

*Water Quality Sampling and Analysis Plan & Ash
Leachate Analysis Plan*

*Phase I, II, III Ash Disposal Facility
Permit No. UGW070002
Sunnyside, Utah*

Sunnyside Cogeneration Associates

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1.0 INTRODUCTION

1.1 OBJECTIVE

This water quality sampling plan is designed for the monitoring of groundwater quality in accordance with groundwater discharge (GWD) permit No. UGW070002 at the proposed Ash Landfill Expansion Facility.

1.2 SITE BACKGROUND AND DESCRIPTION

The Sunnyside Cogeneration Plant is a coal refuse fired electrical power plant located in Sunnyside, Utah (Figure 1) which has been in operation since 1993. The plant utilizes coarse refuse from two refuse piles as its primary fuel source. Ash currently generated at the power plant is transported and disposed of at the existing Ash Landfill Facility located southwest of the plant. Placement of ash began in May, 1993, in Phase I of the Landfill.

2.0 WATER QUALITY SAMPLING

Water quality sampling is required under the GWD permit. Background water quality sampling was conducted for the present Ash Landfill Facility. The sampling parameters, limits, and reporting procedures from the prior water quality sampling plan will be adopted for this plan.

2.1 SURFACE WATER SAMPLING

In accordance with the existing Water Quality Sampling Plan, two surface water sampling points are presently monitored. These locations include Whitmore Springs and the Fresh Water Reservoir.

2.2 GROUND WATER SAMPLING

In accordance with the ground water permit, groundwater down gradient of the Ash Landfill Facility is to be monitored for possible impacts due to ash landfill operations. The Division of Water Quality ground water classification for the aquifer in the vicinity of the current ash landfill is a Class II ground water (TDS 1,000 to 3,000 mg/L). Ground water in the vicinity of the proposed ash landfill expansion area ranges in TDS from 2,510 to 7,180 milligrams per liter (Maxim, 1996). The ground water in the vicinity of the proposed landfill would likely be classified as a Class III ground water.

2.2.1 Existing Monitoring Wells

Presently there are five ground water monitoring wells associated with the existing Ash Landfill Facility. The wells are sampled for the parameters listed in the ground water discharge permit. Descriptions of the wells are presented below:

Monitoring well MW-1 (formerly A-1) was installed in November 1990. It was sampled periodically up to September, 1992. From September 1992 to September 1993 it was sampled monthly. From October 1993 to 2001 it was sampled on quarterly sampling schedule. From 2001 to present it has been on a semi-annual sampling schedule. MW-1 is now associated with the Phase III expansion.

Monitoring well MW-2 was installed September 1992. From September 1992 to September 1993 it was sampled monthly. From October 1993 to 2001 it was sampled on quarterly sampling schedule. From 2001 to present it has been on a semi-annual sampling schedule.

Monitoring well MW-3 was installed September 1992. From September 1992 to September 1993 it was sampled monthly. From October 1993 to 2001 it was sampled on quarterly sampling schedule. From 2001 to present it has been on a semi-annual sampling schedule.

Monitoring well MW-4 was installed in July 1996 as an alternative monitoring point to MW-1. It was sampled on a sampling schedule of 8 events to be completed in one year (to establish background values) to be followed by quarterly sampling. MW-4 was installed between MW-1 and MW-2. From 2001 to present it has been on a semi-annual sampling schedule.

Monitoring well MW-7 was installed in July 1997 as part of the Phase II expansion. It was sampled on a sampling schedule of 8 events to be completed in one year (to establish background values) to be followed by quarterly sampling. MW-7 was installed at the toe of the new sedimentation pond 017. From 2001 to present it has been on a semi-annual sampling schedule.

3.0 SAMPLING AND ANALYSIS

All surface water and ground water sampling associated with the Ash Landfill Expansion will conform to procedures and schedules as outlined in SCA's Ground Water Permit.

All aspects of sampling and analysis under the GWD permit will conform to MAIN's Standard Quality Assurance/Quality (QA/QC) Control Plan. This plan is included as Appendix B. A brief summary of QA/QC protocol is presented below.

A field blank (rinsate blank) and a field duplicate will be collected for every 20 environmental samples collected. Groundwater to be analyzed for dissolved metals will be filtered and preserved with nitric acid. Surface water samples to be analyzed for dissolved metals will not

be filtered. They will be preserved with nitric acid. All samples will be dispensed into appropriate, laboratory –supplied bottles and stored in coolers on ice until received by the analytical laboratory. Appropriate chain of custody procedures and documentation will be followed.

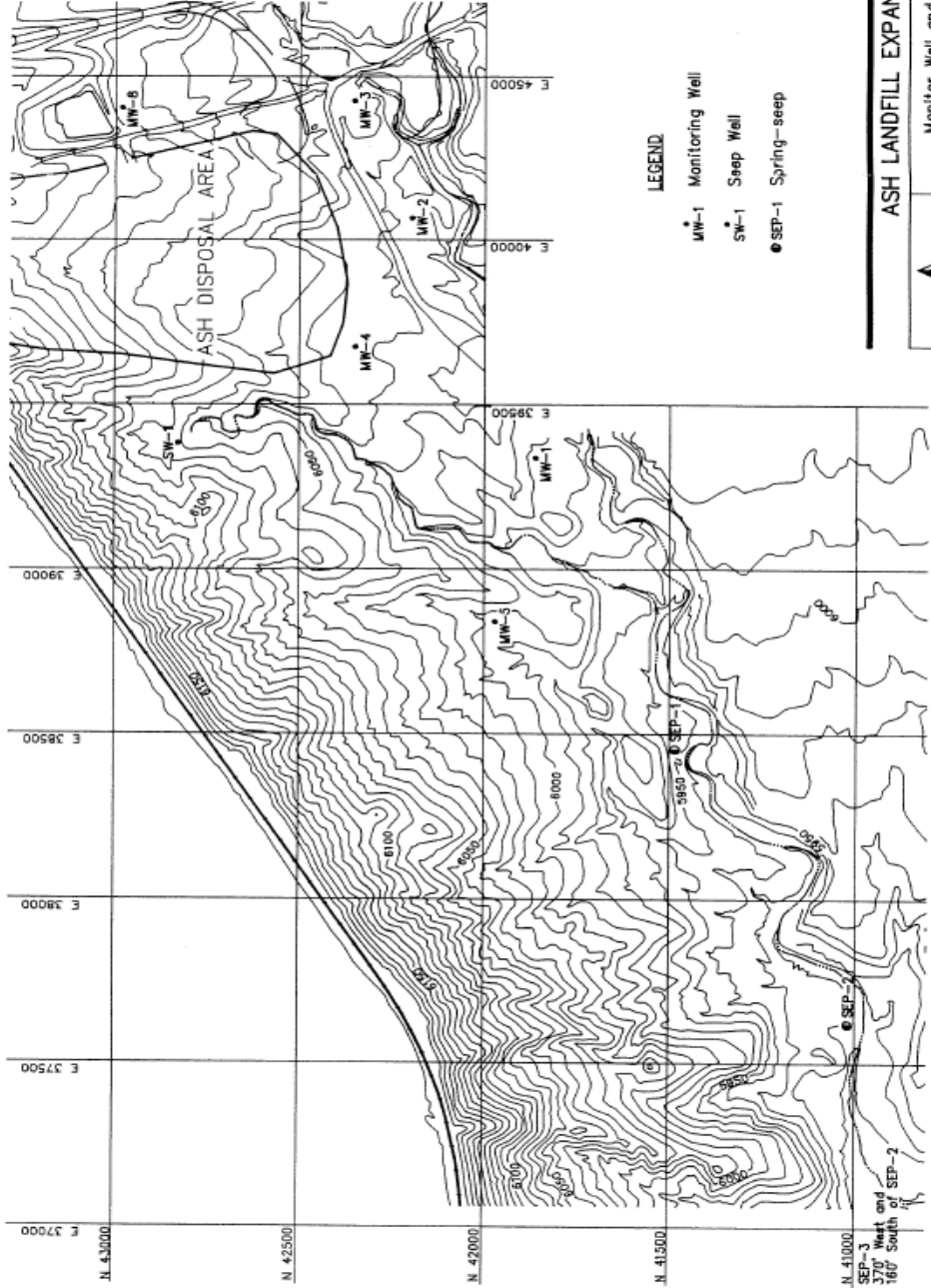
4.0 REPORTING

The water quality sampling results will be submitted in a report to the Division of Water Quality on the following schedule as outlined in the Ground Water Discharge Permit No. UGW070002.

<u>Semi-annually</u>	<u>Report Due On</u>
1 st January, February, March, April, May, June	July 15
2 nd July, August, September, October, November, December	January 15

5.0 REFERENCES

- Barr Engineering, 1996, Engineering report phase 2 ash disposal facility, Permit No. UGW070002, Sunnyside, Utah: Consultant Report, 26 p., tables, figures and appendices.
- C.T. Main, 1990, Groundwater discharge permit application, Sunnyside Cogeneration Associates, Sunnyside, Utah: Revision I, six sections with figures and tables.
- C.T. Main, 1990, Sampling and analysis plan for background groundwater quality determination, Sunnyside Cogeneration Associates, Sunnyside, Utah: four sections with appendices, figures, tables, and drawings.
- Huntingdon Chen Northern Inc. (Maxim), August 1992, Revised Water Quality Sampling Plan for Ground Water Discharge Permit No. UGW070002, Sunnyside Cogeneration Plant, Sunnyside, Utah: Project No. 5-137-91, 5 pages tables, figures, appendices, and drawings.
- Maxim Technologies Inc., 1996, Hydrologic characterization Sunnyside ash landfill expansion, Sunnyside Ash Landfill, Sunnyside Cogeneration Facility, Sunnyside, Utah: Project No. 520950054, 17 pages, figures, tables, and appendices.



LEGEND

- MW-1 Monitoring Well
- SW-1 Seep Well
- SEP-1 Spring—seep

ASH LANDFILL EXPANSION

Monitor Well and Seep Locations
 Sunnyside Cogeneration Facility
 Sunnyside, Utah

MAXIM TECHNOLOGIES INC

CAD: 5002544G Job: 5209500254 Figure 1



Approximate Scale (ft)
 0 300

SUNNYSIDE COGENERATION ASSOCIATES
ASH LANDFILL FACILITY
Ground Water Discharge Permit # UGW070002 Compliance Sampling

MONITORING LOCATIONS

Whitmore Springs
Freshwater Reservoir
Well MW-1
Well MW-2
Well MW-3
Well MW-4
Well MW-7

PARAMETERS

Field Parameters

Temp
pH
SC

BOTTLE AND PRESERVATION REQUIREMENTS

Non-applicable

Analytical Parameters

Metals-
Arsenic
Barium
Cadmium
Copper
Lead
Selenium
Silver
Zinc

1 X 1000ml, poly, filtered at wells
unfiltered at surface water locations,
all preserved with HNO₃, cool.

Inorganics

TDS
pH

1 X 1000ml, poly, unfiltered, raw, cool.

Cations and Anions

Calcium
Hardness (CaCO₃)
Sodium
Potassium
Magnesium
Chloride
Sulfate
Bicarbonate (HCO₃)
Carbonate (CO₃)
Alkalinity (CaCO₃)

1 X 1000ml, poly, unfiltered, raw, cool.

DATA COLLECTION QUALITY ASSURANCE/
QUALITY CONTROL PROGRAM

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1.0 INTRODUCTION

The collection of representative environmental data is neither a straightforward nor easily accomplished task. Measurements are subject to a wide variety of instrument, spatial, and temporal variables. A representative sample of the material from which it is collected must represent accurately the spatial, temporal, physical, and chemical qualities of the material. Standard operating procedures help to minimize those errors which would result in the collection of invalid data or non-representative samples. This is very important as field data collection is the primary basis upon which site investigations, assessments, and remedial actions are based.

There are four basic factors which affect the quality of sampling data. These include:

- 1) selection of the sample collection site; 2) method of sample collection; 3) sample preparation, preservation, and storage methods; and 4) sample analysis.

Samples must be representative of the media from which they were extracted, and maintain their integrity and/or constituents between the time of sampling and the time of analysis. Field measurement devices and procedures also must follow set procedures to obtain precise and accurate readings at representative locations.

This document presents MAIN's SOP for the collection of precise, accurate, and representative field data.

2.0 PRESAMPLING ACTIVITIES

2.1 COMMUNICATION WITH LABORATORY

Communication with laboratory personnel responsible for analysis of the samples prior to sample collection cannot be overemphasized. Lab personnel can be an important source of information and materials if they understand the specifics of the sampling program. Interaction with lab personnel usually improves program efficiency, and the accuracy and completeness of the results. Procedures and analyses being used should be established. Laboratory staff can often provide guidance and suggestions concerning particular problem areas that may develop. Laboratory staff should also understand the chain-of-custody, QA/QC, and labeling procedures that are employed throughout the investigation. Written instructions should be obtained from the laboratory for any non-routine procedures pertaining to sample preparation, preservation, and storage.

2.2 CONTAINER PREPARATION

It is important to use proper sample containers and preservation techniques to minimize the alteration of the sample chemistry between the field and the laboratory. Sample containers will be prepared by the laboratory. Proper preservation will be performed, the jars labeled, and the chain-of-custody initiated prior to any sampling shipment. Container types and preservatives are

shown in Table 1, reprinted from EPA SW-846. Methods of container preparation, sample preservation, sample storage, packing and shipping are discussed in Sections 4 and 5.

2.3 QUALITY CONTROL SAMPLES

Three types of quality control samples will be submitted to the chemical laboratory for analyses.

- 1) Field Blank – To determine the effect of sample handling procedures and the environment on the sample, a field blank will be collected for every 20 environmental samples collected. The water used must be free of the analytes to be tested for. The “blank” water will be poured into the sampling device, then handled as an environmental sample: poured into bottles, preserved, shipped, and analyzed. The field blank must be collected after the sampling device has been decontaminated, but prior to collection of the next environmental sample. The source of the water utilized to generate the field blank will be noted.
- 2) FIELD DUPLICATE – A field duplicate is defined as two samples collected simultaneously at sampling location. Duplicate samples will have a sample number different from the original. Both the “false” and “true” sample numbers will be recorded. On the chain-of-custody forms, the “false” sample number will be used for the duplicate sample. One duplicate sample will be collected for every 20 environmental samples.

3.0 COLLECTION OF ENVIRONMENTAL SAMPLES

3.1 GROUNDWATER SAMPLING

Prior to the start of sampling operations, information will be obtained in order to improve the efficiency cost effectiveness of the sampling program. The specifics of the well construction, including the diameter of the well, the depth of the casing, the depth to the screened portion of the well, the total length of the screen, and the material used in the construction of the well and screen will be reviewed. The well diameter is important since it helps determine sampling equipment and procedures. The majority of wells used only for monitoring have two-inch outside diameter. However, in many cases where groundwater recovery was used to remediate a contamination problem, wells with either four, six, or eight-inch outside diameter well casings may have been used. It is also important to know the accessibility to the wells, which may affect the selection of the sampling equipment and transport of the equipment to the well. Prior to sampling, all well locations will be marked on a site map, the order in which the wells will be sampled will be determined, and specific equipment requirements will be developed.

A general checklist of equipment need to sample groundwater monitoring wells follows:

- 1) Sample collection equipment (bailers, pumps).
- 2) Reagents for sample preservation provided by the laboratory (see Section 4.3).
- 3) Appropriate sample containers provided by the laboratory (see Section 4.4).

- 4) Meters, probes, and standards for desired on site measurements (see Section 4.5).
- 5) Appropriate field and trip blanks, and water.
- 6) Appropriate field duplicate sample containers.
- 7) Forms, labels, and tags (see Section 5.1).
- 8) Monitoring well keys – many monitoring wells have locking caps, and keys are necessary to gain access. In addition, some sites are secured or have a guard on duty, in which case keys and/or permission are necessary.
- 9) Tools to assist in well access – these may include screw drivers, hammers, chisels, pipe, wrenches, chain, or a propane torch. All or any of these may be necessary for moving steel security caps on well which have not been opened recently.
- 10) Electronic water level indicator/graduated depth sounder – these are necessary to determine the static water level and the total depth of the well.
- 11) Pocket calculator – this is used to determine the number of well volumes to be evacuated from a well prior to sampling.
- 12) Log book and indelible ink marker. This is used to record field information.

The measurement of the well volume and water level will be conducted in the following fashion.

- 1) Measure inside diameter of the well.
- 2) In areas with possible non-aqueous phase floating compounds, the procedure outlined in in Section 3.6 will be followed to measure the potential layer thickness prior to purging.
- 3) Measure the static water level from the top of the well pipe (not the protective casing) to within 0.01 ft., using an electronic well probe.
- 4) Determine the total depth of the well from either the well installation logs or direct measurement using an electronic well probe. All measurements are taken from the top of the well casing pipe.
- 5) Calculate the number of linear feet of static water standing in the well (difference between static water level and total depth of the well).
- 6) Calculate the static volume using the following table.

<u>Casing Diameter (inches)</u>	<u>Volume per 100 Feet Casing (cf)</u>	<u>Volume per 100 Feet Casing (gal)</u>
1.0	.5	4
1.5	1.2	9
2.0	2.2	16
3.0	4.9	37
4.0	8.7	65
5.0	13.6	102
6.0	19.6	147

- 7) Rinse the probe and cord thoroughly with distilled water and methanol after each use to avoid possible cross contamination from other wells.
- 8) Remove at least three well volumes of groundwater prior to sample collection. In most cases, removal of three well volumes results in the collection of a representative groundwater sample not influenced by stagnant water remaining in the well casing. In cases where it is suspected that the removal of three well volumes may result in either under-evacuation or over-evacuation of a particular well, continuously monitor the pH, specific conductance, and temperature while removing 10 well volumes from the well. It is recommended that this experiment be conducted several days before the actual collection of samples.
- 9) The pumping mechanism used to purge or evacuate the well is dependent upon the equipment available and the accessibility of the well. A variety of pumps may be used, including hand-operated or motor driven suction pumps, peristaltic pumps, and compressed gas or battery driven pumps. In some cases, hand bailing is the best method. The pumping method depends on the accessibility of the well, depth to water, and well diameter. If the pump being used does not have a flow meter, a graduated plastic pail can be used to measure the total discharge volume. If a pump that could alter the sample characteristics has been used to purge the well, the hose and rope should be removed from the pump and then decontaminated or stored in an appropriately labeled container, if each hose or rope is to be dedicated to the particular well. The pump used for evacuation should be dismantled and decontaminated. Dedicating equipment to each well is the preferred method.
- 10) Certain wells are slow to recharge, and it may be necessary to return several hours or even a day later in order to collect a sample. An alternative sampling method for which recharging slowly is to pump the well dry and collect the sample as water returns into the casing. Either method is acceptable and depends upon the analysis to be conducted, well accessibility, and the cost effectiveness.

The following procedure is recommended for obtaining groundwater samples from monitoring wells:

- 1) Various types of equipment may be used to purge a monitoring well. A bailer is recommended to be used to collect the sample. Although other equipment may be used if it does not affect the water sample's analytes of interest. The bailer can be made of Teflon, PVC (no glued joints), or stainless steel. The use of 3/8" braided nylon rope or fish line is recommended for lowering and raising the bailer.
- 2) To sample the water, slowly lower the bailer down the well until it is submerged, and then pull it out to the surface. Fill the sample bottles directly from the bailer to reduce the probability of cross-contamination and loss of volatile organic compounds. To avoid contamination of the rope, do not allow the rope to contact the ground; either hold it in hand or lay it on a sheet of plastic laid on the ground.

Groundwater chemistry is such that exposure of groundwater samples to atmospheric conditions can result in substantial alteration of the sample's chemical characteristics. To avoid these changes and to maintain sample representativeness, it is imperative that immediately upon collection, the samples be prepared, preserved, and stored in such a manner as to prevent any changes in sample chemistry from occurring. Refer to subsequent subsections of this document for sample preparation, preservation, storage, and in-field measurements procedures.

3.2 SURFACE WATER SAMPLING

The equipment needed for surface water sampling is usually minimal. In many instances, the sample container will serve as the sampling device. However, when analyzing dissolved metals, the sample must be transferred from the sampling device into a filtration apparatus for filtration prior to sample presentation and storage. A recommended list of surface water sampling equipment and accessories is as follows:

- 1) Materials for sample preparation (see Section 4.2).
- 2) Reagents for sample preservation (see Section 4.3).
- 3) Appropriate sample containers (see Section 4.4).
- 4) Meters, probes, and standard for desired on-site measurements (see Section 4.5).
- 5) Appropriate field and trip blanks. The type and number of blanks should be established with the laboratory conducting the analysis.
- 6) Forms, labels, and tags (see Section 5.4).
- 7) Sampling devices – These may include a Kemmerer bottle, the sample containers, or a telescoping aluminum pole with an attached clamp and beaker. Due to problems which may result from the inaccessible nature of many surface sampling locations, field personnel are encouraged to draw upon their own experience and creativity in the design of an appropriate sampling device. All devices must be approved by the Project Manager prior to use.
- 8) Decontamination supplies – These will be used for decontaminating all equipment that comes into contact with the sample (see Section 4.1).
- 9) Log book and indelible ink marker – This is for recording field information.

Most surface water samples are taken as grab samples. Typically, surface water sampling involves immersing the sample container into the water body. The following suggestions are made to help ensure that the samples obtained are truly representative of the water body being sampled.

- 1) Generally, the most representative samples are obtained at mid-channel at one-half of the stream depth in a well-mixed stream.
- 2) Stagnated areas of pools, streams, or rivers may contain zones of pollutant concentration, depending upon the physical and chemical properties of the contaminants and the position of these stagnated waters relative to the sources of contamination.
- 3) Ordinarily sampling should be conducted beginning at the suspected zones of lowest contamination to the zones of highest contamination.
- 4) Excessive agitation of the water, which results in the loss of volatile constituents, should

- be avoided.
- 5) A water sample from the surface should not be taken unless sampling specifically for a non-aqueous phase layer floating on the water. Instead, the sample container should be inverted, lowered to the approximate depth, then held at about a 45 degree angle with the mouth of the bottle facing upstream.

Generally, surface water samples are much more stable than groundwater samples. Surface waters, especially from streams under turbulent flow conditions, tend to be in equilibrium with atmospheric conditions, and therefore will not undergo significant changes in water chemistry after collection. However, it is best to appropriately preserve and store the samples, and to take field measurements immediately after sample collection as described in Sections 3.3, 4.1, 4.2, and 4.3 of this document.

3.3 NON-AQUEOUS PHASE LAYER SAMPLING

If a non-aqueous phase layer (NAPL) is present on the surface of the water in a groundwater monitoring well, the thickness of the NAPL will be measured and a sample of it collected, if necessary.

The NAPL thickness will be measured using one of two techniques. A battery operated device that measures NAPL thickness such as an ORS Interface Probe, will be used first if the thickness is unknown. The sensing probe is lowered slowly down the well until it senses liquid. The depth is recorded. The probe is lowered further down the well until it senses water. Then the probe is moved above and below the NAPL water interface 3 to 4 times to get an accurate interface depth reading, which is recorded.

If the NAPL is less than ¼ inch, a surface sampler will be used to measure the NAPL thickness. The sampler, similar to ORS Surface Samplers, is slowly lowered through the NAPL then brought to the surface for measurement and observation. A surface sampler can be used to also sample the NAPL for chemical analysis.

3.4 FIELD MEASUREMENTS

Whether or not in-field measurements are conducted will depend upon the types of material being sampled, the geochemical environment in which the samples exist, and the desired end use of the collected data. For groundwater samples in particular, it is advisable to take in-field measurements of pH, specific conductance, and temperature. All of these parameters are susceptible to change upon contact with atmospheric conditions. As such, if analyzed in the lab, the values for these parameters may not be representative of the true subsurface environment. Since surface waters, especially those from streams and creeks with turbulent flow, are actually at equilibrium with atmospheric conditions, in-field measurements of these parameters for stream samples is not as critical, but should be conducted regardless.

3.5 SPLIT SAMPLES

Split samples will be provided to the Utah Bureau of Groundwater Pollution Control at their request.

4.0 POST SAMPLE COLLECTION PROCEDURES

After a sample has been collected, it may need to be composited, filtered, preserved, and stored. The sampling equipment must also be decontaminated. Procedures for these operations are described in the following sections.

4.1 COMPOSITING

In cases where composite samples are collected, it may sometimes be desirable to combine and split the samples in the field to ensure a representative aliquot. Another option for water samples is a laboratory composite for separately collected grab samples.

4.2 FIELD FILTRATION

Samples of water that will be analyzed for dissolved metals will be filtered in the field through a 0.45 micron filter. Filtration equipment consists of pump (either peristaltic or hand-operated) silicone tubing, and a filter cartridge similar to a QEDFF-8100 Standard Quick Filter or FF-8200 High Capacity Quick Filter.

The water sample to be filtered will be placed in a bottle containing no acid. It is then drawn through the filter and tubing and collected into another bottle. The filtered water is then preserved appropriately.

4.3 SAMPLE PRESERVATION

Sample preservation should be performed in the field immediately after sample collection and preparation. In many cases where pH control or additions of reagents are required, separate bottles and chemical preservatives may be supplied in the laboratory. In other cases the reagents or preservatives may be placed in the sample bottle prior to delivery to the site. Samples collected for organic and inorganic parameters are preserved by storing at 4° C, using natural ice.

Concentrated acids, bases, and other chemicals used to preserve samples cannot be shipped by air. They should be shipped, before sampling begins, to the site or a location near, preferably the site, by ground transportation if the site is not local to the consultant's office.

4.4 SAMPLE STORAGE

Samples should be stored in a container nonreactive with the sample or any parameter that is being analyzed for. Generally, containers are made of plastic, glass, or Teflon. In general, samples collected for metals and general water quality parameters are stored in plastic bottles.

Samples collected for organic analysis are routinely placed in glass bottles. Soil samples are generally placed in glass jars with Teflon or plastic lid liners. Table 1 details the required containers, preservation techniques, and holding times as required by EPA SW-846.

In most cases, bottles will be supplied by the laboratory conducting the analyses. It will be the responsibility of the sampler to inform the laboratory staff exactly which analyses will be conducted so the lab can supply the proper amount of appropriate bottles. The filled sample bottles must be stored in a cooler with ice.

4.5 EQUIPMENT AND MATERIAL DECONTAMINATION

All equipment and material used for the collection, preparation, preservation, and storage of environmental and hazardous substance samples must be cleaned prior to its use and after each subsequent use. Unless the equipment and materials being used are disposable, dedicated to the sampling location, or of sufficient number so as not to be reused during any one sampling trip, decontamination must be conducted in the field.

The equipment needed for cleaning or decontamination is dependent upon the materials and equipment to be cleaned. If relatively small items are to be cleaned in the field, several small buckets and small containers of reagents or wash liquids are adequate. However, if major items such as large pumps are to be decontaminated, it may be necessary to transport large wash basins and larger volumes of washing solutions. The following is a generalized equipment list to be used during decontamination and cleaning.

- 1) Detergent, such as Alconox.
- 2) Potable water.
- 3) Deionized and/or distilled water.
- 4) Hexane, to remove petroleum products.
- 5) Storage vessels to transport large volumes of water to the site. Plastic carboys that have 5 to 15 gallon capacity and are made with a spigot near the bottom of the tank are recommended. Enough water to handle the needs for the entire day must be supplied. Containers of various sizes are used depending on the sampling program.
- 6) Methanol.
- 7) Buckets for washing and rinsing equipment.
- 8) Paper towels and Chem wipes to remove excess soil or petroleum products before the equipment is decontaminated.

The following procedure will be used to decontaminate the sampling equipment:

- 1) Rinse with hexane to remove tar or oil, if present.
- 2) Wash with a detergent and tap water.
- 3) Rinse with tap water.
- 4) Rinse with high-purity methanol.
- 5) Rinse well with distilled and/or deionized water.
- 6) Use equipment immediately or wrap in aluminum foil for temporary storage.

5.0 SAMPLE PACKAGING, SHIPPING, AND CHAIN-OF-CUSTODY PROCEDURES

Once the samples have been collected, prepared, preserved, and appropriately stored, they must be packaged and shipped. In addition, from the time of sample collection until analyses have been completed, chain-of-custody procedures must be followed to ensure the proper handling of the samples. This section outlines procedures for the packing and shipping of environmental samples and general chain-of-custody procedures.

5.1 PACKAGING AND SHIPPING PROCEDURES FOR ENVIRONMENTAL SAMPLES

All sample containers must be placed in a sturdy, insulated shipping container. A metal or plastic picnic cooler is recommended. The following is an outline of the procedures to be followed.

- 1) Using fiberglass tape, secure the drain plug at the bottom of the cooler to ensure that water from sample container breakage or ice melt does not leak from the cooler.
- 2) Line the bottom of the cooler with a layer of cushioning absorbent material such as vermiculite.
- 3) Pack sample bottles in the cooler. Check screw caps for tightness and mark sample volume level on the outside of large containers.
- 4) Use pieces of carved-out plastic foam to keep large glass containers in place and to prevent breakage.
- 5) Pack small containers, such as 40 milliliter vials, in small plastic sandwich bags. When shipping these with large containers, it is necessary to prevent larger containers from shifting, which might break the smaller containers.
- 6) Pack cushioning material, such as vermiculite or bubble pack, between sample containers.
- 7) Pack absorbent material around plastic bottles in case of breakage or leaks.
- 8) Pack ice, sealed in plastic bags, on top of the samples in the cooler when the samples must be kept cold.
- 9) Seal the chain-of-custody form in a plastic bag and attach it to the inside of the cooler lid.
- 10) Close the lid of the cooler; be sure it is tightly fastened.
- 11) Use fiberglass tape to seal the container between the lid and the cooler. Wrap the tape vertically around the cooler, two wraps each on the long and short dimensions.
- 12) Attach the following information to the outside of the cooler: name and address of the receiving laboratory with return address, arrows indicating "This End Up" on all four sides, and "This End Up" label on the top of the lid.
- 13) Use additional labels such as "Fragile" or "Liquid in Glass" when necessary.
- 14) When the cooler is not equipped with a padlock, apply a signed custody seal and place it between the lid and body of the cooler.

Samples package in this way can be shipped by commercial air cargo transporter. Staff should be prepared to open and re-seal the cooler for inspection when required. Be aware that some commercial carriers have limits as to the number of pounds per item that can be shipped. Inform the laboratory of the containers' Bill of Lading numbers.

5.2 CHAIN-OF-CUSTODY PROCEDURES

Each sample must be labeled using waterproof ink and sealed immediately after it is collected. Labels should be filled out before collection to minimize handling of sample container. Figure 1 is an example of a sample label.

Labels and tags must be firmly affixed to the sample containers. Be sure that the container is dry enough for a gummed label to be securely attached. Tags attached by string are acceptable when gummed labels are not applicable.

Sampling information will be recorded in the field on the Sampling Record form as shown in Figure 2.

Written chain-of-custody procedures must be available and followed whenever samples are collected, transferred, stored, analyzed, or destroyed. The primary objective of these procedures is to create accurate written records that can be used to trace the possession and handling of the sample from the moment of its collection through analysis.

A sample is defined as being in someone's "custody" if:

- 1) it is in one's actual possession, or
- 2) it is one's view, after being in one's physical possession, or
- 3) it is in one's physical possessions and then locked up so that no one can tamper with it, or
- 4) it is kept in a secured area, restricted to authorized personnel only.

The number of persons involved in collecting and handling samples will be kept at a minimum.

The chain-of-custody record will be completed at the time each sample is collected. (Figure 3).

One member of the sampling team will be appointed Field Custodian. The samples and forms are turned over to the Field Custodian by the team members who collected the samples at the end of each day.

When transferring the samples, the transferee must sign and record the date and time on the chain-of-custody record. Custody transfers made to the Field Custodian should account for each sample, although samples may be transferred as a group. Every person who takes custody must fill in the appropriate section of the chain-of-custody record. To minimize the custody records, the number of custodians in the chain-of-possession should be minimized.

The Field Custodian is responsible for properly packaging and dispatching samples to the appropriate laboratory. This responsibility includes filling out, dating, and signing the appropriate portion of the chain-of-custody record.

All packages sent to the laboratory should be accompanied by the chain-of-custody record and other pertinent forms. A copy of these forms should be retained by the originating office (either carbon copy or photocopy). Mailed packages can be registered with return receipt requested. For packages sent by common carrier, receipts should be retained as part of the permanent chain-of-custody documentation.