3.0 Collection of Non-Sampling Data

During the SI, non-sampling data including that required by the USATHAMA Geotechnical Requirements will be collected during the investigation/sampling activities, and will be documented in the field notebooks (USATHAMA, 1987).

Information regarding the lithology and soil types present at the sites will be obtained from soil hand auger holes, soil borings, test pits, and monitor well installation. Well purging measurements will be obtained during monitor well sampling.

Other site-specific information regarding site conditions such as ambient weather conditions, topography and surface drainage, presence of unusual flora or fauna, visible evidence of contamination, presence of unexploded ordnance (UXO) or other safety hazards will also be recorded during drilling and sampling activities.

Groundwater levels will be obtained during sampling at sites where there are existing or new monitor wells to determine groundwater flow direction and gradient.

Pertinent cultural features (e.g., building foundations, culverts, headwalls, pipes) will be noted as necessary during sampling to assist in developing site conceptual models.

The coordinate locations of existing monitor wells will be confirmed by the registered land surveyor; new sampling locations and elevations of monitor well casing will also be determined.

The types and quantities of IDW generated at each site investigated will be documented for proper tracking and disposal of the waste materials.

3.1 Topographic Survey Data

3.1.1 Horizontal Control

Each boring and/or well installed under this DO will be topographically surveyed by QST's licensed surveyor subcontractor [Brooks & Brooks, Inc. (B&B)] to determine its map coordinates using a Universal Transverse Mercator (UTM) or State Planar grid to within $\pm$ 3 ft [$\pm$ 1 meter (m)].

3.1.2 Vertical Control

Elevations for the natural ground surface and the highest point on the rim of the uncapped well casing (not the protective casing) for each bore/well site will be surveyed by a licensed surveyor (B&B) to within ± 0.01 ft [± 0.3 centimeters (cm)] using the National Geodetic Vertical Datum of 1929.

3.1.3 Field Data

The topographic survey will be completed as near to the time of the last well completion as possible, but no longer than 5 weeks after well installation. Survey field data (as corrected), to include loop closure for survey accuracy, shall be included within the geotechnical or final report. Closure will be within the horizontal and vertical limits given. These data will clearly list the coordinates (and system) and elevation (ground surface, top of well, and protective casings) as appropriate, for all borings, wells, and reference marks. All permanent and semipermanent reference marks used for horizontal and vertical control (bench marks, caps, plates, chiseled cuts, rail spikes, etc.) will be described in terms of their name, character, and physical location.

4.0 Investigation-Derived Waste Management Plan

Management of IDW is an integral part of the SI. Wastes must be managed properly to ensure that contamination is not spread to previously uncontaminated areas and to ensure compliance with federal and state regulations. Close coordination with FTMC DOE is important to successful management of IDW.

All work areas around the wells and borings installed as part of this SI will be restored to a condition that meets COE and FTMC approval. This includes cuttings removal, rut repair, and general policing of the area. All borehole cuttings will be collected as they are generated and screened with a photoionization detector (PID). If the PID indicates greater than 50 parts per million (ppm) VOCs in air, then the soil will be containerized in drums. All drilling fluids, well development and purge water, and decontamination fluids will be containerized in drums or other appropriate containers. Each waste stream (e.g., drill fluids, development/purge water, and decontamination fluids) will be segregated.

All drums will be in good condition, properly labeled, and stored in an area designated by the FTMC DOE.

Groundwater collected during the well development, purging, and decontamination water, drill cuttings, and waste soils will be containerized in 55-gal drums for disposal. Each drum lid will be labeled with the appropriate site information using a paint pen or other indelible marker that will not fade when exposed to the weather. The label will include a description of the waste matrix (soil, purge water), the sample location (i.e., monitor well identification), and the date the drum was sealed. A record of the number of drums filled at each site will be included in the logbook before leaving each well site.

The analytical sample results for soil and groundwater samples obtained during this field effort will be used to determine the initial classification of the IDW materials. An initial check will be made of the analytical results to determine if these wastes are to be classified as hazardous waste by the U.S. Department of Transportation (DOT). If levels detected in the environmental soil or groundwater samples are below those which would make the IDW waste toxic, corrosive, ignitable, or reactive, the IDW materials would be determined to be nonhazardous.

If the chemical analyses of environmental soil/water samples from the site indicate the total concentration of an analyte is below the Toxic Characteristics Leaching Procedure (TCLP) maximum acceptable levels presented in 40 Code of Federal Regulations (CFR) 261.24, it would be safe to assume that soil or water from these locations could not leach concentrations above toxic concentration (TC) maximum criteria. These analytes would require no further testing to be classified as a nonhazardous waste.

If chemical analyte concentrations are detected above TCLP maximum acceptable levels, a composite sample of the IDW materials stored at that site will be obtained and analyzed using the TCLP. If the results of the TCLP show concentrations below the maximum allowable limits, the IDW will be classified as nonhazardous. If the results indicate the IDW leaches contaminants in concentrations above the TCLP maximum criteria, then the IDW from that sample location will be classified as hazardous, and must be disposed of in an approved hazardous waste facility.

Immediately upon receiving the results of the analyses, the soil/water drums will be labeled with DOT-approved labels. This labeling process will only be necessary after the final waste determination has been made.

5.0 SI Project Management

This section of the Work Plan (WP) defines the project objectives, describes the organizational structure, identifies key personnel and their responsibilities, defines project communications and reporting requirements, describes management of subcontractors, and outlines a schedule for implementing the site investigation.

In addition to this SI WP, an rule making package (RMP), QAPP, and HASP have been prepared for the FTMC SI. The RMP was prepared to document the overall management approach for the development of the SI plans and includes a discussion of the technical approach, project schedules, detailed costs, and personnel.

A QAPP has been prepared using the USATHAMA Quality Assurance Program (PAM) 11-41 (January, 1990) and the Engineering Support Branch Standard Operating Procedures and Quality Control Manual (EPA, 1991). The QAPP includes details regarding the sample numbering system; data transfer form the field, including hard copy and Installation Restoration Data Management Information System (IRDMIS) transmittals; chain-of-custody; and data validation.

A HASP, developed concurrently with this SI WP, presents all elements required by 29 CFR 1910.120, and addresses the health and safety measures that will be followed at the site when conducting all field activities. None of the 17 SI sites are believed to contain UXO or chemical agents/chemical agent breakdown products. Approval of the HASP will be obtained prior to initiating field sampling activities.

5.1 Project Description and Objectives

DOD is preparing to close FTMC in accordance with BRAC requirements and expeditiously return property to the public. This SI is being completed under DOD, FTMC DOE, ADEM, and EPA guidance and is administered through COE.

The objective of this SI is to gather information to support a site-specific decision regarding the need for further action at selected parcels identified during the EBS prior to transfer. This SI is neither a study of the full extent of contamination at a site nor a risk assessment; rather, it is intended to determine if potential contaminants are present at concentrations that may pose a risk to human health or the environment. A health-based screening procedure will be employed to meet this goal (see Sec. 7.0).

The 17 sites being investigated under this delivery order are listed in Sec. 1.0 of this SI WP.

5.2 Project Organization

Organizations directly involved with supervising implementation of the SI WP include COE, USAEC, FTMC DOE, EPA, ADEM, and QST. QST is contracted by COE to conduct this SI for FTMC. Project organization is discussed in detail in the RMP. Critical project contacts are:

Mr. Ellis Pope, COE	334-690-3077
Mr. Dean Hutchins, USAEC	410-671-1630
Ms. Lisa Kingsbury, FTMC DOE	205-848-7455
Mr. William Elliott, QST (Project Manager)	352-333-3625
Mr. John Herbert, QST (Project Geologist)	352-333-3627

5.3 Subcontractor Management

QST anticipates using two subcontractors for the successful completion of this project. Soil boring and monitor well installation will be performed by Graves Services Company, Inc. of Harpersville, AL. Brooks & Brooks, Inc. of Tuscaloosa, AL, will survey all field investigation locations. These subcontractors were chosen because of their level of expertise and/or work history at the site. Daily supervision of these subcontractors will be the responsibility of the project geologist, or his designate, during field efforts, with the project manager providing overall supervision. The subcontractors will adhere to requirements contained in the QAPP and the project HASP (provided under separate cover).

5.4 Project Communication and Reports

The QST project manager is responsible for communications between QST and the COE Contracting Officer's Representative (COR), including submission of monthly Cost and Performance Reports. All field changes will be discussed between the QST project manager and the COE project manager in a timely manner. Changes requiring modification of schedule, funds authorized, or other contractually stipulated items will also be approved by the COE COR before implementation.

5.5 Project Work Schedule and Deliverables

Deliverables required after collection and analysis of SI environmental samples include SI Reports and Decision Documents. The schedule period extends through the completion and final submittal of the Final SI Report and Final Decision Documents. Field investigations will begin within 30 days of the final SAP, HASP, and QAPP approval. A detailed schedule is presented in the RMP.

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6.0 Field Sampling Methods and Procedures

6.1 General Requirements

This section describes procedures for field activities to be performed during the FTMC SI. The field activities will include the following:

- Soil boring, surface soil, and test pit soil sampling;
- Groundwater screening to include temporary monitor well installation;
- Existing monitor well sampling; and
- Surface water and sediment sampling.

The quality of the data collected in an environmental study depends largely on the quality of the sampling activities. Therefore, field operation must be carefully planned and executed. Procedures for sample collection are described in detail in this section. Detailed procedures for sample handling, preservation, shipping and storage are described in Sec. 7.0 of the QAPP. Field quality control (QC) samples are described under internal quality control checks in Sec. 8.0 of the QAPP. The summary of the number of samples and compounds to be analyzed are provided in Table 2-1 of this document.

6.1.1 Special Sampling Requirements

Samples will be analyzed in the parts per billion range for many compounds; therefore, extreme care must be exercised to prevent sample contamination. The following precautions should be taken when sampling for low level samples:

- A clean pair of new, disposable gloves should be worn for each new sampling station; and
- Sampling must be performed in a way that any material or liquid being collected that contacts the gloves (and/or any external surface of the sample container) does not contaminate the sample.

When sampling for the presence of organic parameters, the following additional precautions should be taken:

- All sample bottles and equipment must be kept away from fuels and solvents.
- Whenever possible, sampling equipment should be made of (in descending order of preference) Teflon®, glass, stainless steel or steel. Other materials, such as plastic, may contaminate samples with phthalate esters that interfere with some analyses.
- Soil samples for volatile analysis should be collected with as little air space as possible to prevent loss to the headspace.

- VOC samples should be containerized before mixing soil/sediment sample material due to the potential for contaminant loss when homogenizing the sample.
- Water samples for volatile analysis must be taken so that no air passes through them (to prevent volatiles from being stripped from the samples); the bottles should be filled by slowly running the sample down the side of the bottle until a convex meniscus forms over the neck of the bottle. The Teflon® side of the septum (in cap) should be positioned against the meniscus and the cap screwed on tightly, and the sample should be inverted and the bottle lightly tapped. The absence of an air bubble indicates a successful seal. If a bubble is evident, the procedure should be repeated. If a successful seal cannot be accomplished in three tries, the sample container should be discarded and a new VOC vial used. A dropped septum should be considered contaminated and should not be reused.

6.1.2 Sampling Equipment Decontamination

To ensure that samples are representative of the system under study, the sampling equipment used to collect the samples must be free of all contaminant constituents that may interfere with the interpretation of the analytical results. To ensure the integrity of all samples collected, the sampling equipment used to collect the samples must be thoroughly cleaned between individual samples. The following sections present the decontamination procedures for all sampling equipment to be used for this SI.

6.1.2.1 Laboratory Decontamination Procedure

Whenever possible, sampling equipment will be cleaned in the laboratory and transported to the job site prior to the field sampling effort. In such instances, the following decontamination procedure will be used:

- Sampling equipment for organic compounds and trace metal analyses:
  - Clean with Liquinox® and tap water (a higher grade of water may always be substituted for tap water) using a brush, if necessary, to remove particulate matter and surface films.
  - Rinse thoroughly with tap water.
  - Rinse thoroughly with 10-percent nitric acid (HNO_3), (avoid this step for metallic sampling equipment).
  - Rinse thoroughly with deionized (DI) water.
  - Rinse twice with pesticide-grade isopropanol.
  - Rinse thoroughly with organic-free water.
  - Allow to air dry.

- For overnight storage or transport to the field, wrap in new aluminum foil or polyethylene, as appropriate.

6.1.2.2 Field Decontamination Procedure

Because this field effort may be lengthy and/or due to the limited numbers of available sampling equipment, field decontamination will be necessary. In such instances, the following field decontamination procedure will be used:

- Sampling equipment for organic compounds and trace metal analyses:
  - Clean with Liquinox® and tap water (a higher grade of water may always be substituted for tap water) using a brush, if necessary, to remove particulate matter and surface films.
  - Rinse thoroughly with tap water.
  - Rinse thoroughly with DI water.
  - Rinse twice with pesticide-grade isopropanol.
  - Rinse thoroughly with organic-free water.
  - Allow to air dry.
  - If organic-free water is not available, allow to air dry after the solvent rinse.
  - For overnight storage, wrap in new aluminum foil or polyethylene, as appropriate.

After all sampling is completed, wash sampling equipment with soap and water and rinse with tap water.

- Groundwater purging and monitoring equipment:
  - Elevation tapes, reusable lanyards, and slugs (slug testing) will be washed with an appropriate soap solution to remove particulates and film, rinsed with tap water, followed by a DI water rinse, allowed to air dry as long as possible, and placed in a polyethylene bag to prevent contamination during storage or transit. If gross contamination is evident, the gross materials will be wiped off as much as practical, then cleaned according to the procedure provided in Sec. 6.1.2.2. Typically, water levels are measured from the top-of-casing of the least contaminated wells to the most contaminated wells to minimize the potential for cross contamination.
  - Submersible pumps used for well purging will be cleaned prior to use and between wells by flushing copious amounts of tap water through the pumps and associated hoses and/or tubing, followed by rinsing with DI water. The exterior of the submersible pumps and hoses that contact formation water will be cleaned by washing with Liquinox® solution, followed by tap water rinse, and a final DI water rinse. To prevent degradation of or damage to submersible pump seals,

impellers, and electric motors, rinsing with solvents and/or acids should not be performed. Typically, analytical samples will not be collected through submersible pumps.
  - Drop pipes and tubing used to purge wells will be cleaned prior to use and between wells by washing with Liquinox® solution, rinsing with tap water or potable water, followed by rinsing with DI water, then rinsing with pesticide-grade isopropanol, with a final rinse of DI water. Typically, analytical samples will not be collected through centrifugal or submersible pumps and/or the associated drop pipes.
- Drilling/Direct Push/Backhoe tools:
  - All drilling/direct push equipment will be cleaned with a high temperature pressure washer prior to shipment to FTMC.
  - Between borings, direct push tools will be cleaned using brushes, Liquinox® and tap water to remove traces of soil, rock, or other contaminants. This wash will be followed with a tap water rinse. In the event that contamination is more difficult to remove from direct push tools, they will be steam cleaned with soap and hot water, followed by a tap water rinse.
  - Between soil sample test pits, the backhoe bucket will be steam cleaned using Liquinox® and tap water to remove traces of soil, rock, or other contaminants.
- QST uses new 1-gal amber boro-silicate glass jugs exclusively for transport of all analyte-free water used in the field. These commercially obtained bottles are used once and then discarded.
- All field decontamination wastes are collected and disposed of according to waste type (i.e., solvents, acids, DI water, and water/soap solutions) (see Sec. 4.0).

6.2 Sampling Methodology

6.2.1 Site Utility Clearance

Prior to initiating any intrusive work, all buried utilities will be located by FTMC personnel or FTMC contractors, and each boring location will be cleared by the appropriate personnel. QST will not initiate any intrusive work unless the site has been cleared by the appropriate FTMC representative.

6.2.2 Soil Sampling Methodology

For the purposes of this SI, surface soil samples will be collected from depths between 0 to 12 inches below ground surface (in-bgs). Where possible, surface soil aliquots for SVOC and metal analysis will be collected from the 0- to 6-inch interval, and VOCs from the 9- to 12-inch interval. Subsurface soil samples will be those samples collected at a depth greater than 1 ft-bgs. The discussion of soil sampling methodology reflects both the equipment used to collect the sample, as well as how the sample is handled and processed after retrieval. Equipment selection is usually based on sample depth and soil/lithology type. Simple, manual techniques and equipment, such as hand-held augers, are usually selected for surface or shallow-subsurface soil sampling. As the depth of the sampling interval becomes greater, some type of powered sampling equipment is usually required to overcome torque induced by soil resistance and depth. Soil samples for this project may be collected using a spoon/trowel, hand auger, backhoe, direct push, or drill rig split-spoon sampler.

6.2.2.1 Hand Auger

Surface soil samples may be collected using a clean, stainless-steel spoon/trowel, or bucket auger. Surface samples collected with a spoon or trowel will be placed directly into the appropriate sample containers. Shallow soil borings may be advanced by using a decontaminated bucket auger. Hand augering is one of the common manual methods used for collecting soil samples. A 4-inch auger-bucket with cutting head will be pushed and twisted into the ground and removed after the bucket is filled. Once the desired sampling interval is reached, the boring auger head will be removed from the hole, and a sampling auger head or Oakfield sampler head will be used to collect the soil sample. The loose slough material at the top of the auger will be discarded prior to removing the soil sample aliquot from the center of the auger. Samples for volatile organic compounds analyses are transferred directly from the sampling equipment into sample containers (no mixing is allowed). The remaining sample material will be homogenized in a stainless-steel bowl with stainless steel utensils, then placed in appropriate sample containers.

At some SI locations a back hoe may be used to dig test pits for inspection purposes and soil sampling where necessary. In the test pits where contamination is suspected, soil samples may be collected using a clean, stainless-steel spoon/trowel, or bucket auger. These soil samples may be taken from the back hoe bucket and transferred into a stainless steel bowl for mixing. Soil to be analyzed for VOCs will be transferred directly from the bowl into appropriate sample containers prior to mixing. Alternately, a bucket auger may be used to collect soil samples from the sides or bottoms of the test pits excavated by the back hoe if contamination is suspected.

6.2.2.2 Direct Push Soil Sampling

In situations where soil/lithologic conditions prevent the efficient use of a bucket auger sampler, it may be necessary to use direct push technology to collect soil samples from the desired depths. The direct push technology is a vehicle-mounted, hydraulically-powered, soil probing machine that uses static force and percussion to advance small diameter sampling tools into the subsurface for collecting soil core, soil gas, or groundwater samples. The following soil sampling method describes the direct push sampling techniques used for the Geoprobe ™ system. For soil sampling, an assembled large bore stainless steel sampler with acetate liner is attached to the leading end of the probe rod and is driven into the subsurface to the top of the desired sampling depth. The sampler remains sealed by the sampler's piston tip accessory until the desired depth is achieved. The piston tip is disengaged using specially designed direct push down-hole tools, and the sampler is advanced an additional 24 inches. The soil sampler is then recovered from the hole and the soil core sample is removed.

6.2.2.3 Hollow-Stem Auger Soil Boring

In situations where soil/lithologic conditions prevent the efficient use of a bucket auger or direct push technology, it may be necessary to use a drill rig advanced split-spoon sampler to collect samples from the appropriate depth interval. Such soil borings will be advanced using a hollow-stem auger. The boring will be sampled at the appropriate depth with a cleaned split-spoon sampler. The split-spoon sampler will be driven its full length (18-inches) with a 140-lb hammer falling 30 inches. The number of blows to drive the sampler each 6-inch segment will be recorded on boring logs by the site geologist. Once the split-spoon is recovered, VOC sample fractions will be obtained immediately from the sampler and placed in appropriate sample containers. The remaining sample material will be mixed in a stainless-steel bowl with stainless-steel utensils, then placed in appropriate sample containers.

6.2.3 Sediment Sampling Methodology

Sediment samples will be collected at select FTMC sites for this SI (see Table 2-1). At locations where both surface water and sediment samples are required, sediment sampling will follow the collection of surface water samples. Based on site-specific conditions, the potential types of sampling equipment that may be used include: stainless steel spoons or trowels, stainless steel bucket augers, or a stainless steel petite ponar dredge. When the sediment samples are to be obtained by wading in shallow water, the sample location will be approached from down stream so as not to disturb the sampling location. If the water body has no noticeable flow (e.g, an impoundment) wading to the sample site will not be allowed. Regardless of the equipment type used to collect the sample, enough sediment material to conduct the analyses will be placed in a stainless steel bowl and the material for VOC analysis immediately containerized. After VOC samples have been collected and thorough mixing is completed, the remaining material will also be containerized, labeled, chilled and prepared for shipment to the appropriate laboratory for analyses.

6.2.4 Soil/Sediment VOC Sampling Collection Procedure

The VOC fraction will be collected as a discrete grab sample directly from the appropriate sampling device. A soil sampling form will be completed for each sample collected (see SI QAPP). A description of each sample location will be included on the sample form with a drawing of where the sample was collected. It is important that the VOC fraction be collected before other sample fractions and as soon as possible after retrieving the sample from the hole. The sample container will be filled leaving as little air space as possible to prevent volatilization. To minimize contaminant loss through agitation/volatilization, samples collected for VOC analysis will never be homogenized or agitated before being placed in the sample container. After filling, each VOC sample container will be sealed and placed in a cooler with ice and chilled to $4 \pm 2°C$.

Duplicate VOC fractions will be collected at a frequency of 10 percent. The collection procedure for the duplicate VOC fraction will be identical to the procedure listed previously and will be collected simultaneously with the VOC fraction.

6.2.5 Non-Volatile Soil/Sediment Sample Collection Procedure

Samples will be collected with a decontaminated spoon, trowel, bucket auger, direct push soil sampler, or split spoon sampler. The following steps will be followed to achieve a uniform representative soil/sediment sample:

- Place the collected soil/sediments in a decontaminated stainless-steel bowl.
- Stir the material in a circular fashion with a stainless steel spoon, occasionally turning the material over.
- Sample mixing will be considered complete when a consistent physical appearance is achieved.

After sample mixing, the sample containers will be filled using the same stainless-steel spoon used for mixing. Samples shall be transferred directly from the mixing bowl to the prelabeled sample container. The sample jar will be sealed and placed in a cooler with ice and chilled to $4 \pm 2°C$.

A soil sampling form will be completed for each soil sample (see SI QAPP). A description of the soil sample location will be included on the sampling form with a drawing of the general sampling area and sample location.

6.3 Temporary Monitor Well Installation

For the SI, QST will use a direct push technology to install temporary monitor wells and collect groundwater screening samples to assess local groundwater quality conditions and to assist the placement of permanent monitor wells at select sites. The direct push technology is a vehicle-mounted, hydraulically-powered, soil probing machine that uses static force and percussion to advance small diameter sampling tools into the subsurface for collecting soil core, soil gas or groundwater samples.

6.3.1 Monitor Well Installation Procedures

Groundwater investigations for this SI will be accomplished by collecting direct push screening samples, or by sampling new or selected existing monitor wells. Prior to initiating any intrusive work with the direct push technology or for the installation of the new monitor wells, all buried utilities will be located by FTMC personnel or FTMC contractors, and each boring location cleared by the appropriate personnel. QST will not initiate any intrusive work unless the site has been cleared by the appropriate FTMC representative.

Borings for temporary monitor well installation will be advanced through the overburden to the first water-bearing zone encountered using direct push technology. The boreholes for the temporary monitor wells will be completed as 2-inch-diameter boreholes. All well drilling and construction will be in accordance with the Geotechnical Requirements (USATHAMA, 1987).

The procedure for constructing monitor well will be as follows:

- The 2-inch borehole will be completed 5 ft into the uppermost waterbearing zone;
- All well screens, risers, caps, and centralizers (if required) will be washed with Liquinox® and water from the COE-approved source prior to insertion into the borehole;
- A 10-ft long, 1.25-inch OD PVC slotted screen (0.010 slot), capped on the bottom, with attached 1.25-inch PVC riser will be emplaced such that it extends from the bottom of the borehole to 2.5 ft above the ground surface;
- Sand pack will be tremied into the annular space up to a point 5-ft above the top of the screen;

- A 1-ft bentonite pellet seal will be placed above the sand pack and allowed to hydrate (limited amounts of water from the COE-approved source may be added to facilitate hydration);
- The remainder of the annular space may be grouted with Type II Portland Cement to the ground surface; and
- A temporary locking mechanism will be installed at the cap.

Upon drilling program completion, information from the well logs will be transferred to the IRDMIS Field Drilling File and Well Construction File and submitted to COE as follows:

- Depths will be recorded in feet and fractions thereof (tenths of feet).
- Soil descriptions will be in accordance with the Unified Soil Classification System (USCS). The QST geologist will prepare these descriptions in the field.
- The downpressure on the bit, blows per 6 inches, or similar measurement will be recorded.
- The depth to water will be indicated as first encountered during drilling. Any distinct water-bearing zones below the first zone will also be noted.
- The drilling equipment will be generally described either on each log or in a general legend and will include such information as rod size, bit type, rig manufacturer, and model.
- Each log will record the drilling sequence.
- All special problems will be recorded.
- The dates for the start and completion of each boring will be recorded on the log.
- Lithological boundaries will be noted on the boring log.
- The original boring logs will be submitted to COE project management after the drilling program is completed.

6.4 Temporary Well Development and Sampling

Temporary wells will be installed, developed, purged/sampled, and removed within a matter of hours. Temporary monitor wells will be sampled immediately after development. Development of temporary monitor wells will begin immediately after installation of the screen and filter pack. A well development form will be completed for each temporary well during development (see SI QAPP).

Temporary well development will be accomplished by pumping, bailing, and/or surging to achieve the most effective well development. During development, the following water quality parameters will be measured and recorded: pH, specific conductance, temperature, and turbidity.

If the well is pumped to dryness or near dryness, the well will be allowed to recover to 80 percent of its original level prior to further development.

Prior to well development, pumps and tubing will be decontaminated as specified in Sec. 6.1.2.2 . No water shall be added to a well after the bentonite seal is in place. No dispersing agents, acids, disinfectants, or other additives shall be used during development or at any other time introduced into the wells.

Initial well development will be accomplished with an electric submersible or centrifugal pump until pH, temperature, and conductivity have stabilized (three successive readings within 5 percent) and turbidity is less than 10 NTUs or has stabilized.

During well development, the well cap and the interior of the well casing will be rinsed with water from that well to remove all extraneous materials (grout, soil, cuttings, sediment). In the event that pumping does not properly develop a well (e.g., some fractures opened by pumping while others remain closed from debris), alternate methods of well development may be employed after discussion with the COE project manager or project geologist.

The following data will be recorded for development and submitted to the COE project geologist after well development is completed at each well:

- Well designation;
- Date(s) of well installation;
- Date(s) of well development;
- Static water level from the top of casing before and 24 hours after development;
- Quantity of standing water in well and annulus prior to development;
- Specific conductivity, temperature, and pH measurements taken and recorded at start, twice during, and at conclusion of well development;
- Depth from top of well casing to bottom of well;
- Screen length;
- Depth from top of well casing to top of sediment inside well, both before and after development;
- Physical characteristics of water removed from well, including changes in clarity, color, particulates, and odor;
- Type and size/capacity of pump and/or bailer used;
- Description of surge technique, if used;
- Height of well casing above or below land surface; and
- Quantity of water removed and time for removal (in both incremental and total values).

Water will be removed from the entire water column during development by periodically raising or lowering the pump intake or bailer stopping point.

6.5 Monitor Well Sampling (Permanent Monitor Wells)

Prior to groundwater sample collection from existing, permanent monitor wells, water levels in all monitor wells will be measured relative to the reference mark of the top-of-well casing. Static water level will be measured using a precleaned steel tape or drop buzzer lowered into the well. Water levels will be recorded again after sampling. Monitor well sampling at the site will generally proceed from the potentially least contaminated wells to the potentially most contaminated wells as best as can be determined based on existing data.

Before sampling begins, a plastic ground cloth will be placed beneath all sampling equipment during well purging and sampling to prevent contamination by surface soils. Well purging will consist of pumping with a submersible or centrifugal pump. The discharge water will be frequently monitored for pH, temperature, turbidity, and specific conductivity. Pumping will continue until three to five well volumes have been removed and/or the pH, temperature, turbidity, and conductivity are stabilized (i.e., until three successive measurements are within 5 percent of one another).

Wells will be sampled within 6 hours of purging or within 10 hours for slowly recharging wells. Wells that recharge very slowly will be purged dry, allowed to recharge at least 80 percent of initial well depth, and purged dry again prior to sampling. If excessive time (> 10 hours) is required for the well to recharge to 80 percent, the QST Project Manager will be notified and COE COR will be consulted. The total amount of water purged from the well will be measured and recorded on well sampling data forms (see SI QAPP).

After purging the well, the sampling team will use new disposable rubber gloves for sample collection. Each well will be sampled with a clean Teflon® bailer. The bailer will be deconned according to procedures in Sec. 6.1.2. New braided nylon line; single-strand, stainless-steel wire; Teflon® coated multistrand wire; or polypropylene monofilament line with a stainless-steel leader will be attached to the bailer, and the cord will be kept from touching the ground during the sampling period. Groundwater samples will be collected in a manner that minimizes aeration to prevent loss of VOCs. The appropriate sample containers will be filled without trapping air bubbles and then tightly capped. All groundwater purging and sampling notes will be recorded on well sampling data forms (see SI QAPP).

During well sampling, information regarding the sampling will be kept in a field notebook. At a minimum, the following data will be collected and recorded on log forms:

- Well number;
- Date;
- Time;
- Static water level [to $\pm$ 0.01 ft];
- Depth of well;
- Number of bailer volumes removed or pumping rate, if applicable;
- Time (duration) of pumping, if applicable;
- Total volume of water evacuated from well;
- Water quality measurements of pH, specific conductance, turbidity, and temperature;
- Other pertinent observations of water samples (color, turbidity, odor, etc.);
- Fractions sampled and preservation method; and
- Signature of sampler and date.

6.6 Surface Water Sampling

Immediately prior to surface water sampling, all sample containers will be properly labeled using waterproof ink. After the samples are collected, they will be preserved and placed into a cooler with ice to be stored at 4°C. VOC sample containers will be pre-preserved in the laboratory prior to mobilization. Preservatives will be added to metal samples after filtration. All samples collected will be shipped daily to the QST laboratory, Gainesville, Florida at the end of the day.

Surface water samples will be collected from select locations at FTMC during this site investigation. At locations where both surface water and sediment samples are required, the surface water samples will be collected first. Samples will be collected by submerging unused, clean, sample container into the surface water until it is filled and then transferring it into the appropriate container. Where flow is present, the container's opening will be positioned to face upstream while the sampling personnel stand downstream to avoid stirring up sediments that may contaminate the sample. Where surface water body conditions prevent sample collection directly into the sample container, a disposable Teflon® bailer or other appropriate sampling device will be used. Volatile samples will be collected first to avoid aeration and resultant loss of volatile species. Surface water samples will be preserved as required, chilled, and packaged for shipment to the appropriate laboratory for analyses. Unfiltered metals fractions will be collected for all surface water samples.

6.7 Surveying

All subsurface soil sample locations, temporary monitor wells, groundwater screening locations, and existing monitor wells will be surveyed by a surveyor licensed in the state of Alabama. X-Y locations of soil borings and groundwater screening sites will be determined by either the Global Positioning System (GPS) or traditional surveying techniques; vertical data are not required. Map coordinates for each sample location will be determined using a Transverse Mercator (UTM) or State Planar grid to within $\pm$ 3 ft ($\pm$ 1 m). If necessary, the elevation of the natural ground surface for each monitor well and the highest point on the top of each monitor well casing will be surveyed to within $\pm$ 0.01 ft ($\pm$ 0.3 cm) using the National Geodetic Vertical Datum of 1929. All surveys and data submittals will be in accordance with the Geotechnical Requirements (USATHAMA, 1987)

6.8 Site Photographs

Photographs will be taken of each well completion, the last well development water, all rock cores, and the trench walls. Slide film will be used for all photographs in 35mm format. A scale will be used to show size and color where appropriate.

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7.0 Data Evaluation Methods

To determine the relative significance of the concentrations detected in samples collected as part of the SI, as well as determining whether further study or action is required, the analytical results will be evaluated using a health-based screening procedure. Health-based screening of data is currently used by EPA to standardize and accelerate the evaluation and cleanup of contaminated media at CERCLA sites. Generally, at sites where contaminant concentrations fall below health-based levels, no further action or study is warranted under CERCLA. Where contaminant concentrations equal or exceed health-based levels, further study or investigation, but not necessarily cleanup, is warranted.

A health-based screening level represents a chemical concentration for a single chemical that does not pose unacceptable health risk (based on EPA toxicity data) to an individual exposed to this level under standard default exposure assumptions associated with the current or projected future land use (i.e., residential or industrial) of a facility. Typically a screening value is overly conservative, to ensure that the comparison is overprotective rather than underprotective. Thus, in conducting the preliminary screen of the analytical data, the site concentrations are compared to health-based screening levels that are based on standardized exposure information, rather than site-specific information. If the preliminary screening values are exceeded, this indicates that further study or investigation, but not necessarily cleanup, is warranted.

Further study may include the development of "site-specific" screening levels, in which site-specific exposure assumptions are considered, to come up with a less conservative but more realistic screening level, one that pertains specifically to the site conditions. Further study may also include additional samples, as one sample triggering a screening level may not be representative of the entire area of exposure. Thus, the ultimate goal of conducting a health-based screen of the data is to determine whether a site can be transferred or whether additional study/investigation is required upon which to make a determination of the suitability of the property for transfer or lease. If contamination at a specific area within the installation does not trigger the preliminary screening values, these results can be used to justify no further action for this area, and suggests that the site is suitable for transfer or lease.

7.1 Health-Based Screening Methodology

7.1.1 Soil

For soil, the analytical results will be evaluated based on EPA's Soil Screening Level (SSL) Guidance (EPA, 1996a) where site data are compared to SSLs, risk-based concentrations derived from standardized equations combining exposure information (e.g., land use assumptions, potential for soil contaminants to leach to groundwater) assumptions with EPA toxicity data. This SSL procedure is similar to EPA Region IV's data evaluation procedures for conducting risk assessments at CERCLA sites. According to Region IV guidance, the site data must undergo a preliminary chemical screening procedure to reduce site data to a manageable size by comparing site levels to risk-based concentrations (RBCs) (EPA, 1996b). RBCs are similar to SSLs. The preliminary screen will entail comparing soil data to generic SSLs (or RBCs) that are based on standard default assumptions. The categories of SSLs to which site concentrations will be compared include: (1) SSLs based on a child residential exposure; (2) SSLs based on an adult worker exposure, and (3) SSLs based on migration of soil contaminants to groundwater. If a generic SSL for an inorganic chemical is exceeded, then, according to the SSL guidance, the concentration should be compared to site-specific background levels. In addition, according to EPA region-wide risk assessment guidance (EPA, 1989a) and Region IV guidance (EPA, 1995a), chemicals that are essential human nutrients need not be considered further in a health evaluation. These essential nutrients include calcium, chloride, iodine, magnesium, phosphorus, potassium, and sodium. If an organic chemical exceeds the generic SSL or an inorganic chemical exceeds the generic SSL, background, or nutritional essential levels, additional study may be warranted in the form of collecting additional data and/or developing site-specific SSLs to provide a more realistic, rather than overly conservative, health screening of the soil data.

Although some of the sites included in this investigation are primarily industrial in nature, an ecological screening will be conducted at those sites where potential ecological receptors could live. As promulgated soil levels or screening levels for ecological exposure have not been established by EPA Region IV, screening levels will be used that have been established by other EPA Regions and by Oak Ridge National Laboratory (ORNL) for groups of ecological receptors that are common to many sites (Efroymson *et al*, 1996; Opresko *et al*, 1995; Will *et al*, 1994). For chemicals or species not having established screening levels, EPA guidance, as well as other guidance such as those published by ORNL, will be used to develop screening levels.

7.1.2 Groundwater

For groundwater, the health-based screen will be conducted in a manner similar to soil. The analytical results for groundwater will be evaluated based on EPA Region IV guidance on data evaluation and identifying chemicals of potential concern (EPA, 1995a). According to EPA guidance, site data are compared to RBCs (EPA, 1996b) for groundwater, concentrations derived from standardized equations combining standard exposure information (e.g., residential potable use of groundwater) assumptions with EPA toxicity data. The preliminary screen will entail comparing groundwater data to generic RBCs (e.g., residential-based) and may include the following categories of RBCs: (1) RBCs based on a adult residential exposure; and (2) ARARs [e.g., maximum contaminant levels (MCLs)]. In the event that a generic RBC for an inorganic chemical is exceeded, then, according to the EPA guidance (EPA, 1995a), the concentration should be compared to site-specific background concentrations as well as nutritional essential levels. If an organic chemical exceeds the generic RBC or an inorganic chemical exceeds the generic RBC, background, or nutritional essential levels, additional study in the form of collecting additional data and/or developing site-specific RBCs to provide a more realistic, rather than overly conservative health screening of the groundwater data may be warranted.

7.1.3 Surface Water/Sediment

Because some areas of the site may have both human and ecological receptors, the detected chemical concentrations in surface water at the site will be compared to the most stringent of the human or ecological health-based guidance values. The hierarchy of surface water values used for the comparison will be established promulgated standards [(i.e., ambient water quality criteria (AWQCs) for the protection of human health and aquatic organisms], when available. Otherwise, RBCs for groundwater may be used for human exposures and EPA Region IV (EPA, 1995b) and EPA Tier II (EPA, 1996c) ecological screening values will be used for ecological considerations.

Because promulgated sediment standards are not available for most compounds, SSLs or RBCs may be used for the human health screen. For ecological exposure, screening values established by EPA Region IV (EPA, 1995b) and EPA Region-wide (EPA, 1996c) will be used. In the absence of EPA ecological screening levels, other scientific literature published by ORNL or the National Oceanic and Atmospheric Association (NOAA) will be used.

Again, as with soil and groundwater, an exceedance of a surface water or sediment criterion or guidance level does not document a risk, as health-based guidance levels are based on standard default exposure assumptions and not site-specific factors (i.e., site-specific land use; habitat types; surface water uses, water quality issues such as hardness, pH, turbidity). Rather, an exceedance of a guidance level indicates further site characterization and site-specific screening values need to be developed.

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