SAMPLING AND ANALYSIS PLAN FOR POND SLUDGE MATERIAL

RF/RMRS-98-291

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Prepared for:

Rocky Flats Environmental Technology Site
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CONCURRENCE SIGNATURES

THE FOLLOWING INDIVIDUALS HAVE REVIEWED THIS PLAN AND CONCUR WITH ITS CONTENTS:

Signature	Date
RMRS Disposal Projects	11/19/98
Waste Certification and Oversight	11/19/98
K-H Analytical Services Division	11/19/98
RMRS Waste Management	11/19/98
RMRS Quality Assurance	11-20-98

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ABBREVIATIONS AND ACRONYMS

ASD	Analytical Services Division
BWRBB	Backlog Waste Reassessment Baseline Book
CCR	Colorado Code of Regulations
CFR	Code of Federal Regulations
CI	Confidence Interval
DOT	U. S. Department of Transportation
DQO	Data Quality Objective
EPA	U. S. Environmental Protection Agency
K-H	Kaiser-Hill, L.L.C.
IDC	Item Description Code
LDR	Land Disposal Restrictions
RDL	Required Detection Limit
mg/kg	Milligrams per Kilogram
mg/l	Milligrams per Liter
PA	Protected Area
pCi/g	pico-Curies per Gram
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
RFETS	Rocky Flats Environmental Technology Site
RMRS	Rocky Mountain Remediation Services
RWP	Radiological Work Permit
SAP	Sampling and Analysis Plan
TCLP	Toxicity Characteristic Leaching Procedure
UCL	Upper Confidence Limit
WAC	Waste Acceptance Criteria
W/RT	Waste/Residue Traveler

1.0 Project Description

The purpose of this project is to collect sample data to verify characterization on pond sludge material. This information will be used to determine processing requirements for the waste and/or to determine that it meets the waste acceptance criteria at an approved off-site disposal site. Based on the analytical results obtained from the sampling event, Rocky Flats Environmental Technology Site (RFETS) will be able to determine if the pond sludge is either Land Disposal Restricted-Compliant (LDR-C) or LDR-Noncompliant (LDR-NC). The samples will be analyzed by both on-site and off-site laboratories for identified regulated metals, regulated volatile organic compounds, and semi-volatile organic compounds, as required by the disposal facility(s) Waste Acceptance Criteria. Additional analyses will be performed to determine radioisotope levels and the physical properties of the waste.

1.1 Description of the Site

The RFETS is located in northern Jefferson County, Colorado, approximately 16 miles northwest of Denver. RFETS is a government-owned, integrated management contractor-operated site that is part of the nationwide nuclear weapons production complex. Major manufacturing, chemical processing, plutonium recovery, and waste treatment facilities occupy approximately 1.6 million square feet of this space. The remaining floor space is occupied by laboratories; administrative offices; warehouses; and utility, security, storage, and construction contractor facilities.

The primary mission of the site, prior to 1991, was production of components for nuclear weapons. Plutonium, uranium, beryllium, and stainless-steel parts were fabricated at the site and shipped off-site for final assembly.. Additional activities included chemical processing to recover plutonium from scrap material, metallurgical research and development, machining, assembly, nondestructive testing, coating, remote engineering, chemistry, and physics.

Presently, the mission at RFETS is:

- To achieve accelerated cleanup and closure of Rocky Flats in a safe, environmentally protective manner and in compliance with applicable state and federal environmental laws;
- To ensure that Rocky Flats does not pose and unacceptable risk to the citizens of Colorado or to the site's workers from either a contamination or an accident; and,
- To work toward the disposition of contamination, wastes, buildings, facilities and infrastructures from Rocky Flats consistent with community preferences and national goals.

1.2 Identification of Types of Waste to be Evaluated

Prior to the start-up of the Liquid Waste Treatment Plant at Building 374 in 1977, wastewater from plant operations was discharged to five (5) lined solar evaporation ponds (207A, 207B (north), 207B (center), 207B (south), and 207C) and from a clarifier tank located between Pond 207A and 207C. Treated aqueous wastes from the waste treatment facility, and occasionally certain untreated wastes from the production plant, were discharged into the solar ponds until 1986. Wastes that were discharged to the solar ponds originated from approximately 30 individual RFETS buildings. These sources included electroplating operations, which involved the use of cyanide; metal machining/manufacturing, which involved the use of solvents; and cleaning/rinsing operations, which involved the use of various acid and caustic solutions.

Based on process knowledge of these operations and the Waste Stream and Residue Identification and Characterization (WSRIC) information, and Halliburton NUS Pond Sludge Waste Characterization Reports, the pond sludge is determined to have the following EPA Hazardous Waste Numbers (EPA Codes):

F001, F002, F005, F006, F007, and F009.

These EPA codes include products such as halogenated and nonhalogenated solvent waste, wastewater treatment waste, and cyanide treatment waste. During the WSRIC effort, solar evaporation pond sludge was also determined to be characteristically hazardous for cadmium. It has been determined that K-series wastes, as defined by 6 CCR

1007-3, Part 261, are not applicable to the pond sludge material because none of the associated activities occurred at RFETS. Additionally, the U- and P-series wastes, as defined by 6 CCR 1007-3, Part 261, were not considered applicable because unused commercial grade chemicals and spill residues were not disposed in the wastewater system. Carbon disulfide, cyclohexanone, and methanol F005 treatment standards do not apply to this material due to: 1) the material is a non-wastewater, and 2) these contaminants are not the only applicable solvents to the waste as F001-F005 solvents (see 40 CFR 268.40, F001-F005 Solvent Waste Treatment Standards). Pond sludge is a non-wastewater as defined by 40 CFR 268.2 (i.e., the waste is greater than 1% Total Organic Carbon and/or exceeds 1% Total Dissolved Solids).

As part of the remediation of the solar evaporation ponds, the sludge was removed. The pond sludges were removed from the ponds using guzzler trucks, the waste was pumped into the tanks, and the water decanted off and sent to Building 374 for treatment. Once the water was removed, more waste was placed in the tank. During this operation, some of the wastes from the 207A pond and 207B pond were mixed. The result was pondsludge material being contained in 80 high-density crosslink polyethylene (HDPE) tanks on the 750 Pad.

1.3 Sampling and Analysis Plan Objectives

The objective of this SAP is to: 1) determine the physical properties (i.e. stratification, density, etc.), 2) obtain representative analytical data from pond sludge material contained in the 80 storage tanks. These storage tanks have been divided into three distinct subpopulations; mixed A&B Pond (28 tanks), C-Pond (50 tanks), and Clarifier (2 tanks). The representative sampling will be accomplished by utilizing the methodology discussed in Section 3.2. This information will be used to make informed decisions regarding the need for stabilization, treatment, and/or demonstrate the pond sludge meets the waste acceptance criteria for the off-site disposal facility. In addition, the LDR nature of the pond sludge will be determined. To meet this objective, analysis must be performed by a Utah certified laboratory. In order to obtain representative samples and to reduce the cost of sampling, *in situ* sampling of the pond sludge material will occur. Once analytical results are received, calculations for representiveness, variance, etc. will be made using EPA QA/G-4, "Guidance for the Data Quality Objectives Process."

1.4 Analytical Requirements

The requirements for analysis of this waste form are based upon the following:

- No characterization of the waste has been performed since the waste has been transferred to the tanks
- All historical waste characterization was based upon sampling of the waste matrix while stored in the Ponds
- Previous waste characterization yielded highly variable analysis results
- Historical analytical data of the pondsludge was incomplete and does not provide needed information for making operational decisions
- Previous analysis was not performed by a State of Utah certified laboratory (a requirement of the identified disposal facility)
- Changes (ie. stratification, evaporation, crystallization) to the waste matrix may have taken place because of the duration of time the pondsludge has been stored in the tanks

The analytical requirements will be divided into two sections: 1) aqueous phase and 2) sludge/solid phase. The analytical requirements for the aqueous phase are based upon the Waste Acceptance Criteria (WAC) for Building 374 Wastewater Treatment Facility (Table 1-1).

Waste characterization requirements for the sludge/solid phase are based on the waste acceptance criteria for Envirocare of Utah and additional, expected requirements for stabilization. Envirocare has a minimum testing requirement for wastes which include volatile and semi-volatile organics, eight RCRA metals (with the addition of Copper and Zinc), Reactivities for Cyanide and Sulfide, Soil pH, and Paint Filter Liquid Test. Additionally, various waste physical properties such as pass through, color, odor, moisture percentage, and gradation must also be determined (Table 1-2). These parameters will also ensure that this waste characterization will meet the waste acceptance criteria for the Nevada Test Site (NTS) disposal facility should this waste ever be able to be disposed at the NTS.

For radiological analyses, Envirocare requires a sufficient number of samples to be analyzed by gamma spectral analysis for all natural and man-made isotopes such that they support the range and weighed average information for the waste stream. If uranium, plutonium, or other non-gamma emitting nuclides are present in the material, all samples must be evaluated by radiochemistry to determine the concentration of these additional contaminants in the material.

The commonly expected isotopes to be found in this waste are Am-241, Pu-238, Pu-239, Pu-240, Pu-241, Pu-242, U-234, U-235, and U-238. These isotopes are specified because they are commonly found in radioactive waste generated at RFETS. If analysis indicates other radioisotopes are present, they will be identified on the analytical reports.

1.5 Use of Result

Results from the execution of this SAP will be reviewed and verified in accordance with Procedure ASD 001, "Data Completion Assessment and Quality Control Verification," and EPA QA/G-4 guidelines, and then used to satisfy the objective provided in Section 1.3. A contractor identified by the Kaiser Hill – Analytical Service Division, performs independent validation of the analytical data.

1.6 Schedule

The schedule for implementing this SAP will be determined based on the Master Project Schedule.

2.0 SAMPLING AND ANALYSIS ORGANIZATION AND RESPONSIBILITIES

The organizations that will be involved in this sampling effort and their responsibilities are presented below.

2.1 Waste Management

Rocky Mountain Remediation Services (RMRS) Waste Management will serve as the management oversight and point of contact for this project. The Waste Disposal Projects (WDP) division of RMRS will identify opportunities for disposal and coordinate efforts to complete the disposal of this waste. For this project, WDP is responsible for SAP preparation, data review, and summarization of analytical data. The Operations division of RMRS will be responsible for the coordination and logistics of the sampling event.

2.2 Analytical Service Division

The Kaiser-Hill - Analytical Service Division (ASD) generates sample requests and sample labels, tracks and receives data packages, and verifies the data. The Analytical Service Division is responsible for the coordination of an independent contractor to perform independent validation. The level of validation for this project is a minimum of 10 % of the analytical data. Advanced Science, Inc. (ASI) is responsible for the collection, receipt, and preparation of samples for shipment on-site or off-site to the designated laboratories.

2.3 Analytical Laboratories

Conducts chemical and radiochemical analyses of samples provided by the ASD. Analyses are conducted in accordance with approved procedures and comply with the Analytical Services Division Quality Assurance/Quality Control (QA/QC) directives. The laboratory shall be a Utah certified laboratory.

2.4 Waste Certification and Oversight

An independent organization that provides final certification that radiologically contaminated waste destined for off-site treatment or disposal conforms to all RFETS requirements and applicable waste acceptance criteria for the treatment or disposal facility.

2.5 Statistical Applications Engineering

An independent organization that reviews plans for sampling, the data generated from analysis of the samples, and provides statistical analysis of the analytical results.

3.0 DATA QUALITY OBJECTIVES

Data quality objectives (DQOs) have been developed to ensure characterization data are of known and acceptable quality and to satisfy the requirements of the treatment/disposal facility, DOT, and the RFETS waste characterization program (ref. "Evaluation Study for 750 Pond Sludge Disposal at the Rocky Flats Environmental Technology Site" and EPA QA/G-4, "The Data Quality Objectives Process"). The data generated must allow the following questions to be answered:

Is the waste form a non-hazardous waste as defined by RCRA? If it is RCRA hazardous, what are the applicable EPA Hazardous Waste Codes?

What radioisotopes are present and at what levels? Do they meet the disposal facility Waste Acceptance Criteria (WAC)?

What is the variance within and between the identified subpopulations?

Is the data generated by this SAP verifiable in accordance with Procedure ASD 001, "Data Completion Assessment and Quality Control Verification?"

Do the Required Detection Limits (RDL) comply with the Analytical Services Division, Statement of Work for Analytical Measurements? Are the RDL's less than ten percent of the regulatory limits specified in 40 CFR 268.43?

Analytical method requirements, discussed in Section 6.0, have been selected based on the DQOs, as outlined in the "Evaluation Study for 750 Pad Pond Sludge Disposal at the Rocky Flats Environmental Technology Site." The associated method detection limits and quality control requirements for the chosen methods will ensure data of known and acceptable quality are collected.

3.1 90 Percent Confidence Limit

To design a statistical based sampling program, some information is required of the population. To determine the number of measurements required to characterize a population, the sample variance is required. Variance can only be determined by obtaining analytical results through a preliminary sampling effort. The preliminary sampling effort is detailed in Section 3.2. Once results from the initial sampling effort are received, the variance from these results will be utilized to determine the additional number of samples required to characterize the waste, utilizing EPA QA/G-4 guidelines. This data will then be used to generate 90% upper confidence limits for the identified physical parameters, mean chemical constituent concentrations, and isotopic activities.

3.2 Representativeness

The ASTM Standard D140-88, "Standard Practice for Sampling Bituminous Materials" was the method selected for determining the initial number of tanks to be sampled. This method specifies that the number of samples must be equal to or greater than the cube root of the inventory population size. An additional two (2) samples will be taken for contingency. This approach is to be used because of the lack of historical analytical data associated with the pond sludge after being placed in the tanks. Due to this lack of information, this approach will serve as a starting point to determine ranges for the parameters of concern.
The total waste population is comprised of pond sludge contained in 80 storage tanks. During the transfer operations to the tanks, efforts were made to maintain segregation of the tanks based upon the origination of the waste. However, during the pumping operations, wastes from the 207A pond and 207B pond were mixed. As a result, the pond sludge material can be divided into three distinct populations; mixed A&B Pond, C-Pond, and Clarifier. Consequently, the cube-root plus two methodology suggests that six tanks from subpopulation "C-Pond" and five tanks from subpopulation "A/B-Pond" should be identified for sampling. Both tanks from the "Clarifier" subpopulation should be sampled. The tanks subject to the sampling/characterization evolution will be randomly chosen using a random number table or software based random number generator (e.g. Microsoft Excel). However, due to physical and safety constraints, some tanks were eliminated from the population considered for sampling. The usefulness of the cube root approach is provided in an internal memo from D. R. Weier to C. E. Baldwin, April 25, 1995, Discussion of Cube-Root-of-N Sample Sizes - DRW-027-95. If the calculated Upper Confidence Limit (UCL) is greater than the regulatory limit for any of the analytes, the EPA QA/G-4 guidelines will be used to determine the additional number of samples that should be taken. These guidelines will yield a result for the additional number of samples to be taken based on the sample variance and the relative proximity of the mean to the regulatory limit.

3.3 Accuracy

A quantitative measure of data quality that refers to the degree of difference between measured or calculated values and the true value of the parameter. The closer the measurement to the true value, the more accurate the measurement.
The actual analytical method and detection limits will be compared with the required analytical method and detection limits. If necessary, additional sampling and analysis may be conducted.
Sampling accuracy will be achieved by using a simple random approach for selecting the wastes to be sampled. This will apply to the identification of the tanks to be sampled within each subpopulation. A sufficient number of analyses must be obtained to adequately determine the range and a weighted average of the parameters of concern in the waste.

3.4 Precision

A quantitative measure of data quality that refers to the reproducibility or degree of agreement among replicate or duplicate measurements of a parameter. The closer the numerical values of the measurements are to each other, the lower the relative percent difference and the greater the precision.
The relative percent difference for the results of the duplicate samples will be tabulated and compared with the project requirements (DQO's). Deficiencies will be noted, and if necessary, additional sampling and analysis may be conducted.
Duplicate samples will be used to insure sampling precision. Duplicate samples will be collected in the same manner and analyzed by the same methods, in the same laboratory as the regular samples. All duplicate samples will be collected at a rate of one per twenty regular samples or, at a minimum, one duplicate sample for each sampled tank. Duplicates will be taken with the same type of sampling equipment used for collection of the regular samples.

3.5 Required Detection Limit and Method Detection Limit

The Analytical Services Division, Statement of Work for Analytical Measurements, sets required detection limits (RDLs). However, the RDL shall not be greater than 10 percent of the regulatory limits specified in 40 CFR

268.43. Method Detection Limits (MDLs) are also addressed in the Analytical Services Division, Statement of Work for Analytical Measurements. The MDLs are determined from sample analyses for the specific matrix types. The MDL will be determined as discussed in Chapter 1 of SW-846.

3.6 Completeness

Through proper control of schedules and personnel, all samples outlined in this SAP are anticipated to be taken. Any sampling exception or deviation to this plan will require the authorization of the Project Manager. Additionally, no changes can be made to this SAP without approval of the organizations originally approving the SAP.
As a contingency, a secondary set of randomly chosen tanks for sampling has been identified (see section 4.3). Through application of the analytical laboratory's QA/QC program, all data generated from the analysis will be verified and useable for its intended purpose.

3.7 Comparability

A quantitative measure defined by the confidence with which one data set can be compared to another. Statistical tests may be used for quantitative comparison between sample sets (populations).
All samples will be collected, analyzed, and the data evaluated using the same techniques.

4.0 SITE SELECTION AND SAMPLING PROCEDURES

4.1 Sampling Approach

In an effort to collect representative samples, 6 tanks from subpopulation "C-Pond," 5 tanks from subpopulation "A/B Pond," and both tanks from the subpopulation "Clarifier" will be sampled. To ensure the sampling approach considers possible stratification within the selected tanks, samples must be obtained at various depths within the sludge. Within each tank, a minimum of three samples will be taken at evenly spaced depths. The sampling depths will be at approximately three feet, six feet, and nine feet. Because of sampling constraints and safety concerns, no sampling point shall be at a depth greater than ten feet. Actual depths will be determined based upon visual observation and the experience of the Sampling Team. Upon breaching each tank through the manway or vent hole, the Sampling Team will lower a sampling device into the tank ("Sludge Judge," auger, bailer, or sludge sampler, depending on consistency of the sample material) collect the sample and withdraw the sample device. If the "Sludge Judge" is utilized, visual observation of stratification within the sampling tool will be performed. The "Sludge Judge" will be marked at one-foot intervals, allowing for stratification determination. Aliquots for the samples will be taken at the prescribed depths; however, if distinct stratification is noted, the sample aliquots will be taken from each stratified layer. The Sample Team will note the depth at which the sample was taken. As an alternative to determine stratification, the sample material will be allowed to slowly flow out of the bottom of the sampling tool and be collected in a clear glass sample container. The Sampling Team shall observe for stratification in the sample material. The sample aliquots will be taken from the waste material that was collected in the container.
Because of the limited access to the contents of the tanks, sample points may be taken directly below the access opening. However, sample point variability will be allowed, based upon the needs, requirements, and experience of the Sample Team.
The samples collected from each of the tanks will be taken to achieve the amount of sample aliquot identified by the ASD for the analytical laboratory to utilize.
The ASD shall generate the sample requests and container labels prior to sampling.

Note: The sampling tool and its' extensions, shall be marked as needed to gauge the depth of the sample, giving the sampler the ability to collect samples at a specified depth in the tank. A coring tool, auger, sludge sampler or "Sludge Judge" will be used to collect samples from the sludge. A scoop may be used to collect solid/crystalline material.

The tanks will be sampled by the sampling team using the following steps:

1. Access to the waste will be through the manway or vent hole opening at the top of each tank.

2. An initial determination will be made (through observation) of the matrix of the waste (solid, liquid, sludge, etc.)

3. To determine the headspace within the tank, the sample tool should be lowered to the top of the waste. Measure the distance to the top of the waste. Record the distance from the top of the tank to the waste layer in the "Comments" section of the Sampling and Analysis Request form and the Field Sampling logbook.

4. After insuring that a sample can be obtained, lower the sample tool into the waste to the identified depth. If no liquid is observed, the use of the coring tool or augering device may be required.

4a. For use of the "Sludge Judge" - lower the first section of the "Sludge Judge" into the waste.

5. Raise the sample tool to the surface. Wipe the outside of the sampling tool with a kimwipe moistened with de-ionized water each time the sampling tool is raised from the tank. Observe and record stratification of the waste in the sample tool. As an alternative to determine stratification, the sample material will be allowed to slowly flow out of the bottom of the sampling tool and be collected in a clear glass sample container. The Sampling Team shall observe for stratification. Transfer an aliquot into the sample collection containers. Record the depth from which the sample was collected in the "Comments" section of the Sampling and Analysis Request form. Also, record the physical appearance of the waste and any other observations in the sampling logbook after descending from the tank. At this time, a sample aliquot for radioactivity screening should be taken.

5a. For use of the "Sludge Judge" - lower the first section of the "Sludge Judge" into the waste, attach the second section, and continue lowering. (This will allow for approximately ten feet of the sampling tool to be submerged into the waste.)

5b. For use of the "Sludge Judge" – Raise the sample tool to expose the upper section of the "Sludge Judge." Wipe the outside of the sampling tool with a kimwipe moistened with de-ionized water. The Sampling Team shall observe for stratification. Slowly unthread the upper section from the lower section, allowing the waste material to drain from the upper section back into the tank. Once the material has cleared the upper section, remove the upper section from the lower section. Raise the sample tool to expose the lower section of the "Sludge Judge." Wipe the outside of the sampling tool with a kimwipe moistened with de-ionized water. The Sampling Team shall observe for stratification. Sample aliquots will be allowed to drain from the lower section into the sample containers. The depths from which the sample was collected will be recorded on the sampling worksheet. The physical appearance of the waste and any other observations will also be recorded in the sampling logbook.

Note: Decontamination of the sampling equipment or the use of new sampling equipment is required for each tank to be sampled.

6. Lower the sample tool to the depth of the next identified sample point.

Note: the above listed steps are repeated until all required samples have been taken.

7. Send the radioactivity screening sample aliquots to the on-site laboratory for radioactivity screening.

8. Prepare samples for transfer to the laboratory for analysis.

Note: Samples are to be stored at 4 degrees Celsius while awaiting radioactivity screening results.

4.2 Sample Handling

The samples will be packaged and shipped to the designated laboratory for analysis. Preservation of samples will be in accordance with procedure CAS SOP 003, "Sampling for Waste Characterization." It must be noted that preservation with acids will only be done on aqueous samples. All solids, sludges, or organic samples will be preserved by temperature only.
Custody seals and Chain-of-Custody forms will be completed in accordance with CAS SOP 003, "Sampling for Waste Characterization."
Unused sample may be returned to the generator for disposal.

4.3 Number of Samples

The total population of 80 tanks containing Pondsludge was divided into three distinct subpopulations, based upon the origination of the waste. These populations are: "Pond C," "Pond A/B," and "Clarifier." The "Pond C" subpopulation consists of fifty tanks, the subpopulation "Pond A/B" consists of 28 tanks, and the "Clarifier" subpopulation consists of two tanks. Tanks to be sampled were determined by assigning numbers to each storage tank within a subpopulation containing pond sludge (some tanks were eliminated from the population of interest based upon physical and/or safety constraints associated with the sampling evolution). The samples were chosen using random number generation, with a uniform distribution. The containers selected are listed below:

Subpopulation "A/B"	**Subpopulation "C"**	**Subpopulation "Clarifier"**
Tank #	***Tank #***	***Tank #***
25.002	25.017	25.083
25.007	25.039	25.084
25.008	25.041	
25.035	25.042	
25.036	25.047	
	25.050	

In the event that any of the above tanks in each identified subpopulation are unable to be sampled, the following list of randomly determined tanks shall be used as substitutes:

Contigency Subpopulation "A/B"	**Contigency Subpopulation "C"**	**Contigency Subpopulation "Clarifier"**
Tank #	***Tank #***	***Tank #***
25.005	25.056	25.083
25.013	25.057	25.084
25.025	25.059	
25.026	25.070	
25.033	25.071	
	25.074	

The number of the storage tank from which the waste samples are taken will be recorded in the field sampling worksheet/logbook along with the sample number (ref. CAS SOP 003 for field sampling worksheet). If samples cannot be obtained from the storage tanks, as outlined in Section 4.3, additional storage tanks must be selected to replace the samples that cannot be obtained. Under no circumstances shall there be less samples taken than identified in Section 4.1.

4.4 Sampling Equipment

Sampling equipment may consist of materials such as a "Sludge Judge," coring tool, bailer, stainless steel auger, stainless steel scoops, stainless steel bowls, plastic bags, sample bottles, personal protective equipment, and kimwipes.

4.5 Quality Control Sampling

Field quality assurance and quality control samples will also analyzed by the laboratory. These samples provide an internal quality control check and consist of duplicates, equipment rinsate blanks, and trip blanks. Collection will be in accordance with CAS SOP 003, "Sampling for Waste Characterization."

Duplicates

Duplicate samples will be collected in the same manner and analyzed by the same methods, in the same laboratory as the regular samples. All duplicate samples will be collected at a rate of one per twenty regular samples, with the same type of sampling equipment used for collection of the regular samples. Non-disposal sampling equipment will be thoroughly decontaminated prior to collecting each and every sample, including the duplicates.

Equipment Rinsate Blanks

Equipment rinsate blanks, if required, will be prepared by collecting dionized water, which has been poured over decontaminated sampling equipment. Rinsate blanks will be collected at routine intervals between regular samples at a rate of one for every twenty regular samples. The rinsate blanks will be submitted with regular samples and analyzed for metals, volatile organics, or semi-volatile organics, as appropriate.

Trip Blanks

A trip blank will accompany each cooler of samples shipped for analysis of volatile and semi-volatile organics. The trip blank will be prepared using de-ionized water and preserved at a temperature of 4^0C. Trip blanks may be evaluated by the Project Manager and reduced in frequency to one per twenty regular organic samples.

4.6 Decontamination Procedures

To prevent cross contamination of samples, all stainless steel sampling equipment will be decontaminated. Disposable sampling equipment may also be used. Sampling equipment decontamination will be accomplished in accordance with CAS SOP 003, "Sampling for Waste Characterization".

4.7 Packaging Requirements

The sample team will follow requirements in Procedure I-97-Traffic-112, Sample Packaging and Transfer.

4.8 Pre-Shipment Samples of Waste to Envirocare of Utah

Pre-Shipment samples will not be considered in the scope of this S.A.P. Once the final waste form of the Pondsludge has been determined, pre-shipment samples will be taken and sent to Envirocare.

4.9 Sample Transfer/Shipment

Shipments of samples to laboratories will comply with the requirements of the Rocky Flats Transportation Safety Manuals.

5.0 DOCUMENTATION AND SAMPLE CUSTODY

Data cannot be considered legally defensible without documented sample custody procedures. Labels and seals are required to identify samples and to verify the sample has not been opened prior to analysis. Logbooks and sampling worksheets are used to document sampling events so the event may be reconstructed at a later date, should the need arise. Logbooks contain other pertinent information such as the physical appearance of the sample. Specific label, seal, and logbook protocols are presented in CAS SOP 003, "Sampling for Waste Characterization."

Chain-of-Custody records are documents demonstrating sample integrity and appropriate sample management and are maintained from collection through disposal. Chain-of-Custody forms are initially completed and signed during sample collection and travel with the samples to receiving personnel at the laboratory.

Sample Request Forms are generated for each sample collected. The Sample Request Form includes information describing:

- Process Contacts
- Required Sample Volume
- Required Quality Assurance Samples
- Availability of Sample Material
- Location of Sample Material
- Random Sample Location
- Radioactivity Concerns
- Directions and Comments to the Sampling Team
- Instructions to the Laboratory
- Analyses Requested

The unique sample identification numbers assigned to each sample container are also printed on the Sample Request Forms. Sample Request Forms are obtained from the Analytical Services Division.

5.1 Records Disposition

Upon receipt of analytical data, the ASD is responsible for the organization and assembly of the sample data package and the supporting documentation package. In order to provide document accountability of the completed analysis records, each item in a sample data package and the supporting documentation package is identified with a reference number before being dispositioned to permanent records. All documents placed in inventory by the ASD are maintained for review or for reproduction.

Copies of the analytical data and other pertinent information associated with this SAP will be dispositioned with the other pondsludge project files and records. The Pondsludge SAP will be controlled by the RMRS Document Control organization.

No unique records are generated as a result of the implementation of this SAP. All records identified will be handled in accordance with the procedures used for implementation.

6.0 ANALYSIS OF WASTE SAMPLES

The ASD will receive the sampling and analysis requests, arrange for a qualified sampling team to perform the sampling evolution, and designate a Utah certified laboratory, either on-site or off-site, to perform the requested analyses.

6.1 Waste Analysis Parameters

Methods used to analyze the samples will be those identified in Table 1-1, Table 1-2 or defined by Analytical Services Division approved documents.

6.2 Data Analysis

Data Quality Objectives (DQO) will be demonstrated using the 90-percent upper confidence limit (UCL) for the mean for each of the analytes. Only acceptable, verified data will be used for characterization. The 90-percent UCL, derived from the 80-percent 2-tailed confidence interval (CI), will be determined using the Students t distribution. Once the results are secured from this sampling event, they will be compared with the DQO's listed in Section 3.0.

7.0 ANALYTICAL QUALITY CONTROL

Quality control requirements for a Utah certified laboratory that support waste analysis are summarized in the Analytical Services Division, Statement of Work for Analytical Measurements, Revision B. These analytical control criteria shall be used to verify that analytical results for organic and inorganic analyses are of a documented precision and accuracy. The laboratories shall analyze calibration standards, interference check samples, blanks, duplicates, and matrix spikes to demonstrate the control criteria have been met.

Data validation/verification will be conducted by the Analytical Services Division, in accordance with Analytical Services Division, Data Assessment Guidelines (DAGR01, DASS01, DASS02, DASS05, DASS08, DARC01, DARC04) to identify data that meet the control criteria and qualifies data that do not.

8.0 REFERENCES

Rocky Flats Plant Transportation Safety Manuals.

Backlog Waste Reassessment Baseline Book. Maintained by RMRS, Waste Systems.

Sampling for Waste Characterization, CAS SOP 003, Revision 0.

Analytical Services On-Site Laboratories Quality Assurance Plan, 3-21000-ALQAP, Revision B.

Data Completion Assessment and Quality Control Verification, ASD 001, Revision 0.

Evaluation Study for 750 Pad Pond Sludge Disposal at the Rocky Flats Environmental Technology Site, Revision 1.

The Data Quality Objectives Process, EPA QA/G-4, Draft Final, 1994.

D. R. Weier to C. E. Baldwin, April 25, 1995, Discussion of Cube-Root-of-N Sample Sizes - DRW-027-95.

Analytical Services Division, Data Assessment Guidelines.

Test Methods for Evaluating Solid Waste Physical/Chemical Methods, SW-846, Third Edition. U.S. Environmental Protection Agency, November, 1986.

Title 6 Colorado Code of Regulations 1007-3, Part 261

Title 40 Code of Federal Regulations, Part 268.2

Title 40 Code of Federal Regulations, Part 268.40

Title 40 Code of Federal Regulations, Part 268.43

Table 1-1, Building 374 Analysis Requirements

Analysis	Method
Gross alpha/Beta Radiation screen (MDA)	Gas Proportional Counting (SW-846, Method 9310)
pH	SW-846, Method 9045
Flashpoint	SW-846, Methods 1010/1020
Chlorine concentration	ASTM-D3761, EPA 300 series
Cyanide concentration	SW-846, Methods 9010/9012
Volatile Organic analysis	EPA SW-846 Methods 8240 or 8260A
Semi-Volatile Organic analysis	EPA SW-846 Method 8270
RCRA Metals	EPA SW-846 Methods 6010 or 7000 series
Mercury	EPA SW-846 Method 7470 or 7471
PCB analysis	EPA SW-846 Method 8080

Table 1-2, Envirocare and Additional Analysis Requirements

Waste Code	Regulated Hazardous Constituent Common Name
F001, F002, F003, F004, & F005	Acetone
	Benzene
	n-Butyl Alcohol
	Carbon Disulfide
	Carbon Tetrachloride
	Chlorobenzene
	o-Cresol
	m-Cresol (difficult to distinguish from p-cresol)
	p-Cresol (difficult to distinguish from m-cresol)
	Cresol-mixed isomers (Cresylic acid) (sum of o-, m-, and p-cresol concentrations)
	Cyclohexanone
	o-Dichlorobenzene
	Ethyl Acetate
	Ethyl Benzene
	Ethyl Ether
	Isobutyl Alcohol
	Methanol
	Methylene Chloride
	Methyl Ethyl Ketone
	Methyl Isobutyl Ketone
	Nitrobenzene
	Pyridine
	Tetrachloroethylene
	Toluene
	1,1,1-Trichloroethane
	1,1,2-Trihloroethane

Waste Code	Regulated Hazardous Constituent Common Name
	1,1,2-Trichloro 1,2,2,-Trifluoroethane
	Trichloroethylene
	Trichloromonofluoromethane
	Xylenes-mixed isomers (sum of o-, m-, p-xylene concentrations)
F003 and / or F005	Carbon Disulfide
	Cyclohexanone
	Methanol

F006 , F007, & F009	Cadmium
	Chromium (Total)
	Cyanides (Total)
	Cyanides (Amenable)
	Lead
	Nickel
	Silver
Waste Code	**Regulated Hazardous Constituent Common Name**
D004	Arsenic
D005	Barium
D006	Cadmium
D007	Chromium
D008	Lead
D009	Mercury
D010	Selenium
D011	Silver
TSDF REQUIRED	Copper
TSDF REQUIRED	Zinc

NOTE: Analysis of Carbon Disulfide, Cyclohexanone, and Methanol not required.

ADDITIONAL ANALYSES	METHOD
Total and Amenable Cyanide	SW-846 9010 or 9012
pH	SW-846 9045
Reactivity (Cyanide and Sulfide)	SW-846 9010 and 9030/9031
Paint Filter Liquids Test	SW-846 9095
Description of Waste	Visual
Gradation of Waste	12", 4", 1", ¼", 1/40", 1/200"
Moisture Content	Karl-Fischer, Gravimetric
Alpha/Beta Screen (MDA)	SW-846 9310
Alpha Spectroscopy	Pu, Am, U isotopics
Gamma Spectroscopy	Other natural and man-made isotopes
Sodium	SW-846, 7000 Series
Potassium	SW-846, 7000 Series
Calcium	SW-846, 7000 Series
Magnesium	SW-846, 7000 Series
Chloride	ASTM D-3761, EPA 300 Series
Nitrate	SW-846 9200, EPA 353 Series
Sulfate	ASTM D-3761, EPA 300 Series
Total Dissolved Solids	EPA 160.1, Standard Method 2540C
Viscosity	Sludge Phase only

750 Pad Pondsludge Inventory

Building or Facility	Tent Number / Unit Number	Tank Number	Permitted Capacity (Gallons)	Contents	Operating Capacity (Gallons)	Active or Inactive / Full or Not Full?	Alarm Type	In Alarm?	Has Tank Permitted/ Operating Capacity Ever Been Exceeded?	Does Permit Description Adequately Describe Use Of Tank?
750 Pad	T-3 / 750.2	25.002	10,000	Pond-A/B Sludge	9,389	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-3 / 750.2	25.003	10,000	Pond-A/B Sludge	9,474	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-3 / 750.2	25.004	10,000	Pond-A/B Sludge	9,389	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-3 / 750.2	25.005	10,000	Pond-A/B Sludge	9,389	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-3 / 750.2	25.006	10,000	Pond-A/B Sludge	9,389	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-3 / 750.2	25.007	10,000	Pond-A/B Sludge	9,389	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-3 / 750.2	25.008	10,000	Pond-A/B Sludge	9,389	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-3 / 750.2	25.009	10,000	Pond-A/B Sludge	9,389	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-3 / 750.2	25.010	10,000	Pond-A/B Sludge	9,221	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-3 / 750.2	25.011	10,000	Pond-A/B Sludge	9,305	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-3 / 750.2	25.012	10,000	Pond-A/B Sludge	9,136	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-3 / 750.2	25.013	10,000	Pond-A/B Sludge	9,474	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-4 / 750.2	25.022	10,000	Pond-A/B Sludge	9,389	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-4 / 750.2	25.023	10,000	Pond-A/B Sludge	9,558	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-4 / 750.2	25.024	10,000	Pond-A/B Sludge	9,305	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-4 / 750.2	25.025	10,000	Pond-A/B Sludge	9,474	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-4 / 750.2	25.026	10,000	Pond-A/B Sludge	9,474	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-4 / 750.2	25.027	10,000	Pond-A/B Sludge	4,822	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-4 / 750.2	25.028	10,000	Pond-A/B Sludge	6,436	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-4 / 750.2	25.029	10,000	Pond-A/B Sludge	4,833	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-4 / 750.2	25.030	10,000	Pond-A/B Sludge	6,183	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-4 / 750.2	25.031	10,000	Pond-A/B Sludge	7,618	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-4 / 750.2	25.032	10,000	Pond-A/B Sludge	9,136	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-4 / 750.2	25.033	10,000	Pond-A/B Sludge	9,643	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-4 / 750.2	25.034	10,000	Pond-A/B Sludge	9,980	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-4 / 750.2	25.035	10,000	Pond-A/B Sludge	9,811	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-4 / 750.2	25 036	10,000	Pond-A/B Sludge	9,727	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-4 / 750.2	25.037	10,000	Pond-A/B Sludge	9,052	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-3 / 750.2	25.001	10,000	Pond-C Sludge	8,968	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-3 / 750.2	25.014	10,000	Pond-C Sludge	8,883	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-3 / 750.2	25.015	10,000	Pond-C Sludge	8,968	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-3 / 750.2	25.016	10,000	Pond-C Sludge	9,052	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-3 / 750.2	25.017	10,000	Pond-C Sludge	9,136	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-3 / 750.2	25.018	10,000	Pond-C Sludge	9,305	Active/Full	Breach Alert	No	No	Yes

750 Pad Pondsludge Inventory

Building or Facility	Room Number	Tank ID	Tank Capacity (Gallons)	Contents	Quantity of Contents (Gallons)	Active or Inactive / Full or Not Full?	Alarm Type	In Alarm?	Has Tank Permitted/ Operating Capacity Ever Been Exceeded?	Does Permit Description Adequately Describe Use Of Tank?
750 Pad	T-3 / 750.2	25.019	10,000	Pond-C Sludge	1,796	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-3 / 750.2	25.02O	10,000	Pond-C Sludge	9,221	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-4 / 750.2	25.021	10,000	Pond-C Sludge	8,377	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-4 / 750.2	25.038	10,000	Pond-C Sludge	9,474	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-4 / 750.2	25.039	10,000	Pond-C Sludge	8,714	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-4 / 750.2	25.04O	10,000	Pond-C Sludge	6,436	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-4 / 750.2	25.041	10,000	Pond-C Sludge	9,474	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-4 / 750.2	25.042	10,000	Pond-C Sludge	8,799	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-6 / 750.2	25.043	10,000	Pond-C Sludge	8,208	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-6 / 750.2	25.044	10,000	Pond-C Sludge	8,714	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-3 / 750.2	25.045	10,000	Pond-C Sludge	9,052	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-6 / 750.2	25.046	10,000	Pond-C Sludge	8,799	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-6 / 750.2	25.047	10,000	Pond-C Sludge	9,305	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-6 / 750.2	25.048	10,000	Pond-C Sludge	8,883	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-6 / 750.2	25.049	10,000	Pond-C Sludge	8,925	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-6 / 750.2	25.05O	10,000	Pond-C Sludge	9,474	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-6 / 750.2	25.051	10,000	Pond-C Sludge	8,546	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-6 / 750.2	25.052	10,000	Pond-C Sludge	8,461	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-6 / 750.2	25.053	10,000	Pond-C Sludge	8,714	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-6 / 750.2	25.054	10,000	Not In Use	0	Active/[illegible]	N/A	N/A	N/A	N/A
750 Pad	T-6 / 750.2	25.055	10,000	Pond-C Sludge	9,052	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-6 / 750.2	25.056	10,000	Pond-C Sludge	8,968	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-6 / 750.2	25.057	10,000	Pond-C Sludge	9,136	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-6 / 750.2	25.058	10,000	Pond-C Sludge	8,630	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-6 / 750.2	25.059	10,000	Pond-C Sludge	8,883	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-6 / 750.2	25.06O	10,000	Pond-C Sludge	9,474	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-6 / 750.2	25.061	10,000	Pond-C Sludge	9,474	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-6 / 750.2	25.062	10,000	Pond-C Sludge	9,052	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-6 / 750.2	25.063	10,000	Pond-C Sludge	9,474	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-6 / 750.2	25.064	10,000	Pond-C Sludge	9,474	Active/Full	Breach Alert	No	No	Yes

750 Pad Pondsludge Inventory

Building or Facility	Room Number	Tank ID	Tank Capacity (Gallons)	Contents	Quantity of Contents (Gallons)	Active or Inactive / Full or Not Full?	Alarm Type	In Alarm?	Has Tank Permitted/ Operating Capacity Ever Been Exceeded?	Does Permit Description Adequately Describe Use Of Tank?
750 Pad	T-6 / 750.2	25.065	10,000	Pond-C Sludge	9,221	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-6 / 750.2	25.066	10,000	Pond-C Sludge	9,474	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-6 / 750.2	25.067	10,000	Pond-C Sludge	9,052	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-6 / 750.2	25.068	10,000	Pond-C Sludge	9,474	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-6 / 750.2	25.069	10,000	Pond-C Sludge	9,136	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-6 / 750.2	25.07O	10,000	Pond-C Sludge	9,558	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-6 / 750.2	25.071	10,000	Pond-C Sludge	9,221	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-3 / 750.2	25.072	10,000	Pond-C Sludge	9,179	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-4 / 750.2	25.073	10,000	Pond-C Sludge	8,799	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-6 / 750.2	25.074	10,000	Pond-C Sludge	8,124	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-6 / 750.2	25.077	10,000	Pond-C Sludge	8,883	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-6 / 750.2	25.078	10,000	Pond-C Sludge	9,136	Active/Full	Breach Alert	No	Nc	Yes
750 Pad	T-6 / 750.2	25.079	10,000	Pond-C Sludge	8,968	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-6 / 750.2	25.08O	10,000	Pond-C Sludge	7,871	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-6 / 750.2	25.081	10,000	Pond-C Sludge	8,124	Active/Full	Breach Alert	No	No	Yes
750 Pad	T-6 / 750.2	25.082	10,000	Not in Use	0	Active/EMT	N/A	N/A	N/A	N/A
750 Pad	T-6 / 750.2	25.083	10,000	Clarifier	~9,000	Active/EMT	N/A	N/A	N/A	N/A
750 Pad	T-6 / 750.2	25.084	10,000	Clarifier	~9000	Active/EMT	N/A	N/A	N/A	N/A
SUMMARY										
Tanks	*Total #*	*Cube Root*								
Pond-C	50	4								
Pond-A/B	28	3								
Clarifier	2	N/A								