MSE Millennium Science & Engineering, Inc.

PROJECT SITE SAMPLING AND ANALYSIS PLAN

USDA FOREST SERVICE, NEMO WORK CENTER
Activity III, Environmental Audit and Reporting (Site Characterization)
Black Hills National Forest, South Dakota
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1.0 INTRODUCTION

The purpose of this Sampling and Analysis Plan (SAP) is to establish the requirements and procedures that will be implemented during field assessment and laboratory verification of contaminants present at USDA Forest Service Nemo Work Center, Black Hills National Forest, South Dakota.

Site characterization activities will consist of, but not limited to, inventorying, classifying, sampling, analysis, field testing, containerizing and shipping. Sampling and analysis procedures are described herein. Sampling and analysis quality assurance/quality control (QA/QC) procedures and data quality objectives are described in this SAP.

Potential contaminants of concern include Pesticides, Herbicides, Volatile Organic Compounds (VOCs), Semivolatile Organic Compounds (SVOCs), and Petroleum Products. Quality control will be applied throughout the entire project including sample collection, laboratory analysis, and data processing and interpretation phases of the work.

2.0 SAMPLING AND ANALYSIS

Sampling will be conducted in accordance with *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, Environmental Protection Agency (EPA) SW-846. SW-846 functions primarily as a guidance document setting forth acceptable methods for hazardous waste-related sampling and analysis requirements. Tables 1 through 3 below outline the samples identified for collection in the Forest Service Request for Proposal Bid Items. Table 4 provides a summary of analyses for all samples to be collected.

TABLE 1 - Base Bid Item Sampling and Analyses Parameters

	Well #	Test Method	Other Test	Remarks
1	MW-1	EPA 524.2		Use portable generator/pump
2	MW-3	EPA 524.2	Tracer Dye	Pump & pwr at wellhead
3	MW-4	EPA 524.2		Use portable generator/pump
4	MW-10	EPA 524.2		Pump & pwr at wellhead
5	MW-11	EPA 524.2		Use portable generator/pump
6	MW-12	EPA 524.2		Use portable generator/pump
7	MW-16	EPA 524.2		Use portable generator/pump
8	MW-17	EPA 524.2	Tracer Dye	Use portable generator/pump
9	MW-19	EPA 524.2		Use portable generator/pump
10	MW-20	EPA 524.2		Use portable generator/pump
11	RW-21	EPA 524.2		Sample at tap at pump house
12	MW-22	EPA 524.2		Use portable generator/pump
13	RW-8 (Nemo Supply)	EPA 524.2		Sample at tap at pump house
14	RW-13 (Weston Supply)	EPA 524.2		Tap Sample
15	RW-15 (Kaberna Supply)	EPA 524.2		Tap Sample
16	Adams	EPA 524.2		Sample at well – use generator
17	Deverman #1	EPA 524.2		Sample at pumphouse
18	Krahn	EPA 524.2		Sample at well – pwr available
19	Langley	EPA 524.2		Tap Sample

20	N4T	EPA 524.2, SW-846 8260, 8015 Modified and TIC identification for all analytes		Sample at well – use generator
21	Old 4T	EPA 524.2		Use portable generator/pump
22	Nemo Church	EPA 524.2		Sample at well – pwr available
23	Original Weston	EPA 524.2		Sample at well – pwr available
24	Post Office/Fire Dept.	EPA 524.2		Sample at well – pwr available
25	School	EPA 524.2		Sample at well – pwr available
26	Troxell	EPA 524.2		Sample at well – pwr available
27	Wick/GR	EPA 524.2		Sample at well – pwr available
28	Kaberna	EPA 524.2		Sample at well – pwr available

TABLE 2 - Additive Bid Item #1 Sampling and Analyses Parameters

Additive Bid Item #1			
Well #	Test Method	Other Test	Remarks
UST MW-3	EPA 524.2, SW-846 8260, 8015 Modified and TIC identification for all analytes	NA	Use portable generator/pump
UST MW-4	EPA 524.2, SW-846 8260, 8015 Modified and TIC identification for all analytes	NA	Use portable generator/pump
UST MW-5	EPA 524.2, SW-846 8260, 8015 Modified and TIC identification for all analytes	NA	Use portable generator/pump

TABLE 3 - Additive Bid Item #2 Sampling and Analyses Parameters

Well # or Soil Sample #	SW-846 Test Method	Other Test	Remarks
Eggers House	Full Phase Organic Analytes* minus Glyphosate	NA	Well sample for unfinished house
Stotts House	Full Phase Organic Analytes* minus Glyphosate	NA	Tap Water Sample
Dishman House	Full Phase Organic Analytes* minus Glyphosate	NA	Tap Water Sample
Soil Sample 1	8260, 8270, 8151, 8081, 8141**	NA	

* Samples must include Methods 524.2 (VOC's), 515.1 (Chlorinated herbicides), 531.1 (Carbamate pesticides), 507 (Organophosphorus pesticides (Lindane)), 508 (Chlorinated pesticides (DDT)), 504.1 (EDB).
** Methods 8260 (EDB, thinners), 8270 (penta, creosote), 8151 (Chlorinated herbicides), 8081 (Chlorinated pesticides (DDT)), 8141 (Organophosphorus pesticides (Lindane)).

TABLE 4 - Summary of all Sampling and Analyses Parameters

WATER SAMPLE ANALYSIS		
# Samples	**Parameters**	**EPA Method**
34 - Water Samples (Total), Split Between Three Activities		
27 of 28	VOC's (EDB)	EPA DW Method 524.2
Mid Cont: Base Bid: 1 of 28	VOCs (EDB, EDC)	EPA DW Method 524.2
1 of 28	VOCs (EDB, EDC & BTEXN with TICs)	SW-846 Method 8260
1 of 28	TPH-GRO	SW-846 Methods 8015 Mod
3 of 3	VOCs (EDB, EDC Only)	EPA DW Method 524.2
Mid Cont: Add bid #1: 3 of 3	VOCs (EDB, EDC & BTEXN with TICs)	SW-846 Method 8260
3 of 3	TPH-GRO	SW-846 Methods 8015 Mod
3 of 3	VOC's (Full Suite)	EPA DW Method 524.2
3 of 3	Chlorinated Herbicides (Full Suite)	EPA DW Method 515.1
Energy: Add bid #2: 3 of 3	Carbamate Pesticdes (Full Suite)	EPA DW Method 531.1
3 of 3	Organophosphorus Pesticides (Lindane)	EPA DW Method 525.2 / 507
3 of 3	Chlorinated pesticides (DDT)	EPA DW Method 505 / 508
Water QC Samples:		
# Samples	Parameters	EPA Method
Blind Field Dupe Rinsate Blank Trip Blank MS/MSD On Lab Sample		SW-846 Methods - as per

SOIL SAMPLE ANALYSIS		
# Samples	**Parameters**	**EPA Method**
1 - Soil Sample (Total)		
1 of 1	EDB, Thinners (Full Suite)	SW-846 Method 8260
1 of 1	SVOCs (Penta, Creosote)	SW-846 Method 8270
Energy: Add bid #2: 1 of 1	Chlorinated Herbicides (Full Suite)	SW-846 Method 8151
1 of 1	Chlorinated pesticides (DDT)	SW-846 Method 8081
1 of 1	Organophosphorus Pesticides (Lindane)	SW-846 Method 8081 / 8141
Soil QC Samples:		
# Samples	Parameters	EPA Method
Blind Field Dupe Rinsate Blank Trip Blank Use TB Above MS/MSD On Lab Sample		SW-846 Methods - as per

MS/MSD - Matrix Spike/Matrix Spike Duplicate
Expedited Analysis Not Requested

2.1 Groundwater Sample Collection

All groundwater samples collected for characterization will be collected in accordance with industry standards and SW-846 protocols. All samples will be collected using decontaminated or disposable implements. The following equipment will be used for the groundwater sampling:

1. Pump and Hose
2. Bailers
3. Nylon Line
4. pH, Conductivity, Temperature meter
5. Water level indicator
6. Decontaminated hand auger or stainless steel sampling spoon
7. Disposable vinyl gloves
8. Sample kit (lab furnished), contains:
   a. Ice chest/cooler
   b. Sample containers with lids
   c. Sample labels
9. Packing material
10. Chain of custody form
11. Return express shipment label/sticker
12. Large (1 gallon) Ziploc® bags
13. Large trash bags
14. Cube ice – 10 pounds
15. Shipping tape/or Duct tape
16. Waterproof marker (e.g., Sharpie®)
17. Ink pens, black or blue
18. Field logbook

Well Sampling Procedures Consist of the Following Steps:

- Purge at least three casing volumes from the well with decontaminated or dedicated sampling equipment, pumps and/or bailers, contain purge water in an appropriate container. The purge water was collected in 55-gallon drums pending treatment;
- During well purging and prior to sample collection, pH, specific conductance and temperature will be monitored until stabilized.
- Collect a groundwater sample using a disposable, dedicated or decontaminated bailer suspended from a clean, disposable cord;
- Transfer the groundwater sample into the appropriate containers for the required laboratory analyses; ensure that proper sample volumes, containers and preservation requirements are addressed;
- Transfer sample containers into a cooler with ice or frozen refrigerant packs for delivery to the laboratory within the allowable holding times for the requested analyses; and

- Document sample custody from time of collection through delivery to the laboratory using standard chain-of-custody records. The time and date of sample collection, sample identification numbers and requested analyses will be documented in the field logbook as an independent sample control record.

2.2 Soil Sample Collection

All soil samples collected for laboratory analysis will be collected in accordance with industry standards and SW-846 protocols. In addition to the sampling equipment used to collect and document water samples, the following equipment will be needed for soil sampling:

1. Hand tools
2. Decontaminated hand auger or shovel
3. stainless steel sampling spoon

Soil Sample Collection Procedures:

All sampling activities will be conducted using safe practices and using appropriate personal protective equipment in accordance with the Site Health and Safety Plan.

Grab Sample Collection

1. Sample locations will be selected based on visible evidence at the site.
2. A decontaminated hand auger, shovel or stainless steel spoon will be used to collect a soil sample from the area of interest.
3. Soil will be transferred from the digging implement directly to the sample containers. The required number of sample containers will be filled completely.
4. The sample containers will be wiped clean with a paper towel and lids screwed back on tightly.
5. Sample containers will be labeled properly and placed in the cooler with ice.

2.3 Sample Identification

Samples will be identified and documented to provide a permanent record of field activities.

Equipment and Materials

The following equipment and materials will be needed to properly document sampling activities.

1. Waterproof marker (e.g., Sharpie®);
2. Ink pens, black or blue;
3. Field logbook;
4. Clip board;
5. Sample labels;
6. Chain of custody form(s) with zip lock bag(s); and
7. Return express shipment label/sticker(s).

Sample Identifier (Name)

All samples will be given a unique identifier that is descriptive of the sample that follows the format shown below.

Sample ID: Site - Sample Type - and Location

For example: Nemo Work Center - W - MW-1
Where: Nemo Work Center = Nemo Work Center Site
W = Water
MW-1 = Monitoring Well

Sample Labels

Sample containers will be labeled to identify the sample and specify the analyses required. Labeling information is listed below. Labels will be filled out using indelible ink marking pens.

1. Project name or site: USFS Nemo Work Center
2. Sample name: *See above*
3. Sample date / time: (mm/dd/yy, military time)
4. Sample type: Soil / Water, or Substance
5. Analyses requested: Per sample schedule Specified in this SAP
6. Preservatives used: None, HCL, etc.
7. Sampler name: Name

Sample Chain of Custody

Sample chain of custody documentation must accompany every shipment of samples to the laboratories. The chain-of-custody forms can be partially filled out in advance, prior to going to the field; however, they will need to be finalized in the field. The following information is to be on all chain of custodies by the sampler:

1. Project name or site: Nemo Work Center, Black Hills NF, South Dakota
2. Project number: S-2484.9
3. Sample name: *See above*
4. Sample date / time: (mm/dd/yy, military time)
5. Sample type: Soil / Water, or Substance
6. Sample amount and/or number of containers
7. Analyses requested: Per sample schedule in this SAP
8. Preservatives used: None, HCL, etc.
9. Sampler name: Name
10. MSE contact name: Mark Lilly
11. Turn around time: Standard
12. Sampler signature
13. Relinquished signature/Date/Time (military)/Received signature.

Logbook

The following information should be recorded in the project logbook for each sample collected:

1. Sample date / time: (mm/dd/yy, military time)

2. Sample name: see above
3. Sample type: Soil / Water, or Substance
4. Sample location (e.g. North wall of excavation, depth)
5. Analyses requested: See below
6. Sampler name:

Note: Sample Names, Dates and Times Will match on all of the labels, chain of custody forms and in the project field log books and data sheets.

2.4 Sample Equipment Decontamination

All equipment that will come in contact with sampled media will first be decontaminated to prevent possible cross contamination between samples that could bias analytical results.

Equipment and Materials

The following equipment will be needed to decontaminate sampling equipment:

1. Tap water
2. Alconox detergent soap
3. Deionized rinse water
4. Scrub brush
5. Clean PVC or stainless steel buckets
6. Aluminum foil

Decontamination Procedures for Sampling Equipment

Equipment requiring decontamination for this project includes the submersible pump, hose, and digging implements. The equipment will be decontaminated prior to use and between samples. Equipment will be disassembled, brushed clean, washed with an Alconox solution, and triple rinsed.

2.5 Analytical Reporting

The laboratory reports will document all aspects of sample management and the analytical results for the project samples. The following is a list of the required information that will be included in the laboratory reports.

- Client name and address
- Client contact
- Laboratory name and address
- Laboratory contact
- Project name
- Client sample names
- Laboratory sample names
- Dates samples were collected, received by the laboratory and analyzed
- Sample custody documentation
- Analytical method number(s) and project protocols
- Case narrative/sample group comments
- Result and qualifier symbol definitions

- Analytical results for all samples and quality control samples
- Quality control parameters including method detection limit (MDL), limits of quantitation (PQL), result qualifiers, dilution factors
- Analyst name and signature
- Laboratory data reviewer name and signature

3.0 QUALITY CONTROL

Quality control is a set of activities and procedures designed to assure the reliability and accuracy of data and the attainment of data quality objectives. Quality control is addressed by establishing both field and laboratory checks that result in qualitative and quantitative measurements of data quality. Field and laboratory quality control procedures are discussed below.

3.1 Data Quality Objectives

The performance criteria for verification of analyses include the method detection level (MDL) and the laboratory practical quantitation level (PQL).

3.2 Field Quality Control Samples

The purpose of quality control samples is to ensure that data are not biased by contamination or sampling error. The following quality control samples will be collected in the field to evaluate sampling procedures and laboratory performance:

Five to ten percent sampling frequency for laboratory quality control analysis are values typically used in environmental testing programs. A frequency of 5 percent was selected for this project because the accuracy and precision of the sampling and analytical methods is generally fair (there are potential problems with interferences or matrix effects) and because the sample size is small which results in a small number of quality control assessments. The proposed frequency of analysis of quality control samples is consistent with the EPA SW-846 Quality control recommendations (reference SW-846 On-line, http://www.epa.gov/epaoswer/hazwaste/test/8_series.htm). Field technicians will prepare quality control samples and their results will be used to assess possible bias of the method accuracy and precision. If 10 percent the number of samples to be collected for the project provide a basis for less one whole quality control sample then no field quality control samples will be collected

3.3 Laboratory Quality Control Procedures

Laboratory quality control procedures adopted for this are those outlined in the Environmental Science Corporation Quality Assurance Plan on file with MSE. The written laboratory Quality Assurance Plan is required to conform to the Bureau of Laboratory Improvement "Rules for the Certification of Environmental Laboratories" that establish the minimum laboratory quality assurance activities required for laboratory certification. Specific procedures addressed by the Laboratory's Quality Assurance Plan include:

- Sample Management;
- Reagent/Standard Preparation;
- General Laboratory Techniques (which are not otherwise specified);

- Test Methods (sample preparation and analysis procedures, instrument standardization, precision and bias, detection and reporting limits, and analytical method-specific quality control procedures);
- Equipment Calibration and Maintenance;
- QC Samples (type, purpose, frequency, acceptance criteria);
- Corrective Action;
- Data Reduction and Validation;
- Reporting; and
- Records Management.

With minor exceptions, the items identified above are activities and procedures that are addressed internally by the laboratory at the level of data quality required for this project. However, project personnel will scrutinize the laboratory reports produced for this project as an additional check of data quality. Specific items to be assessed are:

Data Package Completeness - the laboratory reports will be assessed to confirm that they include a case narrative, appropriate method and/or practical quantitation limits and sample custody documentation.

Laboratory QC Samples - The adequacy of laboratory control procedures will be verified by determining whether laboratory quality control samples are within established control limits. Method blanks will be assessed to identify potential sources of laboratory error associated with the samples. Laboratory control samples will be evaluated to ensure that adequate surrogate recoveries have been achieved for the selected analyses. Laboratory control sample duplicates will be evaluated to verify precision in the laboratory's methodology of each type of analysis. Specifically, LCS and LCS duplicates will be evaluated to determine whether reproducibilities are consistent with project data quality goals as measured by relative percent difference (%RPD). Surrogate recovery data (%REC) for LCS and LCS duplicates will be evaluated to determine whether recoveries are within the established control limits.

Sample Holding Times - Since each EPA analytical method to be performed for the project has a specific holding time, within which sample integrity is judged to be adequate, the date of sample collection, extraction/preparation and analyses will be checked for all analyses. Proper sample preservation will also be documented.

Compound Identification, Quantitation and Detection Limits – Laboratory reports will be reviewed to verify that all requested analyses have been reported and to confirm that analytical method detection limits are adequate to compare the data with project cleanup standards. Identification of tentatively identified compounds and the use of appropriate data qualifiers will be noted as part of this review.

Performance Evaluation - Analytical data will be reviewed to confirm that the data quality criteria have been adequately addressed. Precision, accuracy, representativeness, comparability and completeness (PARCC) Data Quality Indicators will be addressed as part of this evaluation.

3.4 Data Quality Indicators

This section discusses the results of the analytical data quality requirements in terms of data quality indicators.

Precision Assessment

Precision is a measure of reproducibility between LCS and LCS duplicates (analytical precision). Precision is evaluated on the basis of two criteria: relative percent difference (RPD); and the laboratory reporting limit (LRL). The RPD is calculated according to the following formula:

$$RPD = 100\% \times (D_1 + D_2)/(D_1 + D_2)/2$$

where:

D_1 = First Duplicate Value (% Recovery)
D_2 = Second Duplicate Value (% Recovery)

A calculated RPD of ± 20% is acceptable for the project if analytical results are greater than 5 times the LRL. If analytical results are less than 5 times the LRL, then ± the LRL is used as the acceptance criterion. If the analytical result is less than 5 times the LRL, the duplicate sample has to be within the ± LRL range to meet this acceptance criterion.

Accuracy Assessment

The accuracy of the analytical procedures is evaluated based on the measurement or recovery of a known concentration of analyte introduced into a quality control sample (LCS/LCSD, Surrogates). The percent recovery for a spiked sample is calculated according to the following formula:

$$\text{Percent Recovery} = 100\% \times \frac{(\text{Known Concentration} - \text{Measured LCS Concentration})}{\text{Known Concentration}}$$

Spike recovery percentages that are within the historical laboratory control limits (provided on laboratory reports and QC summaries) are deemed acceptable.

Representativeness Assessment

Representativeness is a parameter that expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. The evaluation criteria for representativeness include: (1) implementation of standard operating procedures; (2) adherence to sample holding times; (3) use of analytical detection limits that are at or below regulatory standards; and (4) the absence of contamination in method blanks. In addition, 90% of LCS duplicates should meet RPD goals.

Completeness Assessment

Completeness is defined as the percentage of valid measurements to planned measurements. For the purpose of the completeness calculation, the number of measurements planned is defined as the total number of analytes that the laboratory will

be requested to analyze. The percent completeness of the data will calculated according to the following equation:

$$\text{Completeness} = 100\% \times \frac{\text{Number of Valid Measurements}}{\text{Number of Planned Measurements}}$$

A calculated completeness of 90% or greater is considered acceptable. Analytical results for blanks and laboratory QC samples are not included in this total. Based on this approach, the number of measurements planned is 4.

Corrective Action Summary - The need for corrective action will be determined based on the performance evaluation results for the data quality criteria identified above.