Attachment 2
Section C Waste Characteristics

RCRA PART B PERMIT REAPPLICATION

FOR THE

IDAHO NATIONAL LABORATORY

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Calcined Solids Storage Facility

Attachment 2 - Section C
Waste Characteristics

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CONTENTS

TABLES

C. WASTE CHARACTERISTICS

This section has been prepared for the Idaho Nuclear Technology and Engineering Center (INTEC) Calcined Solids Storage Facility (CSSF) located at the Idaho National Laboratory (INL). The CSSF bins are permitted for tank storage (Process Code S02). The purpose of this section is to describe the process and rationale utilized by the contractor to determine the physical and chemical characteristics of the wastes managed at these units. This section describes hazardous wastes and only the hazardous components of mixed wastes regulated by Hazardous Waste Management Act (HWMA)/ Resource Conservation and Recovery Act (RCRA), the Idaho Administrative Procedures Act (IDAPA), and the Code of Federal Regulations (CFR).

The CSSF is composed of seven bin sets designed to store high-activity mixed wastes produced from calcination in the Waste Calcining Facility (WCF), from 1963 through 1981, and the New Waste Calcining Facility (NWCF), from 1982 through 2000. The bin sets are comprised of an arrangement of bins contained within a concrete vault. Detailed descriptions of CSSF composition and bin set arrangement are provided in Sections B and D of this Part B permit reapplication.

C-1 CHEMICAL AND PHYSICAL ANALYSES: [IDAPA 58.01.05.012 and .008; 40 CFR §§ 270.14(b)(2) and 264.13(a)]

The CSSF units described in this permit reapplication store calcine generated by the WCF and NWCF. Calcine is a granular solid mixed waste without free liquids regulated as hazardous under IDAPA 58.01.05.005 (40 CFR 261, Subparts C and D) and radioactive under the Atomic Energy Act.

Radionuclides that contribute the majority of the activity for wastes managed in the CSSF include Sr-90, Y-90, Ba-137m, and Cs-137. Activity of typical calcine is approximately 10 mCi/g. The exposure rates associated with the calcine routinely exceed 10 rem/h on a 15-mL sample and can pose a potentially serious hazard to workers at the INL, if appropriate protective measures such as time, distance, and shielding are not applied.

Due to the highly radioactive nature of wastes managed in the CSSF, characterization and the assignment of Environmental Protection Agency (EPA) hazardous waste numbers (HWNs) occur through the use of acceptable knowledge, which involves both process knowledge and/or chemical/physical testing of the waste. Listed HWNs are applied based on knowledge of the processes. *A Regulatory Analysis and Reassessment of U.S. Environmental Protection Agency Listed Hazardous Waste Numbers for Applicability to the INTEC Liquid Waste System*, INEEL/EXT-98-01213, Rev. 1, February 1999,

identifies the listed HWNs associated with INTEC waste treatment systems. Characteristic HWNs may be applied by testing the waste according to the methods set forth in Subpart C of 40 CFR Part 261, or according to an equivalent method approved by the Director of the Idaho Department of Environmental Quality (DEQ), or by applying knowledge of the hazard characteristic of the waste in light of the materials or the processes used.

The RCRA Part A Permit application for the CSSF shows 12 EPA HWNs. Of the 12 HWNs identified, four (4) are listed HWNs and eight (8) are characteristic HWNs.

Core samples of alumina and zirconia calcine were obtained from bins within Bin Set 2 in 1978. The purpose of the 1978 sampling was to obtain information on the physical properties and condition of the stored calcine and to determine whether changes occurred during calcine storage to support long-term waste management and calcine retrieval studies. The alumina calcine was retrieved from Bin No. 3 in Bin Set 2, and the zirconia calcine was retrieved from Bin No. 7 in Bin Set 2. These samples were analyzed for radiological constituents. The analytical results showed that the calcine remained unchanged from the time of placement.

Sub samples were taken from the 1978 core samples in June 2003 for RCRA characterization analysis. The overall purpose of this sampling effort was to: (1) provide analyses of a representative sample of the waste in support of the original permit application; (2) correlate characterization data from sampling and analysis of the calcine with predicted modeled values (flow sheets) that were based on characterization of the liquid waste feed to the calciner; and (3) determine whether organic constituents are present in the calcine at concentrations requiring application of the HWMA/RCRA toxicity characteristic codes.

Samples of alumina and zirconia calcine were also collected from the NWCF during a processing campaign in 1993. This calcine was analyzed at the same time as the sub samples collected during the June 2003 sampling event. The analytical data for the samples is shown in Appendix 3 of this permit reapplication.

C-1b Waste in Tank Systems: [IDAPA 58.01.05.008; 40 CFR §§ 264.191(b)(2) and 264.192(a)(2)]

The characteristics of calcine produced from the treatment of liquid radioactive waste correspond to the characteristics of the liquid wastes fed to the calciners. When the calcining process was initiated, the waste feed primarily resulted from the processing and recovery of enriched uranium from spent nuclear fuel. The spent fuels contained aluminum, stainless steel, graphite, or Zircaloy^{R} (a zirconium alloy) as the primary fabrication or cladding material. The chemical characteristics of calcine produced as a result of spent fuel reprocessing were determined and documented based upon the unique constituents contained in each type of fuel element and the methodology used for reprocessing. Later, when spent nuclear fuel reprocessing was discontinued at the INTEC in the early 1990s, other liquid radioactive wastes were calcined. These included liquid mixed wastes generated from activities such as decontamination and subsequent (after first cycle) processing of spent nuclear fuel. These solutions were generally high in sodium and potassium nitrates and are referred to as sodium-bearing waste (SBW). Other newly generated liquid mixed wastes (NGLW), primarily associated with decontamination activities not associated with processing spent fuel, were also transferred to the INTEC Tank Farm Facility. These wastes were subsequently calcined, and are currently stored in the CSSF.

Bin Sets 1, 2, and 3 received calcined waste from the WCF only. These wastes were generated from spent nuclear fuel reprocessing operations occurring at the INTEC. Bin Sets 4, 5, and 6 received calcined waste from the NWCF only. These bins contain calcine resulting from spent fuel reprocessing, SBW, and NGLW. Bin Set 7 has not received any waste.

The chemical composition of calcine includes metal oxides and metal salts of aluminum, boron, cadmium, calcium, chromium, mercury, radionuclides, sodium, and zirconium. The concentration of the principal constituents of aluminum, cadmium, calcium, chromium, fluoride, mercury, sodium, and zirconium is variable, depending on the composition of the waste calcined. Typical calcine composition for each type of liquid radioactive waste treated is given in Table C-1. Approximate calcine composition by Bin Set for Bin Sets #1 through #6 is given in Table C-1.a.

Aluminum, zirconium, zirconia-sodium, and aluminum-sodium calcine are readily distinguished from each other on the basis of chemical composition. Aluminum calcine is predominantly aluminum oxide and contains small amounts of mercury compounds. Zirconium blends can be distinguished from other calcine types by the high percentages of zirconium oxide and calcium fluoride and the absence of cadmium oxide. Zirconia-sodium calcine is readily distinguished from other types by the sodium and potassium content. Aluminum-sodium calcine is readily distinguished from other types by the aluminum oxide and sodium content.

Table C-1. Typical calcined product composition [a] - excluding oxide (in wt%).

Component	Waste Type			
	Aluminum	Zirconium	Fluorinel/SBW	Aluminum Nitrate/SBW
Aluminum	87.3	20.0	20.0	53.4
Boron	0.4	1.1	1.0	0.8
Cadmium	N/A	N/A	5.5	0.2
Calcium	N/A	32.0	31.9	4.0
Chloride	N/A	N/A	0.1	0.4
Chromium	N/A	0.4	0.1	0.1
Fluoride	N/A	25.0	21.9	1.0
Iron	0.1	0.3	0.2	0.4
Mercury	5.5	N/A	0.001	0.003
Nitrate	2.6	0.1	8.1	23.0
Potassium	0.1	0.1	0.9	2.5
Sodium	1.4	N/A	4.1	11.4
Sulfate	1.5	N/A	3.7	1.4
Tin	N/A	0.3	0.2	N/A
Zirconium	N/A	18.2	15.5	0.3

[a] Source: Staiger (2003), Table 3.
SBW = sodium-bearing waste

Table C-1.a. Approximate calcine composition by Bin Set (for Bin Sets #1 to #6).

Component	**Weight %**					
	Bin Set #1	**Bin Set #2**	**Bin Set #3**	**Bin Set #4**	**Bin Set #5**	**Bin Set #6** [d]
Al_2O_3	90.6	39.5	23.8	14.2	14.2	58.8
ZrO_2	---	14.8	17.3	19.4	19.9	2.4
CaF_2	---	34.1	40.3	45.2	46.4	6.8
B_2O_3	0.6	2.1	2.3	2.6	2.6	1.5
Na_2O	3.1	1.0	1.9	4.2	3.6	7.9
K_2O	---	---	0.1	0.9	0.7	1.8
CaO	---	2.5	5.9	8.0	10.9	7.1
Fe_2O_3	0.6	0.3	0.2	0.3	0.2	1.0
Hg	2.9	1.0	---	---	---	---
SO_4	1.2	0.4	0.1	0.3	0.3	1.0
PO_4	---	---	0.1	0.1	0.2	0.1
Cl	---	0.1	0.1	0.1	0.1	0.2
Other	1	4 [b]	8.0[b]	4.8 [b]	1.0	0.7
NO_3 [c]	1	1	~3.5	~5	~5	10.5

a. Source: Berreth (1988), Tables 4-3 and 4-4. NOTE; The referenced Table 4-3 also shows CdO and SnO_2, which are not depicted in Table 4-4 or in the table above.
b. Bin Sets #2, #3, and #4 includes about 3%, 7%, and 4%, respectively as dolomite [$CaMg(C0_3)_2$] start-up material.
c. NO_3 is present as percent of total calcine composition.
d. The composition for Bin Set #6 includes dolomite as components, not as "Other" as previously specified for Bin Sets #1 through #5.

Generally calcine is composed of dry white-to-gray, black, brown, or rust-colored subrounded to rounded grains that average 0.2 mm to 1.0 mm in diameter. The bulk density of calcine varies between 1.0 and 1.7 g/cm^3

C-2 WASTE ANALYSIS PLAN: [IDAPA 58.01.05.008 and 012; 40 CFR §§ 264.13(b) and 270.14(b)(3)]

The regulations under RCRA, as implemented through IDAPA 58.01.05.008 (40 CFR § 264.13), require a Waste Analysis Plan (WAP) for regulated waste management units. This WAP identifies what waste characterization information is needed, the nature and extent of information required, the method(s) by which the information is gathered, and the quality assurance and quality control (QA/QC) goals.

The process outlined in this WAP is implemented for characterization of all mixed/hazardous wastes or potentially hazardous wastes managed at the INTEC units described herein. Wastes subject to this plan include wastes generated from INL operations and treatment residues generated from INL RCRA-regulated waste management activities. As such, this WAP is intended for inclusion in day-to-day waste management operations.

This WAP is established to ensure that all data used for waste characterization are scientifically valid, defensible, and of known precision and accuracy. This objective relies on the identification of appropriate parameters and rationale, analytical methods, sampling methodologies, and quality control.

The objectives of this WAP are as follows:

- Ensure that sufficient information is available to provide safe handling, storage, and treatment of waste materials
- Define the parameters for characterization and the rationale for selection
- Establish consistent sampling, sample management, analytical methods, parameter selection, and controls for wastes received and generated
- Provide a description of the waste stream characterization and approval process from the point of waste generation through final disposition of the waste

- Establish unit-specific waste acceptance criteria (where necessary) for treatment units to ensure that sufficient information is available to determine whether the wastes considered for storage at the respective units meet the requirements established in this permit reapplication

- Define land disposal restriction (LDR) requirements applicable to wastes managed in the miscellaneous treatment, and storage units

- Verify that EPA HWNs for wastes stored or treated are acceptable per the EPA HWNs listed in the Part A permit application.

This WAP will be revised whenever test methods are changed or whenever regulations change that affect the WAP.

C-2a Parameters and Rationale: [IDAPA 58.01.05.008; 40 CFR §§ 264.13(b)(1) and (2)]

Tables C-2 and C-3 outline the parameters for analysis and corresponding rationale that are employed to perform hazardous waste determinations in accordance with IDAPA 58.01.05.006 (40 CFR § 262.11) and to assess LDR requirements. The parameters and rationale presented in these tables are selected to ensure compliance with RCRA and unit-specific waste acceptance requirements, and guarantee safe, compliant treatment and storage. Not all of the parameters identified in Tables C-2 and C-3 are selected for each waste stream. Only the specific parameters applicable to each waste stream are evaluated.

Wastes are characterized and LDR requirements are determined at the point of generation by facility personnel with assistance from other contractor organizations, as needed, by analyzing the waste or by applying process knowledge. The following are examples of process knowledge:

- Raw materials used – knowledge of the type, quantity, and concentration of raw materials used in the system combined with detailed knowledge of the generating process may provide enough information to adequately characterize the waste.

- Process description – pertinent details of the process generating the waste and the chemicals used in the process must be described. The more complex the process, the more information would be required.

- Chemical/material composition specifications – chemical specifications may be available from the purchase specifications of a particular chemical, from product information provided by the manufacturer, or from the labels for the particular chemical in question. For pure chemicals whose contents and characteristics are known (e.g., nitric acid), standard chemical reference materials may supply the required information. Standard material composition reference tables may supply the required information for metals, plastics, and other materials manufactured to certain grades, alloy specifications, etc., whose material contents and characteristics are well known (e.g., Type 304 stainless steel).

- Safety data sheets (SDSs) – chemical specifications and related information are available on these standard reference materials. SDSs may be provided by the manufacturer or acquired through available SDS databases.

- Process reference materials including laboratory notebooks, strip charts, correspondence, chemical analyses, and analytical reports.

- Analytical reports from non-SW-846 chemical analyses or information from similar processes.

If process knowledge is adequate to ensure that a particular constituent is not present in the waste, then analysis for that constituent will not be performed. If process knowledge is not sufficient to eliminate a particular parameter, then that parameter will undergo selection for testing.

Specific parameters selected for RCRA characterization analysis are determined on a case-by-case basis. Facility personnel select the appropriate parameters based on knowledge of the waste source, unit-specific waste acceptance criteria (WAC), and characterization requirements to identify RCRA-regulated wastes. This ensures that the appropriate parameter selection will be matched with the correct analytical method(s) to generate the data required for subsequent management of the waste within the CSSF.

All process knowledge determinations and RCRA characterization analytical results are documented in the facility operating record.

Table C-2. Test methods for waste analysis parameters and rationale.

PARAMETER	TEST METHOD(S)[a]	RATIONALE
Toxicity characteristic	1311 Toxicity characteristic leaching Procedure (TCLP) or process knowledge	Determine the waste and LDR status.
Metals: antimony arsenic barium beryllium cadmium chromium lead mercury nickel selenium silver thallium	3005A, 3010A, 3050B, 3051, 3052, 6010, 7470, 7471 or process knowledge	Determine if the waste is characteristically hazardous for toxicity. Determine reasonably expected underlying hazardous constituents (UHCs).
Volatile and semi-volatile organic compounds	5030B, 5035, 8015, 8082, 8260B, 3510C, 3550B, 3600C, 8270C or process knowledge	Determine whether the waste is characteristically toxic for organic compounds or whether listed waste constituents can be detected. Identify reasonably expected UHCs.
Flash point	1010, 1020, ASTM D93-80, D3828-81 or process knowledge	Determine if waste is characteristically ignitable.
Corrosivity/Acidity, pH or Corrosivity toward steel	ACMM 7012[b], 9040B, 9045C, 9441A or process knowledge	Determine if the waste is characteristically corrosive.
Reactivity (cyanides, sulfides, water reactive, chemical stability, shock sensitive)	C003[c], 9010B, 9013, 9014, 9030B, 9031, 9034, or process knowledge	Determine if waste is characteristically reactive and prevent mixing of incompatible wastes in tank and treatment systems.
Free liquids	9095A Paint Filter Liquids Test, visual inspection or process knowledge	Determine whether the waste is a solid or a liquid.
Total organic carbon (TOC)	9060 or process knowledge	Determine whether organics may be present in measurable quantities.

ASTM = American Society for Testing and Materials
ACMM = Analytical Chemistry Methods Manual

a. Methods are from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846, unless otherwise stated.
b. G. L. Booman, M. C. Elliot, R. B. Kimball, F. O. Cartan, J. E. Rein, "Determination of Free Acid in the Presence of Hydrolyzable Ions," Analytical Chemistry, 30 No. 2 (February 1958), pp. 284-287.
c. Arthur D. Little, Inc., Sampling and Analysis Methods for Hazardous Waste Combustion, EPA-600/8-84-002, NTIS No. PN84-1555845, February 1984.

Table C-3. Test methods, parameters, and rationale for LDR status.

PARAMETER	TEST METHOD(S)[a]	RATIONALE
Toxicity characteristic	1311 Toxicity Characteristic Leaching Procedure (TCLP) or process knowledge	Determine waste and LDR status for toxicity.
Metals: antimony arsenic barium beryllium cadmium chromium lead mercury nickel selenium silver thallium	3005A, 3010A, 3050B, 3051, 3052, 6010, 7470, 7471 or process knowledge	Determine LDR status for toxicity. Evaluate mercury subcategory and UHCs.
Volatile and Semivolatile organic compounds	5030B, 5035, 8015, 8082, 8260B, 3510C, 3550B, 3600C, 8270C or process knowledge	Determine listed waste and LDR status for toxicity. Evaluate UHCs.
Flash point	1010, 1020, ASTM D93-80, D3828-81 or process knowledge	Determine LDR status for ignitability.
Corrosivity/Acidity, pH or Corrosivity toward steel	ACMM 7012[b], 9040B, 9045C, 9441A or process knowledge	Determine LDR status for corrosivity.
Reactivity (cyanides, sulfides, water reactive, chemical stability, shock sensitive)	C003[c], 9010B, 9013, 9014, 9030B, 9031, 9034, or process knowledge	Determine LDR status for reactivity and subcategory.
Free liquids	9095A Paint Filter Liquids Test, visual inspection or process knowledge	Determine whether the waste is a solid or a liquid.
Total organic carbon (TOC)	9060 or process knowledge	Determine wastewater or nonwastewater category
Total suspended solids (TSS)	160.1[d] or process knowledge	Determine wastewater or nonwastewater category

ASTM = American Society for Testing and Materials
ACMM = Analytical Chemistry Methods Manual

a. Methods are from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846, unless otherwise stated.
b. G. L. Booman, M. C. Elliot, R. B. Kimball, F. O. Cartan, J. E. Rein, "Determination of Free Acid in the Presence of Hydrolyzable Ions," Analytical Chemistry, 30 No. 2 (February 1958), pp. 284-287.
c. Arthur D. Little, Inc., "Sampling and Analysis Methods for Hazardous Waste Combustion," EPA-600/8-84-002, NTIS No. PN84-1555845, February 1984.
d. "Methods for Chemical Analysis for Water and Wastes," EPA-600/4-79-020.

C-2a(1) Waste Acceptance Criteria

Wastes processed in the WCF and NWCF were required to meet their WAC prior to acceptance and treatment. Upon generation, calcine was transported to the CSSF for storage without further evaluation.

Although, the CSSF bins are not currently receiving any waste, this permit reapplication allows for the continued use of the Bin Sets 1, 2, 3, 4, and 5 for storage and Bin Sets 6 and 7 for storage and to receive future waste transfers.

The WCF has been closed as a RCRA landfill and the NWCF has undergone RCRA-regulated closure. As part of closure, the waste transfer lines from the WCF were cut and capped and the waste transfer lines from the NWCF to the CSSF have been physically isolated in accordance with the approved closure plan.

C-2a(2) Waste Acceptance Process

Wastes stored in the CSSF were calcined in either the WCF or the NWCF. The WCF completed RCRA-regulated closure in November 1999. RCRA-regulated closure for the NWCF calciner was completed in December 2004.

LDR Requirements

Point-of-generation facility personnel provide waste characterization information and use this information to complete LDR notifications, per IDAPA 58.01.05.011 (40 CFR § 268.7). In cases where facility personnel determine that an LDR waste does not meet the applicable treatment standard(s) set forth in IDAPA 58.01.05.011 (40 CFR § 268, Subpart D), or exceeds the applicable prohibition level(s) set forth in IDAPA 58.01.05.011 (40 CFR § 268.32) or Section 3004(d) of RCRA, facility personnel provide written notice in accordance with IDAPA 58.01.05.011 [40 CFR § 268.7(a)(2)].

In cases where facility personnel determine that a restricted waste is being managed that can be land-disposed without further treatment, facility personnel submit written notice stating that the waste meets (or is exempt from) applicable treatment standards set forth in IDAPA 58.01.05.011 (40 CFR § 268, Subpart D) and the applicable prohibition level(s) set forth in IDAPA 58.01.05.011 (40 CFR § 268.32) or Section 3004(d) of RCRA. The notice must be in accordance with IDAPA 58.01.05.011 [40 CFR § 268.7(a)(3)].

Point-of-generation facility personnel provide LDR notices. Required LDR notifications will be prepared as necessary prior to shipment of any treatment residuals for final disposal according to applicable laws and regulations.

C-2b Test Methods: [IDAPA 58.01.05.008; 40 CFR § 264.13(b)(2)]

Waste Analysis

Analytical methods employed are primarily taken from EPA's *Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods* (SW-846, current edition). In those cases where method-defined parameters[1] are required by regulation, SW-846 methods are always employed. Examples of method-defined parameter methods, where the analytical result is wholly dependent on the process used to make the measurement, include the use of the TCLP to prepare a leachate, flash point, pH, corrosivity tests, and paint filter liquids. The cited test methods will be performed at the laboratories per controlled implementing procedures.

The EPA provides for a degree of flexibility in the use of SW-846 and other approved methods. This flexibility is dependent on the maintenance of precision, accuracy (or bias), recovery,

1. The use of an SW-846 method is mandatory for the following Resource Conservation and Recovery Act (RCRA) applications contained in 40 CFR Parts 260 through 270:
   - Section 260.22(d)(1)(i) - Submission of data in support of petitions to exclude a waste produced at a particular facility (i.e., delisting petitions)
   - Section 261.22(a)(1) and (2) - Evaluation of waste against the corrosivity characteristic
   - Section 261.24(a) - Leaching procedure for evaluation of waste against the toxicity characteristic
   - Section 261.35(b)(2)(iii)(A) - Evaluation of rinsates from wood preserving cleaning processes
   - Sections 264.190(a), 264.314(c), 265.190(a), and 265.314(d) - Evaluation of waste to determine if a free liquid is a component of the waste
   - Sections 264.1034(d)(1)(iii) and 265.1034(d)(1)(iii) - Evaluation of organic emissions from process vents
   - Sections 264.1063(d)(2) and 265.1063(d)(2) - Evaluation of organic emissions from equipment leaks
   - Section 266.106(a) - Evaluation of metals from boilers and furnaces
   - Sections 266.112(b)(1) and (2)(i) - Certain analyses in support of exclusion from the definition of a hazardous waste for a residue which was derived from burning hazardous waste in boilers and industrial furnaces
   - Sections 268.7(a), 268.40(a), (b), and (f), 268.41(a), 268.43(a) - Leaching procedure for evaluation of waste to determine compliance with land disposal treatment standards
   - Sections 270.19(c)(1)(iii) and (iv), and 270.62(b)(2)(i)(C) and (D) - Analysis and approximate quantification of the hazardous constituents identified in the waste prior to conducting a trial burn in support of an application for a hazardous waste incineration permit
   - Sections 270.22(a)(2)(ii)(B) and 270.66(c)(2)(i) and (ii) - Analysis conducted in support of a destruction and removal efficiency (DRE) trial burn waiver for boilers and industrial furnaces burning low risk wastes, and analysis and approximate quantification conducted for a trial burn in support of an application for a permit to burn hazardous waste in a boiler and industrial furnace. Federal Register, Thursday, November 20, 1997, Vol. 62, No. 224, 62079.

representativeness, comparability, and sensitivity (detection, quantitation, or reporting limits) relative to the data quality objectives for the intended use of the analytical results. "If an alternative analytical procedure is employed, then EPA expects the laboratory to demonstrate and document that the procedure is capable of providing appropriate performance for its intended application. This demonstration must not be performed after the fact, but as part of the laboratory's initial demonstration of proficiency with the method. The documentation should be in writing, maintained in the laboratory, and available for inspection upon request by authorized representatives of the appropriate regulatory authorities" (SW-846, Chapter Two, "Choosing the Correct Procedure").

Joint EPA/Nuclear Regulatory Commission (NRC) guidance[2] for mixed waste also provides flexibility in sample sizes with method-defined parameter methods, as long as the resulting test is sufficiently sensitive to measure the constituents of interest at the regulatory levels prescribed in the TCLP. Other variances to published testing and sampling protocols are permissible under 40 CFR §§ 260.20-21, but must be approved prior to implementation by the Director of the DEQ.

The EPA allows for the use of recognized methods other than those prescribed in SW-846. "Whenever methods from SW-846 are not appropriate, recognized methods from source documents published by the EPA, American Public Health Association (APHA), American Society for Testing and Materials (ASTM), the National Institute for Occupational Safety and Health (NIOSH), or other recognized organizations with appropriate expertise should be used, if possible" (SW-846, Chapter One).

Because of the broad range of acceptable methods available for testing specific constituents, and with the rapid incorporation/deletion of methods, not all of the SW-846 methods are specified in Tables C-1 and C-2. Only the currently defined parameter methods are specified.

Calcine requires remote handling and is subject to full RCRA characterization requirements. The remote sample handling requirements and specific process stream requirements may cause deviations in some required analyses systems. For example, the EPA has determined that "if the analyst can demonstrate that the test is still sufficiently sensitive (in the case of reduced sample size in a TCLP extraction) to measure the constituents of interest at the regulatory levels specified in the TCLP and representative of the waste stream being tested" then the sample size can be legitimately decreased.[3] Sample size becomes a critical factor, especially with respect to radiation exposure hazards, and therefore, must be a factor for consideration in any sampling or analytical activity.

2. *Federal Register*, Thursday, November 20, 1997, Vol. 62, No. 224, 62079.

3. Federal Register, Thursday, November 20, 1997, Vol. 62, No. 224, 62079.

The analyses may be performed at INL laboratories or at approved off-Site laboratories. Laboratories contracted by the contractor to perform outside work are audited periodically, to ensure that each laboratory's quality control procedures and standard practice manuals meet the requirements for laboratories conducting EPA test procedures. If the laboratory has not been audited, or has failed to conform to the audit criteria, that laboratory is not authorized by the contractor to conduct waste characterization analysis.

Process Knowledge

The EPA/NRC guidance emphasizes the use of process knowledge to determine if a radioactive waste is hazardous, as a way to avoid unnecessary exposures to radioactivity. Examples of the types of process knowledge information used to characterize wastes for the CSSF are presented in Section C-2a of this permit reapplication. The INL documents process knowledge through Waste Determination and Disposition Forms (WDDFs - waste stream profiles), correspondence, and memoranda maintained in the Document Management System. As a best management practice, the characterization documentation for all active waste streams is reviewed and each stream is recertified annually to ensure the information maintained remains accurate and complete.

All waste characterization information, including documentation of process knowledge, is maintained in the facility operating record.

C-2c Sampling Methods: [IDAPA 58.01.05.008 and 005; 40 CFR § 264.13(b)(3), Part 261 Appendix I]

Facility personnel, in conjunction with Waste Generator Services (WGS), and other organizations as needed, are responsible for characterizing wastes received into the CSSF. Personnel can use process knowledge and/or testing to adequately characterize waste. As part of characterization, the appropriate sampling method is selected based on knowledge of the waste material matrix (e.g., solid, liquid, sludge, radiological component) and radiation exposure considerations, as well as the specific analyte of interest. Facility personnel are also responsible for arranging all sampling and laboratory support and for sample shipments. Sampling personnel document the sampling activities and chain of custody.

Representative waste samples are obtained in accordance with the sampling approaches described in Chapter Nine of Test *Methods for Evaluating Solid Wastes, Physical/Chemical Methods* (SW-846, current edition). Samples are collected using appropriate equipment and methods identified in, but not limited to, the following sources:

- EPA Test Methods for Evaluating Solid Waste, SW-846, Chapter 10, "Sampling Methods," Third Edition
- 40 CFR 261, Appendix I, "Representative Sampling Methods"
- Annual Book of ASTM Standards, American Society for Testing and Materials, Current issue
- Characterization of Hazardous Waste Sites - A Methods Manual, Volume II, Available Sampling Methods, EPA-600/4-84-076, 2nd Edition, December 1984
- "Characterizing Heterogeneous Wastes: Methods and Recommendations," EPA/600/R-92/033, February 1992
- EPA Waste Analysis at Facilities that Generate, Treat, Store, and Dispose of Hazardous Wastes: A Guidance Manual, April 1994
- Other recognized methods from source documents published by the EPA, APHA, ASTM, the NIOSH, or other recognized organizations with appropriate expertise.

The Director of the DEQ must approve any sampling methods that deviate from approved or other recognized methods prior to implementation.

C-2c(1) Standard Sampling Methods

Due to the highly radioactive nature of the calcine stored in the CSSF, sampling occurs infrequently.

Any sampling will be completed in accordance with an approved sampling and analysis plan and conducted in accordance with approved sampling and operating procedures. In general, where standard samples are collected, the following basic sampling guidance is used:

- Obtain samples using precleaned sample equipment, in accordance with the applicable method.
- Fill sample containers. Uniquely identify and label each sample, and document necessary information in the field record (e.g., location, time, characteristics).
- Properly clean and decontaminate the exterior of the sample containers and the sampling hardware.

- Complete the chain-of-custody forms and retain a record copy.

- Deliver the samples and associated forms to the laboratory.

Sampling procedures for calcine may deviate from the standard sampling protocols, due to the hazards associated with radioactive materials. For example, due to radiological concerns, the use of remotely operated sample transfer systems may limit the size of sample containers, prevent sealing of the transfer receptacle, or preclude chain-of-custody and other documentation from directly accompanying the samples. However, all sampling procedures are consistent with the stated goals of SW-846, to collect representative samples and maintain their physical and chemical integrity.

Equipment used to sample waste is disposable or designed for decontamination. Contaminated disposable equipment is managed appropriately. Equipment that can be cleaned and reused is thoroughly decontaminated before reuse or storage. Decontamination solutions are managed appropriately.

C-2c(1)(a) Field Records

Records provide direct evidence and support for the necessary technical interpretations, judgments, and discussions concerning project activities. These records, particularly those anticipated to be used as evidentiary data, directly support current or ongoing technical studies and activities, and provide the historical evidence needed for later reviews and analyses.

Field records may consist of bound field notebooks, sample collection forms, personnel qualification and training forms, sample location maps, equipment maintenance documentation, chain-of-custody forms, and/or sample analysis request forms. Records may include, but are not limited to the following, as applicable:

- Sample Collection–To ensure maximum utility of the sampling effort and resulting data, documentation of sampling protocol, as performed in the field, is essential. Sample collection records may contain the names of persons conducting the activity, sample number, sample location, date and time the sample was taken, equipment used, climatic conditions, documentation of adherence to protocol, and unusual observations.

- Chain-of-Custody Records–The chain of custody involving the possession of RCRA characterization samples from the time they are obtained until they are disposed or shipped off-Site are documented, and may include the project name, signatures of samplers, sample number,

date and time of collection, grab or composite sample designation, signatures of individuals involved in sample transfer, and if applicable, the air bill or other shipping number.

- Quality Control (QC) Samples–Documentation for generation of QC samples, may include trip and equipment rinsate blanks, duplicate samples, and any field spikes.
- Deviations–All deviations from normal sampling and analysis protocols are recorded in the site logbook or project records.
- Reports–A copy of any report issued and any supporting documentation.

C-2c(2) Quality Control

Defensible and valid data are obtained through implementation of the processes controlling characterization and/or sampling and analysis. Such processes include the use of field and laboratory control samples, data validation, sampling performance assessments, and as necessary, corrective action(s) as identified in this section.

C-2c(2)(a) Field Control Samples

Control samples are QC samples that are intended to monitor the performance of the sampling system. In accordance with this WAP, the following field control samples may be collected:

- Field duplicates
- Equipment rinsate
- Trip blank-sample.

C-2c(2)(b) Laboratory Quality Control

Laboratories maintain QA programs to ensure the quality of data produced. Depending on the data end use and overall data quality objectives (DQOs), the laboratory QC samples may include:

- Matrix spike
- Matrix duplicate
- Matrix spike duplicate

- Laboratory blanks
- Control standards.

Off-Site laboratories must be approved by the INL. This approval process requires off-Site laboratories to pass stringent audit criteria included in the U.S. Department of Energy (DOE) Consolidated Audit Program (DOECAP). The DOECAP maintains audit checklists for such laboratory activities as general laboratory practices, quality assurance management systems, organic/inorganic data quality, radiochemistry data quality, electronic data management, hazardous and radioactive materials management, and industrial hygiene. These checklists are available to all facilities within the DOE Complex via the Internet. Once approved, laboratories are audited at regular intervals to ensure performance and QA/QC standards are met.

C-2c(2)(c) Data Validation

Depending on the data end use and overall project DQOs, data validation may include evaluation of the following subjects:

- Completeness of laboratory records with regard to processing of all required samples and analyses
- Implementation of appropriate procedures
- Evaluation of sample analytical data to required detection and quantity
- Evaluation of QC analytical data to applicable control criteria
- Comparison of sample holding times to the required holding times prescribed by this WAP.

All deviations from the applicable guidance are documented, and corrective actions are implemented as necessary.

C-2c(2)(d) Sampling Performance Assessment

A key function of a QC program is the periodic assessment of activities for conformance to required protocols. Sampling performance assessments may evaluate the following activities:

- Completeness of Field Reports–This evaluation determines that a complete record exists for each field activity and that the procedures specified by this WAP or the documents implementing this WAP were executed.

- Identification of Valid Samples–This review involves the evaluation and interpretation of field records to detect problems affecting the representativeness of samples.

All resultant concerns are documented, and corrective actions are implemented as necessary.

C-2c(2)(e) Mitigating Action

Mitigating action measures can be divided into two categories as follows:

- Project Mitigating Action–Mitigating actions are performed when the project objectives are not met, when conditions adverse to quality have been identified, or when an assessment of data reveals questionable or unknown data quality. Conditions adverse to quality are identified promptly, and corrected as soon as possible. When significant conditions adverse to quality are identified, the causes are determined, and mitigating actions to prevent their recurrence are performed and documented.

- Laboratory Mitigating Actions–The laboratory possesses a QA plan identifying analytical acceptance criteria and what actions to take when these criteria are not satisfied.

C-2d Frequency of Analyses: [IDAPA 58.01.05.008; 40 CFR § 264.13(b)(4)]

Waste stream characterizations are reviewed and recertified annually to ensure continued accuracy of the information provided. Typical waste streams managed at the INTEC are generated several times a year from highly controlled processes in which the waste composition remains consistent for the duration of the year. Recharacterization is required when:

- The process generating an established waste stream changes

- The waste characteristics are highly variable from batch to batch

- Analytical results do not correlate with waste profile information

- There is reason to suspect a change in the waste based on inconsistencies in the packaging or labeling of the wastes, or there are inconsistencies between the waste verification results and the waste characterization data provided by the generator

- Facility personnel reject the waste because it is inconsistent with the profile for that waste.

Facility personnel can require additional waste analysis to substantiate waste characterization data prior to acceptance of a waste.

C-2e Additional Requirements for Wastes Generated Off-Site [IDAPA 58.01.05.008; 40 CFR 264.13(c)]

The CSSF does not manage wastes generated off-Site.

C-2f Additional Requirements for Ignitable, Reactive, or Incompatible Wastes: [IDAPA 58.01.05.008; 40 CFR §§ 264.13(b)(6), 40 CFR 264.17]

Calcine generated by the treatment of wastes is a granular solid that does not exhibit the characteristics of ignitability or reactivity.

The CSSF storage units are operated in accordance with defined procedures that prevent incompatible wastes from contacting one-another. The tables in Appendix V of 40 CFR 264/265 and 49 CFR § 177.848 are examples of resources that may be used to determine compatibility. Since calcine was generated from the treatment of wastes with like or similar constituents, incompatibility is not a concern.

C-3 WASTE ANALYSIS REQUIREMENTS PERTAINING TO LAND DISPOSAL RESTRICTIONS [IDAPA 58.01.05.011; 40 CFR § 268]

The Hazardous and Solid Waste Amendments to RCRA authorize the land disposal of certain types of wastes only if LDR treatment standards are met. Information provided in this section describes the additional characterization requirements for assessing LDR applicability and compliance with the treatment standards before land disposal.

C-3a Waste Characterization

LDR applicability is determined for each waste at the point of generation based on the EPA HWNs assigned to individual waste streams. Once LDRs are identified, they remain applicable through

treatment and/or disposal of the final waste form. Calcine or the final waste form will be disposed of in accordance with applicable laws and regulations.

The characterization process for purposes of LDR is the same as that employed during the initial characterization process. Facility personnel, with the assistance of WGS, and other organizations as needed, conduct hazardous waste determinations before management of the waste. The hazardous waste determination includes, where applicable, characteristic and listed EPA HWN determinations in addition to identification of wastewater and non-wastewater treatability groups, UHCs, LDR subcategories, and LDR treatment standards applicable to the waste.

During the initial characterization process, facility personnel select parameters and rationale for testing based on the rationale presented in Table C-2 and on the applicable LDR requirements found within IDAPA 58.01.05.011 and 40 CFR § 268 or process knowledge. If the waste is determined to be subject to the LDR requirements, facility personnel determine if the waste is a wastewater or non-wastewater, and also determine applicable subcategories. TOC and total suspended solids TSS analyses may be used to conduct wastewater/non-wastewater determinations, in cases where process knowledge is not adequate. Additional information on the characterization process is found in Sections C-1 and C-2.

Waste generated from activities such as maintenance and spill cleanup will undergo a hazardous waste determination based on testing and/or process knowledge as outlined within this document. If the waste is determined to be subject to LDR requirements, facility personnel will determine if the waste is a wastewater or non-wastewater and applicable subcategories using the parameters shown in Table C-2 or process knowledge.

C-3b Sampling and Analytical Procedures

Sampling and analysis will follow the same approach as outlined within Sections C-2 through C-2c. Test methods used to assess LDR treatment standards will be based on total analysis, unless otherwise specified in IDAPA 58.01.05.011 (40 CFR §§ 268.40 through 268.48).

C-3c Frequency of Analysis

Compliance with all LDR requirements will be demonstrated and documented prior to disposal of the final waste form. All LDR compliance documentation will be maintained in the facility operating record.

C-4 CALCINED SOLIDS STORAGE FACILITY SUBPART AA, SUBPART BB, AND SUBPART CC APPLICABILITY [IDAPA 58.01.05.008; 40 CFR §§ 264.1030, 264.1050, and 264.1080]

40 CFR 264 Subpart AA Applicability

The requirements contained in 40 CFR 264 Subpart AA do not apply to the CSSF, since it contains no process vents associated with distillation, fractionation, thin-film evaporation, solvent extraction, or air or steam stripping operations.

40 CFR 264 Subpart BB Applicability

The requirements contained in 40 CFR 264 Subpart BB do not apply to the CSSF, since the organic concentration of calcine is less than 10% by weight, as demonstrated by the analytical results provided as Appendix 3 of this permit reapplication.

40 CFR 264 Subpart CC Applicability

The requirements contained in 40 CFR 264 Subpart CC do not apply since the CSSF is a waste management unit used solely for the management of radioactive mixed waste in accordance with all applicable regulations under the authority of the Atomic Energy Act and the Nuclear Waste Policy Act and is specifically exempted per 40 CFR 264.1080(b)(6).