



FIELD SAMPLING PLAN

Prepared for:

Sauer Dump Site Coalition

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym/ Abbreviation	Description
ARAR	applicable or relevant and appropriate requirement
ASL	Active Sanitary Landfill
AST	above ground storage tank
ASTM	American Society for Testing and Materials
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980
CGI	combustible gas indicator
cm/sec	centimeters per second
COC	chain-of-custody
COR	Contracting Officer's Representative
DNAPL	Dense Non-Aqueous Phase Liquid
DO	dissolved oxygen
DOD	Department of Defense
DOT	Department of Transportation
DPDO	Defense Property Disposal Office
DPW	Department of Public Works
EPTFE	expanded polytetrafluoroethylene
FID	flame ionization detector
FPF	field parameter form
FSP	field sampling plan
ft-msl	feet above mean sea level
GC/MS	gas chromatograph/mass spectrometer
GPS	Global positioning system
HASP	Health and Safety Plan
HCl	Hydrochloric Acid
HD	horizontal dipole
Hg	mercury
HSA	hollow stem auger



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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym/ Abbreviation	Description
I.D.	inner diameter
ID	identification
IDW	investigation-derived wastes
IRP	Installation Restoration Program
LNAPL	Light Non-Aqueous Phase Liquid
m	meters
MDE	Maryland Department of the Environment
MEK	methyl ethyl ketone
mg	milligrams
ml/min	milliliters per minute
NGVD 28	National Geodetic Vertical Datum of 1928
NOAA	National Oceanographic and Aeronautic Administration
NPDES	National Pollutant Discharge Elimination System
NPL	National Priority List
NTU	nephelometric turbidity unit
O.D.	outside diameter
ORP	oxidation reduction potential
PA	Preliminary Assessment
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PID	photoionization detector
PPE	personal protective equipment
ppm	parts per million
PPNDP	Passively-Placed Narrow Diameter Point
PQL	Practical Quantitation Limit
PVC	polyvinyl chloride
PWRC	Patuxent Wildlife Research Center
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RCRA	Resource Conservation and Recovery Act



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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym/ Abbreviation	Description
SARA	Superfund Amendments and Reauthorization Act of 1986
SI	Site Investigation
SOP	standard operating procedure
SPT	Standard Penetration Test
STP	Sewage Treatment Plant
SVOC	semivolatile organic compound
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TEPH	total extractable petroleum hydrocarbons
TRPH	total recoverable petroleum hydrocarbons
TVPH	total volatile petroleum hydrocarbons
USCS	Unified Soil Classification System
USEPA	U.S. Environmental Protection Agency
UTM NAD 27	Universal Transverse Mercation North American Datum of 1927
VD	vertical dipole
VOC	volatile organic compound

1.0 INTRODUCTION

The field work and data evaluation will follow U.S. Environmental Protection Agency (USEPA) guidance documents developed for activities performed under the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). Furthermore, procedures will be performed in accordance with Maryland Department of the Environment (MDE).

This Field Sampling Plan (FSP) is intended to provide field procedures to collect information for the Extent of Contamination Study.

Procedures described in this document fully comply with the Health and Safety Plan (HASP) and Quality Assurance Project Plan (QAPP).

1.1 FIELD SAMPLING PLAN

The FSP is organized into five sections as follows:

- **Section 1.0 - Introduction:** Presents FSP organization and site background and physical setting of Sauer Dump Site.
- **Section 2.0 - Sampling Plan Objectives:** Provides description of the objectives of the FSP.
- **Section 3.0 - Technical Approach for Sampling Activities:** Describes the procedures for field activities including geophysical surveys, including determination of a decontamination water source, installation and development of groundwater monitoring wells; sampling of monitoring wells; and direct push technology sampling; collection of surface soil, surface water, and sediment

samples; and hydrogeologic investigations. This section also describes the procedures for the disposal of investigation-derived waste including decontamination water, purge water, and personal protective equipment.

- **Section 4 - Sample Management and Analysis:** This section summarizes the procedures for post sampling activities (e.g., containerization, preservation of samples, and shipping). In addition, the general analytical program for Sauer Dump Site is presented.
- **Section 5 - References**
- **Appendix A: Standard Operating Procedures**

1.2 SITE BACKGROUND

The following sections present known information regarding the Sauer Dump Site. This includes information describing the, physical setting of the area. See the Response Action Plan (RAP) for summary of past activities possibly contributing to potential environmental problems.

1.3 PHYSICAL SETTING

1.3.1 Physical and Physiographic Setting

The site is located in Baltimore County, Maryland, approximately 5 miles east of Baltimore (Figure D1). The Site is located primarily on Parcel 425 and may include portions of Parcels 464, 503, 295, 574, and 137. It is surrounded on the east, north, and west by private, residential lots; and on the south by the Back River (Figure D2). The site is an inactive, privately owned, unpermitted, dump that is located on previously marshy land which was stabilized with fill material. EPA alleged that Mr. Sauer used the site as a salvage/dump yard. Contamination at the Site has been reported in the soils, groundwater, surface-water, and sediments

(ENSAT, 2002a; ENSAT, 2005).

Figure D1 shows the location of the Site on the Middle River United States Geologic Survey (USGS) 7.5-minute-series topographic map. The elevation of the Site ranges from approximately mean sea level to 17 feet above mean sea level (amsl). A mounded area, present in the western and central portions of the Site, exhibits irregular topography typically associated with dump sites (Figure D2). The topography along the eastern and southern portions of the Site is generally more level. A tidal wetland area is present along the southern border of the site. Non-tidal dominated wetlands are present on adjacent properties along the northwestern, southwestern, and southeastern borders (Figure D2).

As of August, 2006, the Site was observed to be heavily vegetated with tall grasses, reeds, trees, and scrub bushes. Accumulations of miscellaneous debris are observed across the site. The site is currently encompassed by a chain link fence to limit access.

See the RAP for more information on the Site setting.

1.3.2 Geology

The geology at the site is mapped as unconsolidated Quaternary age (recent) sedimentary deposits belonging to the Lowland Deposits Unit (MGS, 1968). This unit is characterized by inter-bedded gravels, sand, silt, and clay which vary in thickness from 0 to 150 feet and belong to the Coastal Plain Physiographic Provenance. Although no bedrock outcrops are observed at the former dump, the Site is likely underlain by Cretaceous age Potomac Group sedimentary rocks and

lies to the east of the Fall Line.

See the RAP for more information on Site geology.

1.3.3 Hydrogeology

Groundwater contour maps generated from on-site monitor wells indicate a groundwater flow from the central portions of the site toward the Back River and adjacent wetland areas (Figure 6 of the RAP). As seen in previous investigations the groundwater levels appear to be influenced by tidal variations, especially in wells closer to the Back River. Precipitation events appear to have a marked effect on the water levels of the more upland monitoring points and the pond.

See the RAP for more information on Site hydrogeology

2.0 SAMPLING PLAN OBJECTIVES

The objective of this FSP is to present the proposed technical approach for conducting field operations at the Sauer Dump Site. The purpose of the field investigation activities at the Sauer Dump Site is to collect data in support of the Extent of Contamination Study. The FSP details the standard operating procedures (SOPs) that will be followed for collecting the samples, the equipment which will be utilized for collection of the samples, sample preservation requirements, a list of the SW-846 analytical methodologies which will be used for analysis, and the quality control (QC) criteria that will be adhered to during performance of the field activities.

2.1 APPLICATION AND USE OF THE FIELD SAMPLING PLAN

This document is intended to be used as a foundation for the investigation activities performed by Malcolm Pirnie. The FSP is intended to fulfill all of the objectives outlined in Section 2.

In instances where an activity is new or significantly modified from its coverage in the FSP, QAPP, and HASP, a full description of field activities can be provided. If this activity will recur, an addendum to this document and the QAPP may be drafted

3.0 TECHNICAL APPROACH FOR SAMPLING ACTIVITIES

This section describes the methods to be used in conducting field activities at Sauer Dump Site. This work could include:

- pre-sampling Site reconnaissance,
- surface and subsurface soil sampling,
- surface water/sediment sampling,
- hydrogeologic investigations, and
- sample location and elevation survey.

This section also describes the collection procedures for field QC samples, the decontamination procedures for sampling and heavy equipment, and the management procedures for investigation-derived wastes (IDW).

3.1 SITE RECONNAISSANCE

A pre-sampling Site (Reconnaissance Survey) is an onsite inspection program, consisting of visual observations, and often the use of field monitoring instruments to identify potential health and safety threats and potential sampling locations for further evaluation during subsequent field activities.

Reconnaissance surveys will be performed in accordance with SOP 1 in Appendix A. The results of the reconnaissance survey will be used to determine if field conditions warrant a modification to the proposed sampling activities. Any modifications will be presented to EPA as a RAP Modification Letter. Therefore, the level of detail of the survey must be sufficient to identify appropriate onsite and offsite sampling locations for all potentially affected media. The reconnaissance survey will also locate potential physical hazards (e.g., sumps,

swales, debris), establish site exclusion zones, location for personnel and heavy equipment decontamination, and identify any other site conditions significant to the safe and efficient conduct of site work.

3.1.1 Planning

Planning for a Reconnaissance Survey begins with the collection and review of pertinent, available site data. The following types of information should be sought by the project personnel:

- The current status of the site (i.e., active or inactive).
- The location of any nearby or onsite potable or monitoring wells for sampling purposes.
- The topography, geology, and hydrogeology of the site.
- Accessibility to potential sampling locations.
- Records of past spills or leakage/environmental incidents.
- Previous sampling and analytical data.
- Previous manufacturing operations or records of historical activities.
- Migration/dispersal and toxicological characteristics of suspected site contaminants.
- Proximity to potentially affected populations or sensitive environments.
- Presence of site utilities (e.g., sanitary sewer, storm sewer).
- Presence of USTs, aboveground storage tanks (ASTs), dry wells, pad-mounted transformers, septic tanks, and drain fields.
- Presence of nearby surface water bodies.
- Potential for exposure to vapor contaminants.

If sufficient background information is available, a site sketch should be made showing the locations of pertinent features at and near the site. The sketch should include the access routes, waste disposal areas, major surface water features, well locations, drainage patterns, nearby roads and residents, and proposed sampling locations. If site information is limited, a site sketch should be completed in the field prior to other activities.

3.1.2 Field Observations

It is important that all field personnel continually observe and analyze conditions at the site that may provide clues to the types of wastes present, the extent of contamination, and associated problems. All site observations will be documented for later use in evaluation of the analytical and field measurement of data. Although conditions may vary from site to site, the following observations should be made at each:

- The color, texture, size, and frequencies of soil stains.
- Appearance of water bodies, including color, turbidity, and the presence or absence of oil sheens.
- Presence of organic vapors or odors, including any readings from field monitoring equipment (e.g., photoionization detector [PID], flame ionization detector [FID]).
- Erosion at site, routes of contaminated runoff, appearance and condition of landfill face, exposure of buried drummed waste, and all other conditions at the site that may help to later determine the extent of migration of hazardous wastes present.
- Location of USTs, ASTs, dry wells, septic tanks, drain fields, pad-mounted transformers, and pipe discharge points.

- Photographs of major features at the site are an effective method of documentation, and therefore, an extensive photographic record should be maintained for each site.

3.1.3 Sample Locations

Figure D3 provides a summary of the proposed sample locations. Table 10 in the RAP provides a summary of the proposed samples, sample depths, and analytical methods. The samples will be analyzed for the following:

- Sediments - Lead (Method 6010), PCBs (Method 1668a and 8082),
- Surface water - Lead (dissolved and total Method 6010), PCBs (dissolved and total Method 1668a and 8082),
- Groundwater - Lead (dissolved and total Method 6010), PCBs (dissolved and total Method 1668a and 8082),
- Surface Soil - Lead (Method 6010), PCBs (Method 8082), and
- Subsurface Soil - Lead (Method 6010), PCBs (Method 8082). VOCs (Method 8260) and SVOCs (Method 8270) will be collected at soil boring locations as described below.

3.2 SOIL SAMPLING

Soil samples may be collected to evaluate the impacts Sauer Dump Site to surface and subsurface soil.

Surface soil samples will be collected following the procedure presented in Section 3.2.1. Subsurface soil samples will be collected using procedures presented in Sections 3.2.2. Once collected, all surface and subsurface soil samples will be handled in the same manner. Subsurface soil samples will be field screened with a

properly calibrated PID (VOCs only) or FID (VOCs only). Samples will be collected for VOCs and SVOCs at soil boring locations only at the depth interval with the highest PID reading. To field screen the soil sample, a decontaminated stainless-steel trowel will be used to make a cross-sectional slice(s) of the soil sample, or to score a longitudinal line the length of the soil sample deep enough to expose a porous surface. The 6-inch interval registering the highest PID or FID measurement will be sampled for VOC analysis using a decontaminated small diameter coring device, such as a modified 10-30 mL disposable syringe or small diameter tube/plunger sampler. The sampling device will be capable of collecting 10±2 grams of soil from larger diameter core samplers (e.g., split-spoons) or from freshly exposed soils. In addition, the small diameter coring device will be capable of delivering the sample directly into a sample bottle containing methanol. Therefore, the outside diameter of the small diameter coring device will be smaller than the inner diameter of the sample bottle to avoid loss of sample and ease the soil transfer process.

Once VOC sampling is completed, or if soil samples are only being collected for non-VOC analyses, the following procedure will be followed. A sufficient amount of soil from the specified sampling interval will be placed on a decontaminated stainless-steel tray. After any rocks or organic matter have been removed, the soil will be homogenized using the coning and quartering method (American Society for Testing and Materials [ASTM] C702-80). In this method, the soil will be thoroughly mixed by turning the entire sample over three times using a stainless-steel trowel. Following the last turning, the entire sample will be shoveled into a conical pile in the middle of the tray. The conical pile will then be carefully flattened to a uniform thickness and diameter by pressing down the apex with the trowel. The flattened soil will be divided into four equal quarters. The sampling personnel will then make a determination as to whether the amount of soil on the

tray is larger than the volume of the sample bottles. If the amount of soil is larger, one or two quarters will be discarded. If two quarters are discarded, opposite quarters will be selected. After removal of one or more quarters, the entire coning and quartering sequence will be repeated until the amount of soil on the tray is approximately equal to the volume of the sample bottles to be filled. Then, the required soil volumes will be placed in the sample bottles. In addition to samples collected for chemical analysis, a certain percentage of the subsurface soil samples will undergo physical analysis as presented in Section 3.3.4.

3.2.1 Surface Soil

At most locations, surface soil samples will be collected from under the vegetative mat with a decontaminated stainless-steel bucket auger or stainless-steel trowel. If the 6-inch interval closest to the ground surface is composed mostly of organic debris, it will be discarded. The 0 to 6-inch interval will only be sampled for non-VOC analysis. Samples for VOC analysis will be collected from a 6-inch interval between 6 to 24 inches bgs. All surface soil samples will be collected in accordance with SOP 2 in Appendix A. The VOC sample fractions for soils may be collected using an Encore™ sampler. Three 5 gram samples will be collected per sample location as follows:

- A. Remove EnCore™ sampler from package and attach to the EnCore™ handle.
- B. Quickly collect a 5 gram sample.
- C. Attach cap.
- D. Fill out label and attach to sampler.

3.2.2 Subsurface Soil Sampling

Subsurface soil samples may be collected for physical and chemical analysis from

soil borings and groundwater monitoring well borings. Subsurface soil sampling activities will proceed as follows:

- A. All boring/test pits/well drilling permits will be secured.
- B. Clearance of underground utilities will be obtained from Maryland One-Call. Water used for cleaning sampling equipment and decontaminating drilling equipment will be obtained from the approved water supply source. This source will be sampled and approved by USEPA before being used.

A site geologist will be present during all drilling and soil sample collection activities to maintain descriptive logs and collect appropriate samples for chemical and physical analysis. All drilling and sampling activities requiring the use of a drilling subcontractor will be performed by a Maryland licensed driller.

3.2.2.1 Boring Procedures

The hollow stem auger (HSA) method will be utilized at the Sauer Dump Site. An alternative technique, if debris or other obstacles prevent the use of HSA, will be recommended (e.g., backhoe pits) on an as-needed basis. The hollow stem auger method is described below.

Hollow Stem Auger

The HSA method (ASTM D1452-80) is another potential drilling method that may be used to drill the soil borings and monitoring wells borings at Sauer Dump Site. The HSA method utilizes continuous flight hollow augers with a cutter head mounted on the bottom of the lead auger. A plug is inserted into the hollow center of the cutter head to prevent soil from coming up inside the auger. This center plug has an attached bit that helps to advance the augers.

With the HSA method, soil borings and monitoring well borings will be initially drilled with 4.25-inch I.D. hollow stem augers for the purpose of collecting subsurface soil samples. For each boring that will be completed as a monitoring well, the borehole will be over-reamed prior to initiating well installation procedures. The size of the over-ream will depend on the size of the monitoring well to be installed (e.g., 2-inch, 4-inch, 6-inch). The increased diameter of the larger augers is necessary to prevent bridging of the filter pack during installation. Upon reaching total depth, the augers will be rotated until no additional cuttings are returned to the surface.

During the drilling process, all soil cuttings will be placed in 55-gallon Department of Transportation (DOT)-approved drums, visually inspected for physical description and signs of contamination (e.g., staining), and checked with a PID. These drums will be properly labeled, dated, and moved to a central storage area onsite. The results of the chemical analysis of soil samples collected from the borings along with PID readings from the cuttings will be used to evaluate possible disposal options for the containerized soil.

The breathing zone and the borehole will be monitored with a PID or FID during drilling activities to maintain a safe working environment and indicate potential contamination. Additional monitoring instruments will also be used to maintain safe drilling operations. These instruments include a real-time air monitor for checking airborne particulates (e.g., miniram) and a combustible gas indicator (CGI).

3.2.2.2 Collection Procedures for Subsurface Soil Samples

All soil borings, test pits and monitoring wells may be sampled at 2 to 5-ft

intervals. If sampling at 5-ft intervals is not possible because of the presence of hard rock material in the overburden, the boring will be advanced and sampling will be attempted at an interval where cuttings and drill rate indicate soil suitable for sampling.

The Standard Penetration Test (SPT) method (ASTM D1586-84) will be used for collecting subsurface soil samples. A 2-ft long by 3-inch I.D. decontaminated stainless-steel split-spoon will be driven into the soil by dropping a 140-pound weight a distance of 30 inches. A 3-inch split-spoon is necessary to collect the volume of soil required for physical and chemical analysis. In cases, where soil samples are being collected solely for geotechnical analysis, a 1 3/8-inch I.D. split-spoon sampler will be used in accordance with the ASTM method. Samples collected solely for geotechnical analysis will be in accordance with SOP 3 in Appendix A. Subsurface soil samples will be collected in accordance with SOP 2 in Appendix A. If split-spoon refusal occurs (because of the presence of hard rock material in the overburden), the split-spoon will either be redriven or the boring will be advanced and sampling reattempted at an interval where the drill rate indicates soil suitable for SPT sampling. If an insufficient volume of soil was obtained due to spoon refusal and the above two options do not yield significant sample recovery, a second or third attempt will be made by abandoning the boring and moving the drill rig, usually within 10 ft of the original location.

Abandonment will be conducted in accordance with the procedures outlined below. Once the completion depth for the boring has been reached and all samples have been collected, the boring will either be completed as a groundwater monitoring well, as discussed in Section 3.6.2, or backfilled with native soil if the boring has not advanced either past the water table or to a depth of greater than 25 ft bgs.

3.2.2.3 Stratigraphic Characterization

During drilling of soil borings, excavation of test pits and monitoring wells, geologists will fully describe all activities in field boring logs. Information from the boring logs will be transferred to Field Drilling or Well Construction File forms as soon as possible following completion of the soil boring or monitoring well. The following data will be recorded in the boring logs at the drill site:

- A. Depths in feet and fractions thereof (tenths of a foot). Measurements will be entered on the data entry forms.
- B. Soil descriptions, in accordance with the Unified Soil Classification System (USCS) and prepared in the field by the attending site geologist, which include the following information:
 - Classification
 - USCS symbol
 - Secondary components and estimated percentage
 - Color (using Munsell Soil Color Chart)
 - Plasticity
 - Consistency (cohesive soil) or density (noncohesive soil)
 - Moisture content
 - Texture/fabric/bedding
 - Depositional environment
- C. Cutting descriptions, including basic classification, secondary components, and other apparent parameters.
- D. Visual estimates of secondary soil constituents (If terms such as "trace," "some," or "several" are used, their quantitative meanings will be defined in a general legend).
- E. Length of sample recovered for each sample interval for split-spoon

samples and any evidence of contamination in the sample (e.g., PID/FID readings).

- F. Blow counts, hammer weight, and length of fall for split-spoon samples.
- G. Estimated interval for each sample.
- H. Field instrument readings, (e.g., PID, FID).
- I. Depth to water first encountered during drilling and the method of determination. (Any distinct water-bearing zones below the first zone also will be noted.)
- J. General description of the drilling equipment used, including the rod size, bit type, pump type, rig manufacturer, model, and drilling personnel.
- K. Drilling sequence.
- L. Any unusual problems.
- M. Start and completion dates of all borings, and a chronological time-sequence of all events (including daily drilling footage and quantities).
- N. Lithologic boundaries.

All soil borings will be accurately located on a detailed site map at the time of sample collection and marked with a numbered stake for future reference.

3.2.3 Geoprobe® Soil Sampling

Geoprobe® soil sampling involves hydraulically driving a 1.25-inch O.D. hollow stainless-steel probe rod into the ground. The probe rod contains a clean acetate sampling tube for collecting the soil sample. A rotating impact hammer is included to quickly penetrate concrete or asphalt pavement. Once the underlying soil is encountered, the probe rod is hydraulically driven to the desired sampling depth.

During the collection of discrete soil samples, the sampling tube remains

completely sealed by a locked inner piston while the probe rod is driven to the desired depth. When the target depth is reached, a tool is inserted within the probe rod to the top of the sampling tube. The tool releases the inner piston from its locked position. The probe rod is then driven through the soil, filling the sampling tube. The probe rod is then withdrawn from the hole and the sample tube is retrieved. The sample can then be removed from the tube and placed in sample bottles. Geoprobe® soil samples will be collected in accordance with **SOP 4** in Appendix A.

The use of Geoprobe® soil sampling has several advantages to conventional methods. Samples can be collected more quickly and in locations of limited access and under overhead utility lines. No cuttings are produced when advancing the sampling probes which eliminates the need for costly storage, sampling, and disposal. Geoprobe® sampling can also reduce the number of monitoring wells by screening samples to define the extent of a contaminant plume. The effective working depth of Geoprobe® sampling is approximately 40 ft bgs; however, depths in excess of 70 ft can be attained in fine-grained deposits.

3.2.4 Geotechnical Soil Sampling

Geotechnical analyses may be conducted (as needed) on a certain percentage of the subsurface soil samples collected from soil and borings. Soil samples will be selected for physical testing by the accordance with ASTM Method D1586-84. **SOP 3** of Appendix A describes the collection of soil samples for geotechnical testing.

In order to minimize the disturbance of the soil core, a continuous 12-inch interval of soil will be separated from a split-spoon. This continuous 12-inch core will be placed in a plastic air tight bag and labeled with boring number, sample depth, and

orientation of the sample (i.e., top end of the sample or bottom end of the sample). The sealed bag will be placed in a cooler with cold, wet paper towels for storage and preservation. Each geotechnical soil sample will be analyzed for moisture content (ASTM D-2216), sieve grain size distribution (ASTM D-422) with hydrometer, Atterburg Limits (ASTM D-4318), bulk density (ASTM D-4253), permeability (ASTM D-5084), and specific gravity (ASTM D-854). Each sample will be assigned a USCS symbol and description. The testing results will be used to describe the subsurface soils, verify the site geologist's field logs, and develop site-specific values for soil porosity and hydraulic conductivity in order to evaluate contaminant transport and effective remedial actions.

3.2.5 Soil Sampling from Test Pits

Based on site conditions and efforts from previous site investigations, soil samples may have to be collected from test pits. Test pits will be installed by the utilizing an excavator. Test pits will be dug in 2-foot increments. Depths of excavation will be verified with a surveyor's rod. Soil samples will be collected in accordance with **SOP 4** in Appendix A.

Upon completion of excavation activities, the soil will be placed back in the test pits and graded with the excavator.

3.3 SURFACE WATER SAMPLING

Surface water samples may be collected to evaluate the impacts of study sites on surface water bodies and drainage courses, such as streams and wetlands. To determine the impacts of a specific study site on surface water quality, samples will typically be collected from locations upstream and downstream of the channel segment into which the site drains. Due to the close proximity of the sample

locations to the shore line, the surface water samples will be collected closely after the peak of high tide (during ebb tide) to minimize the disturbance of the river bed and potential entrainment of sediment in the surface water sample. The exact sample time will be determined based on the tidal charts of the sampling day for the Back River. All surface water samples will be collected in accordance with **SOP 5** in Appendix A.

Water quality measurements will be collected during surface water sampling activities. The water quality measurements will include: pH, temperature, conductivity, dissolved oxygen (DO), turbidity, and oxidation reduction potential (ORP). The measurements will be made before and after the samples are collected. If multiple surface water samples are to be collected from a surface water body, samples will be collected from the furthest point downstream, moving upstream as the sampling progresses. Surface water will be sampled before sediment to prevent the collection of fine-grained substrate, which may be introduced into the surface water from sediment sampling activities. Only samples when turbidity values ≤ 10 NTU will be analyzed in the laboratory. All surface water sample locations will be marked on a site map. A description of the sampling point will be entered into the field logbook. The description will be adequate for the sampling point to be located in the future.

3.4 SEDIMENT SAMPLING

Sediment samples may be collected to evaluate the impact on the surrounding surface water bodies and drainage courses. Where specified (in almost all cases), sediment and surface water sampling locations will be the same. Chemical analyses will be the same for the sediment and surface water samples collected from the same location to aid in data comparison and evaluation.

To determine the impacts of a specific study site on sediment quality, samples will be collected from locations upstream and downstream of the channel segment into which the site drains. Sediment samples will be collected from the furthest point downstream, moving upstream as the sampling progresses. Sediment sampling will be conducted in accordance with **SOP 6** in Appendix A.

3.4.1 Collection Procedures for Sediment Samples

Sediment samples will be collected from beneath the organic build-up or detritus material and decomposed organic material will be included in the sample. The decomposed organic material will be retained in the sample due to the potential for this interval to be impacted due to deposition and adsorption. Typical sampling depths may range from the top of sediment to a depth of one foot below the top of sediment. Samples will be collected with a decontaminated stainless-steel bucket auger, if there is little or no water on top of the sediment at the particular sampling location and if the water velocity is low. For sampling locations where the water velocity is high, a decontaminated stainless-steel corer or other device that eliminates sample washing will be used. This will ensure the integrity of the surface layer of sediment and minimize the loss of fine-grained material in the sediment.

3.5 HYDROGEOLOGIC INVESTIGATION

In order to assess the presence of groundwater contamination, a hydrogeologic investigation may be conducted at the Sauer Dump Site. The investigation may involve the installation of permanent groundwater monitoring wells, and collecting groundwater samples from permanent monitoring wells (both newly installed and existing). Permanent groundwater monitoring wells will be drilled using the boring

procedures provided in Section 3.2.2.1. Sections 3.6.1 and 3.6.2 provide details for the design, construction, and installation of permanent groundwater monitoring wells. No new Monitoring Wells are currently planned for in the RAP.

Following installation, permanent monitoring wells will be developed following the procedures listed in Section 3.6.3. Permanent monitoring wells (newly installed and existing) will be sampled using either the conventional or low-flow sampling procedures presented in Sections 3.6.4 and 3.7.5, respectively. Sampling of the newly installed monitoring wells will begin no less than 14 days after completion of well development activities in order to allow sufficient time for aquifer equilibration. An oilwater interface probe will be used for detection of Dense Non-Aqueous Phase Liquids (DNAPLs) and Light Non-Aqueous Phase Liquids (LNAPLs) when sampling permanent monitoring wells.

Hydrogeologic investigations may also provide additional information on site-specific geology/hydrogeology and aid in establishing groundwater flow velocities and gradients. Static water level measurements are used in conjunction with aquifer testing data to estimate hydraulic conductivities and groundwater flow velocities. Collection of static water level measurements is described in Section 3.6.8.

3.5.1 Groundwater Monitoring Well Design and Construction

The actual depth of each monitoring well will depend on the aquifer unit that is to be investigated.

The size of the monitoring well to be installed (e.g., 2-inch, 4-inch) will be specified at future dates during the development of site-specific work plans. The following

materials will be used in constructing permanent monitoring wells:

- A. Flush-threaded Schedule 40 PVC casing that conforms to the National Sanitation Foundation Standard 14 for potable water usage. The I.D. of the PVC casing will depend on the size of the monitoring well to be installed (e.g., 4-inch, 6-inch). No PVC solvents or glues will be used. A 10-ft screen length, slot size 0.010 inch will be located at the base of the well. The 0.010 inch slot size will filter out the finer-grained material of the overburden soils and prevent them from entering the well. A water-tight lockable cap will be placed on top of the riser in each flush-mounted well. For aboveground monitoring wells, an oversized PVC cap will be placed on top of the riser pipe. For all monitoring wells greater than 100 ft, Schedule 80 PVC casing with centralizers may be used.
- B. A mixture in the ratio of 94 lbs. of Portland Type II neat cement, to 6-8 lbs. bentonite, to 8-10 gallons of water will be used to grout the annular space between the casing and the open borehole.
- C. Commercially available granular, powdered bentonite will be mixed with pre-sampled and approved water for making a bentonite slurry.
- D. Clean silica sand (Morie 1 size), will be used in the filter pack around the well screen, compatible with both the screen slot size and aquifer materials.
- E. A protective steel casing will be installed over the top of the PVC riser for monitoring wells finished above grade. The diameter of the protective casing will depend on the size of the monitoring well installed (e.g., 4-inch, 8-inch). The protective casing will extend approximately 2± ft above land surface and will be seated 2± ft into the well seal grout. It will be vented to the atmosphere via a hinged locking cap that will

prevent entry of water, but will not be airtight. In accordance with the *Geotechnical Requirements for Drilling, Monitor Wells, Data Acquisition, and Reports (March 1987)*, a 4-inch diameter drainage port will be installed, centered 1-inch above the level of the internal mortar collar. The steel casing and posts will be painted orange. Wells finished below grade will have a flush-mounted manhole or valve-box type cover marked "monitoring well".

- F. All locks used to secure the monitoring wells will be keyed with the same key.

3.5.2 Groundwater Monitoring Well Installation

Once the drilling has reached the proper depth for well installation, the PVC monitoring well will be placed inside the temporary steel casing or the hollow stem auger. The permanent monitoring wells will be constructed (placement of sand filter pack, bentonite seal, and bentonite cement grout) inside the augers or drill casing as they are gradually removed to allow for proper placement of well construction materials.

When a monitoring well boring is completed, the site geologist will visually inspect the hole and decide on the depth of the well. All well installations will begin within 48 hours of boring completion, and, once begun, will continue uninterrupted until completed. All PVC casings and screens will be steam cleaned prior to installation to ensure that all residual materials are removed. The casings and screens will then be wrapped in clean polyethylene sheeting for transport. All well screens will have a solid bottom. Solid casing will extend from the top of the screen to approximately 2 1/2 ft above land surface. If necessary, the borehole will be backfilled to the desired depth with bentonite grout. The grout will be pumped into

the boring, under pressure, through a tremie pipe that discharges at the bottom of the boring. The filter pack will then be installed through a tremie pipe around the well screen to a height of approximately five feet above the top of the well screen. A bentonite slurry will then be placed above the filter pack to produce a minimum 5-ft thick bentonite seal using a tremie pipe. The bentonite slurry will have the following composition: 50 lbs. of bentonite to 15-35 gallons of water. A grout-cement seal consisting of Portland Type II cement and granular bentonite will extend from the top of the bentonite seal to a depth of approximately six inches to one foot bgs. Grouting activities will be completed as a continuous operation in the presence of the site geologist. The grout will be pumped into the annular space under pressure using a tremie pipe placed at the top of the bentonite seal to ensure a continuous seal. After the grout-cement seal has set (approximately 24 hours), the seal will be checked for settlement and additional grout will be added to fill any depressions, if necessary. Once grouting operations are completed, a square concrete surface cover extending three ft in all directions will be placed from the top of the bentonite grout to 6 inches above the ground surface. An aboveground steel protective casing will be sealed in the cement surface cover for all aboveground finished monitoring wells. In addition, protective posts will be installed around the aboveground finished monitoring wells to prevent damage by vehicular traffic. The protective steel casing and posts for the aboveground finished monitoring wells will be painted orange. For monitoring wells located in heavy traffic areas, flushmounted covers will be installed and the PVC well casing will be finished bgs with a water-tight sealed lockable cap. The flush-mount covers will be marked "monitoring well" to distinguish them from fill ports for USTs. Following completion of all monitoring well installation activities, an ID plate will be affixed to each well.

An as-built construction diagram of the well installation will be included in the

boring log and will show, by depth, the bottom of the boring, screen location, coupling location, granular filter pack, seals, grout, and height of riser above ground surface. The actual composition of the grout, seals, and granular backfill will be recorded on each log. The as-built diagrams will include the protective casing detail. The drilling subcontractor will complete the Form A (*Groundwater Monitoring Well Certification - As-Built Certification*) and submit the original to MDE with a copy to the contractor.

3.5.3 Monitoring Well Development

Newly installed permanent monitoring wells will be developed by pumping the groundwater with a stainless-steel electric-powered submersible pump. The submersible pump intake will be placed below the water level and lowered as the water level drops. The pump will be surged to facilitate the removal of fine sediments at the bottom of the monitoring well. Polyethylene tubing, connected to the pump with stainless-steel clamps, will be used in purging the well. The tubing will be dedicated to each individual well and will be disposed of after use. If well yields cannot sustain the flow rate of the submersible pump, a dedicated bailer will be used to evacuate the well. Water will not be added to the well to aid in development, nor will any type of air-lift technique be used. Measurements of water quality parameters will be recorded every three to five minutes during monitoring well development. The water quality parameters will include: pH, temperature, conductivity, DO, turbidity, and ORP. Development water will be containerized in a portable polyethylene tank and transported to a central storage area, if analytical results for the subsurface soil samples indicate potential contamination. If there is no indication of potential contamination, the development water will be disposed of downgradient of the monitoring well on a grassy surface if it will not present a nuisance to day-to-day installation activities.

The containerized well development water will be sampled and disposed of after consultation with the USEPA.

Well development will begin no sooner than 48 hours, but no later than seven days, after the cement surface covers are in place. Development will proceed until the following conditions are met:

- A. The well water is clear to the unaided eye.
- B. Stabilization of water quality parameters. Stabilization will be defined by the following variances between three successive readings: pH within \pm 0.1%; conductivity within \pm 3%; DO, ORP, and turbidity within \pm 10% (Puls et al., 1995); and temperature within \pm 1°C.
- C. At least three well volumes (including the saturated filter material in the annulus) plus the volume of water added during the drilling process (if any) have been removed from the well.
- D. Five well volumes have been purged, regardless of stabilization of the water quality parameters.
- E. Turbidity measurements are less than or equal to 5 nephelometric turbidity units (NTUs). If it is determined that it is not possible to achieve 5 NTUs, the appropriate NTU value will be assigned after consultation with the,USEPA Region III, and MDE.
- F. The sediment thickness remaining in the well is less than five percent of the screen length.

3.5.4 Conventional Groundwater Sampling

Sampling of new monitoring wells will begin no sooner than 14 days after completion of well development activities in order to allow sufficient time for

aquifer equilibration. The following procedures will be followed on the day of sampling:

- A. The depth to water and total depth of the well will be measured from the top of PVC casing from the pre-marked reference location. The mark will be used as the survey point to measure all water levels or total well depths for the well. The height of the water column in the well will then be calculated.
- B. All sampling equipment will be placed on polyethylene sheeting to prevent contact with the soil.
- C. Groundwater in the screen, well casing, and saturated annulus (filter pack) will be evacuated with a stainless-steel electric-powered submersible pump. The submersible pump intake will be placed below the water level and lowered as the water level drops. Polyethylene tubing, connected to the pump with stainless-steel clamps, will be used in purging the well. The tubing will be dedicated to each individual well and will be disposed of after use. If well yields cannot sustain the flow rate of the submersible pump, a dedicated Teflon® bailer will be used to evacuate the well. If the well purges to dryness, no additional water will be removed.
- D. Water quality parameters (i.e., pH, temperature, DO, conductivity, turbidity, and ORP) will be measured every three to five minutes during pre-sample purging. A monitoring well will be considered ready for sampling when the water quality parameters have stabilized. Water quality variances, which are subject to instrument accuracy, should be as follows: pH within \pm 0.1; conductivity within \pm 3%; ORP within \pm 10 mV; DO and turbidity within \pm 10% (Puls et al., 1995); and temperature within \pm 1°C between three successive readings. Each well will be

sampled after the water level recovers to 80% of its static level or within two hours of purging.

- E. Pre-sample purge water will be containerized in a portable polyethylene tank and transported to a central storage area if analytical results for the subsurface soil samples indicate potential contamination. If there is no indication of potential contamination, the purge water will be disposed of downgradient of the monitoring well on a grassy surface if it will not present a nuisance to day-to-day installation activities.
- F. Sampling will be accomplished using a decontaminated Teflon® bailer. A Teflon®-coated wire leader approximately five feet in length will be attached to the bailer. Disposable nylon rope will be attached to the leader wire and will not come into contact with the water in the monitoring well. The bailer will be slowly lowered into the well so that the water column in the well is minimally impacted.
- G. Sample bottles will be filled in order of decreasing analyte volatility and preserved in accordance with the aqueous preservation procedures provided in Section 4.1.2.
- H. During sampling, primary objectives and considerations include minimizing sample disturbance, avoiding sample exposure to air and extraneous contamination, and preserving sample integrity throughout sample collection. Samples will be filtered at laboratory using standard method 3030b.

3.5.5 Low-flow Groundwater Sampling

Low-flow groundwater sampling minimizes the disturbance of any sediment in the monitoring well and the formation of any additional sediment. The goal of low-flow

sampling is to collect more representative samples by matching the intake velocity of the sampling device with the natural groundwater flow velocity, thereby reducing sample disturbances. The primary advantage of this procedure is the collection of low turbidity samples (i.e., samples with low concentrations of suspended particles) and the reduction of sample aeration, resulting in samples that are more representative of true aquifer conditions. Use of this technique also eliminates the need for collecting and analyzing filtered metal samples, thus saving time and analytical costs. Low-flow sampling also, in most cases, reduces the volume of groundwater purged from the well and associated disposal issues. Low-flow groundwater sampling will be conducted in accordance with SOP 7 (EPA Region III Recommended Procedure for low-flow sampling) in Appendix A. This sampling procedure involves removing groundwater from a monitoring well using a variable speed stainless-steel electric-powered submersible pump placed at the screened interval. The pump intake will be kept at least two feet above the bottom of the monitoring well to prevent mobilization of any sediment present in the bottom of the well. The depth to which the pump is lowered and the sample collected will be recorded so that the pump can be placed in the same location during future sampling events.

Before pumping begins, the water level in the monitoring well will be measured. The water level will be measured at a minimum of every three to five minutes during pumping. Pumping rates will be less than 500 mL per minute. Ideally, a pumping rate will be maintained that results in a stabilized water level (less than 0.3 ft drawdown) in the monitoring well. Water quality parameters (i.e., pH, temperature, conductivity, DO, turbidity, and ORP) will be measured on three to five minute intervals. Stabilization will be defined by the following variances between three successive readings: ORP within ± 10 mV; turbidity and DO within $\pm 10\%$; conductivity within $\pm 3\%$; pH within ± 0.1 (Puls et al., 1995); and temperature

within $\pm 1^{\circ}\text{C}$. If the water quality parameters do not stabilize, pre-sample purging will continue until one well volume has been removed or a purge time of two hours has been exceeded. If drawdown in the monitoring well is greater than 0.3 ft, the pumping rate will be reduced to match the recharge rate of the well, taking care to maintain pump suction and avoid air entrainment in the tubing. In case of air entrainment occurring, the sample will be discarded. If drawdown continues despite reducing the pumping rate, then two alternative methods will be used:

1. The first alternate sampling method will consist of drawing the water level in the well down to some depth greater than 0.3 ft, but above the top of the screened interval where the aquifer's groundwater recharge rate equals the pumps discharge rate. This will be accomplished by increasing the groundwater pumping rate up to 500 milliliters per minute (mL/min) and constantly monitoring the change to the groundwater level in the well. Once the groundwater level in the well stabilizes (i.e., well reaches steady-state), the pumping rate and the water level in the well will remain constant while groundwater quality parameters are evaluated on three to five minute intervals for stabilization. At a minimum, three time the volume of the groundwater drawdown in the well will be removed prior to groundwater sampling. The volume of groundwater drawdown in the well will be calculated by subtracting the constant head level from the initial water level measured in the well prior to pump installation and multiplying the well drawdown length by 0.65 gallons, which is the amount of water contained in one foot of 4-inch I.D. PVC well casing.
2. If the recharge rate of the well is less than 50 to 80 mL/min, a second alternate groundwater sampling method will be used. In this method, purging should be interrupted when the water level drops to the top of the

screened interval. Once the water level drops to the top of the screened interval, the pump will be shut off and the groundwater recharge rate will be measured. If groundwater recharges at a rate greater than 0.5 foot over a 30 minute period, and the groundwater quality parameters have stabilized, the well will be allowed to recharge for a one to two hour period and groundwater sampling will begin. If the observed recharge rate is less than 0.5 foot over a 30 minute period, the pump will be removed from the well and groundwater will be allowed to recharge for a 24 hour period. After the groundwater has recharged, the well will be sampled by placing the low-flow pump at the mid-screen depth of the monitoring well.

If the sampling conditions mentioned above cannot be achieved, groundwater sampling will be collected using a Teflon bailer, as discussed in Section 3.7.4. Teflon® tubing, connected to the pump with stainless-steel clamps, will be used in collecting lowflow groundwater samples. The tubing will be dedicated to each individual well and will be disposed of after use. Sample bottles will be filled in order of decreasing analyte volatility and preserved according to the aqueous preservation procedures provided in Section 4.1.2. Samples will be collected at flowrates of between 100 and 250 mL/min provided that drawdown of the water level within the well does not exceed 0.3 ft. If the drawdown rate exceeds 0.3 ft and the pumping rate cannot be reduced without air entrainment occurring, the two alternate sampling methods mentioned above will be considered. The measurements for determining drawdown will be completed at 3 to 5 minute intervals. Entrainment of air in the tubing must not occur. The sequences associated with this event must be fully documented in the field logbook. VOC samples must be collected first and directly into pre-preserved sample containers. The amount of HCl required for preservation will be determined using an acid blank with well purge water prior to sampling each well. All containers should be filled by

allowing the pump discharge to flow gently down the inside of the container with minimal turbulence. Sample containers shall be filled in order of decreasing volatility.

3.5.6 Groundwater Monitoring Wells Inspection

Groundwater monitoring wells will be inspected in accordance with **SOP 8** in Appendix A. Sites with groundwater monitoring wells require periodic inspections of the wells to determine their integrity and functionality. If available, boring logs and well construction diagrams would be useful to review prior to conducting an inspection. In addition to periodic inspections on sites with established programs, inspections are important to gain information on the usefulness of wells where we are new to the site and/or the wells have not been regularly sampled. A simple checklist on a groundwater monitoring well inspection form can be used to record observations.

3.5.7 Static Water Level and Well-Depth Measurements

Static water level and well-depth measurements will be conducted in accordance with **SOP 9** in Appendix A. Static water level and well-depth measurements at newly installed and existing groundwater monitoring wells will be obtained using an electronic water level sounding device. Using a calibrated sounder, this procedure is accurate to ± 0.01 ft. The tape will be rinsed with water from the approved source, cloth-wiped, and allowed to air dry between consecutive water level measurements. All measurements of the depth to groundwater and well depth will be referenced to a permanently marked reference point on the monitoring wells (highest point on the top rim of the PVC casing). Prior to measurement, water levels in the monitoring wells will be allowed to stabilize for a minimum of 24 hours after well construction, development, or aquifer testing. Where possible, the work

will proceed from the least to the most contaminated wells. The wells will be opened and the headspace monitored with a PID or FID to determine the presence of VOCs. If a floating product layer is detected in the well, an oil/water interface probe will be used to measure the length of the product layer. Collection of static water level and well-depth measurements will be conducted in accordance with **SOP 9** in Appendix A.

3.6 SAMPLING LOCATION AND ELEVATION SURVEY

A sampling location and elevation survey is performed in order to carry out engineering measurements and other surveying operations necessary to map sampling locations and their elevations.

Surveys should be completed by a surveyor who is licensed and registered in the State of Maryland. The latitude and longitude of each surveyed location will be tied to the Universal Transverse Mercation North American Datum of 1927 (UTM NAD 27) in m. Elevations for the natural ground surface

At each surveyed location will be determined using the National Geodetic Vertical Datum of 1928 (NGVD 28) in ft. Measurements should be third order accuracy. Temporary monuments will be set and referenced for future recovery. All monuments will be described in the surveyor's notes and will consist of a permanent mark scribed on sidewalks, paved roads, or curbs. Sufficient descriptions will be provided to facilitate their recovery.

The chronology of performing surveying operations to locate sampling stations is dependent on the nature of the sampling to be performed and the site conditions. Surveying operations to define horizontal and vertical locations of onsite sampling

stations may be performed before or after sampling stations are established. Typical scenarios of such circumstances are:

- Sampling grids will usually be staked out by the contractor Field Operations Leader prior to surveying. The grids should be staked to be easily visible for later surveying.
- Planned surface soil sampling locations can sometimes be staked out and measured for ground elevation by surveyors in advance of the sampling events.
- Unplanned surface soil sampling locations, or those which have been relocated a significant distance away from the planned location to suit site conditions, may be staked for identification by the sampling personnel, and subsequent determination of horizontal positions and ground surface elevations by a surveyor.

3.6.1 Soil Borings

Horizontal locations and ground surface elevations for borings and test pits are used to construct geologic sections or profiles. Horizontal locations (i.e., latitude and longitude) will be determined to ± 3.0 ft and ground surface elevations measured to ± 0.1 ft. The surveyors may stake the location in advance indicating the boring or test pit number, grid coordinates, and ground surface elevation on the stake. A tall witness stake or colored flag should be used to make the location more readily visible. A greater degree of layout accuracy may be required in confined areas, where the drilling or excavation must be performed carefully to avoid disturbances to underground facilities (i.e., utilities, tunnels, foundations, etc.).

3.6.2 Monitoring Wells

The horizontal location of monitoring wells will be determined to within ± 3.0 ft, while the elevations will be determined to within ± 0.01 ft. The surveyor will measure the following three elevations: the top of the inner PVC casing, the top of the outer protective casing (on the lip, not the cap), and the ground surface elevation at the base of the concrete pad. Prior to the start of the survey, Field Team Leader should ensure that the surveyors are given the keys to the locking caps on the wells. The Field Team Leader will also instruct the surveyor to measure the elevation of the top of the inner PVC casing from the pre-marked point. This point will be used as a reference to measure subsequent groundwater elevations. The wellhead elevation and natural ground surface elevation will also be noted and recorded.

3.6.3 Surface Soil, Surface Water, and Sediment Sampling Locations

A Differential Global Positioning System (DGPS) will be used to establish the horizontal location of all surface soil, surface water, and sediment sampling locations. The DGPS unit used for the surveying will be a Trimble Pathfinder Pro XR system that collects real-time, differentially-corrected satellite data. According to the manufacturer, the accuracy of horizontal fixes from the Pathfinder Pro XR unit is plus/minus approximately 12 inches with no data post-processing. All survey data will be downloaded into Trimble's Microsoft Windows-based processing software for data manipulation and then into a CADD and or ArcGis map plotting.

3.7 DECONTAMINATION PROCEDURES FOR SAMPLING AND HEAVY EQUIPMENT

Decontamination of sampling and heavy equipment will follow MDE, and USEPA Region III guidance. An **SOP 10** for conducting decontamination operations is provided in Appendix A.

All decontamination-derived water will be placed in containers and may be consolidated into mobile tanks based on volume. Soil or sludge wastes from decontamination of the drill rig or backhoe will be placed in 55-gallon drums and labeled. Once the drums are full, the containerized waste will be staged near the decon pad area for offsite disposal. Following receipt of the analytical results, the decontamination-derived wastewater will be disposed of after consultation with the USEPA. If the wastewater is uncontaminated, it will be released onto the ground at the contractor's decontamination pad. However, if the wastewater is contaminated, it will be transported an approved off-site facility.

3.7.1 Non-Aqueous Sampling Equipment

All surface soil, subsurface soil, sediment sampling equipment (e.g., stainless-steel bucket augers, split-spoons) will be decontaminated after each use according to the following procedure:

- A. Wash and scrub low-phosphate deter-gent (e.g.,alconox).
- B. Rinse with pre-sampled and approved water.
- C. Rinse with 10% HNO₃ solution.
- D. Rinse with pre-sampled and approved water.
- E. Rinse with optima-grade methanol.

- F. Rinse with hexane (pesticide-grade or better).
- G. Rinse with demonstrated analyte-free distilled and deionized water (five times the volume of solvent used).
- H. Air dry.
- I. Wrap in aluminum foil (shiny side out).

Equipment used in field screening surveys (i.e. reconnaissance surveys) will be decontaminated using pre-sampled and approved water and a low phosphate detergent (e.g.,alconox) only. All split-spoon sampling devices used at the Sauer Dump Site are stainless steel. Therefore, a 10% nitric acid solution will be used in the decontamination sequence.

3.7.2 Aqueous Sampling Equipment

Submersible pumps will be used for pre-sample purging of monitoring wells in the conventional groundwater sampling methodology, as well as monitoring well sampling utilizing the low-flow method (see Section 3.6.5). The submersible pumps will be decontaminated at the beginning of each day and after each well is sampled according to the following procedure:

- A. Wash and flush approximately 5 gallons with pre-sampled and approved water through the pump.
- B. Wash and flush approximately 5 gallons ofalconox (low phosphate detergent) through the pump.
- C. Wash and flush approximately 5 gallons of pre-sampled and approved water through the pump.
- D. Wash and flush approximately 5 gallons demonstrated analyte-free water through the pump.

E. Air dry.

F. Wrap with aluminum foil (shiny side out).

The decontamination procedure for aqueous sampling equipment (i.e., pumps) listed above is consistent with the "between well-decon" specified by EPA in the *Ground Water Sampling Procedure Low Stress (Low Flow) Purging and Sampling SOP (March 1998)*. All remaining aqueous sampling equipment will be decontaminated according to the procedure listed in Section 3.10.1. Examples of such equipment include: Teflon® bailers, stainless-steel pitchers, and tank sampling devices. Dedicated Teflon® bailers will only be decontaminated prior to their first use.

3.7.3 Heavy Equipment

All heavy equipment, such as the drill rig and the backhoe will be decontaminated after each use with pre-sampled and approved water according to the following procedure. The decontamination procedure will include a high-pressure hot water wash, a high-pressure hot water rinse, and air drying. If the high pressure hot water wash is insufficient to clean the heavy equipment, the equipment will be washed with a low-phosphate detergent (e.g.,alconox) and scrubbed with brushes. The equipment will then be rinsed with pre-sampled and approved water. Drilling equipment will be placed on clean polyethylene sheeting during transport and at the drill site. Decontamination of the heavy equipment will be performed at the contractor's decon pad. However, in the event that heavy equipment is potentially contaminated at a Sauer Dump Site, a temporary decon area will be constructed to provide gross decontamination of the heavy equipment. In addition, temporary decontamination pads will be established at study sites where work will be carries out for an extended period of time.

3.8 FIELD QUALITY CONTROL SAMPLES

3.8.1 Source Water

Source water will be used to decontaminate sampling equipment (e.g., stainless-steel trays, splitspoons) after each use. In order to ensure that the decontamination procedure will not cause cross contamination, the source water will be demonstrated analyte-free prior to performance of any environmental sampling. The criteria for analyte-free water will be determined by the detection limits of the laboratory methods used for analysis of the source water sample. Analytes in the source water should be less than the Practical Quantitation Limits (PQLs) for Target Compound List (TCL) Volatiles, TCL Semivolatiles, TCL Pesticides/PCBs, Target Analyte List (TAL) Metals. In instances where analytes have been amended to the above lists, the detected concentrations must also be less than the PQL. Please note that it may not be possible to obtain water below the PQL for all metals. In addition, there are some site specific laboratory and screening methodologies that result in the following requirements for the source water:

The following common laboratory contaminants have allowable limits at 10 times the concentration detected in a blank (i.e., trip blank, rinse blank): methylene chloride, toluene, acetone, 2- butanone, and phthalate esters.

3.8.2 Field Duplicate Samples

Field duplicate samples will be used to provide sampling precision as well as analytical precision. Duplicate samples will be collected at a frequency of one duplicate per 20 samples per sampling technique collected for each medium. Duplicate samples are defined as samples collected simultaneously from the same source under identical conditions. Duplicates of the wipe and chip samples will be

collected adjacent to the original location as co-located samples. For non-volatile fractions, field duplicates will be collected after homogenizing (i.e., coning and quartering) the sample. This will improve precision and incorporate the technique of coning and quartering into the field duplicate.

3.8.3 Rinse Blanks

Rinse blanks will be collected to determine whether the decontamination procedure has been adequately performed and that there is no cross-contamination of samples occurring due to the equipment or residual decontamination solutions. Rinse blanks will be collected at a rate of one per type of sampling equipment per decontamination event. This rate should not exceed one rinse blank per day. A consistent volume of demonstrated analyte-free distilled and deionized water will be poured over the sampling equipment and collected in a sample container. Analysis of rinse blanks will be for all laboratory preservation procedures provided in Section 4.1.2.

3.8.4 Trip Blanks

Trip blanks will be used to determine if any onsite atmospheric contaminants are seeping into the sample bottles, or if any cross-contamination of samples is occurring during shipment or storage of sample containers.

Aqueous Trip blanks will be created onsite at Sauer Dump Site each day that aqueous samples will be collected for VOCs analysis. The aqueous trip blanks will consist of demonstrated analyte-free distilled and deionized water preserved with 1:1 HCl to a pH of less than 2 in 40 mL teflon-lined septum vials. The aqueous trip blanks will accompany the samples into the field prior to sampling, remain with the collected samples during the sampling sequence, accompany all aqueous VOC sample bottles shipped to the offsite laboratory, and remain with the samples at the offsite laboratory prior to analysis.

3.9 MANAGEMENT OF INVESTIGATION-DERIVED WASTES

This section provides specific procedures to be followed in the containerization, handling, and disposal of IDW generated during sampling activities at Sauer Dump Site. Potential IDW which may be generated during field activities at Sauer Dump Site include: liquids, soil/sediment, and disposable field supplies (e.g., plastic sheeting, Tyvek®). The types of wastes included in each of these categories and the applicable handling and disposal procedures are described below and in **SOP 11** in Appendix A. All drums containing soil and sediment wastes and miscellaneous water and solid waste (e.g., personal protective equipment [PPE]) will be transported to the offsite disposal facility. All hazardous waste manifest forms will be signed by Sauer Dump Coalition personnel. Offsite transport and disposal will be in accordance with applicable federal and MDE regulations.

The hazardous or nonhazardous classification of the wastes will be based on the sample analytical results from the Sauer Dump Site where the sampling activities were conducted. Additional analysis maybe required such as Toxicity Characteristic Leaching Procedure (TCLP). Consequently, IDW will be labeled to indicate the type of water, the study sites where the wastes were generated, and the date(s) the wastes were generated.

3.9.1 Liquid Wastes

Liquid wastes consist of water that may or may not be contaminated. Such wastes may be generated from the following activities:

- Well drilling and development,
- Pre-sample purging of monitoring wells, and
- Equipment decontamination.

- Wastes from well drilling, development, and purging will consist of groundwater,

sometimes mixed with aquifer material or rock fragments that are removed from the well along with the water. The stationary tank will be used for storage of water from well drilling and development, and as well as decontamination water. Purge water will be discharged through a carbon bucket to the ground surface.

- Water from development and pre-sample purging of monitoring wells may be containerized depending on the analytical results of the soil samples collected during well installation. The water will be analyzed for TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, the water also would be analyzed to determine if it is Resource Conservation and Recovery Act (RCRA) hazardous (refer to 40 CFR 261.20). If the water is hazardous, it must be transported offsite to a permitted facility for treatment/disposal. Based on historic results, Malcolm Pirnie plans on discharging purge water through a carbon bucket to the ground surface.

3.9.2 Soil and Sediment Wastes

Soil or sediment wastes may be generated from drilling of boreholes or from soil borings and monitoring wells, development and purging of monitoring wells, test pit excavation, steam cleaning of heavy equipment, and sampling activities. Soil and sediment wastes will consist of natural soil particles ranging from clay to gravel in size, and rock cuttings generally 1-inch or smaller. They may be either uncontaminated or contaminated depending on their source. The handling and disposal procedures for soil/sediment wastes derived from drilling, development, or decontamination operations will involve the following steps:

- A. Place soil/sediment in 55-gallon steel drums. Visually inspect and check the soil with a PID and FID.
- B. Adequately label the drums with regard to the type of contents (e.g., drill cuttings), the date of generation, and the sites where the wastes were

generated.

- C. Move the drums to a designated secure area for temporary storage.
- D. Use the analytical results from the environmental samples collected from the associated sites to decide whether the soil/sediment can be disposed of on the surface at its original location (or other - designated areas) or whether it requires special handling (i.e., as a hazardous waste).

Soil/sediment may be placed onsite provided that the following conditions are met.

- The soil/sediment is not considered contaminated.
- No potential to contaminate an uncontaminated aquifer exists.
- The disposal of soil/sediment will not erode/flow either offsite or onsite onto uncontaminated areas.
- The potential to create a health hazard to adjoining property owners through airborne exposure is nonexistent.

3.9.3 Miscellaneous Wastes

Used gloves, core liners, and any other disposable sampling equipment or personal protective equipment will be double bagged and disposed of off-site as non-hazardous waste.

4.0 SAMPLE MANAGEMENT AND ANALYSIS

The procedures described in this section ensure that once representative environmental samples are obtained, they are properly containerized, preserved, shipped, and otherwise handled in a manner that will maintain their chemical integrity. The use of these techniques will ensure the representativeness of a sample and significantly reduce the possibility of sample contamination from external sources. Additional information is also provided in the Sauer Dump Site Generic QAPP and the SOPs in **Appendix A**.

4.1 SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

4.1.1 Containers

All sample containers for both onsite and offsite laboratory analysis will be cleaned prior to use. These pre-cleaning requirements will meet or exceed USEPA requirements. The sample containers to be used for aqueous and soil samples are presented in **Tables 4-1 and 4-2**, respectively.

4.1.2 Sample Preservation and Holding Times

Chemical preservatives will be required for VOC aqueous samples to retard degradation during shipment and storage prior to laboratory analysis. Preservatives will be added to appropriate samples at the time of collection. In addition to chemical preservatives, all samples for chemical analysis will be transported to the laboratory in temperature controlled coolers. The types of preservation required for samples collected during field sampling activities at the Sauer Dump Site, as well as holding times, are contained in **Table 4-1** (aqueous) and **Table 4-2** (solid). Wet ice will be used to maintain the internal cooler temperature at $4 \pm 2^{\circ}\text{C}$.

4.1.2.1 Preservation of Aqueous VOC Samples

Procedures for chemical preservation of aqueous VOC samples are described below:

1. Samples to be analyzed for TCL VOCs will be preserved by addition of the correct volume of 1:1 HCl to reduce the pH to less than 2.
2. Following sample collection, the sample bottle will be capped and the bottle gently agitated in order to homogenize the preservative throughout the sample and to ensure that no air bubbles are present.
3. If air bubbles are present, the sample bottle will be reopened and additional sample water added. Failure to chemically preserve the aqueous VOC sample fraction will reduce the holding time to 7 days.

4.1.2.2 Preservation of Aqueous Non-VOC Samples

Procedures for chemical preservation of aqueous non-VOC samples are described below:

1. All containers will come pre-preserved directly for the laboratory.
2. The sample bottle will be capped, and the bottle gently agitated in order to homogenize the preservative throughout the sample.

**TABLE 4-1
SAMPLE PRESERVATION, BOTTLE REQUIREMENTS,
AND HOLDING TIMES FOR AQUEOUS SAMPLES**

Analyte	Bottle Requirement/Volume	Required Headspace	Preservative	Holding Time
TAL Metals	1-Liter HDPE	10%	HNO ₃ to pH <2, Cool to 4°C	6 months, except Mercury (28 days)
Cyanide	1-Liter HDPE	10%	NaOH to pH >12, Cool to 4°C	14 days
TCL VOCs	40-mL amber glass	0%	HCl to pH < 2, Cool to 4°C	14 days
Hexavalent Chromium	1-Liter HDPE	0%	Cool 4°C	48 hours
TCL SVOCs (including PAHs)	1-Liter amber glass	10%	Cool to 4°C	7 days to extraction (40 days after extraction)
TCL Pesticides/PCBs	1-Liter amber glass	10%	Cool to 4°C, Store in the dark	7 days to extraction (40 days after extraction)

**TABLE 4-2
SAMPLE PRESERVATION, BOTTLE REQUIREMENTS,
AND HOLDING TIMES FOR SOIL AND SEDIMENT SAMPLES**

Analyte	Bottle Requirement/Volume	Required Headspace	Preservative	Holding Time
TAL Metals	250-mL amber glass	10%	Cool to 4°C	6 months, except Mercury (28 days)
Cyanide	250-mL amber glass	10%	Cool to 4°C	14 days
TCL VOCs	EnCore or 60-mL amber glass	NA	Cool to 4°C	48 hour extraction/14 days analysis
TCL SVOCs	250-mL amber glass	10%	Cool to 4°C	14 days
TCL Pesticides/PCBs	250-mL amber glass	10%	Cool to 4°C	14 days (140 days after extraction)

4.1.2.3 *Preservation of Solid Samples*

Procedures for chemical preservation of soil/sediment samples for VOC analysis are described below:

1. Secure the cap of the sample bottle.
2. Document sampling sequence to specifications, including recording the sample date, time, and sampler's initial on the sample bottle. Do not attach any additional labels or tape to the sample bottles.
3. Store the sample bottles at 4°C±2°C. No chemical preservatives are necessary for soil/sediment samples collected for non-VOC analyses.

4.2 *SAMPLE DOCUMENTATION*

Accountability for a sample begins when the sample is collected from its natural environment. A bound field logbook will be maintained to record the acquisition of each sample. COC records for all environmental samples and field QC samples, laboratory results, and any other data generated as a result of sampling activities at Sauer Dump Site will be maintained on file. Copies will be provided for review by regulatory agencies as requested. Sampling locations will be noted on site drawings which will become part of the permanent project records. Monitoring well locations will be surveyed. Other sampling locations will be noted with respect to and referenced to permanent landmarks or site features (e.g., surface water samples) or, where necessary, will be taped off from permanent or semi-permanent site features (e.g., soil borings). This section describes the sample documentation which will be used at Sauer Dump Site

4.2.1 Field Logbook

Information pertinent to the sampling effort and field activities will be conducted in accordance with SOP 12 in Appendix A. Information pertinent to the sampling effort will be recorded in a bound logbook. Each page will be consecutively numbered. Entries will be made in indelible ink, and corrections will consist of line-out deletions that are initialed and dated. The outside cover of the field logbook will contain the installation name and the project-specific sampling event (e.g., Phase I surface soil sampling). In addition, the mailing address and a point-of-contact will be written in the front inside cover of the logbook. At a minimum, entries in a field logbook will include the following:

- Time and date of sample collection;
- Field sample number;
- Detailed description of the sampling location;
- Identification of sampler;
- Type of sample (e.g., groundwater, surface water, etc.)
- Requested analytes;
- Sampling methodology, including distinction between grab and composite sample;
- Sample preservation;
- QC samples associated with this sample;
- Sample shipment (e.g., name of the laboratory and cartage agent, i.e., Federal Express, United Parcel Service, etc.); Field measurements (e.g., PID, pH); and names of personnel conducting the sampling.

Sampling situations vary widely. No general rules can specify the extent of information that must be entered in a logbook. However, records should contain sufficient information so the sampling activity can be reconstructed without relying on the collector's memory.

SOP 11 in Appendix A describes the procedures and personnel responsibilities associated with recording field data at the Sauer Dump Site.

4.2.2 Sample Labeling

Each sample will be assigned a unique sequential number at the time of sampling, which will be permanently affixed to the sample container with polyethylene tape to prevent the loss of the label during shipment. Figure-4 illustrates an example of a sample label. The sample label will be filled out using indelible ink and will include the following information:

- Project name;
- Sample location/site ID;
- Sampling date and time;
- Analyses to be performed;
- Preservative; and
- Sampler.

Labels are to be acquired from the off-site laboratory which have the sample ID numbers preprinted. In cases where pre-printed labels are not used, field personnel will be required to write the sample ID on the samples label. The sample ID will consist of the media type (e.g., SS for surface soil, GW for groundwater), and a sequential sample number. For example, SS-9 would be the sample ID for surface soil sample #9 collected at the Sauer Dump Site. A more detailed discussion of the sample numbering scheme is provided in the Sauer Dump Site Generic QAPP.

4.2.3 Field Parameter Form

In addition to a field logbook, field parameter forms (FPFs) will be used to record information pertinent to the sampling effort. FPFs consist of duplicate pages which are consecutively numbered.

Entries will be made in indelible ink and corrections will consist of line-out deletions that are initialed and dated. At a minimum, entries on the FPF will include the following:

- Installation/site and area;
- Installation code;
- File name;
- Site type;
- Site ID;
- Field sample number;
- Laboratory ID;
- Date/Time (military format);
- Depth of sample collected and units;
- Sampling method;
- Identity of associated QC samples;
- Field measurements and calibration reference;
- Requested analytes;
- Sample container/number of containers;
- Preservation information; and
- Referenced location of sampling site.

4.3 SAMPLE CHAIN-OF-CUSTODY

A sample is considered to be in a person's custody if the sample is:

- In a person's actual possession;
- In view after being in a person's possession; and
- Locked up so that no one can tamper with it after having been in physical

custody.

Evidence of sample custody shall be traceable from the time the cleaned sample containers leave the laboratory until filled sample containers are transmitted back to the onsite or offsite laboratory. To achieve this condition, custody seals and COC documentation will accompany all sample containers.

4.3.1 Custody Seals

After the cooler has been properly secured (see Section 4.4.1), custody seals will be placed across the hinges of the cooler in two places to ensure the integrity of the samples during shipment to the offsite laboratory. Custody seals will be signed and dated prior to shipment of the samples.

4.3.2 Chain-of-Custody

A COC form is a triplicate form which will be created at the time of sample collection and will include samples collected for offsite and onsite analysis. All environmental samples will be kept at 4°-2°C from the time of sample collection until analysis. The COC form will contain the following information:

- 10-digit project number;
- Project name;
- Contractor Point of Contact (name and phone number);
- Names of the samplers;
- Field sample IDs;
- Date of sample collection;
- Sampling times (military format) for all samples;
- Whether the sample is "grab" or "composite";
- Matrix sampled (e.g., soil, water);
- Sample location;
- Analyses to be performed;

- Total number of containers per analysis;
- Preservation requirements for each analysis; and
- The carrier service, airbill number, and analytical laboratory .

Samples designated for onsite or offsite analysis will be released by the contractor's Sample Manager and the pink copy of the COC will be retained and added to the project documentation. Upon completion of the COC, any unused space below the last row will be crossed out with a diagonal line. The contractor's Sample Manager will then sign and date the COC prior to relinquishing the form to the laboratory. An example of a COC form is provided in **SOP 11 in Appendix A**. Samples designated for offsite analysis will be packaged and shipped according to the procedures provided in Section 4.4.

4.4 SAMPLE PACKAGING AND SHIPMENT

This section describes the procedures that will be used for sample packaging and shipment.

4.4.1 Sample Packaging

Samples will be transferred to the offsite laboratory for analysis via waterproof plastic coolers. Before samples can be put in the cooler, any drains will be sealed with tape to prevent leaking. Each cooler will be packed in the following manner:

1. Ensure sample lids are tight.
2. Enclose each sample, properly identified and with a sealed lid, in a clear ziploc bag, and make sure that sample labels are visible.
3. Place about 3 inches of inert cushioning material (e.g., bubble wrap) in the bottom of the cooler.
4. Place all the samples inside a garbage bag and tie the bag.

5. Double bag and seal loose ice to prevent melting ice from soaking the packing material.
6. Place the ice outside the garbage bags containing the samples. Place sufficient ice in cooler to maintain the internal temperature at $4 \pm 2^{\circ}\text{C}$ during transport.
7. Fill cooler with enough absorbent and packing material to prevent breakage of the sample bottles and to absorb the entire volume of the liquid being shipped.
8. Any samples suspected to be of medium/high concentration or containing dioxin must be enclosed in a metal can with a clipped or sealable lid (e.g., paint cans). The samples should be cushioned inside the can with sufficient noncombustible, absorbent material (e.g., vermiculite) to prevent breakage and absorb leakage. Label the outer metal container with the sample number of the sample inside.
9. Enclose all sample documentation (i.e., FPFs, COCs) in a waterproof plastic bag and tape the bag to the underside of the cooler lid. If more than one cooler is being used, place all documentation in one cooler. Number the coolers and note on the sample documentation the cooler number in which each sample was shipped.
10. Tape the cooler shut with clear tape over the hinges and place tape over the cooler drain.
11. Seal coolers at a minimum of two locations with signed custody seals.
12. Attach completed shipping label to the top of the cooler.

4.4.2 Sample Shipment

Sample coolers will be shipped to arrive at the laboratory the morning after sampling (priority overnight) or will be sent by a courier to arrive the same day. The laboratory will be notified of the sample shipment and the estimated date of arrival of the samples being delivered.

4.5 *SAMPLE RECEIPT*

Samples delivered to the offsite analytical laboratory will be accepted by the laboratory technician. Samples can be accepted Monday through Friday. Special arrangements will be required if Saturday delivery is necessitated. COC for laboratory receipt will be established in the following manner:

1. The carrier and the time of arrival are documented in the daily receipt log. The number of items on the COC is checked with the actual number received to ensure that all samples arrived.
2. Notation is made as to whether the shipping container (cooler) was sealed with custody seals.
3. The cooler is opened, and the condition of the cooler is recorded on the Laboratory Cooler Receipt Form. The internal ambient temperature of the cooler is taken, and the samples are itemized. Deviations from the COCs or the RAP, if any, will be noted and reported to the laboratory QA Coordinator.
4. Lot numbers will be assigned to the samples. Reference to field numbers will be documented in the appropriate logbook. All data are entered into the computer tracking system, with analyses required by holding-time specified dates. Once the sample has been transmitted to the offsite laboratory, the following sequence of events will occur:

- The samples are recorded on the Sample Log-In Form to summarize all the information pertaining to the sample/order to instruct the laboratory on the proper analysis and reporting of samples.
- After the samples are logged in, they are assigned to the appropriate locked storage refrigerator.
- All transfers of samples into and out of storage are documented through internal laboratory COC.
- Samples remain in secured storage until removed for sample preparation or analysis.
- A refrigeration log must be generated by laboratory personnel to ensure refrigerators/freezers are operating at the appropriate temperature. The log must indicate the ambient internal temperature as well as the initials of the person recording the reading and the date. Should the temperature fluctuate outside of the specified holding time temperature range, corrective action must be taken immediately.

4.6 ANALYTICAL PROGRAM

In developing the general chemical analytical program at Sauer Dump Site, the following basic elements were considered:

- Identification of target compounds and associated degradation products with respect to historic operations, chemical usage, and the results of previous investigations.

USEPA SW-846 methods will be used for the chemical analysis of samples collected at Sauer Dump Site (see Table 4-3).

**TABLE 4-3
ANALYTICAL METHODS**

Parameter	USEPA SW846 Method Number
Inorganics	3010A/3050B/6010B/6020/7000
Mercury	7470A/7471A
VOCs	5030B/5035/8260B
SVOCs	3520C/3550C/8270C
Pesticides/PCBs	3520C/3550C/8081A/8082/1668a
Cyanide	9010B/9011/9012A
TCLP Metals	1311/3010A/6010B/7470A

Procedures within the following documents have been referenced:

- USEPA, *Test Methods for Evaluating Solid Waste* (SW-846 Methods, including Update III revisions) for TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, cyanide, TVPH, TEPH, explosives;
- ASTM, Standard Method for the Particle-Size Analysis of Soils for Grain Size;
- USEPA, N-Hexane Extractable Material (HEM) and Silica Gel Treated N-Hexane Extractable Material (SGT-HEM) by Extraction and Gravimetry (Oil and Grease and Total Petroleum Hydrocarbons), EPA 821-B-94-004, October 1994.

Methods, specific analytes and respective quantitation limits, are provided in the Sauer Dump Site Generic QAPP.

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FIELD SAMPLING PLAN FIGURES

**FIELD SAMPLING PLAN
Appendix A**

Standard Operating Practices