containing Material (Continued)

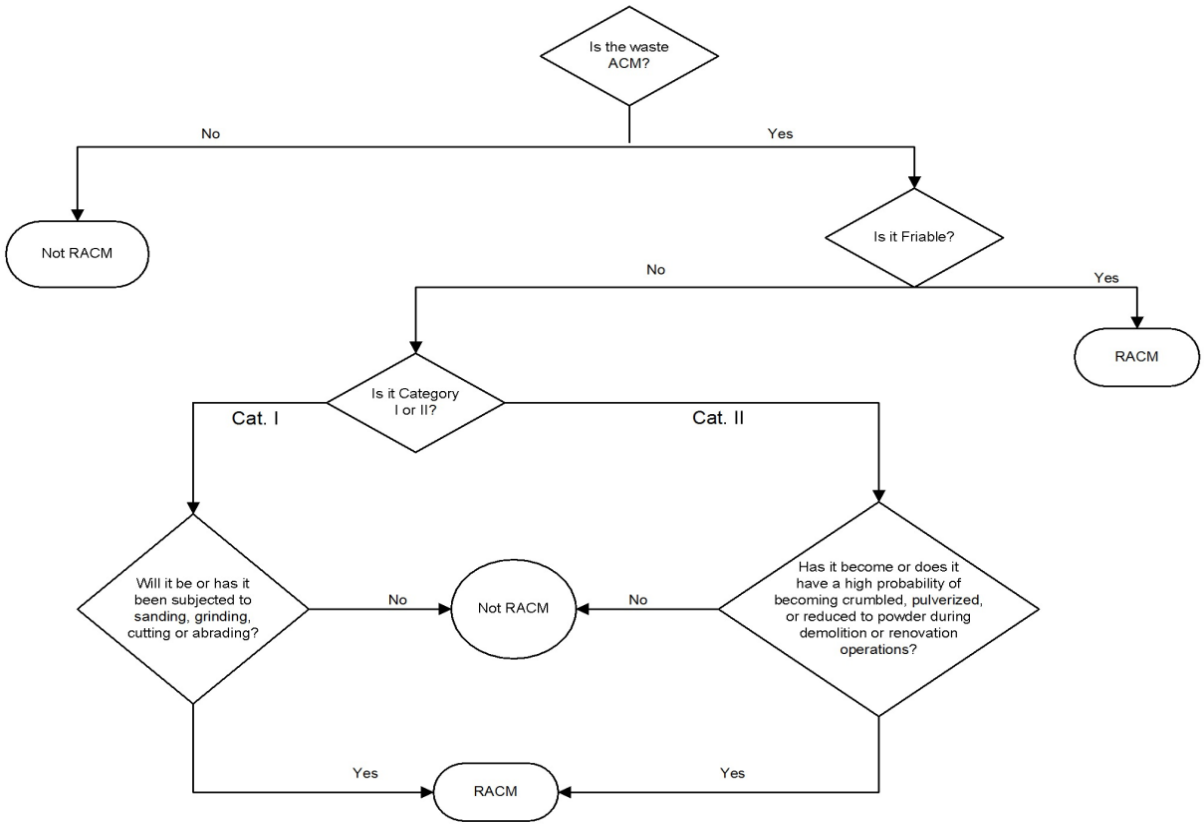
Asbestos Competent Person: A person who, through training and/or experience, is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees; and who has authorization to take prompt corrective measures to eliminate them. CP3-HS-2025, *Competent Person Program*, must be followed to ensure the proper protocol is followed as a competent person. In addition, for Class I and Class II work who is specially trained in a training course which meets the EPA's Model Accreditation Plan (40 *CFR* part 763) for supervisor, or its equivalent.

Regulated Asbestos Containing Material (RACM): RACM is defined as (a) Friable asbestos material, (b) Category I Nonfriable ACM that has become friable, (c) Category I Nonfriable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading, or (d) Category II Nonfriable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of demolition or renovation operations.

Analytical Methods

The analytical method for determining if asbestos is regulated is EPA/600/R-93-116, *Method for the Determination of Asbestos in Bulk Building Materials*. The method for determining asbestos in water is EPA/600/4-83-043, *Analytical Method for the Determination of Asbestos Fibers in Liquids*.

Asbestos Characterization



Appendix J – Radiological Evaluation

NOTE: For the purpose of radiological characterization, specific activities, as listed in 49 *CFR* 173.435, will be used.

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I. Definitions

High-Level Waste is the highly radioactive waste material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations; and other highly radioactive material that is determined, consistent with existing law, to require permanent isolation. **Note:** None are present at the PGDP.

Transuranic Waste is radioactive waste containing more than 100 nCi/g (3,700 bq/g) of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, except for:

(1) High-level radioactive waste;

(2) Waste that the Secretary of Energy has determined, with the concurrence of the Administrator of the Environmental Protection Agency, does not need the degree of isolation required by the 40 *CFR* Part 191 disposal regulations; or

(3) Waste that the Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with 10 *CFR* Part 61.

Low-Level Waste is radioactive waste that is not high-level radioactive waste, spent nuclear fuel, transuranic waste, byproduct material (as defined in section 11e.(2) of the Atomic Energy Act of 1954, as amended), or naturally occurring radioactive material.

Appendix J – Radiological Evaluation (Continued)

II. Basic Information

A. Common Isotopes at the PGDP

Table J.1: Common Isotopes at the PGDP

Isotope	Decay Mode	Analytical Method		Nuclide Type	C-746-U Landfill Limit	10 *CFR* 61.55			
		Preferred	Alternate			Table 1 Limit	Table 2 Limits		
							Column 1	Column 2	Column 3
Am-241	α, γ	Alpha Spec.	Gamma Spec.	F, T	70 pCi/g	100 nCi/g	N/A	N/A	N/A
Co-60	β, γ	Gamma Spec.	N/A	N/A	N/A	N/A	700 Ci/M3	N/A	N/A
Cs-137	β, γ	Gamma Spec.	N/A	N/A	38 pCi/g	N/A	1 Ci/M3	44 Ci/M3	4,600 Ci/M3
K-40	β, γ	Gamma Spec.	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Np-237	α, γ	Alpha Spec.	Gamma Spec.	F, M, T	11 pCi/g	100 nCi/g	N/A	N/A	N/A
Pu-238	α	Alpha Spec.	Gamma Spec.	F, T	78 pCi/g	100 nCi/g	N/A	N/A	N/A
Pu-239/240	α, γ	Alpha Spec.	Gamma Spec.	F, T	72 pCi/g	100 nCi/g	N/A	N/A	N/A
Sr-90	β, γ	Liquid Scintillation	Gamma Spec. or Gas Proportional Counting	N/A	N/A	N/A	0.04 Ci/M3	150 Ci/M3	7,000 Ci/M3
Tc-99	β, γ	Liquid Scintillation	N/A	M	104 pCi/g	3 Ci/M3	N/A	N/A	N/A
Th-228	α	Alpha Spec.	N/A	N/A	8 pCi/g	N/A	N/A	N/A	N/A
Th-230	α	Alpha Spec.	N/A	N/A	200 pCi/g	N/A	N/A	N/A	N/A
Th-232	α	Alpha Spec.	Gamma Spec.	N/A	8 pCi/g	N/A	N/A	N/A	N/A
Th-234	β, γ	Determine from U-238, unless not in secular equilibrium		N/A	320 pCi/g	N/A	N/A	N/A	N/A
U-235 wt%	N/A	Mass Spec.	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U-235 Mass (Note 2)	N/A	Mass Spec.	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total U Mass	α	Mass Spec.	N/A	N/A	150 pCi/g	N/A	N/A	N/A	N/A
U-234	α, γ	Calculate using assay and Total Uranium		N/A	320 pci/g	N/A	N/A	N/A	N/A
U-235	α, γ	Calculate using U-235 mass and U-235 specific activity		F	13 pCi/g	N/A	N/A	N/A	N/A
U-238	α, γ	Calculate using assay and Total Uranium		N/A	320 pCi/g	N/A	N/A	N/A	N/A

Nuclide Type F = Fissile M = Mobile T = Transuranic (TRU)

Note 1: Analysis for other nuclides may be required for some TSDFs.

Note 2: For shipments to facilities other than NNSS, the maximum allowable measurement TPU at one sigma (for material with enriched uranium) is 15% or 1.295E-4 grams for Uranium concentrations that approach TSDF license limits. Uncertainty may be greater for lower concentrations of special nuclear material.

Appendix J – Radiological Evaluation (Continued)

B. Radiological Waste Classification

The purpose of classification is to identify near-surface landfill restrictions. This determination is based on certain long-lived and short-lived radionuclides (found in Tables 1 and 2 in 10 *CFR* §61.55). The calculations are based on the following:

- Calculations are based on the sum of fractions
- If waste contains both Table 1 and Table 2 isotopes, each will be calculated separately
- The classification is based on the table below:

Table J.2: Radiological Waste Classification

Table 1 Sum of Fractions[A] → **Table 2 Sum of Fractions[A] ↓**	**NA**	**< 0.1**	**> 0.1 and < 1.0**	**>1.0**
NA	Class A	Class A	Class C	Greater than Class C
Column 1 < 1.0	Class A	Class A	Class C	Greater than Class C
Column 1 >1.0 and Column 2 <1.0	Class B	Class B	Class C	Greater than Class C
Column 2 >1.0 and Column 3 <1.0	Class C	Class C	Class C	Greater than Class C
Column 3 > 1.0	Greater than Class C	Greater than Class C	Greater than Class C	Greater than Class C

Note [A] Table 1 and Table 2 (Column 1-3) values are included in Table K.1 above.

C. Scaling Factors

A scaling factor is a ratio between a radionuclide that is easy to measure and one or more radionuclides that may be difficult to measure. These ratios are determined by PK or analysis for a particular waste stream. Once the concentration of the easy-to-measure radionuclide is determined, the presence and concentration of the other radionuclides can be calculated using the scaling factor. Scaling factors are often imprecise and dependent on limited or widely scattered data. When a scaling factor is used, information on how the scaling factor was developed and the nature of the original data used to determine the scaling factor must be documented.

Appendix J – Radiological Evaluation (Continued)

NOTE: Scaling factors can apply to laboratory analytical data or field measurements. They should only be used when there is a consistent source of contamination (i.e. process, system, etc.) such that a consistent distribution of isotopes is expected.

D. Unit Conversions

- 1 mr/hr = 30,000 DPM
- 1 Ci = 2.22E+12 DPM (or 3.70 E+10 DPS)
- 1 Ci = 3.70 E+10 Bq
- 1 Bq = 60 DPM (or 1 DPS)

III. Radiological Characterization Methods

Radionuclide characterization consists of identifying the specific radionuclides present in a material and the concentration of those nuclides. Radionuclide characterization occurs through the use of PK and/or sample analysis. Typically, the D&R contractor utilizes one or more of the following methods as applicable for a given waste stream or waste container:

A. Radioactive Sealed Source Calculations

A sealed radioactive source is defined as a radioactive material that is contained in a sealed capsule, sealed between layers of non-radioactive material, or firmly fixed to a non-radioactive surface by electroplating or other means. In addition, a leaking source, by definition, cannot be considered sealed.

Provisions
Characterization of sources should meet the following provisions for the Sealed Source method:

- The sources are considered "sealed" per the definition above.
- Appropriate documentation exists to conduct characterization as specified in this section.
- The appropriate TSDF WAC should be consulted to determine if additional requirements or waivers to these provisions exist.

Method

Since most, if not all, sealed sources are well documented (e.g., vendor information, NMC&A records, etc.), they can be characterized via PK. In some cases, however, there may be sealed sources that lack the documentation necessary to demonstrate the characteristics of the source. In these cases, other methods for determining radioactive content must be pursued consistent with this procedure (e.g., direct assay).

NOTE: In general, radioactive sources destined for NNSS should be characterized using the criteria defined in Appendix M. If a sealed source is to be disposed of at a site other than NNSS, that facility's WAC should be consulted for any additional constraints.

Appendix J – Radiological Evaluation (Continued)

B. Sampling and Laboratory Analysis of Volumetrically Contaminated Waste

This method relies on measurement of radionuclides present in a representative sample or samples to characterize bulk quantities of radioactive materials. Characterization of package activities through sampling can involve analysis for beta, gamma, and/or alpha emitting constituents. In most cases, if the radionuclide mixtures are consistent throughout a waste stream, isotopic distributions can be established for the waste and specific activities can be calculated based on the measured isotope and scaling factors for non-measurable isotopes.

Provisions

Sampling of the waste material for the purposes of determining package activities can be used provided the following provisions are met:

- DQO statements and associated information are documented.
- Sampling and analysis plans, or equivalent are developed.
- The samples for direct measurement quantification are obtained from sub-groups of the waste stream that are representative of the waste materials to be packaged (e.g., sewage sludge, sand filter media, ion exchange resin, etc.).
- The waste must be homogenous or the SAEP must address the homogeneity of the waste.
- The waste stream contains radionuclides that are readily measurable with sufficient sensitivity to ensure that requirements in the TSD WAC are met.

Method

Radioactive package quantification through sampling and analysis relies on two types of methods:

- Measurement of scaled isotopes, or
- Measurement of all appropriate isotopes within the waste.

NOTE 1: Non-Detect values are addressed in Appendix F.

NOTE 2: Selection of laboratory analysis associated with radioisotopes found at the PGDP should consider the mode of decay in selecting the proper analytical method (i.e. alpha spectroscopy, gamma spectroscopy, gross α, gross β, etc.) (See Table K.1).

C. Material Accountability

This method is appropriate when a given quantity and concentration of radioactive material is known within a waste container. This premise can be applied to actual materials in the waste or may be inferred from measurement of the difference between the quantity of radioactive material entering and exiting the process that generated the waste. Use of this method can be applied to radiotracer spike additions, non-sealed sources, controlled radioactive material tests, special nuclear material, and by-product materials.

Appendix J – Radiological Evaluation (Continued)

Provisions
The material accountability method may be used to quantify radioactive content within a waste package provided the following provisions are met:

- For radioactive laboratory spikes, non-sealed sources, special nuclear material, and by-product material, the quantities of radioactivity in the waste are to be documented in records, which can be referenced.
- For controlled radioactive material tests, or where influent and effluent radioactivity will be measured to determine the quantity in the waste, the number and quantity of radionuclides present must be known and relatively constant throughout the process.

Method
Basically, two methods are employed for determining waste package activities using material accountability. If the waste stream is contaminated with radioactive spikes, non-sealed sources, and other known quantities of radioactivity as of a certain date, then the activity can be determined by decay correcting each waste parcel and summing the activities for each waste package.

For waste streams generated from processes where influent and effluent radioactivity concentrations are known and constant, the activity of the waste resulting from the processing can be determined by the following steps:

- Determine the total amount of each radioisotope in the waste by calculating the difference between the influent and effluent radioactive material (mCi/g, µCi/g, mCi/cm3, µCi/cm3, etc.).
- Multiply the radioisotope concentration (i.e., on a weight or volumetric basis) by the total weight or volume of waste in a package. Use appropriate unit conversion.

All supporting documentation (i.e., laboratory notebooks, vendor specifications, NMC&A records, etc.) should be appropriately referenced and readily available for each package of radioactive waste characterized by materials accountability. All calculations used to arrive at isotopic concentrations and waste package content are to be documented and filed for each waste container.

D. Wipe-to-Curie

This method relies on smear data from surface contamination on items/equipment in conjunction with an estimate of the total surface area of the item/equipment.

Provisions
Wipe-to-Curie for contaminated equipment may be employed if the following provisions are met:

- The equipment is predominantly surface contaminated (no significant accumulation of radioactive material).
- The contaminated surface area can be accurately calculated (both internal and external, if applicable).
- The removable and total contamination levels can be estimated (wipe efficiency).
- Isotopic distributions are known and scaling factors have been calculated.

Appendix J – Radiological Evaluation (Continued)

Method
The Wipe-to-Curie method for surface contaminated equipment relies on measurement of wipes taken from the actual equipment. Note that direct reading measurements can be utilized in the place of (or as a supplement to) wipes for characterization of surface contamination. The quantification of individual isotopes can be accomplished through individual analysis of the isotopes or through the use of scaling.

E. Field Methods

1. Non-Destructive Assay via Gamma Spectroscopy

Non-destructive assay (NDA) via gamma spectroscopy is a viable method for those waste streams containing radionuclides that emit gamma radiation of sufficient energy and intensity.

Provisions
NDA of the waste may be an appropriate method provided the following provisions are satisfied:

- The waste stream contains at least one radionuclide in sufficient abundance that it can be accurately quantified through the use of NDA equipment.
- Other non-detectable radionuclides can be assessed because appropriate scaling factors have been developed and documented based on the isotopic distribution of the waste stream.
- The geometry, radionuclide distribution, and shielding of the item being assayed is known or can be adequately modeled in order to determine detection efficiency.

NDA measurement data may be used if it originates from a DOE Approved QSNDA Program or it is historical NDA measurement data that was collected under a DOECAP approved NDA Program and proper verification of data usability, via visual examination and/or physical weight comparisons with like components, has taken place.

Method
NDA is performed through direct measurement of the waste package. The activity of directly assayed radionuclide(s) is reported and all other non-measurable radionuclides are scaled accordingly.

2. Surface Contaminated Objects (SCO) Characterization and Field Survey Requirements

a. SCO Characterization

Characterization of SCO must be formally documented. The documentation process may be accomplished by either 1) utilizing the approved Site SCO worksheet or 2) defining the project specific data applied to the SCO material and obtaining independent verification of the data used. SCO materials destined for disposal at the C-746-U Landfill are subject to the requirements in DOE document titled *Authorized Limits Request for Solid Waste Disposal at C-746-U Landfill at the Paducah Gaseous Diffusion Plant*.

Appendix J – Radiological Evaluation (Continued)

The Site SCO worksheet will calculate the activity of Isotopes associated with SCO and allow for additional amounts of volumetrically contaminated material found in a waste container to be added to the calculation. Verification of the volumetric data may be required per the Calculation Verification Guidance found in Appendix L. The following information is needed prior to using the SCO worksheet:

Correct Waste Profile Number that Waste is to be Shipped Under
Waste Origin (i.e., C-340, C-410, East End Smelter, Site Process Equipment)
RFD Number
WID Number
Container ID Number
Container Barcode
Weight Ticket for container (i.e., Container Gross Weight, Net Waste Weight)
Weight of SCO in container
Weight of volumetric contaminants in container
Volume of Volumetric Materials
Volumetric Material Isotopic Activities
Volume of SCO in container
Size of SCO in container (See Table K.5. for guidance)
Maximum Fixed and Removable Alpha and Beta Survey Results

b. <u>SCO Screening Criteria</u>

Note: The SCO screening protocols, may be implemented in either of two ways.

1. SCO screening may be done in advance or independently of any waste packaging activities. In this case, each individual object or collection of like objects screened must be marked with a unique identifying number (i.e. HP item number). If the object or collection of like objects passes the screening criteria described below it must be marked "OK."
2. SCO screening may be done in conjunction with and to support waste packaging activities, but only in the presence of a WPC/Waste Specialist. In this case, SCO to be packaged may be screened per the protocols listed below, and if it passes the screening criteria, put directly in the container being loaded. Before any screened waste may be placed in a container, however, it must receive the approval of the WPC/Waste Specialist. Additionally, the alpha and beta/gamma activities of the SCO packaged in a container must be documented on a rad survey.

In all cases, results of rad surveys taken to support the screening of SCO must be directly traceable to a unique identifier (i.e. HP item number or inventory number) and a copy of the survey results provided to Waste Generator Services. Surveys specific to the waste may be used for characterization or a statistical evaluation may be applied across a waste stream,

Appendix J – Radiological Evaluation (Continued)

c. <u>Initial Screening</u>

Limitation: No process related equipment shall be screened if it contains hold-up material or if it cannot be determined by visual inspection that no hold-up material is present.

1. Radiological Control Technicians (RCTs) shall use professional judgment and/or PK to ensure surfaces that represent the bounding limits (i.e., maximum values) are surveyed with hand-held friskers to determine the highest alpha activity and the highest beta/gamma activity.
2. If the highest alpha activity is >480,000,000 dpm/100cm2 or if the highest beta/gamma reading is >4,800,000,000 dpm/100cm2, the item(s) cannot be marked "OK" or directly loaded into a container. Item(s) exceeding these criteria should be set aside until further direction is provided by the Transportation Group.
3. If the highest alpha activity is < 240,000 dpm/100 cm2 and the highest beta/gamma activity is < 2,400,000 dpm/100 cm2, then the object(s) passes the initial screening and may either be marked "OK" or directly loaded into a container with concurrence from a WPC. Items surveyed at or below these levels do not require smear samples. **STOP - SCREENING COMPLETE**!

NOTE: **Container Log Documentation Limit**: For item(s) with alpha activity ≥ 5,000 dpm/100 cm2 or beta/gamma activity ≥ 600,000 dpm/100cm2, the approximate surface area of the contamination area, not necessarily for the entire object, should be recorded on form CP3-WM-3015-F01 along with the appropriate HP item number.

Depending on the isotopic activities associated with a waste from a particular location of origin, waste generators (project management) may request an evaluation by the Site Characterization Group to raise the Container Log Documentation Limit associated with a particular waste stream. If the Site Characterization Group raises the documentation limit, an Email to that effect will be sent to the Project Manager for implementation in the field.

4. If the highest alpha activity is ≥ 240,000 dpm/100 cm2 and/or the highest beta/gamma activity is ≥ 2,400,000 dpm/100 cm2, then the object must undergo secondary screening.

d. <u>Secondary Screening</u>

1. For any item exceeding the initial screening criteria, take three separate smears from area of highest alpha activity. Take three separate smears from areas of highest beta/gamma activity. If the highest alpha activity and beta/gamma activity occur in the same area, take only three smears. If three smears cannot be taken, the number of smears that are practicable will be taken.
2. Average the smears for alpha activity and beta/gamma activity. If the average removable alpha activity < 24,000 dpm/100 cm2 and the average removable beta/gamma activity is < 240,000 dpm/100cm2, then the object(s) passes the secondary screening and may be either be marked "OK" or directly loaded into a container with concurrence from a WPC/Waste Specialist. **STOP - SCREENING COMPLETE!**

Appendix J – Radiological Evaluation (Continued)

3. If the average removable alpha activity ≥ 24,000 dpm/100 cm2 and/or the average removable beta/gamma activity is ≥ 240,000 dpm/100cm2, then the object(s) fail the secondary screening and cannot be marked "OK" or directly loaded into a container. Item(s) exceeding these criteria should be set aside until further direction is provided by the Transportation Group.

NOTE: **Survey results (Must be documented)**

C-746-U Landfill Disposition

Refer to DOE document *Authorized Limits Request for Solid Waste Disposal at C-746-U Landfill at the Paducah Gaseous Diffusion Plant*.

e. Administrative Screening Limits

NOTE: Surface Concentration Limits for Authorized Limits at the C-746-U Landfill are isotope specific. Detailed information for the distribution of isotopes associated with surface contaminated materials must be determined in order to verify the limitations are met for each isotope.

1. The rad tech will identify the location(s) for the survey based on procedure or protocol.
2. The rad tech will determine the CPM limits for the specific instrument being used based on the screening limits in Table K.3 as follows:

NOTE: Each individual instrument/probe has a correction factor (CF). The CF consists of instrument efficiency for the type of radiation being detected and a probe size correction to 100 cm2. The CF for each instrument can be found on the instrument or on the individual instrument card.

$$\frac{\text{DPM/100 cm2 SL}}{\text{Instrument CF}} + \text{Background} = _____ \text{ CPM/100 cm2 SL}$$

(1) C-746-U Landfill disposal administrative limits:

$$\frac{100{,}000 \text{ DPM/100 cm}^2\ \beta/\gamma}{\text{Instrument CF}} + \text{Background} = _____ \text{ CPM/100 cm}^2$$

$$\frac{6{,}000 \text{ DPM/100 cm}^2\ \alpha}{\text{Instrument CF}} + \text{Background} = _____ \text{ CPM/100 cm}^2$$

NOTE: TRU material areas require more restrictive limits. Contact Radiological Control for appropriate limits.

(2) SCO II Off-site Shipment administrative limits:

$$\frac{2{,}400{,}000 \text{ DPM/100 cm2}\ \beta/\gamma}{\text{Instrument CF}} + \text{Background} = _____ \text{ CPM/100 cm}^2$$

$$\frac{240{,}000 \text{ DPM/100 cm}^2\ \alpha}{\text{Instrument CF}} + \text{Background} = _____ \text{ CPM/100 cm}^2$$

Appendix J – Radiological Evaluation (Continued)

Table J.3: Site Administrative Screening Limits		
Transportation / Disposal	**C-746-U Landfill (dpm/100 cm^2)**	**SCO II Off-Site Shipment (dpm/100 cm^2)**
Am-241	14,000	
Cs-137	7,600	
Np-237	2,200	
Pu-238	15,600	
Pu-239	14,400	
Pu-240	14,400	
Tc-99	20,800	
Th-228	1,600	
Th-230	40,000	
Th-232	1,600	
U-234	64,000	
U-235	2,600	
U-238	64,000	
Beta/Gamma		2,400,000
Alpha **(dpm/100 cm^2)**		240,000
Note: With regard to SCO-II limits only, items surveyed with total contamination at or below the prescribed levels do not require smear samples to ensure removable contamination requirements for DOT have been met.		

3. The Waste Specialist (or equivalent) will identify the appropriate limit for the project (C-746-U Landfill or SCO II Administrative Limits). The packaging determination will be made as follows:

Appendix J – Radiological Evaluation (Continued)

Table J.4: Packaging Determination		
	Disposition Path	
Survey Results	**C-746-U**	**Offsite**
< Background	Package	Estimate Surface Area[C] and Package
> Background < C-746-U Authorized Limits	Package	Estimate Surface Area[C] and Package
> C-746-U Authorized Limits < SCO II Site Admin. Screening Levels[A]	Do Not Package	Estimate Surface Area[C] and Package
> SCO II Site Admin Screening Levels[A] < SCO II DOT Survey Limits[B]	Do Not Package	Collect Smears. Do not package until removable contamination levels are known[B]
> SCO II DOT Survey Limits[B]	Do Not Package	Do not package unless directed by Transportation Specialist

Notes

[A] Admin Screening Limits for C-746-U or SCO II.

[B] See Table K.6 for DOT Survey Limits for SCO II Total/Removable Contamination.

[C] See Table K.5 for Volume to Surface Area conversion.

Table J.5: Conversion of Direct Survey Data to Total Contamination			
Item Size	**Description**	**Surface Area (in^2) per Volume packaged (ft^3)**	**Survey Equivalents per Volume packaged (ft^3), Surveys/ft^3**
Small (Could Fit inside a 12 oz soda can)	Batteries, small capacitors, paint pens, welding rods, small circuit boards, etc.	16,829	1,087
Medium (Larger than a 12 oz can, but could fit inside a 5 gal pail)	Empty aerosol and paint cans, large circuit boards	9,910	645
Large (Larger than a 5 gal pail)	Pipe, irregularly shaped items, process equipment	2,991	193

Note: Alternative methods may be used to estimate surface area such as direct measurement, aerial density, etc.

Appendix J – Radiological Evaluation (Continued)

4. If the waste is set aside because the SCO II Administrative Screening Limits are exceeded, then a smear sample for removable contamination is required and all survey results must be evaluated per table K.6 prior to packaging.

Table J.6: DOT Survey Limits for SCO II				
Removable ALPHA[A] DPM/100cm^2	**Total ALPHA DPM/100cm^2**	**Removable BETA/GAMMA[A] DPM/100cm^2**	**Total BETA/GAMMA DPM/100cm^2**	**External Dose Rate 3 meters from unshielded materials**
24,000	480,000,000	240,000	4,800,000,000	Not to exceed 1 rem/hr

Note
[A] The actual "survey" limits for removable contamination in this table are 10 times lower than the limits in 49 *CFR*. This is because 49 *CFR* requires that any "smear sample" taken be multiplied by a factor of 10 due to the inefficiency associated with the method.

f. Other Methods

In addition to the methods discussed in this procedure, other methods may be used to characterize radioactive content in a waste package provided that all assumptions, calculations, and supporting information is documented defensible, filed, and readily available for independent review. If other methods are used to quantify radioactive material content, the rationale and characterization methodology shall be thoroughly documented, defensible, readily retrievable and auditable.

Appendix K – Risk Assessment Guidance

Scope

- Risk assessments serve to document the rationale employed to determine the frequency of verification inspection for containerized waste.
- The relative frequency of inspection is based on the potential for non-conforming items in a given waste stream.
- The conditions to be determined during inspection include verifying the container weight, the contents, and the presence or absence of the following:

High/Moderate Risk[6]	Low Risk[6]
Aerosol Cans/Unvented Gas Cylinders or Vessels	Aqueous Liquids (<1% by Volume)[1]
Aqueous Liquids (>1% by Volume)[1]	
Inappropriately Marked or Labeled Containers (e.g. PCB Labels on LLW containers, Incorrect Handwritten Info, Etc.)	Asbestos Containing Material[1]
Labpacks[1,2]	Incidental Hazardous Waste (Batteries, Bulbs, Lead, Leather, Welding Rods, Etc.) [5]
Non-Aqueous Liquids[3] (e.g. oil from packaged oily absorbents)	Resins[1]
Non-Incidental Hazardous Waste[1]	
PCB Waste in a container not identified as PCB[3]	
Sealed Sources	

Notes

[1] Must ensure containers are in the appropriate waste stream.
[2] Labpacks are defined as a package filled with multiple containers of liquid with multiple RCRA Waste Codes.
[3] Identify capacitors, transformers, or other items that contain free liquid on CP3-WM-0437-F08.
[4] Incidental Hazardous Waste Items will be segregated into appropriate waste streams from the inspected containers.
[5] If the profile allows for a waste identified as a risk above, it is not considered a risk on CP3-WM-0437-F07.

- Considerations other than those identified on the *Waste Characterization Risk Assessment* (CP3-WM-0437-F07) may cause the inspection frequency to vary from the guidance shown. The frequencies should be viewed as guidance only, and project personnel may elect to increase the inspections based on other information. That information may be documented on the form.
- Risk Assessments may be waived on a case-by-case basis with the written approval of the Transportation Manager if strong PK exists along with a high level of confidence in the accuracy of the PK for the waste stream.

Appendix K – Risk Assessment Guidance (Continued)

Initial Repackaging/Inspection Frequency Guidelines [Refer to CP3-WM-0437-F07 for categories]

Risk Assessment Results	Population Size*						
	< 100	100	500	1000	1500	2000	2500
All Low (or NA) Potential AND all Low (or NA) Impact	5%	5 containers	20 containers	30 containers	40 containers	50 containers	60 containers
One High/Moderate Potential, AND no High/Moderate Impact	10%	8 containers	25 containers	40 containers	50 containers	60 containers	75 containers
No High/Moderate Potential AND one high/Moderate Impact	10% to 20%	11 to 19 containers	50 to 75 containers	70 to 100 containers	85 to 125 containers	100 to 145 containers	125 to 170 containers
One High/Moderate Potential, AND one High/Moderate Impact	20% to 50%	20 to 50 containers	85 to 170 containers	120 to 250 containers	150 to 300 containers	180 to 360 containers	200 to 400 containers
More than one High/Moderate Potential, AND no High/Moderate Impact	50% to 100%	50 to 100 containers	170 to 350 containers	250 to 500 containers	300 to 750 containers	360 to 900 containers	400 to 1000 containers
More than one High/Moderate Potential, AND one or more High/Moderate Impact	100%	100%	100%	100%	100%	100%	100%

* Ratio number of containers for population sizes between ranges shown

Increasing the Repackaging/Inspection or Reweigh Frequency

One or two non-conforming items or incidents of free liquids found. One or two container weight variances of >10% found	Increase frequency one level
More than two non-conforming items or incidents of free liquids found. More than two container weight variances of >10% found	Up to 100% based on impact of failure

Appendix L – Calculation Verification Guidance

General

Testing and validation of computer programs and verification of data results from those programs (i.e., PSDR data, radioactivity calculations) shall be conducted and documented. Guidance for accomplishing this is as follows:

NOTE: "Built-in" functions of "off-the-shelf" software do not have to be verified (i.e. MS Access, MS Excel, Etc.).

Databases/Spreadsheets for Routine Use (Multiple Users)

Initial Development

- Independent verification of calculation methodology (i.e. formulas used) must be documented.
- All "fields" except for data input shall be "locked".

NOTE 1: Any modification to calculation methodology requires a repeat of the independent verification.

NOTE 2: Verification includes independent confirmation of one or more calculations including unit's analysis, and global verification of formulas. This verification should be documented via the *Calculation Verification and Validation* (CP3-WM-0437-F06).

On-Going Use

- Peer review of 100% of data entry must be documented.
- Peer review of data results must be documented. "Spot Checks" are acceptable.

Databases/Spreadsheets for Single Use

- Independent verification of calculation methodology (i.e. formulas used) must be documented.
- Peer review of 100% of data entry must be documented.
- Peer review of data results must be documented. "Spot Checks" are acceptable.

NOTE: Verification includes independent confirmation of one or more calculations including units analysis, and global verification of formulas.

Appendix M – Equivalent Documentation Requirements

The following minimum requirements in equivalent characterization documentation as defined in DOE O 435.1:

- Physical and chemical characteristics;
- Volume including the waste and any stabilization or absorbent media;
- Weight of the container and contents;
- Identities, activities, and concentrations of major radionuclides;
- Characterization date;
- Generating source; and
- Any other information which may be needed to prepare and maintain the disposal facility performance assessment, or demonstrate compliance with applicable performance objectives.

Review requirements for equivalent documents must be consistent with those for established forms.

Appendix N - Form CP3-WM-0437-F01 – Waste Characterization Documentation (Part A)

Waste Characterization Documentation (Part A)

Complete all applicable sections, mark **all** choices that apply, and attach spreadsheets or narratives as applicable.

Characterization (Physical)

Waste stream general description: _____

Media:

☐ Soil ☐ Wastewater ☐ Waste oil
☐ Absorbents ☐ Lab-packed solid samples ☐ Lab-packed liquid samples
☐ PPE/Plastic/Other secondary waste ☐ Discarded chemicals ☐ Non-wood construction debris
☐ Wood/Paper/Cardboard ☐ Animal carcasses ☐ Biohazard waste
☐ Beryllium-contaminated waste ☐ Sealed sources ☐ Explosives
☐ Etiologic agents ☐ Chelating agents ☐ Pyrophorics
☐ Metal, non-porous surface ☐ Painted or coated surface ☐ Previously treated waste
☐ Color: _____ ☐ Odor: _____ ☐ Other: _____

Matrix:

☐ Solid ☐ Particulate solids ☐ Liquid
☐ Sludge ☐ Gas

Solid Waste:

☐ Asbestos-containing material? ☐ Yes ☐ No [Friable? ☐ Yes ☐ No ☐ NA]
☐ Free Liquids observed or measured (approximate volume: _____ gallons/container)
☐ Moisture content determined (measurement method: _____; percent by weight: _____ %)
☐ More than one layer or media per container [how many: _____; relative volume ratio: _____
☐ Density measured (_____ grams/cc) ☐ Density calculated (_____ lbs/ft^3)
☐ Particle size measured (_____)
☐ Over-sized debris, based on any one of the following criteria (applies to waste without packaging)
  ☐ > 2 feet in all dimensions (C-746-U Landfill)
  ☐ > 10 inches in all dimensions (E. Solutions, Clive, UT)
  ☐ > 12 feet in any dimension (E. Solutions, Clive, UT)
☐ Paint filter test results obtained (Free Liquids? ☐ Yes ☐ No)
☐ Absorbents added (document type and amount on Waste Item Container Log Sheets)
☐ Other: _____

Liquid Waste:

☐ Aqueous ☐ Oil ☐ Organic
☐ pH measured (aqueous liquids) (result: _____ standard pH units)
☐ Corrosivity (non-aqueous liquids) (result: _____ mm/year)
☐ Flash point measured (☐ closed cup ☐ open cup; Result: _____ degrees Fahrenheit)
☐ Duplicate flash point measured (☐ closed cup ☐ open cup; result: _____ degrees Fahrenheit)
☐ Boiling point measured (result: _____ degrees Fahrenheit)
☐ More than one phase observed (number of phases: ; relative volume ratio:
  Example: Number of phases: 2; Relative volume ratio: Liquid (2)/Solid (1)
☐ Specific gravity measured (_____ ☐ standard units ☐ API Units)
☐ Water content measured (_____ mg/L)
☐ Heat content measured (_____ BTUs)
☐ Viscosity measured (_____ ☐ cSt ☐ cP)
☐ Asbestos-containing material
☐ Other: _____

Signature _____ Date _____

Reviewed By _____ Date_____

EXAMPLE

Appendix N - Form CP3-WM-0437-F01 – Waste Characterization Documentation (Part B)

Characterization Package Number: _____

Waste Characterization Documentation (Part B)

Complete all applicable sections, mark **all** choices that apply, and attach spreadsheets or narratives as applicable.

Characterization (Radiological)

General Information

☐ No radiochemical contamination	☐ LLW	☐ TRU Waste
☐ Greater than Class A Waste	☐ Greater than Class C Waste ☐ Other	☐ Sanitary Waste Meeting C746-U Authorized Limits

Volumetric Contamination

☐ Isotopes with activity above MDA:

☐ ^{241}Am ☐ ^{60}Co ☐ ^{137}Cs ☐ ^{40}K ☐ ^{237}Np ☐ ^{238}Pu ☐ $^{239/240}$Pu ☐ ^{90}Sr ☐ ^{99}Tc ☐ ^{230}Th

☐ ^{232}Th ☐ ^{234}Th ☐ ^{234}U ☐ ^{235}U ☐ ^{238}U

Other isotopes with activity above MDA:

☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____

☐ Weight percent ^{235}U > 0.711 (measured/calculated value: _____% (attach spreadsheet for more than one result)

☐ Total grams ^{235}U measured/calculated (result: _____ grams (attach spreadsheet for more than one result)

☐ Data summary attached.

☐ Statistical evaluation was used for characterization. Spreadsheet is attached with minimum, maximum, average, _____UCL (% two-tailed confidence), and analytical project ID(s).

Surface Contaminated Waste

☐ Total contamination survey results obtained

☐ Removable contamination survey results obtained

☐ Data summary attached.

NDA Measurements

☐ NDA analyses performed

☐ Data summary attached. (Include assumed scaling factors, basis of assumptions, and results)

☐ Calculations Reviewed

Signature _____ Date _____

Reviewed By _____ Date_____

EXAMPLE

Appendix N - Form CP3-WM-0437-F01 – Waste Characterization Documentation (Part C)

Characterization Package Number: _____

Waste Characterization Documentation (Part C)

Complete all applicable sections, mark **all** choices that apply, and attach spreadsheets or narratives as applicable.

Characterization (Chemical - TSCA)

General Information

☐ No PCB contamination ☐ Detectable PCB contamination; (Not TSCA-regulated for PCBs) ☐ TSCA Regulated for PCBs

PCB Concentration measured or known from PK

☐ PCBs < 50 ppm
☐ PCBs ≥ 50 ppm AND <500 ppm
☐ PCBs ≥ 500 ppm
☐ PCBs > 10 µg/100 cm^2 AND < 100 µg/100 cm^2
☐ PCBs ≥ 100 µg/100 cm^2
☐ PCBs leaching at < 10 µg/L*
☐ PCBs leaching at ≥ 10 µg/L*

*Pursuant to 40 CFR § 761.356, EPA has not specified a method for determining leachability of PCBs; therefore, any EPA approved leaching method appropriate to the waste matrix for extracting PCBs maybe used.

PCB Waste Type

☐ PCB Remediation Waste (40 CFR 761.61)
☐ PCB Bulk Product Waste (40 CFR 761.62)
☐ Drained PCB containers (40 CFR 761.60(c))
- ☐ Containers previously held < 500 ppm PCBs
- ☐ Containers previously held ≥ 500 ppm PCBs
- ☐ Triple-rinsed

☐ PCB Items/Articles (40 CFR 761.60(b))
- ☐ PCB Capacitors
  - ☐ Small capacitors (< 3lbs dielectric fluid)
  - ☐ Large capacitors (≥ 3lbs dielectric fluid)
  - ☐ Intact, non-leaking
  - ☐ Breached, leaking
    - ☐ Free liquids remaining
    - ☐ No free liquids remaining
- ☐ PCB Transformers
  - ☐ Drained
  - ☐ Not drained
  - ☐ Flushed
- ☐ Lab waste (secondary) from chemical
  - ☐ Liquid
  - ☐ Non-liquid
- ☐ PCB Hydraulic Machines
  - ☐ < 1,000 ppm
  - ☐ ≥ 1,000 ppm
  - ☐ Drained
  - ☐ Not drained
  - ☐ Flushed
- ☐ Other PCB Items/Articles:
  - ☐ Drained
  - ☐ Not drained

☐ Data summary attached.
- ☐ Statistical evaluation was used for PCB characterization. Spreadsheet is attached with minimum, maximum, average, UCL (_____ % two-tailed confidence), and analytical project ID(s).

☐ Treatment Required

☐ Calculations Reviewed

Signature _____ Date _____

Reviewed By _____ Date_____

EXAMPLE

Appendix N - Form CP3-WM-0437-F01 – Waste Characterization Documentation (Part D)

Characterization Package Number: _____

Waste Characterization Documentation (Part D)

Complete all applicable sections, mark **all** choices that apply, and attach spreadsheets or narratives as applicable.

Characterization (Chemical - RCRA)

General Information

☐ Not RCRA-regulated
☐ EPA waste codes apply (listed and/or characteristic) Codes:
☐ LDR/UHC form(s) attached. (applies if EPA waste codes are identified)

RCRA Listed Determination

☐ Spent chemicals from non-specific sources (F-listed). Chemicals: _____
☐ Unused, discarded chemicals, acutely hazardous (P-listed). Chemicals: _____
☐ Unused, discarded chemicals, (U-listed). Discarded chemical products. Chemicals: _____
☐ Listed waste determination has been obtained. (Include documentation in attachments.)

RCRA Characteristic Determination

☐ Data summary attached.
☐ Statistical evaluation was used for characterization. Spreadsheet is attached with minimum, maximum, average, UCL (_____% two-tailed confidence), and analytical project ID(s)

Treatment Required:

☐ None
☐ Incineration
☐ Stabilization
☐ Neutralization
☐ Solidification
☐ Other: _____
☐ Macroencapsulation
☐ Thermal treatment

☐ Calculations Reviewed

Signature _____ Date _____

Reviewed By _____ Date_____

EXAMPLE

Appendix O Form CP3-WM-0437-F02 – Waste Item Information Update

Waste Item Information Update

Multiple Waste Item IDs (WIDs) may be listed if the changes are the same for all WIDs. A spreadsheet may be attached if necessary.

RFD	WID	RFD	WID	RFD	WID

Identify the information that needs to be updated:

Description				
Origin Date	**AD**	**DTS**	**NG Date**	**Weight**
Volume	**Container Type**	**Waste Category**	**EPA Codes**	
Other				

Comments/Reason for Change:

_____

_____

_____

Required Field Work, if any (for Waste Operations use only):

_____

_____

_____

_____

Requested by: _____ **Date:** _____

Approved by: _____ **Date:** _____

Field Work Completed by: _____ **Date:** _____

Field Work Verified by: _____ **Date:** _____

Database Updated by: _____ **Date:** _____

CP3-WM-0437-F02 FR1

EXAMPLE

Appendix P - Form CP3-WM-0437-F03 – Final Packaging Container Characterization

Will the information provided below be used for ALL containers referenced on the Transportation Services Request Form (CP3-WM-3028, *Off-Site Shipping,* Form CP3-WM-3028-F01)? ☐ YES ☐ NO

If NO, then list the Container ID Number(s) below that will be characterized using the information provided below:

Associated Waste Stream Characterization Package Numbers: _____

Physical Properties: **(Please specify if RFD or equivalent information/data has been provided in lieu of description.)**

_____

☐ Solid
☐ Liquid, pH = _____
☐ Sludge, pH= _____
% Moisture: _____

☐ Free liquids, pH = _____
Estimate %: _____
☐ Gas, pressure = _____

Chemical Properties: **(Please specify if RFD or equivalent information/data has been provided in lieu of description.)**

_____

☐ Asbestos (Friable / Non-Friable)

☐ RCRA Hazardous-provide all appropriate waste codes and oldest ASD
_____
_____
_____

☐ PCB-provide specific type and oldest DTS
_____
☐ < 50ppm ☐ PCB Article (≥ 50 ppmm <500)ppm)
☐ ≥ 50ppm ☐ PCB Article (≥ 500 ppm
☐ ≥ 500ppm ☐ PCB Remediation Waste
☐ PCB Bulk Product Waste (known or assumed not in leach)
☐ PCB Bulk Product Waste (known or presumed to leach at > 10 ug/L)

NOTE: **All Applicable EPA Waste Codes, Accumulation Start Dates, and PCB Dates to Storage must be listed in this section or provided to the Transportation Group electronically or via Final Packaging RFD or equivalent documentation.**

Radiological Properties: **(Please specify if TBD or equivalent information/data has been provided in lieu of description.)**

_____

List ALL detectable radionuclides and their associated concentrations in pCi/g.
Please circle the appropriate data type: Maximum Average 95% UCL Other:_____

Nuclide	pCi/g	Nuclide	pCi/g	Nuclide	pCi/g	Nuclide	pCi/g	Nuclide	pCi/g

Provide U-235 wt% _____

Prepared By: _____ Verified By: _____
Signature/ Date Signature/Date

Forward to NMC&A upon completion.

Appendix Q Form CP3-WM-0437-F04 – Land Disposal Notification and Certification

LAND DISPOSAL NOTIFICATION AND CERTIFICATION

Generator Name: US Department of Energy (Paducah Site) Manifest Doc. No. : _____

Profile No.: _____ State Manifest No.: _____

1. Is this waste a non-wastewater or wastewater? (See 40 CFR 268.2) Check ONE: Non-wastewater ☐ Wastewater ☐
2. Identify ALL USEPA hazardous waste codes that apply to this waste shipment, as defined by 40 CFR 261. For each waste code, identify the corresponding subcategory, or check NONE if the waste code has no subcategory. Spent solvent standards are listed on the following page. If F039, multi-source leachate applies those constituents must be listed and attached by the generator. If D001-D043 requires treatment of the characteristic and meet 268.48 standards, then the underlying hazardous constituent(s) present in the waste must be listed and attached.

REF #	3. US EPA HAZARDOUS WASTE CODE(S)	4. SUBCATEGORY ENTER THE SUBCATEGORY DESCRIPTION. IF NOT APPLICABLE, SIMPLY CHECK NONE.		5. HOW MUST THE WASTE BE MANAGED? ENTER LETTER FROM BELOW
		DESCRIPTION	NONE	
1			☐	
2			☐	
3			☐	
4			☐	

To identify F039 or D001-D043 underlying hazardous constituent (s), use the "F039/Underlying Hazardous Constituent Form" provided (Form B1) and check here ☐
If no UHCs are present in the waste upon its initial generation check here: ☐
To list additional USEPA waste code(s) and subcategorie(s), use the supplemental sheet provided (Form A2) and check here: ☐

HOW MUST THE WASTE BE MANAGED? In column 5 above, enter the letter (A, B1, B3, B4, C, D, or E) below that describes how the waste must be managed to comply with the land disposal regulations (40 CFR 268.7). Please understand that if you enter the letter B1, B3, B4, or D, you are making the appropriate certification as provided below. (States authorized by EPA to manage the LDR program may have regulatory citations different from the 40 CFR citations listed below. Where these regulatory citations differ, your certification will be deemed to refer to those state citations instead of the 40 CFR citations.

A. RESTRICTED WASTE REQUIRES TREATMENT
This waste must be treated to the applicable treatment standards set forth in 40 CFR Part 268.40.
☐ For Hazardous Debris: "This hazardous debris is subject to the alternative treatment standards of 40 CFR Part 268.45."

B.1 RESTRICTED WASTE TREATED TO PERFORMANCE STANDARDS
"I certify under penalty of law that I have personally examined and am familiar with the treatment technology and operation of the treatment process used to support this certification. Based on my inquiry of those individuals immediately responsible for obtaining this information, I believe that the treatment process has been operated and maintained properly so as to comply with the treatment standards in 40 CFR Part 268.40 without impermissible dilution of the prohibited waste. I am aware that there are significant penalties for submitting a false certification, including the possibility of fine and imprisonment."

B.3 GOOD FAITH ANALYTICAL CERTIFICATION FOR INCINERATED ORGANICS
"I certify under penalty of law that I have personally examined and am familiar with the treatment technology and operation of the treatment process used to support this certification. Based upon my inquiry of those individuals immediately responsible for obtaining this information, I believe that the nonwastewater organic constituents have been treated by combustion in units as specified in 268.42 Table 1. I have been unable to detect the nonwastewater organic constituents despite having used best good faith efforts to analyze for such constituents. I am aware that there are significant penalties for submitting a false certification, including the possibility of fine and imprisonment."

B.4 DECHARACTERIZED WASTE REQUIRES TREATMENT FOR UNDERLYING HAZARDOUS CONSTITUENTS
"I certify under penalty of law that the waste has been treated in accordance with the requirements of 40 CFR 268.40 or 268.49, to remove the hazardous characteristic. This decharacterized waste contains underlying hazardous constituents that require further treatment to meet treatment standards. I am aware that there are significant penalties for submitting a false certification, including the possibility of fine and imprisonment."

C. RESTRICTED WASTE SUBJECT TO A VARIANCE
This waste is subject to a national capacity variance, a treatability variance, or a case-by-case extension. Enter the effective date of prohibition in column 5 above.
☐ For hazardous debris: "This hazardous debris is subject to the alternative treatment standards of 40 CFR Part 268.45."

D. RESTRICTED WASTE CAN BE LAND DISPOSED WITHOUT FURTHER TREATMENT
"I certify under penalty of law I personally have examined and am familiar with the waste through analysis and testing or through knowledge of the waste to support this certification that the waste complies with the treatment standards specified in 40 CFR 268 Subpart D. I believe that the information I submitted is true, accurate and complete. I am aware that there are significant penalties for submitting a false certification, including the possibility of fine or imprisonment."

E. WASTE IS NOT CURRENTLY SUBJECT TO PART 268 RESTRICTIONS
This waste is a newly identified waste that is not currently subject to any 40 CFR Part 268 restrictions.

I hereby certify that all information submitted in this and all associated documents is complete and accurate, to the best of my knowledge and information.

Signature_____ Title_____ Date_____

Form A1
Page 1 of 2

Appendix Q - Form CP3-WM-0437-F04 – Land Disposal Notification and Certification

LAND DISPOSAL NOTIFICATION AND CERTIFICATION (PHASE IV)

If the waste identified on the first page of this form is described by any of the following USEPA hazardous waste codes: F001, F002, F003, F004, F005, and all solvent constituents will not be monitored by the treater, then each constituent MUST be identified below by checking the appropriate box, and this page must accompany the shipment, along with the previous page of this form. If the waste code F039 describes this waste, then the corresponding list of constituents must be attached. If D001-D043 require treatment to 268.48 standards, then the underlying hazardous constituent(s) must also be attached.

SOLVENT WASTE TREATMENT STANDARDS[2]					
F001 through F005 spent solvent constituents and their associated USEPA hazardous waste code(s).	Treatment Standard[1]		F001 through F005 spent solvent constituents and their associated USEPA hazardous waste code(s).	Treatment Standard[1]	
	Wastewaters	Nonwastewaters		Wastewaters	Nonwastewaters
Acetone (F003)	0.28	160	Methanol (F003)	5.6	0.75 (TCLP)[3]
Benzene (F005)	0.14	10	Methylene chloride (F001, F002)	0.089	30
n-Butanol (n-butyl alcohol) (F003)	5.6	2.6	Methyl ethyl ketone (F005)	0.28	36
Carbon disulfide (F005)	3.8	4.8 (TCLP)[3]	Methyl isobutyl ketone (F003)	0.14	33
Carbon tetrachloride (F001)	0.057	6.0	Nitrobenzene (F004)	0.068	14
Chlorobenzene (F002)	0.057	6.0	2-Nitropropane (F005)	INCIN or {(WETOX or C HOXD) followed by CARBN}	INCIN
o-Cresol (F004)	0.11	5.6	Pyridine (F005)	0.014	16
Cresol (m- and p- isomers) (F004)	0.77	5.6	Tetrachloroethylene (F001, F002)	0.056	6.0
Cyclohexanone (F003)	0.36	0.75 (TCLP)[3]	Toluene (F005)	0.080	10
o-Dichlorobenzene (F002)	0.088	6.0	1,1,1-Trichloroethane (F001, F002)	0.054	6.0
2-Ethoxyethanol (F005) also called ethylene glycol, monoethyl ether	INCIN or BIODG	INCIN	1,1,2-Trichloroethane (F002)	0.054	6.0
Ethyl acetate (F003)	0.34	33	Trichloroethylene (F001, F002)	0.054	6.0
Ethyl benzene (F003)	0.057	10	Trichloromonofluoromethane (F002)	0.020	30
Ethyl ether (F003)	0.12	160	1,1,2-Trichloro-1,2,2-trifluoroethane (F002)	0.057	30
Isobutanol (Isobutyl Alcohol) (F005)	5.6	170	Xylenes (sum of o-, m-, and p-isomers) (F003)	0.32	30

[1] All spent solvent treatment standards are measured through a total waste analysis (TCA), unless otherwise noted. Wastewater units are mg/l, nonwastewater are mg/kg.

[2] For contaminated soils using the alternative soil treatment standards, the treatment standards for F001-F005 spent solvents must be a 90% reduction of the constituents or less than 10x the standard listed.

[3] These solvents require a TCLP standard with units of mg/l.

SUBCATEGORY REFERENCE

D001:

A. Ignitable characteristic wastes, except for the 40 CFR 261.21(a) (1) High TOC subcategory, that are managed in non-CWA/non-CWA equivalent/non-Class I SDWA systems.

B. Ignitable characteristic wastes, except for the 40 CFR 261.21(a) (1) High TOC subcategory, that are managed in CWA/CWA-equivalent or Class I SDWA systems.

C. High TOC Ignitable characteristic liquids subcategory based on 40 CFR 261.21(a) (1) – Greater than or equal to 10% total organic carbon.

D002:

D. Corrosive characteristic wastes that are managed in non-CWA/non-CWA-equivalent/non-Class I SDWA systems.

E. Corrosive characteristic wastes that are managed in CWA, CWA-equivalent, or Class I SWDA systems.

Form A1
Page 2 of 2

EXAMPLE

Appendix Q - Form CP3-WM-0437-F04 – Land Disposal Notification and Certification

LAND DISPOSAL NOTIFICATION AND CERTIFICATION (PHASE IV)

Generator Name: US Department of Energy (Paducah Site) Manifest Doc. No. : _____

Profile No.: _____ State Manifest No.: _____

This form is a continuation from form A1 for a waste identified by more than five USEPA waste code/subcategory groups. This page by itself IS NOT an acceptable Land Disposal Notification and Certification Form.

Continue (from form A1, Page 1) to identify ALL USEPA hazardous wastes that apply to this waste shipment (as defined by 40 CFR 261). For each waste number, identify the corresponding subcategory (write in the description from 40 CFR 268.40, or check NONE if the waste does not have a subcategory.). Also identify in column 5 how the waste must be managed. Spent solvents are listed on Form A1, Page 2. F039 constituent(s) and underlying hazardous constituent(s) if applicable, must be listed and attached.

REF #	3. US EPA HAZARDOUS WASTE CODE(S)	4. SUBCATEGORY ENTER THE SUBCATEGORY DESCRIPTION. IF NOT APPLICABLE, SIMPLY CHECK NONE.		5. HOW MUST THE WASTE BE MANAGED? ENTER LETTER FROM FORM A1, PAGE 1
		DESCRIPTION	NONE	
5			☐	
6			☐	
7			☐	
8			☐	
9			☐	
10			☐	
11			☐	
12			☐	
13			☐	
14			☐	
15			☐	
16			☐	
17			☐	
18			☐	
19			☐	
20			☐	
21			☐	
22			☐	
23			☐	
24			☐	
25			☐	
26			☐	
27			☐	
28			☐	
29			☐	
30			☐	
31			☐	
32			☐	
33			☐	
34			☐	
35			☐	

I hereby certify that all information submitted in this and all associated documents is complete and accurate, to the best of my knowledge and information.

Signature _____

Title _____ Date _____

Form A2
Page 1 of 2

EXAMPLE

Appendix Q -Form CP3-WM-0437-F04 – Land Disposal Notification and Certification

LAND DISPOSAL NOTIFICATION AND CERTIFICATION (PHASE IV)

Generator Name: US Department of Energy (Paducah Site) Manifest Doc. No. : _____

Profile No.: _____ State Manifest No.: _____

This form is a continuation from form A1 for a waste identified by more than five USEPA waste code/subcategory groups. This page by itself IS NOT an acceptable Land Disposal Notification and Certification Form.

Continue (from form A1, Page 1) to identify ALL USEPA hazardous wastes that apply to this waste shipment (as defined by 40 CFR 261). For each waste number, identify the corresponding subcategory (write in the description from 40 CFR 268.40, or check NONE if the waste does not have a subcategory.). Also identify in column 5 how the waste must be managed. Spent solvents are listed on Form A1, Page 2. F039 constituent(s) and underlying hazardous constituent(s) if applicable, must be listed and attached.

REF #	3. US EPA HAZARDOUS WASTE CODE(S)	4. SUBCATEGORY ENTER THE SUBCATEGORY DESCRIPTION. IF NOT APPLICABLE, SIMPLY CHECK NONE.		5. HOW MUST THE WASTE BE MANAGED? ENTER LETTER FROM FORM A1, PAGE 1
		DESCRIPTION	NONE	
36			☐	
37			☐	
38			☐	
39			☐	
40			☐	
41			☐	
42			☐	
43			☐	
44			☐	
45			☐	
46			☐	
47			☐	
48			☐	
49			☐	
50			☐	
51			☐	
52			☐	
53			☐	
54			☐	
55			☐	
56			☐	
57			☐	
58			☐	
59			☐	
60			☐	
61			☐	
62			☐	
63			☐	
64			☐	
65			☐	

I hereby certify that all information submitted in this and all associated documents is complete and accurate, to the best of my knowledge and information.

Signature _____

Title _____ Date _____

Form A2
Page 2 of 2

EXAMPLE

Appendix Q - Form CP3-WM-0437-F04 – Land Disposal Notification and Certification

F039/UNDERLYING HAZARDOUS CONSTITUENT (UTS) (Phase IV)

Generator Name: US Department of Energy (Paducah Site) Manifest Doc. No. : _____

Profile No.: _____ State Manifest No.: _____

If D001-D043 requires treatment to the 40 CRF 268.48 standards, then each underlying hazardous constituent (UHC) present in the waste at the point of generation and at a level above the Universal Treatment Standard (UTS) constituent specific standard must be listed. Write the letter (A1, B1, B2, B3, or C that corresponds to the letter on the land disposal form A1) beside each constituent present to properly describe how the constituent(s) must be managed under 40 CFR 268.7. If contaminated soil requires treatment to 40 CFR 268.49 standards, then each UHC in the waste at the point of generation and at a level above 10 times the UTS must be listed. Write the appropriate letter which corresponds to the letter on the LDR form.

CONSTITUENT	HOW MUST THIS CONSTITUENT BE MANAGED?	WW (mg/l)	NWW (mg/kg) unless noted	CONSTITUENT	HOW MUST THIS CONSTITUENT BE MANAGED?	WW (mg/l)	NWW (mg/kg) unless noted
Acenaphthylene		0.059	3.4	2-Chloro-1,3-butadiene		0.057	0.28[1]
Acenapthene		0.059	3.4	Chlorodibromomethane		0.057	15
Acetone		0.28	160	Chloroethane		0.27	6.0
Acetonitrile		5.6	38[1]	bis(2-Chloroethoxy)methane		0.036	7.2
Acetophenone		0.010	9.7	bis(2-Chloroethyl)ether		0.033	6.0
2-Acetylaminofluorene		0.059	140	Chloroform		0.046	6.0
Acrolein		0.29	NA	bis(2-Chloroisopropyl)ether		0.055	7.2
Acylamide		19[1]	23[1]	p-Chloro-m-cresol		0.018	14
Acrylonitrile		0.24	84	2-Chloroethyl vinyl ether		0.062[1]	NA [1]
Aldicarb sulfone		0.056[1]	0.28[1]	Chloromethane/Methyl chloride		0.19	30
Aldrin		0.021	0.066	2-Chloronaphthalene		0.055	5.6
4-Aminobiphenyl		0.13	NA	2-Chlorophenol		0.044	5.7
Aniline		0.81	14	3-Chloropropylene		0.036	30
Anthracene		0.059	3.4	Chrysene		0.059	3.4
Aramite		0.36	NA	o-Cresol		0.11	5.6
alpha-(BHC)		0.00014	0.066	m-Cresol		0.77	5.6
beta-(BHC)		0.00014	0.066	p-Cresol		0.77	5.6
delta-(BHC)		0.023	0.066	m-Cumenyl methylcarbamate		0.056[1]	1.4[1]
gamma-(BHC)		0.0017	0.066	Cyclohexanone		0.36	0.75 mg/l[1]
Barban		0.056[1]	1.4[1]	o,p'-DDD		0.023	0.087
Bendiocarb		0.056[1]	1.4[1]	p,p'-DDD		0.023	0.087
Benomyl		0.056[1]	1.4[1]	o,p'-DDE		0.031	0.087
Benzene		0.14	10	p,p'-DDE		0.031	0.087
Benz(a)anthracene		0.059	3.4	o,p'-DDT		0.0039	0.087
Benzal chloride		0.055[1]	6.0[1]	p,p'-DDT		0.0039	0.087
Benzo(b)fluoranthene[3]		0.11	6.8	Dibenz(a,h)anthracene		0.055	8.2
Benzo(k)fluoranthene[3]		0.11	6.8	Dibenz(a,e)pyrene		0.061	NA
Benzo (g,h,i)perylene		0.0055	1.8	1,2-Dibromo-3-chloropropane		0.11	15
Benzo(a)pyrene		0.061	3.4	1,2-Dibromomethane/ Ethylene dibromide		0.028	15
Bromodichloromethane		0.35	15	Dibromomethane		0.11	15
Bromomethane/Methyl Bromide		0.11	15	m-Dichlorobenzene		0.036	6.0
4-Bromophenyl phenyl ether		0.055	15	o-Dichlorobenzene		0.088	6.0
n-Butyl alcohol		5.6	2.6	p-Dichlorobenzene		0.090	6.0
Butylate		0.042[1]	1.4[1]	Dichlorodifluoromethane		0.23	7.2
Butyl benzyl phthalate		0.017	28	1,1-Dichloroethane		0.059	6.0
2-sec-Butyl-4,6-dinitrophenol/Dinoseb		0.066	2.5	1,2-Dichloroethane		0.21	6.0
Carbaryl		0.006[1]	0.14[1]	1,1-Dichloroethylene		0.025	6.0
Carbenzadim		0.056[1]	1.4[1]	trans-1,2-Dichloroethylene		0.054	30
Carbofuran		0.006[1]	0.14[1]	2,4-Dichlorophenol		0.044	14
Carbofuran phenol		0.056[1]	1.4[1]	2.6-Dichlorophenol		0.044	14
Carbon disulfide		3.8	4.8 mg/l TCLP[1]	2,4-Dichlorophenoxyacetic acid/2,4-D		0.72	10
Carbon tetrachloride		0.057	6.0	1,2-Dichloropropane		0.85	18
Carbosulfan		0.028[1]	1.4[1]	cis-1,3-Dichloropropylene		0.036	18
Chlordane (alpha and gamma isomers)		0.0033	0.26	trans-1,3-Dichloropropylene		0.036	18
p-Chloroaniline		0.46	16	Dieldrin		0.017	0.13
Chlorobenzene		0.057	6.0	Diethyl phthalate		0.20	28

Form B1
Page 1 of 3

EXAMPLE

Appendix Q - Form CP3-WM-0437-F04 – Land Disposal Notification and Certification

CONSTITUENT	HOW MUST THIS CONSTITUENT BE MANAGED?	WW (mg/l)	NWW (mg/kg) unless noted	CONSTITUENT	HOW MUST THIS CONSTITUENT BE MANAGED?	WW (mg/l)	NWW (mg/kg) unless noted
Chlorobenzilate		0.10	NA	p-Dimethylaminoazobenzene		0.13[1]	NA
2,4-Dimethyl phenol		0.036	14	Methylene chloride		0.089	30
Dimethyl phthalate		0.047	28	Methyl ethyl ketone		0.28	36
Di-n-butyl phthalate		0.057	28	Methyl isobutyl ketone		0.14	33
1,4-Dinitrobenzene		0.32	2.3	Methyl methacrylate		0.14	160
4,6-Dinitro-o-cresol		0.28	160	Methyl methansulfonate		0.018	NA
2,4-Dinitrophenol		0.12	160	Methyl parathion		0.014	4.6
2,4-Dinitrotoluene		0.32	140	Metolcarb		0.056[1]	1.4[1]
2,6-Dinitrotoluene		0.55	28	Mexacarbate		0.056[1]	1.4[1]
Di-n-octyl phthalate		0.017	28	Molinate		0.042[1]	1.4[1]
Di-n-propylnitrosamine		0.40	14	Naphthalene		0.059	5.6
1,4-Dioxane		12.0	170	2-Naphthylamine		0.52	NA
Diphenylamine[3]		0.92	13[1]	o-Nitroaniline		0.27[1]	14[1]
Diphenylnitrosamine[3]		0.92	13[1]	p-Nitroaniline		0.028	28
1,2-Diphenylhydrazine		0.087	NA	Nitrobenzene		0.068	14
Disulfoton		0.017	6.2	5-Nitro-o-toluidine		0.32	28
Dithiocarbamates (total)		0.028	28[1]	o-Nitrophenol		0.028[1]	13[1]
Endosulfan I		0.023	0.066	p-Nitrophenol		0.12	29
Endosulfan II		0.029	0.13	N-Nitrosodiethylamine		0.40	28
Endosulfan sulfate		0.029	0.13	N-Nitrosodimethylamine		0.40	2.3[1]
Endrin		0.0028	0.13	N-Nitroso-di-n-butylamine		0.40	17
Endrin aldehyde		0.025	0.13	N-Nitrosomethylethylamine		0.40	2.3
EPTC		0.042[1]	1.4[1]	N-Nitrosomorpholine		0.40	2.3
Ethyl acetate		0.34	33	N-Nitrosopiperidine		0.013	35
Ethyl benzene		0.057	10	N-Nitrosopyrrolidine		0.013	35
Ethyl cyanide/Propanenitrile		0.24	360	Oxamyl		0.056[1]	0.28[1]
Ethyl ether		0.12	160	Parathion		0.014	4.6
Bis(2-Ethylhexyl)phthalate		0.28	28	Total PCBs (sum of all PCB isomers or all Aroclors)		0.10	10
Ethyl methacrylate		0.14	160	Pebulate		0.042[1]	1.4[1]
Ethylene oxide		0.12	NA	Pentachlorobenzene		0.055[1]	10[1]
Famphur		0.017	15	PeCDDs (All Pentachlorodibenzo-p-dioxins)		0.000035	0.001
Fluoranthene		0.068	3.4	PeCDFs(All Pentachlorodibenzofurans)		0.000035	0.001
Fluorene		0.059	3.4	Pentachloroethane		0.055	6.0
Formetanate hydrochloride		0.056[1]	1.4[1]	Pentachloronitrobenzene		0.055	4.8
Heptachlor		0.0012	0.066	Pentachlorophenol		0.089	7.4
Heptachlor epoxide		0.016	0.066	Phenacetin		0.081	16
Hexachlorobenzene		0.055	10	Phenanthrene		0.059	5.6
Hexachlorobutadiene		0.055	5.6	Phenol		0.039	6.2
Hexachlorocyclopentadiene		0.057	2.4	Phorate		0.021	4.6
HxCDDs (All Hexachrorodibenzo-p-dioxins)		0.000063	0.001	Phthalic acid		0.055[1]	28[1]
HxCDFs (All Hexachlorodibenzofurans)		0.000063	0.001	Phthalic anhydride		0.055	28[1]
Hexachloroethane		0.055	30	Physostigmine		0.056[1]	1.4[1]
Hexachloropropylene		0.035	30	Physostigmine salicylate		0.056[1]	1.4[1]
Indeno(1,2,3-c,d)pyrene		0.0055	3.4	Promecarb		0.056[1]	1.4[1]
Iodomethane		0.19	65	Pronamide		0.093	1.5
Isobutyl alcohol		5.6	170	Propham		0.056[1]	1.4[1]
Isodrin		0.021	0.066	Propoxur		0.056[1]	1.4[1]
Isosafrole		0.081	2.6	Prosulfocarb		0.042[1]	1.4[1]
Kepone		0.0011	0.13	Pyrene		0.067	8.2
Methacrylonitrile		0.24	84	Pyridine		0.014	16
Methanol		5.6	0.75 mg/l[1]	Safrole		0.081	22
Methapyrilene		0.081	1.5	Silvex/2,4,5-TP		0.72	7.9
Methiocarb		0.056[1]	1.4[1]	1,2,4,5-Tetrachlorobenzene		0.055	14
Methomyl		0.028[1]	0.14[1]	TCDDs (All Tetrachlorodibenzo-p-dioxins)		0.000063	0.001
Methoxychlor		0.25	0.18	TCDFs (All Tetrachlorodibenzo-furans)		0.000063	0.001
3-Methylcholanthrene		0.0055	15	1,1,1,2-Tetrachloroethane		0.057	6.0
4,4'-Methylene bis(2-chloroaniline)		0.50	30	1,1,2,2-Tetrachloroethane		0.057	6.0

Form B1
Page 2 of 3

EXAMPLE

Appendix Q - Form CP3-WM-0437-F04 – Land Disposal Notification and Certification

CONSTITUENT	HOW MUST THIS CONSTITUENT BE MANAGED?	WW (mg/l)	NWW (mg/kg) unless noted	CONSTITUENT	HOW MUST THIS CONSTITUENT BE MANAGED?	WW (mg/l)	NWW (mg/kg) unless noted
Tetrachloroethylene		0.056	6.0	**INORGANIC CONSTITUENTS**			
2,3,4,6-Tetrachlorophenol		0.030	7.4	Antimony		1.9	2.1 mg/l TCLP
Thiodicarb		0.0191	1.4[1]	Antimony		1.9	1.15 mg/l TCLP[4]
Thiophanate-methyl		0.0561	1.4[1]	Arsenic		1.4	5.0 mg/l TCLP
Toluene		0.080	10	Barium		1.2	7.6 mg/l TCLP
Toxaphene		0.0095	2.6	Barium		1.2	21 mg/l TCLP[4]
Triallate		0.042[1]	1.4[1]	Beryllium		0.82	0.014 mg/l TCLP
Tribromomethane/Bromoform		0.63	15	Beryllium		0.82	1.22 mg/l TCLP[4]
2,4,6-Tribromophenol		0.035	7.4	Cadmium		0.69	0.19 mg/l TCLP
1,2,4-Trichlorobenzene		0.055	19	Cadmium		0.69	0.11 mg/l TCLP[4]
1,1,1-Trichloroethane		0.054	6.0	Chromium (Total)		2.77	0.86mg/l TCLP
1,1,2-Trichloroethane		0.054	6.0	Chromium (Total)		2.77	0.60 mg/l TCLP[4]
Trichloroethylene		0.054	6.0	Cyanides (Total)		1.2	590
Trichloromonofluoromethane		0.020	30	Cyanides (Amenable)		0.86	30[1]
2,4,5-Trichlorophenol		0.18	7.4	Fluoride		35	NA[4]
2,4,6-Trichlorophenol		0.035	7.4	Lead		0.69	0.37 mg/l
2,4,5-Trichlorophenoxyacetic acid/2,4,5-T		0.72	7.9	Lead		0.69	0.75 mg/l[4] TCLP
1,2,3-Trichloropropane		0.85	30	Mercury (Nonwastewater from Retort)		NA	0.20 mg/l TCLP
1,1,2-Trichloro-1,2,2-trifluoroethane		0.057	30	Mercury (All others)		0.15	0.025 mg/l TCLP
Triethylamine		0.081[1]	1.5[1]	Nickel		3.98	5.0 mg/l TCLP
Tris-(2,3-Dibromopropyl)phosphate		0.11	0.10[1]	Nickel		3.98	11 mg/l TCLP[4]
Vernolate		0.042[1]	6.0[1]	Selenium		0.82	0.16 mg/l TCLP
Vinyl chloride		0.27	6.0	Selenium		0.82	5.7 mg/l TCLP[5]
Xylenes – mixed isomers (sum of o-,m-, and p-xylene		0.32	30	Silver		0.43	0.30 mg/l TCLP
				Silver		0.43	0.14 mg/l TCLP[4]
				Sulfide		14	NA[2]
				Thallium		1.4	0.078 mg/l TCLP[1]
				Thallium		1.4	0.20 mg/l TCLP[4]
				Vanadium		4.3[2]	1.6 mg/l TCLP[2]
				Zinc		2.61	4.3 mg/l TCLP[2]

[1] These constituents are only applicable as underlying hazardous constituents. These constituents are not constituents that require treatment in F039 wastes.
[2] Not an underlying hazardous constituent requiring treatment in a D001-D043 waste.
[3] These compounds are regulated by the sum of their concentration instead of as individual constituents.
[4] These constituents are effective in authorized states or states with no LDR program on 8/24/99. These concentrations are effective in all other states upon adoption by the state.
[5] Effective 8/24/98 in unauthorized states or states with no LDR program. Selenium at 5.7 mg/l is not an underlying hazardous constituent in D001-D043 waste. This becomes effective in authorized states upon adoption by the state.

Form B1
Page 3 of 3

EXAMPLE

Appendix R - Form CP3-WM-0437-F05 – PGDP Waste Characterization Verification

PGDP Waste Characterization Verification

A. WASTE GROUP IDENTIFICATION

1. Requestor:	**2. Phone:**	**3. Requestor Project:**	**4. Verification No.:**
5. Date:	**6. Material Description:**		**7. Waste Characterization Package Number:**

B. WASTE GROUP CHARACTERIZATION INFORMATION

1. Description of Generation Process (Attach Documentation):

2. Characterization Data (Attach Documentation):

☐ Analytical data **not directly** related to this waste was obtained, reviewed for usability, and used for characterization.

☐ Analytical data **directly** related to this waste was obtained, reviewed for usability, and used for characterization.

Data source: _____ Project ID(s): _____

C. INVENTORY

☐ See Attached List _____ page(s) attached

RFD Number	Waste Item Description (WID) Number	RFD Number	Waste Item Description (WID) Number
1.		6.	
2.		7.	
3.		8.	
4.		9.	
5.		10.	

D. EVALUATION & APPROVAL

☐ This is a new characterization. The above listed inventory is characterized by Waste Characterization Package Number: _____.

☐ This is a re-characterization. The above listed inventory was formerly characterized by Waste Characterization Package Number: _____. Remove inventory from former Waste Characterization Package.

Rationale: Include supporting evidence the waste containers listed above meet the radiological, chemical, and physical criteria specified in the Waste Characterization Package Number to which it is being added.

☐ Documentation Attached ☐ Additional Narrative Attached

Requestor/Preparer

Waste Characterization Technical Reviewer: _____ Date: _____

Comments from Waste Characterization Technical Reviewer:

Approval (including verification of calculations, as applicable):

Waste Characterization Technical Reviewer: _____ Date: _____

Appendix S - Form CP3-WM-0437-F06 – Calculation Verification and Validation

Calculation Verification and Validation

Database Title:		
Project Using Calculations:		
Originator:		
Originator's Discipline:		
Computer Program Used:		
Status of Calculations:		
Purpose:		
Summary of Calculation Worksheet:		
Brief Description of Characterization Process:		
Attachments:		
Originator:		
Print	Signature	Date
Verifier:		
Print	Signature	Date
Verifier Comments:		

EXAMPLE

Appendix T - Form CP3-WM-0437-F07 – Waste Characterization Risk Assessment/Final Characterization Review

Chg A

Project: _____ **Number of Containers:** _____

Waste Description: _____ **Characterization Package #:** _____

Risk Assessment/Mitigation Requirements (as determined by Appendix K)

Repackaging/Inspection Purpose: Identification of Non-conforming / Regulated Items

Potential for inappropriate segregation

Waste Condition	High / Moderate	Low	NA
Generator's WM program known and acceptable			
Generator's WM Program questionable or unknown			
This waste stream has potential to contain resins			
Waste well described and documented			
Waste description unknown or incomplete			
Control of generation and/or storage acceptable			
Control of generation and/or storage questionable or unknown			
Other:			

Impact of Failure (non-conforming, regulated items found at treatment/disposal location)

Category of Waste	High / Moderate	Low	NA
Non-conforming RCRA waste to a RCRA-permitted facility			
Non-conforming RCRA waste to a non-RCRA-permitted facility			
Non-conforming TSCA waste to a TSCA facility			
Non-conforming TSCA waste to a non-TSCA facility			
Non-conforming LLW items to an offsite disposal facility			
Non-conforming LLW items to the C-746-U Landfill			
Other:			

	Tabulate Totals for Factors Above		
Risk Assessment Factors	**High/Mod**	**Low**	**N/A**
Potential for Inappropriate Segregation			
Impact for non-conforming, regulted items found at T/D Location			
Potential for Free Liquids			
Impact of Free Liquids found at T/D Location			
Total Potential			
Total Impact			

Repackaging/Inspection Purpose: Identification of Free Liquids

Potential for free liquids

Condition	High / Moderate	Low	NA
Waste media is prone to free liquids (sludge, etc.)			
Waste is not prone to free liquids (dry, non-absorbent-type waste)			
Waste was generated under unknown or (potentially) wet conditions			
Waste was generated in known dry conditions			
Free liquids may have entered the waste containers during storage			
Other:			

Impact of Failure (free liquids found at treatment/disposal location)

Category of waste	High / Moderate	Low	NA
RCRA/TSCA waste sent to a facility that can treat liquids			
RCRA/TSCA waste sent to a facility that CANNOT treat liquids			
LLW sent to an offsite disposal facility that can treat/dispose liquids			
LLW sent to an offsite disposal facility that CANNOT treat/dispose liquids			
LLW sent to the C-746-U Landfill			
Other:			

Use Factor Totals to Calculate Number of Containers to be Inspected

Guidelines	High / Moderate Potential	High / Moderate Impact	Low or N/A
5%	0	0	=/> 1
10%	1	0	=/> 1
10% to 20%	0	1	=/> 1
20% to 50%	1	1	=/> 1
50% to 100%	> 1	0	=/> 1
100%	> 1	> 1	=/> 1

Number of Containers: _____

Samples Size: _____

			Population Size (Number of Containers)						
RISK ASSESSMENT RESULTS			< 100	100	500	1000	1500	2000	2500
All Low (or NA) Potential AND all Low (or NA) Impact			5%	5	20	30	40	50	60
One High/Moderate Potential, AND No High/Moderate Impact			10%	8	25	40	50	60	75
No High/Moderate Potential, AND One High/Moderate Impact			10 to 20%	11-19	50-75	70-100	85-125	100-145	125-170
One High/Moderate Potential, AND One High/Moderate Impact			20 to 50%	20-50	85-170	120-250	150-300	180-360	200-400
> One High/Moderate Potential, AND No High/Moderate Impact			50 to 100%	50-100	170-350	250-500	300-750	360-900	400-1000
> One High/Moderate Potential, AND =/> High/Moderate Impact			100%	100%	100%	100%	100%	100%	100%

Ratio number of containers for population sizes between ranges shown

Number of containers to repackage or observe: *(see CP3-WM-0437, Appendix K)*
Number of containers to reweigh: *(see CP3-WM-0437, Appendix K)*

Comments:

_____

Approvals

	Signature	Date
Preparer:		
Peer Reviewer:		

Risk/Characterization Review (Prior to Adding to IWTS) - All Characterizaton Packages

	Signature	Date	Printed Name	Title (if not Transportation Manager)
Transportation Mgr or Designated SME:				

EXAMPLE

Appendix U - Form CP3-WM-0437-F08 – Waste Characterization Risk Assessment Field Observations Checklist

Risk Assessment Container Inspections

Container ID	Barcode	WITS Weight (lb.)	Measured Weight (lb.)	Weight Variance >10% (Y/N)	Content Different than RFD (Y/N)	Free Liquid Observed (If Yes, see Note below) (Y/N)	Non-Aqueous Liquid Observed (Y/N)	Labeling different than the Waste Category (Y/N)	Any Non-Conforming Items Found as specified in PAD-WD-0437, Att. O and/or the Work Instructions (Y/N)	NOTE: Any "YES" responses that are not allowed by the Waste Profile May Require additional inspections up to and including 100% inspection, refer to PAD-WD-0437 Attach "O" for possible increase in inspections and comment appropriately below at "Inspection Response Comments" . Container Comments

Scale # & Calibration Date:

If any "YES" responses above, do they fall outside of the Waste Profile? (Y/N) _____ **If "Yes", comment below on additional inspection including up to 100% if req'd.**

Inspection Response Comments: _____

If content different than RFD, explain: _____

If Free Liquid Observed, describe: _____

Prepared By: _____ **Date:** _____

Verified By: _____ **Date:** _____

EXAMPLE

CP3-WM-0437-F08 FR1