

ATTACHMENT 4

SAMPLING PROCEDURES TEST METHODS

CHAPTER 1

1.0 SAMPLING QUALITY ASSURANCE AND QUALITY CONTROL

1.1 GENERAL

1.1.1 Level of Experience

All sampling personnel shall be acquainted with the sampling requirements of this program, the associated documentation, field procedures, preservation methods, cleaning and decontamination requirements, health and safety requirements, use of equipment, and any pertinent protocols prepared by Permittee. The team leader shall have at least one year of experience in groundwater sampling.

1.1.2 Manpower

At least two sampling persons shall be present at each sampling.

1.1.3 Duration

Water levels in all wells shall be measured within a 24 - hour period. All wells shall be sampled within a 96 - hour period. Delays beyond this time shall be documented and explained in the report for the monitoring event.

1.1.4 Equipment Constraints

Samples will be obtained with a submersible pump, a peristaltic pump, or a bailer if needed. The pumps shall be equipped with flexible inert tubing. The tubing shall be dedicated for each well if possible. If it is not possible to have dedicated tubing, new clean tubing shall be used for each well. Bailers shall be fluorocarbon resin material (Teflon), polyethylene, poly-vinyl chloride (PVC), or stainless steel with fluorocarbon coated wire, fiberglass, single-strand stainless steel wire, or nylon twine. Polyethylene bailers, PVC bailers, and nylon twine are disposable items used only once; they shall not be decontaminated and re-used at multiple wells. Each bailer shall

be equipped with a ball check valve in the bottom, which forms a watertight seal when raised. Submersible pumps shall be stainless steel in construction and decontaminated properly between each well.

1.1.5 Sample Containers Composition

Sample containers will be of the compositions and volumes indicated in Table 1.

1.1.6 Decontamination, Cleaning, and Storage of Sampling Equipment and Containers

All sampling equipment will be cleaned using the decontamination procedures outline below before each use. To minimize the potential for cross-contamination between wells, all downhole sampling equipment will be decontaminated between wells, according to the procedures outlined below.

Sample equipment will be cleaned and prepared for field use according to the following procedures:

- a. Laboratory-grade detergent and potable water wash
- b. Potable water rinse
- c. Triple deionized water rinse

The sample equipment shall be allowed to air dry to the extent possible. All sampling equipment will be stored in an area where no contamination will occur.

1.1.7 Sample Container Labeling

Sample bottles will be prelabeled to the extent possible before the bottles are shipped to the site. In order to maintain confidentiality, the site will not be identified as a Permittee named facility nor its geographic location listed. Sample labels will include the following information:

- a. Sample number as noted in field logbook
- b. Sample type; i.e., parameters for analysis
- c. Organization collector represents (employer)
- d. Name of collector
- e. Date and time of collection

1.1.8 Preservatives

All sampling containers shall come from the lab with the appropriate preservatives as shown in Table 1 and shall be shipped from the laboratory with the appropriate preservatives (see Table 1) already added to the appropriate containers.

1.1.9 Preparation and Specifications of Water, Reagents, and Preservatives

The following water quality will be required for dilutions, blanks, and final rinse water:

<u>Analysis</u>	<u>Water Type</u>	<u>Reference</u>
Metals	ASTM Type II	SW846
Organics	Organic Free Water	SW846
pH	Distilled Water	EPA-600/4-79-019
Sulfate, Chloride	Distilled Water	EPA-600/4-79-019
Specific Conductance	Distilled Water	EPA-600/4-79-019
Total Organic Halogen	Reagent Water	SW846 TOX Method 9020
Total Organic Carbon	C02 Free, Double-Distilled Water	EPA-600/4-79-020

1.1.10 Blanks, Duplicates, and Quality Control

Two types of blanks pertain to sampling quality control: the trip blank and the equipment blank. Trips blanks for VOA analysis will be prepared in the lab by filling each sample bottle with distilled water. The blanks will be transported to the site, handled as any other sample, and returned to the lab in the same manner. If there is reason to suspect that certain detected parameters are due to contamination in handling, the suspected contamination can be evaluated by analyzing the trip blank.

One VOA trip blank (consisting of 3 VOA vials) must be prepared for each cooler that contains VOA samples. Trip blanks for other parameters are optional.

Note that it is important to prepare trip blanks in a clean atmosphere. VOA blanks are particularly vulnerable to contamination from many sources; for example, electrical tape can cause vinyl chloride contamination, and silicone sealant can cause methylene chloride contamination.

Equipment blanks are collected to test decontamination procedures and are prepared principally when non-dedicated sampling equipment is used (i.e., pumps). This will indicate the effectiveness of the field equipment decontamination. At least one set of equipment blanks will be collected per event. Laboratory-grade distilled water shall be used and the blank shall be collected in the same fashion as the actual sample.

Matrix Spike and Matrix Spike Duplicate (MS/MSD) samples are collected to evaluate the effects of sample matrix on the precision and accuracy of the analytical methods. MS/MSD samples shall be collected immediately after collection of the primary sample in the same manner and using the same types of containers. The MS/MSD samples shall be labeled in a way that indicates which primary sample they are associated with.

Points will be selected for quality control prior to initiation of the sampling program. At the points selected for quality control, either a duplicate (to check analytical precision) or a field blank (to check sampling precision) will be collected. Duplicate and field blank samples will be handled no differently than any other samples. One duplicate will be prepared for every 10 samples.

Field blanks will be collected by pouring laboratory-grade distilled water into the appropriate sample containers located near the well head. Site conditions should be the same as at the time of sample collection. The field blank sample for metals analysis will not be filtered.

Duplicate samples are a check on laboratory precision and, as such, must be identified in the field so that the laboratory is unaware of which sample has been duplicated. It is imperative that the sample numbers selected for the split sample be recorded in the field log book since this will be the only record of the splitting.

Duplicate samples shall be collected by alternately filling the primary and the duplicate sample containers. Both samples are then handled in the same manner as all other samples.

As stated above, a VOA trip blank shall be prepared for each cooler containing samples for volatile organic analysis. At least one equipment blank, one duplicate, one field blank, and one MS/MSD set must be collected for each event.

1.2 GROUNDWATER SAMPLING

1.2.1 Field Instruments Preparation

Prior to shipping to the field, all instruments shall be tested to ensure they are operating correctly. Tests shall include battery checks, calibration with standard reference solutions, and calibration checks against other standard reference solutions. Reference solutions shall bracket the anticipated (probable) range to be encountered.

Recalibration shall be performed in the field as necessary should the calibration range be higher or lower than field conditions.

Instrumentation reference solutions and other pertinent data required for this sampling program are shown in Table 2.

1.2.2 Field Instrumentation Calibration

After shipping to the site and prior to actual sampling, all field instruments shall be calibrated as indicated on Table 2 as follows:

a. pH Meter

The pH meter must be calibrated at least once each day using two different pH buffer solutions. The probe must be rinsed thoroughly between buffer measurements with distilled/deionized water and again after calibration is completed. The buffer solutions used will be recorded in the field logbook. A third pH buffer solution in the expected pH range of the well water samples will be used to check the pH meter standardization. If the reading differs by more than 0.1 pH units, the instrument will be recalibrated. If unacceptable deviations still occur, the operating manual will be consulted for the prescribed action; or an alternate, properly functioning pH probe will be used.

b. Specific Conductivity Meter

The specific conductance/thermistor meter is less likely to exhibit random fluctuations and will only require daily standardization against a known KCl solution. Thoroughly rinse the probe with distilled/deionized water after immersing in the KCl standard solution. Note that specific conductance is temperature dependent; and, therefore, the meter readings must be adjusted to reflect the temperature of the standard solution

c. Temperature Measurement

Probe temperature readings must also be checked daily. This is accomplished by taking a temperature reading using the probe and comparing with temperature measurements made using a mercury thermometer. If the temperature probe is not properly calibrated, the probe will be brought into calibration according to the manufacturer's recommendations as specified in the operation/maintenance manuals provided with the unit.

d. Total Water Quality Meter

If a water quality meter is used (measuring pH, temperature, dissolved oxygen, conductivity, turbidity, and salinity in one unit) calibration shall be performed daily during sampling by submersing the unit in a container of the appropriate auto-calibration solution. All reading shall be recorded in the log book and checked against the standard value for the solution (given on the solution container). If the readings deviate more than the given tolerance (see calibration solution container), recalibrate the unit. If unacceptable deviations still occur, the operating manual will be consulted for the prescribed action; or an alternate, properly functioning water quality meter will be used.

1.2.3 Sequence of Well Sampling

The wells shall be sampled in the following order. *MW-19, MW-17D, MW14D, MW-1, MW-10, MW-12, MW-8, MW-22, MW-24, MW-23, MW-21, MW-13, MW-9, and MW-5.*

1.2.4 Field Log Book

The field logbook is a bound, consecutively paginated notebook used to record field data measurements and observations. It serves as the permanent record of all events occurring during the sampling event.

Entries into the logbook must be made in waterproof ink. Information during each event will vary according to site-specific facilities procedures and conditions but will, at a minimum, contain the following details:

- a. Sampling date and time
- b. Sampling locations and identification numbers
- c. Purpose of sampling
- d. Names of field crew present at the site
- e. Brief description of weather conditions including temperature reading, wind direction and strength, and precipitation

- f. Identification of well and initial groundwater level measurement, and total depth of well
- g. PID readings, odors, and other readings pertaining to air quality
- h. Time well was purged, well evacuation details prior to sampling (to include purge volume), sample collection procedure, and well sampling sequence.
- i. Final field water quality measurements including:
 - 1) pH
 - 2) Specific Conductance
 - 3) Water Temperature
- j. Types of sample containers used and sample identification numbers, parameters to be measured, sampling remarks/observations, identification of blanks, duplicates, etc.
- k. Sample numbers and identification of duplicate samples, sample distribution and transporter, collection of quality assurance/control samples.

Each page must be initialed by the individual keeping the logbook. Upon returning to the office, a copy of the field log entries will be provided for the project files.

1.2.5 Vapor Detection at the Well Head

Prior to removing any well water or taking any level measurements, the air space within the protective casing will be monitored by a photoionization detector (PID). The humidity of the well may interfere with the operation of the PID in which case the probe may be held beside the well head for vapor detection.

All readings must be noted in the field logbook. In the event of readings above background, the sampling team will move upwind until the vapors have cleared.

1.2.6 Water Level Measuring and Detection/Sampling of Immiscible Layers

Based on the past 8 years of groundwater sampling, floating or submerged immiscible layers are not expected. However, while not expected, floating or submerged immiscible layers may exist. Should this occur, the sampling plan shall be revised to allow for sampling the floating and submerged layers and for evaluating volatile organic acids, acid extractables, and base neutrals.

Prior to evacuation of the wells, the following procedures should be implemented:

- a. Remove locking and protective caps
- b. Sample the air in the well head for organic vapors using a PID; record measurement, and allow the vapors to clear prior to recording water levels
- c. Determine from top of casing the static groundwater level using a water level meter as well as the total well depth. Record to the nearest 0.01 feet. The probe, which contacts the water surface, must be rinsed three times with distilled water between each well.
- d. Lower a dual-interface probe into the well, or product gauging paste applied to a water level probe, to determine the existence of any immiscible layer(s), light and/or dense.
- e. If immiscible layer(s) are detected, sample the layer with a peristaltic pump or a top filling fluorocarbon resin bailer.
- f. Evacuate the well as required.

1.2.7 Well Volume Calculations

The firm performing the sampling will obtain the elevation of the reference mark on the PVC casing or the top of casing from Permittee prior to sampling.

As discussed in Section 1.2.6, groundwater elevation shall be measured by a water level meter accurate to within 0.01 feet. Measurements are taken with respect to the depth below the reference mark located on the well casing or the top of casing and recorded in the field logbook. By subtracting the depth to water surface from the depth of the well and referring to Table 3, the sampling team will calculate the volume of water contained in the well.

Note that any reporting of water level measurements must be with respect to mean sea level in units of feet.

1.2.8 Well Evacuation

Wells shall be evacuated until the pH, specific conductance, and temperature readings have stabilized (10 percent). At a minimum, indicator parameters will be measured at least 5 times. At least three well volumes will be evacuated as determined in Section 1.2.7, unless the well is purged dry. If the well recharges slowly (i.e., time for evacuation of one well volume is greater than 30 minutes and the well is almost dry) only one evacuation is necessary. Samples may then be taken after the well has sufficiently recharged.

All dedicated sample equipment shall not be allowed to contact the ground. The dedicated tubing will be coiled on to a clean plastic sheet and not allowed to contact the ground.

To prevent degassing of volatiles from the water, the peristaltic or submersible pump must be operated so as to not exceed a maximum flow rate of 100 ml/minute during sample collection. The maximum flow rate during purging shall not exceed 2,000 ml/minute. If a bailer is used it will not be allowed to drop into the well. The check valve (s) must be periodically observed as ongoing experience indicates, for fouling may result in reduced delivery capacity or in aeration of the sample.

The PID will be used to monitor the atmosphere in the immediate vicinity of the well head while purging and sampling operations occur. Readings above background will result in immediate evacuation of the well head until the vapors have dispersed.

The presence of floating or submerged layers must be noted in the field log book as well as pertinent observations such as color, clarity, odor, etc.

Activities, which may contribute to contamination during sampling, such as decontamination activities, are strictly prohibited in the immediate sampling area.

1.2.9 Sequence of Sample Withdrawal

Samples will be collected and containerized in order of the volatilization sensitivity of the parameters. The order of collection will be:

- a. Volatile organics *

- b. Semi-volatile organic acids*
- c. Total organic halogens*
- d. Total organic carbon*
- e. Acid extractable and base neutral compounds**
- f. Total metals
- g. Dissolved metals
- h. Phenol
- i. Cyanide
- j. Sulfate
- k. Nitrate

* Sample vials will be filled so there are no air spaces

** Bottles will be filled so there is minimal air space. Caps shall be secured snugly but not tightly to prevent backing off of the caps and introduction of air.

Samples will be collected in a controlled manner with a minimum of agitation. Sample containers will be filled in accordance with the requirements shown in Table 1. The pH and specific conductance also will be measured at the lab.

1.2.10 Sample Filtration

Samples for dissolved metals must be field filtered through sterile-packaged 0.45-micron filters prior to adding to sample container. Filters will be glass, polyethylene, or equivalent inert material and the type and brand will be noted in the field logbook.

1.2.11 Sample Storage

All sample containers must be immediately put on ice and maintained at a maximum temperature of 4⁰C until the samples are analyzed. Sample storage times in the field will be kept to a minimum and samples will be submitted to the laboratory on a daily basis.

1.3 SAMPLE DOCUMENTATION

1.3.1 Sample Custody Seals

Sample Cooler seals will be placed on every cooler in order to detect unauthorized tampering of samples following sample collection up to the time of analysis. Laboratory supplied seals will be used for this purpose. The seal will include the following information:

- a. Collector's name and signature
- b. Date and time of signature

The seal must be attached in such a way that it is necessary to break it in order to open the container. Seals must be affixed before the samples leave the custody of sampling personnel. Seals of electrical tape or glue or sealant are unacceptable.

1.3.2 Chain of Custody

Sample custody forms must be completed at the time of sampling in accordance with the requirements of SW-846 (See Figure 1). The specific analysis for each sample must be provided on the form. A detailed list of required analysis may be attached to the form if required. The following chain of custody procedure must be implemented by the field team leader to assure sample integrity.

Samples will be under custody of the sampling team leader. The samples will be considered in custody when:

- a. They are in his/her possession;
- b. They are in view after being in possession;
- c. They are locked up or sealed securely to prevent tampering; or
- d. They are in a designated secure area.

The original of the sample custody form must accompany the samples at all times after collection. A copy of the sample custody form will be held by the sampling team leader.

When samples are transferred in possession, the individuals relinquishing and receiving will sign, date, and note the time and sample or sampling chest condition on the form.

All persons handling the samples must sign for delivery and for receipt. A carbon copy will be retained by the sampling team leader and will be given to the project manager for the project file after the sampling crew returns to the office. When the laboratory completes the analyses, this original is to be returned by the laboratory to the project manager for the project files.

1.3.3 Sample Delivery

After the samples have been collected, it will be the responsibility of the sampling team leader to arrange for delivery of the shipping containers to the laboratory and to assure that the proper chain of custody is documented. The field team leader or designee must either overnight mail or deliver the samples to the laboratory as soon as possible after returning from the sampling trip. If overnight mail is used it is imperative that the sample containers be packaged properly in order to prevent breakage and to maintain a maximum temperature of 4°C. Also the laboratory should be contacted to ensure that someone will be at the laboratory to receive the samples and make sure they are checked in and stored properly.

Upon transfer of sample custody, the shipping containers will be examined to certify that they have not been disturbed. This observation, the deliverer's and receiver's signatures, and dates and times of custody transfer must be noted on the chain of custody form. The original and duplicate chain of custody forms must accompany these samples and be signed by the laboratory. The chain of custody form will remain with the samples and the completed form will be returned by the laboratory along with the results of the sample analyses for placement in project files.

1.3.4 Documentation and Document Routing

Upon returning to the office, the sampling team leader must:

- a. Provide a copy of the field log pages for the project file. The field log book must be stored in a secure area for safekeeping.
- b. Place the copy of the custody form in the project files. When received from the laboratory, the original custody form must also be placed in the project files.

1.3.6 Data Deliverables and Evaluation

For analyses associated with the Hazardous Waste Surface Impoundments, the laboratory will provide a data package that includes QC data but not raw data. Data deliverables for RCRA activities conducted as part of the VIWP implementation will be presented in the Notification Letter and consistent with the methodology defined in the VIWP. The laboratory Practical Quantitation Limits (PQL=s) will serve as the detection limit for parameters analyzed.

Data received from the laboratory will be reviewed by a chemist and a data validation report prepared describing the validation process and presenting the validated data. Validated data will be used for submittals to the UDEQ where data quality is a requisite for decision making and the validation report submitted along with the laboratory results. Data used as a screening tool may not be subject to validation.

CHAPTER 2

2.0 LABORATORY QUALITY ASSURANCE/QUALITY CONTROL PLAN

2.1 GENERAL

2.1.1 Laboratory

The laboratory(s) invited to perform the analyses outlined in Table 1 will submit a Quality Assurance/Quality Control (QA/QC) plan to Permittee. No analytical work will be performed until the QA/QC plan has been reviewed and approved by Permittee.

The laboratory will follow EPA guidelines and meet EPA requirements as outlined in:

- a. SW-846, "Test Methods for Evaluating Solid Waste Physical/Chemical Methods, 11 Third Edition (November 1986); Final Update I, July 1992; Final

Update IIA, August 1993; Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, June 1997.

- b. EPA-600/4-79-020, "Methods for Chemical Analysis of Water and Wastes," revised March 1983.
- c. EPA-600/4-79-019, "Handbook for Analytical Quality Control in Water and Wastewater Laboratories," 1979.
- d. QAMS - 005/80, "Interim Guidelines and Specifications for Preparing Quality Assurance Plans," 1980.
- e. 40 CFR 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act."

2.1.2 Laboratory Certifications

Laboratories performing analytical work to support groundwater monitoring under Section V of this Permit are required to be certified by the Utah Department of Health, Division of Laboratories (a Certified Laboratory@). Ten percent (10%) of any analyses performed under a screening program by a non-certified laboratory (such as a close-support field laboratory) shall be sent to a Certified Laboratory as a quality-control measure. Any determination of No Further Action under Permit Conditions must be supported by at least one verification analysis performed by a Certified Laboratory. In addition to the Utah Certification, a Certified Laboratory shall have one of the following certifications or approvals:

- a. EPA Public Drinking Water Supply Certification
- b. EPA Contract Laboratory Program
- c. U.S. Army **Environmental Center** Contract Laboratory Program.

2.1.3 Laboratory Administration

The laboratories performing analytical work will be required to include the following information on their QA/QC plan:

- a. Laboratory organization and chain of command including whom will be Permittee's contact person in the laboratory, the sample custodian, supervisors, and analysts, identifying-specific persons via flow chart or other method.

- b. Description of each position, its requirements including experience, certifications, and degrees.
- c. Seminars and training programs to which laboratory employees are sent including safety and right-to-know training.
- d. Resumes of all personnel to be involved in the analytical program.

2.1.4 Analytical Methods

Where possible, analytical methods will be in accordance with the methods specified in:

- a. SW-846, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," Third Edition (November 1986); Final Update I, July 1992; Final Update IIA, August 1993; Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, June 1997.
- b. EPA-600/4-79-020, "Methods for Chemical Analysis of Water and Wastes," March 1983 Revision.
- c. 40 CFR 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act: Final Rule and Interim Final Rule and Proposed Rule," October 26, 1984.

In cases where this is not possible, a reference method will be given from the best available source.

Table 1 summarizes analytical requirements.

2.1.5 Water Quality

The following water quality will be required for dilutions, blanks and final rinse water, and in analytical procedures.

<u>Analysis</u>	<u>Water Type</u>	<u>Reference</u>
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Metals	ASTM Type II	SW846
Organics	Organic Free Water	SW846
pH	Distilled Water	EPA-600/4-79-019
Specific Conductance	Distilled Water	EPA-600/4-79-019
Total Organic Halogen	Reagent Water	SW846 TOX Method 9020
Total Organic Carbon	C02 Free, Double-Distilled Water	EPA-600/4-79-020

2.1.6 Solvent, Reagent, and Reference Quality

All solvents and reagents shall be American Chemical Society (ACS) Certified Grade and will conform to specifications set by the Committee on Analytical Reagents of the ACS where such specifications exist (ASTM Volume 11.02, page 64).

All standards will be ACS reference grade standards or will be prepared from ACS analytical reagent grade chemicals using ACS approved methods. For calibration purposes, standards will be purchased or prepared to bracket the anticipated range for each analyte.

2.1.7 Laboratory Quality Assurance Program Plan

The Permittee will maintain the Quality Assurance Program Plan and Analytical Support Plan for each of the laboratories used for environmental sampling at the facility. The QA/QC plan will contain Standard Operating Procedures (SOPs) for all activities that could directly or indirectly influence the data quality plus SOPs for all analyses and instrumentation that will be used in the program. SOPs will include corrective action procedures for improperly functioning equipment, data of unacceptable quality, samples of questionable integrity and discovery of sample contamination. Quality assurance goals for analytical parameters by test method will be identified.

2.1.8 Quality Control for Analytical Performance

Quality control for analytical performance will be performed on a daily basis for each parameter. Quality control will be performed to assess both accuracy and precision by establishing upper and lower control limits using EPA accepted procedures.

**SAMPLING AND PRESERVATION PROCEDURES FOR DETECTION
MONITORING^a (Cont.)**

References: Test Methods for Evaluating Solid Waste – Physical/Chemical Methods,
Final Update III, June 1997 (SW-846)
Methods for Chemical Analysis of Water and Wastes (EPA-600/4-79-020, March
1983.
Standard Methods for the Examination of Water and Wastewater, 18th edition,
1992

- ^b CONTAINER TYPES: G = Glass
P = Plastic (polyethylene)
T = Fluorocarbons resins (PTFE, Teflon®, FEP, PFA, etc.)
- ^c Based on the requirements for detection monitoring (265.93), the owner/operator must collect a sufficient volume of groundwater to allow for the analysis of four separate replicates.
- ^d Shipping containers (cooling chest with ice or ice pack) should be certified as to the 4°C temperature at the time of sample placement into these containers. Preservation of samples required that the temperature of collected samples must be adjusted to the 4°C immediately after collection. Shipping coolers must be at 4°C and maintained at 4°C upon placement of sample and during shipment. Temperature blanks are to be placed into the shipping chest to document shipping temperature. Chain of Custody forms will have shipping/receiving and in-transit (maximum/minimum) temperatures for recording data and verification.
- ^e Do not allow any head space in the container.
- ^f Use ascorbic acid only in the presence of oxidizing agents.