WATER DISTRIBUTION SYSTEM
BETWEEN OFF-POST SUPPLY WELLS AND DISTRIBUTION POINTS
FORMER FIRE TRAINING AREA AT MARSHALL ARMY AIRFIELD
(FT. RILEY ALTERNATE WATER SUPPLY)

FORT RILEY, KANSAS

1. **WORK PLAN**
2. **SITE SAFETY AND HEALTH PLAN**
3. **SAMPLING AND ANALYSIS PLAN**
4. **CONTRACTOR QUALITY CONTROL PLAN**

Prepared for
USACE - KANSAS CITY DISTRICT

CONTRACT NO. DACW41-95-D-0022
DELIVERY ORDER 0012

Prepared By
Bay West, Inc.

Bay West

10620 Widmer Rd.
Lenexa, KS 66215

J970236

Table of Contents

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for the
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JULY 2002

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Prepared for

U.S. ARMY ENGINEERING DISTRICT,
KANSAS CITY
ATTN: RICK VAN SAUN
601 E. 12th St.
Kansas City, MO 64106-2896

Prepared by

BAY WEST, INC.
10620 Widmer
Lenexa, KS 66215

Philip Dula
Project Manager

July 2002

BW97023

TABLE OF CONTENTS

APPENDICES

1.0 INTRODUCTION

This Work Plan covers the installation and testing of water distribution systems for the Racetrack facility and one (1) trailer home located off-post and northeast of Marshall Army Airfield, Fort Riley, Kansas (Figure 1). This project was tasked under US Army Corps of Engineers (USACE) Contract DACW 41-95-D-0022, Delivery Order 0012.

All site activities conducted by Bay West and it's subcontractors shall adhere to the provision of this Work Plan. All work performed under this Workplan shall be conducted in accordance with the US Army Corps of Engineers (USACE) Scope of Work (SOW) provided in Appendix A.

2.0 PROJECT MANAGEMENT/CONDUCT

The Bay West SPIDT Program Manager is Brad Kulberg. The Bay West designated Project Manager (PM) for this project is Philip Dula. Mr. Dula will be responsible for oversight and control of all project activities. In addition, Bay West has designated Mr. Keith Ellis as Site Manager who shall supervise site activities in the absence of the PM. Table 1 contains the names, titles, and contact information for the PM, Site Manager, and other principal personnel involved in the project. Mr. Kulberg's, Mr. Dula's and Mr. Ellis's resumes are included in Appendix B.

The PM shall have the qualifications and authority to oversee coordination of all project activities and shall maintain contact with the Contracting Officer. He shall be responsible for obtaining answers to inquiries from the Contracting Officer's Technical Representative (COTR) and Technical Manager (TM) both during and after the period of the contract for this work. The Site Manager shall be experienced in the field activities associated with the drilling and installation of wells and installation of water distribution systems.

3.0 NOTIFICATIONS AND APPROVALS

Prior to conducting any site activities, USACE shall obtain a written right of entry release from each Property Owner and/or occupant(s) affected by those activities. Property Owner(s) and/or occupant(s) shall be informed of the nature and duration of site activities, anticipated disruption of use of the property, etc. Release(s) shall be obtained no later than one (1) week before the scheduled start of site activities. Bay West shall notify USACE in writing of the start of site activities no less than one (1) week from the scheduled start date. Bay West shall inform the COTR on the day of initial arrival at the site. Should any significant event occur during the site activities, to include fire, accident, damage to buildings or grounds, etc., Bay West shall immediately notify USACE of the following:

- The nature and extent of the event
- Assistance required, if any
- Subsequent activities undertaken as a result of the event
- The anticipated effect on site operations
- Other pertinent information

At the first opportunity after the event, Bay West shall submit a written report of the event to USACE that describes the event and any proposed or completed resolution actions that have been undertaken or are planned.

4.0 PROJECT REQUIREMENTS

The referenced contract includes the performance of all specified work, including the furnishing by Bay West of all management, supervision, labor, equipment, tools, materials, supplies, services, and the payment of all taxes, licenses, and other costs incidental to performance of the subsurface drilling, well installation, and piping. Project supervision shall be under the direction of the PM.

Bay West, Inc. will provide all services necessary to install two off-post water supply wells, distribution piping, and service connections to supply water to four distribution points. General project requirements of this scope of work consist of providing services as necessary to perform the following activities: installation and testing of the domestic water supply wells, installation of distribution piping, installation of service connections, performance of required system testing, preparation of a final report, and restoration of site to previous conditions to include, but not limited to, grading, compaction, and seeding. Specific project requirements include:

The Race Track well location as currently designed in the September 1998 design will be relocated to a point within 45 feet north of utility/electric pole # 6-36 SPPA 45/5-35 and approximately 135 feet southeast of well R-4. The new well will be installed to bedrock, screened in the bottom 30-40 feet depending on depth to bedrock and the vadose zone (water table). The pump will be located ten feet from the top of the bedrock.

Electrical power for the race track replacement well will be obtained from the Flint Hills Rural Electric Cooperation. To provide the necessary power for the 15 HP, 3 phase, 480 V pump it will be necessary to install additional utility poles, heavier gauge electrical overhead line, and a larger capacity transformer to this location.

The re-designed distribution system will provide water service to the old house structure located approximately 150 feet northwest of the racetrack replacement well location, and a small concession stand and restroom area located in the pit area, and a concession stand in the grandstand area. The existing line running from well R-1 to the grandstand will be capped and abandoned in place. It should be noted that the old house structure was identified as an additional concession stand by Mr. Thompson (property owner) during the December 17, 2001 site visit. The concession area had not been included in the previous design.

Five existing wells designated R-1, R-2, R-3, R-4,and M-1 shall be plugged and abandoned per State of Kansas well abandonment regulations. These regulations are included as Appendix 3 of this document. A concrete vault at R-4 shall be removed. The existing pumps and piping at well R-4 shall be removed, rinsed and stockpiled on site. An attempt shall be made to pull the existing casings at each well to be removed. If the casing cannot be pulled, it shall be cut 3' feet below ground surface and plugged with grout according to Kansas regulations. The removed casing shall be rinsed on site and properly disposed

of. The decontamination process will involve cleaning with a non-phosphate detergent and triple rinsing the removed casing. All fluids used to decontaminate the casing will be contained in 55-gallon drums and appropriately labeled per USACE and Federal requirements. The containerized decontamination fluids and the casings from well R-1 and R-2, shall be disposed of at the Fort Riley Environmental Waste Management Center. The casings from wells R-3, R-4, and M-1 can be disposed of as normal waste. A sample of the decontamination fluids will be collected and submitted for VOC analysis per EPA Method 8260.

The new water line shall extend from the well along the crest of the slope formed by a former oxbow until it is due south of the point where the new standpipe shall be installed. At the point were the new water line transects the race track, it shall be jacked under the track.

A new 3" PVC standpipe with outlet height of 10' and a radius of 4' shall be constructed in line with the existing pit area concession stand. This standpipe will be utilized as a water truck fill station. This structure will replace the existing water truck fill station and will be located approximately 310 feet east of the Pit Area restrooms. The distribution system shall be designed to provide a 200-gpm capacity at the standpipe outlet. A new 10'x 20'x 6" concrete pad shall be installed centered at the standpipe at the west- end of the pad. A light fixture similar to existing exterior light fixtures at the racetrack shall be mounted on the standpipe pole and tied into the existing electrical distribution system. The property owner presently has planned to relocate the existing light poles, located along the inside of the track and shorten the track straight aways.

The existing water truck fill station located at the western loop of the track will be removed and the debris disposed as normal waste. The existing piping will be capped and abandoned in place.

A shelter shall be provided for a new 525-gallon capacity pressure tank that is to be located at the restroom facility in the pit area. The shelter will be installed on a 10'x 10'x 6"concrete pad. The shelter will have dimensions of 8'x 8'x8' with one access door. The shed supplied will be of pre-fabricated construction. The water distribution system shall be designed so that it can be winterized. At a minimum, a valve vault and drain back valves shall be installed at the truck fill standpipe, the old house and the manhole in the pit area. The pressure tank, well head, and associated piping shall be designed so they can be drained completely.

Bay West will install a replacement well for the existing well identified as M-1 that supplies water to a mobile home located on property adjacent to the Racetrack. The M-1 Replacement Well will be designed to provide a minimum of 10 GPM. The existing 30-gallon hydro pneumatic tank located in the machine shop adjacent to the trailer will be retained.

Bay West's drilling subcontractor shall be responsible for the drilling and geo-technical sampling of pilot holes; geotechnical analysis of samples; final well designs based on aquifer characteristics and sample results; drilling, development, and pump testing of wells; abandonment of three (5) existing wells.

4.2 Health and Safety

Bay West has prepared and submitted as Section 2 of this document a Site Health and Safety Plan (SHSP) for all activities engaged in during the course of the installation. Subcontractor(s) may choose to adopt or expand upon the SHSP to meet this requirement. However, all Subcontractor-supplied SHSPs are subject to review and approval of Bay West and COTR and must include, at a minimum, the requirements outlined in the SHSP.

All work will be conducted under strict compliance with the SHSP. All Bay West subcontractor site personnel will have reviewed and signed the SHSP prior to completing any site activities. It is anticipated that all work will be conducted with Level D (modified) personal protective equipment (PPE).

5.0 DRILLING EQUIPMENT AND CAPABILITIES

The drill rigs and equipment of subcontracted drilling company will be inspected by the Site Manager prior to commencement of work activity to determine that the capabilities and functions are adequate for the scope of work.

The drilling rig utilized for this project will be in good operating condition and capable of installing wells in unconsolidated clay and noncohesive granular soil above and below the saturated zone.

6.0 PERMITS AND LICENSES

The Drilling Subcontractor shall possess a valid Well Driller's License in accordance with Kansas Department of Health and Environment (KDHE) requirements. All drilling/construction personnel shall meet the training requirements specified in 29 CFR 1910.120, "Health and Safety Requirements." Bay West shall notify the COTR to allow sufficient time for utilities to be clearly marked prior to starting work. Bay West will obtain all necessary permits for the drilling and installation of the two water wells.

7.0 WELL DRILLING/INSTALLATION

7.1 Reference Standards (Latest Edition)

ASTM D4SS-63:	Analysis of Soils
ASTM F480:	Standard Specification for Thermoplastic Well Casing Pipe and Couplings Made in Standard Dimension Ratios (SDR), Schedule 40 and Schedule 80
ASTM D1785-88	Standard Specification for Poly Vinyl Chloride (PVC) Plastic Particle Size
AWWA A-100-90	Water Wells
AWWA B300	Hypochlorites
KDHE Article 30	WATERWELL CONSTRUCTION AND ABANDONMENT

7.2 Preparatory Inspection

7.2.1 Site Conditions

Bay West shall verify work site conditions and conduct all preparatory inspections necessary to determine the full extent of the work required to make the completed installation conform to the drawings and specifications. Discrepancies or inaccuracies that will prevent full prosecution of the specified work shall be resolved prior to commencement of the work.

Bay West will be responsible for marking all drilling locations and locating buried utilities, if present. In areas where there is the potential for buried utilities to be present, Bay West will hand auger to a depth below which underground utilities may be expected. Bay West will not begin drilling at any location until the locations of utilities have been reviewed, the well locations have been staked, and the USACE COTR has issued authorization to proceed.

7.2.2 Materials

No materials will be delivered on site until approved for use by the USACE PM. All materials on site will be properly stored.

7.2.3 Equipment

The Bay West Site Manager will verify that all equipment for well bore drilling, well installation, well testing and waste materials management is available and operational.

7.3 Preparation

7.3.1 Preparatory Meeting

The Bay West Site Manager shall conduct a preparatory meeting with the COTR to finalize coordination of material delivery/storage, potable water availability, waste management, quality control, well installation, well development and well pumping tests.

All equipment and materials shall be in good operating condition at all times and operated and maintained in strict conformance with manufacturers' recommendations.

7.3.3 Training

Bay West will have the appropriate equipment and trained/licensed personnel to perform all activities and supply all materials and services as specified herein.

7.3.4 Site Geology Review

Bay West will review the site geology with the COTR for potential borehole drilling and well casing installation problems.

7.3.5 Borehole Siting

Boreholes shall be sited based on a review of pilot hole data analysis. The Bay West Site Manager shall verify the location of each well bore with the COTR. The exact depth below ground surface will be reviewed, interpreted and finalized from the field survey data provided by USACE and obtained from KDHE well records within a ½ mile radius of the site.

7.3.6 Staging and Storage Areas

Any onsite staging and storage areas that are necessary during site activities shall be approved by the COTR. Drill cuttings may be temporarily stored at the Bay West's temporary storage area or disposed of as approved by the COTR.

7.3.7 Water Source

The COTR will identify or provide one source of potable water for use during drilling and well installation. Bay West shall be responsible for obtaining the water from the designated source and transporting the water to the drilling site.

7.3.8 Decontamination

All prefabricated equipment and related accessories intended for downhole placement shall be decontaminated at the place of manufacture and shipped to the site in hermetically sealed packages. If the packages tear or otherwise become ineffective in sealing the equipment from exposure to contaminates. Bay West will than decontaminate those materials as required before placing down the borehole.

All drilling equipment in contact with the borehole, screens and casings used for wells subject to water sampling shall be in a sterile and contaminant-free condition when placed into the borehole. Well materials shall be steam cleaned, with potable water only, prior to installation in the borehole and protected by wrapping them in plastic or placing them on a clean surface while holding for downhole placement.

Drilling equipment in contact with the borehole materials shall be decontaminated between movement to well locations to prevent cross-contamination. The PM shall coordinate the location of decontamination point and approval of decontamination apparatus/system with the COTR.

7.3.9 Waste Management Coordination

The Bay West Site Manager shall ensure that sufficient containers are present and positioned for collecting drill cuttings, well development water, and well pumping discharge water. The PM shall coordinate with the COTR for appropriate sampling and disposal of cuttings and liquids. All solids and waste will be contained in 55-gallon drums, appropriately labeled per USACE and Federal regulations, and transported to the Ft. Riley Environmental Waste Management Center.

7.4 Test Holes

Bay West's subcontractor with Bay West Site Manager oversight shall drill one (1) test hole at each well location as described in Section 7.5.2 (Borehole Drilling Method). Borings shall be advanced to bedrock or until drilling is terminated under instruction COTR. The nominal anticipated depth of borings is forty to fifty feet (40-50 ft) below ground surface (bgs). Soil samples shall be taken during drilling as described in Section 7.6 (Sampling Procedures).

7.5 Well Drilling

7.5.1 Well Boring Location/Size/Depth

The well boring shall be drilled at locations shown on Drawing C-31 (Appendix 4) and to depth as specified or directed by the COTR. The boring diameter shall be of sufficient size to allow for the accurate placement of the screen, well casing, centralizers, filter pack, tremie pipe, seals, filter pack, and grout. Boring sizes for wells shall be not less than twelve inches (12 in) and not greater than eighteen inches (18 in) in diameter. Casing diameters for the M- 1 Replacement and Racetrack wells are five inches (5 in) and eight inches (8 in), respectively.

Boreholes may be drilled to beyond the required depth to allow for cutting settlement.

Bay West is responsible for determining actual well depth and confirming well design requirements in order to meet the well performance noted in Section 4.1 (General System Requirements) and Section 7.9 (Well Performance Testing).

7.5.2 Borehole Drilling Method

Boreholes for test holes and wells shall be drilled using the air rotary drilling technique or other technique, subject to approval by the PM/COTR, that allows acquisition of spilt spoon sampling. Boring advancement shall be commenced, stopped, and resumed as directed by the COTR.

Any and all air used will be filtered prior to injection while advancing the boring and will contain no petroleum hydrocarbons. In all cases, no additives that allow growth (such as plant mucilage), or that contain petroleum distillates (such as kerosene or diesel fuel) will be introduced into the drilling fluid. Teflon-based lubricants or teflon tape are acceptable to be used between the drill rods.

Water injection will be allowed during drilling of shallow borings with prior approval and at the discretion of the PM in cases when drilling becomes difficult. All water introduced during drilling will be from the potable water supply or from another water source approved by the PM/COTR.

When drilling well boreholes, Bay West shall maintain well plumbness and alignment as defined in the AWWA A-100-90 standard. The AWWA A 100-90 standard will be strictly adhered to in order to evaluate the acceptability of the wells. The drilling contractor will not be compensated for borings deemed unacceptable because of poor plumbness and alignment. Completed well casings will be tested for alignment.

7.5.3 Air Monitoring

The borehole area must be monitored during drilling using a photoionization detector (PID). If PID readings are higher than 5 parts per million (ppm) in the ambient air above the borehole, drilling will be suspended and the PM/COTR contacted immediately. Drilling may resume only after investigation and, if necessary, correction of the condition(s) causing high PID readings.

Borehole/Well Cuttings shall be discharged onto heavy plastic laid on the ground or into plastic-lined pits. Cuttings shall be disposed of as specified in Section 7.15 (Disposal of Cuttings and Well Development Water).

7.5.5 Borehole Flushing

After the completed well depth is reached and the borehole is stabilized, the borehole shall be flushed to remove suspended cuttings. Drill rods or drill casing shall be removed in a manner (e.g. vented hoisting swivel) that minimizes the creation of differential pressures between the flushing fluid and the formation.

7.6 Sampling Procedures

Split spoon sampling shall be conducted to allow for an accurate assessment of subsurface conditions. Soil samples shall be taken at five foot (5 ft) intervals during drilling. The drill rod string holding the bottom plug and cutter in place shall be withdrawn from the borehole in sections, the sampler attached, the drill rod string reconnected, and the sample taken. The split spoon shall be driven up to two feet (2 ft) into the formation. Once the sample is retrieved, the split spoon shall be opened and the sample removed.

The description of the sample shall be noted on the well log. After acquisition, samples shall be placed in a suitable container and kept for later shipment to the laboratory for grain-size-distribution. Samples shall be analyzed in accordance with ASTM Standard D422 (Particle Size Analysis of Soils).

7.7 Well Designer Qualifications

Well design shall be performed by a qualified geologist or engineer with experience in designing water wells. All well design parameters shall be submitted to USACE for review and approval prior to performing well installation.

Each well design shall conform to the General Design Requirements shown on Drawing C-31. Final selection of detail design elements and apportionment of filter pack, transition pack, Bentonite grout, etc., shall be based on analysis of pilot hole sampling results, boring logs, and soil borings.

7.8. Well Casing/Screen Materials

The well casings shall be manufactured from PVC and shall conform to ASTM F-480 "Standard Specification for Thermoplastic Well Casing Pipe and Couplings Made in Standard Dimension Ratios (SDR), Schedule 40 and Schedule 80". The general design requirement for the M- 1 Replacement well and the Racetrack Replacement well casing is Schedule 80. As noted in Section 7.5.1 (Well Boring Location/Size/Depth), casing diameters for the M-l Replacement and Racetrack Replacement wells are five inches *(5* in) and eight inches (8 in), respectively. Casing sections shall be flush threaded with O-ring seals.

Screen materials shall be Schedule 40 PVC, with nonclogging, wirewrapped continuous slot strainers. Screen diameters shall be consistent with well casing diameters. Screen lengths and slot openings shall be selected based on analysis of pilot hole sampling results. For the purposes of screen length measurement, connecting rings on screen sections are considered as screen material.

7.8.1 Well Casing/Screen Assembly and Installation

The well casing and screen will be assembled and placed down borehole as specified and as shown on the manufacturer's literature and Bay West's final design drawings. Assembly will include bottom cap, screen, riser casing and centralizers. Assembled well casing will be suspended from surface in a manner to preclude accidental movement during backfill of annular space.

7.8.2 Borehole Bottom Blank and Plug

The borehole shall be sealed to the bottom of the filter pack elevation with a one foot (1 ft) Schedule 40 PVC blank and plug. The plug shall be the same diameter as the riser/casing and shall be fastened to the blank using flush threads as described in Section 7.8.1 (Well Casing/Screen Materials).

7.8.3 Filter Pack Selection and Placement

Filter pack material shall be clean, washed, free draining, durable, rounded siliceous sand. Material shall be free of clays and other foreign materials. Exact gradation of filter pack material and its placement of the filter pack shall be determined after a review of pilot hole test results, but in general the filter pack will extend from a depth of 5 feet below the bottom of the screened interval to 10 feet above the top of the screened interval.

The filter pack shall be installed through a tremie pipe placed so that filter pack material will not drop more than 10 feet below the bottom of the tremie. The depth to the top of the material will be continuously sounded using a weighted measuring line as the filter pack is installed. Outer drill casing or casing pipe will be raised periodically as the filter pack is installed, taking care to ensure that the top of the filter pack material is always above the bottom of the outer drill casing being removed/lifted.

After initial filter pack placement, the inside of the well screen will be gently swabbed for approximately 15 minutes to encourage settling of the newly installed filter pack. Additional material will then be added until the top of the filter pack is at the correct depth.

Any water added to tremie the sand shall be potable grade obtained in accordance with Section 7.3.7 (Water Source). All filter pack material shall be protected from contamination prior to placement by either storing it in plastic-lined bags or in a location protected from the weather and contamination on plastic sheeting. All filter pack materials shall be transported to the well site in a manner that prevents contamination by other soils, oils and grease, and other chemicals.

7.8.4 Transition Sand Placement

Pack the annular space around the casing above the filter pack with the specified transition sand to a thickness of not less than 2 feet using the same techniques as for the filter pack.

7.8.5 Bentonite Seal Placement

A minimum five foot (5 ft) bentonite seal consisting of Volclay grout (or approved equal) shall be tremie injected/placed into the specified interval above the transition sand after the sand has been allowed to settle. Prepare bentonite slurry in a mixing plant at the bentonite powder to water ratio recommended by the manufacturer. The quantity of bentonite seal will be calculated on the basis of the required filled annulus volume. The consistency of the slurry will be measured using a mud balance. After the bentonite seal is installed to the correct depth and the outer casing is raised so that the bottom of the casing is at the top of seal, the bentonite seal shall be allowed to set-up for a period of at least one

hour before any other activity on the well is performed
The well casing shall extend above ground surface to facilitate development and testing. The borehole annular space from the top of the bentonite seal to approximately 20 feet below the finish grade (bottom of wellhead slab) shall be filled with cement/ bentonite grout. All backfill of boring must be approved by the COTR. Boreholes shall be cleaned of drill cuttings to at least 1.5 feet below the bottom well assembly.

7.8.6 Pitless Adapter Installation

Pitless adapters shall be installed such that the adapter discharge pipe elevation is below the frost line and the adapter cap and vent port piping (if so equipped) project approximately twelve inches (12 inches) above finished grade when the minimum piping bury depth noted in Section 8.3.2 (Depth and Separation) is achieved. If steel well drop pipe is used, welded connections to the adapter shall be full, continuous running welds for the full thickness of the pipe wall and will be in accordance with applicable standards of the American Welding Society. If PVC drop pipe is used, the connection shall provide full compression of the well pipe seal to the adapter.

7.8.7 Wellhead Completion

The well head shall be provided with a minimum two foot by two foot by four inch minimum thickness (2 ft x 2 ft x 4 inch) continuous pour concrete slab. Concrete shall conform to the requirements of ASTM Standard C150 (Portland Cement). The slab shall be graded away from the wellhead to prevent accumulation or inflow of storm water runoff.

The final 20 feet of annular space below the bottom of the wellhead slab shall be filled with a cement/bentonite grout. The top of the grout will be set at the T.O.C. (top of concrete) elevation of the wellhead slab. The space between the grout and the slab shall be filled and finished during installation of the slab.

7.9 Well Development

Well development shall be performed as soon as practical after installation, but no sooner than 24 hours after grouting is completed. The following goals are established for determining that well development is satisfactory:

The first requirement is hydraulic in nature and assures that the well is hydraulically efficient, meaning that minimal head loss will occur due to formation disturbance during drilling. The recommended procedure is to surge the well for 1/2 to 1 hour, let the water level in the well recover fully, and then pump the well at a constant rate for a fixed time (e.g., 20 minutes). Pumping rate during development shall be 1.5 times the design flow rate for the well. One half-hour should be sufficient for water level recovery, but measurements of water elevation must be made to confirm a return to equilibrium. This development-test cycle is repeated as many times as necessary until the ending drawdowns for two successive cycles are essentially the same (no further reduction in drawdown). The rate of pumping shall be held constant from one cycle to the next. The hydraulic requirement for well development is met when drawdown reduction ceases, assuming the well has been adequately stressed by the development method.

A second requirement is that the wells will be developed until the water is generally clear and free of silt. The EPA Drinking Water Maximum Contaminant Level Guideline (MCLG) of 0.5. 1.0 Nephelometric Turbidity Units (NTUs) will be used as a goal for well development. Turbidity shall be measured with a portable turbidity meter such as that manufactured by Hach (model 2 lOOP) or approved equal.

The wells shall be developed by alternately pumping and surging using the airlift pump or turbine pump with surge block installed to the development pipe. A hydrocarbon air filter shall be used within the airlift system. Water generated during development of the wells shall be managed per Section 7.15 (Disposal of Drill Cuttings and Well Waste Water).

7.9.2 Well Development by Surging

Surging shall be completed with a spudding action (up and down motion) by using either a single or double solid or valved surge block or by cycling the supply or test pump.

Caution: A loose fitting surge block must be used in order to prevent damage to the screen.

The spudding action shall be a minimum of 30 strokes per minute. The surge block is lowered until it is below the static water level and a relatively gentle surging action is begun. As water begins to move easily in and out of the well screen, the length of stroke of the surge block is increased, thus increasing the force of the surging movement. Surging shall proceed from top of screen to bottom in a manner to prevent the surging tool from becoming sand blocked or causing damage to the screened section. If the surging action causes the disruption of the seal around the casing, use of the surge block must be discontinued.

When accumulated sediment reaches a depth of one (1) foot in the lower screen length, the sediment shall be removed by bailing or other appropriate method before well development continues. Well development shall continue until the water is relatively free from sand, silt, and turbidity, and the water pH, conductivity, and temperature are stable, within 10% over three successive water grab samples. Final approval of the well development shall be by the COTR.

7.9.3 Well Development by Airlift

The airlift method shall consist of a system which prevents spraying of contaminants into the air. It may be necessary to install an eductor pipe in the well. The eductor pipe system will minimize the chance to letting a large burst of air injected into the well screen intake area to be projected into the formation.

When accumulated fines reach a depth of one (1) foot in the lower screen length, the fines shall be removed by bailing, pumping or other appropriate method before well development continues. Well development shall continue until the water is relatively free from sand, silt, and turbidity, and the water pH, conductivity, and temperature are stable, within 10% over three successive water grab samples. Final approval of the well development will be by the COTR.

7.10 Well Performance Testing

A well performance pumping test shall be performed by Bay West's well installation subcontractor. The pumping tests are intended to assure that installed wells function properly, identify sand production problems, and to determine the wells' capacity. The wells shall be step-tested to determine specific capacity. Each well must be able to pump at the maximum pumping rate specified by the COTR. Each well shall recover from development procedures for a minimum of 24 hours prior to the well test. All test results (drawdowns and pumping rates) shall be submitted to the COTR for review and approval.

During performance testing, no drilling, excavation, development, or other pumping shall be allowed other than chemical agitation with a bubbler.

7.10.1 Equipment

Bay West shall install a temporary pump capable of producing up to twice the design flowrate of the well and all other temporary support equipment as required to perform the test. The pump shall be set to within 3 feet of the bottom of the well screen. The Contractor shall furnish a calibrated flow meter and accessories necessary to accurately measure up to the maximum flow from the pump, and a bubbler, electrical tape, or other method of accurately determining water level in the wells under all test conditions. The Contractor shall assume all liability for damage to the pump from sand or other material entering the well.

7.10.2 Sand Content Test

Following development, the well shall be pumped at the approximate design flow rate until turbidity levels have stabilized. After pumping at this rate for 2 hours, the sand content shall not exceed 5 milligrams per liter (mg/L) of water as determined for a sample of water representative of the entire flow in the discharge line. Sand content is defined as the dry weight of material retained by the #200 sieve per volume of water. If the sand content is still 5 mg/L or greater after 2 hours, development shall resume until sand content is reduced to 5 mg/L. When the sand content criterion has been met, the well shall be overpumped at a discharge rate approximately 50 percent greater that the design rate for 15 minutes. Samples of suspended sediments shall be collected and measured.

7.10.3 Step-Drawdown Tests

After installing appropriate pumping equipment in the well, Bay West's drilling subcontractor shall conduct step-drawdown tests before performing other tests. First, measurement of the static water level in the well shall be performed. The water level is considered "static" when the water level fluctuates less than 0.1 feet in 30 minutes.

Pumping is then commenced at a constant rate (±5 percent) equal to 1/4 of the design flowrate of the well and continue for 2 hours or shorter (i.e., one hour) until the drawdown at the well is stabilized. Water levels shall be measured and recorded during the test every 30 seconds for the first five minutes, every minute for the next five minutes, every five minutes for 10 to 45 minutes, then every 15 minutes for 45 to 120 minutes. The sounding tube shall be used for measuring water levels. The pumping rate shall then be increased to 1/2 of the desired production rate and continued for another one or two hours. Measurements shall be taken according to the same schedule as previously described. This shall be repeated for the 3/4 production and full production rate.

Immediately following this step, two additional steps shall be conducted according to the same production increase rate, to determine if the well has sufficient capacity to produce at those rates for the required time (120 minutes). If the pump breaks sections at this pumping rate prior to the two hours, only one subsequent step at a higher rate need be attempted; however; the flow rate shall be reduced until the water level, while pumping stabilizes at least 2 feet above the pump intake and the test shall be continued for the remainder of the two hours. If the test is interrupted prior to completion other than by direction of the COTR, the test shall be rerun at no cost to the Government. The pump test and/or sand content test may indicate incomplete well development due to collection of excessive fines in the well or by exhibiting an increasing capacity with increase(s) in pumping rate(s). If this phenomenon occurs, the COTR may direct the removal of sand or sediment from the well, additional development, and additional testing.

Discharge water will contained in a sufficiently large tank(s), transported and discharged as described in Section 7.15 (Disposal of Drill Cuttings and Well Wastewater).

7.11 Quality Control

7.11.1 Field Inspections

Field inspections shall be performed by Bay West to qualitatively assess the work and materials including, but not limited to the following:

A. Visual inspection of all materials used and the review of all material certifications before they are placed down hole.

B. That all down hole materials and equipment are properly protected from contamination during transport and installation and, if required, decontaminated prior to use.

C. That screens and casings for wells, subject to water sampling, were kept in a sterile and contaminant-free condition until placed in the ground.

D. That drilling equipment is properly cleaned to prevent cross contamination from previous boreholes.

E. That the ground surface is protected from drilling fluid/waste contamination during well installation and the drilling/development fluids and other generated wastes are properly contained.

F. That the well installation meets the requirements of this section.

G. That the final borehole/well depth is properly achieved and confirmed by the COTR.

H. That a boring log/monitor well record is maintained for each borehole.

That a well completion record was prepared for each well.

J. That the boring log and well completion records are submitted as required to KDHE with duplicate copies provided to the COTR.

7.11.2 Well Protection and Identification

At all times during the progress of the work, precautions shall be used to prevent tampering with the well or the entrance of foreign material into it. Wellheads shall be locked and kept secure at all times. A metal tag shall be affixed to the well cap. The metal tag shall be stamped with the well identification number and the top of casing elevation (in msl feet) as determined by the Bay West's subcontracted surveyor. Bay West shall provide 2 sets of keys per wellhead lock to the COTR.

7.11.3 Groundwater Observations

Observations and recording of water levels during and at the completion of the drilling operations on a site shall be made according to the following guidelines:

A. Date, time, and depth from the ground surface to the first encountered water surface.

B. Notes pertaining to any noticeable loss or rise of water during the advancing of a boring, to include date, time, and depth to which the water dropped in the boring or height to which it rose in the casing.

C. Date, time, and depth to the water surface at the completion of each borehole, both

immediately before removing the casing and before leaving the boring location after the drill casing has been removed.

D. Notes regarding weather: precipitation, temperature (estimate to nearest 100 °F), etc.

E. Notes regarding any special drilling techniques or procedures, such as the use of any drilling fluids other than water.

7.11.5 Groundwater Testing

At the completion of pump testing of each well, groundwater samples shall be acquired. One record sample and duplicate sample shall be taken from each well. Samples shall be analyzed for the presence of compounds on the Target Compounds List (TCL) using EPA method 8260. The analytical laboratory must carry USACE certification. Quality Assurance/Quality Control (QA/QC) samples, to include field blanks for non-dedicated sampling equipment, trip blanks for sample storage and transport to the analytical laboratory, and one (MS/MSD) sample shall also be acquired.

7.12 Abandonment and Completion of Borings

A. Borings shall not be abandoned before reaching the final depth authorized by the COTR except with the approval of the COTR.

B. Borings abandoned before reaching required depth, because of an obstruction or other reasonable cause not permitting completion of the boring by supplementary boring adjacent to the original boring, may be made by means other than specified only with the COTR approval.

7.13 Fluids, Solvents, Glues and Lubricants

Bay West will not introduce any fluids other than potable water into a well unless specifically approved by the COTR. No glue or welding solvents will be allowed in casing assembly. Oil, grease, or other petroleum-derived lubricants will not be used on drill rods, tools, and casings.

7.14 Decontamination

All drill rigs, pumps, and tools (casing and rods) shall be steam cleaned, and if necessary, scrubbed with tri-sodium phosphate (TSP) and potable water prior to setting up at the drilling location and prior to site departure. More frequent decontamination of rigs may be required at the direction of the COTR. Containerize decontamination water, if cuttings generated during drilling are determined to be contaminated, as described in Section 7.15 (Disposal of Cuttings and Well Waste Water). Alternative decontamination procedures and methods shall be approved by the COTR prior to their use. Perform decontamination at a designated area as authorized by the COTR.

7.15 Disposal of Drilling Cuttings and Well Waste Water

7.15.1 Drilling Cuttings

Cuttings generated during drilling when PID readings are lower than 5 ppm in the ambient air above the cuttings can be disposed of on-site in the immediate vicinity of the boring by spreading them out level on the ground surface upon completion of drilling. It is anticipated based on pervious site investigations that this will be the exercised disposal option.

If however, cuttings generated during drilling when PID readings are higher than 5 ppm in the ambient air above the cuttings and decontamination fluids must be segregated in DOT approved containers supplied by the Contractor and transported, at the end of activity or each day after coordination with the COTR and Fort Riley authorities. If this option is required a change order will be requested.

7.15.2 Well Waste Water

Bay West will containerize all well development and pumping test water and test for organic contaminants of concern by gas chromatograph (GC) method or other method approved by the COTR. If contaminant concentrations are below the applicable MCLs/MCLGs or other threshold(s) as designated by the COTR, it is permissible to discharge the water onto the ground. It is anticipated based on pervious site investigations that this will be the exercised disposal option.

If however, concentrations are greater than MCLs or other threshold(s) as designated by the COTR, the water shall be appropriately characterized, containerized, transported and disposed off-site. If this option is required a change order will be requested.

Bay West will ensure that all transportation and disposal means and methods comply with all state and Federal regulatory authorities. Bay West will furnish the COTR with written documentation and records verifying receipt and the quantity received of each load at the disposal facility and verification of proper disposal.

7.16 Well Acceptance

It is the responsibility of the Contractor to properly construct and install, develop, and test all wells according to the requirements of this Work Plan so that they are suitable for the intended purpose.

7.17 Documentation

7.17.1 Borehole Logging

During the progress of each test hole and well boring, a continuous and accurate log of the materials encountered and a complete record of the operation of installing the well casing shall be maintained. Soil cuttings observed shall be described on MRK Forms 55 and *55-2* and in accordance with the Unified Soil Classification System. The Contractor shall be aware of hole depth at all times and shall inform the COTR of the same upon request.

Records shall include at least the following data:

A. Names of driller and inspector.

B. Dates and times of beginning and completion of work.

C. Identifying number and location of test boring.

D. Diameter and description of casing.

E. Total length of each size of casing.

F. Length of casing extending below ground surface at the completion of the boring.

G. Depth to top of each different material penetrated.

7.17.2 Well Design

Upon completion of test hole boring, the well designer shall develop a detailed design for the well associated with location. Well designer qualifications are noted in Section 7.7 (Well Designer Qualifications). Documentation of the detailed design of each well shall be provided by Bay West. Minimum documentation shall include:

A. Description of drilling method.

B. Diameter, depth, and description of borehole

C. Diameter, length, and description of casing and well screen, to include connection method(s).

D. Well bottom finishing.

E. Type(s), grade(s), and installed depths of borehole finishing materials (i.e., transition sand, bentonite, grout, etc.)

G. Surface finish details, to include concrete slab and wellhead.

H. Detailed design drawing(s) and material specification(s).

7.17.3 Well Construction

Upon completion of each well and boring, Bay West will complete a construction diagram with the following items included:

A. Total depth of the completed boring or well.

B. The depth of location of any lost drilling fluids, materials, or tools.

C. The nominal hole diameter of the borehole, piezometer, and well.

D. The amount of cement (number of pounds per cubic feet or bags) used for the seals.

E. The amount of bentonite (number of pounds or cubic feet or bags) used for seals.

F. The depth and description of the casing (riser pipe).

G. The complete description (including length, diameter, slot size, etc.) of well screens.

H. Detailed as-built drawings of each well installed.

I. Required information for registration of well with KDHE.

J. Other pertinent data requested by the COTR

8.0 EXCAVATION, TRENCHING, AND BACKFILL

This Section includes procedures and requirements for excavation of trenches for underground pipe and electrical utilities; installation of compacted bedding below pipe and electrical utilities; and backfilling and compaction to subgrade elevations.

8.1 Reference Standards (Latest Edition)

ASTM D422: Particle Size Analysis of Soils

ASTM D1556:Test Method for Density of Soil In-Place by the Sand-Cone Method

ASTM D2167:Test for Density of Soil In-Place by the Rubber-Balloon Method

ASTM D2487:Classification of Soils for Engineering Purposes

ASTM D2922:Test for Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth)

ASTM D4253:Test Method for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table

ASTM D4254:Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

8.2 Borrow Material

8.2.1 Quantity Required

Bay West shall provide the PM/COTR with an estimate of the borrow material required to perform excavation cover and other work requiring borrow materials prior to beginning site activities.

8.2.2 Source Designation and Approval

Bay West shall designate the source(s) of borrow material and demonstrate to the PM/COTR that the material meets the requirements of Sections 8.2.3 (Suitable Materials) and 8.2.5 (Borrow Sand).

8.2.3 Suitable Materials

Suitable borrow materials shall include material classified using the Unified Soil Classification System as GW, GP, SW, SP, GM, GC, SM, SC, CL, CH, or as approved by the Engineer as per ASTM D422, D424 and D2487.

Suitable borrow material shall be chemically uncontaminated and free from debris, organic material, large stones and excess moisture that will prevent proper compaction. Suitable borrow material can be obtained from either onsite or offsite sources.

8.2.4 Unsuitable Materials

Unsatisfactory materials include materials classified using the Unified Soil Classification System as PT, OH, OL and materials of any classification that are determined by the Engineer as too wet for use in the backfilling operations. Salt, sulphur and hydrocarbon or other chemically impregnated soils shall be considered unsuitable for reuse.

Borrow sand for pipe and electrical conduit and cable bedding shall be sound, hard, durable, angular materials meeting the following gradation requirements:

SIEVE (U. S. Standard)	PERCENT PASSING (by Weight)
3/8"	100
#4	95-100
#40	12-60
#200	0-12

8.3 Conduct of Work

8.3.1 Preparation

Prior to excavating or trenching operation, location of all existing installations shall be verified.

B. Identify required lines, levels, contours and datum.

C. Protect bench marks, existing structures, fences, sidewalks, paving and curbs from excavation equipment and vehicular traffic.

D. Protect above and below grade utilities which are to remain.

E. Cut out soft areas of subgrade not capable of insitu compaction. Backfill with suitable fill and compact to density equal to or greater than requirements for subsequent backfill materials.

F. Verify fill materials to be reused are acceptable.

G. Any damage to underground installations shall be repaired, including but not limited to repairing drooped and wrapped piling.

H. Protect plant life, lawns, rock outcropping and other features remaining as a portion of final landscaping.

8.3.2 Depth and Separation

Minimum depth of excavations and trenching for water piping and electrical cable shall be four feet (4 ft) bgs. The minimum distance between adjacent walls of excavations and trenches for water piping and electrical cable shall be one foot (1 ft).

All excavations shall be protected and guarded against danger to life and property and shall conform to OSHA "Construction Standard for Excavations" (29 CFR Part 1926.650-.652, Subpart P). Permanent excavations or fill shall have retaining walls sufficient in strength to retain the embankment, together with any surcharge loads, unless the sides slope sufficiently for this retention.

A. Excavate subsoil required for piping/electrical cable installation

B. Cut trenches sufficiently wide to enable installation of utilities and allow inspection.

C. Excavation shall not interfere with normal 45 degree bearing splay of existing foundations.

D. The bottom of all excavations shall be properly leveled and all loose material shall be removed or compacted before placing concrete or installing pipe. Excavations shall be kept free of water and debris until the underground piping installation has been tested.

E. Correct areas over-excavated by error by placing lean concrete in the excavation to the correct elevation.

F. No excavation shall be left unattended prior to backfilling and compaction.

8.3.4 Horizontal Augering

Excavation for piping under the Racetrack racing surface shall be performed by horizontal auger or directional drilling. Approach angle for the drilling shall not exceed 30 degrees from horizontal and shall be compatible with the depth of excavation adjoining the augered excavation. Radius of curvature for the drilling shall be not less than 150 feet. Step-off distance for drilling shall be determined in the field and shall be based on site-specific constraints on track racing surface banking and width and location of adjoining excavations on both sides of the track.

8.3.5 Bedding

Bedding shall conform to one of the classes below. If no class is specified, then Class "C" bedding shall be used.

NOTE: Bedding and backfill requirements for areas where horizontal augering has been conducted are described in Section 11.6.2 (Underground Duct with Concrete Encasement).

Class A Concrete Cradle Bedding requires embedment of the lower part of the pipe in plain or reinforced concrete of suitable thickness and extending up to the sides of the pipe a distance not less than 25% of the depth of the pipe.

Class B First Class Bedding requires the pipe to be placed on the fine granular materials foundation extending up to the center line of the pipe. The trench is then filled to 1 ft. over the top of the pipe with granular material in 6 inch layers and compacted to fill all the space around the pipe.

Class C Ordinary Bedding requires placing the pipe on fine granular material cradle extending up to the sides of the pipe a distance not less than 1/6 the depth of the pipe. The trench is then filled to 6 inches over the top of the pipe with granular material placed and compacted to fill all space around the pipe.

Class D Impermissible Bedding allows the pipe to be placed on the bottom of the trench with no effort to shape the trench to fit the pipe. Fill is placed around the pipe.

8.3.6 Backfilling

A. Backfill shall proceed as soon as possible after the installed pipe system has been tested, inspected and accepted.

B. Backfill shall be added in maximum twelve inch (12 in) lifts and must be traffic-compacted prior to placement of additional lift(s).

C. Backfill trencher to contours and elevations with unfrozen materials.

D. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.

E. Backfill around outlet pipe trenches shall be conducted in maximum six inch (6 inch) lifts and compacted using a hand-held mechanical tamper. Care must be taken to preserve the integrity of the watertight seal when compacting fill around wellheads.

F. For granular soils fill, place and compact materials in continuous layers not exceeding six inches compacted depth.

G. Compact granular backfill that is insensitive to compaction moisture to an in-place density of at least 70 percent relative density, as defined in ASTM D4253 and ASTM D4254.

H. For cohesive soils fill, place and compact material in continuous layers not exceeding 8 inches compacted depth.

I. Clay sands and cohesive soils that are sensitive to compaction moisture shall be placed and compacted to at least 95 percent of the Standard Proctor maximum density determined in accordance with ASTM 1557 and ASTM D 2922. Moisture content of the fill shall be controlled within ± 2 percent of optimum moisture.

Upon placement and compaction of each lift of cohesive material, the surface shall be tilled or scarified to a depth of two inches prior to the placement of subsequent lift.

Employ a placement method that does not disturb or damage foundation perimeter drainage, foundation waterproofing and protective cover utilities in trenches.

Maintain optimum moisture content of backfill materials to attain required compaction density.

Remove surplus backfill materials from site.

N. Leave fill material stockpile areas completely free of excess fill materials.

8.4 Tolerances

The top surface of backfilling shall be completed to within plus or minus one inch from surrounding surface.

8.5 Field Quality Control

The Contractor shall conduct field density tests during backfill and fill placement. The tests shall be performed by qualified Soil Technicians working under the direction of a Soils Engineer registered in Kansas. Field density tests shall be performed in accordance with ASTM D 2922, and ASTM 1557.

Tests shall be conducted after every 1500 cubic yards and every 500 feet of fill or backfill in trenches or around structures. If tests indicate work does not meet specified requirements, remove work, replace and retest at no cost to the Government.

8.6 Site Restoration

At the conclusion of the work at each well, boring location, and excavation, Bay West shall remove all equipment, tools, material, and supplies and shall leave the site clean and clear of all debris generated by the work. All earth cuttings and drilling fluid generated while advancing the borings and the discharge water from well development, well purging, and aquifer testing shall be collected and managed in accordance with the requirements of 7.15 (Disposal of Drilling Cuttings and Well Waste Water). Method(s) and results of site restoration activities are subject to review and approval by the PM and COTR.

Site restoration shall be conducted in all areas that have been disturbed by drilling or excavation activities. At a minimum, all disturbed areas shall be backfilled to approximate the original contours. All filled areas shall be compacted using a hand-operated compactor, with additional fill added as required, to restore original contours.

Prior to re-vegetation, disturbed areas shall be tilled to a depth of two inches (2 in) using a rototiller or other approved method. All excavated or disturbed areas shall be seeded with annual rye grass or similar grass at a rate of 250 pounds of pure live seed (minimum)per acre.

Straw or hay mulch which is free of weeds, mold, and other deleterious material shall be spread uniformiy over seeded areas at a rate of two tons per acre. Spreading may be conducted by hand, blower-type mulch spreader, or other approved method. Mulch shall be crimped to prevent the mulch and seed from blowing or washing away. The Contractor shall conduct initial watering after seeding and mulch spreading. Maintenance of restored areas shall then be the responsibility of the Property Owner(s).

9.0 PIPING/PLUMBING INSTALLATION

9.1 System Design

Calculations for piping sizes, system capacities, pressure drops, etc. are provided in Appendix B. Control valves shown on Drawings 1 2PQ6960 1-02 and 12Q69601 -03 are manually-operated unless otherwise noted. Controls for buried valves shall be installed and marked per Sections 9.7.1 (General Installation Requirements) and 9.7.2 (Piping Installation)

9.2 Piping Classification

Piping conforming to ASTM Standard D1785 will be used for water distribution piping. The D2241 standard designated in the Project Scope of Work is based on a pressure rating of 100 psig. The D1785 piping, in Schedule 40 thickness, has maximum working pressure ratings as follows:

Nominal Pipe Diameter Maximum	Working Pressure
1 inch	450 psig
2 inch	280 psig
4 inch	220 psig

The maximum pressure as noted in the system calculations contained in this document is 200 feet of water head (200 ft H_20), or 87 psig. This provides working pressure safety factors of 5.2, 3.3, and 2.5 for the one inch, two inch, and four inch pipe sizes, respectively.

9.3 Quality Assurance

Pipes, pipe fittings, valves, specialties and supporting devices shall be furnished by a manufacturer who has made these items for a period of at least five years. The entire installation shall equal or exceed the minimum requirements of The National Plumbing Code, and the Building Codes or regulations, laws, or rules promulgated by regulatory authorities having jurisdiction. In the event such requirements conflict with this Workplan, the more stringent shall apply. Testing of piping systems shall be performed as specified under the various types of piping.

9.4 Reference Standards (Latest Edition)

The National Plumbing Code and regulations of the jurisdictional authorities.

B. ASTM D 1784:

C. ASTM D 1785:

D. ASTM D 2564:

E. ANSI A 21.10:

F. ANSIA21.11:

G. Specification For Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Poly (VinylChloride) (CPVC) Compounds

H. Specification for Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120

I. Specification for Joining Cement, PVC Pipes, Schedules 40 and 80

J. Gray-Iron and Ductile-Iron Fittings, 2 inch through 48 inch for Water and Other Liquids (AWWA C 110)

K. Rubber Gasket Joints for Cast-Iron and Ductile-Iron Pressure Pipe and Fittings (AWWA Clll)

9.5 Coordination

Bay West shall examine all drawings and specifications of all divisions of the project to assure himself that provisions have been made for all services under his jurisdiction. Should the Contractor discover an omission of service, the Contractor shall inform the PM of his findings.

9.6 Job Conditions

Do not perform soldering when the temperature of the base metal is less than 0^0F. Do not perform soldering when surfaces are wet from rain or ice.

9.7 Execution

9.7.1 General Installation Requirements

Unless otherwise specified, all valves shall be the same size as the piping in which said valve is being installed. All piping shall be of the best quality, new material, straight, true, and free of all defects. All pipe cuts shall be reamed even with the inside diameter of the pipe. All pipe threads shall be cut full and true. All piping shall be properly supported, and installed with proper provisions to prevent sagging, vibration from water hammer, or damage from expansion and contraction.

The Contractor shall be responsible for the coordination of his work with the other portions of the work. He shall take adequate precautions to protect or replace existing pavements, gutters, side-walks, curbs, utilities, adjoining property, adjacent buildings, etc. and bear all expense necessary to replace or repair damage thereto as a result of his operation.

All piping shall be installed and supported with due provision for expansion and contraction. Piping shall slope to drain and shall have no dips or pockets to prevent complete drainage.

Unless otherwise indicated all piping shall be installed in the following manner:

A. Suit building conditions.

B. Provide additional offsets, fittings, valves, drains, etc., where required by construction coordination and work of other trades.

C. Run in pipe chases and recesses, where applicable. Do not cover before examination and testing.

D. Run parallel with or at right angles to walls and other piping, neatly spaced and with plumb risers.

E. Maintain minimum one inch clearance between hubs, coverings, and adjoining work.

F. Valves: accessible, but no valve handles pointing down.

G. Provide reducing fittings for changes in pipe size: no bushings permitted.

H. Use extra heavy pipe for nipples where unthreaded portions of pipe is less than 1-1/2" long. No close nipples permitted.

I. Provide adequate access doors for valve and other equipment servicing, where applicable.

J. Upon completion of the work, Bay West shall clean out all lines, adjust all controls, valves, etc., and leave the completed systems in satisfactory working order.

9.7.2 Piping Installation

A. Grade piping on a continuous slope to at least 1/8" per foot fall and no less than the slope of the main piping to which it is connected.

B. Run horizontal piping with a minimum pitch of one inch in 40 feet.

C. Use reducers to change pipe sizes on lines.

D. Use long sweep bends, Y-fittings, 1/8 or 1/16 bends, or combination Y and 1/8 bends to make changes in direction.

E. Connect and install all service water piping, sizes as shown, to all equipment and outlets.

F. Pipe or tubing shall be free from cuts, dents, or other surface damage. Remove damaged pipe and replace with new pipe or tubing.

G. Cut square and ream ends of tubes and pipes.

I. For cemented joints, penetrate fully and fill the joint completely with cement.

J. Ream and clean ends of threaded pipes before assembling with fittings and apply cement to pipe threads only.

K. Make connections to equipment and fixtures without strain to the fixture or equipment.

L. When connecting piping to sleeves, fill the annular space between pipe and sleeves with non-metallic, permanently flexible compound and tightly seal to form an effective seal against ground water under all operating conditions.

9.7.3 Installation in Horizontal Boreholes

Encase piping in concrete extending the concrete encasement at least 5 feet beyond the edges of paved areas or the Speedway racing surface. Where piping runs under existing roads, cut and patch the pavement. The top of the concrete encasement shall not be less than 18 inches below grade except that under roads and pavement it shall be not less than 24 inches below grade.

Changes in direction of runs exceeding a total of 10 degrees, either vertical or horizontal, shall be performed by long sweep bends having a minimum radius of curvature of 25 feet. Sweep bends may be made up of one or more curved or straight sections of piping. Piping and electrical conduit separators shall be of precast concrete, high impact polystyrene, steel, or a combination of these.

9.7.4 Piping Thrust Blocks

Thrust restraint blocks shall be provided for plugs, tees, or bends on piping of four inches (4 in) or larger with deflections of 11.25 degrees or larger in the vertical or horizontal direction. Valves on piping of four inches (4 in) diameter or larger shall also be provided with thrust restraint blocks. Thrust blocks shall be fabricated from concrete.

9.8 Field Quality Control

9.8.1 Protection of Piping and Equipment

Protect pipe, openings, valves, and fixtures from dirt, foreign objects, and damage during the construction period. Replace damaged piping, valves, and fixtures or other appurtenances without cost to the Owner should the damage occur prior to final acceptance of the work. Flush piping with chemically treated water until systems are clean and free of scale, slag, dirt, oil, grease or other foreign material prior to testing.

Do not repair leaks in threads, occurring while pipe is under test or thereafter, by mechanical caulking. Do not introduce material inside the piping system which has the purpose of stopping leakages. Repair leaks in threaded piping by breaking the joint, cutting new threads on the pipe and installing a new pipe fitting.

9.9 Pressure and Leakage Testing

Pressure testing of piping shall be conducted no less than five (5) days after all piping components have been installed and excavations have been backfilled and shall be conducted concurrently with leakage testing (Section 9.9.2). The PM and COTR shall be notified in advance of making tests. Test all piping in the presence of the PM and COTR using the procedure given below. Test the entire piping system, repair or replace any visibly leaking components, and repeat until found leak free in the presence of and to the satisfaction of the PM and COTR. The allowable leakage rate be calculated using the formula:

L=NDP/K where L = Allowable leakage rate, gallons/hour
N = Number of joints in piping system being tested
D = Piping nominal diameter, inches
P = Square root of system test pressure, psig
K = 7400

Leakage at a rate greater than the calculated figure over the required test duration or failure to maintain testing pressure over the test duration shall be considered as a test failure.

9.9.1 Pressure Test Procedures

A. Fill the entire system with water and vent all air from the system at least 24 hours before the actual test pressure is applied.

B. Apply 100 psi hydrostatic test pressure when water and average ambient temperatures are approximately equal and constant.

C. Maintain test pressure for a minimum of two hours without drop after the pump has been disconnected.

D. Visually inspect joints while pipe is under test pressure.

9.9.2 Leakage Testing Procedures

A. Prior to conducting testing, consult piping manufacturer to determine coefficients of diametric expansion, pressure elongation, and other special testing considerations.

Fill the entire system with water and vent all air from the system at least 24 hours before the actual test pressure is applied.

C. Place the allowed water leakage volume in a sealed container attached to the supply side of the system testing pump. No other sources of water makeup or supply will be used during the testing.

D. Apply 100 psig hydrostatic test pressure when water and average ambient temperatures are approximately equal and constant.

E. Maintain test pressure for a minimum of two hours without drop after the pump has been disconnected.

9.9.3 Retesting Requirements

If deficiencies or failures to achieve testing requirements are noted, deficiency corrections, system repairs and/or testing equipment adjustments shall be conducted and the tests repeated until specified performance is obtained. Such additional testing shall be at no cost to the Government, USACE, or Property Owner(s).

9.10 Cleaning and Sterilizing Water Systems

A. Flush entire piping and equipment connected downstream from the wellhead shutoff valve with water to remove sediment after completion of tests, replacements or repairs.

B. Use chlorine for disinfection in the form of hypochlorite solution or in the form of compressed gas applied through an approved chlorinator.

C. Operate valves and equipment during chlorination to insure that chlorine reaches all parts of the system.

D. Feed water and chlorination agent into the system at a rate providing for 50 PPM of chlorine and allow to stand 24 hours before flushing.

E. Residual chlorine, at the end of the 24 hour retention period shall not be less than 10 PPM.

F. Flush treated water from the system completely after disinfection.

G. Continue flushing until samples show that the quality of the water delivered is comparable with public water supply and satisfactory to the public health authority having jurisdiction.

H. Do not take samples from hydrants or through unsterilized hose.

9.11 Service Training

Upon completion of the piping and plumbing system installations, Bay West shall regulate and adjust all controls, valves, regulators, etc., as necessary to obtain properly operating systems. Bay West shall then place the various systems in complete operating condition subject to the PM's, Property Owner's and/or COTR's approval. The installations shall not be considered complete until Bay West has thoroughly instructed the PM, Property Owner, and COTR as to the proper procedure to be followed in operating the various systems and the Property Owner

understands the correct method of regulating, starting, and stopping each system and part thereof under year-around operating conditions.

The Contractor shall provide warranty information on work performed and equipment provided to the USACE and Property Owner(s).

10.0 EXISTING WELL ABANDONMENT

Five (5) existing wells (shown on Drawing C-1.1, Appendix D) shall be abandoned in accordance with KDHE requirements for wells in unconfined aquifers as described in KDHE regulation K.A.R 28-30-7(a) and (b). (Appendix C)

11.0 UNDERGROUND UTILITIES

This section covers the furnishing of all material, equipment, accessories, tools, services, transportation, labor and supervision required for underground electrical work.

11.1 References

The publications listed below shall be the latest edition and form a part of this specification to the extent referenced. The publications are referred to in the text by the basis designation only.

American National Standards Institute, Inc. (ANSI) ANSI C2 National Electrical Safety Code

Association Of Edison Illuminating Companies (AEIC)

AEIC C56	Ethylene Propylene Rubber Insulated Shielded Power Cable Rated 5 through 69 kV

Institute Of Electrical And Electronics Engineers (WEE) IEEE 48 High-Voltage Alternating-Current Cable Terminations

IEEE 404	Cable Joints for Use with Extruded Dielectric Cable Rated 5000 V through 46000V and Cable Joints for Use with Laminated Dielectric Cable Rated 2500 V through 500,000 V

National Electrical Manufacturers Association (NEMA)

NEMA RN 1	Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit. NEMA TC 2 Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC 80)
NEMA TC 6	Fittings for ABS and PVC Plastic Utilities Duct for Underground Installation
NEMA WC8	Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

National Fire Protection Association (NFPA) NFPA 70 National Electrical Code

Underwriters Laboratories, Inc. (UL) UL 6 Rigid Metal Conduit, Ninth Edition

UL 44	Rubber-Insulated Wires and Cables, Twelfth Edition
UL 83	Thermoplastic-Insulated Wires and Cables, Ninth Edition
UL 467	Grounding and Bonding Equipment, Sixth Edition
UL 486A	Wire Connectors and Soldering ugs for Use with Copper Conductors, Seventh Edition
UL 510	Insulating Tape, Sixth Edition
UL 514A	Metallic Outlet Boxes, Seventh Edition
UL 541B	Fittings for Conduit and Outlet Boxes, Second Edition
UL 1242	Intermediate Metal Conduit, First Edition

11.2 Quality Assurance

Each cable splicer may be required to make an approved dummy splice in the presence of the Contractor in accordance with cable manufacturer's instructions. The Contractor shall furnish the material for dummy splices.

11.3 Certificate of Competency for Cable Splicer/Terminator

Certification of the qualification of the cable splicer/terminator shall be submitted, for approval, 30 days before splices or terminations are to be made in medium voltage (5 kV to 35 kV) cables. The certification shall include the training, and experience of the individual on the specific type and classification of cable to be provided under this contract The certification shall indicate that the individual has had three or more years recent experience splicing and terminating medium voltage cables. The certification shall also list a minimum of three splices/terminations that have been in operation for more than one year. In addition, the individual may be required to perform a dummy or practice splice/termination kit, and detailed Manufacturer's instructions for the cable to be spliced. The Contractor reserves the right to require additional proof of competency or to reject the individual and call for certification of an alternate cable splicer.

11.4 Materials

11.4.1 Conduit

Minimum conduit size shall be 3/4-inch. Rigid metal conduit shall be Type UL 6, galvanized steel. Plastic conduit and tubing shall be Type NEMA TC 2, Type EPC-PVC, EPC-40-PVC and EPC-80--PVC, as required

11.4.2 Fittings

Metal fittings shall Be Type L S 14A and UL S 14B, with steel conduit, rigid shall be cast-metal with gasketed closures. PVC fittings shall be Type NEMA
TC6,NEMATC9

11.4.3 Tape

UL 510, plastic insulating tape, capable of performing in a continuous temperature environment of 80 degrees C.

11.5 Power Wire, Cable, and Ancillary Materials

11.5.1 Wire and Cable Conductor Sizes

Power wire and cable conductors shall be copper, designated by American Wire Gauge (AWG). Insulated conductors shall bear the date of Manufacturer imprinted on the wire insulation with other identification. Wires and cables manufactured more than 12 months prior to date of delivery to the job site shall not be used. Provide conductor identification within each enclosure where a tap, splice or termination is made.

11.5.2 Medium Voltage Cables

AEIC CS 6, NEMA WC 8, EPR insulation, 15 KV shielded power cable type MV9O, single copper conductor, class B stranded, 133 percent insulation level, with overall black polyethylene jacket. The year of manufacture shall be durably marked on the outer surface of each cable at regular intervals throughout cable length.

11.5.3 Medium Voltage Cable Terminators

Medium voltage cable terminators shall be Type IEEE 48 Class 1. Provide terminators for termination of single conductor cables. Terminator installations shall include stress relief cones for shielded cables. Those for mounting on conduit shall be the stuffing box type with conduit coupling and means for securing and sealing the cable. Do not use aluminum and copper bearing parts in contract with each other.
Components shall be from one Manufacturer. Furnish installation instructions including stress relief devices.

Heat shrinkable type terminators shall be provided for terminating single conductor, extruded dielectric, nonmetallic jacketed type cables for service voltage up to 35KV. The indoor and outdoor terminator shall be the product of one manufacturer who shall furnish components in the form of a kit, including complete instructions which shall be followed for assembly and installation, suitable for the type and materials of the cable terminated. The terminator shall consist of a uniform cross section heat shrinkable polymeric construction stress relief tubing and environmentally sealed outer coverings that is non-tracking, resists heavy atmospheric contaminants, ultra violet rays and oxidative decomposition. The terminator kits shall be factory engineered and shall accommodate any common form of cable shielding (metallic tape or wire shield) or construction without the need for special adapters.

Provide heat shrinkable sheds or skirts of the same materials for outdoor application as well as ground braid and clamp.

11.5.4 Fireproofing Tape

Furnish tape composed of a flexible conformable unsupported intumescent elastomer. Tape shall be not less than .030 inches thick, non-corrosive to cable sheath, self-extinguishing, noncombustible, and shall not deteriorate when subjected to oil, water, gases, salt water, sewage, and fungus.

11.5.5 Pull Wire

No. 14 hot-dip galvanized steel or plastic rope having a minimum tensile strength of 200 pounds in each empty duct. Leave a minimum of 24 inches of slack at each end of the pull wires.

11.5.6 Ground and Bonding Equipment

Grounding and bonding equipment must comply with UL 467 requirements.

11.6 Installation

Installation of underground utilities must comply with all applicable requirements of NEPA 70 and ANSI C2.

11.6.1 Earthwork

Excavation, backfilling, and pavement repairs for electrical requirements shall conform to the requirements of Section 8.0 (Excavation, Trenching, and Backfill).
Separate cables, crossing cables or metal piping from each other by not less than 12 inches of well tamped earth.

B. Connections

Provide cables in one piece without splices between connections except where the distance exceeds the lengths in which cables are manufactured.

C. Bends

Bends in cables shall have an inner radius not less than 12 times the cable diameter.

D. Horizontal Slack

Leave a horizontal slack of approximately 3 feet in the ground on each end of cable runs, on each side of connection boxes, and at points where connections are brought aboveground. Where cable is brought aboveground, leave additional slack to make necessary connections.

E. Identification Markers

Provide a marker slab at each change of direction of cable, over the ends of ducts or conduits which are installed under paved areas and roadways, and over each splice. Identification slabs shall be of concrete approximately 20 inches square by 6 inches thick and shall be set flat in the ground so that top surface projects not less than 3/4 inch, nor more than 1 1/4 inches aboveground. The concrete shall have a compressive strength of not less than 3,000 psi and have a smooth troweled finish on exposed surface. Inscribe an identifying legend such as "electric cable", "telephone cable", "splice", or other applicable designation on the top surface before concrete hardens. Letters or figures shall be approximately 2 inches high and grooves shall be approximately 1/4 inch in width and depth. Install slabs so that the side nearest the inscription on top shall include an arrow indicating the side nearest the cable.

F. Cable End Seal

Use heat shrink adhesive coated caps on cable ends or tape cable ends immediately after cutting to prevent moisture from entering the cable. Varnish the tape when cable is not expected to be connected for at least 72 hours.

11.6.2 Underground Duct with Concrete Encasement

Under roads and paved areas, encase ducts in concrete. Extend the concrete encasement at least 5 feet beyond the edges of paved areas or the Speedway racing surface. Conduits to be installed under existing paved areas which are not to be disturbed, roads, and the Speedway racing surface shall be zinc coated, rigid steel, jacked into place. Do no use the hydraulic jet method. Where conduit runs under existing roads, cut and patch the pavement as indicated. The top of the concrete encasement shall not be less than 18 inches below grade except that under roads and pavement it shall be not less than 24 inches below grade.

Duct line shall have a continuous slope downward toward manholes and away from buildings with a pitch of not less than 3 inches in 100 feet. Except at conduit risers, accomplish changes in direction of runs exceeding a total of 10 degrees, either vertical or horizontal, by long sweep bends having a minimum radius of curvature of 25 feet. Sweep bends may be made up of one or

more curved or straight sections of combinations thereof. Manufactured bends shall have a minimum radius of 18 inches for use with conduits of less than 3 inches in diameter and a minimum radius of 36 inches for ducts of 3 inches in diameter and larger. All 90 degree bends shall be galvanized rigid metal conduit.

Terminate conduits in end-bells where duct lines enter manholes and handholes. Separators will be of precast concrete, high impact polystyrene, steel, or a combination of these. Stagger conduit joints by rows and layers to provide a duct line having the maximum strength. During construction, protect partially completed duct lines form the entrance of debris such as mud, sand, and dirt with suitable conduit plugs. As each section of a duct line is completed from manhole, handhole to manhole handhole, draw a stiff bristle brush having the same diameter as the duct through the duct, until duct is clear of particles of earth, sand, and gravel; then immediately install end plugs.

11.6.3 Cable Pulling

Test duct lines with a mandrel and thoroughly swab out to remove foreign material before pulling cables. Pull cables down grade with the feed-in point at the highest elevation. Use flexible cable feeds to convey cables through manhole or junction box where space permits by training cable around the interior to form one complete loop. Maintain minimum allowable bending radii in forming such loops.

Cable pulling tensions shall not exceed the maximum pulling tension recommended by the cable Manufacturer.

11.6.4 Secondary Cable Runs in Nonmetallic Duct Conduit

Although not indicated, include an insulated copper equipment grounding conductor sized as required by the rating of the overcurrent device supplying the phase conductors, in nonmetallic duct conduit, for secondary cable runs, 600 volts and less.

11.6.5 Cable Terminating

Protect terminations of insulated power and lighting cables from accidental contact, deterioration of coverings and moisture by providing terminating devices and materials. Install terminations of insulated power and lighting cables, cable joints and medium voltage terminations in accordance with the Manufacturer's requirements. Make voltage terminations with materials and methods as indicated or specified herein or as designated by the written instructions of the cable manufacturer and termination kit manufacturer.

11.6.6 Grounding Systems

Grounding systems shall be as required by NFPA 70 and ANSI C2. Non-current carrying metallic parts associated with electrical equipment shall have a maximum resistance to solid "earth" ground not exceeding 5 ohms.

A. Grounding Electrodes

Provide cone pointed driven ground rods driven full depth plus 6 inches, installed when indicated to provide an earth ground of the value stated for the particular equipment being grounded.

B. Grounding Connections by Exothermic Type Process

Make grounding connections which are buried or otherwise normally inaccessible by exothermic type process, except for those connections where access for periodic testing is required. Make thermit welds strictly in accordance with the weld Manufacturer's written recommendations. Welds which have "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable. Mechanical connectors are not required at thermit weldments.

C. Compression Round Grid Connector

For accessible connections in lieu of an exothermic type process, a compression ground grid connector of a type which uses a hydraulic compression tool to provide the correct circumferential pressure may be used. Tools and dies shall be as recommended by the manufacturer. An embossing die code or other standard method shall provide visible indication that a connector has been adequately compressed on the ground wire.

D. Grounding Conductors

Use bare soft-drawn copper wire No. 4 AWG minimum unless otherwise indicated or specified.

E. Ground Rod Connections

Connect copper-clad steel ground rods only to copper ground conductor and weld the connection. Insulate entire area of the rod in the vicinity of the weld and the connecting wire and seal against moisture penetration.

F. Conduit

Provide empty conduits with No. 14 AWG zinc coated steel wire or a plastic rope having a breaking strength of at least 200 lbs. Leave 24 inches of spare at each end of the pull.

11.7.0 Distribution Conductors 600 Volt Class

Test 600 volt class conductors to verify that no short circuits or accidental grounds exist. Make tests using an instrument which applies a voltage of approximately 500 volts to provide a direct reading in resistance; minimum resistance shall be 250,000 ohms.

11.7.1 Medium Voltage Cables

After installation and before placing in service, perform a DC hi-pot test on cables rated above 600 volts. Test the medium voltage cables after installation in accordance with the requirements of the appropriate "Voltage Tests After Installation" paragraphs in the particular IPCEA specification for the cable involved. Adhere to precautions and limits as specified in the applicable standards. Current sensing circuits in test equipment shall measure only the leakage current associated with the cable under test, and shall not include internal leakage current of the test equipment. Perform the following test procedures and record the results for each cable test.

A. Record temperature and relative humidity. Do not perform tests unless weather is clear and relative humidity is below 70 percent.

B. Test each conductor individually with other conductors grounded. Shields shall be grounded.

C. Terminations shall be properly corona suppressed by guard ring, field reduction sphere, or other suitable methods.

D. Perform insulation resistance and continuity test prior to hi-pot test.

E. Apply a DC hi-pot in at least five equal increments until maximum test voltage is reached. Record a DC leakage current at each step after a constant stabilization time consistent with system charging current decay. One hundred percent voltage shall be reached in a maximum of 60 seconds.

F. Separable insulated connectors shall be plugged into insulated bushings.

G. Raise the test conductor to a maximum test voltage and hold for a total of 15 minutes. Readings of leakage current shall be recorded each minute.

H. Reduce the conductor test potential to zero and apply the grounds for at least 10 minutes.

I. The DC test voltage shall be 53 KV or as specified for terminators in IEEE Standard 48 or Manufacturer's specifications.

J. Furnish the Contractor with three copies of test results.

11.7.2 Ground Rods

Test ground rods for ground resistance value before connecting wires. Use a portable ground testing megger to test each ground or group of grounds. The instrument shall be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground electrode under test. Provide one copy of the megger manufacturer's directions for use of the ground megger indicating the method to be used.

TABLE 1
SUBCONTRACTOR FIRMS

Subcontractor Firm	Major Task(s) Performed	Manager/Foreman
Layne-Western 1011 W. Harry St. Wichita, KS 67213	Test Hole/Well Drilling Well Installation Well Abandonment	Don Cailluett
TBD	Electrical System Installation	TBD
Environmental Science Crop. A 29 Lake Lotawana, MO 64086	Soil/Water Sample Analysis	Rodney Mann
Don's Mechanical 1912 Winona Cir. Junction City, KS 66444	Plumbing Inspection- Water Lines	
Kaw Valley Engineering 14631 W 95th St. Lenexa, KS 66215	Geotechnical Analysis/Surveying	
Flint Hills Rural Electric 1564 S. 1000 Rd Council Grove, KS 66846	Installation of 3-Phase Power Line	Damien Herbert Operations Manager

Figure 1

SITE LOCATION MAP

FIGURE 1. SITE LOCATOR MAP

SCALE 1" : 2000'

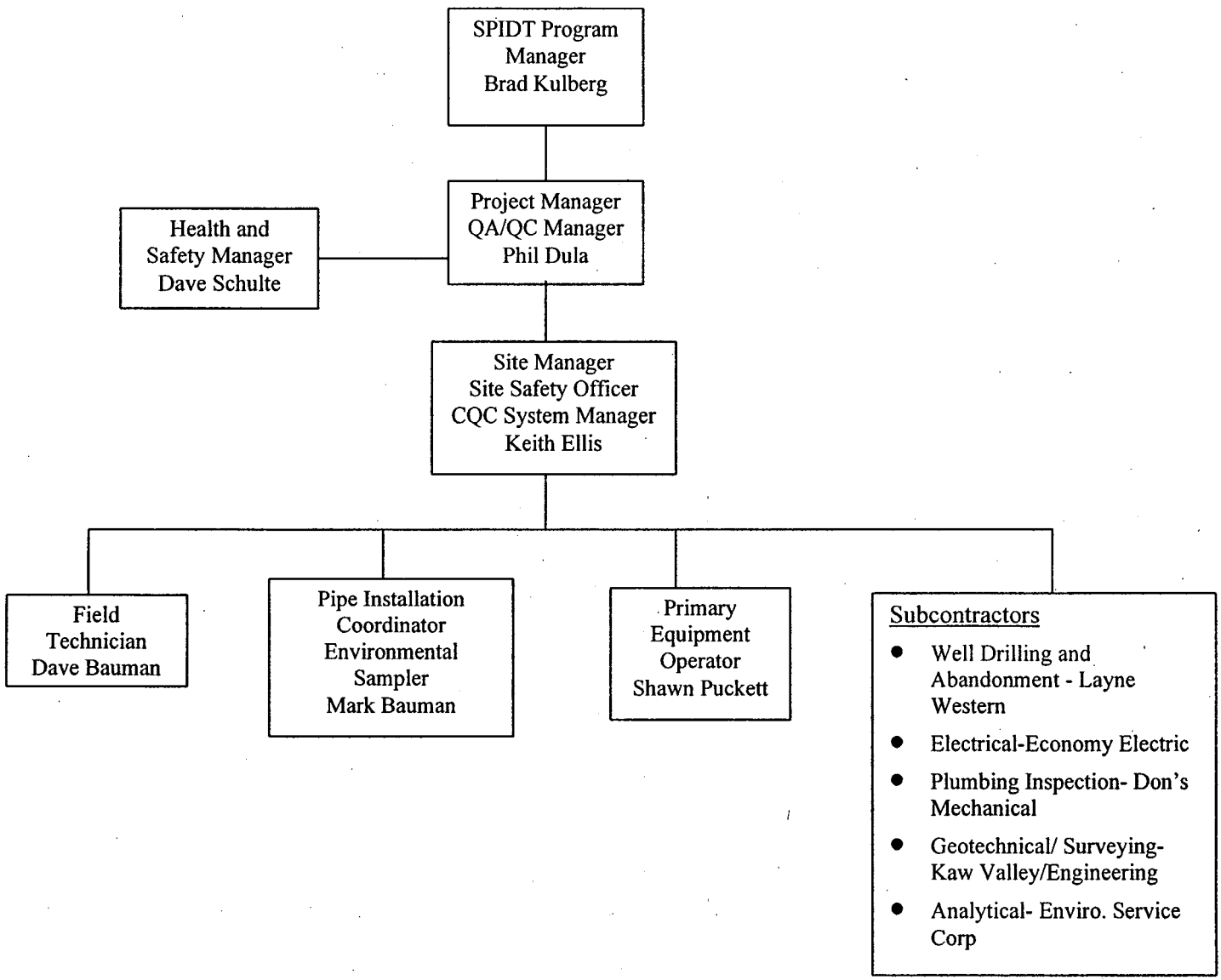
1202604-001

TABLE 1

KEY PROJECT PERSONNEL

TABLE 1- PROJECT STAFF

TITLE	NAME	PHONE #
SPIDT Contract Program Manager	Brad Kulberg	651-291-0456
Project Manager	Philip Dula	913-663-2915 (Cell) 913-205-5386
QA/QC Manager	Philip Dula	913-663-2915 (Cell) 913-205-5386
Safety Manager	Dave Schulte	651-291-0456
Site Manager	Keith Ellis	913-663-2915 (Cell) 913-205-5387
Site Safety Manager	Keith Ellis	913-663-2915 (Cell) 913-205-5387
Contract Compliance Control (CQC) System Manager	Keith Ellis	913-663-2915 (Cell) 913-205-5387
Primary Equipment Operator	Shawn Puckett	913-663-2915
Pipe Installation Coordinator	Mark Bauman	913-663-2915
Environmental Sampler	Mark Bauman	913-663-2915
Field Technician	Dave Bauman	913-663-2915



APPENDIX A

SCOPE OF WORK

SCOPE OF WORK

Provide Water Distribution System
Between Off-Post Supply Wells and Distribution Points
Former Fire Training Area at Marshall Army Airfield
Fort Riley, Kansas
Contract DACW41-95-D-0022

1. **Objective.** Bay West, Inc. will provide all services necessary to install two off-post water supply wells, distribution piping, and service connections to supply water to four distribution points.

2. **Scope.** General project requirements of this scope of work consist of providing services as necessary to perform the following activities: installation and testing of the domestic water supply wells, installation of distribution piping, installation of service connections, performance of required system testing, preparation of a final report, and restoration of site to previous conditions to include, but not limited to, grading, compaction, and seeding.

3. **Description of Work.** Bay West shall perform and assume all responsibility for the accuracy and completeness of the following work and services in accordance with criteria and instructions specified herein. In addition the following revisions have been incorporated into the scope of work and design of the alternate water supply.

   3.1 The Race Track well location as currently designed in the September 1998 design will be relocated to a point within 45 feet north of utility/electric pole # 6-36 SPPA 45/5-35 and approximately 135 feet southeast of well R-4. The new well will be installed to bedrock, screened in the bottom 30-40 feet depending on depth to bedrock and the vadose zone (water table). The pump will be located ten feet from the top of the bedrock.

   3.2 Electrical power for the race track replacement well as located/described in Section 3.1 will be obtained from the Flint Hills Rural Electric Cooperation. To provide the necessary power for the 15 HP, 3 phase, 480 V pump it will be necessary to install additional utility poles, heavier gauge electrical overhead line, and a larger capacity transformer to this location.

   A second option has been evaluated and included in the project cost estimate for the use of a diesel fuel powered generator to provide power to the Racetrack Replacement Well. This option is not part of the project SOW and if selected will be addressed per a contract modification.

   3.3 The re-designed distribution system will provide water service to the old house structure located approximately 150 feet northwest of the racetrack replacement well location, and a small concession stand and restroom area located in the pit

area, and a concession stand in the grandstand area. The existing line running from well R-1 to the grandstand will be capped and abandoned in place. It should be noted that the old house structure was identified as an additional concession stand by Mr. Thompson (property owner) during the December 17, 2001 site visit. The concession area had not been included in the previous design.

3.4 Five existing wells designated R-1, R-2, R-3, R-4,and M-1 shall be plugged and abandoned per State of Kansas well abandonment regulations. These regulations are included as Appendix 2 of this document. A concrete vault at R-4 shall be removed. The existing pumps and piping at well R-4 shall be removed, rinsed and stockpiled on site. An attempt shall be made to pull the existing casings at each well to be removed. If the casing cannot be pulled, it shall be cut 3' feet below ground surface and plugged with grout according to Kansas regulations. The removed casing shall be rinsed on site and properly disposed of. The decontamination process will involve cleaning with a non-phosphate detergent and triple rinsing the removed casing. All fluids used to decontaminate the casing will be contained in 55-gallon drums and appropriately labeled per USACE and Federal requirements. The containerized decontamination fluids and the casings from well R-1 and R-2, shall be disposed of at the Fort Riley Environmental Waste Management Center. The casings from wells R-3, R-4, and M-1 can be disposed of as normal waste. A sample of the decontamination fluids will be collected and submitted for VOC analysis per EPA Method 8260.

3.5 The new water line shall extend from the well along the crest of the slope formed by a former oxbow until it is due south of the point where the new standpipe shall be installed. At the point were the new water line transects the race track, it shall be jacked under the track.

3.6 A new 3" PVC standpipe with outlet height of 10' and a radius of 4' shall be constructed in line with the existing pit area concession stand. This standpipe will be utilized as a water truck fill station. This structure will replace the existing water truck fill station and will be located approximately 310 feet east of the Pit Area restrooms. The distribution system shall be designed to provide a 200-gpm capacity at the standpipe outlet. A new 10'x 20'x 6" concrete pad shall be installed centered at the standpipe at the west- end of the pad. A light fixture similar to existing exterior light fixtures at the racetrack shall be mounted on the standpipe pole and tied into the existing electrical distribution system. The property owner presently has planned to relocate the existing light poles, located along the inside of the track and shorten the track straight aways.

3.7 The existing water truck fill station located at the western loop of the track will be removed and the debris disposed as normal waste. The existing piping will be capped and abandoned in place.

3.8 A shelter shall be provided for a new 525-gallon capacity pressure tank that is to be located at the restroom facility in the pit area. The shelter will be installed on a 10'x 10'x 6"concrete pad. The shelter will have dimensions of 8'x 8'x8' with one access door. The shed supplied will be of pre-fabricated construction. The water distribution system shall be designed so that it can be winterized. At a minimum, a valve vault and drain back valves shall be installed at the truck fill standpipe, the old house and the manhole in the pit area. The pressure tank, well head, and associated piping shall be designed so they can be drained completely.

3.9 Bay West will install a replacement well for the existing well identified as M-1 that supplies water to a mobile home located on property adjacent to the Racetrack. The M-1 Replacement Well will be designed to provide a minimum of 10 GPM. The existing 30-gallon hydro pneumatic tank located in the machine shop adjacent to the trailer will be retained.

3.10 Bay West, Inc. shall propose a schedule to complete construction by August 1, 2002.

3.11 Bay West, Inc shall mobilize and perform fieldwork upon notification by the Contracting Officer.

4. Document Distribution

4.1 Pre-Final (95%) Design- Bay West, Inc. shall provide a 95% design submittal including revised plans and specifications and supporting design computations. These documents shall be distributed as indicated in the attached Document Distribution List.

4.2 Final (100%) Design- Bay West, Inc. shall incorporate all comments received from the government on the 95% design submittal. Bay West, Inc shall provide a 100% design submittal including revised plans and specifications and supporting design computations. These documents shall be distributed as indicated in the attached Document Distribution List.

Document Distribution List
Water Distribution and Well Installation
Fort Riley, Kansas

Addressee	Number of Copies (1) 95%	100%
Commander USACE, Kansas City District ATTN: CENWK-PM-ED (R. Van Saun) 601 East 12th Street Kansas City, Missouri 64106-2896	3	3
Fort Riley Area Office U.S. Army Corps of Engineers P.O. Box 2189 Fort Riley, Kansas 66442-6016	3	3
Directorate of Environmental & Safety ATTN: AFZN-ES-OM Building 407, Main Post Fort Riley, Kansas 66442-6016	3	3
Craig Bernstein, Remedial Project Manager U.S. Environmental Protection Agency, Region VII Removal Enforcement Section, Superfund Division Assessment & Restoration Section, Superfund Unit 901 North 5th Street Kansas City, Kansas 66101		2
Rob Weber Kansas Department of Health and Environment Bureau of Environmental Remediation 1000 Southwest Jackson Suite 410 Topeka, Kansas 66612-1367		2

4.3 Release of Information. Bay West shall not publicize, nor release in any manner, information or data in regard to projects on which they may be working or negotiating with this office, not discuss prior to public release by this office, a project, any future program, or any planning with anyone not directly concerned with the project. Any inquiries in regard to these matters shall be referred to the Contracting Officer or Kansas City District Technical Manager (CENWK-PE-EA).

4.4 Contractor Identification. While on the confines of Fort Riley, Kansas, (and associated off-post areas) all contractor and subcontractor personnel shall carry picture ID card with the persons name, and the name of the company he or she works for clearly visible. These ID cards shall be worn on the outside of the clothing over the right or left breast

pocket. (necklace type ID card holders may pose a safety risk to the wearer if machinery is being used.) Furthermore, all contractors and subcontractor owned or leased vehicles must be identified by signage, showing the name of the company that is actually accomplishing the field work. Temporary magnetic signs attached to the exterior of both the right and left side of the vehicle will suffice. The vehicle identification requirement extends to all vehicles, including automobiles leased for administrative purposes.

5. **Project Management.** Bay West shall assign a principal or key employee to serve as the Project Manager. The Project manager shall oversee the coordination of the entire project and shall be capable of administering all instructions from the Contracting Officer and octaining answers to all questions from the Technical Manager during and after the period of the contract. During the execution of the work under the contract, the Contractor shall keep close contacts with Technical Manager. All written and electronic documents shall be annotated and returned to the Technical Manager.

Person	**Representing**
Richard Shields or Oral Saulters	Fort Riley Directorate of Environmental & Safety
Rick Van Saun	Project Manager/Technical Manager, USACE
Trudy Shannon	Contracting Officer's Representative

6. **Report**. Bay West will submit a Work Plan per section 1.3.2.1 of Specifications Section 02521 Water Well Construction of this submittal. The Work Plan will be submitted within 1 week of notice to proceed. A Project Health & Safety Plan per USACE requirements will be submitted at this time as well. Bay West, Inc shall prepare and submit a project report within four weeks of the completion of all field activities. The report shall be submitted in two iterations (Draft and Final) and shall be submitted in nine copies for the Draft and thirteen copies for the final PLANS AND DETAIL DRAWINGS

7. **Special Requirements**.

   7.1 **Coordination and Notification Requirements**. Bay West, Inc is responsible to coordinate all logistical details of each stage of the work. Bay West, Inc shall notify the Corps and Fort Riley two (2) weeks prior to commencing fieldwork. In addition, the A-E shall notify the Fort Riley and the Contracting Officers Representative (COR) the day of arrival on site.

During the work, Bay West, Inc will immediately notify the Corps of and significant events that occur. Bay West, Inc will subsequently furnish a written record to describe the events and the proposed or completed resolution actions that were taken.

APPENDIX B

RESUMES KEY PERSONNEL

Bradley Kulberg

SPIDT Program Manager

Mr. Kulberg is a project manager for Bay West's Remediation services. His responsibilities include cost estimating, remedial project management, and proposal preparation. He coordinates field activities and personnel for hazardous waste remediation projects, UST removals and installations, and construction site activities, and supervises cost estimating for remediation projects. His 12 years of environmental experience include both project management and field work, and specific experience in proposal development. His key experience includes the following:

Statistics

Years Experience: 12
Education: BS, Electrical Engineering
Certifications:
- 40-hour OSHA-trained for hazardous waste site and emergency response work
- 8-hour OSHA-trained to supervise personnel at hazardous waste sites
- Certified UST Contractor, MN

- **PCB Excavation/Disposal, Brooklyn Park Dump Superfund Site, Minnesota, and Continental Steel Superfund Site, Kokomo, Indiana, Maecorp, 1987.** Mr. Kulberg was an on-site waste disposal coordinator at these sites. Maecorp was the prime contractor working under the EPA Region V ERCS contract. Duties included scheduling and tracking transportation and disposal services for over 1,200 tons of bulk PCB-contaminated soil from each site. The Kokomo site involved transportation via railroad gondola cars. Qualified to supervise personnel at hazardous waste sites according to OSHA 1910.120 *Management and Supervisor Training.*

- **Small Project Indefinite Delivery Type (SPIDT) Contract for Environmental Services, U.S. Army Corps of Engineers, Kansas City District, 1995-98.** Mr. Kulberg serves as Project Manager for various delivery orders (DOs) under this multi-DO contract. DOs completed to date have included waste characterization, consolidation, and containerization; excavation and debris disposal; stream bank stabilization; AST upgrades; soil vapor surveys; and transformer removal.

- **Landfill Excavation, Fort Snelling National Cemetery, Minnesota, U.S. Army Corps of Engineers, St. Paul District, 1995.** Mr. Kulberg prepared the proposal and cost estimate for this project, and served as project manager during its execution. This project involved the remediation of a landfill which contained hazardous waste. Approximately 13,000 cubic yards of material were excavated. Mr. Kulberg also submitted a value engineering proposal which saved the customer $7,000 on the total cost of the project.

- **Bioremediation, Duluth International Airport, Minnesota, EETCO for the Minnesota Air National Guard, 1995.** Mr. Kulberg prepared the cost estimate for this project which included the design of a ground water treatment and soil remediation system; Bay West provided these systems as well as a bioremediation system.

- **Drum Location/Identification, Lemberger Superfund Site, Whitelawn, Wisconsin, Confidential PRP Group, 1989.** As project manager for this site, Mr. Kulberg was involved from the proposal, startup, and initial remediation phases of this project, which included the location and identification of 1,300 buried drums and compressed gas cylinders.

- **Drum Excavation, Willow Drum Superfund Site, Detroit, Michigan, Confidential PRP Group, 1988.** Mr. Kulberg served as project manager at this site, where 2,000 drums of flammable hazardous waste and 7,000 gallons of bulk flammable, chlorinated sludge were present. All waste streams were characterized, transported, and disposed of in less than 60 days after mobilization.

PHILIP DULA, CPG, CHMM
Kansas City Office Manager
Project Manager

Education/Dates:
- MBA/1999
- MS Geology/1982
- BA Biology/1977

Special Qualifications/Training/Registrations:
- Certified Professional Geologist (CPG), MO, AR
- Certified Hazardous Materials Manager (CHMM)
- 40-Hour OSHA Training
- 8-Hour OSHA Supervisor Training

Years Experience: 20
Location: Lenexa, KS

Mr. Dula has 20 years experience in environmental investigation and remediation. His technical expertise is in the initial evaluation of site environmental problems and the development and implementation of cost-effective methods of remediation. Through his experience, he has overseen the completion and/or implementation of more than $20M of environmental services under both cost reimbursable and firm fixed price contracts. He has managed programs and projects for the USACE and US EPA Regions VI and VII, including an ARCS contract. He has completed environmental projects in 12 states throughout the Midwest, Southeast, and Northeast. He is knowledgeable in Federal, State, and/or local laws, regulations, and guidance documents, including US EPA, DOT, OSHA regulations.

In addition to his environmental consulting career experience Mr. Dula spent 5 –years with the Pennzoil Exploration Company as an Exploration Geologist and Geophysicist.

PROJECT EXPERIENCE:

- *Tank Demolition, Former Olathe Naval Air Station, USACE Kansas City District, Gardner, KS.* Mr. Dula managed the demolition of two 250,000-gallon, reinforced concrete, aircraft fuel underground storage tanks from this site.

- *UST Removal Contract, USACE - Kansas City District, KS, MO, NE, IA*. Mr. Dula managed UST removals and closures at several sites throughout the 4-state area. The largest project, which took place at Forbes Field, Topeka, KS, involved removing 54 fuel oil tanks. Other sites included minuteman missile sites. Work also included building demolition and abatement of asbestos associated with older boilers.

  - *Environmental SPIDT Contract, USACE - Kansas City District, Various Sites, NE, IA, MO, KS*. Mr. Dula serves as Program Manager for various task orders (TOs) under this multi-TO contract. Bay West was awarded this contract in 1995, and has performed 18 TOs to date, including excavation and debris disposal; stream bank stabilization; AST upgrades; soil vapor surveys; UST removals, and PCB transformer removal.

- *ARCS Contract Site Assessment, US EPA Region VII*. As project manager, Mr. Dula directed completion of 60 preliminary assessments, 28 RCRA facility assessments, 42 site investigations, 45 site inspection prioritization's, and 5 fully documented HRS packages. He directed a pilot study to implement SACM principles on 4 inactive lead-mining sites.

- Tinker AFB, Oklahoma City, OK, Tank Removals. As Program Manager Mr. Dula directed the removal of 4 chemical tanks each with a capacity of 80 cubic yards. These tanks contained alum, lime, and urea that were formerly used in the facility's industrial wastewater treatment plant (IWWTP). Bay West emptied and decontaminated the tanks and then dismantled the tanks for disposal to a steel recycler. The tanks were located on the second floor of the IWWTP building and therefore their removal required Bay West to perform structural improvements to ensure the building's structural integrity was maintained. Bay West also removed 400 linear feet of associated piping, and coordinated disposal of the tanks, piping, chemicals, and rinsate waters. Bay West received a contract modification/change order to remove an additional 60 cubic yard AST containing soda ash at the IWWTP. Bay West utilized a crane to lift and lower the tank after emptying and decontaminating the AST.

KEITH ELLIS
Site Supervisor/SSHO

Education/Dates:

Special Qualifications/Training/Registrations:

- 40-Hour OSHA Training
- 8-Hour OSHA Supervisor Training
- 8-Hour OSHA Train-the-Trainer for hazardous waste site training
- OSHA Excavation & Trenching Training
- Confined Space Entry
- Asbestos Inspector Training (AHERA Regulations, TSCA Title II and the State of Missouri)
- Hazard Awareness and Remediation Class, Weapons of Mass Destruction
- U.S. Army Corps of Engineers Construction Quality Management for Contractors
- Licensed to Remove, Install & Test Underground Storage Tanks in Kansas.

Years Experience: 24
Location: Lenexa, KS

Mr. Ellis has 22 years industrial experience and 13 years environmental experience serving as site supervisor, field technician, and equipment operator. He is trained to operate heavy equipment including backhoes, trackhoes, loaders, and dozers. He has participated in sampling programs for water and sludge from surface impoundments, subsurface soils, surface water and ground water. His background includes working as industrial hygiene technician at Tinker Air Force Base, Oklahoma City, serving as a health and safety/remediation technician for Foster Wheeler Environmental Services, and working as both a commercial driver and aviation structural mechanic.

PROJECT EXPERIENCE:

- *Health & Safety/Engineering Oversight, St. Louis Airport (SLAP) FUSRAP Site, MO* - Mr. Ellis was Bay West's site safety & health officer at the SLAP project site. Work involved the cleanup of a FUSRAP/Superfund site. Mr. Ellis performed hazard evaluation and monitoring, tailgate safety meetings and coordination with the safety & health manager. This project is under Bay West's TERC with Stone & Webster and the Omaha District.

- *Health & Safety Officer, Badger Army Ammunition Plant, Baraboo, WI* - Mr. Ellis was Bay West's site safety & health officer at the project site. Work involved the dredging of a grovers bay site. Mr. Ellis performed hazard evaluation and monitoring, tailgate safety meetings and coordination with the safety & health manager. This project is under Bay West's TERC with Stone & Webster and the Omaha District.

- *Process Assessment Program, Tinker Air Force Base, OK.* Mr. Ellis served as industrial hygiene technician, conducting surveys and interviewing base personnel for information related to confined-space evaluations, chemical inventories, heat/cold stress, radio frequency emitters, microwaves, radioactive sources, respiratory protection, and safe work areas. Data entry is performed and a report is generated with a cost estimate for future IH evaluations.

- *Health & Safety Oversight/Equipment Operation, Various Sites.* Mr. Ellis performed health and safety services for various companies, utilizing his health and safety expertise. He was responsible for monitoring, sampling, and documentation of soils, water, and excavated materials. Mr. Ellis monitored the excavation of soils using backhoes, trackhoes, and track loader for health and safety compliance. He was responsible for collection of ground water data for RCRA quarterly sampling events; surface and subsurface soil investigations; geological logging of ground water monitoring well installation; slug testing, and documentation of these activities. Mr. Ellis also conducted monitoring for the presence of toxic substances using photoionizer detector and LEL/Oxygen monitor.

- *Drum Investigation, US Naval Air Station, Bermuda.* Mr. Ellis was responsible for identification and packaging of unknown hazardous waste. Drums and the surrounding area were monitored utilizing the photoionizer detector, LEL/Oxygen meter and rad meter.

- *Site Remediation, Municipal Property, Raytown, MO.* Mr. Ellis performed backhoe trenching and monitoring excavated drums with a photoionization

detector and SENSIDYNE-HAZCAT KIT for chemical identification at this site. He also collected soil and water samples during the site characterization visit. Looking for buried transformers. . .

- *Amoco GW Sampling, Sugar Creek, MO, slug testing, to ID contaminated plume, site investigation. . . field tech. . .*

- *Lead Abatement, National Guard Firing Ranges, MO & IA* – Mr. Ellis served as SSHO for the decontamination three fire ranges contaminated with lead. He monitored the lead decontamination activities, including the health & safety of the subcontractor, ensured the filtration systems were working properly, and coordinated proper waste disposal.

- *Radiological Site Remediation, St. Louis Airport (SLAP) FUSRAP Site, MO* - Mr. Ellis performed SSHO activities related to the cleanup of radiological-contaminated soil. He performed hazard evaluation and monitoring, tailgate safety meetings, inspection & maintenance of respirators and other safety equipment, and coordination with the safety & health manager. He also assisted in the preparation of a site drug & alcohol policy.

- *Lead-Contaminated Soil Cleanup, Bureau of Mines, MO* – Mr. Ellis performed SSHO activities related to the excavation of 500 cy of lead-contaminated soil.

- *Drum Investigation, US Naval Air Station, Bermuda.* Mr. Ellis was responsible for identification and packaging of unknown hazardous waste. Drums and the surrounding area were monitored utilizing the photoionizer detector, LEL/Oxygen meter and rad meter.

- *Site Remediation, Raytown, MO.* Mr. Ellis performed backhoe trenching and monitoring excavated drums with a photoionization detector and SENSIDYNE-HAZCAT KIT for chemical identification at this site. He also collected soil and water samples during the site characterization visit. Looking for buried transformers. . .

- *Process Assessment Program, Tinker Air Force Base, OK.* Mr. Ellis served as industrial hygiene technician, conducting surveys and interviewing base personnel for information related to confined-space evaluations, chemical inventories, heat/cold stress, radio frequency emitters, microwaves, radioactive sources, respiratory protection, and safe work areas. Data entry is performed and a report is generated with a cost estimate for future IH evaluations.

- *Site Remediation, USACE Kansas City District, Rolla University, MO.* Mr. Ellis served as environmental technician during the excavation of approximately 500 cubic yards of lead-contaminated soil at a former foundry/research site. He performed sampling and equipment operation. This project was performed for the U.S. Army Corps of Engineers, Kansas City District, under Bay West's Small Project Indefinite Delivery Type (SPIDT) contract.

APPENDIX C

STATE OF KANSAS WELL INSTALLATION AND WELL ABANDONMENT REQUIREMENTS

STATE OF KANSAS
DEPARTMENT OF HEALTH & ENVIROMENT

ARTICLE 30
WATER WELL CONTRACTOR'S LICENSE
WATER WELL CONSTRUCTION
AND ABANDONMENT

28-30

Kansas Administrative Regulations
Kansas Department of Health and Environment

Notice to Reader

The following regulations represent an electronic facsimile of Kansas Administrative Regulations, promulgated by the Kansas Department of Health and Environment and published by the Kansas Secretary of State. While every effort has been made to assure the accuracy, these electronic copies do not represent the official regulations of the state. The official regulations are the bound copies printed by the Secretary of State.

Where possible KDHE will append changed regulations to the appropriate article. Once again, the lack of any attachments should not be construed as meaning there are no revisions.

Nothing contained herein should be construed as legal advice by KDHE. If you are not an attorney, you should secure competent counsel to interpret the regulations and advise you.

Office of Public Information
Kansas Department of Health & Environment

Notes

The *Kansas Register* notes the following changes:

ment system, or the function of the monitoring systems unless necessary to comply with the requirements in this regulation.

(ii) If the owner or operator demonstrates that disturbance of the final cover, liner or other component of the containment system, including any removal of waste, will not increase the potential threat to human health or the environment, the disturbance may be approved by the director.

(4) The owner or operator shall prepare a post-closure plan not later than the effective date of this regulation, or by the initial receipt of waste, whichever is later, and submit it to the director.

(5) Following completion of the post-closure care period for each MSWLF unit, the owner or operator shall submit a certification to the director. The certification shall be signed by an independent registered professional engineer, or approved by the director, and must verify that post-closure care has been completed in accordance with the post-closure plan. (Authorized by K.S.A. 1993 Supp. 65-3406; implementing K.S.A. 65-3401; effective Oct. 24, 1994.)

Article 30.—WATER WELL CONTRACTOR'S LICENSE; WATER WELL CONSTRUCTION AND ABANDONMENT

28-30-1. (Authorized by K.S.A. 1979 Supp. 82a-1202, 82a-1205; effective, E-74-34, July 2, 1974; modified, L. 1975, ch. 481, May 1, 1975; revoked May 1, 1980.)

28-30-2. Definitions. (a) "License" means a document issued by the Kansas department of health and environment to qualified persons making application therefore, authorizing such persons to engage in the business of water well contracting.

(b) "Department" means the Kansas department of health and environment.

(c) "Abandoned water well" means a water well determined by the department to be a well:

(1) whose use has been permanently discontinued;

(2) in which pumping equipment has been permanently removed;

(3) which is either in such a state of disrepair that it cannot be used to supply water, or has the potential for transmitting surface contaminants into the aquifer, or both;

(4) which poses potential health and safety hazards; or

(5) which is in such a condition that it cannot be placed in active or inactive status.

(d) "Water well contractor" or "contractor" means any individual, firm, partnership, association, or corporation who constructs, reconstructs, or treats a water well. The term shall not include:

(1) an individual constructing, reconstructing or treating a water well located on land owned by the individual, when the well is used by the individual for farming, ranching, or agricultural purposes or for domestic purposes at the individual's place of abode; or

(2) an individual who performs labor or services for a licensed water well contractor at the contractor's direction and under the contractor's supervision.

(e) "Aquifer" means an underground formation that contains and is capable of transmitting groundwater.

(f) "Confined aquifer" is an aquifer overlain and underlain by impermeable layers. Groundwater in a confined aquifer is under pressure greater than atmospheric pressure and will rise in a well above the point at which it is first encountered.

(g) "Unconfined aquifer" is an aquifer containing groundwater at atmospheric pressure. The upper surface of the groundwater in an unconfined aquifer is the water table.

(h) "Domestic uses" means the use of water by any person or family unit or household for household purposes, or for the watering of livestock, poultry, farm and domestic animals used in operating a farm, or for the irrigation of lands not exceeding a total of two acres in area for the growing of gardens, orchards and lawns.

(i) "Public water-supply well" means a well that:

(1) provides groundwater to the public for human consumption; and

(2) has at least 10 service connections or serves an average of at least 25 individuals daily at least 60 days out of the year.

(j) "Groundwater" means the part of the subsurface water which is in the zone of saturation.

(k) "Grout" means cement grout, neat cement grout, bentonite clay grout or other material approved by the department used to create a permanent impervious watertight bond between the casing and the undisturbed formation surround-

ing the casing or between two or more strings of casing.

(1) "Neat cement grout" means a mixture consisting of one 94 pound bag of portland cement to five to six gallons of clean water.

(2) "Cement grout" means a mixture consisting of one 94 pound bag of portland cement to an equal volume of sand having a diameter no larger than 0.080 inches (2 millimeters) to five to six gallons of clean water.

(3) "Bentonite clay grout" means a mixture consisting of water and commercial grouting or plugging sodium bentonite clay containing high solids such as that manufactured under the trade name of "volclay grout," or an equivalent as approved by the department.

(A) The mixture shall be as per the manufacturer's recommendations to achieve a weight of not less than 9.4 pounds per gallon of mix. Weighting agents may be added as per the manufacturer's recommendations.

(B) Sodium bentonite pellets, tablets or granular sodium bentonite may also be used if they meet the specifications listed in paragraph (k)(3) of this regulation.

(C) Sodium bentonite products that contain low solids, are designed for drilling purposes, or that contain organic polymers shall not be used.

(l) "Pitless well adapter or unit" means an assembly of parts installed below the frost line which will permit pumped groundwater to pass through the wall of the casing or extension thereof and prevent entrance of contaminants.

(m) "Test hole" or "hole" means any excavation constructed for the purpose of determining the geologic, hydrologic and water quality characteristics of underground formations.

(n) "Static water level" means the highest point below or above ground level which the groundwater in the well reaches naturally.

(o) "Annular space" means the space between the well casing and the well bore or the space between two or more strings of well casing.

(p) "Sanitary well seal" is a manufactured seal installed at the top of the well casing which, when installed, creates an airtight and watertight seal to prevent contaminated or polluted water from gaining access to the groundwater supply.

(q) "Treatment" means the stimulation of production of groundwater from a water well, through the use of hydrochloric acid, muriatic acid, sulfamic acid, calcium or sodium hypochlorite, polyphosphates or other chemicals and mechanical means, for the purpose of reducing or removing iron and manganese hydroxide and oxide deposits, calcium and magnesium carbonate deposits and slime deposits associated with iron or manganese bacterial growths which inhibit the movement of groundwater into the well.

(r) "Reconstructed water well" means an existing well that has been deepened or has had the casing replaced, repaired, added to or modified in any way for the purpose of obtaining groundwater.

(s) "Pump pit" means a watertight structure which:

(1) is constructed at least two feet away from the water well and below ground level to prevent freezing of pumped groundwater; and

(2) houses the pump or pressure tank, distribution lines, electrical controls, or other appurtenances.

(t) "Grout tremie pipe" or "grout pipe" means a steel or galvanized steel pipe or similar pipe having equivalent structural soundness that is used to pump grout to a point of selected emplacement during the grouting of a well casing or plugging of an abandoned well or test hole.

(u) "Uncased test hole" means any test hole in which casing has been removed or in which casing has not been installed.

(v) "Drilling rig registration license number" means a number assigned by the department which is affixed to each drilling rig operated by or for a licensed water well contractor.

(w) "Active well" means a water well which is an operating well used to withdraw water, or to monitor or observe groundwater conditions.

(x) "Inactive status" means a water well which is not presently operating but is maintained in such a way that it can be put back in operation with a minimum of effort.

(y) "Heat pump hole" means a hole drilled to install piping for an earth coupled water source heat pump system, also known as a vertical closed loop system. (Authorized by K.S.A. 1992 Supp. 82a-1205 and implementing K.S.A. 82a-1202, K.S.A. 1992 Supp. 82a-1205, 82a-1213; effective, E-74-34, July 2, 1974; modified, L. 1975, ch. 481, May 1, 1975; amended May 1, 1980; amended May 1, 1987; amended Nov. 22, 1993.)

28-30-3. Licensing. (a) Eligibility. To be eligible for a water well contractor's license an applicant shall:

(1) pass an examination conducted by the department; or

(2) meet the conditions contained in subsection (c).

(b) Application and fees.

(1) Each application shall be accompanied by an application fee of $10.00.

(2) Before issuance of a water well contractor's license, each contractor shall pay a license fee of $100.00 plus $25.00 for each drill rig operated by or for the contractor. These fees shall accompany the application and shall be by bank draft, check or money order payable to the Kansas department of health and environment—water well licensure.

(c) Reciprocity.

(1) Upon receipt of an application and payment of the required fees from a nonresident, the secretary may issue a license, providing the nonresident holds a valid license from another state and meets the minimum requirements for licensing as prescribed in K.S.A. 82a-1207, and any amendments thereto.

(2) If the nonresident applicant is incorporated, evidence shall be submitted to the department of health and environment showing that the applicant meets the registration requirements of the Kansas secretary of state.

(3) Nonresident fees for a license shall be equal to the fee charged a Kansas contractor by the applicant's state of residence but shall not be less than $100.00. The application fee and drill rig license fee shall be the same as the Kansas resident fees.

(d) License renewal.

(1) Each licensee shall make application for renewal of license and rig registrations before July 1 of each year by filing the proper renewal forms provided by the department and fulfilling the following requirements:

(A) payment of the annual license fee and a rig registration fee for each drill rig to be operated in the state;

(B) filing of all well records for each water well constructed, reconstructed or plugged by the licensee in accordance with K.S.A. 28-30-4 during the previous licensure period;

(C) filing a report, on a form provided by the department, of all approved continuing education units earned by the licensee during the previous licensure period;

(D) satisfying the continuing education requirements set forth in subsection (g); and

(E) providing any remaining outstanding information or records requested that existed prior to the issuance of revocation of a license.

(2) Failure to comply with paragraphs (A), (B), (C), (D) and (E) above shall be grounds to revoke the existing license and terminate the license renewal process.

(e) Water well construction fee. A fee of $5.00 shall be paid to the Kansas department of health and environment, either by bank draft, check or money order, for each water well constructed by a licensed water well contractor. The construction fee shall be paid when the contractor requests the water well record form WWC-5 from the department, or shall accompany the water well records submitted on form WWC-5 as required under K.A.R. 28-30-4. No fee shall be required for reconstructed or plugged water wells.

(f) License number. Each drill rig operated by or for a licensed water well contractor shall have prominently displayed thereon the drill rig license number, as assigned by the department, in letters at least two inches in height. Decals, paint, or other permanent marking materials shall be used.

(g) Continuing education requirements. Licensed water well contractors shall earn at least eight units of approved continuing education per year beginning with the first full year of licensure or the renewal period. One unit of continuing education shall equal 50 minutes of approved instruction except for trade shows and exhibitions which shall be counted as one unit per approved trade show and exhibition attended. (Authorized by K.S.A. 1992 Supp. 82a-1205; implementing K.S.A. 82a-1202, K.S.A. 1992 Supp. 82a-1205, 82a-1206, 82a-1207, 82a-1209; effective, E-74-34, July 2, 1974; effective May 1, 1975; amended May 1, 1980; amended May 1, 1983; amended May 1, 1987; amended Nov. 22, 1993.)

28-30-4. General operating requirements. (a) *Water well record.* Within 30 days after construction or reconstruction of a water well, the water well contractor shall submit a report of such work, to the Kansas department of health and environment and to the landowner, on the water well record form, form WWC-5, provided by the department. The contractor shall report to the department and to the landowner on the water well record or attachments made thereto any polluted or other noncompliant conditions which the contractor was able to correct and any conditions which the contractor was unable to correct. The contractor shall report to the department and the landowner the plugging of any abandoned water well. The report shall in-

clude the location, landowner's name, method, type of plug material, its placement and amount used to plug the abandoned water well.

A landowner who constructs, reconstructs, or plugs a water well, which will be or was, used by the landowner for farming, ranching or agricultural purposes or is located at the landowner's place of abode, shall submit a water well record, on form WWC-5, of such work to the department within 30 days after the construction, reconstruction or plugging of the water well. No fee shall be required from the landowner for the record.

(b) *Artificial recharge and return.* The construction of artificial recharge wells and freshwater return wells shall comply with all applicable rules and regulations of the department.

(c) *Well tests.* When a pumping test is run on a well, results of the test shall be reported on the water well record, form WWC-5, or a copy of the contractor's record of the pumping test shall be attached to the water well record.

(d) *Water samples.* Within 30 days after receipt of the water well record, form WWC-5, the department may request the contractor, or landowner who constructs or reconstructs his or her own water well, to submit a sample of water from the well for chemical analysis. Insofar as is possible, the department will define in advance areas from which well water samples are required. (Authorized by K.S.A. 82a-1205 and implementing K.S.A. 82a-1202, 82a-1205, 82a-1212, 82a-1213; effective, E-74-34, July 2, 1974; modified, L. 1975, ch. 481, May 1, 1975; amended May 1, 1980; amended May 1, 1987.)

28-30-5. Construction regulations for public water supply and reservoir sanitation zone wells. All activities involving public water supply wells and wells located in reservoir sanitation zones shall conform to existing statutes, and rules and regulations, of the Kansas department of health and environment, including K.A.R. 28-10-100, 28-10-101, and 28-15-16. (Authorized by K.S.A. 82a-1205; implementing K.S.A. 82a-1202, 82a-1205; effective, E-74-34, July 2, 1974; effective May 1, 1975; amended May 1, 1980; amended May 1, 1983; amended May 1, 1987.)

28-30-6. Construction regulations for all wells not included under section 28-30-5. (a) Each water well shall be so located as to minimize the potential for contamination of the delivered or obtained groundwater and to protect groundwater aquifers from pollution and contamination.

(b) Grouting.

(1) Constructed or reconstructed wells shall be sealed by grouting the annular space between the casing and the well bore from ground level to a minimum of 20 feet or to a minimum of five feet into the first clay or shale layer if one is present, whichever is greater. If a pitless well adapter or unit is being installed, the grouting shall start below the point at which the pitless well adapter or unit attaches to the well casing and shall continue a minimum of 20 feet below this point, or to a minimum of five feet into the first clay or shale layer, whichever is greater.

(2) To facilitate grouting, the grouted interval of the well bore shall be drilled to a minimum diameter at least three inches greater than the maximum outside diameter of the well casing. If a pitless well adapter or unit is being installed on the well's casing, the well bore shall be a minimum diameter of at least three inches greater than the outside maximum diameter of the well casing through the grouted interval below the point where the pitless well adapter or unit attaches to the well casing.

(c) If groundwater is encountered at a depth less than the minimum grouting requirement, the grouting requirement may be modified to meet local conditions if approved by the department.

(d) Waters from two or more separate aquifers shall be separated from each other in the bore hole by sealing the bore hole between the aquifers with grout.

(e) The well casing shall terminate not less than one foot above the finished ground surface. No casing shall be cut off below the ground surface except to install a pitless well adapter unit, which shall extend at least 12 inches above the ground surface. No opening shall be made through the well casing except for the installation of a pitless well adapter designed and fabricated to prevent soil, subsurface and surface water from entering the well.

(f) Well vents shall be used and shall terminate not less than one foot above the ground surface and shall be screened with brass, bronze, copper screen or other screen materials approved by the department which are 16-mesh or greater and turned down in a full 180 degree return bend so as to prevent the entrance of contaminating materials.

(g) Prior to completion of a constructed or reconstructed well, the well shall be cleaned of mud, drill cuttings and other foreign matter so as to make it suitable for pump installations.

(h) Casing. All wells shall have durable watertight casing from at least one foot above the finished ground surface to the top of the producing zone of the aquifer. The watertight casing shall extend not less than 20 feet below the ground level. Exceptions to either of the above requirements may be granted by the department if warranted by local conditions. The casing shall be clean and serviceable and of a type to guarantee reasonable life so as to insure adequate protection to the aquifer or aquifers supplying the groundwaters. Used, reclaimed, rejected, or contaminated pipe shall not be used for casing any well. All water well casing shall be approved by the department.

(i) All wells, when unattached during construction, reconstruction, treatment or repair, or during use as cased test holes, observation or monitoring wells, shall have the top of the well casing securely capped in a watertight manner to prevent contaminating or polluting materials from gaining access to the groundwater aquifer.

(j) During construction, reconstruction, treatment or repair and prior to its first use, all wells producing water for human consumption or food processing shall be disinfected according to K.A.R. 28-30-10.

(k) The top of the well casing shall be sealed by installing a sanitary well seal.

(l) All groundwater producing zones that are known or suspected to contain natural or man-made pollutants shall be adequately cased and grouted off during construction of the well to prevent the movement of polluted groundwater to either overlying or underlying fresh groundwater zones.

(m) Toxic materials shall not be used in the construction, reconstruction, treatment or plugging of a water well unless those materials are thoroughly flushed from the well prior to use.

(n) Any pump pit shall be constructed at least two feet away from the water well. The pipe from the pump or pressure tank in the pump pit to the water well shall be sealed in a watertight manner where it passes through the wall of the pump pit.

(o) Water wells shall not be constructed in pits, basements, garages or crawl spaces. Existing water wells which are reconstructed, abandoned and plugged in basements shall conform to these rules and regulations except that the finished grade of the basement floor shall be considered ground level.

(p) All drilling waters used during the construction or reconstruction of any water well shall be initially disinfected by mixing with the water enough sodium hypochlorite to produce at least 100 milligrams per liter, mg/l, of available chlorine.

(q) Natural organic or nutrient producing material shall not be used during the construction, reconstruction, or treatment of a well unless it is thoroughly flushed from the well and the groundwater aquifer or aquifers before the well is completed. Natural organic or nutrient producing material shall not be added to a grout mix used to grout the well's annular space.

(r) Pump mounting.

(1) All pumps installed directly over the well casing shall be so installed that an airtight and watertight seal is made between the top of the well casing and the gear or pump head, pump foundation or pump stand.

(2) When the pump is not mounted directly over the well casing and the pump column pipe or pump suction pipe emerges from the top of the well casing, a sanitary well seal shall be installed between the pump column pipe or pump suction pipe and the well casing. An airtight and watertight seal shall be provided for the cable conduit when submersible pumps are used.

(s) Construction of sand point or well point water wells. Sand point or well point water wells shall be constructed by drilling or boring a pilot hole to a minimum depth of three feet below ground surface. The pilot hole shall be a minimum of three inches greater in diameter than the drive pipe or blank casing if the casing method is used. Sand point wells shall only be completed by using the casing method or the drive pipe method as described in paragraphs (1) and (2) below or other methods as described in paragraph (3) below. Sand point wells constructed prior to the effective date of this regulation shall not be required to meet these requirements. All sand point wells that are replaced, constructed, reconstructed or plugged after the effective date of this regulation shall meet these regulations.

(1) Casing method. Approved, durable, watertight well casing shall be set from a minimum of three feet below the ground surface to at least one foot above the ground surface. The casing shall be sealed between the casing and the pilot hole with

approved grouting material from the bottom of the casing to ground surface. The drive pipe shall be considered the pump drop pipe. For underground discharge completions, a "T" joint shall be used. The drive pipe shall be capped with a solid cap at the "T" joint when the casing method is used. An approved sanitary well seal and a well vent shall be installed on the top of the well casing in accordance with K.A.R. 28-30-6 (f) and (k).

(2) Drive pipe method. Sand point wells may be installed without a casing for above ground discharge completions only. In such completions, the drive pipe shall terminate at least one foot above finished ground level. The annular space between the drive pipe and the pilot hole shall be sealed with approved grouting material from the bottom of the pilot hole to ground surface. The top of the drive pipe shall be sealed airtight and watertight with a solid cap of the same material as the drive pipe. A well vent shall not be required for the drive pipe method.

(3) Other methods. Other methods may be specfically approved by the department on a case-by-case basis by using the appeal procedure included in K.A.R. 28-30-9.

(4) Abandonment of sand point wells. Upon abandonment of a sand point well, the contractor or landowner shall either pull the drive pipe or leave it in place. If the drive pipe is left in place, the sand point well shall be plugged from the bottom of the well to three feet below the ground surface with approved grouting material. The drive pipe well shall be cut off three feet below the ground surface and the remaining three foot deep hole shall be backfilled with surface soil.

If the drive pipe is completely pulled, the remaining hole shall be plugged with approved grouting material from the bottom of the remaining hole to three feet below the ground surface. The hole shall be backfilled with surface soil from 3 feet to ground surface. (Authorized by K.S.A. 1991 Supp. 82a-1205; implementing K.S.A. 82a-1202, K.S.A. 1991 Supp. 82a-1205; effective, E-74-34, July 2, 1974; modified, L. 1975, ch. 481, May 1, 1975; amended May 1, 1980; amended May 1, 1983; amended May 1, 1987; amended June 21, 1993.)

28-30-7. Plugging of abandoned wells, cased and uncased test holes. (a) All water wells abandoned by the landowner on or after July 1, 1979, and all water wells that were abandoned prior to July 1, 1979 which pose a threat to groundwater supplies, shall be plugged or caused to be plugged by the landowner. In all cases, the landowner shall perform the following as minimum requirements for plugging abandoned wells.

(1) The casing shall be cut off three feet below ground surface and removed.

(2) All wells shall be plugged from bottom to top using volumes of material equaling at least the inside volume of the well.

(3) Plugging top of well:

(A) For cased wells a grout plug shall be placed from six to three feet below ground surface.

(B) For dug wells, the lining material shall be removed to at least five feet below ground surface, and then sealed at five feet with a minimum of six inches of concrete or other materials approved by the department. Compacted surface silts and clays shall be placed over the concrete seal to ground surface.

(4) Any groundwater displaced upward inside the well casing during the plugging operation shall be removed before additional plugging materials are added.

(5) From three feet below ground level to ground level, the plugged well shall be covered over with compacted surface silts or clays.

(6) Compacted clays or grout shall be used to plug all wells from the static water level to six feet below surface.

(7) All sand and gravel used in plugging abandoned domestic or public water supply wells shall be chlorinated prior to placement into a well.

(b) Abandoned wells formerly producing groundwater from an unconfined aquifer shall be plugged in accordance with the foregoing and in addition shall have washed sand, and gravel or other material approved by the department placed from the bottom of the well to the static water level.

(c) Abandoned wells, formerly producing groundwater from confined and unconfined aquifers or in confined aquifers only, shall be plugged according to K.A.R. 28-30-7(a) and by using one of the following additional procedures:

(1) The entire well column shall be filled with grout, or other material approved by the department, by use of a grout tremie pipe.

(2) A 10 foot grout plug shall be placed opposite the impervious formation or confining layer above each confined aquifer or aquifers by use of a grout tremie pipe; and

(A) The space between plugs shall be filled with clays, silts, sand and gravel or grout and shall be placed inside the well so as to prevent bridging.

(B) A grout plug at least 20 feet in length shall be placed with a grout pipe so at least 10 feet of the plug extends below the base of the well casing and at least 10 feet of the plug extends upward inside the bottom of the well casing.

(C) A grout plug at least 10 feet in length shall be placed from at least 13 feet below ground level to the top of the cut off casing.

(3) Wells that have an open bore hole below the well casing, and where the casing was not grouted into the well bore when the well was constructed, shall be plugged by (1) or (2) above except that the top 20 feet of well casing shall be removed or perforated with a casing ripper or similar device prior to plugging. If the well is plugged according to part (2) of this subsection, the screened or perforated intervals below the well casing shall be grouted the entire length by use of a grout tremie pipe.

(d) Plugging of abandoned holes. If the hole penetrates an aquifer containing water with more than 1,000 milligrams per liter, mg/l, total dissolved solids or is in an area determined by the department to be contaminated, the entire hole shall be plugged with an approved grouting material from the bottom of the hole, up to within three feet of the ground surface using a grout tremie pipe or similar method. From three feet below ground surface to ground surface the plugged hole shall be covered over with compacted surface silts or clays; otherwise, the hole shall be plugged in accordance with the following paragraphs.

(1) Plugging of abandoned cased test holes. The casing shall be removed if possible and the abandoned test hole shall be plugged with an approved grouting material from the bottom of the hole, up to within three feet of the ground surface, using a grout tremie pipe or similar method. From three feet below ground surface to ground surface the plugged hole shall be covered over with compacted surface silts or clays. If the casing cannot be removed, in addition to plugging the hole with an approved grouting material the annular space shall also be grouted as described in K.A.R. 28-30-6 or as approved by the department.

(2) Abandoned uncased test holes, exploratory holes or any bore holes except seismic or oil field related exploratory and service holes regulated by the Kansas corporation commission under K.A.R. 82-3-115 through 82-3-117. A test hole or bore hole drilled, bored, cored or augered shall be considered an abandoned hole immediately after the completion of all testing, sampling or other operations for which the hole was originally intended. The agency or contractor in charge of the exploratory or other operations for which the hole was originally intended is responsible for plugging the abandoned hole using the following applicable method, within three calendar days after the termination of testing or other operations.

(A) The entire hole shall be plugged with an approved grouting material from bottom of the hole, up to within three feet of the ground surface, using a grout tremie pipe or similar method.

(B) From three feet below ground surface to ground surface the plugged hole shall be covered over with compacted surface silts or clays.

(C) For bore holes of 25 feet or less, drill cuttings from the original hole may be used to plug the hole in lieu of grouting material, provided that an aquifer is not penetrated or the bore hole is not drilled in an area determined by the department to be a contaminated area.

(3) Plugging of heat pump holes drilled for closed loop heat pump systems. The entire hole shall be plugged with an approved grouting material from bottom of the hole, to the bottom of the horizontal trench, using a grout tremie pipe or similar method approved by the department.

(e) Abandoned oil field water supply wells. A water well drilled at an oil or gas drilling site to supply water for drilling activities shall be considered an abandoned well immediately after the termination of the oil or gas drilling operations. The company in charge of the drilling of the oil or gas well shall be responsible for plugging the abandoned water well, in accordance with K.A.R. 28-30-7(a), (b), and (c), within 30 calendar days after the termination of oil or gas drilling operations.

Responsibility for the water well may be conveyed back to the landowner in lieu of abandoning and plugging the well but the well must conform to the requirements for active or inactive status. The transfer must be made through a legal document, approved by the department, advising the landowner of the landowner's responsibilities and obligations to properly maintain the well, including the proper plugging of the well when it is abandoned and no longer needed for water production activities. If a transfer is to be made, the oil or gas drilling company shall provide the department with a copy of the transfer document within 30 calendar days after the termination of

oil or gas drilling operations. Within 30 calendar days of the effective date of the transfer of the well the landowner shall notify the department of the intended use and whether the well is in active status or inactive status in accordance with K.A.R. 28-30-7(f).

(f) Inactive status. Landowners may obtain the department's written approval to maintain wells in an inactive status rather than being plugged if the landowner can present evidence to the department as to the condition of the well and as to the landowner's intentions to use the well in the future. As evidence of intentions, the owner shall be responsible for properly maintaining the well in such a way that:

(1) The well and the annular space between the hole and the casing shall have no defects that will permit the entrance of surface water or vertical movement of subsurface water into the well;

(2) the well is clearly marked and is not a safety hazard;

(3) the top of the well is securely capped in a watertight manner and is adequately maintained in such a manner as to prevent easy entry by other than the landowner;

(4) the area surrounding the well shall be protected from any potential sources of contamination within a 50 foot radius;

(5) if the pump, motor or both, have been removed for repair, replacement, etc., the well shall be maintained to prevent injury to people and to prevent the entrance of any contaminant or other foreign material;

(6) the well shall not be used for disposal or injection of trash, garbage, sewage, wastewater or storm runoff; and

(7) the well shall be easily accessible to routine maintenance and periodic inspection.

The landowner shall notify the department of any change in the status of the well. All inactive wells found not to be in accordance with the criteria listed in lines one through seven above shall be considered to be abandoned and shall be plugged by the landowner in accordance with K.A.R. 28-30-7(a) through (c). (Authorized by K.S.A. 82a-1205; implementing K.S.A. 82a-1202, 82a-1205, 82a-1212, 82a-1213; effective, E-74-34, July 2, 1974; modified, L. 1975, ch. 481, May 1, 1975; amended May 1, 1980; amended May 1, 1983; amended May 1, 1987.)

28-30-8. Pollution sources. Well locations shall be approved by municipal and county governments with respect to distances from pollution sources and compliance with local regulations. The following minimum standard shall be observed.

(a) The horizontal distances between the well and the potential source of pollution or contamination such as sewer lines, pressure sewer lines, septic tanks, lateral fields, pit privy, seepage pits, fuel or fertilizer storage, pesticide storage, feed lots or barn yards shall be 50 feet or more as determined by the department.

(b) Proper drainage in the vicinity of the well shall be provided so as to prevent the accumulation and ponding of surface water within 50 feet of the well. The well shall not be located in a ravine or any other drainage area where surface water may flow into the well.

(c) When sewer lines are constructed of cast iron, plastic or other equally tight materials, the separation distance shall be 10 feet or more as determined by the department.

(d) All wells shall be 25 feet or more from the nearest property line, allowing public right-of-ways to be counted; however, a well used only for irrigation or cooling purposes may be located closer than 25 feet to an adjoining property where:

(1) such adjoining property is served by a sanitary sewer and does not contain a septic tank system, disposal well or other source of contamination or pollution; and

(2) the property to be provided with the proposed well is served by both a sanitary sewer and a public water supply. (Authorized by and implementing K.S.A. 82a-1202, 82a-1205; effective, E-74-34, July 2, 1974; modified, L. 1975, ch. 481, May 1, 1975; amended May 1, 1980; amended May 1, 1987.)

28-30-9. Appeals. (a) Requests for exception to any of the foregoing rules and regulations shall be submitted to the department in writing and shall contain all information relevant to the request.

(1) Those requests shall specifically set forth why such exception should be considered.

(2) The department may grant exceptions when geologic or hydrologic conditions warrant an exception and when such an exception is in keeping with the purposes of the Kansas groundwater exploration and protection act.

(b) Appeals from the decision of the department shall be made to the secretary, who after due consideration may affirm, reverse or modify the

decision of the department. (Authorized by K.S.A. 82a-1205; implementing K.S.A. 82a-1202, 82a-1205; effective, E-74-34, July 2, 1974; effective May 1, 1975; amended May 1, 1980; amended May 1, 1983; amended May 1, 1987.)

28-30-10. Water well disinfection for wells constructed or reconstructed for human consumption or food processing. (a) Gravel for gravel-packed wells shall be disinfected by immersing the gravel in a chlorine solution containing not less than 200 milligrams per liter, mg/l, of available chlorine before it is placed in the wells annular space.

(b) Constructed or reconstructed wells shall be disinfected by adding sufficient hypochlorite solution to them to produce a concentration of not less than 100 mg/l of available chlorine when mixed with the water in the well.

(c) The pump, casing, screen and pump column shall be washed down with a 200 mg/l available chlorine solution.

(d) All persons constructing, reconstructing or treating a water well and removing the pump or pump column, replacing a pump, or otherwise performing an activity which has potential for contaminating or polluting the groundwater supply shall be responsible for adequate disinfection of the well, well system and appurtenances thereto. (Authorized by and implementing K.S.A. 82a-1202, 82a-1205; effective, E-74-34, July 2, 1974; modified, L. 1975, ch. 481, May 1, 1975; amended May 1, 1980; amended May 1, 1987.)

Article 31.—HAZARDOUS WASTE MANAGEMENT STANDARDS AND REGULATIONS

28-31-1. General provisions. (a) Any reference in these rules and regulations to standards, procedures, or requirements of 40 CFR Parts 124, 260, 261, 262, 263, 264, 265, 266, 268, or 270, as in effect on July 1, 1992, and 49 CFR Parts 172, 173, 178 or 179, as in effect on October 1, 1992, inclusive shall constitute a full adoption by reference of the part, subpart, and paragraph so referenced, including any notes and appendices associated therewith, unless otherwise specifically stated in these rules and regulations.

(b) When used in any provision adopted from 40 CFR Parts 124, 260, 261, 262, 263, 264, 265, 266, 268, or 270, as in effect on July 1, 1992, inclusive, references to "the United States" shall be replaced with "the state of Kansas," "environmental protection agency" shall be replaced with the "Kansas department of health and environment," "administrator" or "regional administrator" shall be replaced with the "secretary" and "Federal Register" shall be replaced with the "Kansas Register." (Authorized by and implementing K.S.A. 65-3431; effective, E-82-20, Nov. 4, 1981; effective May 1, 1982; amended, T-86-32, Sept. 24, 1985; amended May 1, 1986; amended May 1, 1987; amended May 1, 1988; amended Feb. 5, 1990; amended April 25, 1994.)

28-31-2. Definitions. (a) Incorporation. 40 CFR 260 subpart B, as in effect on July 1, 1992, is adopted by reference.

(b) "Disposal authorization" means approval from the secretary to dispose of hazardous waste in Kansas.

(c) "EPA generator" means any person who meets any of the following conditions:

(1) Generates in any single calendar month or accumulates at any time 1,000 kilograms (2,200 pounds) or more of hazardous waste;

(2) generates in any single calendar month or accumulates at any time 1 kilogram (2.2 pounds) of acutely hazardous waste; or

(3) generates or accumulates at any time 25 kilograms (55 pounds) or more of debris and contaminated materials from the clean up of spillage of acutely hazardous waste.

(d) "Kansas generator" means any person who meets all of the following conditions:

(1) Generates 25 kilograms (55 pounds) or more of hazardous waste and less than 1,000 kilograms (2,200 pounds) in any single calendar month;

(2) accumulates at any time no more than 1,000 kilograms (2,200 pounds) of hazardous waste or 1 kilogram (2.2 pounds) of acutely hazardous waste; and

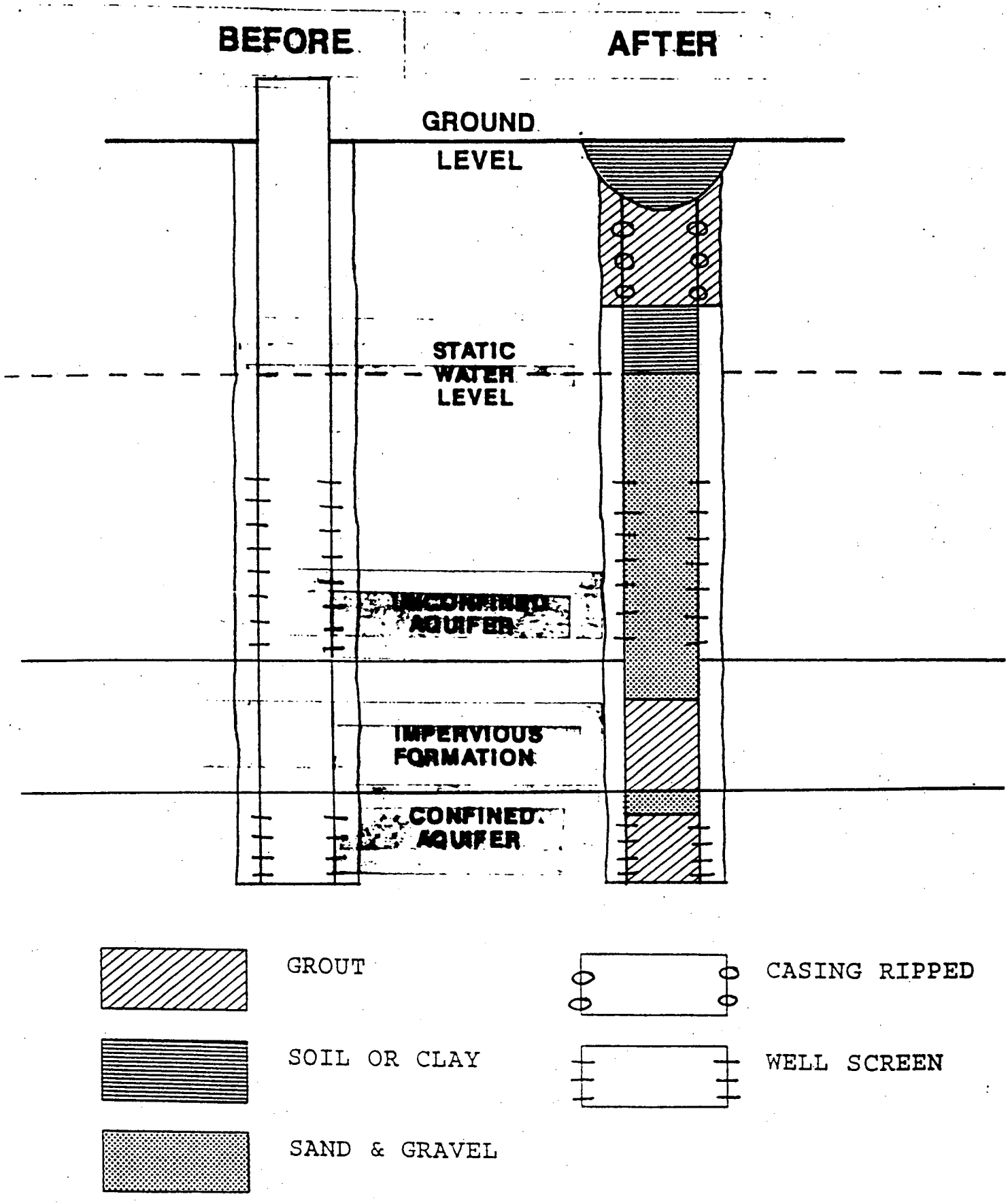
(3) generates or accumulates at any time no more than 25 kilograms (55 pounds) of debris and contaminated materials from the clean up of spillage of acutely hazardous waste.

(e) "Small quantity generator" means any person who meets all of the following conditions:

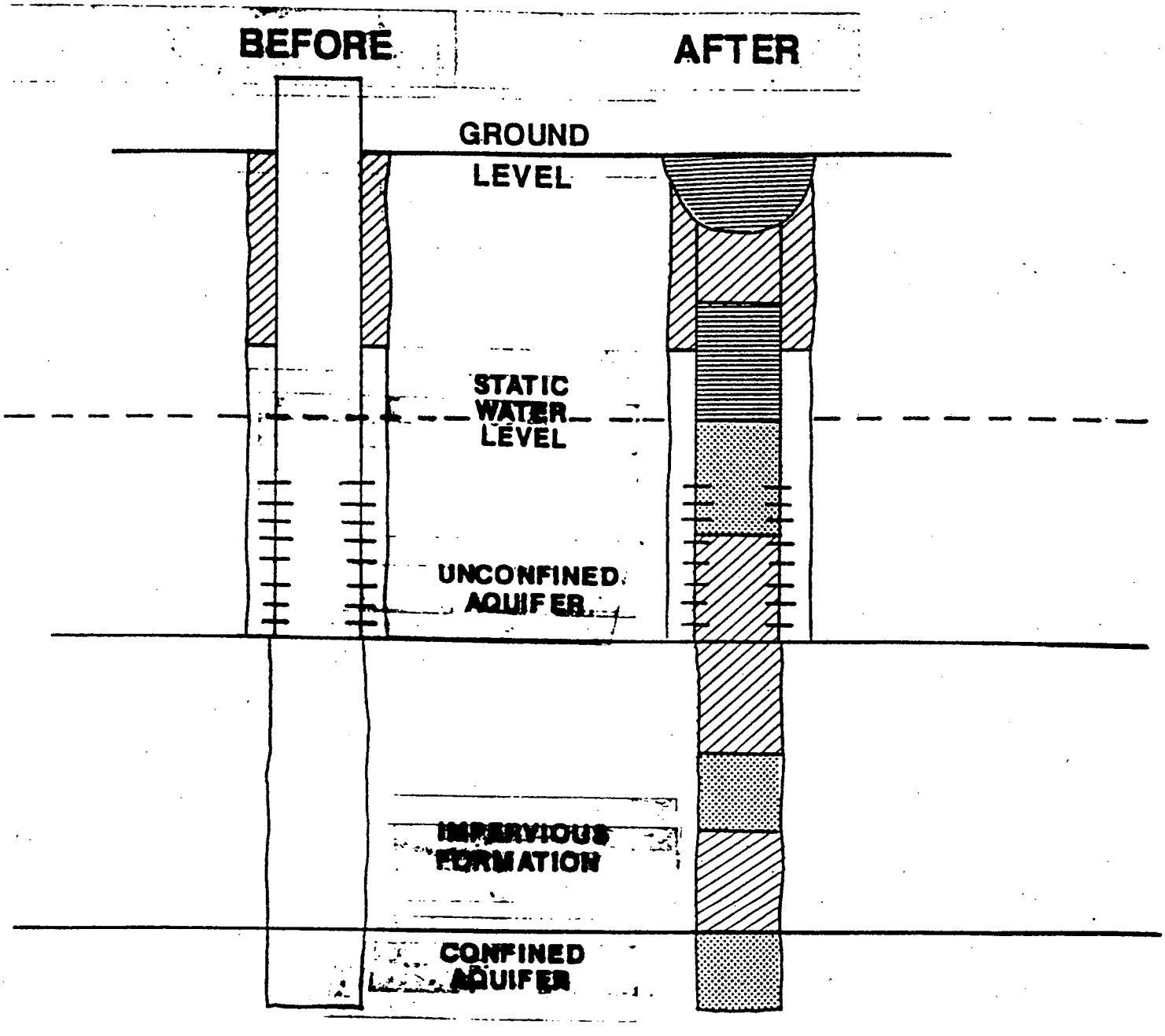
(1) Generates less than 25 kilograms (55 pounds) of hazardous waste, or less than 1 kilogram (2.2 pounds) of acutely hazardous waste in any single calendar month; and

(2) accumulates at any time less than 1,000 kilograms (2,200 pounds) of hazardous waste or 1

PLUGGING of an UNCONFINED, CONFINED WELL
(not grouted)



PLUGGING of an UNCONFINED, CONFINED WELL
(open hole, grouted)



GROUT

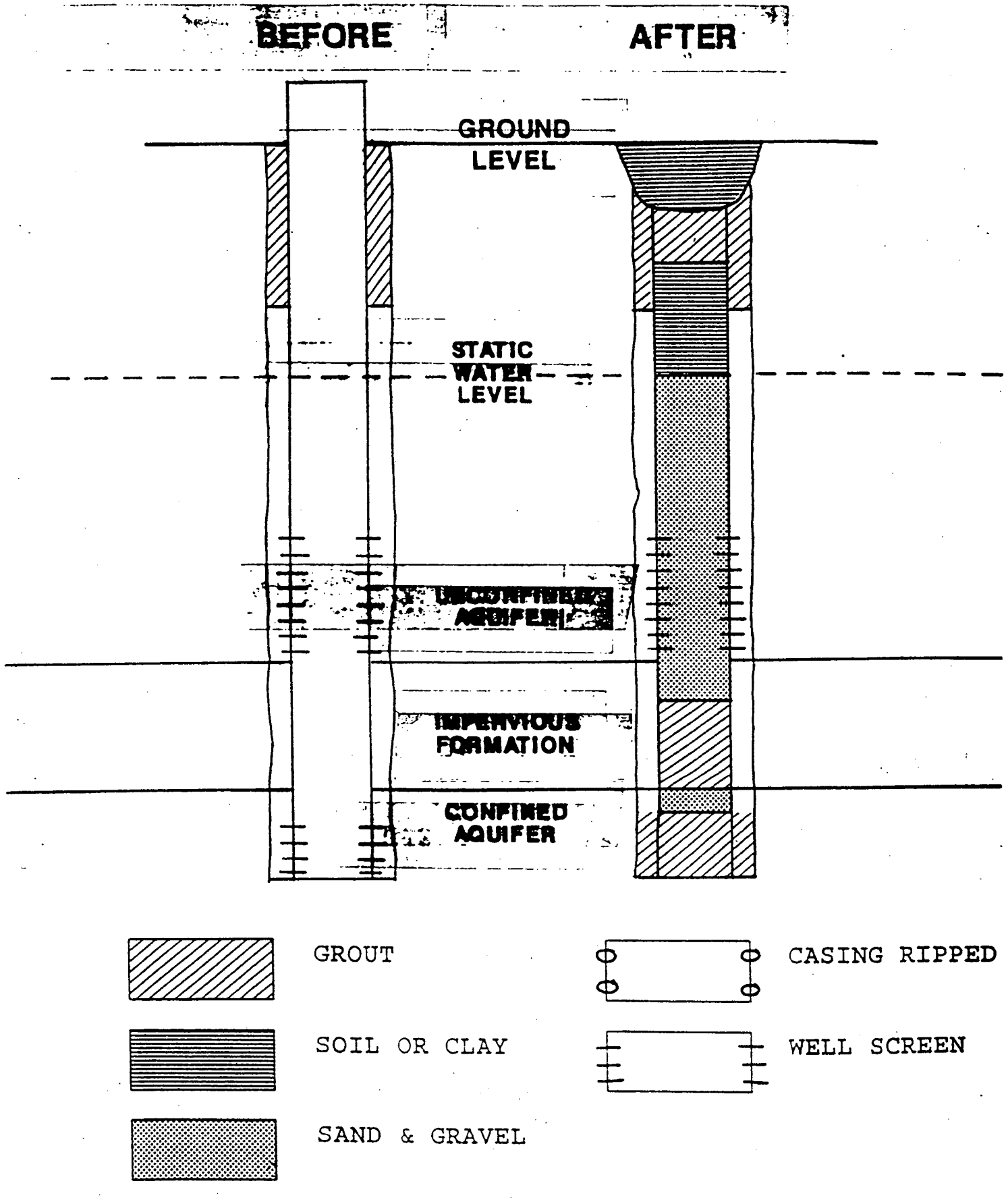
SOIL OR CLAY

SAND & GRAVEL

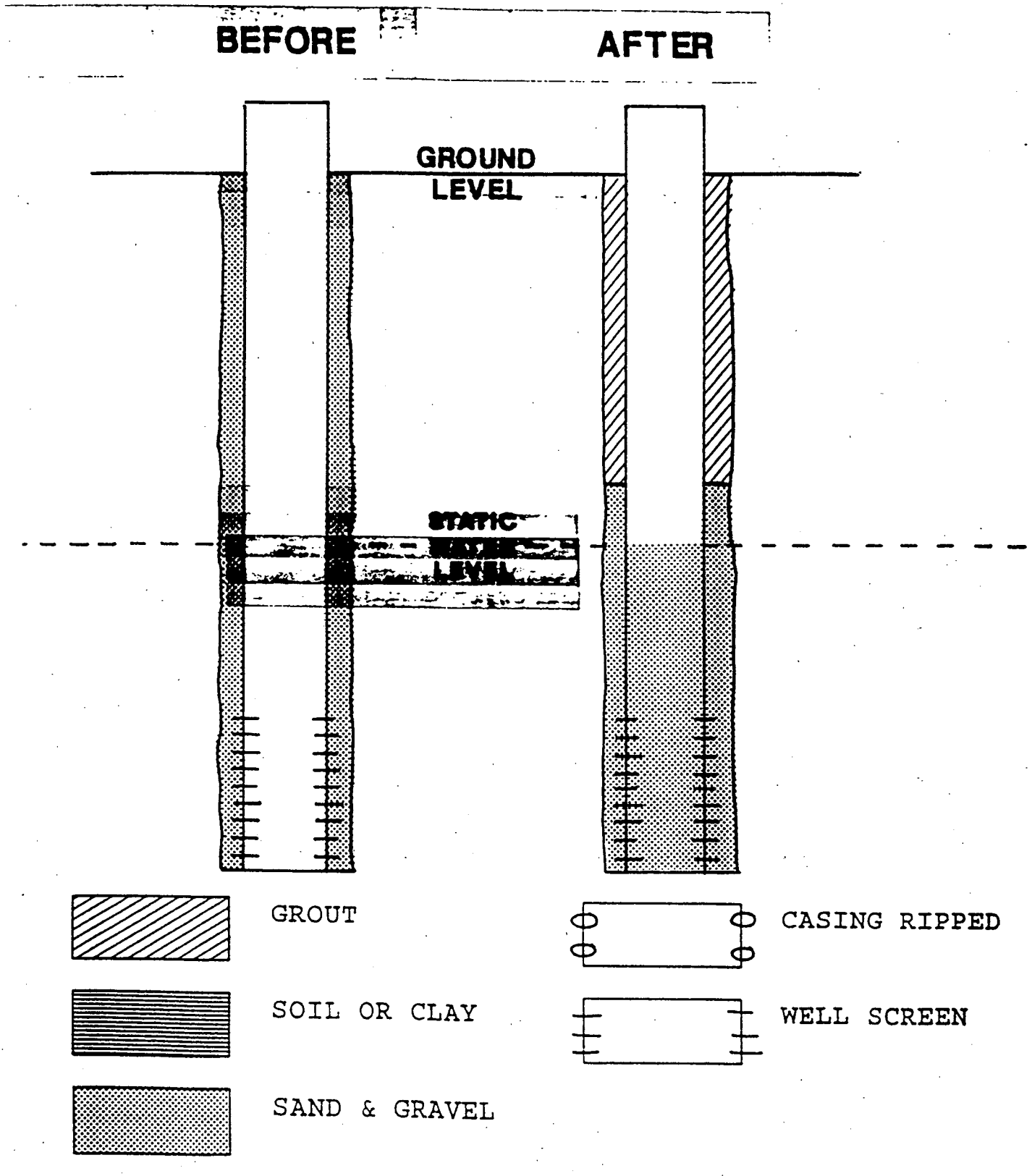
CASING RIPPED

WELL SCREEN

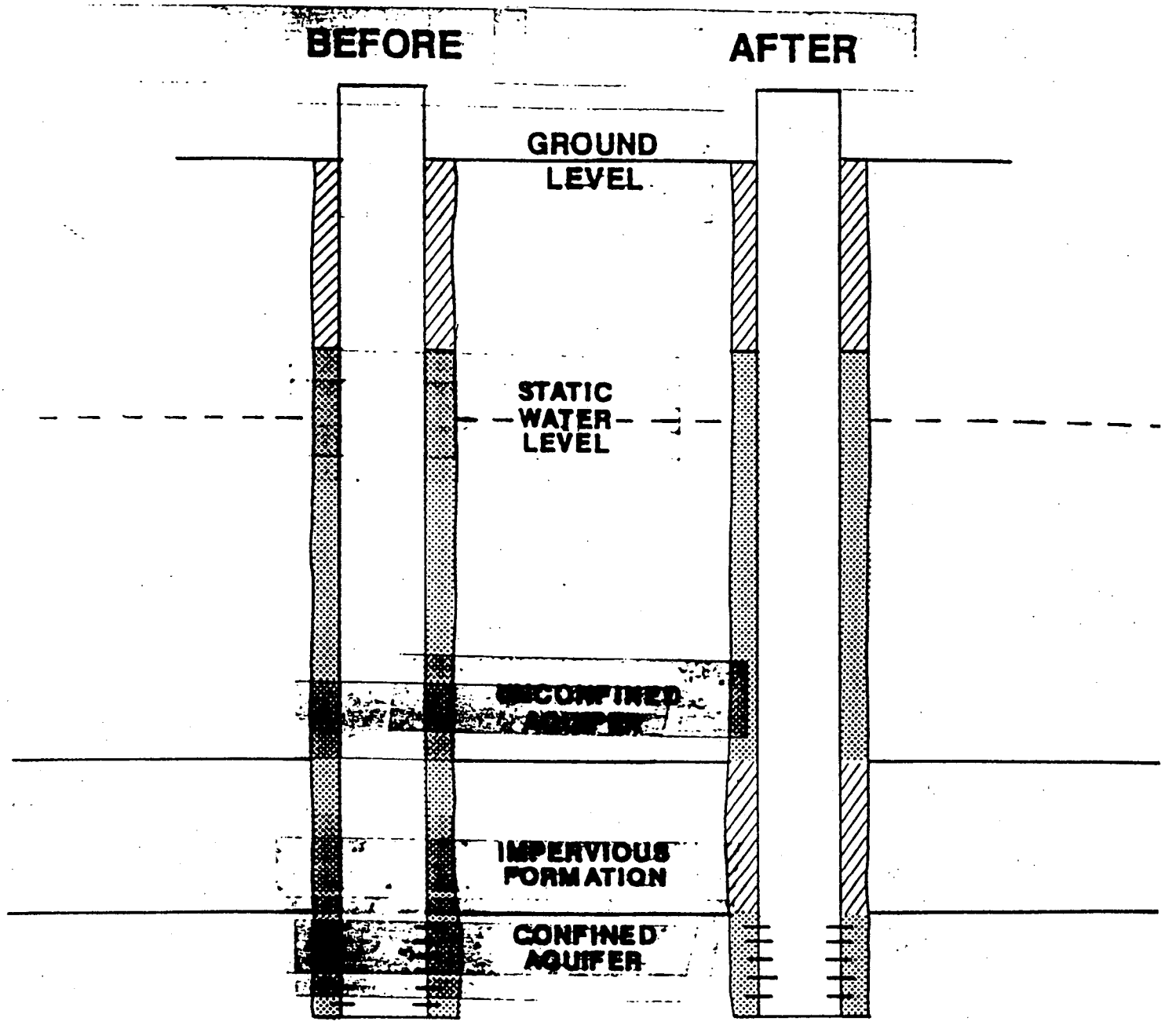
PLUGGING of an UNCONFINED, CONFINED WELL
(grouted)



GROUTING an UNCONFINED WELL



GROUTING a CONFINED WELL



GROUT

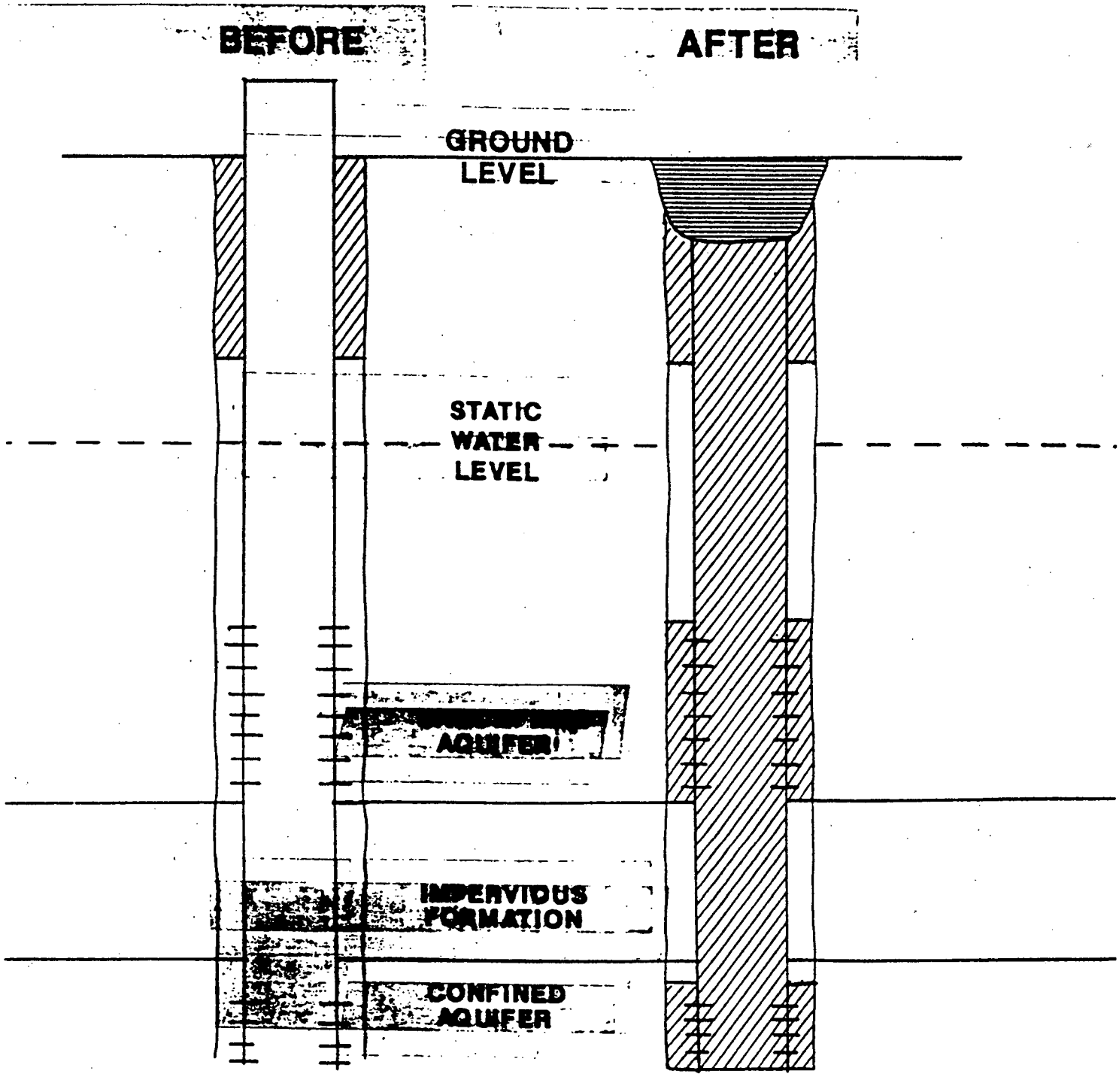
SOIL OR CLAY

SAND & GRAVEL

CASING RIPPED

WELL SCREEN

PLUGGING of a WELL by FILLING with GROUT (grouted)



State of Kansas
Mike Hayden, Governor

Department of Health and Environment
Division of Environment

Stanley C. Grant, Ph.D., Secretary

Forbes Field, Bldg. 740, Topeka, KS 66620-0002

(913) 29
FAX (913) 29

Policy Memorandum 87-3
March 1987

FROM: Gyula F. Kovach, P.E.

SUBJECT: KDHE REQUIREMENTS FOR PLUGGING ABANDONED WATER WELLS

PURPOSE:

To establish the Bureau of Water Protection's policy regarding plugging requirements for abandoned water wells. This policy is to assure the intent of the requirements of the Kansas Groundwater Exploration and Protection Act, K.S.A. 82a-1201, et seq. and implementing regulations, K.A.R. 28-30-1thru 10, are met when plugging abandoned water wells. This policy applies to public water wells, private water wells and monitoring wells.

BACKGROUND:

The Kansas Groundwater Exploration and Protection Act was established by the 1973 Kansas Legislature to provide ". . . for the exploration and protection of groundwater through the licensing and regulation of water well contractors in Kansas, . . . by requiring proper description of the location, drilling and well construction, and proper plugging of abandoned water wells and test holes . . . ." K.S.A. 82a-1213 requires all holes drilled and abandoned in search of a water supply to be properly plugged by a licensed drilling contractor in accordance with Department rules and regulations. Any unplugged water well shall be plugged or caused to be plugged by the landowner in accordance with Department rules and regulations. Department requirements for plugging abandoned wells and test holes are found at K.A.R. 28-30-7. THis regulation sets forth specific details and procedures which must be followed by water well contractors and landowners when plugging abandoned wells or exploratory test holes. Neither the Kansas Groundwater Protection and Exploration Act nor the implementing Kansas administrative regulations require a landowner who drills a water well on his own property and which will be used by the individual for farming, ranching or agricultural purposes or at the individual's abode, or who plugs a test hole or a water well, to be a licensed water well contractor. However, the individual landowner must follow the specific detailed requirements found in the Act and the regulations when drilling or plugging a well.

This policy memorandum does not apply to underground injection wells. Those wells are covered by more stringent plugging requirements.

POLICY:

Abandoned water wells and test holes, whether cased or uncased, shall be plugged in accordance with the requirements of K.A.R. 28-30-7. Landowners are not required to be licensed water well contractors to either drill and construct a water supply well, or to plug abandoned water wells if constructed or plugged by a licensed water well contractor. Any individual or firm not licensed as a water well contractor, who plugs a water well when the water well is not on the individual's premises, is in violation of the Kansas Groundwater Exploration and Protection Act. A report, filed on form WWC-5 (copy attached), shall be completed and submitted for each water well constructed, reconstructed, or plugged.

Questions concerning this policy statement should be referred to the Kansas Department of Health & Environment, Bureau of Water, (913) 296-5522

Charles Konigsberg, Jr., M.D., M.P.H., Director of Health (913) 296-1343

James Power, P.E., Director of Environment (913) 296-1535

Lorne Phillips, Ph.D., Director of Information Systems (913) 296-1415

Roger Carlson, Ph.D., Director of the Kansas H and Environmental Labo (913) 296-1619

Example

WATER WELL RECORD Form WWC-5 KSA 82a-1212 Plugging Report

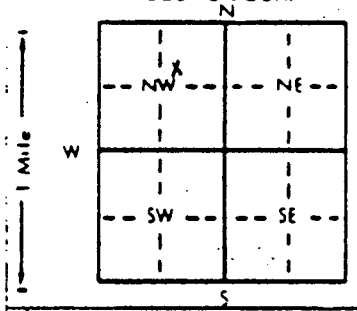
1 LOCATION OF WATER WELL: County: Gray | Fraction: SW ¼ NE ¼ NW ¼ | Section Number: 13 | Township Number: T 26 S | Range Number: R 29 E

Distance and direction from nearest town or city street address of well if located within city?
225 S & 0.25 E. of Ingalls

2 WATER WELL OWNER: John Doe
RR, St. Address, Box #: RR 2
City, State, ZIP Code: Ingalls, KS 67858

Board of Agriculture, Division of Water Resources Application Number: 18651

3 LOCATE WELL'S LOCATION WITH AN "X" IN SECTION BOX:



4 DEPTH OF COMPLETED WELL 241 ft. ELEVATION
Depth(s) Groundwater Encountered 1 ft. 2 ft. 3
WELL'S STATIC WATER LEVEL 65 ft. below land surface measured on mo/day/yr 2-16-81
Pump test data: Well water was ft. after hours pumping
Est. Yield gpm: Well water was ft. after hours pumping
Bore Hole Diameter in. to ft., and in. to
WELL WATER ~~TO BE~~ was USED AS: 5 Public water supply 8 Air conditioning 11 Injection well
1 Domestic 3 Feedlot 6 Oil field water supply 9 Dewatering 12 Other (Specify below)
(2 Irrigation) 4 Industrial 7 Lawn and garden only 10 Monitoring well
Was a chemical/bacteriological sample submitted to Department? Yes ....No.... If yes, mo/day/yr sample was mitted
Water Well Disinfected? Yes No

5 TYPE OF BLANK CASING USED: 5 Wrought iron 8 Concrete tile CASING JOINTS: Glued Clamped
(1 Steel) 3 RMP (SR) 6 Asbestos-Cement 9 Other (specify below) Welded
2 PVC 4 ABS 7 Fiberglass Threaded
Blank casing diameter 16 in. to ft., Dia in. to ft., Dia in. to
Casing height above land surface 3 ft. below, weight lbs./ft. Wall thickness or gauge No.

TYPE OF SCREEN OR PERFORATION MATERIAL: 7 PVC 10 Asbestos-cement
1 Steel 3 Stainless steel 5 Fiberglass 8 RMP (SR) 11 Other (specify)
2 Brass 4 Galvanized steel 6 Concrete tile 9 ABS 12 None used (open hole)

SCREEN OR PERFORATION OPENINGS ARE: 5 Gauzed wrapped 8 Saw cut 11 None (open hole)
1 Continuous slot 3 Mill slot 6 Wire wrapped 9 Drilled holes
2 Louvered shutter 4 Key punched 7 Torch cut 10 Other (specify)

SCREEN-PERFORATED INTERVALS: From ft. to ft., From ft. to
From ft. to ft., From ft. to
GRAVEL PACK INTERVALS: From ft. to ft., From ft. to
From ft. to ft., From ft. to

6 GROUT MATERIAL: 1 Neat cement (2 Cement grout) 3 Bentonite 4 Other
Grout Intervals: From 6 ft. to 3 ft., From ft. to ft., From ft. to

What is the nearest source of possible contamination:
1 Septic tank 4 Lateral lines 7 Pit privy (10 Livestock pens) 14 Abandoned water well
2 Sewer lines 5 Cess pool 8 Sewage lagoon 11 Fuel storage 15 Oil well/Gas well
3 Watertight sewer lines 6 Seepage pit 9 Feedyard 12 Fertilizer storage 16 Other (specify below)
13 Insecticide storage
Direction from well? Southeast How many feet? 150 ft.

FROM	TO	LITHOLOGIC LOG	FROM	TO	PLUGGING INTERVALS
241	65	sand + gravel (248.8 cubic ft.)			
65	6	Clays (83.4 cubic ft.)			
6	3	Cement grout (4.2 cubic ft.)			

CONTRACTOR'S OR LANDOWNER'S CERTIFICATION: This water well was (1) constructed, (2) reconstructed, or (3) plugged under my jurisdiction and this record is true to the best of my knowledge and belief.
Completed on (mo/day/year) 2-16-81
This Water Well Record was completed on (mo/day/yr) 2-20-81
Water Well Contractor's License No.
under the business name of
by (signature): John Doe

INSTRUCTIONS: Use typewriter or ball point pen. PLEASE PRESS FIRMLY and PRINT clearly. Please fill in blanks, underline or circle the correct answers. Send top three copies to Kansas Department of Health and Environment, Bureau of Water, Topeka, Kansas 66620-7320, Telephone 913-296-5545. Send one to WATER WELL OWNER and retain one for your records.

SIGNIFICANCE OF WATER MINERALIZATION

Total Dissolved Solids: The total dissolved solids is a measure in weight (mg/l) of the mineral matter dissolved in the water. This figure multiplied by 8.34 gives pounds of mineral matter per million gallons of water. The U.S. Public Health Service Drinking Water Standards recommend less than 500 mg/l total solids for drinking or culinary uses. If such water is not available 1000 mg/l will be considered satisfactory. The specific conductance (micromhos per centimeter) is a measure of the water's ability to conduct an electric current and is therefore an indication of the ionic strength, or mineralization, of the water.

Total Hardness: The calcium ion and the magnesium ion cause the hardness of water and the sum of the two, both expressed as $CaCO_3$, is termed the total hardness. Hardness is undesirable in water in that it produces an insoluble sticky curd with soap and produces scaling in teakettles and hot water tanks. A total hardness above 400 mg/l as $CaCO_3$ is considered excessive for public water supplies in Kansas. Hardness can be removed readily by the softening process.

Sodium: Sodium is not particularly significant physiologically except to those persons having an abnormal sodium metabolism and who are thus on a restricted sodium diet. It is important in irrigation waters because a high sodium to calcium-magnesium ratio tends to decrease the permeability of the soil and thus will have a harmful effect on soil structure. The base exchange or zeolite process of softening increases the sodium content of the water being softened. Limit 100 mg/l

Iron and Manganese: Iron and manganese have little significance physiologically but they are undesirable in a public water supply because both will produce staining of laundered fabrics and porcelain plumbing fixtures and create consumer complaint. If present in an appreciable amount iron gives the water a rusty turbid appearance and an unpleasant taste. Both substances create problems in the chlorination of water. The U.S.P.H.S. Drinking Water Standards recommend that iron be less than 0.3 mg/l and manganese less than 0.05 mg/l. Iron and manganese can be readily removed by treatment, particularly if lime-soda softening is also being practiced.

Sulfate: Sulfate is one of the principal mineralizing characteristics of water in Kansas and if present in large amounts it will impart a bitter taste to the water and it may act as a laxative to people who are not accustomed to drinking the water. The drinking water standards recommend that sulfate be less than 250 mg/l. Sulfate cannot be removed economically.

Chloride: Chloride is one of the principal mineralizing substances present in water in Kansas. When present in sufficient amount, chloride imparts a salty taste to the water but otherwise has little or no physiological significance when present in concentrations not offensive to taste. The drinking water standards recommend that chloride be less than 250 mg/l. Chloride cannot be removed economically.

Nitrate: Nitrate is important in drinking water because high concentrations may produce cyanosis or methemoglobinemia in infants. The recommended limit for public water supplies in Kansas is 10 mg/l nitrate (as N) when used for infants under one year of age. Older children and adults are not affected. Nitrate is also important in water to be used for livestock watering because excessive amounts may be harmful, particularly to young animals. Nitrate cannot be removed economically.

Fluoride: Fluoride is important in drinking water because in high concentration it may produce a mottling or discoloration of the tooth enamel of children and in low concentration it does not afford sufficient protection for the prevention of dental decay in children. A concentration of 1.0 mg/l fluoride is considered optimum for public water supplies in Kansas and a concentration of 1.5 mg/l fluoride is the recommended limit. It is recommended that fluoride be added to public water supplies when the concentration is substantially less than the optimum.

Phosphate: Total phosphate represents all forms of phosphate in water including polyphosphates used in the treatment of water. Phosphate in water has little physiological significance but it does stimulate the growth of algae and thus may cause water treatment problems. If a poly-phosphate is being fed to stabilize iron it is recommended that the feed rate be limited to 3 mg/l phosphate per 1 mg/l iron.

* * * * *

- mg/l = milligrams per liter
- One gallon weighs 8.34 pounds
- 1 mg/l = 8.34 lbs. per million gallons
- 17.1 mg/l = 1 grain per gallon
- To obtain results in grains per gallon divide results in milligrams per liter by 17.1.
- Reacting values are in terms of milligram equivalents per liter

KANSAS STATE DEPARTMENT OF HEALTH AND ENVIRONMENT

DIVISION OF ENVIRONMENT
(March 1975)

DISINFECTION TABLE TO DISINFECT THE WELL WATER

(Produces a 100 mg/liter chlorine solution per-foot of casing size)

CASING SIZE Nominal diameter (INCHES)	GALLONS OF WATER PER ONE FOOT OF CASING SIZE (GAL/FT/CA. SIZE)	OUNCES OF PRODUCT ADDED TO DISINFECT ONE (1) FOOT OF WATER PER CASING SIZE		
		5.25% to 6.0% Chlorine	10% Chlorine	70% Chlorine
		PRODUCT: Clorox, Purex, Sno-White, Kandu, Topco, Action, White Magic, Surefine and MC_2 or other brand names. (sodium hypochlorite)	PRODUCT: Liquid Bleach. Purchased from a chemical supply company. (sodium hypochlorite)	PRODUCT: High test Calcium Hypochlorite. Purchased from a chemical supply company. (calcium hypochlorite)
		(FLUID OUNCES)	(FLUID OUNCES)	(DRY OUNCES)
1.25	0.06	0.015	0.008	0.0011
1.50	0.09	0.023	0.012	0.0017
2	0.16	0.041	0.021	0.0031
2.5	0.25	0.064	0.033	0.0048
3	0.37	0.094	0.049	0.0071
3.5	0.50	0.127	0.067	0.0095
4	0.65	0.165	0.087	0.0124
5	1.02	0.259	0.136	0.0194
6	1.50	0.381	0.200	0.0286
8	2.60	0.660	0.347	0.0495
10	4.08	1.036	0.544	0.0777
12	5.87	1.490	0.782	0.1118
14	8.00	2.031	1.066	0.1523
16	10.44	2.650	1.391	0.1988
18	13.21	3.354	1.761	0.2515
24	23.50	5.966	3.132	0.4474
30	36.70	9.317	4.891	0.6988

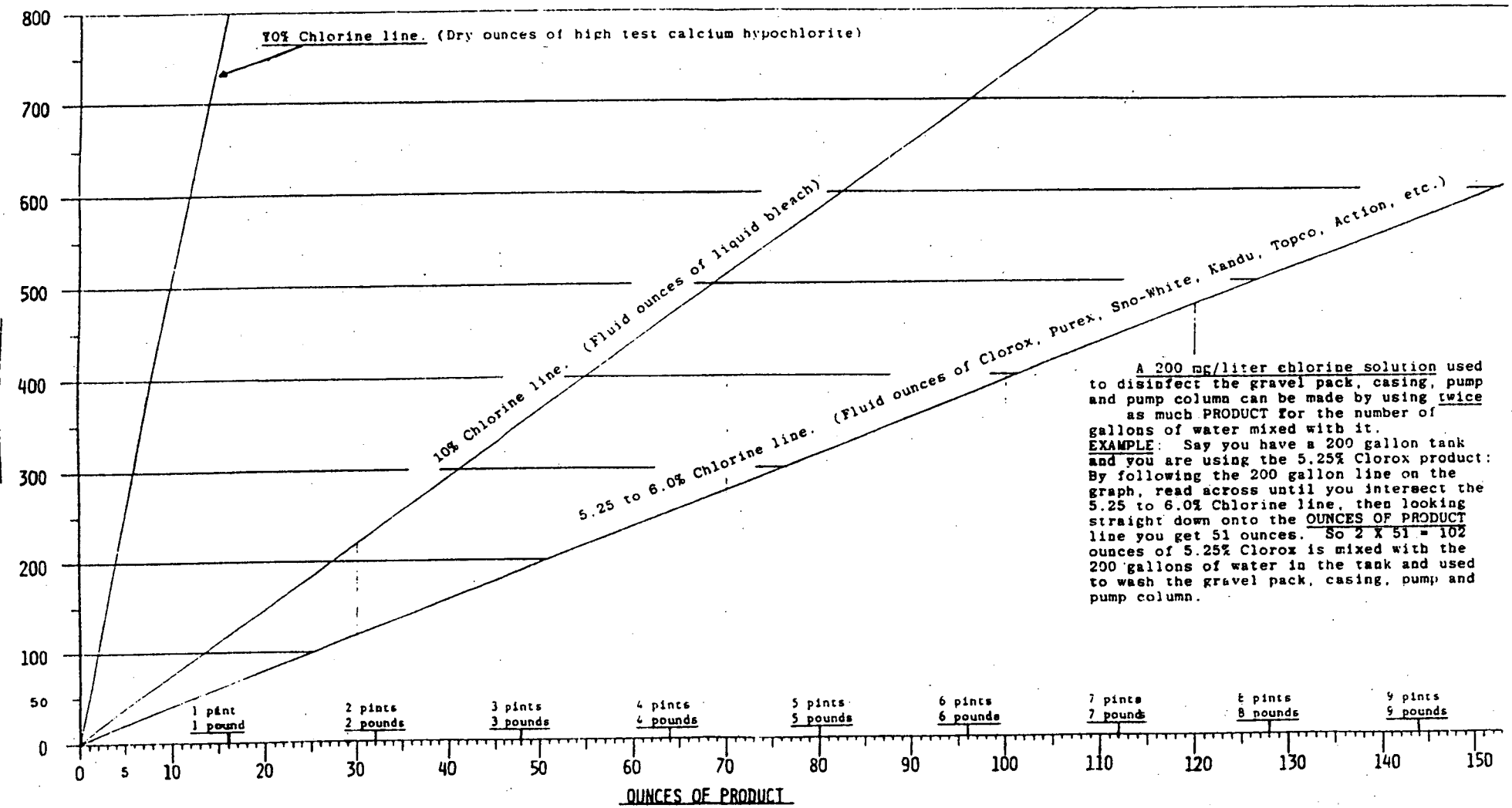
1. FORMULA TO FIND HEIGHT OF WATER COLUMN: (total depth of water well) - (measured static water level) = (height of water column)
EXAMPLE: (216 feet depth of well) - (37 feet static water level) = (179 feet of water column)

2. FORMULA TO FIND NUMBER OF OUNCES USED TO DISINFECT THE WELL WATER: (height of water column) X (ounces of PRODUCT added to disinfect one (1) foot of water per casing size) = (ounces of PRODUCT needed to be placed and mixed with the water in the well) EXAMPLE: For a 5 inch casing using 5.25% Clorox Product: (179 feet) X (0.259) = (46.36 fluid ounces) Which is approximately 3 pints of Clorox placed down the well and mixed with the well water by surging and left standing in the well for 8-10 hours to properly disinfect the well water.

(1) foot of casing size) X (height of water

DISINFECTION GRAPH TO DISINFECT THE WELL WATER

(PRODUCES A 100 MG/LITER CHLORINE SOLUTION WHEN MIXED WITH THE NUMBER OF GALLONS OF WATER)



A 200 mg/liter chlorine solution used to disinfect the gravel pack, casing, pump and pump column can be made by using twice as much PRODUCT for the number of gallons of water mixed with it.

EXAMPLE: Say you have a 200 gallon tank and you are using the 5.25% Clorox product: By following the 200 gallon line on the graph, read across until you intersect the 5.25 to 6.0% Chlorine line, then looking straight down onto the OUNCES OF PRODUCT line you get 51 ounces. So 2 X 51 = 102 ounces of 5.25% Clorox is mixed with the 200 gallons of water in the tank and used to wash the gravel pack, casing, pump and pump column.

NOTE: 1 PINT = 16 FLUID OUNCES
1 POUND = 16 DRY OUNCES

METHODS FOR CHLORINATING PRIVATE WATER SUPPLIES

1. The well cover should be removed so that fluid can be dumped or poured into the well, if possible the pumping system should remain functional. Caution must be taken to avoid electrical shock.

2. The volume of water contained in the system should be estimated so that the appropriate amount of chlorine bleach can be added. The volume of water in the well, piping, pressure tank, and water heater must be totaled.

   a. The volume of the well should be estimated by subtracting the depth to the water inside the well from the total depth of the well. This will tell you how many feet of water are in the well. The attached chart shows how many gallons of water per foot are contained in each different size (diameter) wells.

   b. The volume of the water heater and the pressure tank (if used) should be readily available.

   c. The piping from the well to the point of use can be estimated at between 20 and 100 gallons depending on the length and size of piping to the house and the number of sinks, toilets, showers or other dispensers. If the well is a long distance from the house (over 200 ft.) some additional volume should be added.

   d. Total the volume of water contained in the entire system.

      a. The amount of water contained in the well _____

      b. Capacity of the water heater _____
         Capacity of the pressure tank _____

      c. Estimated volume contained in the piping _____

      d. Total: Add the four numbers above to obtain the total volume of water in the system. _____

   One ounce of chlorine bleach should be added for every 2 gallons of water in the system. More chlorine may be required for heavy concentrations of bacteria to insure that the disinfection of the system is complete. In most cases 1/2 to 1 gallon of chlorine laundry bleach is an ample amount to obtain complete disinfection of the system even with heavy bacteria concentrations. The chlorine bleach should be diluted before it is added to the well to minimize any corrosion of metal casing or pump parts from concentrated chlorine.

3. Obtain a tank or enough clean buckets or containers which can be filled with chlorinated water to equal at least the volume of water contained in the well. The chlorine solution can be mixed up by adding 1 oz. of chlorine bleach to every 2 gallons of water in the containers. These containers should be placed near the well before the chlorine solution is mixed since they will be poured into the well once step 4 has been completed.

4. Add the required amount of chlorine to the well. Run the hose from the nearest faucet to the well and circulate the chlorine mixture through the hose and back into the well. By circulating the water in the well an even mixture of chlorine solution can be obtained. While mixing the chlorine solution with the hose the sides of the casing and the drop pipe for the pump can be washed with the chlorinated mixture.

   A strong odor of chlorine smell should be present after the mixing process has been completed. If the chlorine smell is not strong more chlorine should be added.

5. Pour the mixture of chlorinated water into the well and allow the well to set for 2 or more hours before proceeding with step 6.

6. Run water from each faucet in the distribution system until a chlorine odor is present in the water. This should be done for hot and cold water. The hot water should take longer than the cold because the hot water tank holds a large volume of water. Chlorinated water should be allowed to enter all of the lines in the distribution system including lines to bathtubs, showers, toilets, and outside hydrants so complete disinfection can be achieved. Carbon filters should be removed or bypassed. The air pressure should be released from the pressure tank (except those with a permanent air cushion) so that the entire tank may be filled with chlorinated water.

   Caution: Some pressure tanks may be damaged by strong chlorine solutions. The manufacturer should be contacted to provide needed information about disinfection of the pressure tank.

It may be necessary to repeat steps 4 and 5 if the chlorine smell reaching the faucets is weak. The chlorinated water should be allowed to remain in the well and piping for 12 to 24 hours if possible.

The chlorinated water contained in the system should be pumped to waste when the allotted time has passed. The water having a strong chlorine smell should not be discharged to a septic tank as it may kill the needed microorganisms in the septic system. This water should be discharged onto a driveway or area where damage will not be done to vegetation or other property. The chlorinated water contained in the plumbing system should be discharged until the chlorine odor is absent from all water sources. A small amount of chlorinated water contained in the plumbing of the house should not affect the septic tank. If bacteria problems persist the chlorination process may need to be repeated.

After the well has been chlorinated the well must be sealed to prevent surface water, small animals and insects from entering the well. A screened vent should be provided in the casing or well seal so air may enter the well but water and insects cannot.

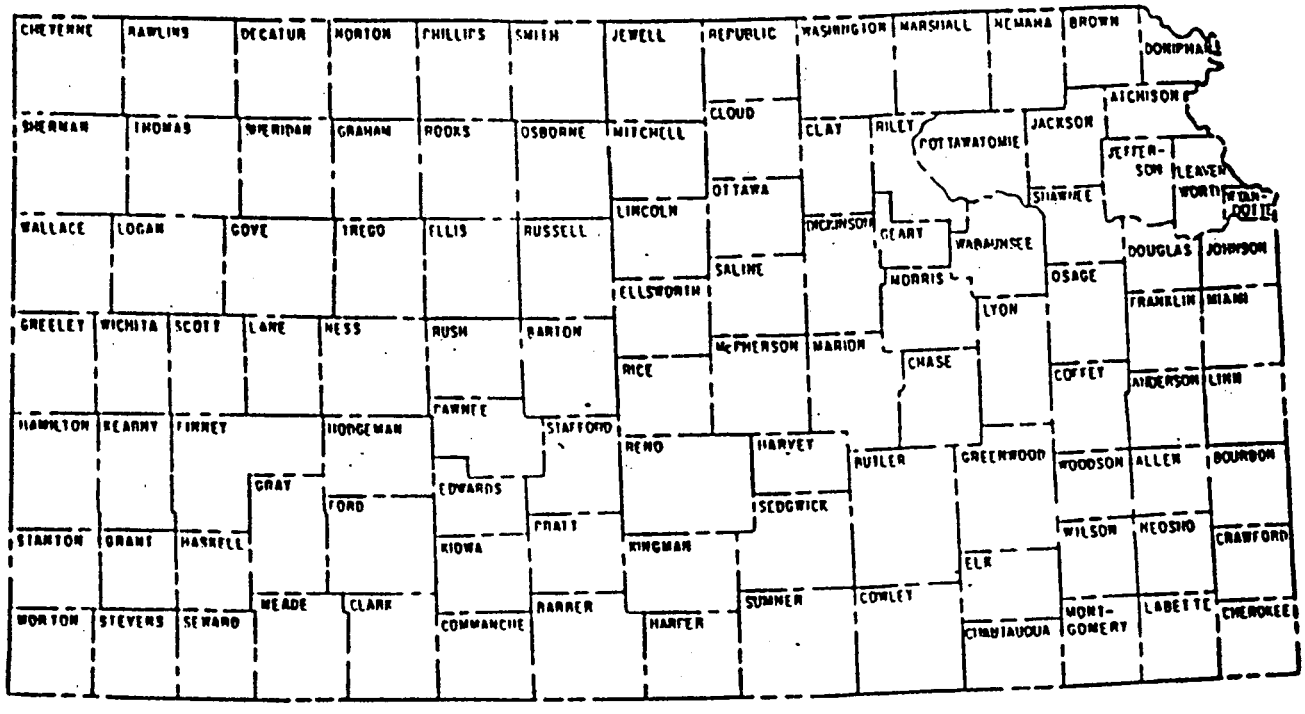
Some wells are constructed so that it is not possible to install a positive well seal such as a dug well. These wells can be reconstructed and cased or a continuous chlorination system can be installed which will kill the unwanted bacteria.

If after reading this publication you are unsure of this procedure for chlorination you may contact the Bureau of Water within the Department of Health and Environment located in Topeka (913) 296-5523 or one of the six district offices at the locations shown below.

Dodge City - (316) 225-0596
Wichita - (316) 838-1071
Chanute - (316) 431-2390
Lawrence - (913) 842-4600
Salina - (913) 827-9639
Hays - (913) 625-5664

dg

Pipe Or Well Diameter (Inches)	Gallons Of Water Per Foot Of Length
1/2	.010
3/4	.023
1	.041
1 1/4	.067
1 1/2	.092
2	.163
2 1/2	.255
3	.37
3 1/2	.50
4	.65
5	1.02
6	1.50
8	2.60
10	4.08
12	5.87
14	8.00
16	10.44
18	13.21
24	23.50
30	36.70



1. SOUTHWEST DISTRICT OFFICE - 302 W. McArtor Rd., Dodge City 67801 - 316/225-0596

   Ubel, Don C. - Env. Geol. II - North Star Route - Dodge City - 225-1697

2. SOUTH CENTRAL DISTRICT OFFICE - 1919 Amidon, Ste. 130, Wichita 67203 - 316/838-1071

   O'Connor, Ralph E. - Env. Geol. II - 2257 S. Ridgewood, Wichita - 686-9175
   Parker, Kyle - Env. Geol. I - 1956 N. Gow, Wichita - 945-8452
   Marcotte, Stanley - Env. Tech. IV - 1939 N. Gow, Wichita - 945-2807

3. SOUTHEAST DISTRICT OFFICE - 1500 W. 7th, P.O. Box 888, Chanute 66720 - 316/431-2390

   Thornton, William - Env. Geol. II - 913 W. 4th, Chanute - 431-6438
   McKee, Norman L. - Env. Tech. IV - 1503 W. 14th, Chanute - 431-0359

4. NORTHEAST DISTRICT OFFICE - 808 W. 24th St., Lawrence 66046 - 913/842-4600

   Glotzbach, Marvin W. - Env. Geol. II - 3640 SE Howard Dr., Topeka - 235-8942
   Roth, Meredith - Env. Tech. IV - 2710 SE 32nd, Topeka - 266-2987

5. NORTH CENTRAL DISTRICT OFFICE - 2501 Market Pl, Ste. D & E, Salina 67401 - 913/825-

   Robl, Dale A. - Env. Geol. I - 2204 Huntington Rd., Salina - 825-6507

6. NORTHWEST DISTRICT OFFICE - 2301 E. 13th, Hays 67601 - 913/625-5663

   Larson, Michael K. - Env. Geol. II - 501 W. 37th #5, P.O. Box 1193, Hays - 625-4110

WATER WELL PLUGGING RECORD Form WWC-5P KSA 82a-1212

1 LOCATION OF WATER WELL:	Fraction	Section Number	Township Number	Range Number
County:	1/4 1/4 1/4			

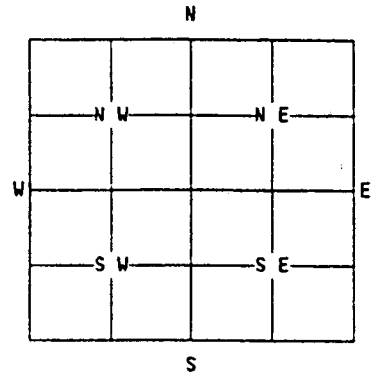
Distance and direction from nearest town or city street address of well if located within city?

2 WATER WELL OWNER:

RR#, St. Address, Box #:
City, State, ZIP Code :

Board of Agriculture, Division of Water Resources
Application Number:

3 MARK WELL'S LOCATION WITH AN "X" IN SECTION BOX:



4 DEPTH OF WELL.....ft.

WELL'S STATIC WATER LEVEL.....ft.

WELL WAS USED AS:

1 Domestic 5 Public Water Supply 9 Dewatering
2 Irrigation 6 Oil Field Water Supply 10 Monitoring Well
3 Feedlot 7 Lawn and Garden Only 11 Injection Well
4 Industrial 8 Air Conditioning 12 Other.....

Was a chemical/bacteriological sample submitted to Department? Yes....No....
If yes, mo/day/yr sample was submitted.....

Water Well Disinfected: Yes..... No.....

5 TYPE OF BLANK CASING USED:

1 Steel 3 RMP (SR) 5 Wrought 7 Fiberglass 9 Other (specify below)
2 PVC 4 ABS 6 Asbestos-Cement 8 Concrete Tile .....

Blank casing diameter.....in. Was casing pulled? Yes..... No..... If yes, how much.....
Casing height above or below land surface.....in.

6 GROUT PLUG MATERIAL: 1 Neat cement 2 Cement grout 3 Bentonite 4 Other.....

Grout Plug Intervals: From.....ft. to.....ft., From.....ft. to .....ft., From..... to.....ft.

What is the nearest source of possible contamination:

1 Septic tank 6 Seepage pit 11 Fuel storage 16 Other (specify below)
2 Sewer lines 7 Pit privy 12 Fertilizer storage .....
3 Watertight sewer lines 8 Sewage lagoon 13 Insecticide storage
4 Lateral lines 9 Feedyard 14 Abandoned water well
5 Cess Pool 10 Livestock pens 15 Oil well/Gas well

Direction from well? ..... How many feet? .....

FROM	TO	PLUGGING MATERIALS

7 CONTRACTOR'S OR LANDOWNER'S CERTIFICATION: This water well was plugged under my jurisdiction and was completed on (mo/day/year)..... and this record is true to the best of my knowledge and belief. Kansas Water Well Contractor's License No. ..... This Water Well Record was completed on (mo/day/year) ..... under the business name of ..... by (signature) .....

INSTRUCTIONS: Use typewriter or ball point pen. Please press firmly and print clearly. Please fill in blanks, underline or circle the correct answers. Send top three copies to Kansas Department of Health and Environment, Bureau of Water, Topeka, Kansas 66620-0001. Telephone: 913/296-3565. Send one to Water Well Owner and retain one for your records.

~~KEA~~
REC'D
Oct 95

STATE OF KANSAS
DEPARTMENT OF HEALTH AND ENVIRONMENT

ARTICLE 12

GROUNDWATER EXPLORATION AND PROTECTION ACT

Bureau of Water
Industrial Program Section
Forbes Field, Building 283
Topeka, Kansas 66620
913/296-5524

ARTICLE 12

Groundwater Exploration and Protection Act

82a-1201. Title. This act shall be known as the "Kansas groundwater exploration and protection act:.

History: L. 1973, ch. 417, § 1; July 1.

82a-1202. Declaration of purpose. It is the purpose of this act to provide for the exploration and protection of groundwater through the licensing and regulation of water well contractors in Kansas to protect the health and general welfare of the citizens of this state; to protect groundwater resources from waste and potential pollution by requiring proper description of the location, drilling and well construction, and proper plugging of abandoned water wells and test holes; and to provide data on potential water supplies through well logs, well pumping tests and water quality tests which will permit the economic and efficient utilization and management of the water resources of this state.

In order to achieve these objectives, this act requires licensing of water well contractors; provides for the establishment of standards for well construction, reconstruction, treatment and plugging; requires each licensed water well contractor to keep and transmit to the state, upon request, a copy of the log of the well, pump test data if available, and water quality samples; and maintains within the state geological survey of Kansas a record system of well logs and water quality data which will be available to the public.

History: L. 1973, ch. 417, § 2; L. 1979, ch. 334, § 1; July 1.

82a-1203. Definitions. As used in this act, unless the context otherwise requires:

(a) "Construction of water wells" means all acts necessary to obtaining groundwater by any method for any use including, without limitation, the location of and excavation for the well.

(b) "Person" means any individual, association, firm, partnership, corporation or governmental entity.

(c) "Sand point" or "well point" means any driven well which is 25 feet or less in depth and is constructed by manually driving into the ground a drive point fitted to the lower end of tightly connected sections of pipe that are 2 inches or less in diameter.

(d) "Domestic uses" means the use of water by any person, family unit or household or household purposes, the watering of livestock, poultry, farm and domestic animals used in operating a farm or the irrigation of lands not exceeding a total of two acres of area for the growing of gardens, orchards or lawns.

(e) "Secretary" means the secretary of health and environment

(f) "Water well" means any excavation that is drilled, cored, bored, washed, driven, dug, jetted, or otherwise constructed, when the intended use of such excavation is for the location, diversion, artificial recharge, or acquisition of groundwater.

(g) "Water well contractor" or "contractor" means any person who constructs, reconstructs or treats a water well. The tern shall not include:

(1) An individual while in the act of constructing a water well on land which is owned by such individual and is used by such individual for domestic purposes at such individual's place of abode, but only when the well is constructed in compliance with prescribed minimum well standards as provided in this act; or

(2) an individual who performs labor or services for a licensed water well contractor at such contractor's direction and under such contractor's supervision.

History: L. 1973, ch. 417, § 3; L. 1974, ch. 352, § 172; L. 1989, ch 311, § 1; July 1.

82a-1205. Administration and enforcement of act; license fees; licenses; inspection; personnel; report. (a) The secretary shall be responsible for the administration and enforcement of the provisions of this act and any rules and regulations adopted pursuant thereto.

(b) The secretary shall fix by rules and regulations reasonable license fees annually for each contractor and for each drill rig operated by or for such contractor. The secretary shall fix by rules and regulations an additional fee for each well drilled except as provided in paragraphs (1) and (2) of subsection (c) of K.S.A. 82a-1203 and amendments thereto. Such fees shall be in an amount, which, together with any other funds available therefor, will produce an amount, which will properly administer the provisions of this act. Any nonresident may secure a water well contractor's license in Kansas upon approval of an application therefor by the secretary and the payment of the fee equal to the fee charged for a similar nonresident license by the state in which the applicant is a resident, but in no case shall the fee be less than that charged a Kansas resident.

(c) The secretary shall have the power and authority and may cause to be inspected water wells in all phases of construction, reconstruction, treatment or plugging, and shall have access to such wells at all reasonable times. The secretary shall have general supervision and authority over the construction, reconstruction and treatment of all water wells and the plugging of holes drilled and abandoned in search of a groundwater supply or hydrogeological information.

(d) The secretary may employ within funds available such engineering, geological, legal, clerical and other personnel as may be necessary for the proper performance of responsibilities under this act. Such employees shall be within the classified service under the Kansas civil service act.

(e) The secretary is authorized and directed to cause examination to be made of applicants for licensing; to renew such licenses; to adopt rules and regulations necessary to establish continuing education requirements for persons licensed under this act; to issue licenses to qualified water well contractors in this state; to revoke or suspend licenses after their issuance is hereafter determined, after notice to the person affected and an opportunity for hearing; and to reinstate licenses previously revoked when justification therefor is shown.

(f) The secretary shall prepare, in the form and manner prescribed by law, a report on the administration of this act.

History: L. 1973, ch. 417, § 5; L. 1974, ch. 352, § 173; L. 1979, ch. 334, § 2; L. 1983, ch. 286, § 8; L. 1991, ch 293 § 1; July 1.

82a-1206. Licensure of water well contractors; application fee; disposition of moneys; water well contractors licensing fund abolished; standards for grating license. (a) Each well contractor desiring to engage in the business of constructing, reconstructing or treating water wells in this state shall make initial application for a license to the secretary. Every contractor making such application shall set out such information as may be required upon forms to be adopted and furnished by the secretary. The secretary shall charge an application fee as established by regulation for the filing of such initial application by a contractor, and the secretary shall not act upon any application until such application fee has been paid.

(b) All application fees and license fees collected hereunder shall be remitted to the state treasurer at least monthly. Upon receipt of any such remittance, the state treasurer shall deposit the entire amount thereof in the state treasury and the same shall be credited to the state general fund. On July 1, 1983, the director of accounts and reports shall transfer all moneys in the water well contractors licensing fund to the state general fund. All liabilities of the water well contractors licensing fund are hereby transferred to and imposed upon the state general fund. The water well contractors licensing fund is hereby abolished.

(c) A license to construct water wells shall be issued to any applicant if, under the standards set forth in K.S.A. 82a-1207 and amendments thereto, the secretary shall determine such applicant is qualified to conduct water well construction operations. In the granting of such licenses due regard shall be given to the interest of the state of Kansas in the protection of its underground water resources. Application fees paid hereunder shall be retained by the secretary whether such initial license is issued or denied, but if denied, the license fee shall be refunded.

(d) Applicants for licenses hereunder who are engaged in business as water well contractors in this state, if incorporated, shall submit evidence of current good standing with the registration requirements for corporations of the secretary of state.

History: L. 1973, ch. 417, § 6; L. 1974, ch. 352, § 174; L. 1979, ch. 334, § 3; L. 1983, ch. 286, § 14; July 1.

82a-1207. Investigation of qualifications; examination. Under such reasonable rules and regulations as the secretary may adopt pertaining to the business of water well contracting and construction of water wells, the secretary shall investigate by examination or otherwise, the qualifications of all applicants for initial licenses as water well contractors to construct, reconstruct or treat wells for production of underground waters in this state. Where an examination is required, such examination may be oral or written or both. The qualifications required of each candidate for such an examination are as follows:

(a) Familiarity with Kansas water laws, sanitary standards for water well drilling and construction of water wells and rules and regulations relating to water well construction, reconstruction, treatment and plugging as adopted by the secretary;

(b) Knowledge of groundwater and subsurface geology in its relation to well construction.

The examinations conducted by the secretary shall be held at such times and places as he may determine. Failure of an applicant to pass such examination shall disqualify him from making further application for a period of one (1) month. The secretary shall act within a reasonable time upon all applications for licenses hereunder.

History: L. 1973, ch. 417, § 7; L. 1974, ch. 352, § 175; L. 1979, ch. 334, § 4; July 1.

82a-1209. Terms of license; renewal; fees; revocation, when. The term of all licenses issued under the provisions of this act shall be July 1 of each year through the following June 30.

Any contractor licensed under the provisions of this act may, on or before July 1, each year, renew such license by paying the annual fee as determined by the secretary and complying with continuing education requirements established by the secretary. If the licensee has not met the requirements for renewal of the license on or before July 1, the license shall be revoked by the secretary. Prior to such revocation, however, the secretary shall notify the applicant of the secretary's intention to revoke at least 10 days prior to the time set for action to be taken, by notice to the applicant at the address appearing on such license in the records and files of the secretary and compliance with the provision of the Kansas administrative procedure act. A license, once revoked, may not be reinstated unless the revocation resulted because of an error of the secretary or other reason not the fault of the licensee. A person whose license has been revoked and who desires to continue to engage in the business of water well construction in this state, must make application as provided for in K.S.A. 82a-1207, and amendments thereto. Such applicant may be required to retake the examination.

History: L. 1973, ch. 417, § 9; L. 1974, ch. 352, § 177; L. 1979, ch. 334, § 5; L. 1984, ch. 313, § 147; L. 1991, ch. 293, § 2; July 1.

82a-1210. Revocation of license, when; complaints against licensee; notice and hearing. Any license issued under this act may be revoked by the secretary (1) when the licensee has practiced fraud or deceit in obtaining a license or otherwise engaging in activities regulated by this act; (2) for negligence or incompetence; or (3) for violating any requirement of this act. Any person, in addition to the secretary, may make complaint against any licensee. Notice shall be given to the licensee of the specific charges, in accordance with the notice provisions of the Kansas administrative procedure act. Prior to revocation or suspension of a license, the water well contractor shall be afforded the opportunity promptly to bring the well up to standard or to correct the error resulting in the complaint. Compliance must be acceptable to the secretary. The secretary shall not revoke any license pursuant to this section without giving the licensee an opportunity for hearing in accordance with the provisions of the Kansas administrative procedure act.

History: L. 1973, ch. 417, § 10; L. 1974, ch. 352, § 178; L. 1979, ch. 334, sec 6; L. 1984, ch. 313, § 148; July 1, 1985.

82a-1211. Appeal from decisions of secretary. Appeals from decisions of the secretary may be taken in accordance with the provisions of the act for judicial review and civil enforcement of agency actions.

History: L. 1973, ch. 417, § 11; L. 1974, ch. 352, § 179; L. 1984, ch. 313, § 149; July 1, 1985.

82a-1212. Log of drilling, boring or digging; contents; filed with state geological survey. Any water well contractor licensed under this act who constructs, reconstructs or plugs a water well shall keep a careful and accurate log of the construction, reconstruction or plugging of such well and shall furnish a record of said well log to the secretary within thirty (30) days after completion of such well in such form as the secretary might require. The log shall show:

(a) The name and address of the landowner and the legal description of the location of the well;

(b) The character and depth of the formation passed through or encountered;

(c) The depth at which water is encountered;

(d) The static water level of the completed well;

(e) A copy of the record of pumping test, if any; and

(f) The construction or reconstruction details of the completed water well including lengths and sizes of casing, length and size of perforations or screens, and length and size of gravel packing; [and]

(g) The amount, type and placement of plug materials used in plugging a water well.

A water sample shall be furnished to the secretary, upon request, within thirty (30) days after completion of such well unless an extension of time is granted by the secretary, in which case, the sample shall be furnished to the secretary within such extended period of time. The well logs and a copy of the water quality analysis shall be transmitted by the secretary to the state geological survey and kept on file by the survey and be available to the public.

History: L. 1973, ch. 417, § 12; L. 1974, ch. 352, § 180; L. 1979, ch. 334, § 7, July 1.

82a-1213. Abandoned holes; plugging; failure to properly seal. All holes drilled in search of a water supply and abandoned, shall be properly plugged by the drilling contractor in accordance with rules and regulations established by the secretary in order to assure adequate and proper plugging of abandoned wells to prevent pollution of existing groundwater. Any contractor who fails to properly seal any exploratory wells drilled in search of a water supply and abandoned by him or her shall be subject to the penalties set out in this act. All unplugged abandoned water wells shall be plugged or caused to be plugged by the landowner in accordance with rules and regulations established by the secretary in order to assure adequate and proper plugging of abandoned water wells to prevent pollution to existing groundwater supplies, except that no unplugged abandoned water well existing on the effective date of this act which is not polluting or threatening to pollute a groundwater supply shall be required to be plugged.

History: L. 1973, ch. 417, § 13; L. 1974, ch. 352, § 181; L. 1979, ch. 334, § 8; July 1.

82a-1214. Penalty for violations of act; enforcement of act. Any person who shall willfully violate any lawful rule or regulation of the secretary relating to water well contracting, or who shall engage in the business of constructing, reconstructing or treating water wells without first having obtained a license as in this act required, or who shall knowingly violate any provisions of this act, shall be guilty of a class B misdemeanor and subject to the penalties therefor as provided by law. In addition the secretary of health and environment is hereby authorized to apply to the district court for enforcement of this act or rules and regulations adopted under this act in accordance with the provisions of the act for judicial review and civil enforcement of agency actions.

History: L. 1973, ch. 417, § 14; L. 1974, ch. 352, § 182; L. 1979,ch. 335, § 1; L. 1984, ch. 313, § 150; July 1, 1985.

82a-1215. Severability. If any word, phrase, sentence or provision of this act is determined to be invalid, such invalidity shall not affect the other provisions of this act and they shall be given effect without the invalid provision, and to this end the provisions of this act are declared to be severable.

History: L. 1973, ch. 417, § 15; July 1.

82a-1216. Civil penalties and orders; appeals; disposition of penalties. (a) Any person who violates any provision of the Kansas groundwater exploration and protection act, any rules or regulations adopted thereunder or any order issued by the secretary thereunder shall incur in addition to other penalties provided by law, a civil penalty not to exceed $5,000 for each violation. In the case of a continuing violation every day such violation continues shall be deemed a separate violation.

(b) The secretary of the department of health and environment or the director of the division of environment, if designated by the secretary, upon a finding that a person has violated any provision of Kansas groundwater exploration and protection act, or any order issued or rule or regulation adopted thereunder, may: (1) Issue a written order requiring that necessary remedial or preventive action be taken within a reasonable time period; (2) assess a civil penalty for each violation within the limits provided in this section which shall constitute an actual and substantial economic deterrent to the violation for which is assessed; or (3) both issue such order and assess such penalty. The order shall specify the provisions of the act or rules or regulations alleged to be violated and the facts constituting each violation. Said order shall include the right to a hearing. Any such order shall become final unless, within 15 days after service of the order, the person named therein shall request in writing a hearing by the secretary. If a hearing is requested, the secretary shall notify the alleged violator or violators of the date, place and time of the hearing.

(c) No civil penalty shall be imposed under this section except after notification by issuance and service of the written order and hearing, if a hearing is requested, in accordance with the provisions of the Kansas administrative procedure act.

(d) Any person aggrieved by an order of the secretary made under this section may appeal such order to the district court in the manner provided by the act for judicial review and civil enforcement of agency actions.

(e) Any penalty recovered pursuant to the provisions of this section shall be remitted to the state treasurer, deposited in the state treasury and credited to the state general fund.

(f) Nothing in this act shall be construed to abridge, limit or otherwise impair the right of any person to damages or other relief on account of injury to persons or property and to maintain any action or other appropriate proceeding therefor.

History: L. 1989, ch. 311, § 2; July 1.

82a-1217. Restraining orders and injunctions; proof required. (a) Notwithstanding the existence or pursuit of any other remedy, the secretary may maintain, in the manner provided by the act for judicial review and civil enforcement of agency actions, an action in the name of the state of Kansas for injunction or other process against any person to restrain or prevent any violation of the provision of the Kansas groundwater exploration and protection act or of any rules and regulations adopted thereunder.

(b) In any civil action brought pursuant to this section in which a temporary restraining order, preliminary injunction or permanent injunction is sought, it shall be sufficient to show that a violation of the provisions of this act or the rules and regulations adopted thereunder has occurred or is imminent. It shall not be necessary to allege or prove at any stage of the proceeding that irreparable damage will occur should the temporary restraining order, preliminary injunction or permanent injunction not be issued or that the remedy at law is inadequate.

History: L. 1989, ch. 311, § 3; July 1.

82a-1218. Application of penalties to sand and well point wells, exception. (a) The provisions of K.S.A. 82a-1216 and 82a-1217 shall not apply with respect to any sand point or well point which is used for domestic purposes, or the reconstruction, replacement or treatment thereof, and which has not been abandoned, until the secretary adopts minimum standards for the construction, reconstruction, treatment or plugging of sand points or well points, except that a temporary restraining order, preliminary injunction or permanent injunction may be obtained pursuant to K.S.A. 82a-1217 if a health hazard is shown to exist or to be imminent.

History: L. 1989, ch. 311, § 4; July 1.

82a-1219. Act supplemental to Kansas groundwater exploration and protection act. K.S.A. 82a-1216, 82a-1217 and 82a-1218 shall be part of and supplemental to the Kansas groundwater exploration and protection act.

History: L. 1989, ch. 311, § 5; July 1.

APPENDIX D

DRAWINGS

US Army Corps
of Engineers

Kansas City District

You Matter – We Care

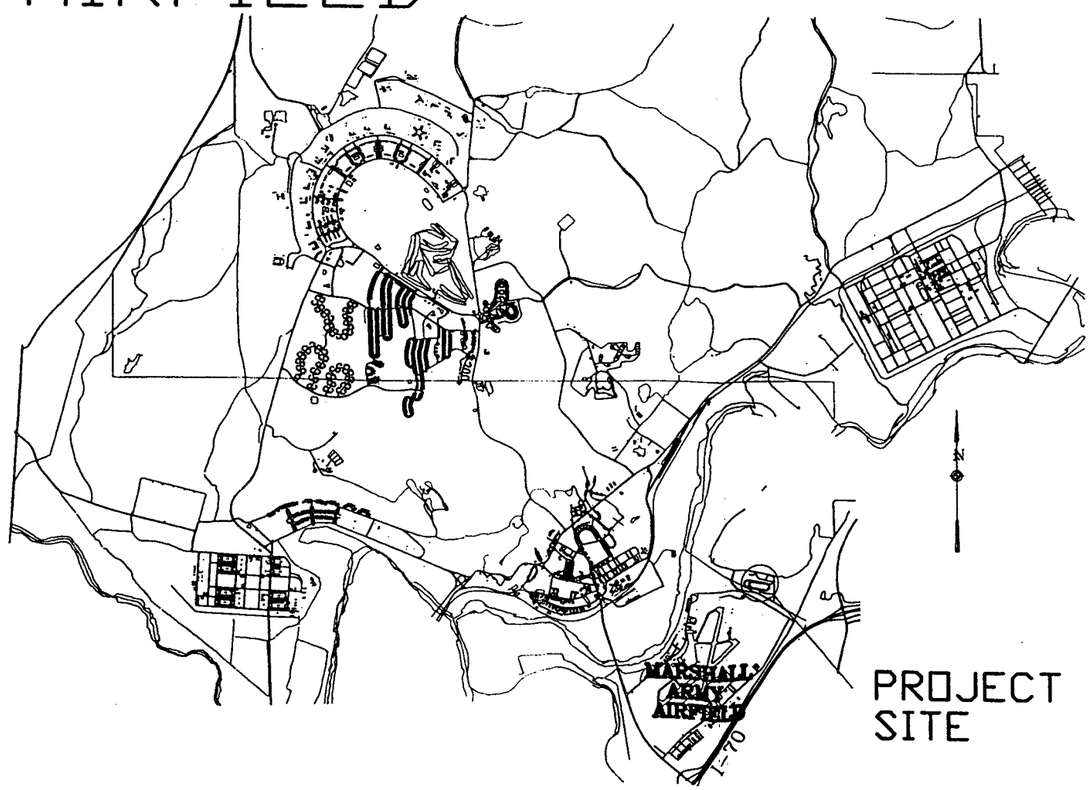
OFF-POST ALTERNATE WATER SUPPLY

FORMER FIRE TRAINING AREA
MARSHALL ARMY AIRFIELD

Fort Riley, Kansas

September 1998
(Revised May 2002)

IFB# DACW41-95-D-0022



INDEX OF DRAWINGS

GENERAL

CIVIL

NOTES:

1. LEGENDS ARE COMPOSED OF STANDARD SYMBOLS AND ARE PERTINENT TO THE CONDITIONS OF THIS SET OF DRAWINGS TO THE EXTENT APPLICABLE.

2. ADDITIONAL LEGENDS AND/OR ANOTHER LEGEND SHEET MAY APPEAR IN THIS SET OF DRAWINGS TO INDICATE SPECIFIC CONDITIONS IN LIEU OF SYMBOLS SHOWN ON THIS SHEET.

3.THE INFORMATION SHOWN ON DRAWINGS REFLECTING THE EXISTING CONDITIONS WAS TAKEN FROM AVAILABLE DRAWINGS AND SURVEYS, AND FURNISHED FOR INFORMATION PURPOSES AS RELATED TO THE PROJECT SCOPE OF WORK. THESE DRAWINGS ARE NOT TO BE CONSTRUED AS "AS-BUILT" CONDITIONS.

CIVIL LEGEND

FUTURE / EXISTING / NEW

- BUILDINGS
- ROADS
- CURB & GUTTER
- WALKS
- CONTOURS (22 / 12)
- SPOT GRADE ELEVATIONS (772)
- DIRECTION OF DRAINAGE
- CULVERT
- STORM DRAIN (SD)
- SUBDRAIN
- SUBDRAIN OUTLET LINE
- WATERLINE (W)
- SANITARY SEWER (S)
- WASTE DRAIN (WD)
- SUBDRAIN FLUSHING & OBSERVATION RISER (OR)
- MANHOLE SELF EXPLANATORY DEPENDING ON TYPE OF UTILITY LINE
- CURB INLET
- DROP INLET #2 (DI 2)
- FIRE HYDRANT
- GATE VALVE & VALVE BOX OR SERVICE STOP & BOX
- RAILROAD
- DRILL HOLE
- POST INDICATOR VALVE (PIV)
- PROPERTY LINE MONUMENT (PM)
- UNDERGROUND STEAM SUPPLY (US) — GAS METER
- FIRE PROTECTION WATERLINE (FW)
- GAS (G)
- GAS MAIN
- GAS METER (M)
- PROJECT LIMIT
- CROSS WALK
- SIGN
- SIGN

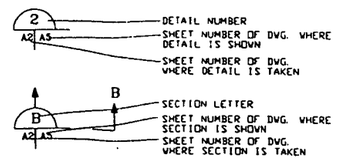
VALVES AND FITTINGS

- GLOBE VALVE
- GATE VALVE
- SWING CHECK VALVE
- HOSE GATE VALVE
- PLUG VALVE
- NEEDLE VALVE
- STRAINER
- RELIEF VALVE
- MOTOR OPERATED VALVE
- TEMPERATURE REGULATING VALVE
- SOLENOID VALVE
- PRESSURE REDUCING VALVE
- FLOAT VALVE
- ANCHOR
- EXPANSION JOINT
- ELBOW DOWN
- ELBOW UP
- TEE DOWN
- TEE UP
- CAP
- UNION
- CALIBRATED BALANCE VALVE
- COMBINATION VALVE (FLOW CONTROL, STRAINER, BALL VALVE AND UNION)
- BALL VALVE
- REDUCING OR INCREASING FITTING
- THERMOMETER AND WELL

FENCES

- x — EXISTING CHAIN LINK SECURITY

SYMBOL IDENTIFICATION



US Army Corps of Engineers
Kansas City District

No.	Description	Symbol	Appr.	Date

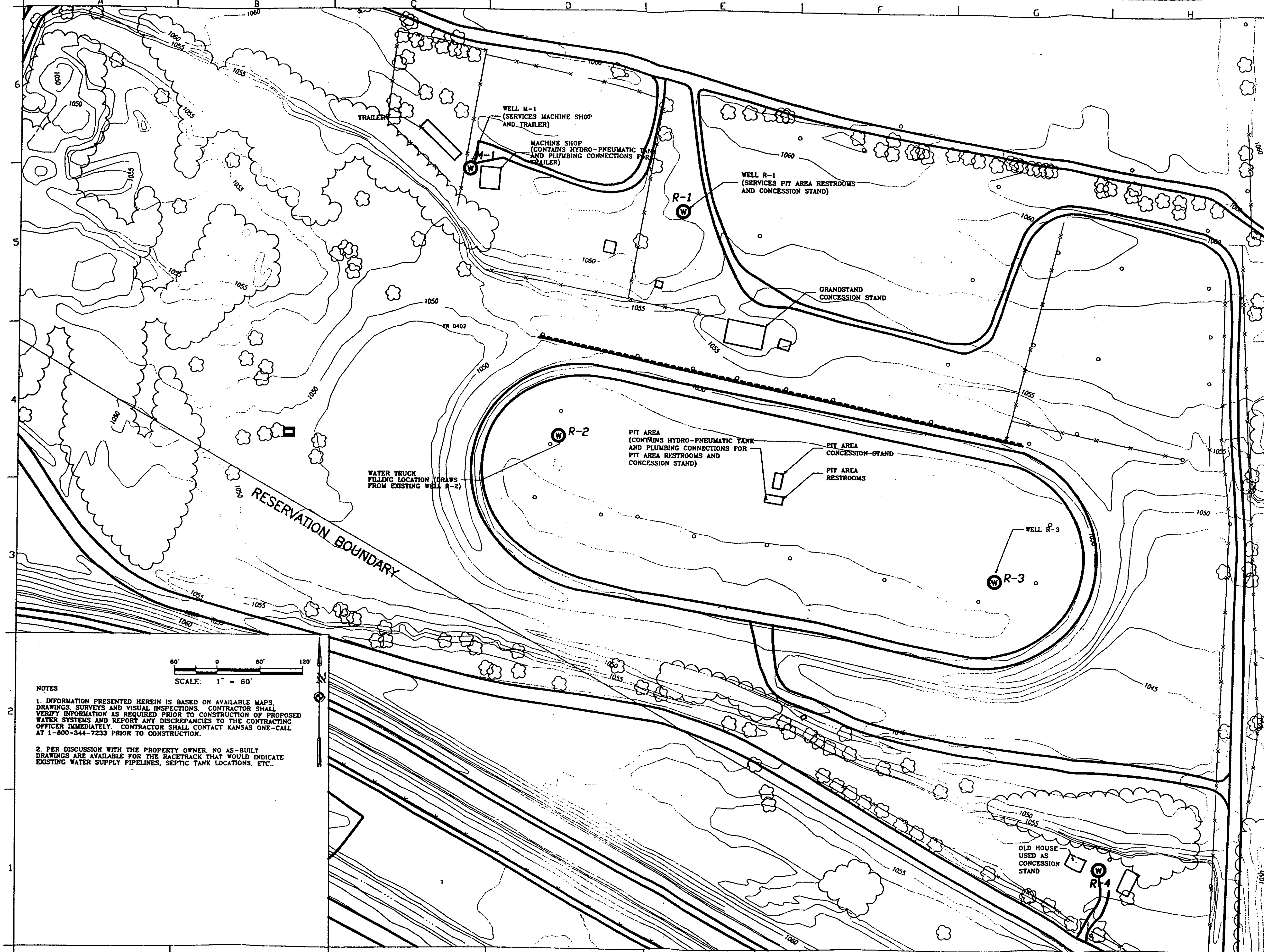
Designed by JSJ | Date Sep 1998 | Rev. X
Drawn by JSJ | Chd by TEE | Design file no. | Drawing code X
Reviewed by RKW | File name mas42001 | Plot scale X | Plot scale 1-qf
Submitted by TEE

U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
KANSAS CITY, MISSOURI

FORT RILEY, KANSAS
OFF-POST ALTERNATE WATER SUPPLY
IFB NO. DACW-41-95-B-0022

INDEX, LEGEND AND GENERAL NOTES

Sheet reference number:
T-2.1



NOTES

1. INFORMATION PRESENTED HEREIN IS BASED ON AVAILABLE MAPS, DRAWINGS, SURVEYS AND VISUAL INSPECTIONS. CONTRACTOR SHALL VERIFY INFORMATION AS REQUIRED PRIOR TO CONSTRUCTION OF PROPOSED WATER SYSTEMS AND REPORT ANY DISCREPANCIES TO THE CONTRACTING OFFICER IMMEDIATELY. CONTRACTOR SHALL CONTACT KANSAS ONE-CALL AT 1-800-344-7233 PRIOR TO CONSTRUCTION.

2. PER DISCUSSION WITH THE PROPERTY OWNER, NO AS-BUILT DRAWINGS ARE AVAILABLE FOR THE RACETRACK THAT WOULD INDICATE EXISTING WATER SUPPLY PIPELINES, SEPTIC TANK LOCATIONS, ETC..

US Army Corps of Engineers
Kansas City District

Symbol	Description	Date	Appr.

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
KANSAS CITY, MISSOURI

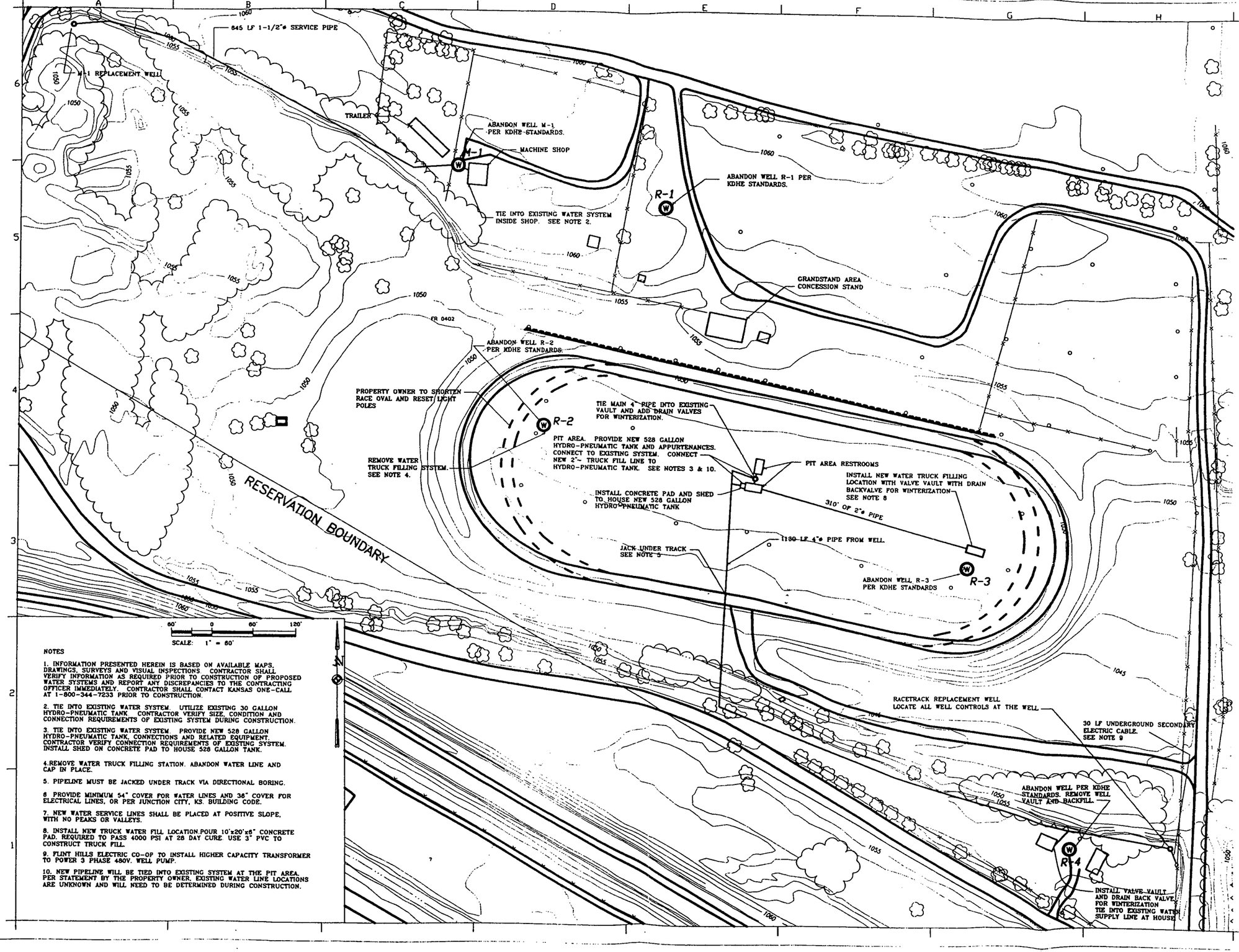
Designed by: RCJ		Date: Sep 1998	Rev. X
Dwn by: RCJ	Ckd by: TEW	Design file no. X	
Reviewed by: ROW		Drawing code: X	
Submitted by: WRK		File name: gaaa0101; Plot date: X; Plot scale: 1"=60'	

FORT RILEY, KANSAS
OFF-POST ALTERNATE WATER SUPPLY
IFB NO. DACW-41-95-D-0022

EXISTING CONDITIONS

Sheet reference number:

C-1.1



NOTES

1. INFORMATION PRESENTED HEREIN IS BASED ON AVAILABLE MAPS, DRAWINGS, SURVEYS AND VISUAL INSPECTIONS. CONTRACTOR SHALL VERIFY INFORMATION AS REQUIRED PRIOR TO CONSTRUCTION OF PROPOSED WATER SYSTEMS AND REPORT ANY DISCREPANCIES TO THE CONTRACTING OFFICER IMMEDIATELY. CONTRACTOR SHALL CONTACT KANSAS ONE-CALL AT 1-800-344-7233 PRIOR TO CONSTRUCTION.

2. TIE INTO EXISTING WATER SYSTEM. UTILIZE EXISTING 30 GALLON HYDRO-PNEUMATIC TANK. CONTRACTOR VERIFY SIZE, CONDITION AND CONNECTION REQUIREMENTS OF EXISTING SYSTEM DURING CONSTRUCTION.

3. TIE INTO EXISTING WATER SYSTEM. PROVIDE NEW 528 GALLON HYDRO-PNEUMATIC TANK, CONNECTIONS AND RELATED EQUIPMENT. CONTRACTOR VERIFY CONNECTION REQUIREMENTS OF EXISTING SYSTEM. INSTALL SHED ON CONCRETE PAD TO HOUSE 528 GALLON TANK.

4. REMOVE WATER TRUCK FILLING STATION. ABANDON WATER LINE AND CAP IN PLACE.

5. PIPELINE MUST BE JACKED UNDER TRACK VIA DIRECTIONAL BORING.

6. PROVIDE MINIMUM 54" COVER FOR WATER LINES AND 36" COVER FOR ELECTRICAL LINES, OR PER JUNCTION CITY, KS. BUILDING CODE.

7. NEW WATER SERVICE LINES SHALL BE PLACED AT POSITIVE SLOPE, WITH NO PEAKS OR VALLEYS.

8. INSTALL NEW TRUCK WATER FILL LOCATION. POUR 10'x20'x6" CONCRETE PAD. REQUIRED TO PASS 4000 PSI AT 28 DAY CURE. USE 3" PVC TO CONSTRUCT TRUCK FILL.

9. FLINT HILLS ELECTRIC CO-OP TO INSTALL HIGHER CAPACITY TRANSFORMER TO POWER 3 PHASE 480V. WELL PUMP.

10. NEW PIPELINE WILL BE TIED INTO EXISTING SYSTEM AT THE PIT AREA, PER STATEMENT BY THE PROPERTY OWNER. EXISTING WATER LINE LOCATIONS ARE UNKNOWN AND WILL NEED TO BE DETERMINED DURING CONSTRUCTION.

US Army Corps of Engineers
Kansas City District

Description	Appr.	Symbol

Date: Sep 1998	Rev. 2
Design File no.	
Drawing Code:	
File name: dwa1d030	
Plot with 2 Plot scale=1.000	

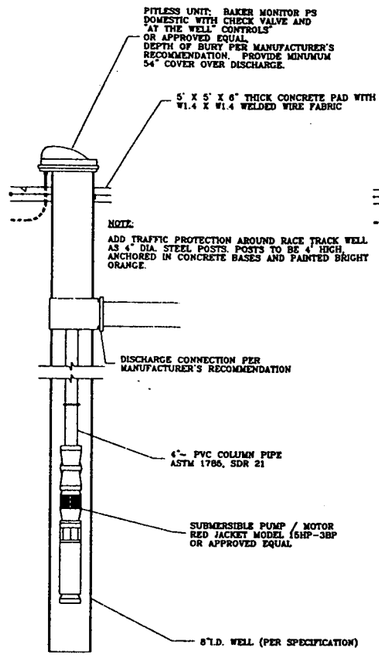
Designed by: BDI	Drawn by: BDI	Checked by:
Reviewed by: BDR	Submitted by: WRE	

U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
KANSAS CITY, MISSOURI

FORT RILEY, KANSAS
OFF-POST ALTERNATE WATER SUPPLY
I/F'B NO. DACW-41-95-B-0022

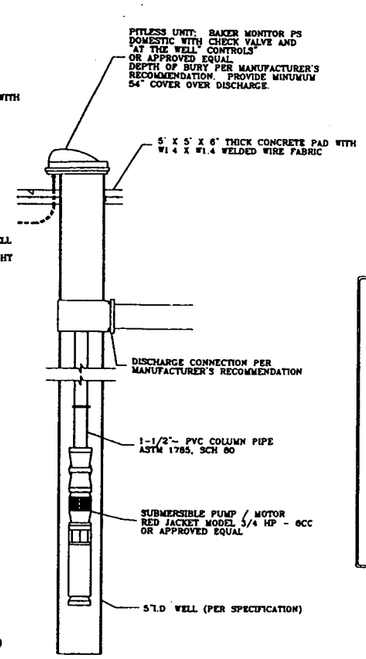
SITE PLAN

Sheet reference number:
C-3.1



RACETRACK REPLACEMENT WELL DETAIL

NOT TO SCALE



M-1 REPLACEMENT WELL DETAIL

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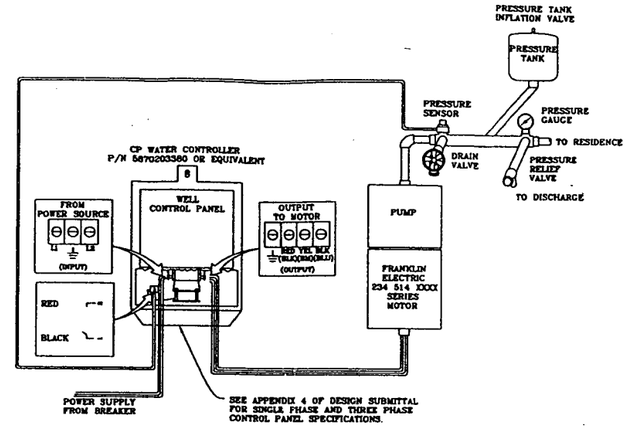

TYPICAL WELL CONTROL DETAIL

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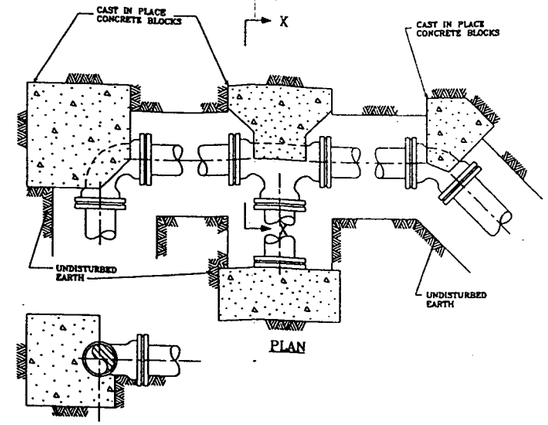


FITTING SIZES	BEARING AREA OF BLOCK IN SQ. FT.				
	TEE, WYE & END	90° BEND	45° BEND	22 1/2° BEND	11 1/4° BEND
4"	1.9	2.7	1.4	.75	.5

NOTE: ABOVE AREAS ARE BASED ON AN ALLOWABLE SOIL BEARING PRESSURES OF 2000 POUNDS PER SQ. FT.

TYPICAL CONCRETE BLOCKING DETAILS

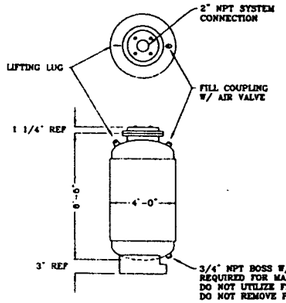
NOT TO SCALE

NOTES:

1. PLACE 4 mil. POLYETHYLENE BETWEEN CONCRETE AND FITTING (CONCRETE SHALL NOT INTERFERE WITH JOINT.)
2. MINIMUM CONCRETE THICKNESS SHALL BE 12"
3. THE HORIZONTAL DIMENSION OF THE BEARING AREA SHALL BE BETWEEN 0.8 AND 1.25 TIMES THE VERTICAL DIMENSION
4. THRUST BLOCK ORIENTATION SHALL BE SUCH THAT THE CENTER OF THE FITTING CORRESPONDS WITH THE CENTER OF THE THRUST BLOCK.
5. THRUST BLOCKS ARE NOT REQUIRED FOR PIPE SIZES SMALLER THAN 4"

TYPE I SERIES

ASME BAG TYPE HYDRO-PNEUMATIC TANK



SPECIFICATIONS

- TYPE DESIGN & CONSTRUCTION: ASME SECTION VIII DIVISION 1
- MAXIMUM WORKING PRESSURE: 125 PSI
- MAXIMUM OPERATING TEMPERATURE: 160° F
- FACTORY PRECHARGE: 12 PSI - ADJUSTABLE IN THE FIELD TO A MAXIMUM OF 60 PSI. FOR HIGHER PRECHARGE PRESSURE - CONSULT FACTORY.
- FINISH: GRAY PRIMER
- FOR VERTICAL INSTALLATION ONLY
- FULL COUPLING ADDED TO PROTECT CHARGING VALVE

APPLICATIONS

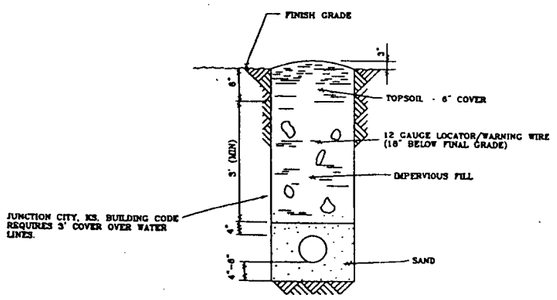
- FOR USE IN HYDROPNEUMATIC APPLICATIONS
- FDA APPROVED POTABLE MATERIAL
- FOR SIZING TANK - PLEASE REFER TO TECHNICAL BULLETIN 002.
- FOR HYDRONIC EXPANSION AND NON-POTABLE HYDRO-PNEUMATIC APPLICATIONS, USE JBER SERIES - SPECIFICATION SHEET 615.
- FOR HIGHER TEMPERATURE POTABLE HYDRO-PNEUMATIC TANK, USE JFTA SERIES - SPECIFICATION SHEET 6998.

528 GALLON HYDRO-PNEUMATIC TANK DETAIL

NOT TO SCALE

NOTE:

TANK TO BE INSTALLED ON A 10'x10'x6" CONCRETE PAD ADJACENT TO THE WESTERN WALL OF THE PIT AREA RESTROOM BUILDING AN 8'x8'x8' BARON STORAGE BUILDING WILL BE INSTALLED TO PROTECT THE TANK. BUILDING SPECIFICATIONS ARE INCLUDED IN APPENDIX 4 OF THE DESIGN SUBMITTAL.

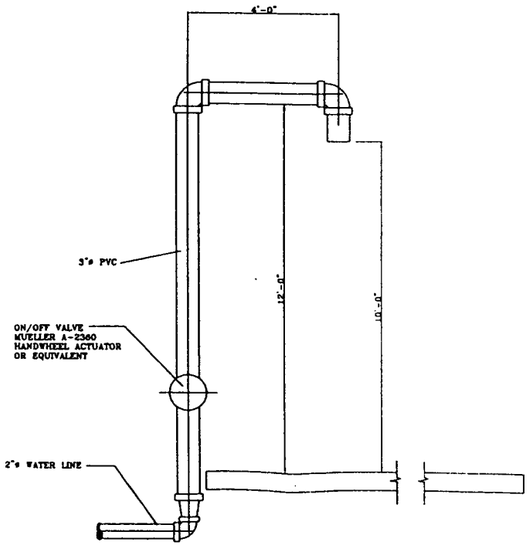


TYPICAL TRENCH DETAIL

NOT TO SCALE

NOTE:

MATCH SURROUNDING GRADE AND SURFACING FOR ROAD AND RACETRACK CROSSINGS.



TRUCK FILL STATION

NOT TO SCALE

NOTES:

1. 10' x 20' x 6" CONCRETE PAD 4000 PSI COMPRESSION STRENGTH @ 28 DAYS
2. 12" SPACING/CENTERS ON REBAR
3. MUELLER VALVE, SELF DRAINING FOR FREEZE PROTECTION

US Army Corps of Engineers
Kansas City District

No.	Description	Date	Appr.

Designed by: RDJ	Date: Sep 1998	Rev. X
Dwn by: RDJ	Chkd by: TEW	Design file no. X
Reviewed by: RDF		Drawing code: X
Submitted by: PWL		File name: mmal60001 Plot date: X Plot scale: 1"=X"

U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS KANSAS CITY, MISSOURI

FORT RILEY, KANSAS
OFF-POST ALTERNATE WATER SUPPLY
IFB NO. DACW-41-95-B-0022

DETAILS

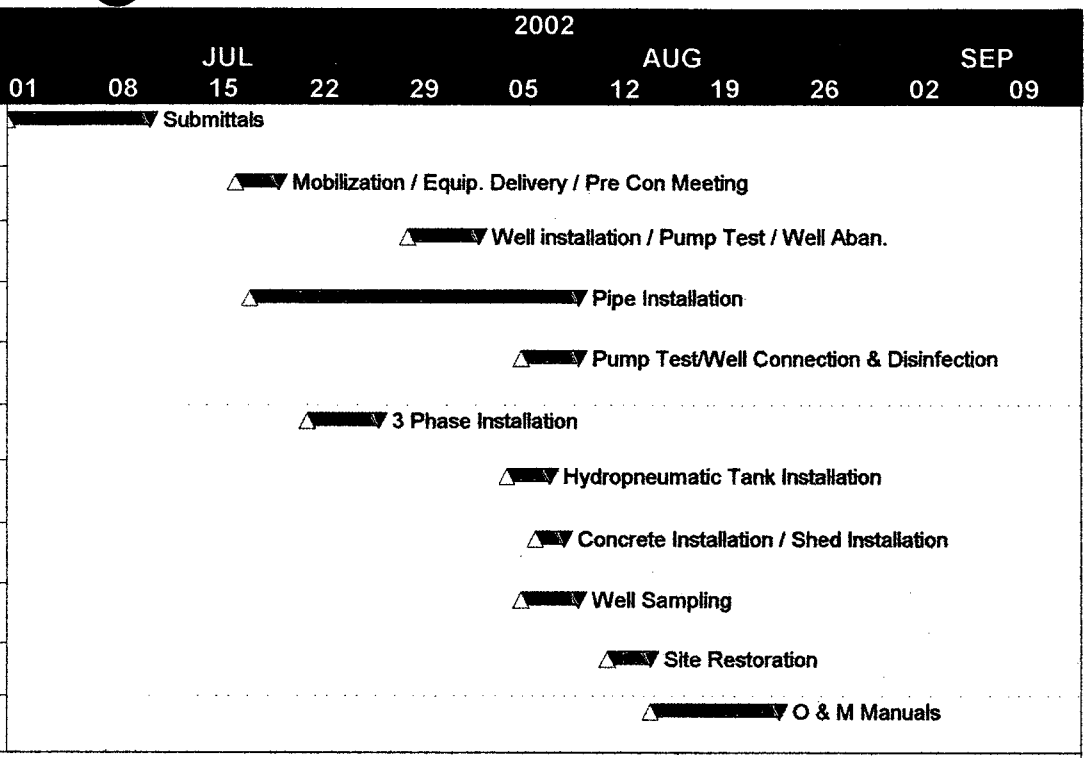
Sheet reference number:

C-6.1

APPENDIX E

PROPOSED PROJECT SCHEDULE/TIMELINE

Act ID	Description	Early Start	Early Finish
TASK 1	Submittals	01JUL02	10JUL02
TASK 2	Mobilization / Equip. Delivery / Pre Con	17JUL02	19JUL02
TASK 3	Well installation / Pump Test / Well	29JUL02	02AUG02
TASK 4	Pipe Installation	18JUL02	09AUG02
TASK 5	Pump Test/Well Connection &	06AUG02	09AUG02
TASK 6	3 Phase Installation	22JUL02	26JUL02
TASK 7	Hydropneumatic Tank Installation	05AUG02	07AUG02
TASK 8	Concrete Installation / Shed Installation	07AUG02	08AUG02
TASK 9	Well Sampling	06AUG02	09AUG02
TASK 10	Site Restoration	12AUG02	14AUG02
TASK 11	O & M Manuals	15AUG02	23AUG02

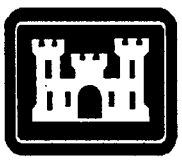


SITE SAFETY AND HEALTH PLAN
for the
WATER DISTRIBUTION SYSTEM BETWEEN OFF-POST SUPPLY WELLS AND DISTRIBUTION POINTS FORMER FIRE TRAINING AREA AT MARSHALL ARMY AIRFIELD FT. RILEY, KS
JULY 2002

DACW41-95-D-0022
DELIVERY ORDER 0012

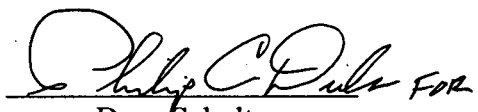
Prepared for

U.S. ARMY ENGINEERING DISTRICT,
KANSAS CITY
ATTN: RICK VAN SAUN
601 E. 12th St.
Kansas City, MO 64106-2896



Prepared by

BAY WEST, INC.
10620 Widmer
Lenexa, KS 66215



Dave Schulte
Health & Safety Manager

July 2002

BW970236

SITE SAFETY AND HEALTH PLAN
for the
Small Project Indefinite
Delivery Type Contract (SPIDT)

Ft. Riley Water Supply System Installation

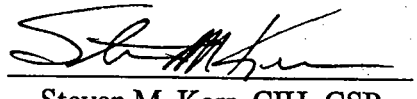
DACW41-95-D-0022

Submitted to

U.S. ARMY ENGINEERING DISTRICT,
KANSAS CITY
ATTN: CEMRK-CT-H/STICHWEH
757 Federal Bldg., 601 E. 12th St.
Kansas City, MO 64106-2896

Submitted by

BAY WEST, INC.
5 Empire Drive
St. Paul, MN 55103-1867



Steven M. Kerr, CIH, CSP
Industrial Hygienist

August 1997

BW970236

TABLE OF CONTENTS

ATTACHMENTS

1.0 INTRODUCTION

1.1 General Safety Policy

It is the policy of Bay West to provide a safe and healthy work environment to all employees and to ensure protection and preservation of the environment to the greatest extent possible.

1.2 Purpose

This Site Safety and Health Plan (SSHP) provides the guidelines for work to be performed at Ft. Riley near Junction City, Kansas, in association with the U.S. Army Corps of Engineers Small Project Indefinite Delivery Type Contract (SPIDT).

1.3 Scope and Application

This SSHP applies to all Bay West personnel, subcontractors to Bay West, and visitors to the project site during the period of work performance. The scope of this SSHP applies to work performed at Ft. Riley near Junction City, Kansas. The scope of work for this project includes the following activities:

- Drilling of two water supply wells
- Installation of approximately 2,750 feet of water supply line and electrical line in four foot deep trenches
- Connecting the system to one residential and two commercial users

The listed activities will not be performed in areas which are contaminated with hazardous materials; therefore, exposure to hazardous materials is not anticipated during any of the activities, including well drilling.

1.4 Regulations and Criteria

This SSHP complies with the following regulations and standards:

- Title 29, Code of Federal Regulations, Parts 1910 and 1926 (as applicable)
- USACE Safety and Health Requirements Manual, EM 385-1-1

1.5 Plan Use and Maintenance

This SSHP must be maintained at the site location throughout performance of the project tasks. It is subject to change based upon conditions encountered at the site. The site supervisor has the authority to modify the contents of this SSHP to adequately protect the health and safety of the project work crew. All modifications must be communicated and approved by the Health and Safety Manager and the USACE.

2.0 STAFF ORGANIZATION, QUALIFICATIONS, and RESPONSIBILITIES

2.1 Key Positions

A listing of key personnel involved in site activities and their primary responsibilities are provided below.

Position	Name	Company	Phone Number
Program Manager	Brad Kulberg	Bay West, Inc.	651/291-3444
Project Manager	Phil Dula	Bay West, Inc.	913/663-2915
Safety & Health Mgr./Industrial Hygienist	Dave Schulte	Bay West, Inc.	651/291-3460
Site Supervisor/Site Safety Officer	Keith Ellis	Bay West, Inc.	913/663-2915

Program Manager: The Program Manager is responsible for overall contract communications with the USACE Contracting Officer and management and quality control of SPIDT contract activities.

Project Manager: The project manager is responsible for planning and oversight of the project activities and acts as an interface between the field location and corporate office.

Site Supervisor: The Site Supervisor is responsible for command and supervision of site activities and shall function as the Site Safety and Health Officer (SSHO) in the absence of a dedicated SSHO.

Safety and Health Manager/Certified Industrial Hygienist: The Safety and Health Manager/CIH is responsible for development and approval of this SSHP and overall management of the health and safety program for this project.

2.2 Subcontractors and Site Visitors

Subcontractor and site visitor personnel associated with this project must adhere to the guidelines and provisions contained in this SSHP. All subcontractor and site visitor activities must be coordinated and approved by the Site Supervisor.

3.0 EMPLOYEE TRAINING

3.1 General Training Requirements

All site workers who perform activities which may result in exposure to the hazardous contaminants must have received training in accordance with 29 CFR 1910.120 (HAZWOPER) to include initial 40 hour hazardous waste site worker training (or equivalent), three days of supervised activities, and annual 8 hour refresher training.

3.2 Site Specific Training

All site personnel must receive training and acknowledge understanding of the contents of this SSHP prior to performing work at the project site. This training will include a review of the project tasks and responsibilities, hazards expected to be encountered, and means of hazard control. This training will be documented on the attached training acknowledgment form (Attachment 1).

4.0 MEDICAL SURVEILLANCE

4.1 General Medical Surveillance Requirements

All site workers who perform activities which may result in exposure to the hazardous contaminants must be a participant of a medical surveillance program meeting the requirements established in 29 CFR 1910.120. Site workers must have received a medical examination within the previous year (two years if permitted by a physician) and be approved to wear respiratory protective equipment.

5.0 HAZARD EVALUATION

5.1 Site Location and Contaminant Characterization

The work will be performed at the Former Fire Training Area at Marshall Army Airfield, Ft. Riley, Kansas. A map showing the location of site is contained in Attachment 2.

5.2 Anticipated Chemical Hazards

Since all project work will be performed outside of known contaminated areas, exposure to hazardous site contaminants is not anticipated. However, unanticipated contact with trichloroethylene (TCE)-contaminated soils may occur if drilling occurs into contaminated areas. The hazards and physical and chemical characteristics of TCE are summarized in the following table:

Exposure Limits:	PEL = 100 ppm IDLH = 1000 ppm
Vapor Pressure:	58 mm Hg
Solubility:	Insoluble
Lower explosive limit:	8%
Routes of exposure:	Inhalation, absorption
Exposure effects:	Eye and skin irritation, headache, vertigo, fatigue, giddiness, tremors, nausea, vomiting, dermatitis, liver injury [potential carcinogen]

Personnel may be exposed to PVC solvent and glue and gasoline and diesel fuel during the installation of the water distribution system. Material Safety Data Sheets for these materials are included in Attachment 3.

5.3 Anticipated Physical Hazards

Drilling and Excavation: Drilling and excavation of soil material will expose workers to heavy equipment, noise, overhead hazards, underground and aboveground utilities, and the potential for cave-ins. These hazards will be controlled through the use of PPE, administrative controls (routine inspections, utility identification, qualified personnel), safety meetings, and awareness to the hazards.

Manual Material Handling: Physical movement of materials and equipment, such as during excavation, drilling, and pipe installation activities, may present hazards leading to injuries such as sprains, strains, and minor hand, arm and feet injuries. Additionally, the potential for slips, trips, and falls will be present. These hazards will be controlled through the use of PPE, using mechanical assistance to lift or move heavy equipment, and working in groups of 2 or more employees.

Trench Excavation: Protection at the top of excavation slopes will be maintained in conformance with EM-385-1-1 Section 25. Excavation shall be inspected by a competent person a minimum of once per day. Personnel shall not enter the excavation unless protective systems such as sloping/benching or shoring are in place. Soils, equipment, and materials shall be kept 2 feet from the face of excavation.

Heat Stress: This project will be performed in July through August and therefore heat stress will pose a threat to our field staff. All field personnel will be required to read and acknowledge our company's SOP regarding Heat/Cold Stress and Adverse Weather Conditions (Attachment 9. The Bay West SSO will monitor field staff for heat stress.

5.4 Activity Hazard Analysis

An activity hazard analysis has been developed for the project activities. These analyses are contained in Attachment 4.

6.0 INJURY and ILLNESS PREVENTION

6.1 Safety Meetings

Safety meetings shall be held by the Site Supervisor each day of the project. All site workers must attend the daily safety meeting. Topics discussed and personnel attendance shall be documented on the Bay West Safety Meeting Form (Attachment 5).

6.2 Safety Inspection

The Site Supervisor shall inspect the project location prior to commencing site work and at least daily thereafter at each site. Hazards identified or unsafe work practices shall be identified and corrected.

6.3 Work Practices

Eating, drinking, chewing gum or tobacco, smoking, or any practice that may lead to the hand to mouth transfer and ingestion of contamination is prohibited.

Site workers must exercise good personal hygiene and must wash exposed skin (hands and face) when exiting the project location and before eating or drinking.

Access to project work area shall be restricted to authorized personnel and controlled by marking the perimeter of the work area with yellow barricade tape (or similar material).

The worksite shall be kept in a clean and orderly condition. Equipment and materials shall be properly stored and maintained when not in use.

7.0 PERSONAL PROTECTIVE EQUIPMENT

7.1 General Personal Protection Equipment (PPE)

Due to the limited hazards anticipated for this project, Level D PPE will be required initially for the both the drilling and piping installation/trenching activities. Upgrade to additional levels of PPE may be necessary as discussed in the following section. Components of the various PPE levels are specified in the following table:

PPE Level	Components
Level B	Same items listed for Level C below, with the following additions: • Supplied air respirator (SCBA or airline with escape SCBA)
Level C	Same items listed for Level D below, with the following additions: • Air purifying respirator with organic vapor cartridge • Tyvek protective suit • Disposable boot covers • Nitrile outer gloves and surgical inner gloves
Level D	• Coveralls (or similar work clothing) • ANSI-approved safety boots • Safety glasses • Hard hat • Hearing protection (if needed)

7.2 PPE Upgrade/Downgrade

If ambient air monitoring indicates the presence of TCE vapors above background levels, upgrade to Level C or Level B PPE may be necessary based on the following monitoring results obtained from a PID with a 10.2 eV lamp:

Airborne Concentration	Required PPE
<22 ppm	Level D
22 ppm	Level C
297 ppm	Level B

8.0 DECONTAMINATION

Decontamination activities for personnel and equipment is not anticipated. If contamination is encountered, all potentially contaminated PPE will need to be containerized and drilling equipment decontaminated.

9.0 EMPLOYEE and WORKSITE MONITORING

9.1 Monitoring Equipment and Methods

Monitoring will be performed during intrusive activities (e.g., drilling, excavation, pipe installation) to confirm the absence of site contaminants in the work areas. A photoionization detector (PID) with a 10.2 eV lamp will be used to periodically monitor the ambient work area during these activities. Prior to beginning these activities, the background concentration should be obtained and used as a basis for further monitoring.

10.0 EMERGENCY RESPONSE and CONTINGENCY PLANNING

10.1 Emergency Coordination and Planning

The site supervisor is responsible for management of emergency activities which may include responses to medical, fire, or injury occurrences. Prior to commencement of work at the site, the site supervisor shall discuss with site workers the actions to be taken in the event of an emergency, the location of emergency equipment, and the identity and location (route) to the designated medical facility.

10.2 Medical Emergency Information

Accidents or incidents requiring medical assistance shall be reported to the Site Supervisor. If emergency medical services are required, dial 911. The designated medical provider for non-emergency medical situations is:

Geary Community Hospital
1102 St. Mary's Road
Junction City, KS 66441
785/238-4131

A map showing the project and hospital locations is attached (Attachment 2).

10.3 Injury Reporting

All injury and non-injury accidents must be reported to the site supervisor and documented. Information concerning accidents shall be documented and reported on USACE form 3394 (Attachment 6).

10.4 Emergency Equipment and Personnel

The following emergency equipment shall be maintained near the vicinity of the work area and shall be easily accessible if needed:

- First aid kit
- Fire extinguisher
- Telephone
- Eye wash (bottles)

At least two persons shall be at the project site who are first aid and CPR trained.

10.5 Spill Control

The potential for releases of hazardous materials brought onto the site is minimal due to the limited quantities which shall be used (e.g., gasoline for generators and other powered equipment). However, in the event of a release of such materials, the released material and any contaminated soils must be controlled and containerized.

ATTACHMENT 1

Training Acknowledgment Form

BAY WEST INC.
TRAINING ACKNOWLEDGMENT FORM

Ft. Riley Water Distribution System Installation
Contract #DACW 41-95-D-0022
Ft. Riley, Kansas

Employee/Visitor Name: _____

The contract for the above project requires the following:

- that you be provided with and complete formal and site-specific training;
- that you be supplied with proper personal protective equipment including respirators if needed;
- that you be trained in its use;
- and that you receive a medical examination to evaluate your physical capacity to perform your assigned work tasks, under the environmental conditions expected, while wearing the required personal protective equipment.

Those things are to be done at no cost to you. By signing this certificate, you are acknowledging that your employer has met these obligations to you.

I HAVE READ, UNDERSTAND AND AGREE TO FOLLOW THE SITE SAFETY AND HEALTH PLAN FOR THIS SITE.

Name: Date:

_____ _____

FORMAL TRAINING: I have completed the following training courses that meet OSHA requirements:

	Date Completed
40 hour HAZWOPER	_____
8 hour supervisory	_____
8 hour refresher	_____
First aid/CPR	_____

(You must provide copies of course completion certificates for these courses.)

SITE-SPECIFIC TRAINING: I have been provided and have completed the site-specific training required by this Contract. _____ (initials)

RESPIRATORY PROTECTION: I have been trained in accordance with the criteria in my employer's respiratory protection program. I have been trained in the proper work procedures and use and limitation of the respirator I will wear. I have been trained in and will abide by the facial hair policy. _____ (initials) or _____ Not applicable.

RESPIRATOR FIT-TEST TRAINING: I have been trained in the proper selection, fit, use, care, cleaning, maintenance, and storage of the respirator that I will wear. I have been fit-tested in accordance with the criteria in Bay West's Respiratory Program and have received a satisfactory fit. I have been taught how to properly perform positive and negative pressure fit-checks upon donning negative pressure respirators each time. _____ (initials) or _____ Not applicable.

MEDICAL EXAMINATION: I have had a medical examination within the last 12 / 24 (circle one) months which was paid for by my employer. The examination met the requirements of 29 CFR 1910.120. A physician made a determination regarding my physical capacity to perform work tasks on the project while wearing protective equipment, possibly including a respirator. I was personally provided a copy and informed of the results of that examination. The physician determined that there:

_____were no limitations to performing the required tasks.

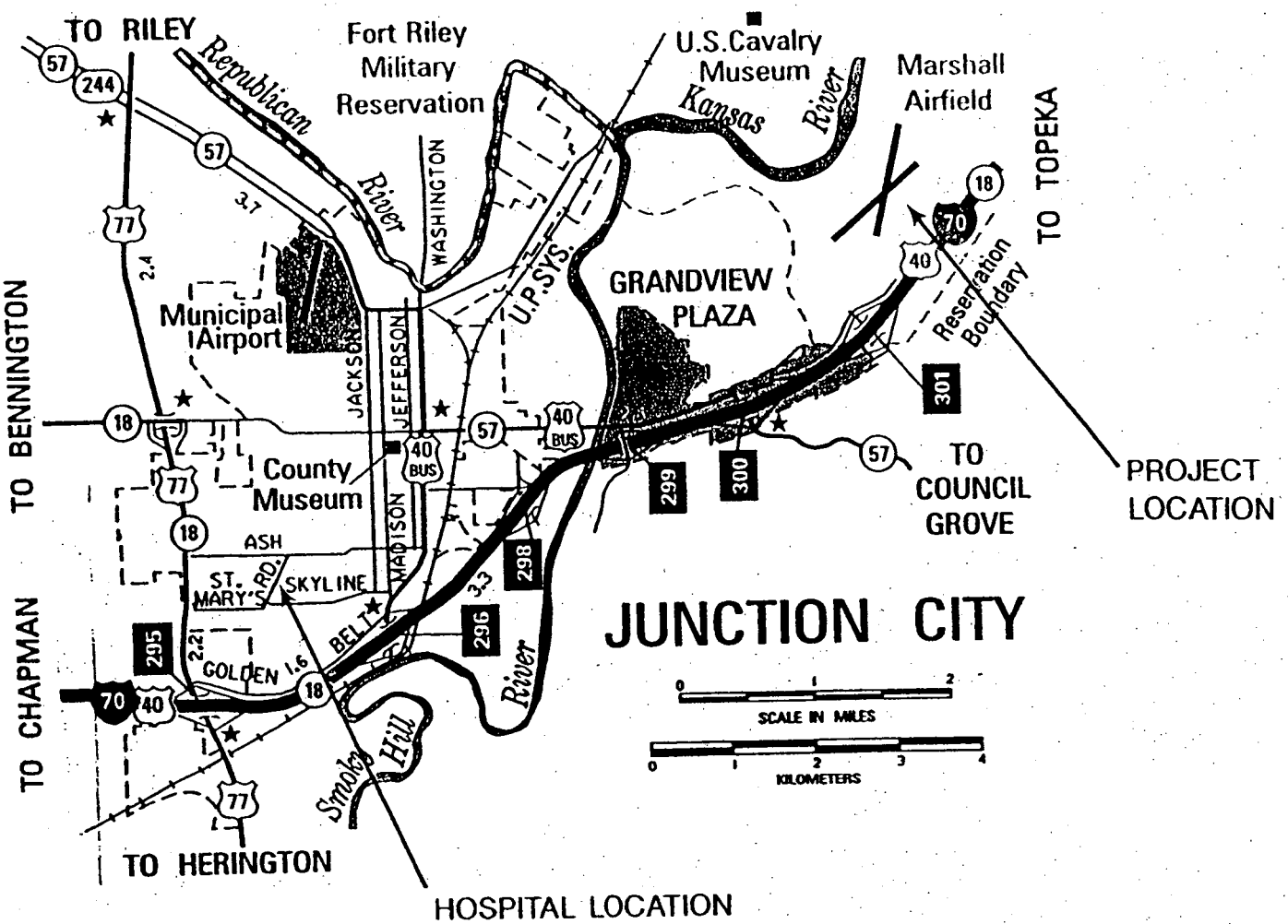
_____were identified physical limitations to performing the required work tasks.

Date of medical examination: _____

Employee/Visitor Signature:	
Printed Name:	
Date:	
Social Security Number:	

ATTACHMENT 2

Facility Location Map
and
Hospital Route

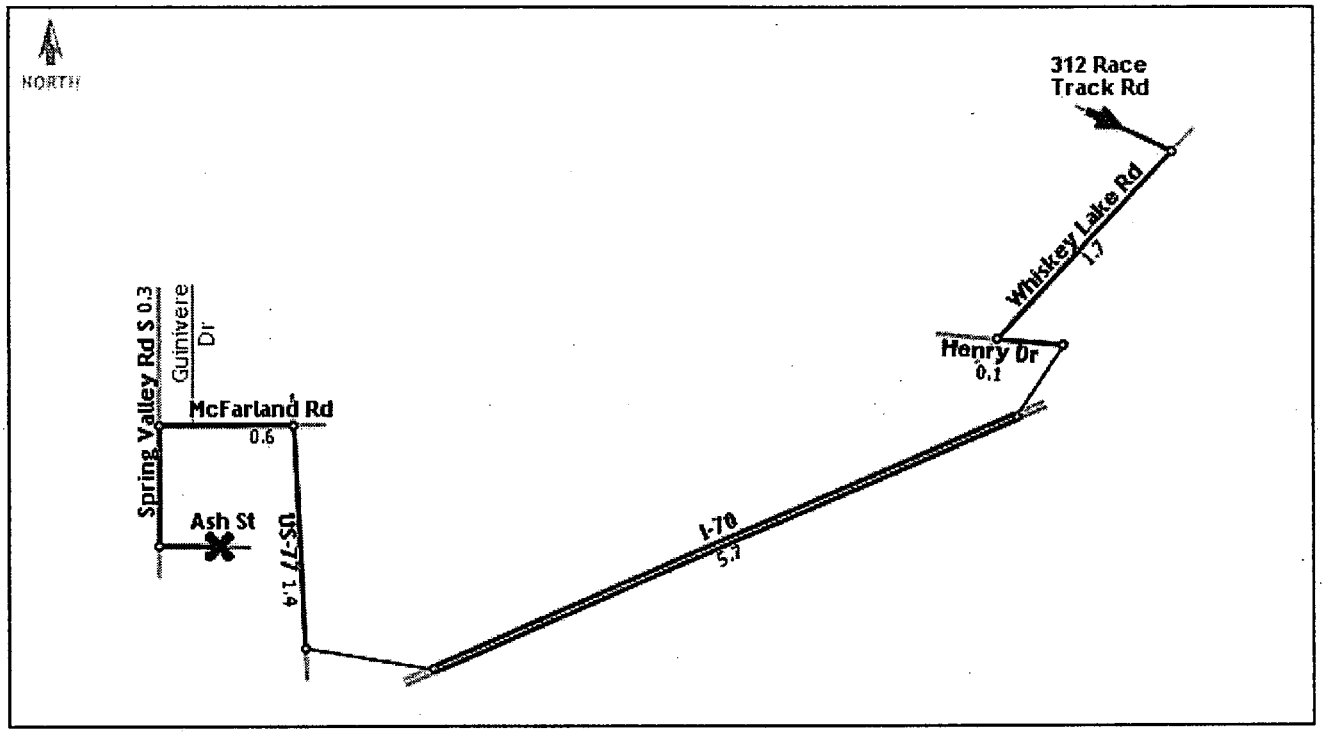

TO RILEY
Republican River
Fort Riley Military Reservation
U.S.Cavalry Museum
Kansas River
Marshall Airfield
TO TOPEKA
WASHINGTON
JACKSON
JEFFERSON
U.P.SYS.
Municipal Airport
GRANDVIEW PLAZA
Reservation Boundary
TO BENNINGTON
County Museum
ASH
ST. MARY'S RD.
SKYLINE
MADISON
BELT
GOLDEN
TO COUNCIL GROVE
PROJECT LOCATION
JUNCTION CITY
TO CHAPMAN
TO HERINGTON
Smoky Hill River
HOSPITAL LOCATION
SCALE IN MILES
KILOMETERS

MAPBLAST!
Everyone needs a little direction in life

From: 312 Race Track Rd
Junction City, KS 66441-7661

To: Ash St
Junction City, KS

The estimated travel time is 16 minutes for 10.02 miles of travel, total of 10 steps.



	Directions	Elapsed Distance
1	Begin at **312 Race Track Rd** on **Race Track Rd** and go Southeast for 700 feet	0.1
2	Turn right on **Whiskey Lake Rd** and go Southwest for 1.7 miles	1.8
3	Turn left on **Henry Dr** and go East for 400 feet	1.9
4	Turn right on ramp and go Southwest for 900 feet	2.0
5	Bear right on **I-70,KS-18,US-40** and go Southwest for 6 miles	7.7
6	Exit **I-70,KS-18,US-40** via ramp to **US-77,KS-18** and go West for 0.2 miles	7.9
7	Turn right on **US-77,KS-18** and go North for 1.3 miles	9.2
8	Turn left on **McFarland Rd** and go West for 0.5 miles	9.8
9	Turn left on **Spring Valley Rd S** and go South for 0.2 miles	10.0
10	Turn left on **Ash St** and go East for 70 feet to **Ash St**	10.0

ATTACHMENT 3

Material Safety Data Sheets

89

al Safety Data Sheet

y sed to comply with
HA's Hazard Communication Standard.
CFR 1910.1200. Standard must be
nsulted for specific requirements.

U.S. Department of Labor

Occupational Safety and Health Administration
(Non-Mandatory Form)
Form Approved
OMB No. 1218-0072

ENTITY *(As Used on Label and List)*
PVC Cement

Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.

ection I

anufacturer's Name: OS PRODUCTS CO. INC.	Emergency Telephone Number: 215 679 6262
dress *(Number, Street, City, State, and ZIP Code)*: TH STREET	Telephone Number for Information: 215 679 6262
EAST GREENVILLE, PA. 18041	Date Prepared: 12 15 86
	Signature of Preparer *(optional)*

ection II — Hazardous Ingredients/Identity Information

azardous Components (Specific Chemical Identity; Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	% *(optional)*
TETRAHYDROFURAN (THF) 37% (109-99-9)	CAS# 109-99-9	200		
CYCLOHEXANONE 2%= (108-94-1)	CAS#108-94-1	50		
PVC RESIN 14% (9002-86-2)	CAS#	N/A		
~~METHYL ETHYL KETONE - 47% (78-93-3)~~	CAS#78-93-3	200		

Section III — Physical/Chemical Characteristics

Boiling Point F	151	Specific Gravity (H_2O = 1)	N/A
Vapor Pressure (mm Hg.) 068 F	143	Melting Point	N/A
Vapor Density (AIR = 1)	2.49	Evaporation Rate (Butyl Acetate = 1)	

Solubility in Water: COMPLETE

Appearance and Odor: CLEAR, ETHEREAL ODOR

Section IV — Fire and Explosion Hazard Data

Flash Point (Method Used)	Flammable Limits	LEL	UEL
CLOSED CUP 6 DEG F		2%	11.8

uishing Media: ANSUL "PURPLE-K POTASSIUM BICARBONATE, "AERO-FOAM" ALCOHOL RESISTANT FOAM

Special Fire Fighting Procedures: N/A

Unusual Fire and Explosion Hazards: PEROXIDES MAY FORM ON LONG STANDING WHICH SHOULD BE DESTROY

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

Form Approved
OMB No. 44-R1387

MATERIAL SAFETY DATA SHEET

Required under USDL Safety and Health Regulations for Ship Repairing, Shipbuilding, and Shipbreaking (29 CFR 1915, 1916, 1917)

SECTION I

2/20/81

MANUFACTURER'S NAME	EMERGENCY TELEPHONE NO.
Oatey Co.	216/267-7100

ADDRESS (Number, Street, City, State, and ZIP Code): 4700 West 160th Street Cleveland OH 44135

CHEMICAL NAME AND SYNONYMS	TRADE NAME AND SYNONYMS
	PVC Cement, All Weather

CHEMICAL FAMILY	FORMULA

SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS Tetrahydrofuran	68-72	200	FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES Cyclohexanone	9-15	50	OTHERS		
OTHERS					

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)

SECTION III - PHYSICAL DATA

BOILING POINT (°F.)	151	SPECIFIC GRAVITY (H_2O=1)	0.945
VAPOR PRESSURE (mm Hg.)	145	PERCENT, VOLATILE BY VOLUME (%)	89
VAPOR DENSITY (AIR=1)	2.5	EVAPORATION RATE (_____ =1)	8
SOLUBILITY IN WATER	Negligible		

APPEARANCE AND ODOR: Low viscosity colorless liquid with ether-like odor.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used)	FLAMMABLE LIMITS	Lel	Uel
60°F. Closed Cup.		1.8%	11.8%

EXTINGUISHING MEDIA: Water spray, dry chemical or carbon dioxide foam.

SPECIAL FIRE FIGHTING PROCEDURES: High pressure water spray, dry chemical or carbon dioxide fire extinguisher directed at base of flames.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Main hazard is flammability. Keep away from open flame, sparks, heat. Vapor is heavier than air and will settle on floor or in low areas.

(90)

terial Safety Data Sheet

...y be used to comply with OSHA's Hazard Communication Standard, 29 CFR 1910.1200. Standard must be consulted for specific requirements.

U.S. Department of Labor
Occupational Safety and Health Administration
(Non-Mandatory Form)
Form Approved
OMB No. 1218-0072

IDENTITY (As Used on Label and List)	Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.
PVC Cement and HC Cement	

Section I

Manufacturer's Name Cresline Plastic Pipe Co., Inc.	Emergency Telephone Number (812) 428-9300
Address (Number, Street, City, State, and ZIP Code) 955 Diamond Avenue	Telephone Number for Information Same
Evansville, IN 47711	Date Prepared 5-27-86
	Signature of Preparer (optional)

Section II — Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity; Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
Tetrahydrofuran	200	200		
Methyl Ethyl Ketone	200	200		
Cyclohexanone	50	25		

Section III — Physical/Chemical Characteristics

Boiling Point	151°F	Specific Gravity (H_2O = 1)	0.91
Vapor Pressure (mm Hg.)	143	Melting Point	N.A.
Vapor Density (AIR = 1)	2.5	Evaporation Rate (Butyl Acetate = 1)	8

Solubility in Water: N.A.

Appearance and Odor: Low viscosity liquid with ether-like odor

Section IV — Fire and Explosion Hazard Data

Flash Point (Method Used) 6°F (TCC)	Flammable Limits	LEL 2%	UEL 12%

Extinguishing Media: Carbon dioxide or dry chemical

Special Fire Fighting Procedures: N.A.

Unusual Fire and Explosion Hazards: Vapor is heavier than air and may travel along floor or ground to ignition sources away from use area.

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U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

Form Approved
OMB No. 44-R1387

MATERIAL SAFETY DATA SHEET

Required under USDL Safety and Health Regulations for Ship Repairing, Shipbuilding, and Shipbreaking (29 CFR 1915, 1916, 1917)

SECTION I

2/20/81

MANUFACTURER'S NAME	EMERGENCY TELEPHONE NO.
Oatey Co.	216/267-7100

ADDRESS (Number, Street, City, State, and ZIP Code): 4700 West 160th Street Cleveland OH 44135

CHEMICAL NAME AND SYNONYMS	TRADE NAME AND SYNONYMS
	PVC Cement-Heavy Duty-Clear
CHEMICAL FAMILY	FORMULA

SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS Tetrahydrofuran	68-72	200	FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES Cyclohexanone	9-13	50	OTHERS		
OTHERS					

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)

SECTION III - PHYSICAL DATA

BOILING POINT (°F.)	151	SPECIFIC GRAVITY (H_2O=1)	0.945
VAPOR PRESSURE (mm Hg.)	145	PERCENT, VOLATILE BY VOLUME (%)	89
VAPOR DENSITY (AIR=1)	2.5	EVAPORATION RATE (_____=1)	8
SOLUBILITY IN WATER	Negligible		

APPEARANCE AND ODOR: Low viscosity colorless liquid with ether-like odor.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used)	FLAMMABLE LIMITS	Lel	Uel
6°F, Closed Cup.		1.8%	11.8%

EXTINGUISHING MEDIA: Water spray, dry chemical or carbon dioxide foam.

SPECIAL FIRE FIGHTING PROCEDURES: High pressure water spray, dry chemical or carbon dioxide fire extinguisher directed at base of flames.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Main hazard is flammability. Keep awy from open flame, sparks, heat. Vapor is heavier than air and will settle on floor or in low areas.

M

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

Form Approved
OMB No. 44-R1387

MATERIAL SAFETY DATA SHEET

Required under USDL Safety and Health Regulations for Ship Repairing, Shipbuilding, and Shipbreaking (29 CFR 1915, 1916, 1917)

SECTION I

2/20/81

MANUFACTURER'S NAME	EMERGENCY TELEPHONE NO.
Oatey Co.	216/267-7100
ADDRESS (Number, Street, City, State, and ZIP Code) 4700 West 160th Street Cleveland OH 44135	
CHEMICAL NAME AND SYNONYMS	TRADE NAME AND SYNONYMS PVC Cement REGULAR
CHEMICAL FAMILY	FORMULA

SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS Tetrahydrofuran	23-27	200	FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES Cyclohexanone	4-8	50	OTHERS		
OTHERS Methyl Ethyl Ketone	55-59	200			

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)

SECTION III - PHYSICAL DATA

BOILING POINT (°F.)	151	SPECIFIC GRAVITY (H_2O=1)	0.945
VAPOR PRESSURE (mm Hg.)	145	PERCENT, VOLATILE BY VOLUME (%)	89
VAPOR DENSITY (AIR=1)	2.5	EVAPORATION RATE (BUTYL ACETATE = 1.0	8
SOLUBILITY IN WATER	Negligible		
APPEARANCE AND ODOR	Low viscosity colorless liquid with ether-like odor.		

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used)	FLAMMABLE LIMITS	Lel	Uel
60F. Closed Cup.		1.8%	11.8%

EXTINGUISHING MEDIA
Water spray, dry chemical or carbon dioxide foam.

SPECIAL FIRE FIGHTING PROCEDURES
High pressure water spray, dry chemical or carbon dioxide fire extinguisher directed at base of flames.

UNUSUAL FIRE AND EXPLOSION HAZARDS
Main hazard is flammability. Keep away from open flame, sparks, heat. Vapor is heavier than air and will settle on floor or in low areas.

644013-00

644013-00 MOBILITH SHC RR 221
MATERIAL SAFETY DATA BULLETIN

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1. PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: MOBILITH SHC RR 221
SUPPLIER: EXXONMOBIL OIL CORPORATION
3225 GALLOWS RD.
FAIRFAX, VA 22037
- Hour Emergency (call collect): 609-737-4411
oduct and MSDS Information: 800-662-4525 856-224-4644
CHEMTREC: 800-424-9300 202-483-7616

2. COMPOSITION/INFORMATION ON INGREDIENTS

CHEMICAL NAMES AND SYNONYMS: SYN. HYDROCARBONS AND ADDITIVES
INGREDIENTS CONSIDERED HAZARDOUS TO HEALTH:
This product is not formulated to contain ingredients which have exposure limits established by U.S. agencies. It is not hazardous to health as defined by the European Union Dangerous Substances/Preparations Directives. See Section 15 for a regulatory analysis of the ingredients.
See Section 15 for European Label Information.
See Section 8 for exposure limits (if applicable).

3. HAZARDS IDENTIFICATION

S OSHA HAZARD COMMUNICATION STANDARD: Product assessed in accordance th OSHA 29 CFR 1910.1200 and determined not to be hazardous.
FECTS OF OVEREXPOSURE: No significant effects expected.
EMERGENCY RESPONSE DATA: White Grease. DOT ERG No. : NA

FIRST AID MEASURES

EYE CONTACT: Flush thoroughly with water. If irritation occurs, call a physician.
SKIN CONTACT: Wash contact areas with soap and water. High pressure accidental injection through the skin requires immediate medical attention for possible incision, irrigation and/or debridement.
INHALATION: Not expected to be a problem.
INGESTION: Not expected to be a problem when ingested. If uncomfortable seek medical assistance.

5. FIRE-FIGHTING MEASURES

EXTINGUISHING MEDIA: Carbon dioxide, foam, dry chemical and water fog.
SPECIAL FIRE FIGHTING PROCEDURES: Water or foam may cause frothing. Use water to keep fire exposed containers cool. Water spray may be used to flush spills away from exposure. Prevent runoff from fire control or dilution from entering streams, sewers, or drinking water supply.
SPECIAL PROTECTIVE EQUIPMENT: For fires in enclosed areas, fire fighters must use self-contained breathing apparatus.
USUAL FIRE AND EXPLOSION HAZARDS: None. Flash Point C(F): > 204(400) (ASTM D-93). Flammable limits - LEL: NA, UEL: NA.
NFPA HAZARD ID: Health: 0, Flammability: 1, Reactivity: 0
HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide. Metal oxides. Elemental oxides.

6. ACCIDENTAL RELEASE MEASURES

NOTIFICATION PROCEDURES: Report spills as required to appropriate authorities. U. S. Coast Guard regulations require immediate reporting of spills that could reach any waterway including intermittent dry creeks. Report spill to Coast Guard toll free number (800) 424-8802. In case of accident or road spill notify CHEMTREC (800) 424-9300.
PROCEDURES IF MATERIAL IS RELEASED OR SPILLED: Shovel up and dispose of at an appropriate waste disposal facility in accordance with current applicable laws and regulations, and product characteristics at time of disposal.
ENVIRONMENTAL PRECAUTIONS: Prevent spills from entering storm sewers or drains and contact with soil.
PERSONAL PRECAUTIONS: See Section 8

7. HANDLING AND STORAGE

NDLING: High pressure injection under the skin may occur due to the pture of pressurized lines. Always seek medical attention.
STORAGE: Do not store in open or unlabelled containers. Store away from strong oxidizing agents or combustible material.

---

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

VENTILATION: No special requirements under ordinary conditions of use and with adequate ventilation.
RESPIRATORY PROTECTION: No special requirements under ordinary conditions of use and with adequate ventilation.
EYE PROTECTION: Generally eye contact is unlikely with this type material. If eye contact is likely, safety glasses with side shields or chemical type goggles should be worn.
SKIN PROTECTION: If prolonged or repeated skin contact is likely, oil impervious gloves should be worn. Good personal hygiene practices should always be followed.
EXPOSURE LIMITS: This product does not contain any components which have recognized exposure limits.

PHYSICAL AND CHEMICAL PROPERTIES

Typical physical properties are given below. Consult Product Data Sheet for specific details.
APPEARANCE: Grease
COLOR: White
ODOR: Mild
ODOR THRESHOLD-ppm: NE
pH: NA
BOILING POINT C(F): NE
DROP POINT C(F): > 246(475)
FLASH POINT C(F): > 204(400) (ASTM D-93)
FLAMMABILITY: NE
AUTO FLAMMABILITY: NE
EXPLOSIVE PROPERTIES: NA
OXIDIZING PROPERTIES: NA
VAPOR PRESSURE-mmHg 20 C: < 0.1
VAPOR DENSITY: NE
EVAPORATION RATE: NE
RELATIVE DENSITY, 15/4 C: 0.909
SOLUBILITY IN WATER: Negligible
PARTITION COEFFICIENT: > 3.5
VISCOSITY AT 40 C, cSt: > 198.0
SCOSITY AT 100 C, cSt: NE
UR POINT C(F): NA
FREEZING POINT C(F): NE

VOLATILE ORGANIC COMPOUND: NE
NOTE: MOST PHYSICAL PROPERTIES FOR OIL COMPONENT.
NA=NOT APPLICABLE NE=NOT ESTABLISHED D=DECOMPOSES
FOR FURTHER TECHNICAL INFORMATION, CONTACT YOUR MARKETING REPRESENTATIVE

---

10. STABILITY AND REACTIVITY

STABILITY (THERMAL, LIGHT, ETC.): Stable.
CONDITIONS TO AVOID: Extreme heat.
INCOMPATIBILITY (MATERIALS TO AVOID): Strong oxidizers.
HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide. Metal oxides. Elemental oxides.
HAZARDOUS POLYMERIZATION: Will not occur.

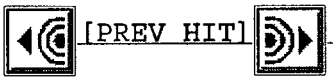
---

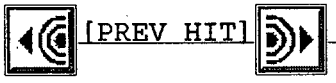
11. TOXICOLOGICAL DATA

---ACUTE TOXICOLOGY---
ORAL TOXICITY (RATS): Practically non-toxic (LD50: greater than 2000 mg/kg). ---Based on testing of similar products and/or the components.
DERMAL TOXICITY (RABBITS): Practically non-toxic (LD50: greater than 2000 mg/kg). ---Based on testing of similar products and/or the components.
INHALATION TOXICITY (RATS): Not applicable ---Harmful concentrations of mists and/or vapors are unlikely to be encountered through any customary or reasonably foreseeable handling, use, or misuse of this product.
EYE IRRITATION (RABBITS): Practically non-irritating. (Draize score: greater than 6 but 15 or less). ---Based on testing of similar products and/or the components.
SKIN IRRITATION (RABBITS): Practically non-irritating. (Primary Irritation Index: greater than 0.5 but less than 3). ---Based on testing of similar products and/or the components.
OTHER ACUTE TOXICITY DATA: The acute toxicological results summarized above are based on testing of representative [PREV HIT] [NEXT HIT]**Mobil** products.

---SUBCHRONIC TOXICOLOGY (SUMMARY)---
Representative [PREV HIT] [NEXT HIT]**Mobil** formulations have been tested at th [PREV HIT] [NEXT HIT]**Mobil**Environmental and Health Sciences Laboratory by dermal applications to rats 5 days/week for 90 days at doses significantly higher than those expected during normal industrial exposure. Extensive evaluations, including microscopic examination of internal organs and clinical chemistry of body fluids, showed no adverse effects.

---REPRODUCTIVE TOXICOLOGY (SUMMARY)---
Dermal exposure of pregnant rats to representative formulations did not cause adverse effects in either the mothers or their offspring.

---SENSITIZATION (SUMMARY)---
Representative  [PREV HIT][NEXT HIT]**Mobil** formulations have not caused skin sensitization in guinea pigs.

---OTHER TOXICOLOGY DATA---
This product is formulated with a synthetic hydrocarbon as the base stock. The  [PREV HIT][NEXT HIT]**Mobil** Environmental and Health Sciences Laboratory has tested representative synthetic base stocks to assess their potential adverse effects on human health. Assessment of human health effects was based on acute oral, dermal, and inhalation toxicity; eye and skin irritation; subchronic dermal toxicity and reproductive studies; guinea pig sensitization; and mutagenicity and chromosomal damage assays. None of these base stocks appears to pose a health hazard to humans under conditions of expected use.

---

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL FATE AND EFFECTS: Not established.

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13. DISPOSAL CONSIDERATIONS

WASTE DISPOSAL: Product is suitable for burning in an enclosed, controlled burner for fuel value or disposal by supervised incineration. Such burning may be limited pursuant to the Resource Conservation and Recovery Act. In addition, the product is suitable for processing by an approved recycling facility or can be disposed of at an appropriate government waste disposal facility. Use of these methods is subject to user compliance with applicable laws and regulations and consideration of product characteristics at time of disposal.
RCRA INFORMATION: The unused product, in our opinion, is not specifically listed by the EPA as a hazardous waste (40 CFR, Part 261D), nor is it formulated to contain materials which are listed hazardous wastes. It does not exhibit the hazardous characteristics of ignitability, corrosivity, or reactivity and is not formulated with contaminants as determined by the Toxicity Characteristic Leaching Procedure (TCLP). However, used product may be regulated.

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14. TRANSPORT INFORMATION

```
 'A DOT:  NOT REGULATED BY USA DOT.
  D/ADR:  NOT REGULATED BY RID/ADR.
IMO:  NOT REGULATED BY IMO.
IATA:  NOT REGULATED BY IATA.
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15. REGULATORY INFORMATION

Governmental Inventory Status: All components comply with TSCA, and EINECS/ELINCS.
EU Labeling: EU labeling not required.
U.S. Superfund Amendments and Reauthorization Act (SARA) Title III:
This product contains no "EXTREMELY HAZARDOUS SUBSTANCES".
SARA (311/312) REPORTABLE HAZARD CATEGORIES: None.
This product contains no chemicals subject to the supplier notification requirements of SARA (313) toxic release program.
The following product ingredients are cited on the lists below:

CHEMICAL NAME	CAS NUMBER	LIST CITATIONS
LITHIUM HYDROXIDE (0.13%)	1310-65-2	22
LITHIUM-SOAP THICKENER (8.95%)	7620-77-1	22
FATTY ACIDS, C16-22, LITHIUM SALTS '1.10%)	68783-36-8	22

--- REGULATORY LISTS SEARCHED ---

1=ACGIH ALL	6=IARC 1	11=TSCA 4	16=CA P65 CARC	21=LA RTK
2=ACGIH A1	7=IARC 2A	12=TSCA 5a2	17=CA P65 REPRO	22=MI 293
3=ACGIH A2	8=IARC 2B	13=TSCA 5e	18=CA RTK	23=MN RTK
4=NTP CARC	9=OSHA CARC	14=TSCA 6	19=FL RTK	24=NJ RTK
5=NTP SUS	10=OSHA Z	15=TSCA 12b	20=IL RTK	25=PA RTK
				26=RI RTK

Code key: CARC=Carcinogen; SUS=Suspected Carcinogen; REPRO=Reproductive

---

16. OTHER INFORMATION

USE: LITHIUM COMPLEX GREASE
NOTE: PRODUCTS OF EXXON [PREV HIT] [NEXT HIT] **MOBIL** CORPORATION AND ITS AFFILIATED COMPANIES
ARE NOT FORMULATED TO CONTAIN PCBS.

Please call the Customer Response Center on 800-662-4525 for formulation disclosure.

****

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For Internal Use Only:  MHC:  1* 1* NA 1* 1*, MPPEC:  A, TRN:  644013-00,
 'CS97:  970097, REQ:  MRCTEC - LUBES, SAFE USE:  L
 .IS Approval Date: 30NOV2000
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gally required information is given in accordance with applicable
information given herein is offered in good faith as accurate, but
without guarantee. Conditions of use and suitability of the product for
particular uses are beyond our control; all risks of use of the product
are therefore assumed by the user and WE EXPRESSLY DISCLAIM ALL
WARRANTIES OF EVERY KIND AND NATURE, INCLUDING WARRANTIES OF
MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE IN RESPECT TO
THE USE OR SUITABILITY OF THE PRODUCT. Nothing is intended as a
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[HOME] [SEARCH] [PREV LIST] [CURR LIST] [NEXT LIST] [FIRST DOC]
[PREV DOC] [CURR DOC] [NEXT DOC] [LAST DOC] [TOP] [PREV HIT] [HELP]

Material Safety Data Sheet

10% AROMATIC DIESEL FUEL

April 30, 1993

PHILLIPS CHEMICAL COMPANY
A Division of Phillips Petroleum Company
Bartlesville, Oklahoma 74004

PHONE NUMBERS
Emergency: (918) 661-8118
Technical Services: (918) 661-9091
For Additional MSDSs: (918) 661-7297

A. Product Identification

Synonyms: 10% Aromatic Low Sulfur Diesel Fuel
Chemical Name: Mixture
Chemical Family: Hydrocarbons
Chemical Formula: Mixture
CAS Reg. No.: Mixture
Product No.: RF3900

Product and/or Components Entered on EPA's TSCA Inventory: YES

This product is in U.S. commerce, and is listed in the Toxic Substances Control Act (TSCA) Inventory of Chemicals; hence, it may be subject to applicable TSCA provisions and restrictions.

B. Components

Ingredients	CAS Number	% By Wt.	OSHA PEL	ACGIH TLV
Paraffinic hydrocarbons	64742-96-7	> 80	NE	NE
Olefinic hydrocarbons	Various	< 5	NE	NE
Aromatic hydrocarbons	Various	< 10	NE	NE
may include Benzene	71-43-2	< 5	1 ppm*	10 ppm
Sulfur	7704-34-9	< 500 ppm	NE	NE

* Work operations exempted by the Benzene Standard, 29 CFR 1910.1028, will have a 10 ppm 8 hour TWA.

C. Personal Protection Information

Ventilation: Use adequate ventilation.

Respiratory Protection: Not generally required unless needed to prevent respiratory irritation. In case of spill or leak resulting in unknown concentration, use NIOSH/MSHA approved supplied air respirator.

Eye Protection: For splash protection, use chemical goggles and

face shield.

Skin Protection: Use gloves resistant to the material being used. (ie. neoprene or Nitrile rubber). Use protective garments to prevent excessive skin contact.

NOTE: Personal protection information shown in Section C is based upon general information as to normal uses and conditions. Where special or unusual uses or conditions exist, it is suggested that the expert assistance of an industrial hygienist or other qualified professional be sought.

D. Handling and Storage Precautions

Do not get in eyes, on skin or on clothing. Avoid breathing vapors, mist, fume or dust. Do not swallow. May be aspirated into lungs. Wear protective equipment and/or garments described in Section C if exposure conditions warrant. Wash thoroughly after handling. Launder contaminated clothing before reuse. Use with adequate ventilation.

Keep away from heat, sparks, and flames. Store in a well-ventilated area. Store in a closed container. Bond and ground during transfer.

E. Reactivity Data

Stability:	Stable
Conditions to Avoid:	Not Established
Incompatibility (Materials to Avoid):	Oxygen and strong oxidizing agents
Hazardous Polymerization:	Will not occur
Conditions to Avoid:	Not Established
Hazardous Decomposition Products:	Carbon and sulfur oxides and various hydrocarbons formed when burned.

F. Health Hazard Data

Recommended Exposure Limits:

Not Established

Acute Effects of Overexposure:

Eye: May cause mild irritation, with stinging and redness of the eyes.

Skin: May cause severe irritation. Repeated or prolonged contact may cause defatting of the skin, resulting in dermatitis. Dermal LD50 for diesel fuel is > 5 ml/kg (rabbit).

Inhalation: May cause irritation to nose, throat or lungs. Headache, nausea, dizziness, unconsciousness may occur.

Ingestion: May cause irritation to intestines. May cause headache, nausea, unconsciousness. If swallowed, may be aspirated

resulting in inflammation and possible fluid accumulation in the lungs. Oral LD50 for diesel fuel is 9 ml/kg (rat).

Subchronic and Chronic Effects of Overexposure:

Combustion, a normal use of diesel fuel, results in an exhaust that has been associated with lung cancer in animals. There is limited evidence to suggest an association between occupational exposure to diesel exhaust and lung cancer in humans.

Carbon monoxide inhalation may cause carboxyhemoglobinemia. Chronic exposure to carbon monoxide causes fatigue, poor memory, loss of sensation in fingers, visual disturbances and insomnia. Carboxyhemoglobinemia is frequently misdiagnosed as flu.

Sensitive sub-populations to the inhalation of carbon monoxide exist. Carbon monoxide displaces oxygen in the bloodstream and therefore, can adversely effect people with pre-existing heart disease, pregnant women and smokers.

Other Health Effects:

No known applicable information.

Health Hazard Categories:

	Animal	Human		Animal	Human
Known Carcinogen	___	___	Toxic	___	___
Suspect Carcinogen	___	___	Corrosive	___	___
Mutagen	___	___	Irritant	_X_	_X_
Teratogen	___	___	Target Organ Toxin	_X_	_X_
Allergic Sensitizer	___	___	Specify - Lung-Aspiration Hazard		
Highly Toxic	___	___			

First Aid and Emergency Procedures:

Eye: Flush eyes with running water for at least fifteen minutes. If irritation or adverse symptoms develop, seek medical attention.

Skin: Immediately wash skin with soap and water for at least fifteen minutes. If irritation or adverse symptoms develop, seek medical attention.

Inhalation: Remove from exposure. If breathing is difficult, give oxygen. If breathing ceases, administer artificial respiration followed by oxygen. Seek immediate medical attention.

Ingestion: Do not induce vomiting. Seek immediate medical attention.

Note to Physician: Gastric lavage using a cuffed endotracheal tube may be performed at your discretion.

G. Physical Data

Appearance:	Pale yellow liquid
Odor:	Mild
Boiling Point:	340-660F (171-349C)
Vapor Pressure:	Not Established
Vapor Density (Air = 1):	>1
Solubility in Water:	Negligible
Specific Gravity (H2O = 1):	0.82 at 60/60F (16/16C)
Percent Volatile by Volume:	100
Evaporation Rate (Butyl Acetate=1):	<1
Viscosity:	2.7 cSt @ 104 F (40C)

H. Fire and Explosion Data

Flash Point (Method Used):	> 130F (>54C) (Estimated)
Flammable Limits (% by Volume in Air):	LEL - Not Established UEL - Not Established
Fire Extinguishing Media:	Dry chemical, foam or carbon dioxide (CO2)
Special Fire Fighting Procedures:	Evacuate area of all unnecessary personnel. Shut off source, if possible. Use NIOSH/MSHA approved self-contained breathing apparatus and other protective equipment and/or garments described in Section C if conditions warrant. Water fog or spray may be used to cool exposed containers and equipment. Do not spray water directly on fire - product will float and could be reignited on surface of water.
Fire and Explosion Hazards:	Carbon and sulfur oxides and various hydrocarbons formed when burned.

I. Spill, Leak and Disposal Procedures

Precautions Required if Material is Released or Spilled:
Evacuate area of all unnecessary personnel. Wear protective equipment and/or garments described in Section C if exposure conditions warrant. Shut off source, if possible and contain spill. Protect from ignition. Keep out of water sources and sewers. Absorb in dry, inert material (sand, clay, etc.). Transfer to disposal drums using non-sparking equipment.

Waste Disposal (Insure Conformity with all Applicable Disposal Regulations):
Incinerate or place in permitted waste management facility.

J. DOT Transportation

Shipping Name:	Diesel fuel
Hazard Class:	3 (Flammable liquid)
ID Number:	NA 1993
Packing Group:	III
Marking:	Diesel fuel, 1993
Label:	None
Placard:	Flammable/1993
Hazardous Substance/RQ:	Not applicable
Shipping Description:	Diesel fuel, 3 (Flammable liquid), NA 1993, PG III

Packaging References: 49 CFR 173.150, 173.203, 173.241

NOTE: This product may be reclassed as a combustible liquid when shipped domestically, by land only. If reclassed as a combustible liquid, this product is unregulated by DOT when shipped in non-bulk quantities.

K. RCRA Classification - Unadulterated Product as a Waste

Ignitable (D001)

Prior to disposal, consult your environmental contact to determine if TCLP (Toxicity Characteristic Leaching Procedure, EPA Test Method 1311) is required. Reference 40 CFR Part 261.

L. Protection Required for Work on Contaminated Equipment

Contact immediate supervisor for specific instructions before work is initiated. Wear protective equipment and/or garments described in Section C if exposure conditions warrant.

M. Hazard Classification

_X_ This product meets the following hazard definition(s) as defined by the Occupational Safety and Health Hazard Communication Standard (29 CFR Section 1910.1200):

_X_ Combustible Liquid	___ Flammable Aerosol	___ Oxidizer
___ Compressed Gas	___ Explosive	___ Pyrophoric
___ Flammable Gas	_X_ Health Hazard (Section F)	___ Unstable
___ Flammable Liquid	___ Organic Peroxide	___ Water Reactive
___ Flammable Solid		

___ Based on information presently available, this product does not meet any of the hazard definitions of 29 CFR Section 1910.1200.

N. Additional Comments

SARA 313

This product contains the following chemical or chemicals subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372. (See Section B).

Benzene

ATTACHMENT 4

Activity Hazard Analysis

ACTIVITY HAZARD ANALYSIS		
Activity: Well Drilling		**Analyzed by: Steve Kerr**
Principle Steps	**Hazards**	**Recommended Controls**
Rig mobilization and set up	Noise, moving equipment	PPE (initial: level D)
Well Drilling	Noise, moving equipment, underground/overhead utilities, exposure to site contaminants, potential exposure to site contaminants	PPE (initial: level D), hearing protection, site controls (exclusion and decon zone establishment), monitoring, awareness of hazards, training, utility locate,
Equipment to be used	**Inspection Requirements**	**Training Requirements**
Drilling equipment Personal protection equipment (level D)	Daily equipment inspection	Site specific health and safety plan training Hazwoper training (initial and refresher)

ACTIVITY HAZARD ANALYSIS		
Activity: Trenching		**Analyzed by: Steve Kerr**
Principle Steps	**Hazards**	**Recommended Controls**
Trench Excavation	Cave-in/collapse, noise, work near heavy equipment, potential exposure to site contaminants	PPE (Initial: level D), protective systems for excavations, awareness of hazards, training, location of underground/aboveground utilities, administrative controls (daily inspection by competent person), monitoring
Equipment to be used	**Inspection Requirements**	**Training Requirements**
Excavator/back hoe Personal protection equipment (level D)	Daily equipment inspection Daily excavation inspection	Site specific health and safety plan training Hazwoper training (initial and refresher) Excavation competent person training

ACTIVITY HAZARD ANALYSIS		
Activity: Pipe installation		**Analyzed by: Steve Kerr**
Principle Steps	**Hazards**	**Recommended Controls**
Install PVC piping and connect system	Cave-in, noise, work near heavy equipment, underground utilities, exposure to hazardous materials, potential exposure to site contaminants	PPE (Initial: level D), protective systems for excavations, awareness of hazards, training, location of underground/aboveground utilities, administrative controls (daily inspection by competent person), monitoring
Equipment to be used	**Inspection Requirements**	**Training Requirements**
	Daily equipment inspection Daily excavation inspection	Site specific health and safety plan training Hazwoper training (initial and refresher) Excavation competent person training

ATTACHMENT 5

Bay West Safety Meeting Form

BAY WEST, INC.
SAFETY MEETING REPORT

ıte:	Time:	Duration of meeting:	Job #:
Location:		Project/Group:	

Type of meeting: ____ Daily ____Weekly ____ Monthly ____ Other:_____

Items/Issues discussed:

1.

2.

3.

4.

5.

6.

7.

Attach minutes of safety meeting if taken.

Safety questions/issues raised:	Actions/Follow-up needed:
1.	
2.	
3.	
4.	
5.	
6.	

Remarks:

Meeting conducted by:

Forward a copy of the completed report to Health and Safety.

DOCS #26212
Rev. 2, 9/96

ATTACHMENT 6

USACE Accident Investigation and Reporting Form

ety (If only)	REPORT NO	EROC CODE	UNITED STATES ARMY CORPS OF ENGINEERS ACCIDENT INVESTIGATION REPORT *(For Use of this Form See Attached Instructions and USACE Suppl to AR 385-40)*	REQUIREMENT CONTROL SYMBOL: CEEC-S-8(R2)

ACCIDENT CLASSIFICATION

NNEL CLASSIFICATION	INJURY/ILLNESS/FATAL	PROPERTY DAMAGE	MOTOR VEHICLE INVOLVED	DIVING
:NT ☐ CIVILIAN ☐ MILITARY	☐	☐ FIRE INVOLVED ☐ OTHER	☐	☐
☐ CONTRACTOR	☐	☐ FIRE INVOLVED ☐ OTHER	☐	☐
☐ PUBLIC	☐ FATAL ☐ OTHER		☐	

PERSONAL DATA

NAME *(Last,First,MI)*	b. AGE	c. SEX ☐ MALE ☐ FEMALE	d. SOCIAL SECURITY NUMBER __ __ __ , __ __ / __ __ __ __	e. GRADE

JOB SERIES/TITLE	g. DUTY STATUS AT TIME OF ACCIDENT	h. EMPLOYMENT STATUS AT TIME OF ACCIDENT
	☐ ON DUTY ☐ TDY ☐ OFF DUTY	☐ ARMY ACTIVE ☐ ARMY RESERVE ☐ VOLUNTEER ☐ PERMANENT ☐ FOREIGN NATIONAL ☐ SEASONAL ☐ TEMPORARY ☐ STUDENT ☐ OTHER *(Specify)*

GENERAL INFORMATION

DATE OF ACCIDENT *(month/day/year)* / /	b. TIME OF ACCIDENT *(Military time))*	c. EXACT LOCATION OF ACCIDENT	d. CONTRACTOR'S NAME (1) PRIME: (2) SUBCONTRACTOR:
CONTRACT NUMBER ☐ CIVIL WORKS ☐ MILITARY ☐ OTHER *(Specify)*	f. TYPE OF CONTRACT ☐ CONSTRUCTION ☐ SERVICE ☐ A/E ☐ DREDGE ☐ OTHER *(Specify)*	g. HAZARDOUS/TOXIC WASTE ACTIVITY ☐ SUPERFUND ☐ DERP ☐ IRP ☐ OTHER *(Specify)*	

CONSTRUCTION ACTIVITIES ONLY *(Fill in line and corresponding code number in box from list - see instructions)*

CONSTRUCTION ACTIVITY	(CODE)	b. TYPE OF CONSTRUCTION EQUIPMENT	(CODE)

INJURY / ILLNESS INFORMATION *(Include name on line and corresponding code number in box for items e, f & g - see instructions)*

SEVERITY OF ILLNESS / INJURY (CODE)	b. ESTIMATED DAYS LOST	c. ESTIMATED DAYS HOSPITALIZED	d. ESTIMATED DAYS RESTRICTED DUTY

BODY PART AFFECTED	(CODE)	g. TYPE AND SOURCE OF INJURY/ILLNESS	(CODE)
PRIMARY		TYPE	
SECONDARY		SOURCE	
NATURE OF ILLNESS / INJURY			

PUBLIC FATALITY *(Fill in line and corresponding code number in box - see instructions)*

a. ACTIVITY AT TIME OF ACCIDENT (CODE)	b. PERSONAL FLOATATION DEVICE USED?
	☐ YES ☐ NO ☐ N/A

MOTOR VEHICLE ACCIDENT

a. TYPE OF VEHICLE	b. TYPE OF COLLISION	c. SEAT BELTS	USED	NOT USED	NOT AVAILABLE
☐☐ PICKUP/VAN ☐☐ AUTOMOBILE ☐☐ TRUCK ☐☐ OTHER *(Specify)*	☐ SIDE SWIPE ☐ HEAD ON ☐ REAR END ☐ BROADSIDE ☐ ROLL OVER ☐ BACKING ☐ OTHER *(Specify)*	(1) FRONT SEAT			
		(2) REAR SEAT			

PROPERTY/MATERIAL INVOLVED

a. NAME OF ITEM	b. OWNERSHIP	c. $ AMOUNT OF DAMAGE
(1)		
(2)		
(3)		

VESSEL / FLOATING PLANT ACCIDENT *(Fill in line and corresponding code number in box from list - see instructions)*

OF VESSEL/FLOATING PLANT (CODE)	b. TYPE OF COLLISON/MISHAP (CODE)

ACCIDENT DESCRIPTION *(Use additional paper, if necessary)*

(Proponent CEMP-S)

The injury or condition selected below must be caused by a specific incident or event which occurred during a single work day or shift.

GENERAL NATURE CATEGORY	CODE	NATURE OF INJURY NAME
TRAUMATIC INJURY OR DISABILITY	TA	AMPUTATION
	TB	BACK STRAIN.
	TC	CONTUSION; BRUISE; ABRASION
	TD	DISLOCATION
	TF	FRACTURE
	TH	HERNIA
	TK	CONCUSSION
	TL	LACERATION, CUT
	TP	PUNCTURE
	TS	STRAIN, MULTIPLE
	TU	BURN, SCALD, SUNBURN
	TI	TRAUMATIC SKIN DISEASES/ CONDITIONS INCLUDING DERMATITIS
	TR	TRAUMATIC RESPIRATORY DISEASE
	TQ	TRAUMATIC FOOD POISONING
	TW	TRAUMATIC TUBERCULOSIS
	TX	TRAUMATIC VIROLOGICAL/ INFECTIVE/PARASITIC DISEASE
	T1	TRAUMATIC CEREBRAL VASCULAR CONDITION/STROKE
	T2	TRAUMATIC HEARING LOSS
	T3	TRAUMATIC HEART CONDITION
	T4	TRAUMATIC MENTAL DISORDER; STRESS; NERVOUS CONDITION
	T8	TRAUMATIC INJURY — OTHER (EXCEPT DISEASE, ILLNESS)

*A nontraumatic physiological harm or loss of capacity produced by systemic infection; continued or repeated stress or strain; exposure to toxins, poisons, fumes, etc.; or other continued and repeated exposures to conditions of the work environment over a long period of time. For practical purposes, an occupational illness/disease or disability is any reported condition which doses not meet the definition of traumatic injury or disability as described above.

GENERAL NATURE CATEGORY	CODE	NATURE OF INJURY NAME
*NON-TRAUMATIC ILLNESS/DISEASE OR DISABILITY		
RESPIRATORY DISEASE	RA	ASBESTOSIS
	RB	BRONCHITIS
	RE	EMPHYSEMA
	RP	PNEUMOCONIOSIS
	RS	SILICOSIS
	R9	RESPIRATORY DISEASE, OTHER
VIROLOGICAL, INFECTIVE & PARASITIC DISEASES	VB	BRUCELLOSIS
	VC	COCCIDIOMYCOSIS
	VF	FOOD POISONING
	VH	HEPATITIS
	VM	MALARIA
	VS	STAPHYLOCOCCUS
	VT	TUBERCULOSIS
	V9	VIROLOGICAL/INFECTIVE/ PARASITIC—OTHER
DISABILITY, OCCUPATIONAL	DA	ARTHRITIS, BURSITIS
	DB	BACK STRAIN, BACK SPRAIN
	DC	CEREBRAL VASCULAR CONDITION; STROKE
	DD	ENDEMIC DISEASE (OTHER THAN CODE TYPES R&S)
	DE	EFFECT OF ENVIRONMENTAL CONDITION
	DH	HEARING LOSS
	DK	HEART CONDITION
	DM	MENTAL DISORDER, EMOTIONAL STRESS NERVOUS CONDITION
	DR	RADIATION
	DS	STRAIN, MULTIPLE
	DU	ULCER
	DV	OTHER VASCULAR CONDITIONS
	D9	DISABILITY, OTHER
SKIN DISEASE OR CONDITION	SB	BIOLOGICAL
	SC	CHEMICAL
	S9	DERMATITIS, UNCLASSIFIED

g. TYPE AND SOURCE OF INJURY/ILLNESS (CAUSE) - Type and Source Codes are used to describe what caused the incident. The Type Code stands for an ACTION and the Source Code for an OBJECT or SUBSTANCE. Together, they form a brief description of how the incident occurred. Where there are two different sources, code the initiating source of the incident (see example 1, below). Examples.

(1) An employee tripped on carpet and struck his head on a desk.
TYPE: 210 (fell on same level) SOURCE: 0110 (walking/working surface)

NOTE: This example would NOT be coded 120 (struck against) and 0140 (furniture).

(2) A Park Ranger contracted dermatitis from contact with poison ivy/ oak.
TYPE: 510 (contact) SOURCE: 0920 (plant)

(3) A lock and dam mechanic punctured his finger with a metal sliver while grinding a turbine blade.
TYPE: 410 (punctured by) SOURCE: 0830 (metal)

(4) An employee was driving a government vehicle when it was struck by another vehicle..
TYPE: 800 (traveling in) SOURCE: 0421 (government-owned vehicle, as driver)

NOTE: The Type Code 800, "Traveling In" is different from the other type codes in that its function is not to identify factors contributing to the injury or fatality, but rather to collect data on the type of vehicle the employee was operating or traveling in at the time of the incident.

Select the most appropriate TYPE and SOURCE identifier from the list below and enter the name on the line and the corresponding code in the appropriate box.

CODE	TYPE OF INJURY NAME
	STRUCK
0110	STRUCK BY
0111	STRUCK BY FALLING OBJECT
0120	STRUCK AGAINST
	FELL, SLIPPED, TRIPPED
0210	FELL ON SAME LEVEL
0220	FELL ON DIFFERENT LEVEL
0230	SLIPPED, TRIPPED (NO FALL)
	CAUGHT
0310	CAUGHT ON
0320	CAUGHT IN
0330	CAUGHT BETWEEN
	PUNCTURED, LACERATED
0410	PUNCTURED BY
0420	CUT BY
0430	STUNG BY
0440	BITTEN BY
	CONTACTED
0510	CONTACTED WITH (INJURED PERSON MOVING)
0520	CONTACTED BY (OBJECT WAS MOVING)
	EXERTED
0610	LIFTED, STRAINED BY (SINGLE ACTION)
0620	STRESSED BY (REPEATED ACTION)
	EXPOSED
0710	INHALED
0720	INGESTED
0730	ABSORBED
0740	EXPOSED TO
0800	TRAVELING IN

CODE	SOURCE OF INJURY NAME
0100	BUILDING OR WORKING AREA
0110	WALKING/WORKING SURFACE (FLOOR, STREET, SIDEWALKS, ETC)
0120	STAIRS, STEPS
0130	LADDER
0140	FURNITURE, FURNISHINGS, OFFICE EQUIPMENT
0150	BOILER, PRESSURE VESSEL
0160	EQUIPMENT LAYOUT (ERGONOMIC)
0170	WINDOWS, DOORS
0180	ELECTRICITY

b. TYPE OF CONSTRUCTION EQUIPMENT – Select the equipment involved in the accident from the list below. Enter the name and ...ce the corresponding code number identified in the box. If ...pment is not included below, use code 24, "OTHER", and write ...pecific type of equipment.

CONSTRUCTION EQUIPMENT

1. GRADER
2. DRAGLINE
3. CRANE (ON VESSEL/BARGE)
4. CRANE (TRACKED)
5. CRANE (RUBBER TIRE)
6. CRANE (VEHICLE MOUNTED)
7. CRANE (TOWER)
8. SHOVEL
9. SCRAPER
10. PUMP TRUCK (CONCRETE)
11. TRUCK (CONCRETE/TRANSIT MIXER)
12. DUMP TRUCK (HIGHWAY)
13. DUMP TRUCK (OFF HIGHWAY)
14. TRUCK (OTHER)
15. FORKLIFT
16. BACKHOE
17. FRONT-END LOADER
18. PILE DRIVER
19. TRACTOR (UTILITY)
20. MANLIFT
21. DOZER
22. DRILL RIG
23. COMPACTOR/VIBRATORY ROLLER
24. OTHER

INSTRUCTIONS FOR SECTION 5 – INJURY/ILLNESS INFORMATION

a. SEVERITY OF INJURY / ILLNESS - Reference para 2-10 of USACE Suppl 1 to AR 385-40 and enter code and description from list below.

NOI NO INJURY
FAT FATALITY
PTL PERMANENT TOTAL DISABILITY
PPR PERMANENT PARTIAL DISABILITY
LWD LOST WORKDAY CASE INVOLVING DAYS AWAY FROM WORK
NLW RECORDABLE CASE WITHOUT LOST WORKDAYS
RFA RECORDABLE FIRST AID CASE
NRI NON-RECORDABLE INJURY

b. ESTIMATED DAYS LOST – Enter the estimated number of workdays the person will lose from work.

c. ESTIMATED DAYS HOSPITALIZED – Enter the estimated number of workdays the person will be hospitalized.

d. ESTIMATED DAYS RESTRICTED DUTY – Enter the estimated number of workdays the person, as a result of the accident, will not be able to perform all of their regular duties.

e. BODY PART AFFECTED – Select the most appropriate primary and when applicable, secondary body part affected from the list below. Enter body part name on line and place the corresponding code letters identifying that body part in the box.

GENERAL BODY AREA	CODE	BODY PART NAME
ARM/WRIST	AB	ARM AND WRIST
	AS	ARM OR WRIST
TRUNK, EXTERNAL MUSCULATURE	B1	SINGLE BREAST
	B2	BOTH BREASTS
	B3	SINGLE TESTICLE
	B4	BOTH TESTICLES
	BA	ABDOMEN
	BC	CHEST
	BL	LOWER BACK
	BP	PENIS
	BS	SIDE
	BU	UPPER BACK
	BW	WAIST
	BZ	TRUNK OTHER
HEAD, INTERNAL	C1	SINGLE EAR INTERNAL
	C2	BOTH EARS INTERNAL
	C3	SINGLE EYE INTERNAL
	C4	BOTH EYES INTERNAL
	CB	BRAIN
	CC	CRANIAL BONES
	CD	TEETH
	CJ	JAW
	CL	THROAT, LARYNX
	CM	MOUTH
	CN	NOSE
	CR	THROAT, OTHER
	CT	TONGUE
	CZ	HEAD OTHER INTERNAL
ELBOW	EB	BOTH ELBOWS
	ES	SINGLE ELBOW
FINGER	F1	FIRST FINGER
	F2	BOTH FIRST FINGERS
	F3	SECOND FINGER
	F4	BOTH SECOND FINGERS
	F5	THIRD FINGER
	F6	BOTH THIRD FINGERS
	F7	FOURTH FINGER
	F8	BOTH FOURTH FINGERS
TOE	G1	GREAT TOE
	G2	BOTH GREAT TOES
	G3	TOE OTHER
	G4	TOES OTHER
HEAD, EXTERNAL	H1	EYE EXTERNAL
	H2	BOTH EYES EXTERNAL
	H3	EAR EXTERNAL
	H4	BOTH EARS EXTERNAL
	HC	CHIN
	HF	FACE
	HK	NECK/THROAT
	HM	MOUTH/LIPS
	HN	NOSE
	HS	SCALP
KNEE	KB	BOTH KNEES
	KS	KNEE
LEG, HIP, ANKLE, BUTTOCK	LB	BOTH LEGS/HIPS/ ANKLES/BUTTOCKS
	LS	SINGLE LEG/HIP ANKLE/BUTTOCK
HAND	MB	BOTH HANDS
	MS	SINGLE HAND
FOOT	PB	BOTH FEET
	PS	SINGLE FOOT
TRUNK, BONES	R1	SINGLE COLLAR BONE
	R2	BOTH COLLAR BONES
	R3	SHOULDER BLADE
	R4	BOTH SHOULDER BLADES
	RB	RIB
	RS	STERNUM (BREAST BONE)
	RV	VERTEBRAE (SPINE; DISC)
	RZ	TRUNK BONES OTHER
SHOULDER	SB	BOTH SHOULDERS
	SS	SINGLE SHOULDER
THUMB	TB	BOTH THUMBS
	TS	SINGLE THUMB
TRUNK, INTERNAL ORGANS	V1	LUNG, SINGLE
	V2	LUNGS, BOTH
	V3	KIDNEY, SINGLE
	V4	KIDNEYS, BOTH
	VH	HEART
	VL	LIVER
	VR	REPRODUCTIVE ORGANS
	VS	STOMACH
	VV	INTESTINES
	VZ	TRUNK, INTERNAL; OTHER

f. NATURE OF INJURY/ILLNESS - Select the most appropriate nature of injury / illness from the list below. This nature of injury / illness shall correspond to the primary body part selected in 5e, above. Enter the nature of injury / illness name on the line and place the corresponding CODE letters in the box provided.

INSTRUCTIONS FOR SECTION 13—CAUSES

a. DIRECT CAUSES—The direct cause is that single factor which most directly lead to the accident. See examples below.

b. INDIRECT CAUSES—Indirect causes are those factors which contributed to but did not directly initiate the occurrence of the accident.

Examples for section 13:

a. Employee was dismantling scaffold and fell 12 feet from unguarded opening.
Direct cause: failure to provide fall protection at elevation.
Indirect causes: failure to enforce USACE safety requirements; improper training/motivation of employee (possibility that employee was not knowledgeable of USACE fall protection requirements or was lax in his attitude towards safety); failure to ensure provision of positive fall protection whenever elevated; failure to address fall protection during scaffold dismantling in phase hazard analysis.

b. Private citizen had stopped his vehicle at intersection for red light when vehicle was struck in rear by USACE vehicle. (note USACE vehicle was in proper/safe working condition).
Direct cause: failure of USACE driver to maintain control of and stop USACE vehicle within safe distance.
Indirect cause: Failure of employee to pay attention to driving (defensive driving).

INSTRUCTIONS FOR SECTION 14—ACTION TO ELIMINATE CAUSE(S)

DESCRIPTION—Fully describe all the actions taken, anticipated, and recommended to eliminate the cause(s) and prevent reoccurrence of similar accidents/illnesses. Continue on blank sheets of paper if necessary to fully explain and attach to the completed report form.

INSTRUCTIONS FOR SECTION 15—DATES FOR ACTION

a. BEGIN DATE—Enter the date when the corrective action(s) identified in Section 14 will begin.

b. COMPLETE DATE—Enter the date when the corrective action(s) identified in Section 14 will be completed.

c. TITLE AND SIGNATURE—Enter the title and signature of supervisor completing the accident report. For a GOVERNMENT employee accident/illness the immediate supervisor will complete and sign the report. For PUBLIC accidents the USACE Project Manager/Area Engineer responsible for the USACE property where the accident happened shall complete and sign the report. For CONTRACTOR accidents the Contractor's project manager shall complete and sign the report and provide to the USACE supervisor responsible for oversight of that contractor activity. This USACE Supervisor shall also sign the report. Upon entering the information required in 15.d, 15.e and 15.f below, the responsible USACE supervisor shall forward the report for management review as indicated in Section 16.

d. DATE SIGNED—Enter the month, day, and year that the report was signed by the responsible supervisor.

e. ORGANIZATION NAME—For GOVERNMENT employee accidents enter the USACE organization name (Division, Branch, Section, etc.) of the injured employee. For PUBLIC accidents enter the USACE organization name for the person identified in block 15.c. For CONTRACTOR accidents enter the USACE organization name for the USACE office responsible for providing contract administration oversight.

f. OFFICE SYMBOL—Enter the latest complete USACE Office Symbol for the USACE organization identified in block 15.e.

INSTRUCTIONS FOR SECTION 16—MANAGEMENT REVIEW (1st)

1ST REVIEW—Each USACE FOA shall determine who will provide 1st management review. The responsible USACE supervisor in section 15.c shall forward the completed report to the USACE office designated as the 1st Reviewer by the FOA. Upon receipt, the Chief of the Office shall review the completed report, mark the appropriate box, provide substantive comments, sign, date, and forward to the FOA Staff Chief (2nd review) for review and comment.

INSTRUCTIONS FOR SECTION 17—MANAGEMENT REVIEW (2nd)

2ND REVIEW—The FOA Staff Chief (i.e., FOA Chief of Construction, Operations, Engineering, Planning, etc.) shall mark the appropriate box, review the completed report, provide substantive comments, sign, date, and return to the FOA Safety and Occupational Health Office.

INSTRUCTIONS FOR SECTION 18—SAFETY AND OCCUPATIONAL HEALTH REVIEW

3RD REVIEW—The FOA Safety and Occupational Health Office shall review the completed report, mark the appropriate box, ensure that any inadequacies, discrepancies, etc, are rectified by the responsible supervisor and management reviewers, provide substantive comments, sign, date and forward to the FOA Commander for review, comment, and signature.

INSTRUCTION FOR SECTION 19—COMMAND APPROVAL

4TH REVIEW—The FOA Commander shall (to include the person designated Acting Commander in his absence) review the completed report, comment if required, sign, date, and forward the report to the FOA Safety and Occupational Health Office. Signature authority shall not be delegated.

ATTACHMENT 7

Comment Response

COMMENT RESOLUTION			
No.	**Page**	**Section**	**Comment and Response**
1	1	1.3	Comment: The last paragraph in this section states 'non-HAZWOPER" personnel may be used. The work to be conducted is located on an HTRW site. Therefore, "non-HAZWOPER" personnel may NOT be used. It is also stated in the "Work plan" that workers will be trained in accordance with 29 CFR 1910.120. Since non-HAZWOPER personnel cannot be used at this site; all references to this must be removed. Response: HAZWOPER personnel will be used.
2	3	3.0 and 4.0	Comment: The requirements of these sections require documentation. The documentation for medical surveillance and training need to be contained in this Site Safety and Health Plan as an Attachment. All documentation must be current (e.g., 40 and 8 hour certificates dated with in the last year). Response: All site workers are required to provide documentation of training and medical surveillance. Documentation will be provided as workers are assigned to the project. The need for this documentation is specified on the Training Acknowledgment Form in Attachment 1.
3	4	5.2	Comment: Information about TCE needs to also indicate that it is a "potential carcinogen" or "Ca". Response: Added as specified.
4	4	5.3	Comment: It is recommended that a sub-section be inserted for each hazard. Each sub-section must specify the hazard, the potential sources of the hazard at the site and how the hazard is going to be controlled on the site. Response: Additional information has been added to this section as suggested.
5	4	Attachment 4	Comment: The "Activity Hazard Analysis" needs to be expanded to provide the hazard information required by EM 385-1-1, Fig. 1-1. Response: Expanded as suggested.

6	7	9.1	Comment: Monitoring needs to be conducted during all intrusive activities. This must include drilling, excavation, and pipe installation. Response: HASP has been modified as requested.
7	7	10.4	Comment: This section needs to be renamed "Emergency Equipment and Personnel." The section needs to specify that the site will have two (2) personnel who are first aid and CPR trained at all times. Certificates dated within the last three (3) years need to also be attached to this document. Response: HASP has been modified as requested.

ATTACHMENT 8

LYME DISEASE

PREVENTION

Check and recheck for ticks when you are in tick-infested areas.

These actions can reduce your chances of getting a tick-borne disease.

- When in deer tick habitat, walk in the center of the trail to avoid picking up ticks from grass and brush.
- Wear light-colored clothes so ticks are visible.
- Create a barrier to ticks by tucking pants into socks or boots and tuck long-sleeved shirt into pants.
- If you use an insect repellent, carefully follow directions on container.
- After being outdoors in tick habitat, do a complete body check, shower and vigorously towel dry.
- Take precautions when in tick habitat, but don't panic if you find a deer tick on you.

Check the hair of children, especially the hairline and behind the ears.

Check your dog or cat for ticks before allowing the animal inside your home.

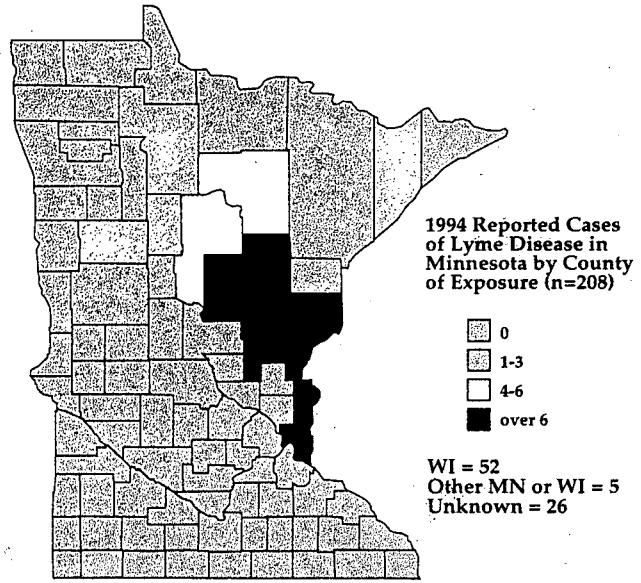
TICK REMOVAL

The risk of getting a tick-borne disease is small if the tick is removed soon after it becomes attached.

- Use tweezers to grasp the tick close to its mouth.
- Gently and S-L-O-W-L-Y pull the tick outward.
- To avoid contact with the bacteria, if present, do not squeeze the tick's body.
- Apply an antiseptic to the bite.
- Watch for early signs and symptoms of Lyme disease, ehrlichiosis and babesiosis.

EXPOSURE

Do you live, work or play in an area that has deer ticks?



Deer ticks are found primarily in counties north and east of the Mississippi River in Minnesota, and throughout western Wisconsin. In the Twin Cities Metropolitan Area, deer ticks are frequently found in Washington, northern Ramsey and Anoka counties.

For more information about:

Signs and symptoms, diagnosis, treatment and prevention of Lyme disease, ehrlichiosis and babesiosis, call the Minnesota Department of Health at (612) 623-5414.

Deer ticks and camping, hiking and recreational areas, call the Minnesota Department of Natural Resources at (612) 296-6157 (Metro area) or 1-800-766-6000.

Deer ticks in the Twin Cities Metropolitan Area, call the Metropolitan Mosquito Control District at (612) 645-9149.

Minnesota Department of Health
Disease Prevention and Control
717 Delaware Street SE
Minneapolis, MN 55440-9441

This brochure was funded by the Centers for Disease Control and Prevention.
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IC# 141-0596 MDH, 11/95

LYME DISEASE

LYME DISEASE

Lyme disease is an illness that may affect the skin, joints, nervous system, heart, and other areas of the body. People of all ages can get Lyme disease, which is caused by the bacteria, *Borrelia burgdorferi*. The bacteria is transmitted to humans and some domestic animals by the bite of an infected deer tick. The deer tick — *Ixodes scapularis* — is also called the black-legged or bear tick.

SIGNS & SYMPTOMS

Recognizing the early signs and symptoms of Lyme disease is important.

If you have one or more of these signs and symptoms within 3 to 30 days after a tick bite, see your physician immediately.

- A characteristic skin rash, called erythema migrans, has a "bull's eye" appearance — a red ring with a central clearing. Not everyone recognizes or gets the rash. Many people only have the rash without the other symptoms.
- Fever and chills
- Fatigue
- Headache
- Muscle and joint pain

The rash begins as a small, raised red area that may expand to several inches in diameter. It may appear on one or more places on the body, may include one or more rashes, and is usually not painful or itchy.

Days or weeks later, the illness may progress and include one or more of the following signs and symptoms:

- Multiple rashes
- Facial paralysis on one side
- Fever, stiff neck, headache
- Weakness, numbness or pain in arms and legs
- Irregular heart beat
- Persistent malaise and fatigue

If a person is not treated early in the disease, these late signs and symptoms may develop months or years after the tick bite:

- Chronic arthritis in one or more joints, usually the knees, which may be swollen and painful
- Neurologic impairment
- Fatigue

DIAGNOSIS & TREATMENT

Early diagnosis and treatment can make a difference. The early stages of Lyme disease are more effectively treated with antibiotics.

The diagnosis of Lyme disease is based on the signs and symptoms, presence of the rash, and a history of exposure to deer ticks. A blood test may be helpful in confirming the diagnosis. A diagnosis of Lyme disease can be difficult when a person does not have the rash.

Lyme disease is treated with antibiotics. Treatment in the early stages can prevent later problems, such as arthritis. Treatment is also available for the later stages.

OTHER TICK-BORNE DISEASES

Two diseases which appear to be less common than Lyme disease — human granulocytic ehrlichiosis and babesiosis — can also be transmitted by the deer tick.

The signs and symptoms of **human granulocytic ehrlichiosis** (HGE) can include:

- Fever (over 102°)
- Chills and shaking rigors
- Severe headache
- Muscle aches

Less frequent symptoms of ehrlichiosis include nausea, vomiting, loss of appetite, weight loss, abdominal pain, cough, diarrhea, aching joints and change in mental status. Ehrlichiosis is treated with antibiotics.

Babesiosis is a protozoan infection. Signs and symptoms include:

- High fever
- Chills
- Headache
- Muscle aches
- Fatigue
- Loss of appetite

Symptoms usually go away without treatment, but some cases may be severe. Babesiosis is treated with antimicrobial drugs.

See your physician if you suspect either of these diseases.

THE DEER TICK

Deer ticks search for a host from the tips of grasses and brush. Ticks get the bacteria from the white-footed mouse and other small rodents. An infected tick may feed on and transmit the bacteria to a human or an animal.

The ticks shown below are the approximate size during different stages of its life.

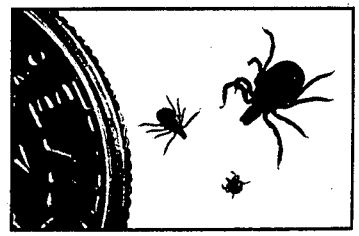
- ***Larva***
  The eggs hatch into tiny larva, which may become infected from the first meal.
- ***Nymph***
  Most cases of Lyme disease are caused by the nymph, which looks like a freckle or speck of dirt. The nymph feeds from May through August.

Adult male and female
The larger adult ticks feed in late fall and early spring, but are easier to see and remove. After feeding on deer, the female lays her eggs.

Engorged tick
This is the size of a fully engorged adult female deer tick.

Wood ticks (also called dog ticks)
are larger than deer ticks, have white markings on their back, and do not transmit Lyme disease.

Not all people bitten by a deer tick will get a disease. Not all deer ticks carry the bacteria. However, if a deer tick is infected, it must be attached for at least 24 hours before it can transmit the bacteria.



Enlarged stages of the deer tick appear next to an enlarged dime.
Left: Nymph
Center: Larva
Right: Adult Female

ATTACHMENT 9

Heat Stress SOP

Bay West

Standard Operating Procedure

Heat/ Cold Stress and Severe Weather Work Guidelines

Revised: 8/30/01

Review and Approval:

Reviewed by: _____ Date: _____
Anthony J. Kuehn, ASP OHST, ACLM, Health and Safety Specialist

Approved by: _____ Date: _____
Don Erickson, REM, CHMM, President

Filing Instructions:

This procedure replaces Bay West's SOP "Adverse Weather Work Guidelines" dated 11/6/96. File this SOP in the Bay West SOP binder and remove the former procedure. Questions and requests for information regarding this SOP should be directed to the Health and Safety Specialists. This SOP cannot be edited, changed, or revised without the approval of the individuals listed above, and all edits, changes, and revisions must be routed through the Document Management Coordinator.

5 Empire Drive
St. Paul, Minnesota 55103
612/291-0456 1-800-279-0456
FAX 612/291-0099
DOC #55708

1. INTRODUCTION

1.1. Purpose

This standard operating procedure (SOP) provides guidelines for the safe performance of work in adverse weather conditions including hot or cold environments and severe weather. The diversity of work locations and tasks performed by Bay West personnel may require workers to be exposed to a variety of these conditions.

1.2. Scope

This SOP applies to both regularly scheduled and emergency response operations.

2. RESPONSIBILITIES

Site Supervisors are responsible for implementing this procedure at work sites, and for adequately preparing for work in adverse or inclement weather. They are also responsible for the overall safety of their employees and for determining when to discontinue work due to adverse weather.

Employees are responsible for complying with the provisions of this SOP and for adequately preparing for work in adverse or inclement weather.

Health and Safety Specialists are responsible for providing employee training for this SOP, assisting in the evaluation of work site environmental conditions, and for assisting in the assignment or procurement of safety equipment and the development of procedures to reduce the effects of adverse weather at work sites.

3. PROCEDURE

3.1. Cold Weather Work

3.1.1. Hazards

Hazards associated with work in cold environments include cold injuries (e.g., frostbite and hypothermia) and an impaired ability to work.. Factors which influence the onset and severity of cold stress injuries include:

- *Temperature*: Low temperatures increase the occurrence of cold stress; however, cold stress injuries can occur in relatively warm temperatures.
- *Wind:* Wind increases the effect of cold temperatures and accelerates the onset of cold stress injuries. The combined effect of wind and temperature is commonly known as 'wind chill' or 'equivalent chill temperature.'
- *Water and Moisture:* The presence of water on the clothing or skin increases the conduction of heat from the body. Like wind, water also accelerates the onset of cold stress injuries.

3.1.2. Cold Stress Injuries

3.1.2.1. Frostbite

Frostbite occurs when temperatures fall below the freezing temperature. Frostbite causes damage by freezing tissue or by restricting blood flow to tissues. Frostnip (superficial frostbite) is a mild and less serious form of frostbite which affects the outer layers of skin but may progress to frostbite. Frostbite and frostnip primarily occur on extremities and areas of the body with a high surface-area-to-volume ratio such as toes, fingers, ears, and nose. Signs of superficial and deep frostbite include:

Superficial:

- White or grayish-yellow skin color
- Pain early and subsiding later
- Skin surface will feel hard or crusty and underlying tissue soft when gently depressed

Deep:

- Affected part feels hard, solid, and cannot be depressed
- Blisters appear in 12 to 36 hours
- Affected part is cold with pale, waxy skin
- A painfully cold part suddenly stops hurting

Treatment: All frostbite injuries should be provided with first aid treatment and medical attention should be immediately sought. First aid procedures include removing cold or wet/damp clothing and replacing with dry clothing or coverings. Also, remove clothing that may be restricting blood flow to the affected area. Rewarm the affected area with warm (not hot) water. This process takes 20 to 40 minutes and should be continued until the tissues are soft and pliable *Do not vigorously rub the affected area or allow victim to walk on frostbitten feet or toes or damage to the tissues may result.*

3.1.2.2. Hypothermia

Hypothermia is the general cooling of the core body temperature and is a life-threatening situation. Although associated with cold weather, hypothermia can occur at temperatures far above the freezing point. The consumption of alcohol and sedatives also increase the risk of hypothermia. Symptoms of hypothermia may include: shivering; apathy; listlessness; sleepiness or unconsciousness; slow pulse or respiration; and freezing of extremities. Coma and death can result unless the cooling process is reversed.

Treatment: Immediate medical care should be provided to anyone suffering from hypothermia. Interim first aid procedures should include prompt removal of the victim from the cold environment and transfer to a warm area. Wet or damp clothes should be removed and replaced with dry clothes or blankets. The victim's head should be covered to prevent heat loss. If medical facilities cannot be accessed within 12 hours, the victim should be externally warmed by submersion in warm water (if the victim is conscious) or by using an electric blanket or heat packs. External heat sources should not exceed 108 °F. The victim should be handled gently at all times including during transportation to a medical facility.

3.1.3. Monitoring and Injury Prevention Techniques

3.1.3.1. Chill Temperatures

Table 1, *"Equivalent Chill Temperatures,"* (adapted from ACGIH 2001 Threshold Limit Values) contains equivalent chill temperatures (ECT- wind chill factor) for various wind speeds and air temperatures. The ECT should be used when estimating the combined cooling effect of wind and low air temperatures on exposed skin or when determining clothing insulation requirements to maintain the deep body core temperature. The following actions shall be taken during extreme cold work situations:

- When the ECT falls below -25 °F, outdoor or exposed work shall be performed on a case-by-case basis with input from the Manager, Safety and Health, and the Project Manager.
- When the ECT falls below -72 °F, no outdoor or exposed work shall be performed.

3.1.3.2. Recommended Work/Rest Schedule

Table 2, *"Warm-Up Schedule for a Four Hour Shift,"* contains the recommended work/rest schedule for various temperature ranges and wind speeds. Site supervisors shall establish a work/break schedule based upon actual site conditions to ensure employees are allowed adequate breaks to allow for re-warming.

3.1.3.3. Additional Cold Work Guidelines

- Workers should be under constant protective observation (buddy system, or supervision)
- Employees should be properly attired for cold weather work (pack-type boots, layered clothing, full-body coverage, face masks).
- Avoid getting wet by immersion, splashing, or contact with any liquid and especially volatile solvents such as gasoline.
- Work rate should not be so high as to cause heavy sweating, resulting in wet clothing.
- Change wetted clothing immediately in a heated area and do not resume work until comfortably reheated and authorized to return to work by the field supervisor.
- If clothing is wetted by volatile liquids or other contaminants, do not bring contaminated clothing into the rest area. Especially if the area is heated by an open flame system (e.g. propane, butane heater).
- Avoid touching bare metal surfaces when the temperature is less than 20°F.
- Stop work and proceed immediately to a warming area if experiencing chills, drowsiness, heavy shivering, excessive fatigue, frostnip, frostbite, irritability, or euphoria.

- At the end of the work shift, take extra care to dry out boot liners or replace liners for the next shift.
- Non-combustible exothermic hand-warmers can be used in footwear and handwear.
- Provide hot liquids to drink such as hot cocoa, and de-caffinated coffee, or tea. Alcohol consumption is prohibited consumed during work shift and employees avoid alcohol after the work shift. Intake of caffinated liquids should be limited because of diuretic and circulatory effects.
- Unacclimated employees require several supervised, partial workdays to acclimate.
- Protective clothing may become brittle, and more susceptible to cracking and tearing.
- Work should be scheduled so that sitting or standing still for long periods of time is minimized.

TABLE 1: EQUIVALENT CHILL TEMPERATURES

Estimated Wind Speed (MPH)	Actual Thermometer Reading (°F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Temperature (°F)											
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	40	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-48	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-124
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	25	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect.)	Little danger (for properly clothed person). No work restrictions apply.				Increasing danger (Flesh may freeze within 1 minute.)			Great danger! (Flesh may freeze within 30 seconds.)				

TABLE 2: WARM-UP SCHEDULE FOR FOUR-HOUR SHIFT

Air Temperature - Sunny Sky		No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
°C	°F	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks
-26° to -28°	-15° to -19°	Normal	1	Normal	1	75 min	2	55 min	3	40 min	4
-29° to -31°	-20° to -24°	Normal	1	75 min	2	55 min	3	40 min	4	30 min	5
-32° to -34°	-25° to -29°	75 min	2	55 min	3	40 min	4	30 min	5	Non-Emergency Work Should Cease	
-35° to -37°	-30° to -34°	55 min	3	40 min	4	30 min	5	Non-Emergency Work Should Cease			
-38° to -39°	-35° to -39°	40 min	4	30 min	5	Non-Emergency Work Should Cease					
-40° to -42°	-40° to -44°	30 min	5	Non-Emergency Work Should Cease							
-43° and below	-45° and below	Non-Emergency Work Should Cease									

3.2. Work in Hot Environments

3.2.1. Overview

Exposure to hot environments and/or work requiring the use of personal protective equipment (PPE) can lead to the onset of heat-related illnesses (heat stress). Factors which affect heat stress include:

- ***Environmental conditions:*** Ambient temperature, relative humidity, exposure to sunlight or infra-red radiation, and air flow influence the external heat load to employees and their ability to reduce the stress caused by the heat.
- ***Metabolic/physical characteristics of employees:*** The general fitness and acclimation of the employee, clothing or PPE requirements, and work practices and task requirements influence the affect of heat on an employee.

Heat stress encompasses several types of heat-related illnesses, which range from relatively minor to life-threatening conditions. Although heat stress is often a common and major hazard at work locations, the onset of heat stress can be controlled and limited through the proper selection of PPE, providing adequate rest facilities and drinking water/fluids, employee monitoring, and training employees to be aware of the symptoms of heat stress.

3.2.2. Heat Stress Illnesses

Heat stress includes several different types of illnesses. These illnesses may progress from the mild conditions to the severe. Therefore, prevention, recognition, and treatment of the mild forms of heat stress may prevent the more severe types from occurring.

3.2.2.1. Heat Rash

Heat rash (also known as prickly heat) occurs when sweat is prevented from evaporating such as when wearing impermeable clothing and gloves. This causes a rash to develop, which is characterized by tiny red, raised blisters on the skin and a pricking sensation.

Treatment: Employees with heat rash should try to keep their skin cool and dry and should utilize good personal hygiene practices (e.g., frequent showers).

3.2.2.2. Heat Syncope

Heat syncope usually occurs when persons stand still in hot environments. Under these conditions the body reacts to heat by diverting blood flow to the arms and legs to increase the cooling ability of the body. When this happens, blood is diverted from the brain and causes dizziness and fainting.

Treatment: Move the victim to a cool shaded area and allow them to rest in a reclined position.

3.2.2.3. Heat Cramps

Heat cramps occur in working muscles that are deficient in electrolytes. Profuse sweating depletes the body of necessary electrolytes and is especially apparent in people who are unaccustomed to strenuous work or who are not acclimated. Heat cramps occur primarily in arm, leg, and abdominal muscles.

Treatment: Move victims to a cool shaded area and allow them to rest the cramping muscle. Administer electrolyte replacement drinks (e.g., Gatorade).

3.2.2.4. Heat Exhaustion

Heat exhaustion is characterized by fatigue, nausea, headache, dizziness, profuse sweating, increased pulse rate, and mildly increased body temperature in some cases. It is usually caused by prolonged exposure to strenuous work in hot environments or inadequate replacement of fluids, which causes personnel to become dehydrated. Heat exhaustion can progress to heat stroke if not recognized and treated.

Treatment: Move victims to a cool shaded area and allow them to rest. Have the victim lie down and elevate his/her legs. Cool the victim with cold packs or wet towels and fan him/her. If the victim is conscious give him/her fluids. Medical attention should be sought for severe cases or when the condition does not improve after a short period of time.

3.2.2.5. Heat Stroke

The most serious form of heat stress is heat stroke. Heat stroke is a serious medical emergency, which will result in brain damage and death if the victim does not receive prompt medical attention. The condition occurs when the body's sweat resources have been depleted and the worker can no longer regulate or control increases in body temperature. The onset of heat stroke can be rapid with very little warning to the victim that a severe situation exists. Symptoms of heat stress include confusion, impaired judgment, unconsciousness, and hot, red and dry skin (the perspiration mechanism has stopped).

Treatment: MEDICAL EMERGENCY! Prompt medical attention is required. Victims should be immediately cooled while waiting for emergency services. Place the victim in a cool, shaded area. Cooling with water should be performed. If possible, wrap the victim in a wet sheet and fan to increase air flow and evaporative cooling.

3.2.3. Monitoring and Injury Prevention Techniques

3.2.3.1. Monitoring for Heat Stress

Monitoring for heat stress can be performed both on the environment to predict situations for work settings, which may result in heat stress conditions, or on personnel to detect the onset of heat stress on the individual.

- Environmental monitoring can be useful for projects of long duration and relatively unchanging environmental conditions. The primary form of measurement uses a Wet Bulb Globe Temperature (WBGT) thermometer. The WBGT provides a corrected temperature based upon environmental temperature, humidity, and radiant heat from sunlight. Table 3, *"Permissible Heat Exposure Threshold Limit Values,"* (ACGIH 2001 Threshold Limit Values), contains the recommended work/rest regimen for various WBGT temperature ranges and workloads.
- Three types of employee monitoring can be performed:

- *Heart Rate:* Count the radial pulse during a 30-second period as early as possible in the rest period following work. If the heart rate exceeds 110 beats per minute (bpm), shorten the next work cycle by one-third and keep the rest period the same. Repeat this procedure for subsequent rest periods.
- *Oral Temperature:* Use a clinical thermometer or similar device to measure the oral temperature at the end of the work period (before drinking). If the temperature exceeds 99.6 °F, shorten the next work period by one-third and keep the rest period the same. Repeat this procedure for subsequent rest periods.
- *Body Water Loss:* Measure weight on an accurate scale at the beginning and end of each work day. If the end weight is more than 1.5% less than the beginning weight, the employee's fluid intake is inadequate.

Table 3. Screening Criteria for Heat Stress Exposure (WBGT Values in F° and (C°)

	Acclimatized				Unacclimatized			
Work Demands	**Light**	**Moderate**	**Heavy**	**Very Heavy**	**Light**	**Moderate**	**Heavy**	**Very Heavy**
100% Work	85.1 (29.5)	81.5 (27.5)	78.8 (26)		81.5 (27.5)	77 (25)	72.5 (22.5)	
75% Work 25% Rest	86.9 (30.5)	83.3 (28.5)	81.5 (27.5)		84.2 (29)	79.7 (26.5)	76.1 (24.5)	
50% Work 50% Rest	88.7 (31.5)	85.1 (29.5)	83.3 (28.5)	81.5 (27.5)	86 (30)	82.4 (28)	79.2 (26.5)	77 (25)
25% Work 75% Rest	90.5 (32.5)	87.8 (31)	86 (30)	85.1 (29.5)	87.8 (31)	84.2 (29)	82.4 (28)	79.7 (26.5)

Note-Because of the physiological strain associated with Very Heavy work among less fit workers regardless of WBGT, criteria values are not provided for continuous work and for up to 25% rest in an hour. The screening criteria are not recommended, and a detailed analysis and/or physiological monitoring should be used.

3.2.3.2. Preventing Heat Stress

Due to the nature of work performed by Bay West, exposure to hot environments in some situations cannot be avoided entirely (e.g. an emergency spill response situation). Pre-planned scheduled work however can be evaluated on a case by case basis. In attempts to properly protect workers from the risks of heat related disorders, several actions can be taken to reduce the likelihood of heat stress illness or the severity of the conditions.

- *Employee Diet:* Eat a proper diet and drink adequate quantities of liquid before and during strenuous work. Avoid fatty, heavy meals and food which is harder to digest than lighter, nutritious meals. Liquids should replenish electrolytes lost with sweat. Avoid alcohol intake. Since thirst is not a good indicator of your body's need for fluids, drink liquids even if not thirsty.

- *Acclimatization:* Acclimatization is the process of getting accustomed to work in hot environments. The process takes 5-7 days in which the quantity of time spent in hot environments is progressively increased.
- *Physical Fitness:* Persons who are in good physical condition are less likely to be stricken by heat-related illnesses. Fit people carry less body weight and are able to adapt to warmer environments than obese or unfit people.
- *Clothing:* The type of clothing worn greatly impacts the onset of heat stress. When possible, wear lightweight, breathable clothing. If this is not possible (e.g. ER spill response with protective clothing, PPE ,respirators, etc.) , plan more or longer breaks which allow workers to get out of protective clothing.
- *Work Planning:* If possible, perform strenuous labor activities during cooler periods of the workshift, avoiding the 11:00 A.M. – 5:00 P.M time span. Plan adequate breaks during work planning to allow for rest. Add additional workers to assist in handling materials or performing tasks to reduce the overall stress on persons.
- *Monitoring:* Environmental and employee monitoring can be performed to predict conditions, which may lead to the onset of heat stress. OSHA has published an Outdoor Humidity Index worksheet that can be used as work planning a guideline (see below).

HEAT STRESS INDEX

RELATIVE HUMIDITY (%)

T		0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	85	100
E	120	107	111	116	123	130																
M	115	103	107	111	115	120	127	135	143	151						D	A	N	G	E	R	
P	110	102	105	108	112	117	123	130	137	143	150						S	I	D	E		
E	105	95	97	100	102	105	109	113	118	123	129	135	142	149								
R	100	91	93	95	97	99	101	104	107	110	115	120	132	132	138	144						
A	95	87	88	90	91	93	94	96	98	101	104	107	114	114	119	124	130	136				
T	90	83	84	85	86	87	88	90	91	93	95	96	100	100	106	108	109	113	117	122		
U	85	78	79	80	81	82	83	84	85	86	87	88	91	91	91	93	95	97	99	102	105	108
R	80	73	74	75	76	77	77	78	79	79	80	81	83	83	83	86	86	86	84	88	89	91
E	75	69	69	70	71	72	72	73	73	74	74	75	76	76	76	77	77	78	78	79	79	80
F°	70	64	64	65	65	66	66	67	67	68	68	69	70	70	70	70	70	71	71	71	71	72

80-90 Caution-Fatigue possible with prolonged exposure and physical activity

90-105 Extreme Caution-Sunstroke and heat exhaustion are possible with prolonged exposure and physical activity

106-130 Danger!-Sunstroke and heat exhaustion likely! Heatstroke possible with prolonged exposure and physical activity

Over 130-Extreme Danger!-Heatstroke or sunstroke imminent! Bay West will suspend work until conditions change.

3.3. Work During Severe Weather

3.3.1. Overview

Bay West employees may be exposed to a variety of work locations or situations where they may be affected by inclement weather. The severity of these situations and the associated hazards can range from mild and relatively non-hazardous to severe and life-threatening conditions. Inclement weather may include high winds, thunderstorms, rain and hail, lightning, blizzards, tornadoes, and flash floods. These situations may present a hazard, not only at a worksite, but also during transportation to and from the worksite. Also, special work locations, such as work on open water, may be affected by adverse weather conditions differently than at routine work locations.

All employees should be aware of the weather conditions expected to be present at a work site and should prepare accordingly. Proper clothing/protective equipment is available for use in adverse weather conditions including gloves, insulated boots, and raincoats and pants. If other types of clothing or equipment are required, contact the health and safety specialists.

3.3.2. Monitoring Weather Conditions

Changing weather conditions and conditions which could lead to hazardous situations should be monitored. Warnings or indications of severe weather including visual recognition of oncoming severe weather, warnings or watches issued by the National Weather Service, or public warning sirens should be observed and appropriate actions taken when necessary. Survey work locations and surroundings and plan where to seek shelter if required. Be careful when working in low-lying areas (including storm sewers) during periods of heavy rain. Anticipate and plan for poor road conditions caused by inclement weather.

3.3.3. Imminent Danger Conditions

In addition to the severe cold/heat discussed in earlier sections, several severe weather conditions present imminent danger to employees. Lightning presents an immediate and life-threatening situation which requires immediate attention. No work shall be performed outdoors when there is lightning (visible or invisible) and/or audible thunder in the area. When lightning or thunder is observed (visually or by ear), immediately stop work and seek shelter in a building or vehicle or, if these are not available, crouch down in a low-lying area. Do not use trees for overhead protection! Stop work if there is a tornado warning situation or the civil defense sirens sound. Seek protective shelter as necessary.

4. REFERENCE

American Conference of Governmental Industrial Hygienists, Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, 2001.

Occupational Safety And Health Administration, Technical Manual-Section III, Chapter 4, 2001.

5. FORMS

No forms are required to execute this SOP.

6. TRAINING REQUIREMENTS

All employees shall be provided training for the contents of this procedure. The training should include refresher training to update employees of actions to be taken during various weather seasons.

7. DEFINITIONS

No specific definitions exist for this SOP.

8. RECORDS

No records are required to be kept regarding the execution of this SOP.

SAMPLING AND ANALYSIS PLAN
for the
WATER DISTRIBUTION SYSTEM BETWEEN OFF-POST SUPPLY WELLS AND DISTRIBUTION POINTS FORMER FIRE TRAINING AREA AT MARSHALL ARMY AIRFIELD FT. RILEY, KS
JULY 2002

DACW41-95-D-0022
DELIVERY ORDER 0012

Prepared for

U.S. ARMY ENGINEERING DISTRICT,
KANSAS CITY
ATTN: RICK VAN SAUN
601 E. 12th St.
Kansas City, MO 64106-2896

Prepared by

BAY WEST, INC.
10620 Widmer
Lenexa, KS 66215

Philip Dula
Project Manager

July 2002

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Table of Contents

List of Tables

List of Figures

List of Appendices

List of Acronyms

Acronym	*Title*
°C	degrees Celsius
°F	degrees Fahrenheit
ABC	airway, breathing, and circulation
ABIH	American Board of Industrial Hygiene
ACGIH	American Conference of Governmental Industrial Hygienists
ACM	asbestos-containing materials
AHA	Activity Hazard Analysis
ANSI	American National Standards Institute
APR	air-purifying respirator
AST	aboveground storage tank
ASTM	American Society for Testing and Materials
ATSDR	Agency for Toxic Substance and Disease Registry
BTEX	benzene, toluene, ethyl benzene, and xylene
BZ	breathing zone
CBC	complete blood count
CQCSM	Contractor Quality Control Systems Manager
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
CLP	U.S. EPA Contract Laboratory Program
COC	Chain-of-Custody
COR	Contracting Officer Representative
CPR	cardiopulmonary resuscitation
CRZ	contamination reduction zone
dBA	A-weighted decibel(s)
DCQCR	Daily Construction Quality Control Report
DEET	diethyltoluamide
DOD	Department of Defense
DOT	U.S. Department of Transportation
DQOs	data quality objectives
EKG	electrocardiogram
ERC	Emergency Response Coordinator
EZ	exclusion zone
FS	Feasibility Study
GC/MS	Gas chromatography/mass spectrometry
GFCI	ground-fault circuit interrupter
HTRW	hazardous, toxic and radioactive waste

IDLH	immediately dangerous to life and health
IT	IT Corporation
LEL	lower explosive limit
MCL	Maximum Containment Level
MCLG	Maximum Containment Level Goal
mg/kg	milligram(s) per kilogram
mg/m^3	milligram(s) per cubic meter (of air)
MSDS	Material Safety Data Sheet
MSHA	Mine Safety and Health Administration
NIOSH	National Institute for Occupational Safety and Health
NJDEP	New Jersey Department of Environmental Protection
NPL	National Priorities List
NRR	Noise Reduction Rating
O_2	oxygen
OSHA	Occupational Safety and Health Administration
PCB	polychlorinated biphenyls
PEL	permissible exposure limit
PID	photoionization detector
PM	Project Manager
PPE	personal protective equipment
ppm	parts per million
pvc	polyvinyl chloride
QA	Quality assurance
QC	Quality control
QCSM	Quality Control System Manager
RCRA	Resource Conservation and Recovery Act
RFA	Request for Analysis
RI	Remedial Investigation
RPD	Relative percent difference
RRF	Relative response factor
RSD	Relative standard deviation
SAP	Sampling and Analysis Plan
SHM	Safety and Health Manager
SMAC 24	Sequential Multiple Analyzer Computer
SOP	Standard Operating Procedure
SOW	scope of work
SS	Site Superintendent
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
STEL	short-term exposure limit
SZ	support zone

List of Acronyms (contd.)

Acronym	*Title*
TLV	Threshold Limit Value
TSCA	Toxic Substances Control Act
TWA	time-weighted average
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USEPA	U.S. Environmental Protection Agency
UST	underground storage tank
VOA	volatile organics analysis
VOC	volatile organic compound

1.0 Introduction

This Sampling and Analysis Plan (SAP) was developed to provide information and guidance to field personnel concerning the acquisition of chemical data from the Ft. Riley Alternative Water Supply Project during sampling and analysis activities. The SAP includes the field activities and off-site laboratory performance criteria, and deliverables associated with the acquisition and reporting of chemical data. This SAP was prepared in accordance with the USACE specifications for the Contract DACW 41-95-D-0022 Delivery Order #12.

The strategies proposed may be modified to accommodate the actual site conditions. Any modifications will be discussed, documented, and approved by the USACE Contracting Officer , or his approved representative (USACE COR), prior to implementation.

The overall objectives of the SAP are:

1. To document specific objectives, procedures, and rationales for fieldwork and sample analytical work
2. To provide a mechanism for planning and approving site and laboratory activities
3. To document that sampling and analysis activities are necessary and sufficient
4. To provide a common point of reference for parties to evaluate the comparability and compatibility of objectives and the sampling and analysis activities

2.0 Scope of Work

This SAP addresses the sampling and analysis of ground water, development water, and decontamination water. The sampling and analyses efforts will be supported by a sample collection team and an off-site analytical laboratory.

The SAP consists of a Field Sampling Plan (FSP) and a Quality Assurance Project Plan (QAPP). The FSP and QAPP are presented in Section 3.0 and Section 4.0, respectively.

3.0 Field Sampling Plan

3.1 Introduction

The FSP outlines the field sampling activities for the sampling program, including objectives, rationale, sampling locations, sampling methodologies, and general analytical requirements.

3.2 Sampling Objectives

The primary objective of the chemical sampling programs developed for this project will be to collect representative samples that will provide accurate analytical data. This data is necessary to characterize the quality of groundwater as a potable water supply and for characterization of well development and decontamination water for disposal. Where applicable, standard EPA sampling guidelines, including those specified in "Test Method of Evaluating Solid Waste - Physical/Chemical Methods" (3rd Edition), EPA SW-846, November 1980, will be followed.

3.3 Sampling Location, Frequency and Analytical Parameters

The preliminary sampling strategy is to collect representative water samples from the two water wells to be installed and from outlets supplied by these wells. Representative samples from each spigot and from decontamination and development water will be collected to determine the water quality characteristics of the water produced from the Racetrack Replacement Well and Replacement Well M-1. All containerized development water and decontamination water will be characterized for disposal requirements. If anayltical results indicate that the target anayltes are below respective MCLs/MCGLs than per the USACE this water can be discharged to the ground. If MCLs/MCGLs are exceeded the water will be transported to the Ft. Riley Environmental Waste Management Center. Water samples will be analyzed for VOCs per EPA Method 8260.

All samples will be analyzed by Environmental Science Corp, Inc. with a requested one-week TAT. The water samples will be analyzed for volatile organic compounds as specified in the USACE SOW. The selected analytical method is EPA Method 8260.

3.4 Sample Designation

Samples collected in association with this project will be placed in containers appropriately labeled to uniquely identify each sample. Sample containers will be supplied by the subcontracted laboratory. A sample numbering system shall be established for the project per Bay West's Standard Operating Procedure (SOP), "Sample Numbering". Appendix A contains a copy of this SOP. The sample designation includes the sample, the sample matrix (e.g., tank soil, PPE, decon water, tank liquids, tank solids, tank coatings, drummed soil, drummed oil and soil-pile) and the name of the site.

3.5 Sampling Equipment and Procedures

The sampling equipment selected for use during this project will be constructed of materials that will not react with or contaminate the sample matrices collected through its use.

The sample containers with the appropriate preservation, sample coolers, ice packs, and Laboratory Grade Certified Contaminant-Free Water, will be provided by the laboratory.

Sample containers will be purchased new by the laboratory as described in the Environmental Service Corporation's Laboratory Quality Management Manual included as Appendix B.

3.5.1 Sample Equipment Decontamination Procedures

Decontamination of all reusable sampling equipment during the project will be performed before initial use on site and between each use at each sample location. The decontamination procedure will be performed in the following order:

1) Non-phosphate detergent and water wash
2) Water rinse
3) Deionized water rinse

Decontamination will take place in a designated area with a means to containerize any waste decontamination liquid. The decontamination area will be located close to the defined exclusion zone on site.

Liquids generated during the decontamination procedures will be collected, containerized, and appropriately labeled pending disposal characterization. All containerized liquids are presently planned to be transported to the Ft. Riley Environmental Waste Management Center if the analytical sample results exceed any MCL/MCLG for the target VOCs. Per the USACE SOW, if analytical results do not exceed the respective regulatory limit the water can be discharged to the ground surface.

3.6 Sample Handling and Analysis

3.6.1 Field Sample Collection Logs

A sample collection log will be completed for each of the samples collected. Sample collection logs will contain, at a minimum, the following information:

- Project name
- Unique sample number
- Collection date and time
- Sampler's initials
- Sample location
- Container type and size
- Analysis requested
- Depth of sample (if applicable)
- Field observations
- Sample Type - composite or grab
- Sample matrix
- Weather conditions
- Problems encountered, if any.

An example of the sample collection log that will be used during the project is included as Figure 3-1. This documentation will provide an inventory and field sampling record of the samples collected during field sampling activities and will allow the Contractor Quality Control System Manager (CQCSM) to monitor the timeliness and completeness of sampling activities in the field on a real time basis. This documentation will also be used as an inventory checklist by which the shipment of samples to the analytical laboratory will be verified. The sample collection logs will be compiled in sequence, by date, for inclusion in the project file.

The Bay West Site Supervisor will maintain a daily record of field activities on the Daily Construction Quality Control Report (DCQCR). The DCQCRs will be compiled in sequence, by date, for inclusion in the project file.

3.6.2 Master Sample Log

Samples will be tracked by the CQCSM on a Master Sample Log. The Master Sample Log will contain the following information:

- Sample number
- Date sample was collected
- Sample matrix
- Sample location
- Analysis requested
- Date results are due

Based on the limited amount of anticipated sampling, the Master Sample Log will be updated on a weekly basis with a personal computer enabling weekly printouts for the status of sample collection and analysis. An example template of the proposed Master Sample Log is presented in Figure 3-2.

3.6.3 Sample Preservation and Holding Times

Samples will be placed on ice in ice chests for shipment, and will be stored at approximately 4°C until analyzed. In addition to cooling samples, chemical preservatives will be used in the appropriate samples as required. Holding times and preservation of samples will follow the guidelines as recommended in the USEPA SW-846. Table 4-1 summarizes the required holding times and preservation techniques that will be observed for this project. Any proposed or anticipated deviations from these holding times will be discussed and approved by the USACE before implementation.

3.6.4 Sample Shipping

The shipment of samples to the analytical laboratory will be performed in accordance with the U.S. Department of Transportation (DOT) regulations (49 CFR) when shipped to the laboratory by over the road courier. Samples will be placed in coolers with bagged ice or recyclable blue ice blocks. All samples will be wrapped with bubble wrap or secured in foam holders to preclude breakage of the sample container and loss of sample.

The International Air Transportation Association (IATA) regulations will be adhered to when shipping samples using air courier services.

3.6.5 Request for Analysis/Chain-of-Custody

The RFA/COC (Figure 3-3) used during this project will provide the formal request for sample analyses and custody exchange record for project samples submitted to the laboratory. The RFA/COC forms used will be completed, signed, and distributed as follows:

- One copy retained by the CQCSM for inclusion in the project files/daily QC report/final report
- The original sent to the analytical laboratory with the sample shipment.

Upon sample receipt at the contract laboratory, the laboratory sample custodian will inventory shipment of samples before signing and dating the original custody form. The laboratory sample custodian will then make a note on the custody form of any discrepancy in the number of samples or breakage of samples upon receipt. The CQCSM will be notified immediately of any problems identified with shipped samples. The laboratory will initiate an internal chain of custody that will track procession of the samples within the various areas of the laboratory per the Laboratory Quality Management Manual.

3.7 Laboratory Certificates of Analysis

The results for all samples delivered to the laboratory for analysis will be reported on a laboratory certificate of analysis along with associated analytical quality assurance data for inclusion into the project files/QC reports/final report. These certificates of analysis will be issued for project samples receiving analysis and will contain the following information:

- Field sample number
- Laboratory sample number
- Sampling date
- Sample preparation date
- Sample analysis date

- Sample results in appropriate units
- Referenced methods and associated detection limits
- QC acceptance criteria.

4.0 Quality Assurance Project Plan

4.1 Project Description

The work at the Ft. Riley Alternative Water Supply Site includes:

- Installation of 2 replacement water wells
- Abandonment of 5 existing well and the
- Installation of the piping for the new water distribution system.

The Data Quality Objectives associated with these activities are summarized below.

Determination of the Waste Classification of Drummed Water. Drummed development water and decontamination water, may require off-site disposal. Representative samples of each will be collected and analyzed to determine the hazardous or non-hazardous nature of these waste materials. If the composite water sample analytical results are below regulatory limits for the respective target analysis the water per USACE instruction can be discharged to the ground.

In order to meet DQOs, quality assurance/quality control (QA/QC) requirements are specified in Section 4.3 for the following data quality parameters: precision, sensitivity, accuracy, representativeness, comparability, and completeness.

4.2 Project Organization and Responsibilities

4.2.1 Project Organization

The project organization chart, Figure 4-1, is included in this Sampling and Analysis Plan (SAP) and defines the lines of authority as well as reporting functions of personnel performing quality related activities. The following paragraphs provide a summary of the responsibilities of key project personnel performing activities which affect the quality of the project.

4.2.1.1 Quality Assurance/Quality Control Director

The Bay West Project Operations QA/QC Manager reports to the Bay West Project Manager, for direction on all quality matters. The QA/QC Manager is responsible for the planning, development, implementation, and effectiveness of the project-specific QC program, including the Contractor Quality Control Plan and the Sampling and Analysis Plan. The effectiveness of the program is measured through the use of audits, surveillance, document reviews, and other QA monitoring activities defined throughout this document.

4.2.1.2 Quality Control Compliance Systems Manager (CQCSM)

The CQCSM or authorized designee will be on Site when project activities are in progress. The CQCSM is responsible for the implementation and enforcement of the Contractor Quality Control Plan and the Sampling Analysis Plan (SAP) during site preparation, operations, and closure activities to verify that the quality of the materials, workmanship, and operations complies with the specified requirements throughout the duration of the project.

He has the authority to identify and report quality problems, reject nonconforming materials, initiate corrective actions, and recommend solutions for nonconforming activities. He also has the authority to stop work or control further processing, delivery, or installation activities until satisfactory disposition and implementation of corrective actions is achieved.

4.2.1.3 Laboratory QA/QC Personnel

The Laboratory Quality Organization will be provided in the Laboratory Quality Management Manual, included as Appendix B. Laboratory personnel with QA/QC responsibilities include the Laboratory Project Supervisor, Laboratory Quality Control Officer, and Laboratory Sample Custodian.

4.3 Quality Assurance Objectives

The primary analytical quality assurance (QA) objective is to produce analytical data that can be used to assess site activities relative to the DQOs established for this project. In order to meet the DQOs, requirements are specified in this document for the following data quality parameters: precision, sensitivity, accuracy, representativeness, comparability, and completeness. The quantitative requirements for precision, accuracy, completeness, and sensitivity, as they pertain to this project for field and laboratory measurements, are provided below. Further, this section discusses the methods used to evaluate precision, accuracy, completeness, and sensitivity. The procedures used to verify that the required representativeness and comparability goals are achieved are also discussed in this section.

Precision will be assessed by the analysis by the analytes of laboratory matrix spike duplicate samples or replicate analyses. Relative percent difference (RPD) between laboratory duplicates must be within laboratory control limits RPDs apply to sample results that are a minimum of five times the laboratory reporting limits. If concentrations are below five times the reporting limits, precision will not be assessed using control limit of two times the reporting limit.

Split samples will be collected to assess field sampling precision. Split sample analyses measure both field and laboratory precision; therefore, the results may contain more variability than laboratory duplicates which measure laboratory performance only. It is also expected that soil split sample results will have greater variance than aqueous samples due to the difficulties associated with collecting homogeneous soil split samples. Split sample RPDs must be within 35% for aqueous samples and within 50% for soil samples for concentrations that are greater than five times the laboratory reporting limit.

Accuracy will be assessed through analysis of continuing calibration standards, laboratory control samples (LCS) and matrix spike/matrix spike duplicates (MS/MSDs). In addition, accuracy will be assessed from surrogate and internal standard recoveries where applicable. Acceptance limits for LCSs, MS/MSDs, and surrogates will be based on previously established laboratory control limits for samples of similar matrix.

Representativeness refers to the degree to which a sample taken from a site accurately represents the matrix being sampled. Representativeness will be maximized by the use of EPA procedures for the collection and preservation of samples and by completing sample extraction and analyses within EPA specified holding times summarized in Table 4-1.

Comparability refers to the use of consistent procedures, reporting units, quantitation limits, second source LCSs, standardized methods of field analysis and standardized data format with document control and data validation. The analysis of LCSs provides a verification that the contract laboratory can accurately determine the concentration of a standard which has been verified by an independent manufacturer.

Completeness: Data completeness is a measure of the extent to which the data base resulting from a measurement effort fulfills the data requirement objectives. For this project, completeness will be defined as the number of valid sample results as a percentage of the number of samples submitted for analysis. Completeness is assessed by the following equation:

The completeness objective will be used to help to evaluate the accuracy and precision of the analytical measurements.

Sensitivity refers to the measurable concentration of an analyte which can be determined with a designated level of confidence. Sensitivity is established by laboratory reporting limits.

4.4 Sampling Procedures

Samples will be collected as described in Section 3.0. If changes in sampling procedures are required due to an unforeseen condition, these changes will be approved by USACE, and documented in the DCQCRs.

The CQCSM will monitor all sampling activities associated with the project for proper sample documentation as well as adherence to this SAP. Sample traceability will be maintained through the use of a project-specific RFA/COC form, sample collection sheets, the master list of samples collected, and the unique alphanumeric sample identification number applied to each sample collected in the field.

4.4.1 Sample Handling

Samples for chemical analysis will be collected and placed in labeled containers provided by the laboratory. Bay West will label sample containers with the appropriate information: project name, preservation (if applicable) analyses to be performed, sample identification, date and time of collection, and initials of sampling team. Samples will be uniquely identified for each sample location. A numbering system is to be used for this project that will provide a tracking procedure to allow retrieval of information regarding a particular sample. A listing of sample identification numbers will be maintained by the sample CQCSM or his designee.

Samples will be transferred to coolers packed with ice and ice packs to maintain the temperature inside the cooler at approximately 4°C. Samples will then be shipped to the laboratory within twenty-four hours of sample collection. Saturday deliveries will be scheduled, as needed, with the laboratory in order to complete delivery of samples within twenty-four hours.

Sample transportation will comply with U.S. Department of Transportation requirements. Sample preservation and cooler temperatures will be verified by the laboratory upon receipt. The respective sample container volumes, methods of preservation, and holding time requirements are summarized in Table 4-1.

4.4.2 Field Quality Control Samples

Quality assurance and quality control samples will be collected and analyzed for the purposes of assessing the quality of the project sampling and analytical efforts. The data obtained from the analysis of QA/QC samples will be assessed with respect to all project DQOs before determining the usefulness of the project specific samples.

Quality control samples will be collected during field sampling activities to provide a measure of quality assurance for the project samples. The samples that will be collected include equipment rinsates and split samples.

- Equipment Rinsate Samples

  Equipment rinsates will be collected and analyzed to verify that the decontamination procedures implemented on reusable sampling equipment is adequately preventing cross-contamination. Equipment rinsates will be collected at a frequency of one per type of sampling equipment used per day of sampling for each analytical parameter.

- Split Samples

  Split samples will be collected and analyzed during the sampling operation. Split samples will be collected at a minimum rate of 10 percent of the total number of samples per sampling event. The analytical results will be used as an indication of proper sample collection procedures and accuracy of the respective analytical laboratories. With the exception of the volatile portion/fraction of the sample analysis, all split samples will be thoroughly mixed to homogenize the sample before on-site analysis. The volatile fraction will be a grab sample collected from only one of the composite sample points. The USACE representative and sampling personnel will be notified in advance by the CQCSM. This will allow the respective laboratories receiving the samples to be properly prepared. Furthermore, sampling personnel will be prepared to collect enough sample volume to meet the analytical requirements for both the USACE and Bay West selected laboratories.

- Duplicate Samples

  Duplicate samples will be collected and analyzed during the sampling operation. Duplicate samples will be collected at a minimum rate of 10 percent of the total number of samples per sampling event. The analytical results will be used as an indication of proper sample collection procedures and accuracy of the Bay West subcontract analytical laboratory. All duplicate samples will be thoroughly mixed to homogenize the sample before on-site analysis.

4.5 Sample Custody and Documentation Procedures

As described in Section 3.6, the sample custody and sample documentation procedures implemented during this project will meet or exceed the requirements specified in the appropriate EPA guidelines. Sample custody and traceability will be the responsibility of sampling personnel from the time of sample collection until the samples are received by the analytical laboratory. Thereafter sample custody will be maintained by Environmental Science Corporation (ESC) Nashville, TN in accordance with procedures described in the Laboratory Quality Management Manual. The Laboratory Quality Management Manual for the ESC laboratory is included as Appendix B.

4.6 Calibration Procedures and Frequency

Specific calibration procedures for the sampling and analytical instrumentation used during this project are provided in the laboratory SOPs. These SOPs specify the calibration procedures and frequency requirements as well a routine maintenance schedule that is recommended. The analytical calibration procedures, frequencies, acceptance criteria, and corrective actions are included in Appendix B.

4.7 Analytical Procedures

ESC will be equipped with the analytical instrumentation necessary to complete the desired sample analyses. The analysts performing the sample preparation and analysis will be familiar with the preparation and analytical methodologies selected, proper instrument operation, instrument calibration, QA/QC requirements, and instrument preventive maintenance.

Standard analytical methods and procedures will be followed during the analysis of samples. The analytical parameters that will be implemented are discussed under Section 3.0.

4.7.1 Analytical Holding Times, Preservation Methods and Turnaround Times

The analytical holding times and preservation methods, summarized in Table 4-1, will be observed. The RFA/COC accompanying each group of samples submitted for analysis will indicate the analytical laboratory TAT requirements for the submission of analytical data to the project. The analytical laboratory TATs, anticipated to be one week for the respective sampling events, are presented in Section 3.0 of this SAP.

4.7.2 Analytical Project Deliverables

The analytical data will be reported by ESC on Certificates of Analysis in their final report. Results for samples will also include the following back-up QA/QC data:

- Continuing calibration results
- Surrogate recoveries (if applicable)
- Batch QA/QC results
- Internal standard of data (if applicable)

4.7.3 Data Reduction

Data reduction consists of manual and computer data reduction procedures and calculations. Computer data reduction procedures and calculations will be checked manually by the laboratory to verify compound identification and quantitation adhere to method requirements. The laboratory will be responsible for maintaining a listing of computer-based data reduction programs and SOPs for data reduction. Sample preparation or extraction logs will be used to document sample preparation information (e.g., preparation weights, volumes, reagents). Instrument injection logs or bench sheets will also be maintained for each instrument.

Qualitative identification and quantitation of organic analytes will be performed by experienced analysts in accordance with analytical method requirements.

4.7.4 Laboratory Data Review

Laboratory data review procedures are included in the Laboratory Quality Management Manual provided in Appendix B.

4.8 Analytical Data Review

As previously discussed, the laboratory will provide sample results and the following back-up QA/QC data with:

- Continuing calibration standard summary forms
- Surrogate recoveries with applicable control limits
- Batch QA/QC results including method blanks, MS/MSDs, and LCSs
- Volatile and semi-volatile internal standard areas, if applicable.

A qualified data validator or chemist will review the backup QA/QC data and applicable split sample results prior to final acceptance of data. If QA/QC requirements are not met, corrective actions will be implemented.

4.9 Data Validation

Data validation will be performed for the analytical data generated for the water sampling and waste classification sampling by a qualified validator.

4.9.1 Records Management

In order to track the submittal of samples to the laboratory and the receipt of sample analytical data, records management systems will be implemented at the analytical laboratory. This system will allow for easy retrieval of sample collection information and analytical results.

All original and supporting information generated in the field will be retained in the on-site project files for the duration of the project. The project files will include original field logs, original records, RFA/COC records, Certificates of Analysis, analytical data packages, and quality assurance program documentation. The project files compiled at the site will be placed into the documentation archives of Bay West. Bay West's archive system and associated storage procedures will provide the necessary data access and required security to prevent data tampering. All analytical data and supporting documentation, which includes data sheets, calibration records, raw sample data, and actual sample data, will be maintained in the laboratory project files for the duration of the project.

4.9.2 Matrix Spike/Matrix Spike Duplicates

Matrix spike/matrix spike duplicate (MS/MSD) collected at five percent frequency in order to evaluate the accuracy and precision with respect to the sample matrix. MS/MSDs will be prepared, at the laboratory, by spiking the sample prior to sample preparation and analysis with the appropriate matrix spike compounds.

4.10 Performance and System Audits

A performance audit is a review of the laboratory's operation or field sampling operations (when applicable) to verify that the necessary facilities, equipment, staff, and procedures are in place to generate acceptable data. Bay West routinely performs laboratory performance audits prior to initiation of work with a specified laboratory. A performance audit of field sampling activities will be performed by the CQCSM or designee at the beginning of the field sampling program to evaluate the field sampling program with the requirements specified in this document.

The CQCSM, in conjunction with the Laboratory Quality Control Officer, the analyst, analyst's supervisor, and Project Manager will formulate recommendations to correct any deficiencies in the analytical protocol or data observed during the validation process.

These corrective measures will be in accord with the Laboratory Quality Management Manual and this SAP.

A system audit verifies the ability of the laboratory to correctly identify and quantitate compounds in blind check samples submitted by a regulatory agency. Certifications maintained by ESC are provided in the Laboratory Quality Management Manual, Appendix B.

4.11 Audit Procedures

Sampling performance will be audited through the observation of all activities associated with the sampling operations by the Bay West CQCSM.

4.12 Preventive Maintenance

Preventive maintenance procedures will be carried out on field equipment by Bay West personnel in accordance with the procedures outlined by the manufacturer's equipment manuals. Maintenance activities involving field equipment will be recorded.

Minimally, field and laboratory instruments will undergo maintenance on an annual basis and when calibration, blank, or QC analyses indicate that maintenance is necessary to correct or improve system performance. Maintenance, whether performed by laboratory personnel or manufacturer, is documented as an entry in the appropriate log. Log entries include the reason for maintenance, maintenance performed, date, and initials of the person in charge during maintenance.

4.13 Corrective Action

The need for corrective action occurs when a circumstance arises that has a negative impact on the quality or validity of the analytical data generated during sample analysis. For corrective action to be initiated, awareness of a problem must exist. In most instances, the personnel conducting the field work and the laboratory analysis are in the best position to recognize problems that will affect data quality. Keen awareness on their part can frequently detect minor instrument changes, drifts, or malfunctions, which can be corrected promptly, thus preventing a major breakdown in the quality control system in place. If major problems arise, they are in the best position to decide upon the proper corrective action and initiate it immediately, thus minimizing data loss. Therefore, the field sampling and laboratory analysis personnel will have a prime responsibility for

recognizing a nonconformance and the need for corrective action. Each nonconformance shall be documented by the personnel identifying or originating it. Documentation shall include:

- Identification of the individual(s) identifying or originating the nonconformance
- Description of the nonconformance
- Any required approval signatures
- Method(s) for correcting the nonconformance (corrective action) or description of the variance granted
- Schedule for completing corrective action.

Documentation shall be made available to the analyst, group leader, and the Laboratory PM. It is the responsibility of each of these individuals to notify the appropriate Bay West project personnel of the nonconformance and corrective action implemented. All project samples affected will be listed on the Nonconformance Report. Decisions on whether to take corrective action and what action(s) to take will be made by the Bay West PM, Laboratory QC Representative, or their authorized designee. When a corrective action is taken by any of the operations or analytical laboratory personnel, they will be responsible for notifying the Laboratory QC Representative so that, if deemed necessary, quality assurance surveillance of the affected sampling or analytical system can be intensified. Nonconformance and corrective action reports will become part of the project files and analytical reports, as well as other project supporting data files.

A second recognition level of the need for corrective action will be determined by the CQCSM, who will determine the need for corrective action from the results of the internal audits conducted and from review of the quality assurance data generated during the study. The Laboratory PM will be responsible for initiating corrective action by immediately notifying the CQCSM during the sample analysis phase. The appropriate management will then be responsible for initiating corrective action and verifying that the corrective action procedures produce the desired results.

Ultimately, the personnel performing and checking the sampling and analysis procedures and analytical results must participate in the decision making process when corrective actions become necessary. To reach the proper decision, each individual must understand the project analytical DQOs as well as the contractual DQOs required to meet these

objectives. Personnel involved in the project will receive or have available to them an approved copy of this SAP and will be informed of these objectives prior to their participation. Each individual will have the responsibility to notify the respective field sampling or laboratory operations supervisor whenever a measurement system fails to meet the desired project objectives. If a situation arises requiring corrective action, the following closed-loop corrective action system will be used:

- Define the problem
- Assign responsibility for investigating the problem
- Investigate and determine the cause of the problem
- Determine corrective action course to eliminate the problem
- Assign responsibility for implementing the corrective action
- Determine the effectiveness of the corrective action and implement the correction
- Verify that the corrective action has eliminated the problem
- If not completely successful, begin back at first step.

4.14 Quality Assurance Reporting

The Bay West PM, Laboratory QC Representative, and the Laboratory PM will review the SAP during the course of the project's execution. The QCM will immediately notify the Bay West PM or the Laboratory PM of any event or occurrence that could have a significant effect on the validity of the analytical results.

Notification will be verbal, followed by a written memorandum which includes the proposed corrective action. Quality assurance reports will be submitted as required by the project and included in the project files.

TABLES

- **TABLE 4-1**

SUMMARY OF REQUIRED HOLDING TIMES AND PRESERVATION OF SAMPLES

- **TABLE 4-2**

WATER SAMPLING, SUMMARY OF TARGET ANALYTES, EPA METHOD 8260 AND DETECTION LIMITS

TABLE 4-3

PLANNED SAMPLES.

TABLE 4-1

SUMMARY OF REQUIRED HOLDING TIMES AND PRESERVATION OF SAMPLES.

Target Compounds	Analytical Methods (EPA-SW)	Container	Preservation	Holding Time
Volatiles Organics	8260 GC/MS	3, 40 ml Glass Vials (3/Samples)	F,G,H	14 Days
Coliform, Total	9132	1, 8 oz. glass Bottle	F, H	24-30 Hours
Lead	6010 ICP	1, 8 oz glass	B	6-Months

F = $Na_2S_2O_3$ (0.008%) If residual Cl_2 is present.
G = HCL pH < 2
H = Ship with Ice to 4°C
B = HNO_3, pH<2 Ice to 4°C

TABLE 4-2
WATER SAMPLING, SUMMARY OF TARGET ANALYTES, EPA METHOD 8260 AND METHODS AND DETECTION LIMITS.

Parameter	Det. Limit	Units	Method
Acetone	0.050	mg/l	8260
Acrylonitrile	0.050	mg/l	8260
Benzene	0.0010	mg/l	8260
Bromochloromethane	0.0010	mg/l	8260
Bromodichloromethane	0.0010	mg/l	8260
Bromoform	0.0010	mg/l	8260
Bromomethane	0.0010	mg/l	8260
Carbon disulfide	0.050	mg/l	8260
Carbon tetrachloride	0.0010	mg/l	8260
Chlorobenzene	0.0010	mg/l	8260
Chlorodibromomethane	0.0010	mg/l	8260
Chloroethane	0.0010	mg/l	8260
Chloroform	0.0050	mg/l	8260
Chloromethane	0.0010	mg/l	8260
Dibromomethane	0.0010	mg/l	8260
1, 2-Dichlorobenzene	0.0010	mg/l	8260
1, 4-Dichlorobenzene	0.0010	mg/l	8260
Trans-1, 4-Dichloro-2-butene	0.0010	mg/l	8260
1, 1- Dichloroethane	0.0010	mg/l	8260
1, 2- Dichloroethane	0.0010	mg/l	8260
1, 1-Dichloroethane	0.0010	mg/l	8260
cis-1, 2- Dichloroethane	0.0010	mg/l	8260
trans-1, 2- Dichloroethane	0.0010	mg/l	8260
1, 2-Dichloropropane	0.0010	mg/l	8260
cis-1, 3-Dichloropropene	0.0010	mg/l	8260
trans-1, 3-Dichloropropene	0.0010	mg/l	8260
Ethylbenzene	0.0010	mg/l	8260
2-Hexanone	0.050	mg/l	8260
Iodomethane	0.050	mg/l	8260
2-Butanone (MEK)	0.050	mg/l	8260
Methylene Chloride	0.0050	mg/l	8260
4-Methyl-2-pentanone (MIBK)	0.050	mg/l	8260
Styrene	0.0010	mg/l	8260
1,1,1,2-Tetrachloroethane	0.0010	mg/l	8260
1,1,2,2-Tetrachloroethane	0.0010	mg/l	8260
Tetrachloroethene	0.0010	mg/l	8260
Toluene	0.0010	mg/l	8260
1,1,1-Trichloroethane	0.0010	mg/l	8260
1,1,2 Trichloroethane	0.0010	mg/l	8260
Trichloroethene	0.0010	mg/l	8260
Trichlorofluoromethane	0.0010	mg/l	8260
1,2,3-Trichloropropane	0.0010	mg/l	8260
Vinyl acetate	0.0010	mg/l	8260
Vinyl Chloride	0.0010	mg/l	8260
Xylenes, Total	0.0030	mg/l	8260

TABLE 4-3
PLANNED SAMPLES

Location	Analytical Method			Total Samples	QA/QC Samples
	EPA-SW 8260 Volatile Organics	6010 Lead	EPA-SW 9132 Coliform		
Racetrack Replacement Well	•	•	•	3	3
M-1 Replacement Well	•	•	•	3	
Racetrack Entrance Concession Stand 2 Sink Spigots	•	•	•	6	2
Racetrack Grandstand Concession 4 Sink Spigots	•	•	•	10	
Racetrack Pit Area 2 Sinks	•	•	•	6	
Trailer Home 2 Sinks	•	•	•	6	2
Trailer Home Shower	•	•		2	
Well Development Water	•	•		2	1
Decontamination Water	•	•		4	1

QA/QC Samples = Duplicate, Rinsate, MRD/USACE Samples

See Table 4-1 for Sample Container and Preservative Requirements

FIGURES

FIGURE 3-1

- **SAMPLE COLLECTION LOG**

FIGURE 3-2

- **EXAMPLE MASTER SAMPLE LOG**

FIGURE 3-3

- **REQUEST FOR ANAYSIS/CHAIN OF CUSTODY FORM RFA/COC**

FIGURE 4-1

- **PROJECT ORGANIZATION CHART**

Figure 3-1: Sample Collection Log

Project #:_____ Client:_____ Date:_____

Site Location: _____ Sampler: _____ Page _____ of _____

_____ PM: _____

	BW Sample #	Pump Type and Number	Sample Type/Media	Pump Flow (L/min) Pre	Post	Average	Sample Time Start	End	Total	Volume
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

	Employee/Area Sampled	PPE Used/Environmental Conditions	Activities Performed
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Additional Notes: _____

Rev. 1, 4/96

BAY WEST
Figure 3-2: Master Sample Log

Sample Date	Sample Name	Sample Number	Matrix	Requested Analysis	COC Number Delivery Date

Figure 3-2

Figure 3-3: Chain of Custody Form

Alternate billing information:

Analysis/Preservative/Container

Chain of Custody
Page 1 of 2

Prepared by:
ENVIRONMENTAL SCIENCE CORP.
12065 Lebanon Road
Mt. Juliet, TN 37122
(615) 758-5858
(800) 767-5859
FAX (615) 758-5859

Report to:
NPDES/PWSID/Facility ID#:
Phone:
Project: Annual Sludge - SOUR/Class "B" Fecal
FAX:
Sampling Site:
FAX Results? __No __Yes
Date Results Needed:
P.O #
Collected by (print)
Collected by (signature):

**Rush? (Check requested turnaround.. the selected Rush charge will apply.)
___ 24-48 hr 100%
___ 48-72 hr 50%
**Lab MUST Be Notified Ahead

CoCode: (lab use only)
Format: C-SLUDGE
Quote/Order #: 1892
Cooler #:
Ship Via: UPS Ground

Sample Location/ID	Sample Type* (C)omp/(G)rab	Date Collected	Time Collected		No. of Cntrs	1.) BNA's-1L-Gls Amb; NaThio-1	2.) Class "B" Fecal Coliform-125ml-HDPE, NaThio-7	3.) Cyanide-250ml-HDPE, NaOH-1	4.) Kjeldahl Nitrogen, TKN. -250ml-HDPE, H2SO4-1	5.) Metals/GFAA-500ml-HDPE, Add HNO3-1	6.) NO3, NO2-125ml-HDPE No Pres-1	7.) Pest/PCB-1L-Gls Amb, No Pres-1	Sample # (lab use only)	
Sludge Digester	G				17	X	X	X	X	X	X	X		

ON SITE INFORMATION pH: _____ S.U.
Temperature: _____ C
Residual Chlorine: _____ mg/l

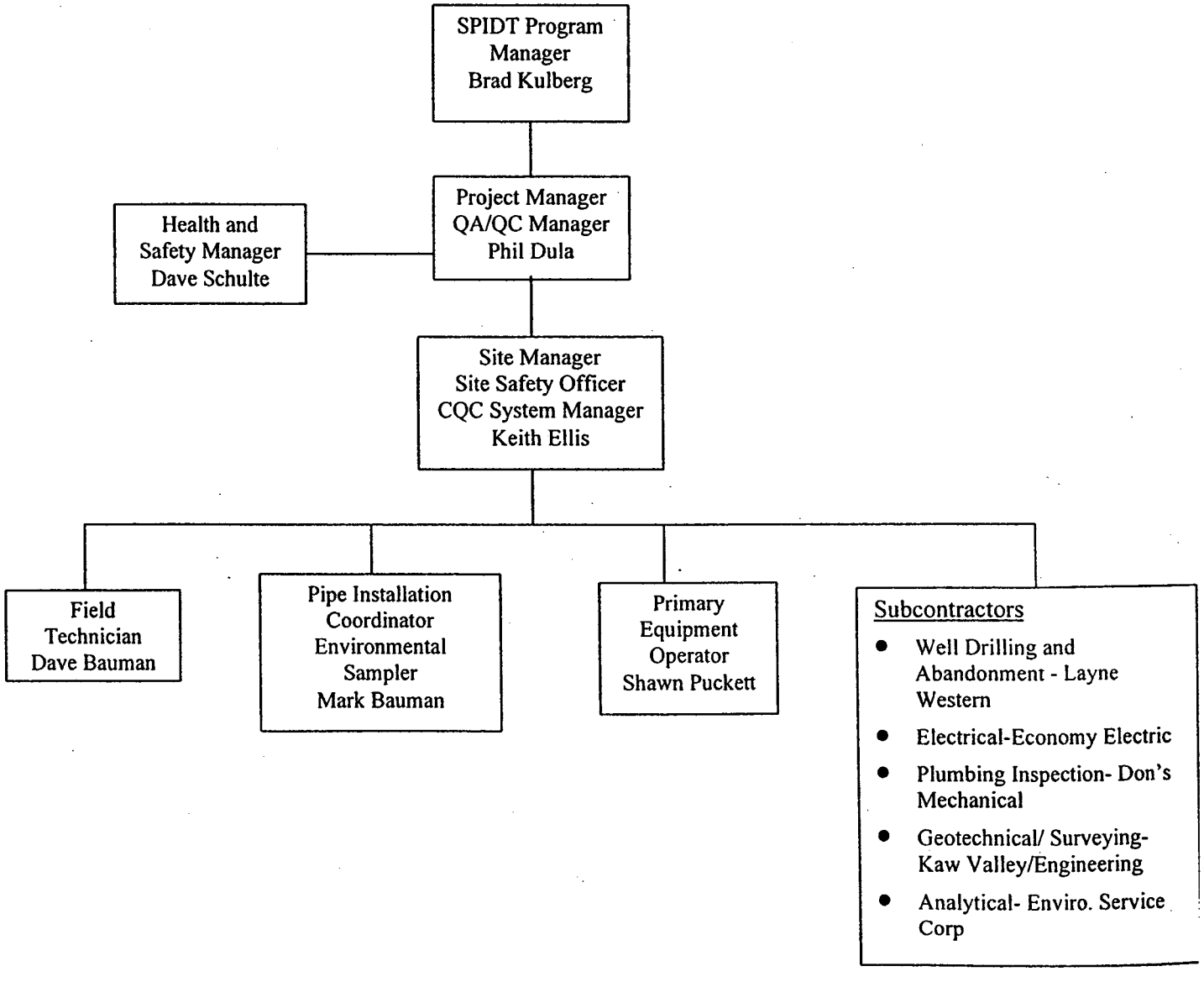
Remarks: 5.) As (G), Be (I), Cd (I), Cr (I), Cu (I), Pb (I), Hg, Mo (I), Ni (I), Se (Ti), Zn (I)

Please call our Biomonitoring Section before shipping Fecal Coliform samples. Thanks!

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Samples returned via: ☐ UPS ☐ FedEx ☐ Courier ☐ _____		Condition: (lab use only)	
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Temp:	Bottles Received:		
Relinquished by: (Signature)	Date:	Time:	Received for lab by: (Signature)	Date:	Time:	pH Checked: Yes No	NCF: Yes No

Figure 4-1: Project Organization Chart

TITLE	NAME	PHONE #
SPIDT Contract Program Manager	Brad Kulberg	651-291-0456
Project Manager	Philip Dula	913-663-2915 (Cell) 913-205-5386
QA/QC Manager	Philip Dula	913-663-2915 (Cell) 913-205-5386
Safety Manager	Dave Schulte	651-291-0456
Site Manager	Keith Ellis	913-663-2915 (Cell) 913-205-5387
Site Safety Manager	Keith Ellis	913-663-2915 (Cell) 913-205-5387
Contract Compliance Control (CQC) System Manager	Keith Ellis	913-663-2915 (Cell) 913-205-5387
Primary Equipment Operator	Shawn Puckett	913-663-2915
Pipe Installation Coordinator	Mark Bauman	913-663-2915
Environmental Sampler	Mark Bauman	913-663-2915
Field Technician	Dave Bauman	913-663-2915



APPENDIX A

Bay West Field SOP

Sampling Numbering

1.0 SAMPLE CHAIN-OF-CUSTODY/DOCUMENTATION

1.1

Hard-cover bound field logbooks with sequentially numbered pages will be used to document field investigation activities. The logbooks will contain the actual field data or references to other field documents that contain a specific description of every activity that has occurred in the field on any given day. All entries into the logbook will be signed and dated. In general, all documents will be completed in black ink. Errors will be corrected by crossing out with a single line and then dating and initialing the correction. The use of correction fluid will not be permissible. The following is a partial list of the types of information to be recorded:

- Date and time of entry
- Names of personnel on-site.
- Number of samples taken
- Sample collection method
- Description of sampling points (field screening and clearance sampling)
- Date and time of collection
- Sample identification numbers
- Sample start and finish time, site temperature, and atmospheric pressure
- Photograph references and site sketches
- Summary of field task related to sampling
- Decontamination procedures
- Records of telephone conversations
- Calibration of equipment used
- Field corrective actions taken
- Changes to Work Plan procedures, sample locations, and sample depths will be documented with the corresponding supporting rationale.

1.2 Sample Numbering System

Field sampling personnel will properly identify all samples taken in the field with an adhesive sample label attached to the sample container. The sample label will contain the site name, field identification number, the date, time, and location of the sample collection, identification of preservatives used. The labels will be placed on the bottles so as not to obscure any data. Sample information will be legibly printed

with waterproof ink. The sample identification numbers will be used on all field sheets, chain-of-custody forms, and all other documentation records.

Samples will be labeled with the following scheme:

N N N N C 1 2 3 4 5

The "NNNN" portion of the sample ID will consist of the unique site code: SL01, SL02, SL03, etc. for the Sample Locations; and IDWT for the IDW samples.

The "C" portion of the sample ID will consist of a code describing the sample media type, as follows:

S - soil
W - decontamination water

The characters 1, 2, 3 signify the sample number collected from that media and will be identified as 001 for the first sample, 002 for the second sample and so on. Duplicate samples will continue to be numbered in the same sequence. The location of all samples and numbers of all duplicates must be listed in the field note book.

The characters 4 and 5 will be used to identify split samples sent to the Chemical Quality Assurance Branch (CQAB). The letters "QA" will be used for this purpose. Split samples sent to the contractor laboratory (Specialized Assays) will be blind duplicates; therefore, the fourth and fifth characters will be left blank on those samples.

An example of the sample identification scheme is FLW-99-SB-1-001:

Project Code –	Year -	Sample Type -	Boring No. -	Sample Interval
FLW	99 -	SB	1 -	001

The project code identifies the site. The 'year' portion of the sample ID will consist of the year: 99 for 1999 or 00 for 2000. The 'sample type' portion of the sample ID will consist of a code describing the sample type; SB for soil boring. The number characters will signify the sequential boring number and will be identified as 1 for the first boring, 2 for the second boring and so on. The second set of number characters will signify the sample interval and will be identified as 001 for the first interval, 002 for the second interval and so on. The depths corresponding to the sample interval will be recorded in the logbook.

Duplicate samples will continue to be numbered in the same sequence. The location of all samples and numbers of all duplicates will be listed in the field logbook.

1.3 Chain-of-Custody (COC) Documentation

Sample custody will be managed from time of collection through analysis and through final sample disposition. This custody is in three parts: 1) sample collection, 2) laboratory analysis, and 3) final evidence files. Final evidence files, including all originals of laboratory reports, are maintained under document control in a secure area.

A sample or evidence file is under your custody if it is:

- in your possession;
- In your view, after being in your possession;
- in your possession and you place them in a secured location;
- in a designated secured area.

The sample packaging and shipment procedures summarized below ensure that the samples arrive at the laboratory with the COC form (see Appendix 4) intact.

Field Procedures

a) The field sampler will be personally responsible for care and custody of the samples until they are transferred or properly dispatched.

b) All samples will be labeled with sample identification numbers and locations.

c) Sample labels will be completed for each sample using waterproof ink unless prohibited by weather conditions.

Transfer of Custody and Shipment Procedures

a) Samples will be accompanied by a properly completed COC form. The sample numbers and locations will be listed on the COC form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record will document transfer of custody of samples from the sampler to another person, to the laboratory, to a delivery service, or to/from a secured storage area.

b) Samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis with a separate signed COC enclosed in each sample box or cooler. Shipping containers will be sealed and secured with strapping tape and Bay West custody seals for shipment. The preferred procedure will include the use of a custody seal attached to the front right and back left of the container. The custody seals will be covered with clear plastic tape and the container strapped shut with strapping tape in at least two locations.

c) All shipments will be accompanied by the COC record identifying the contents. The original record will accompany the shipment, and a carbon copy will be retained by the sampler for return to the sampling office.

d) If the samples will be sent by common carrier, a Bill of Lading will be used. Bill of Lading receipts will be retained as part of the permanent documentation. If sent by mail, the package will be registered with return receipt requested. Commercial carriers are not required to sign off on the custody form if it is sealed, inside the sample container, and the custody seals is intact.

2.0 SAMPLE PACKAGING AND SHIPPING

Samples will be shipped in metal, or plastic-composite equivalent strength, ice chests or coolers. Coolers without drain plugs are preferred. If the cooler has a drain plug, the plug should be taped or fixed shut so ice water or other liquids inside the cooler are not discharged during shipping or handling. For water samples, the volume level will be marked outside of the container with a grease pen. Each container will be wrapped with "bubble wrap" or placed in foam sample holders and placed in a ziplock bag with the label side facing outward (if possible) so the label is easy to read. The seal on the ziplock bag will be closed and the bag and container placed in a ice chest.

To prepare the cooler for shipment, inert, absorbent, and cushioning material, such as vermiculite or styrofoam, will be placed on the bottom of the cooler. Containers will be placed upright in the cooler so they do not touch. Additional inert packing material shall be put in the cooler to partially cover the sample bottles.

If required, ice will be double-bagged in sealed plastic bags. The double bags will minimize chances of ice melt leakage into the cooler. Enough ice bags will be placed in the cooler to cover all samples, and any remaining voids will be filled with inert packing material.

Completed COC Forms will be placed in a plastic bag and taped to the inside lid of the cooler. After confirming that the cooler drain is taped shut, the lid of the cooler will be secured with strapping tape. The cooler will be closed securely with strapping tape at a minimum of two locations. A completed shipping label will then be affixed to the top of the cooler. Signed custody seals will be affixed on the front and back of the cooler and covered with wide clear tape. "This Side Up" and "Fragile" labels should be placed on at least two sides of each cooler

Sample Shipment

Samples will be shipped (for overnight delivery) on the day of collection, if collected Monday through Friday; otherwise, samples collected Saturday will be shipped two-day delivery on Monday, and samples collected Sunday will be shipped Monday for overnight delivery on Tuesday.

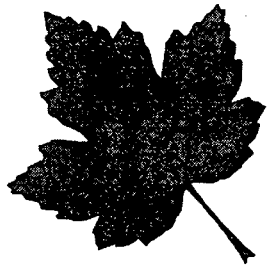
All samples will be shipped overnight by a cargo-only freight service. Samples will not be shipped by commercial passenger surface or air carriers. An airbill will be completed for each cooler with the airbill number recorded in the field logbook for each set of samples shipped to the analytical laboratory. Bay West will use Federal Express to ship samples. Sample pick-ups will be scheduled on a daily basis or hand delivered by the site supervisor to the local Junction City, KS Federal Express office. Pick-ups can be made on Monday through Friday no later than 5:00 p.m. and no later than 12:00 p.m. on Saturday. Priority overnight shipment will be requested for all samples shipped to off site laboratories so that sample holding times are not violated.

All samples for off-site analysis will be shipped to:

Environmental Science Corp.
12065 Lebanon Rd.
Mt. Juliet, TN 37122
Phone: 615-758-5858

APPENDIX B

Environmental Science Corp., Inc. Laboratory Quality Management Manual



ENVIRONMENTAL SCIENCE CORPORATION

QUALITY ASSURANCE MANUAL

Disclaimer

The Environmental Science Corporation Quality Assurance Manual is a living document. It is reviewed and revised at least annually. The information stated herein is subject to change at any time due to updates to QC Limits, methods, operations, equipment, staff, etc. At the time of distribution the requestor will receive the most recent version of the manual and will be assigned a control number. The control number will help ESC to track what version is sent. The date stated on the Table of Contents represents the version number.

COMPREHENSIVE QUALITY ASSURANCE PLAN

for

ENVIRONMENTAL SCIENCE CORPORATION
12065 LEBANON ROAD
MT. JULIET, TENNESSEE 37207
(615)758-5858

Prepared by

ENVIRONMENTAL SCIENCE CORPORATION
12065 LEBANON ROAD
MT. JULIET, TENNESSEE 37207
(615)758-5858

NOTE: The ESC QA Plan has been approved by the following people. A signed approval sheet is available upon request.

Paulette G. Lankford, Ph.D., President	Date
Peter A. Schulert, CEO	Date
Judith R. Morgan, M.S., Quality Assurance Manager	Date
Eric Johnson, Laboratory Support Manager	Date
Roberto Celia, Inorganic Laboratory Manager	Date
William Mock, Organic Laboratory Manager	Date
Rodney Shinbaum, Biomonitoring Laboratory Manager	Date

2.0 TABLE OF CONTENTS

2.0 TABLE OF CONTENTS

2.0 TABLE OF CONTENTS

2.0 TABLE OF CONTENTS

2.0 TABLE OF CONTENTS

2.0 TABLE OF CONTENTS

2.0 TABLE OF CONTENTS

2.0 TABLE OF CONTENTS

2.0 TABLE OF CONTENTS

2.0 TABLE OF CONTENTS

2.0 TABLE OF CONTENTS

2.0 TABLE OF CONTENTS

2.0 TABLE OF CONTENTS

2.0 TABLE OF CONTENTS

2.0 TABLE OF CONTENTS

2.0 TABLE OF CONTENTS

2.0 TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES

LIST OF FIGURES

3.0 STATEMENT OF POLICY

Environmental Science Corporation (ESC) is an environmental analytical firm providing analytical and support services to clients nationwide. Specific service areas include the following:

- drinking water analysis
- industrial wastewater analysis and management
- hazardous waste characterization and identification
- industrial process assessment
- permit application assistance
- regulatory document guidance
- biological assessments
- water quality management

ESC is devoted to providing reliable and accurate data and recognizes that this is a necessity to establish sound, objective, and legally-defensible positions or opinions for clients regarding compliance with environmental regulations.

The management of ESC is committed to maintaining a quality assurance/quality control program that allows data generated by ESC, or any subcontractors under ESC's supervision, to meet these important accuracy goals. The most important aspect of the program is to ensure that all activities whether involving sampling, analytical or engineering activities, are congruent with EPA laboratory practices and regulatory guidelines. ESC personnel who have direct responsibility for overseeing the quality assurance program report to ESC's president.

This Quality Assurance Plan outlines the procedures that have been developed to implement this policy and integrated into ESC's standard operating procedures. The policies adopted by ESC are stated such that the manual serves as a QA handbook of responsibilities for all laboratory personnel. This document is also used as a supplement for project planning, client reference, and personnel training.

This document is reviewed annually to assess the need for revisions in the quality assurance procedures. The revisions will reflect improvements made to the program as a result of changes in analytical capabilities of ESC as well as changes in sampling techniques, EPA requirements, and methodology upgrades or changes.

4.0 ORGANIZATION AND RESPONSIBILITY

Environmental Science Corporation, offers diverse environmental capabilities that allows us to serve our clients with specialized services, regulatory consulting, field sampling and laboratory operations. A brief outline of the organization and responsibilities as they apply to the ESC Quality Assurance Program is presented below.

Responsibility for all QA/QC activities resides with Dr. Paulette G. Lankford, President, as evidence of ESC's managerial commitment to generating legally defensible data and providing sound environmental risk management techniques to its clients. Her duties also include short- and long-range plan development for corporate growth and quality control. Dr. Lankford has over 30 years experience in directing and operating laboratories. Her responsibilities include the direction and review of the laboratory and the internal support sections. Her past experience includes building and managing large specialized laboratories for national companies. Consulting projects have included process management, design of marketing programs, and developing technical training programs. She is the author of several publications in laboratory management. Dr. Lankford received her doctorate from Vanderbilt University and her bachelor's degree from Duke University.

Judith R. Morgan, Master of Science in Analytical Chemistry, is the ESC laboratory Director of Regulatory Affairs and serves as the laboratory QAO. She has been serving the environmental industry since 1986. Majority of her experience is specific to quality and regulatory matters. In matters of laboratory QA/QC, she reports directly to Dr. Lankford, President, thus making her QAO functions separate from laboratory operations. She is responsible for laboratory QA plans, initiating and overseeing audits, activating corrective measures (when necessary) and preparing internal QA/QC reports.

Tom White, Master of Science in Chemistry, is the ESC Technical Director. With over twelve years of experience in the environmental industry, Mr. White is responsible for critical internal communications. He is responsible for all technical aspects of the Laboratory Information Managment System (LIMS) as well as PC controlled instrumentation. He is experienced in the operation of several analytical instruments and has served previously as Laboratory Director and Laboratory Validator. His diverse experience allows him to coordinate both production and communication issues, therefore allowing data management, storage and transfer to operate at an optimum level.

Roberto Celia, with a B.S. Degree in Chemistry/Biology from Middle Tennessee State University, is the Inorganic Laboratory Supervisor. He has extensive experience since 1983 in the analysis of water, wastewater, solids, and hazardous waste samples. He is experienced in the operation of various analytical instruments including AA, IR, and UV visible spectroscopy and gas chromatography. He is responsible for all technical aspects of inorganic sample handling (including storage and holding times of samples, extracts, digestates), analysis, quality control,

and documentation.

William G. Mock is the Supervisor of the Organic Laboratory and has served the environmental industry since 1990. He is currently responsible for volatile and semi-volatile analysis of water and soils using Standard Methods, SW-846, TPH DRO, TPH California, EPH NC methodology, TPH GRO, TPH California, VPH NC methodology and analysis of wastewater by the EPA 600 series methods. He also performs all calculations and reviews the quality control relating to the data generated. Prior to performing organic analysis, he worked in the extraction lab where he was responsible for doing DRO, BNA, Pesticide, Herbicide, and Oil and Grease extractions. He is proficient in the extractions used for drinking water, wastewater, soil, sludge, and oils.

Rodney Shinbaum is a Senior Aquatic Biologist and manager of the Biomonitoring section Mr. Shibaum reviews and approves all data reduction associated with the Biomonitoring Section. Scheduling of tests and personnel is paramount to achieve success and quality analyses of toxicity samples -- most of which require immediate analytical turnaround times. Mr. Shinbaum's expertise includes biological assessment of aquatic habitats. Since he entered the environmental industry in 1994, his responsibilities have included coordination with clients' analytical needs regarding NPDES compliance, scheduling testing, and data reduction and interpretation of toxicity tests. Additionally, his experience includes Toxicity Identification Evaluation and Toxicity Reduction Evaluations (TIE's and TRE's). He also supervises the Class B Fecal Coliform testing to meet compliance regulations for the 503 Sludge Regulations.

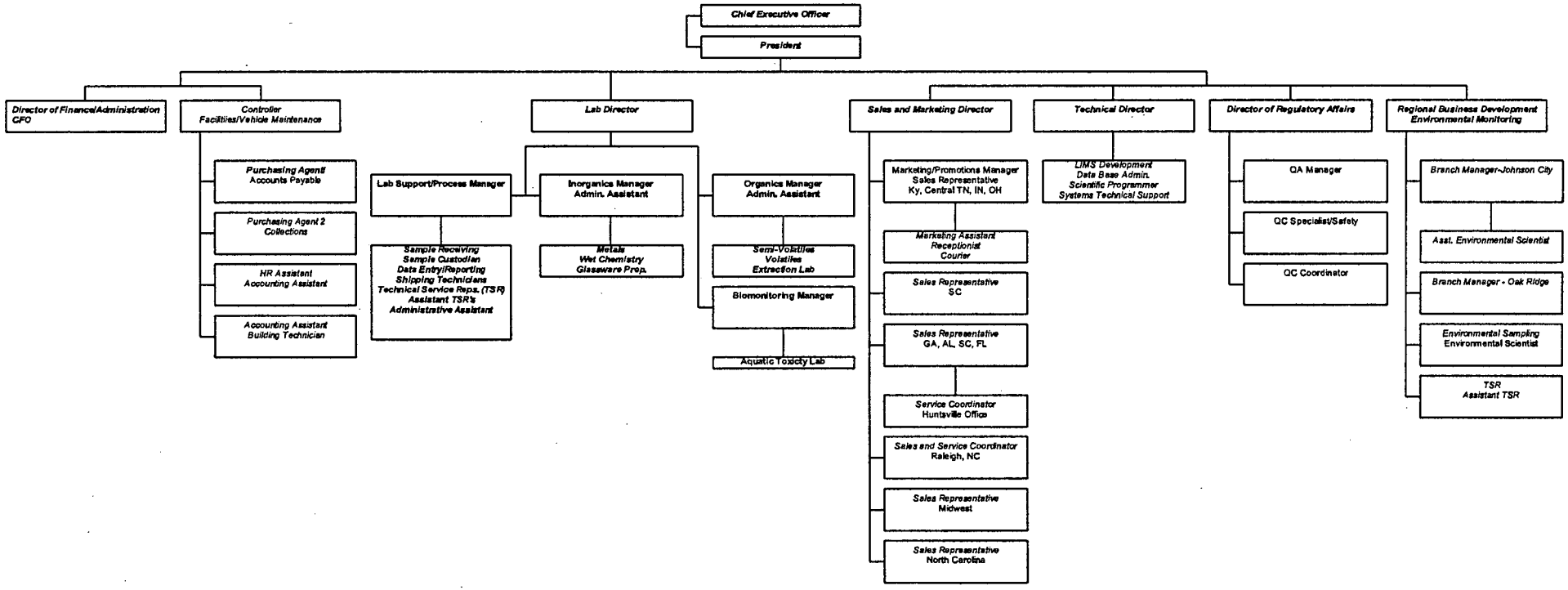
Eric Johnson, Laboratory Support Manager, provides ESC with necessary experience for all aspects of sample handling from sample shipping and receiving to sample disposal. He has a B.S. degree in Chemistry from Lambuth University and has been involved in many aspects of environmental analyses since 1991. Laboratory samples are received into his department (along with completed chain-of-custody forms), checked for container integrity, logged into a computerized laboratory information management system (LIMS) that assigns each sample a unique number, checked for pH with narrow-range pH paper and pH-adjusted (if necessary), checked for temperature at receipt, and stored under appropriate conditions. He reports directly to the Laboratory Manager and supervises sample receipt, and disposal.

The management of ESC is the main support of the quality program. Each manager is aware of the requirements of our external auditing agencies and are responsible to ensure that the requirements of each agency are met by their respective departments. ESC maintains full compliance and agreement with the following organizations/regulations: A2LA, ISO 17025, AIHA, EPA GALP/GLP, NELAC, and individual states who carry primacy concerning certification and regulation.

Figure 4.1 is an organizational chart that shows how the key individuals relate to each other.

FIGURE 4.1

Environmental Science Corporation
Organization Chart



5.0 QUALITY ASSURANCE OBJECTIVES

This section includes all field and chemical analytical (measurement) capabilities of ESC that are pertinent to most programs and regulations. Sample preparation methods are detailed in Table 5.1. Table 5.2 represents established quality assurance objectives for laboratory analytical procedures. Table 5.3 represents established field quality assurance objectives. Method numbers are referenced from EPA regulations or documents. "Water" method numbers are the methods as required by CFR 40 Part 136 of the Clean Water Act. "Groundwater" and "solid" method numbers are those listed under the Resource Conservation and Recovery Act (RCRA) document, SW-846; however, all analysis for RCRA sites must conform to SW-846.

5.1 BIOMONITORING LAB QA TARGETS

7-Day Fathead Minnow (*Pimephales promelas*) Larval Survival and Growth Test; Test Method 1000.0 from "Short Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms" (EPA/600/4-91-002, 7-94).

3-Brood *Ceriodaphnia dubia* Survival and Reproduction Test; Test Method 1002.0 from "Short Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms" (EPA/600/4-91/002).

Fathead Minnow (*Pimephales promelas*) Acute Toxicity Test (24, 48 or 96 hour duration); referenced in "Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms" (EPA/600/4-90/027F, 8-93).

Ceriodaphnia dubia Acute Toxicity Test (24, 48 or 96 hour duration); referenced in "Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms" (EPA/600/4-90/027).

5.2 METHOD DETECTION LIMIT

Analytes, preparative and analytical methods, matrices, accuracy and precision targets, and MDL's and PQL's are presented in Table 5.1.

All detection limits are comparable to those established by the EPA and are not typically lower than recommended detection limits. To determine whether the EPA detection limit is being achieved, a MDL study is performed according to 40 CFR Part 136 Appendix B. The standard deviation of seven standards at or near the expected detection limit is calculated. The method detection limit (MDL) is calculated as follows:

$$MDL = 3.14S \quad (3.14 \text{ is the Student's T value for n-1})$$

where S=standard deviation. If the MDL is higher than the EPA-method-suggested MDL, the calculated value is used for reporting.

MDLs are recalculated on an annual basis or sooner if a material change in the instrumentation or method is enacted, or a change in the calibration response factor is noted.

Method Detection Limits (MDLs) are set such that the risk of reporting a false positive is less than 1%. MDLs are determined using the method specified in the Federal Register, 40CFR Part 139 Appendix B unless the possibility exists for significant systematic bias from analytical steps. In that case (primarily inorganic constituents) the IUPAC method is followed, accounting for systematic bias. Published MDLs may be set higher than experimentally determined MDLs to 1) avoid observed positive interferences from matrix effects or common reagent contaminants or 2) for reporting convenience (i.e., to group common compounds with similar but slightly different experimentally determined MDLs).

Practical Quantitation Limits (PQLs) are set at 3 to 5 times the reported MDL unless otherwise noted. Because PQL level checks are required, ease of preparation of commercial analytical mixes may dictate to some extent the reported PQL. Generally the PQL is not set at less than 3 times the MDL. However, in some instances, systematic bias (i.e., analyte background in reagents, etc.) necessitates that the reported MDL be elevated to levels that are readily quantifiable. In those instances, the PQL may be set at a level less than three times the reported MDL.

Matrices are denoted as follows:

w: surface, ground and waste water
s: soil, sediment, solid
ws: waste
tclp: EPA 1311 extract
splp: EPA 1312 extract

Spike Levels (from which QA targets were developed) are as follows:

Medium range (20-80 % of calibration range)

Additionally, analytes and methods are aggregated into analyte groups in Table 5.2 to simplify the presentation of information in other sections of this document. Note that MDL's and PQL's for soil/sediment matrices are based on method-specific sample dry weights. Detection limits may vary from that published, due to moisture content, dilution effects, interferences, special reporting requirements, etc. "PQL" in Table 5.2 denotes reporting limit. Reporting limits are reported in units of parts per billion (ppb) unless otherwise noted.

The QA targets for all inorganic analyses are within the range of 80 - 120 % for accuracy [except for metals in solid samples, which have been set based on method defined limits (75-125 %)] and $\leq$ 20 RPD for precision, unless laboratory -generated data indicate that tighter control limits can be routinely maintained. This convention was adopted due to the fact that targets set according to historical data are usually less stringent. The organic QA targets are statutory in nature; warning and control limits for organic analyses are initially set for groups of compounds based on preliminary method validation data. When additional data is available, the QA targets may be reconsidered. All QA targets are routinely re-evaluated at least annually (and updated, if necessary) against laboratory generated data to insure targets continue to reflect realistic, methodologically achievable goals.

SW-846 SAMPLE PREPARATION METHODS
TABLE 5.1

Inorganics

SAMPLE PREPARATION METHOD NUMBER	DESCRIPTION	MATRIX	SAMPLE PREP. FOR THESE METHODS:
9010B	Cyanide Distillation	*w*	9012A
9013	Cyanide Distillation	*solids and oils*	9012A
1311	TCLP Extraction	*s, ws*	6010B, 6020, 7470A, 7471A, 8021B, 8260B, 8270C, 8081A, 8082, 8151A
3015	Microwave Digestion	*w*	6010B, 6020
3051	Microwave Digestion	*s, ws*	6010B, 6020
3010A	Hot Plate Digestion	*w*	6010B, 6020
3050B	Hot Plate Digestion	*s, ws*	6010B, 6020

SW-846 SAMPLE PREPARATION METHODS
TABLE 5.1

Organics

SAMPLE PREPARATION METHOD NUMBER	DESCRIPTION	MATRIX	SAMPLE PREP. FOR THESE METHODS:
3510C	Liquid/Liquid Extraction	*w*	8141A, 8081A, 8082, 8100, 8270C, 8310
3520C	Continuous Liq/Liq	*w*	8141A, 8081A, 8082, 8100, 8270C, 8310
3540B/3541	Soxhlet Extraction	*s, ws*	8141A, 8081A, 8082, 8100, 8270C, 8310
3550B	Sonication	*s, ws*	8141A, 8081A, 8082, 8100, 8270C, 8310
3580A	Waste Dilution	*ws, oil*	8141A, 8081A, 8082, 8100, 8270C
3585	Waste Dilution	*ws, oil*	8021B, 8260B, 8015B
5030B	Purge and Trap	*w*	8021B, 8260B, 8015B
5035	Purge and Trap	*s, ws*	8021B, 8260B, 8015B
3640A	Gel Permeation	*w, s, ws*	8081A, 8100, 8270C
3650B	Acid/Base Partition	*w, s, ws*	8081A, 8082
3660B	Sulfur Clean up	*w, s, ws*	8081A, 8082
3665A	Sulfuric Acid/Permanganate	*w, s, ws*	8081A, 8082
3620B	Florisil Column Cleanup	*s, ws, oil*	8081A, 8082

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Metals

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
(ICP-AES)	Aluminum	200.2 (mod.)	200.7	w	80 - 120	<20	100	1
(ICP-AES)		3051 (mod.)	6010B	s	75 - 125	<20	500	1
(ICP-AES)		3050B (mod.)	6010B	s	75 – 125	<20	500	1
(ICP-AES)		200.2 (mod.)	200.7	w	80 - 120	<20	100	1
(ICP-AES)		3015/3010 (mod.)	6010B	w	80 - 120	<20	100	1
(ICP-AES)	Antimony	200.2 (mod.)	200.7	w	80 - 120	<20	2	1
(ICP-AES)		3051 (mod.)	6010B	s	75 - 125	<20	100	1
(ICP-AES)		3050B (mod.)	6010B	s	65 – 95*	<20	100	1
(ICP-MS)		200.2 (mod.)	200.8	w	80 - 120	<20	1	1
(ICP-MS)		3051 (mod.)	6020 (mod.)	s	75-125	<20	50	1
(ICP-AES)		200.2 (mod.)	200.7	w	80 - 120	<20	2	1
(ICP-AES)		3015/3010 (mod.)	6010B	w	80 - 120	<20	2	1
*Limits determined from historical data.								
(ICP-AES)	Arsenic	200.2 (mod.)	200.7	w	80 - 120	<20	5	1
(ICP-AES)		1311, 1312	6010B	tclp, splp	80 - 120	<20	5	1
(ICP-AES)		3051 (mod.)	6010B	s	75 - 125	<20	250	1
(ICP-AES)		3050B (mod.)	6010B	s	75 – 125	<20	250	1
(ICP-AES)		3015/3010 (mod.)	6010B	w	80 - 120	<20	250	1
(ICP-MS)		200.2 (mod.)	200.8	w	80 - 120	<20	1	1
(ICP-MS)		3051 (mod.)	6020 (mod.)	s	75-125	<20	50	1
(ICP-AES)	Barium	200.2 (mod.)	200.7	w	80 - 120	<20	2	1
(ICP-AES)		1311-12	6010B	tclp, splp	80 - 120	<20	2	1
(ICP-AES)		3051 (mod.)	6010B	s	75 - 125	<20	100	1
(ICP-AES)		3050B (mod.)	6010B	s	75 – 125	<20	100	1
(ICP-AES)		3015/3010 (mod.)	6010B	w	80 - 120	<20	100	1

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Metals (continued)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
(ICP-AES)	Beryllium	200.2 (mod.)	200.7	w	80 - 120	<20	2	1
(ICP-AES)		3051 (mod.)	6010B	s	75 - 125	<20	100	1
(ICP-AES)		3050B (mod.)	6010B	s	75 – 125	<20	100	1
(ICP-AES)		3015/3010 (mod.)	6010B	w	80 - 120	<20	100	1
(ICP-AES	Boron	200.2 (mod.)	200.7	w	80 - 120	<20	100	1
(ICP-AES		3051 (mod.)	6010B	s	75 - 125	<20	5000	1
(ICP-AES)		3015/3010 (mod.)	6010B	w	80 - 120	<20	5000	1
(ICP-AES)	Cadmium	200.2 (mod.)	200.7	w	80 - 120	<20	2	1
(ICP-AES)		1311-1312	6010B	tclp, splp	80 - 120	<20	2	1
(ICP-AES)		3051 (mod.)	6010B	s	75 - 125	<20	100	1
(ICP-AES)		3050B (mod.)	6010B	s	75 – 125	<20	100	1
(ICP-MS)		200.2 (mod.)	200.8	w	80 - 120	<20	1	1
(ICP-MS)		3051 (mod.)	6020 (mod.)	s	75-125	<20	50	1
(ICP-AES)		3015/3010 (mod.)	6010B	w	80 - 120	<20	2	1
(ICP-AES)	Calcium	200.2 (mod.)	200.7	w	80 - 120	<20	100	1
(ICP-AES)		3051 (mod.)	6010B	s	75 - 125	<20	5000	1
(ICP-AES)		3050B (mod.)	6010B	s	75 – 125	<20	5000	1
(ICP-AES)		3015/3010 (mod.)	6010B	w	80 - 120	<20	100	1
(ICP-AES)	Chromium	200.2 (mod.)	200.7	w	80 - 120	<20	2	1
(ICP-AES)		1311-12	6010B	tclp, splp	80 - 120	<20	2	1
(ICP-AES)		3051 (mod.)	6010B	s	75 - 125	<20	100	1
(ICP-AES)		3050B (mod.)	6010B	s	75 – 125	<20	100	1
(ICP-MS)		200.2 (mod.)	200.8	w	80 - 120	<20	1	1
(ICP-MS)		3051 (mod.)	6020 (mod.)	s	75-125	<20	50	1
(ICP-AES)		3015/3010 (mod.)	6010B	w	80 - 120	<20	2	1

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Metals (continued)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
(ICP-AES)	Cobalt	200.2 (mod.)	200.7	w	80 - 120	<20	100	1
(ICP-AES)		3051 (mod.)	6010B	s	75 - 125	<20	500	1
(ICP-AES)		3050B (mod.)	6010B	s	75 – 125	<20	500	1
(ICP-MS)		200.2 (mod.)	200.8	w	80 - 120	<20	1	1
(ICP-MS)		3051 (mod.)	6020 (mod.)	s	75-125	<20	50	1
(ICP-AES)		3015/3010 (mod.)	6010B	w	80 - 120	<20	100	1
(ICP-AES)	Copper	200.2 (mod.)	200.7	w	80 - 120	<20	10	1
(ICP-AES)		1311-12	6010B	tclp, splp	80 - 120	<20	10	1
(ICP-AES)		3051 (mod.)	6010B	s	75 - 125	<20	500	1
(ICP-AES)		3050B (mod.)	6010B	s	75 – 125	<20	500	1
(ICP-MS)		200.2 (mod.)	200.8	w	80 - 120	<20	1	1
		3015/3010 (mod.)	6020 (mod.)	w	80 - 120	<20	1	
(ICP-MS)		3051 (mod.)	6020 (mod.)	s	75-125	<20	50	1
(ICP-AES)		3015/3010 (mod.)	6010B	w	80 - 120	<20	10	1
(ICP-AES)	Iron	200.2 (mod.)	200.7	w	80 - 120	<20	20	1
(ICP-AES)		3051 (mod.)	6010B	s	75 - 125	<20	1000	1
(ICP-AES)		3050B (mod.)	6010B	s	75 – 125	<20	1000	1
(ICP-AES)		3015/3010 (mod.)	6010B	w	80 - 120	<20	20	1
(ICP-AES)	Lead	200.2 (mod.)	200.7	w	80 - 120	<20	5	1
(ICP-AES)		1311-12	6010B	tclp, splp	80 - 120	<20	5	1
(ICP-AES)		3051 (mod.)	6010B	s	75 - 125	<20	250	1
(ICP-MS)		200.2 (mod.)	200.8	w	80 - 120	<20	1	1
(ICP-MS)		3051 (mod.)	6020 (mod.)	s	75-125	<20	50	1
(ICP-MS)		3050B (mod.)	6020	s	75 – 125	<20	50	1
(ICP-MS)		3015/3010 (mod.)	6020 (mod.)	w	80 - 120	<20	1	
(ICP-AES)		3015/3010 (mod.)	6010B	w	80 - 120	<20	5	1
(ICP-AES)	Magnesium	200.2 (mod.)	200.7	w	80 - 120	<20	100	1
(ICP-AES)		3051 (mod.)	6010B	s	75 - 125	<20	5000	1
(ICP-AES)		3050B (mod.)	6010B	s	75 – 125	<20	5000	1
(ICP-AES)		3015/3010 (mod.)	6010B	w	80 - 120	<20	100	1

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Metals (continued)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
(ICP-AES)	Manganese	200.2 (mod.)	200.7	w	80 - 120	<20	10	1
(ICP-AES)		3051 (mod.)	6010B	s	75 - 125	<20	500	1
(ICP-AES)		3050B (mod.)	6010B	s	75 – 125	<20	500	1
(ICP-AES)		3015/3010 (mod.)	6010B	w	80 - 120	<20	10	1
(CVAA)	Mercury	245.2 (mod.)/7470A	245.2/7470A	w	80 - 120	<20	0.02	1
(CVAA)		1311-12	7470A	tclp,splp	80 - 120	<20	0.02	1
(CVAA)		7471 (mod.)	7471	s	75 - 125	<20	2	1
(ICP-AES)	Molybdenum	200.2 (mod.)	200.7	w	80 - 120	<20	2	1
(ICP-AES)		3051 (mod.)	6010B	s	75 - 125	<20	100	1
(ICP-AES)		3050B (mod.)	6010B	s	75 – 125	<20	100	1
(ICP-AES)		3015/3010 (mod.)	6010B	w	80 - 120	<20	2	1
(ICP-AES)	Nickel	200.2 (mod.)	200.7	w	80 - 120	<20	10	1
(ICP-AES)		3051 (mod.)	6010B	s	75 - 125	<20	500	1
(ICP-AES)		3050B (mod.)	6010B	s	75 – 125	<20	500	1
(ICP-MS)		200.2 (mod.)	200.8	w	80 - 120	<20	1	1
(ICP-MS)		3051 (mod.)	6020 (mod.)	s	75-125	<20	50	1
(ICP-AES)		3015/3010 (mod)	6020 (mod.)	w	80 - 120	<20	1	1
(ICP-AES)		3015/3010 (mod.)	6010B	w	80 - 120	<20	10	1

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Metals (continued)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
(ICP-AES)	Potassium	200.2 (mod.)	200.7	w	80 - 120	<20	100	1
(ICP-AES)		3051 (mod.)	6010B	s	75 - 125	<20	5000	1
(ICP-AES)		3050B (mod.)	6010B	s	75 – 125	<20	5000	1
(ICP-AES)		3015/3010 (mod.)	6010B	w	80 - 120	<20	100	1
(ICP-AES)	Selenium	200.2 (mod.)	200.7	w	80 - 120	<20	5	1
(ICP-AES)		1311-12	6010B	tclp, splp	80 - 120	<20	5	1
(ICP-AES)		3051 (mod.),	6010B	s	75 - 125	<20	250	1
(ICP-AES)		3050B (mod.)	6010B	s	75 – 125	<20	250	1
(ICP-AES)		3015/3010 (mod.)	6010B	w	80 - 120	<20	5	1
(ICP-MS)		200.2 (mod.)	200.8	w	80 - 120	<20	1	1
(ICP-MS)		3015/3010 (mod.)	6020	w	80 - 120	<20	1	1
(ICP-MS)		3051 (mod.)	6020 (mod.)	s	75 -125	<20	50	1
(ICP-AES)	Silver	200.2 (mod.)	200.7	w	80 - 120	<20	2	1
(ICP-AES)		1311-12	6010B	tclp, splp	80 - 120	<20	2	1
(ICP-AES)		3051 (mod.),	6010B	s	75 - 125	<20	100	1
(ICP-AES)		3050B (mod.)	6010B	s	75 – 125	<20	100	1
(ICP-AES)		3015/3010 (mod.)	6010B	w	80 - 120	<20	2	1
(ICP-MS)		200.2 (mod.)	200.8	w	80 - 120	<20	1	1
(ICP-MS)		3015/3010 (mod.)	6020	w	80 - 120	<20	1	1
(ICP-MS)		3051 (mod.)	6020 (mod.)	s	75 -125	<20	50	1
(ICP-AES)	Sodium	200.2 (mod.)	200.7	w	80 - 120	<20	100	1
(ICP-AES)		3051 (mod.)	6010B	s	75 - 125	<20	5000	1
(ICP-AES)		3050B (mod.)	6010B	s	75 – 125	<20	5000	1
(ICP-AES)		3015/3010 (mod.)	6010B	w	80 - 120	<20	100	1
(ICP-AES)	Strontium	200.2 (mod.)	200.7	w	80 - 120	<20	10	1
(ICP-AES)		3051 (mod.)	6010B	s	75 - 125	<20	500	1
(ICP-AES)		3050B (mod.)	6010B	s	75 – 125	<20	500	1
(ICP-AES)		3015/3010 (mod.)	6010B	w	80 - 120	<20	10	1

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Metals (continued)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
(ICP-MS)	Thallium	200.2 (mod.)	200.8	w	80 - 120	<20	1	1
(ICP-MS)		3051 (mod.)	6020 (mod.)	s	75 - 125	<20	50	1
(ICP-AES)		200.2 (mod.)	200.7	w	80 - 120	<20	5	1
(ICP-AES)		3051 (mod.)	6010B	s	75 - 125	<20	250	1
(ICP-AES)		3050B (mod.)	6010B	s	75 – 125	<20	250	1
(ICP-AES)		3015/3010 (mod.)	6010B	w	80 - 120	<20	5	1
(ICP-AES)		3015/3010 (mod.)	6020	w	80 - 120	<20	1	1
(ICP-AES)	Tin	200.2 (mod.)	200.7	w	80 - 120	<20	10	1
(ICP-AES)		3051 (mod.)	6010B	s	75 - 125	<20	500	1
(ICP-AES)		3050B (mod.)	6010B	s	75 – 125	<20	500	1
(ICP-AES)		3015/3010 (mod.)	6010B	w	80 - 120	<20	10	1
(ICP-AES)	Titanium	200.2 (mod.)	200.7	w	80 - 120	<20	10	1
(ICP-AES)		3051 (mod.)	6010B	s	75 - 125	<20	500	1
(ICP-AES)		3015/3010 (mod.)	6010B	w	80 - 120	<20	10	1
(ICP-AES)	Vanadium	200.2 (mod.)	200.7	w	80 - 120	<20	10	1
(ICP-AES)		3051 (mod.)	6010B	s	75 - 125	<20	500	1
(ICP-AES)		3050B (mod.)	6010B	s	75 – 125	<20	500	1
(ICP-AES)		3015/3010 (mod.)	6010B	w	80 - 120	<20	10	1
(ICP-AES)	Zinc	200.2 (mod.)	200.7	w	80 - 120	<20	10	1
(ICP-AES)		3051 (mod.)	6010B	s	75 - 125	<20	500	1
(ICP-AES)		3050B (mod.)	6010B	s	75 – 125	<20	500	1
(ICP-MS)		200.2 (mod.)	200.8	w	80 - 120	<20	1	1
(ICP-MS)		3051 (mod.)	6020 (mod.)	s	75-125	<20	50	1
(ICP-MS)		3015/3010 (mod.)	6020 (mod.)	w	80 - 120	<20	1	1
(ICP-AES)		3015/3010 (mod.)	6010B	w	80 - 120	<20	10	1

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Wet Chemistry

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean -Up
(Titrimetric)	Alkalinity	n/a	310.1	w	85 - 115	<20	10000	1
(Flow Analysis)	Ammonia	n/a SOP	350.1 350.1 (mod.)	w s	85 - 115 80 - 120	<20 <20	100 400	1 1
(DO Meter)	Biochemical Oxygen Demand	n/a	405.1, SM5210	w	85 - 115	<20	10000	1
(DO Meter)	Biochemical Oxygen Demand - carbonaceous	n/a	SM5210B	w	85 - 115	<20	10000	1
(Spectrophotometric)	Chemical Oxygen Demand	n/a	410.4	w	85 - 115	<20	10000	1
(Ion Chromatography)	Chloride	n/a SOP	300.0/9056 300.0	w s	85 - 115 80 - 120	<20 <20	1000	1 1
(wheatstone bridge)	Conductivity	n/a	120.1/9050A	w	85 - 115	<20	1000	1
(Flow Analysis)	Cyanide	335.4 EPA 9012A	335.4 EPA 9012A	w s	85 - 115 80 - 120	<20 <20	5	2 2
(Ion Chromatography)	Fluoride	n/a	300.0/9056	w	85 - 115	<20	100	1
(Autoanalyzer)	Hardness	n/a	130.1	w	85 - 115	<20	30000	1
(Titrimetric)	Hardness	n/a	130.2	w	85 - 115	<20	1000	1
(Spectrophotometric)	Hexavalent Chromium	n/a SOP	SM3500 CrD/7196A 7196A	w s	85 - 115 80 - 120	<20 <20	10	1 1

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Wet Chemistry (continued)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean -Up
(Pensky-Marten)	Ignitability	n/a	SW 846 1010	ws	n/a	<20	n/a	1
(Spectrophotometric)	Methylene Blue Active Substances	n/a	425.1	W	85-115	<20	100	1
(Ion Chromatography)	Nitrate-Nitrite	n/a n/a SOP	300.0 9056 9056	w w s	85 - 115 85 - 115 80 - 120	<20 <20 <20	100 100	1 1 1
(Ion Chromatography)	Nitrite	n/a SOP	300.0/9056 300.0/9056	w s	85-115 80-120	<20 <20	100	1 1
(Ion Chromatography)	Nitrate	n/a SOP	300.0/9056 300.0/9056	w s	85 - 115 80 - 120	<20 <20	100	1 1
(Gravimetric)	Oil and Grease	n/a	413.1	w	80 - 120	<20	1000	1
(Titrimetric)	Percent Water	n/a	Karl Fisher	ws	n/a	<20	n/a	1
	pH	n/a n/a	150.1, 9040B 150.1, 9045C	w s	n/a n/a	<1 <1	n/a n/a	1 1
(Spectrophotometeric)	Phosphate (ortho)	n/a SOP	365.1 365.1	w s	85 - 115 80 - 120	<20 <20	25 625	1 1
(Spectrophotometeric)	Phosphorous/Total	365.4 SOP	365.4 365.4	w s	85 - 115 80 - 120	<20 <20	25 625	1 1
(Spectrophotometeric)	Residual Chlorine	330.5	330.5	w	85 - 115	<20	100	1

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Wet Chemistry (continued)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean -Up
(Gravimetric)	Residue, Total (TS)	n/a	160.3	w	80 - 120	<20	1000	1
(Gravimetric)	Residue, Filterable (TDS)	n/a	160.1	w	80 - 120	<20	1000	1
(Gravimetric)	Residue Non-Filterable (TSS)	n/a	160.2	w	80 - 120	<20	1000	1
(Gravimetric)	Residue, Total (TS)	n/a	160.3	w	80 - 120	<20	1000	1
(Gravimetric)	Residue, Total Volatile (TVS)	n/a	160.4	w,s	80 - 120	<20	1000	1
(Ion Chromatography)	Sulfate	n/a SOP	300.0/9056 300.0/9056	w s	85 - 115 80 - 120	<20 <20	5000	1 1
(Spectrophotometric)	Sulfide	n/a	376.2	w	85 - 115	<20	100	1
(Titrimetric)	Sulfite	377.1	377.1	w	85 - 115	<20	500	1
(Autoanalyzer)	Total Kjeldahl Nitrogen	351.2 SOP	351.2 351.2	w s	85 - 115 80 - 120	<20 <20	500	1 1
(Combustion/IR)	Total Organic Carbon	n/a	415.1	w	85 - 115	<20	2000	1
(Combustion/IR)	Dissolved Inorganic Carbon	n/a	SOP	w	85 - 115	<20		1
TOX	Total Organic Halogens	n/a	9020A	w	80 - 120	<20	10	1
TOX	EOX	SOP	9023	s	80 - 120	<20	20000	1

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Wet Chemistry (continued)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean -Up
(Autoanalyzer)	Total Phenol	420.2 9066	420.2 9066	w s, ws	85 - 115 80 - 120	<20 <20	50 50	1 1
(IR)	Total Recoverable Petroleum Hydrocarbons	418.1 SOP	418.1 9073	w s	85 - 115 80 - 120	<20 <20	10000 10000	1 1
(nephelometric)	Turbidity	n/a	180.1	w	n/a	<20	n/a	1
(colorimetric)	Color	n/a	110.2	w	n/a	<20	n/a	1

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Volatile Organics (Purge & Trap GC/MS)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
VOC GC/MS	Acetone	5035 5030	8260B 624, 8260B	s w	10-152 10-152	<40 <40	50 50	1 1
VOC GC/MS	Acrolein	5035 5030	8260B 624, 8260B	s w	19-89 19-89	<40 <40	50 50	1 1
VOC GC/MS	Acrylonitrile	5035 5030	8260B 624, 8260B	s w	1-165 1-165	<37 <37	50 50	1 1
VOC GC/MS	Benzene	5035 5030, 1311-12 524.2	8260B 624, 8260B 524.2	s w, tclp, splp w	44-158 44-158 70-130	<39 <39 <30	1.0 1.0 0.5	1 1
VOC GC/MS	Bromodichloromethane	5035 5030, 1311-12 524.2	8260B 624, 8260B 524.2	s w, tclp, splp w	52-133 52-133 70-130	<52 <52 <30	1.0 1.0 0.5	1 1
VOC GC/MS	Bromoform	5035 5030, 1311-12 524.2	8260B 624, 8260B 524.2	s w, tclp, splp w	55-123 55-123 70-130	<36 <36 <30	1.0 1.0 0.5	1 1
VOC GC/MS	Bromomethane	5035 5030, 1311-12 524.2	8260B 624, 8260B 524.2	s w, tclp, splp w	2-178 2-178 70-130	<40 <40 <30	1.0 1.0 0.5	1 1
VOC GC/MS	2-Butanone (MEK)	5035 5030	8260B 624, 8260B	s w	6-141 6-141	<40 <40	50 50	1 1

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Volatile Organics (Purge & Trap GC/MS)
(continued)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
VOC GC/MS	Carbon disulfide	5035 5030	8260 624, 8260B	s w	13-158 13-158	<52 <52	50 50	1 1
VOC GC/MS	Carbon tetrachloride	5035 5030, 1311-12 524.2	8260B 624, 8260B 524.2	s w, tclp, splp w	35-153 35-153 70-130	<35 <25 <30	1.0 1.0 0.5	1 1
VOC GC/MS	Chlorobenzene	5035 5030, 1311-12 524.2	8260B 624, 8260B 524.2	s w, tclp, splp w	61-128 61-128 70-130	<35 <25 <30	1.0 1.0 0.5	1 1
VOC GC/MS	Chloroethane	5035 5030, 1311-12 524.2	8260B 624, 8260B 524.2	s w, tclp, splp w	38-148 38-148 70-130	<35 <35 <30	1.0 1.0 0.5	1 1
VOC GC/MS	2-Chloroethyl vinyl ether	5035 5030, 1311-12	8260B 624, 8260B	s w, tclp, splp	60 - 135 70 - 130	<35 <35	1.0 1.0	1 1
VOC GC/MS	Chloroform	5035 5030, 1311-12 524.2	8260B 624, 8260B 524.2	s w, tclp, splp w	25-166 25-166 70-130	<35 <25 <30	1.0 1.0 0.5	1 1
VOC GC/MS	Chloromethane	5035 5030, 1311-12	8260B 624, 8260B	s w, tclp, splp	9-158 9-158	<35 <35	1.0 1.0	1 1
VOC GC/MS	2-Chlorotoluene	5035 5030, 1311-12 524.2	8260B 624, 8260B 524.2	s w, tclp, splp w	49-139 49-139 70-130	<41 <41 <30	1.0 1.0 0.5	1 1
VOC GC/MS	Dibromochloromethane	5035 5030 524.2	8260B 624, 8260B 524.2	s w w	66-120 66-120 70-130	<17 <17 <30	1.0 1.0 0.5	1 1

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Volatile Organics (Purge & Trap GC/MS)
(continued)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
VOC GC/MS	1,2-Dichlorobenzene	5035 5030, 1311-12 524.2	8260B 624, 8260B 524.2	s w, tclp, splp w	69-112 69-112 70-130	<35 <25 <30	1.0 1.0 0.5	1 1
VOC GC/MS	1,3-Dichlorobenzene	5035 5030, 1311-12 524.2	8260B 624, 8260B 524.2	s w, tclp, splp w	50-132 50-132 70-130	<31 <31 <30	1.0 1.0 0.5	1 1
VOC GC/MS	1,4-Dichlorobenzene	5035 5030, 1311-12 524.2	8260B 624, 8260B 524.2	s w, tclp, splp w	66-109 66-109 70-130	<35 <25 <30	1.0 1.0 0.5	1 1
VOC GC/MS	Dichlorodifluoromethane	5035 5030 524.2	8260B 624, 8260B 524.2	s w w	12-159 12-159 70-130	<51 <51 <30	1.0 1.0 0.5	1 1
VOC GC/MS	1,1-Dichloroethane	5035 5030, 1311-12 524.2	8260B 624, 8260B 524.2	s w, tclp, splp w	23-175 23-175 70-130	<49 <49 <30	1.0 1.0 0.5	1 1
VOC GC/MS	1,2-Dichloroethane	5035 5030, 1311-12 524.2	8260B 624, 8260B 524.2	s w, tclp, splp w	32-161 32-161 70-130	<35 <25 <30	1.0 1.0 0.5	1 1
VOC GC/MS	1,1-Dichloroethene	5035 5030, 1311-12 524.2	8260B 624, 8260B 524.2	s w, tclp, splp w	24-162 24-162 70-130	<49 <49 <30	1.0 1.0 0.5	1 1

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Volatile Organics (Purge & Trap GC/MS)
(continued)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
VOC GC/MS	cis-1,2-Dichloroethene	5035 5030 524.2	8260B 624, 8260B 524.2	s w w	28-157 28-167 70-130	<47 <47 <30	1.0 1.0 0.5	1 1
VOC GC/MS	trans-1,2-Dichloroethene	5035 5030, 1311-12 524.2	8260B 624, 8260B 524.2	s w, tclp, splp w	30-155 30-155 70-130	<48 <48 <30	1.0 1.0 0.5	1 1
VOC GC/MS	1,2-Dichloropropane	5035 5030, 1311-12 524.2	8260B 624, 8260B 524.2	s w, tclp, splp w	60-133 60-133 70-130	<48 <48 <30	1.0 1.0 0.5	1 1
VOC GC/MS	cis-1,3-Dichloropropene	5035 5030, 1311-12 524.2	8260B 624, 8260B 524.2	s w, tclp, splp w	54-125 54-125 70-130	<38 <38 <30	1.0 1.0 0.5	1 1
VOC GC/MS	trans-1,3-Dichloropropene	5035 5030, 1311-12 524.2	8260B 624, 8260B 524.2	s w, tclp, splp w	46-123 46-123 70-130	<38 <38 <30	1.0 1.0 0.5	1 1
VOC GC/MS	Ethylbenzene	5035 5030, 1311-12 524.2	8260B 624, 8260B 524.2	s w, tclp, splp w	54-135 54-135 70-130	<37 <37 <30	1.0 1.0 0.5	1 1
VOC GC/MS	2-Hexanone	5035 5030	8260B 624, 8260B	s w	42-119 42-119	<37 <37	50 50	1 1
VOC GC/MS	Methylene chloride	5035 5030, 1311-12 524.2	8260B 624, 8260B 524.2	s w, tclp, splp w	16-175 16-175 70-130	<53 <53 <30	1.0 1.0 0.5	1 1
VOC GC/MS	4-Methyl-2-pentanone	5035 5030	8260B 624, 8260B	s w	36-128 36-128	<42 <42	50 50	1 1
VOC GC/MS	Methyl-t-butyl ether	5035 5030	8260B 624, 8260B	s w	41-130 41-130	<45 <45	1.0 1.0	1 1

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Volatile Organics (Purge & Trap GC/MS)
(continued)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
VOC GC/MS	Styrene	5035 5030 524.2	8260B 624, 8260B 524.2	s w w	53-131 53-131 70-130	<33 <33 <30	1.0 1.0 0.5	1 1
VOC GC/MS	Tetrachloroethene	5035 5030, 1311-12 524.2	8260B 624, 8260B 524.2	s w, tclp, splp w	64-132 64-132 70-130	<19 <19 <30	1.0 1.0 0.5	1 1
VOC GC/MS	1,1,2,2-Tetrachloroethane	5035 5030, 1311-12 524.2	8260B 624, 8260B 524.2	s w, tclp, splp w	54-127 54-127 70-130	<33 <33 <30	1.0 1.0 0.5	1 1
VOC GC/MS	Toluene	5035 5030, 1311-12 524.2	8260B 624, 8260B 524.2	s w, tclp, splp w	57-140 57-140 70-130	<42 <42 <30	1.0 1.0 0.5	1 1
VOC GC/MS	Trichloroethene	5035 5030, 1311-12 524.2	8260B 624, 8260B 524.2	s w, tclp, splp w	61-127 61-127 70-130	<23 <23 <30	1.0 1.0 0.5	1 1
VOC GC/MS	1,1,1-Trichloroethane	5035 5030 524.2	8260B 624, 8260B 524.2	s w w	21-163 21-163 70-130	<35 <25 <30	1.0 1.0 0.5	1 1
VOC GC/MS	1,1,2-Trichloroethane	5035 5030, 1311-12 524.2	8260B 624, 8260B 524.2	s w, tclp, splp w	73-120 73-120 70-130	<35 <25 <30	1.0 1.0 0.5	1 1

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Volatile Organics (Purge & Trap GC/MS)
(continued)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
VOC GC/MS	Trichlorofluoromethane	5035 5030, 1311-12 524.2	8260B 624, 8260B 524.2	s w, tclp, splp w	2-182 2-182 70-130	<35 <35 <30	1.0 1.0 0.5	1 1
VOC GC/MS	Vinyl chloride	5035 5030 524.2	8260B 624, 8260B 524.2	s w w	4-156 4-156 70-130	<33 <33 <30	1.0 1.0 0.5	1 1
VOC GC/MS	M & P Xylenes	5035 5030, 1311-12 524.2	624, 8260B 624, 8260B 524.2	s w, tclp, splp w	52-136 52-136 70-130	<48 <48 <30	1.0 2.0 0.5	1 1
VOC GC/MS	O Xylenes	5035 5030, 1311-12 524.2	624, 8260B 624, 8260B 524.2	s w, tclp, splp w	52-137 52-137 70-130	<41 <41 <30	1.0 1.0 0.5	1 1

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Volatile Organics (Purge & Trap GC/MS) Additional Compounds (Appendix)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
VOC GC/MS	Ethanol	5030	8260B	w	70 - 130	<30	100	7
VOC GC/MS	Acetonitrile	5030	8260B	w	70 - 130	<30	50	7
VOC GC/MS	Allyl Chloride	5030	8260B	w	70 - 130	<30	5	7
VOC GC/MS	t-butyl alcohol	5030	8260B	w	70 - 130	<30	50	7
VOC GC/MS	Chloroprene	5030	8260B	w	70 - 130	<30	50	7
VOC GC/MS	Propionitrile	5030	8260B	w	70 - 130	<30	50	7
VOC GC/MS	Methacrylonitrile	5030	8260B	w	70 - 130	<30	50	7
VOC GC/MS	Isobutanol	5030	8260B	w	70 - 130	<30	100	7
VOC GC/MS	Methyl methacrylate	5030	8260B	w	70 - 130	<30	5	7
VOC GC/MS	1,4-Dioxane	5030	8260B	w	70 - 130	<30	100	7
VOC GC/MS	Ethyl methacrylate	5030	8260B	w	70 - 130	<30	5	7
VOC GC/MS	Cis-1,4-dichloro-2-butene	5030	8260B	w	70 - 130	<30	5	7
VOC GC/MS	Cyclohexanone	5030	8260B	w	70 - 130	<30	10	7
VOC GC/MS	Trans-1,4-dichloro-2-butene	5030	8260B	w	70 - 130	<30	5	7
VOC GC/MS	Pentachloroethane	5030	8260B	w	70 - 130	<30	5	7

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Semi-Volatile Organics (GC/MS)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
BNA GC/MS	4-Chloro-3-methylphenol		625	w	49- 128	<34	10	7
		3510	8270C	w	49- 128	<34	10	7
		3550	8270C	s	49- 128	<34	330	7
BNA GC/MS	2-Chlorophenol		625	w	60-102	<25	10	7
		3510	8270C	W	60-102	<25	10	7
		3550	8270C	s	60-102	<25	330	7
BNA GC/MS	p-Cresol	3510, 1311-12	8270C	w,tclp,splp	64-104	<31	10	7
		3550	8270C	s	64-104	<31	330	7
BNA GC/MS	o-Cresol	3510, 1311-12	8270C	w,tclp,splp	60-109	<30	10	7
		3550	8270C	s	60-109	<30	330	7
BNA GC/MS	2,4-Dichlorophenol		625	w	66-110	<25	10	7
		3510	8270C	w	66-110	<25	10	7
		3550	8270C	s	66-110	<25	330	7
BNA GC/MS	2,4-Dimethylphenol		625	w	69-107	<38	10	7
		3510	8270C	w	69-107	<38	10	7
		3550	8270C	s	69-107	<38	330	7
BNA GC/MS	2,4-Dinitrophenol		625	w	29-95	<35	10	7
		3510	8270C	w	29-95	<35	10	7
		3550	8270C	s	29-95	<35	330	7
BNA GC/MS	2-Methyl-4,6-dinitrophenol		625	w	19-166	<30	10	7
		3510	8270C	W	19-166	<30	10	7
		3550	8270C	s	19-166	<30	330	7
BNA GC/MS	2-Nitrophenol		625	w	67-107	<33	10	7
		3510	8270C	w	67-107	<33	10	7
		3550	8270C	s	67-107	<33	330	7

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Semi-Volatile Organics (GC/MS)
(continued)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
BNA GC/MS	4-Nitrophenol		625	w	16-181	<37	10	7
		3510	8270C	w	16-181	<37	10	7
		3550	8270C	s	16-181	<37	330	7
BNA GC/MS	Pentachlorophenol		625	w	63-115	<22	10	7
		3510, 1311-12	8270C	tclp,splp	63-115	<22	10	7
		3550	8270C	s	63-115	<22	330	7
BNA GC/MS	Phenol		625	w	61 – 106	<37	10	7
		3510	8270C	w	61 – 106	<37	10	7
		3550	8270C	s	61 – 106	<37	330	7
BNA GC/MS	2,4,5-Trichlorophenol	3510, 1311-12	8270C	w,tclp,splp	66 - 105	<57	10	7
		3550	8270C	s	66 - 105	<57	330	7
BNA GC/MS	2,4,6-Trichlorophenol		625	w	64 - 113	<23	10	7
		3510, 1311-12	8270C	w,tclp,splp	64 - 113	<23	10	7
		3550	8270C	s	64 - 113	<23	330	7
BNA GC/MS	Acenaphthene		625	w	56 - 111	<24	10	7
		3510	8270C	w	56 - 111	<24	10	7
		3550	8270C	s	56 - 111	<24	330	7
BNA GC/MS	Acenaphthylene		625	w	60 - 121	<24	10	7
		3510	8270C	w	60 - 121	<24	10	7
		3550	8270C	s	60 - 121	<24	330	7
BNA GC/MS	Aniline	3510	8270C	w	3 - 189	<37	10	7
		3550	8270C	s	3 - 189	<37	330	7
BNA GC/MS	Anthracene		625	w	55 - 119	<22	10	7
		3510	8270C	w	55 - 119	<22	10	7
		3550	8270C	s	55 - 119	<22	330	7

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Semi-Volatile Organics (GC/MS)
(continued)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
BNA GC/MS	1,2-Diphenylhydrazine (as Azobenzene)	3510	8270C	w	59 – 120	<26	10	7
		3550	8270C	s	59 – 120	<26	330	7
BNA GC/MS	Benzo(a)anthracene		625	w	54 - 107	<25	10	7
		3510	8270C	w	54 - 107	<25	10	7
		3550	8270C	s	54 - 107	<25	330	7
BNA GC/MS	Benzo(b)fluoranthene		625	w	44 - 138	<26	10	7
		3510	8270C	w	44 - 138	<26	10	7
		3550	8270C	s	44 - 138	<26	330	7
BNA GC/MS	Benzo(k)fluoranthene		625	w	47 - 143	<27	10	7
		3510	8270C	w	47 - 143	<27	10	7
		3550	8270C	s	47 - 143	<27	330	7
BNA GC/MS	Benzo(a)pyrene		625	w	57 - 136	<25	10	7
		3510	8270C	w	57 - 136	<25	10	7
		3550	8270C	s	57 - 136	<25	330	7
BNA GC/MS	Benzo(g,h,i)perylene		625	w	47 - 145	<24	10	7
		3510	8270C	w	47 - 145	<24	10	7
		3550	8270C	s	47 - 145	<24	330	7
BNA GC/MS	Benzyl alcohol	3510	8270C	w	53 - 113	<37	10	7
		3550	8270C	s	53 - 113	<37	330	7
BNA GC/MS	Butyl benzyl phthalate		625	w	54 - 122	<27	10	7
		3510	8270C	w	54 - 122	<27	10	7
		3550	8270C	s	54 - 122	<27	330	7

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Semi-Volatile Organics (GC/MS)
(continued)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
BNA GC/MS	Benzidine		625	w	0 - 247	<320	10	7
		3510	8270C	w	0 - 247	<320	10	7
		3550	8270C	s	0 - 247	<320	330	7
BNA GC/MS	Benzoic Acid	3510	8270C	w	8 - 174	<31	10	7
		3350	8270C	s	8 - 174	<31	330	7
BNA GC/MS	Biphenyl	3510	8270C	w	50 - 150	<25	10	7
		3350	8270C	s	50 - 150	<25	330	7
BNA GC/MS	4-Bromo phenyl phenyl ether		625	w	50 - 129	<22	10	7
		3510	8270C	w	50 - 129	<22	10	7
		3550	8270C	s	50 - 129	<22	330	7
BNA GC/MS	Carbazole	3510	8270C	w	5 - 171	<18	10	7
		3350	8270C	s	5 - 171	<18	330	7
BNA GC/MS	4-Chloroaniline	3510	8270C	w	6 - 215	<31	10	7
		3550	8270C	s	6 - 215	<31	330	7
BNA GC/MS	Bis(2-Chloroethyl) ether		625	w	53 - 106	<35	10	7
		3510	8270C	w	53 - 106	<35	10	7
		3550	8270C	s	53 - 106	<35	330	7
BNA GC/MS	Bis(2-Chloroethoxy) methane		625	w	53 - 103	<33	10	7
		3510	8270C	w	53 - 103	<33	10	7
		3550	8270C	s	53 - 103	<33	330	7
BNA GC/MS	Bis(2-Chloroisopropyl) ether		625	w	54 - 118	<25	10	7
		3510	8270C	w	54 - 118	<25	10	7
		3550	8270C	s	54 - 118	<25	330	7

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Semi-Volatile Organics (GC/MS)
(continued)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
BNA GC/MS	Bis(2-Ethylhexyl) phthalate		625	w	53 - 110	<28	10	7
		3510	8270C	w	53 - 110	<28	10	7
		3550	8270C	s	53 - 110	<28	330	7
BNA GC/MS	2-Chloronaphthalene		625	w	62 - 107	<26	10	7
		3510	8270C	w	62 - 107	<26	10	7
		3550	8270C	s	62 - 107	<26	330	7
BNA GC/MS	4-Chlorophenyl phenyl ether		625	w	54 - 135	<27	10	7
		3510	8270C	w	54 - 135	<27	10	7
		3550	8270C	s	54 - 135	<27	330	7
BNA GC/MS	Chrysene		625	w	54 - 105	<25	10	7
		3510	8270C	w	54 - 105	<25	10	7
		3550	8270C	s	54 - 105	<25	330	7
BNA GC/MS	Dibenz(a,h)anthracene		625	w	52 - 161	<25	10	3
		3510	8270C	w	52 - 161	<25	10	3
		3550	8270C	s	52 - 161	<25	330	3
BNA GC/MS	Dibenzofuran	3510	8270C	w	56 - 116	<27	10	7
		3550	8270C	s	56 - 116	<27	330	7
BNA GC/MS	1,2-Dichlorobenzene		625	w	55 - 105	<26	10	7
		3510	8270C	w	55 - 105	<26	10	7
		3550	8270C	s	55 - 105	<26	330	7
BNA GC/MS	1,3-Dichlorobenzene		625	w	52 - 150	<30	10	7
		3510	8270C	w	52 - 150	<30	10	7
		3550	8270C	s	52 - 150	<30	330	7

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Semi-Volatile Organics (GC/MS)
(continued)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
BNA GC/MS	1,4-Dichlorobenzene		625	w	54 - 100	<31	10	7
		3510, 1311-12	8270C	w, tclp, splp	54 - 100	<31	10	7
		3550	8270C	s	54 - 100	<31	330	7
BNA GC/MS	3,3'-Dichlorobenzidine		625	w	35 - 174	<25	10	7
		3510	8270C	w	35 - 174	<25	10	7
		3550	8270C	s	35 - 174	<25	330	7
BNA GC/MS	Diethyl phthalate		625	w	61 - 117	<21	10	7
		3510	8270C	w	61 - 117	<21	10	7
		3550	8270C	s	61 - 117	<21	330	7
BNA GC/MS	Dimethyl phthalate		625	w	61 - 116	<22	10	7
		3510	8270C	w	61 - 116	<22	10	7
		3550	8270C	s	61 - 116	<22	330	7
BNA GC/MS	Di-n-butyl phthalate		625	w	48 - 135	<31	10	7
		3510	8270C	w	48 - 135	<31	10	7
		3550	8270C	s	48 - 135	<31	330	7
BNA GC/MS	Di-n-octyl phthalate		625	w	36 - 162	<29	10	7
		3510	8270C	w	36 - 162	<29	10	7
		3550	8270C	s	36 - 162	<29	330	7
BNA GC/MS	2,4-Dinitrotoluene		625	w	57 - 143	<26	10	7
		3510, 1311-12	8270C	w, tclp, splp	57 - 143	<26	10	7
		3550	8270C	s	57 - 143	<26	330	7
BNA GC/MS	2,6-Dinitrotoluene		625	w	60 - 128	<25	10	7
		3510	8270C	w	60 - 128	<25	10	7
		3550	8270C	s	60 - 128	<25	330	7
BNA GC/MS	Fluoranthene		625	w	46 - 129	<41	10	7
		3510	8270C	w	46 - 129	<41	10	7
		3550	8270C	s	46 - 129	<41	330	7

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Semi-Volatile Organics (GC/MS)
(continued)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
BNA GC/MS	Fluorene		625	w	56 - 125	<28	10	7
		3510	8270C	w	56 - 125	<28	10	7
		3550	8270C	s	56 - 125	<28	330	7
BNA GC/MS	Hexachlorobenzene		625	w	48 - 125	<22	10	7
		3510, 1311-12	8270C	w,tclp,splp	48 - 125	<22	10	7
		3550	8270C	s	48 - 125	<22	330	7
BNA GC/MS	Hexachlorobutadiene		625	w	57 - 128	<34	10	7
		3510, 1311-12	8270C	w,tclp,splp	57 - 128	<34	10	7
		3550	8270C	s	57 - 128	<34	330	7
BNA GC/MS	Hexachlorocyclopentadiene		625	w	60 - 128	<35	10	7
		3510	8270C	w	60 - 128	<35	10	7
		3550	8270C	s	60 - 128	<35	330	7
BNA GC/MS	Hexachloroethane		625	w	66 - 100	<33	10	7
		3510, 1311-12	8270C	w,tclp,splp	66 - 100	<33	10	7
		3550	8270C	s	66 - 100	<33	330	7
BNA GC/MS	Indeno(1,2,3-cd)pyrene		625	w	49 - 147	<25	10	7
		3510	8270C	w	49 - 147	<25	10	7
		3550	8270C	s	49 - 147	<25	330	7
BNA GC/MS	Isophorone		625	w	63 - 114	<30	10	7
		3510	8270C	w	63 - 114	<30	10	7
		3550	8270C	s	63 - 114	<30	330	7
BNA GC/MS	2-Methylnaphthalene	3510	8270C	w	53 - 115	<28	10	7
		3550	8270C	s	53 - 115	<28	330	7
BNA GC/MS	Naphthalene		625	w	53 - 110	<27	10	7
		3510	8270C	w	53 - 110	<27	10	7
		3550	8270C	s	53 - 110	<27	330	7

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Semi-Volatile Organics (GC/MS)
(continued)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
BNA GC/MS	2-Nitroaniline	3510 3550	8270C 8270C	w s	60 - 124 60 - 124	<24 <24	10 330	7 7
BNA GC/MS	1-Methylnaphthalene	3510 3550	8270C 8270C	w s	53 - 115 53 - 115	<28 <28	10 330	7 7
BNA GC/MS	3-Nitroaniline	3510 3550	8270C 8270C	w s	68 - 116 68 - 116	<37 <37	10 330	7 7
BNA GC/MS	4-Nitroaniline	3510 3550	8270C 8270C	w s	49 - 194 49 - 194	<30 <30	10 330	7 7
BNA GC/MS	Nitrobenzene	 3510, 1311-12 3550	625 8270C 8270C	w w,tclp,splp s	55 - 108 55 - 108 55 - 108	<31 <31 <31	10 10 330	7 7 7
BNA GC/MS	N-Nitrosodimethylamine	 3510 3550	625 8270C 8270C	w w s	47 - 114 47 - 114 47 - 114	<42 <42 <42	10 10 330	7 7 7
BNA GC/MS	N-Nitroso-di-n-propylamine	3510 3550	8270C 8270C	w s	59 - 106 59 - 106	<26 <26	10 330	7 7
BNA GC/MS	N-Nitrosodiphenylamine	3510 3550	8270C 8270C	w s	58 - 101 58 - 101	<21 <21	10 330	7 7
BNA GC/MS	Phenanthrene	 3510 3550	625 8270C 8270C	w w s	56 - 119 56 - 119 56 - 119	<24 <24 <24	10 10 330	7 7 7
BNA GC/MS	Pyrene	 3510 3550	625 8270C 8270C	w w s	0 - 247 0 - 247 0 - 247	<40 <40 <40	10 10 330	7 7 7

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Semi-Volatile Organics (GC/MS, GC-FID)
(continued)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
BNA GC/MS	Pyridine	3510	8270C	w	13 - 106	<31	10	7
		3550	8270C	s	13 - 106	<31	330	7
BNA GC/MS	1,2,4-Trichlorobenzene		625	W	56 - 107	<31	10	7
		3510	8270C	W	56 - 107	<31	10	7
		3550	8270C	S	56 - 107	<31	330	7

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Semi-Volatile Organics (GC/MS) Additional Compounds (Appendix)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
BNA GC/MS	N-nitrosomethylethylamine	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	N-nitrosodiethylamine	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	N-nitrosopyrolidine	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	N-nitrosomorpholine	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	N-nitrosopiperidine	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	Alpha,alpha-Dimethylphenethylamine	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	N-nitrosodi-n-butylamine	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	p-Phenylenediamine	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	2-Naphthylamine	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	1-Naphthylamine	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	Diphenylamine	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	p-Dimethylaminoazobenzene	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	Pentachloroethane	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	Hexachloropropene	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	1,2,4,5-Tetrachlorobenzene	3510	8270C	w	25 -130	<40	50	7

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Semi-Volatile Organics (GC/MS, GC-FID) Additional Compounds (Appendix)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
BNA GC/MS	1-Chloronaphthalene	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	Pentachlorobenzene	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	5-Nitro-o-toluidine	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	sym-Trinitrobenzene	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	Pentachloronitrobenzene	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	4-Aminobiphenyl	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	Isodrin	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	Kepone	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	2-Acetylaminofluorene	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	o,o,o-Triethylphosphorothioate	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	Thionazin	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	Sulfotepp	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	Phorate	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	Dimethoate	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	Disulfoton	3510	8270C	w	25 -130	<40	50	7

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Semi-Volatile Organics (GC/MS, GC-FID) Additional Compounds (Appendix)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
BNA GC/MS	Methyl parathion	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	Parathion	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	Famphur	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	2-Picoline	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	Methyl methanesulfonate	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	Ethyl methanesulfonate	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	Acetophenone	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	2,6-Dichlorophenol	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	Safrole	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	Isosafrole	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	1,4-Naphthoquinone	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	2,3,4,6-Tetrachlorophenol	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	Diallate (trans)	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	Phenacetin	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	Diallate (cis)	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	Pronamide	3510	8270C	w	25 -130	<40	50	7

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Semi-Volatile Organics (GC/MS, GC-FID) Additional Compounds (Appendix)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
BNA GC/MS	Dinoseb	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	4-Nitroquinoline-1-oxide	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	Methapyriline	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	Aramite	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	Chlorobenzilate	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	3,3'-Dimethylbenzidine	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	7,12-Dimethylbenz(a)anthracene	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	3-Methylcholanthrene	3510	8270C	w	25 -130	<40	50	7
BNA GC/MS	Dibenz (a,j)acridine	3510	8270C	w	25 -130	<40	50	7

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Semi-Volatile Organics (HPLC) PAH Compounds

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
HPLC	Acenaphthalene	3510 3550	8310	w s	60 - 140 60 - 140	<30 <30	0.5 20	7 7
HPLC	Acenaphthene	3510 3550	8310	w s	60 - 140 60 - 140	<30 <30	0.5 20	7 7
HPLC	Anthracene	3510 3550	8310	w s	60 - 140 60 - 140	<30 <30	0.5 20	7 7
HPLC	Benzo (a) anthracene	3510 3550	8310	w s	60 - 140 60 - 140	<30 <30	0.5 20	7 7
HPLC	Benzo (a) pyrene	3510 3550	8310	w s	60 - 140 60 - 140	<30 <30	0.5 20	7 7
HPLC	Benzo (b) fluoranthene	3510 3550	8310	w s	60 - 140 60 - 140	<30 <30	0.5 20	7 7
HPLC	Benzo (g,h,I) perylene	3510 3550	8310	w s	60 - 140 60 - 140	<30 <30	0.5 20	7 7
HPLC	Benzo (k) fluoranthene	3510 3550	8310	w s	60 - 140 60 - 140	<30 <30	0.5 20	7 7
HPLC	Dibenzo (a,h) anthracene	3510 3550	8310	w s	60 - 140 60 - 140	<30 <30	0.5 20	7 7
HPLC	Fluoranthene	3510 3550	8310	w s	60 - 140 60 - 140	<30 <30	0.5 20	7 7
HPLC	Fluorene	3510 3550	8310	w s	60 - 140 60 - 140	<30 <30	0.5 20	7 7

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Semi-Volatile Organics (HPLC) PAH Compounds
(continued)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
HPLC	Indeno (1,2,3-c,d) pyrene	3510 3550	8310	w s	60 - 140 60 - 140	<30 <30	0.5 20	7 7
HPLC	1-Methylnaphthalene	3510 3550	8310	w s	60 - 140 60 - 140	<30 <30	0.5 20	7 7
HPLC	2-Methylnaphthalene	3510 3550	8310	w s	60 - 140 60 - 140	<30 <30	0.5 20	7 7
HPLC	Naphthalene	3510 3550	8310	w s	60 - 140 60 - 140	<30 <30	0.5 20	7 7
HPLC	Phenanthrene	3510 3550	8310	w s	60 - 140 60 - 140	<30 <30	0.5 20	7 7

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Petroleum Hydrocarbons - GC Methods

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
GC	Petroleum Range Organics (TRPH)	FL-PRO FL-PRO (sonication)	FL-PRO FL-PRO	w s	50 - 150 50 - 150	<30 <30	100 4000	1 1
GC	Petroleum Range Organics (TRPH)	3510C 3550B	EPH TN EPH TN	w s	50 - 150 50 - 150	<30 <30	100 4000	1 1
GC	Petroleum Range Organics (TRPH)	3510C 3550B	8015 Mod 8015 Mod	w s	50 - 150 50 - 150	<30 <30	100 4000	1 1
GC	Petroleum Range Organics (TRPH)	MADEP EPH MADEP EPH	MADEP EPH MADEP EPH	w s	50 - 150 50 - 150	<30 <30	100 4000	1 1
GC	Petroleum Range Organics (TRPH)	3510C 3550B	DRO DRO	w s	50 - 150 50 - 150	<30 <30	100 4000	1 1
GC	Petroleum Range Organics (TRPH)	OA2 OA2	OA2 OA2	w s	50 - 150 50 - 150	<30 <30	100 100	1 1
GC	Petroleum Range Organics (TRPH)	MADEP VPH MADEP VPH	MADEP VPH MADEP VPH	w s	50 - 150 50 - 150	<30 <30	100 100	1 1
GC	Petroleum Range Organics/BTEX (TRPH)	5030B 5035	GRO/8015 Mod GRO/8015 Mod	w s	50 - 150 50 - 150	<30 <30	100 100	1 1
GC	Petroleum Range Organics/BTEX (TRPH)	5030B 5035	8015 Mod 8015 Mod	w s	50 - 150 50 - 150	<30 <30	100 100	1 1
GC	Petroleum Range Organics (TRPH)	OA1 OA1	OA1 OA1	w s	50 - 150 50 - 150	<30 <30	100 100	1 1

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Pesticides (GC-ECD)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
GC-ECD	Aldrin	(based on 3510)	SOP (based on 608)	w	50 - 150	<30	0.5	4
		(based on 3510)	SOP (based on 608)	w	50 - 150	<30	0.5	4
		(based on 3550)	SOP (based on 8081A)	s	50 - 150	<30	20	4, 7
GC-ECD	Alpha-BHC	(based on 3510)	SOP (based on 608)	w	50 - 150	<30	0.5	4, 5
		(based on 3510)	SOP (based on 608)	w	50 - 150	<30	0.5	4, 5
		(based on 3550)	SOP (based on 8081A)	s	50 - 150	<30	20	4, 5, 7
GC-ECD	Beta-BHC	(based on 3510)	SOP (based on 608)	w	50 - 150	<30	0.5	4, 5
		(based on 3510)	SOP (based on 608)	w	50 - 150	<30	0.5	4, 5
		(based on 3550)	SOP (based on 8081A)	s	50 - 150	<30	20	4, 5, 7
GC-ECD	Delta-BHC	SOP(based on 3510)	SOP (based on 608)	w	50 - 150	<30	0.5	4, 5
		SOP(based on 3510)	SOP (based on 608)	w	50 - 150	<30	0.5	4, 5
		SOP(based on 3550)	SOP (based on 8081A)	s	50 - 150	<30	20	4, 5, 7
GC-ECD	Gamma-BHC	SOP (based on 3510)	SOP (based on 608)	w	50 - 150	<30	5	4, 5
		SOP (based on 3510)	SOP (based on 608)	w	50 - 150	<30	5	4, 5
		SOP (based on 3550)	SOP (based on 8081A)	s	50 - 150	<30	200	4, 5, 7

QA Targets for Accuracy, Precision and PQL's

Pesticides (GC-ECD)
(continued)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
GC-ECD	Chlordane technical	SOP (based on 3510) SOP (based on 3550)	SOP (based on 608) SOP (based on 8081A)	w s	50 - 150 50 - 150	<30 <30	0.5 20	4, 5 4, 5, 7
GC-ECD	p,p'-DDD	SOP (based on 3510) SOP (based on 3510) SOP (based on 3550)	SOP (based on 608) SOP (based on 608) SOP (based on 8081A)	w w s	50 - 150 50 - 150 50 - 150	<30 <30 <30	0.5 0.5 20	4, 5 4, 5 4, 5
GC-ECD	p,p'-DDE	SOP (based on 3510) SOP (based on 3510) SOP (based on 3550)	SOP (based on 608) SOP (based on 608) SOP (based on 8081A)	w w s	50 - 150 50 - 150 50 - 150	<30 <30 <30	0.5 0.5 20	4, 5 4, 5 4, 5
GC-ECD	p,p'-DDT	SOP (based on 3510) SOP (based on 3510) SOP (based on 3550)	SOP (based on 608) SOP (based on 608) SOP (based on 8081A)	w w s	40 - 160 40 - 160 40 - 160	<30 <30 <30	0.5 0.5 20	4, 5 4, 5 4, 5
GC-ECD	Dieldrin	SOP (based on 3510) SOP (based on 3510) SOP (based on 3550)	SOP (based on 608) SOP (based on 608) SOP (based on 8081A)	w w s	50 - 150 50 - 150 50 - 150	<30 <30 <30	0.5 0.5 20	4 4 4
GC-ECD	Endosulfan I	SOP (based on 3510) SOP (based on 3510) SOP (based on 3550)	SOP (based on 608) SOP (based on 608) SOP (based on 8081A)	w w s	50 - 150 50 - 150 50 - 150	<30 <30 <30	0.5 0.5 20	4 4 4

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Pesticides (GC-ECD)
(continued)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
GC-ECD	Endosulfan II	SOP (based on 3510)	SOP (based on 608)	w	50 - 150	<30	0.5	4
		SOP (based on 3510)	SOP (based on 608)	w	50 - 150	<30	0.5	4
		SOP (based on 3550)	SOP (based on 8081A)	s	50 - 150	<30	20	4, 7
GC-ECD	Endosulfan sulfate	SOP (based on 3510)	SOP (based on 608)	w	40 - 160	<30	0.5	4
		SOP (based on 3510)	SOP (based on 608)	w	40 - 160	<30	0.5	4
		SOP (based on 3550)	SOP (based on 8081A)	s	40 - 160	<30	20	4, 7
GC-ECD	Endrin	SOP (based on 3510)	SOP (based on 608)	w	40 - 170	<30	0.5	4
		SOP (based on 3510)	SOP (based on 608)	w	40 - 170	<30	0.5	4
		SOP (based on 3550)	SOP (based on 8081A)	s	40 - 170	<30	20	4, 7
GC-ECD	Endrin aldehyde	SOP (based on 3510)	SOP (based on 608)	w	50 - 150	<30	0.5	4
		SOP (based on 3510)	SOP (based on 608)	w	50 - 150	<30	0.5	4
		SOP (based on 3550)	SOP (based on 8081A)	s	50 - 150	<30	20	4, 7
GC-ECD	Endrin ketone	SOP (based on 3510)	SOP (based on 608)	w	50 - 150	<30	0.5	4
		SOP (based on 3550)	SOP (based on 8081A)	s	50 - 150	<30	20	4, 7

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Pesticides (GC-ECD)
(continued)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
GC-ECD	Heptachlor	SOP (based on 3510)	SOP (based on 608)	w	50 - 150	<30	0.5	4, 5
		SOP (based on 3510)	SOP (based on 608)	w	50 - 150	<30	0.5	4, 5
		SOP (based on 3550)	SOP (based on 8081A)	s	50 - 150	<30	20	4, 5, 7
GC-ECD	Heptachlor epoxide	SOP (based on 3510)	SOP (based on 608)	w	50 - 150	<30	0.5	4
		SOP (based on 3510)	SOP (based on 608)	w	50 - 150	<30	0.5	4
		SOP (based on 3550)	SOP (based on 8081A)	s	50 - 150	<30	20	4, 7
GC-ECD	Isodrin	SOP (based on 3510)	SOP (based on 608)	w	50 - 150	<30	0.5	4
		SOP (based on 3550)	SOP (based on 8081A)	s	50 – 150	<30	20	4,7
GC-ECD	Methoxychlor	SOP (based on 3510)	SOP (based on 608)	w	40 - 160	<30	0.5	4
		SOP (based on 3510)	SOP (based on 608)	w	40 - 160	<30	0.5	4
		SOP (based on 3550)	SOP (based on 8081A)	s	40 - 160	<30	20	4, 7
GC-ECD	Mirex	SOP (based on 3510)	SOP (based on 608)	w	50 - 150	<30	0.5	4
		SOP (based on 3510)	SOP (based on 608)	w	50 - 150	<30	0.5	4
		SOP (based on 3550)	SOP (based on 8081A)	s	50 - 150	<30	20	4, 7

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Pesticides (GC-ECD)
(continued)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
GC-ECD	PCB 1016	SOP (based on 3510) SOP (based on 3550)	SOP (based on 608) SOP (based on 8082)	w s	50 - 150 50 - 150	<30 <30	10 400	4, 5, 7 4, 5, 7
GC-ECD	PCB 1221	SOP (based on 3510) SOP (based on 3550)	SOP (based on 608) SOP (based on 8082)	w s	50 - 150 50 - 150	<30 <30	5 200	4, 5, 7 4, 5, 7
GC-ECD	PCB 1232	SOP (based on 3510) SOP (based on 3550)	SOP (based on 608) SOP (based on 8082)	w s	50 - 150 50 - 150	<30 <30	5 200	4, 5, 7 4, 5, 7
GC-ECD	PCB 1242	SOP (based on 3510) SOP (based on 3550)	SOP (based on 608) SOP (based on 8082)	w s	50 - 150 50 - 150	<30 <30	5 200	4, 5, 7 4, 5, 7
GC-ECD	PCB 1248	SOP (based on 3510) SOP (based on 3550)	SOP (based on 608) SOP (based on 8082)	w s	50 - 150 50 - 150	<30 <30	5 200	4, 5, 7 4, 5, 7
GC-ECD	PCB 1254	SOP (based on 3510) SOP (based on 3550)	SOP (based on 608) SOP (based on 8082)	w s	50 - 150 50 - 150	<30 <30	5 200	4, 5, 7 4, 5, 7
GC-ECD	PCB 1260	SOP (based on 3510) SOP (based on 3550)	SOP (based on 608) SOP (based on 8082)	w s	50 - 150 50 - 150	<30 <30	5 200	4, 5, 7 4, 5, 7
GC-ECD	Toxaphene	SOP (based on 3510) SOP (based on 3550)	SOP (based on 608) SOP (based on 8081A)	w s	50 - 150 50 - 150	<30 <30	10 400	4, 5 4, 5, 7
GC-ECD	Trifluralin	SOP (based on 3510) SOP (based on 3550)	SOP (based on 608) SOP (based on 8081A)	w s	50 - 150 50 - 150	<30 <30	5 200	4 4, 7

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Miscellaneous Pesticides (GC-ECD)
(continued)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
GC ECD	1, 2 Dibromoethane (EDB)	504/8011	504/8011	w	70 - 130	<30	0.02	1
GC ECD	1, 2 Dibromo-3-chloro-propane (DBCP)	504/8011	504/8011	w	70 - 130	<30	0.02	1
GC ECD	1,2,3-Trichloropropane	504/8011	504/8011	w	70 - 130	<30	0.5	1

Table 5.2
QA Targets for Accuracy, Precision and PQL's

Herbicides (GC-ECD)

Analysis Group	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Prec. (% RPD)	PQL (ppb)	Clean-Up
GC-ECD	2,4,5-T	SOP SOP	SOP (based on 615/8151A) SOP (based on 8151A)	w s	50 - 150 50 - 150	<30 <30	2 70	1 1
GC-ECD	2,4,5-TP (Silvex)	SOP SOP	SOP (based on 615/8151A) SOP (based on 8151A)	w s	50 - 150 50 - 150	<30 <30	2 70	1 1
GC-ECD	2,4-D	SOP SOP	SOP (based on 615/8151A) SOP (based on 8151A)	w s	50 - 150 50 - 150	<30 <30	2 70	1 1
GC-ECD	2,4-DB	SOP SOP	SOP (based on 615/8151A) SOP (based on 8151A)	w s	50 - 150 50 - 150	<30 <30	2 70	1 1
GC-ECD	Dalapon	SOP SOP	SOP (based on 615/8151A) SOP (based on 8151A)	w s	50 - 150 50 - 150	<30 <30	2 70	1 1
GC-ECD	Dicamba	SOP SOP	SOP (based on 615/8151A) SOP (based on 8151A)	w ws	50 - 150 50 - 150	<30 <50	2 70	1 1
GC-ECD	Dichloroprop	SOP SOP	SOP (based on 615/8151A) SOP (based on 8151A)	w ws	50 - 150 50 - 150	<30 <50	2 70	1 1
GC-ECD	Dinoseb	SOP SOP	SOP (based on 615/8151A) SOP (based on 8151A)	w s	50 - 150 50 - 150	<30 <30	2 70	1 1
GC-ECD	MCPA	SOP SOP	SOP (based on 615/8151A) SOP (based on 8151A)	w s	50 - 150 50 - 150	<30 <50	2 70	1 1
GC-ECD	MCPP	SOP SOP	SOP (based on 615/8151A) SOP (based on 8151A)	w s	50 - 150 50 - 150	<30 <50	2 70	1 1

KEY TO ANALYTE GROUPS

GROUP	ANALYTE	ANALYTICAL REGIME
ICP-AES	Metals	ICP (radial) Emission Spectroscopy
CVAA	Metals	Cold Vapor
ICP-MS	Metals	ICP Mass Spectroscopy
	Nutrient/Major Ions	Automated Flow Injection
	Nutrient/Major ions	Segmented Flow Analyzer
	Nutrient/Major ions	Wet Chemical Analysis
	Nutrient/Major ions	Gravimetric
	Nutrient/Major ions	Ion Chromatography
	Nutrient/Major ions	Spectrophotometric
	Nutrient/Major ions	Combustion/IR
	Nutrient/Flaspoint	Pensky Marten Tester
	Nutrient/Percent Water	Karl Fisher Titration
VOC GC/MS	Volatiles	GC/MS
BNA GC/MS	Acid Extractables	GC/MS
BNA GC/MS	Base Neutral Extractables	GC/MS
GC	Petroleum-Range Organics	GC/FID
GC-ECD	Pesticides (GC) - Chlorinated	GC/ECD
HPLC	PAH's	HPLC

KEY TO CLEAN - UP PROCEDURES

1. Not applicable.
2. Clean up included in preparation or analysis method.
3. EPA 3660A (Sulfur Clean-Up)
4. EPA 3620 (Florisil).
5. EPA 3665 (H_2SO_4).
6. C18 solid phase extraction.
7. EPA 3640A (Gel Permeation Chromatography).

TABLE 5.3

FIELD QUALITY ASSURANCE OBJECTIVES

PARAMETER	MATRIX	REFERENCE METHOD
Conductivity[1]	*w*	EPA 120.1
pH[1]	*w*	EPA 150.1
Temperature	*all*	EPA 170.1
Turbidity	*w*	EPA 180.1
pH[1]	*w*	SW-846 9040B
pH[1]	*s, ws*	SW-846 9045C
Conductivity[1]	*w*	SW-846 9050A
Dissolved Oxygen	*w*	EPA 360.1

References:

EPA: Methods for Chemical Analysis of Water and Wastes, March 1983, EPA/600/4-79-020.

40 CFR 136, Guidelines Establishing Test Procedures for the Analysis of Pollutants.

SW-846: Test Methods for Evaluating Solid Waste, Third Edition.

6.0 SAMPLING PROCEDURES

6.1 INTRODUCTION

This section will discuss the standard practices and procedures utilized by ESC personnel for site selection and sample collection in various matrices. Also discussed are, field QA/QC procedures, and equipment care and calibration for field sampling activities. Proper collection and handling of samples is of the utmost importance to insure that collected samples are representative of the target matrix. To accomplish this, proper sampling, handling, preservation and quality control techniques for each matrix must be established and strictly followed. Precise identification of the collected samples and field documentation including a complete chain of custody are also vital and will be discussed in detail later in this section.

6.2 LIST OF SAMPLING CAPABILITIES

• Parameter Group	• Sample Source
Extractable Organics	Surface water, wastewater, groundwater, stormwater runoff, drinking water, sediments, soils, chemical/hazardous wastes, domestic wastewater sludges, hazardous waste sludges
Volatile Organic Compounds (VOCs)	Surface water, wastewater, groundwater, stormwater runoff, drinking water, sediments, soils, chemical/hazardous wastes, domestic wastewater sludges, hazardous waste sludges
Metals	Surface water, wastewater, groundwater, stormwater runoff, drinking water, sediments, soils, chemical/hazardous wastes, domestic wastewater sludges, hazardous waste sludges
Inorganic Anions	Surface water, wastewater, groundwater, stormwater runoff, drinking water, sediments, soils, chemical/hazardous wastes, domestic wastewater sludges, hazardous waste sludges
Organics	Surface water, wastewater, groundwater, stormwater runoff, drinking water, sediments, soils, chemical/hazardous wastes, domestic wastewater sludges, hazardous waste sludges

6.2 LIST OF SAMPLING CAPABILITIES (continued)

Parameter Group	Sample Source
Physical Properties	Surface water, wastewater, groundwater, stormwater runoff, drinking water, sediments, soils, chemical/hazardous wastes, domestic wastewater sludges, hazardous waste sludges
Cyanide	Surface water, wastewater, groundwater, stormwater runoff, drinking water, sediments, soils, chemical/hazardous wastes, domestic wastewater sludges, hazardous waste sludges
Microbiology	Surface water, groundwater, drinking water, wastewater
Macroinvertebrate Identification	Surface water, wastewater, sediments
Biotoxicity	Surface water and wastewater

6.3 GENERAL CONSIDERATIONS

The following procedures are used in all of ESC's sampling activities. These procedures must be considered in relation to the objectives and scope of each sampling event.

6.3.1 Selecting a Representative Sampling Site

Selecting a representative sampling site is dependent upon the matrix to be sampled and t|w type of analyses required. These matrix specific procedures are discussed in subsequent sections.

6.3.2 Selection and Proper Preparation of Sampling Equipment

The type of sampling equipment to be used is specific to the sample matrix and the analyses to be conducted. These will be discussed later in this section. Section 6.10 describes the equipment cleaning procedures utilized by ESC personnel.

6.3.3 Sampling Equipment Construction Materials

To prevent direct contamination or cross-contamination of the collected sample, great attention must be given to the construction material of the sampling equipment. Materials used must be inert, non-porous and easy to clean. The desired materials are; Teflon®, glass, stainless steel and plastic. Plastics may not be used for collections where organics are to be analyzed. Stainless steel may not be used where metals are to be analyzed.

6.3.4 Selection of Parameters to be Measured

Parameters to be analyzed are usually dictated by, and based upon, regulated monitoring conditions (NPDES or RCRA permits, for example). If these do no apply, proper analyses will be determined by ESC or the client, based upon federal regulations specific to the matrix being investigated.

6.3.5 Order of Sample Collection

Unless field conditions demand otherwise, the order of sample collection is as follows:

1. Volatile organic compounds (VOCs)
2. Extractable Organics (includes Total Recoverable Petroleum Hydrocarbons [TRPH], Oil & Grease, Pesticides and Herbicides)
3. Total metals
4. Dissolved metals
5. Microbiological
6. Inorganics (includes Nutrients, demands, and Physical Properties)
7. Radionuclides

6.3.6 Special Precautions for Trace Contaminant Sampling

Many contaminants can be detected in the parts per billion and/or parts per trillion range and extreme care must be taken to prevent cross-contamination. Therefore, certain precautions apply where samples are collected for trace contaminants. These precautions are:

- A new pair of disposable latex gloves must be worn at each sampling location.
- Sample containers for samples suspected of containing high concentrations of contaminants shall be sealed in separate plastic bags immediately after collecting and preserving.
- If possible, background samples and source samples should be collected by different field teams. If different field teams cannot be used, all background samples shall be

collected first and placed in separate ice chests or shipping containers. Samples of waste or highly contaminated samples shall not be placed in the same container as environmental samples. Ice chests or shipping containers for source samples or samples suspected to contain high concentrations of contaminants shall be destroyed and discarded after use.

- If possible, one member of the field team should handle all data recording, while the other members collect samples.

- When sampling surface waters, water samples should always be collected before sediment samples are collected.

- Sample collection activities should proceed from the suspected area of least contamination to the suspected area of greatest contamination.

- ESC personnel should use equipment constructed of Teflon®, stainless steel, or glass that has been properly precleaned (Section 6.10) for collecting samples for trace metals or organic compounds analyses. Teflon®, glass, or plastic is preferred for collecting samples where trace metals are of concern. Equipment constructed of plastic or PVC shall not be used to collect samples for trace organic compounds analyses.

- When fuel powered units are utilized, they will be placed downwind and away from any site activities.

- Monitoring wells with free product shall not be sampled for trace contaminate analysis.

6.3.7 Sample Handling and Mixing

Sample handling should be kept to a minimum. ESC personnel must use extreme care to avoid sample contamination. If samples are placed in an ice chest, personnel should ensure that sample containers do not become submerged or tip over as this may result in cross-contamination. Small sample containers (e.g., VOCs or bacterial samples) should be placed in air-tight plastic bags to prevent cross-contamination.

Once a sample has been collected, it may have to be split into separate containers for different analyses. A liquid sample will be split by shaking the container or stirring the sample contents with a clean pipette or precleaned Teflon® rod. Then the contents are alternately poured into respective sample containers. Items used for stirring must be cleaned in accordance with the guidelines set forth in Section 6.10. Samples for VOCs must be collected as direct grabs.

A soil sample may be split but first it must be mixed as thoroughly as possible to ensure a representative sample of the parent material. This is accomplished using the quartering method. The soil is placed in a sample pan and divided into quarters. Each quarter is mixed separately, then all quarters are mixed together. This is repeated several times until the sample is thoroughly mixed. If a round bowl is used for mixing, mixing is achieved by stirring the material in a circular fashion and occasionally turning the material over. Soil and sediment samples collected for volatile organic compounds shall not be mixed. The appropriate sample container should be filled completely with no headspace remaining. Moisture content inversely affects the accuracy of mixing and splitting a soil sample.

6.3.8 Quality Control Samples

Quality control samples must be collected on all sampling projects to demonstrate that the sample materials have not been tainted by sampling equipment, chemical preservatives or procedures relating to the sample collection, transportation and storage. Section 11 provides a full discussion and examples of field and laboratory quality control checks. A summary of the recommended frequency for collecting field quality control samples is presented below.

6.3.8.1 Quality Control Samples

Number of samples	Precleaned equipment blank[1]	Field cleaned equipment blank	Trip blank (VOCs)	Duplicate
10 or more	minimum of 1 then 5%	minimum of 1 then 5%	one per cooler[2]	minimum one then 10%[3]
5 - 9	one	one	NR	one
less than 5	one	one	NR	NR

1 Pre-cleaned blanks are to be collected after the initial decontamination procedure has been completed but before the first sample is collected. Only one pre-cleaned or field-cleaned blank is required if less than 10 samples are collected. Only analyte-free water as defined in this document will be used in the preparation of any field and/or equipment blank.

2 Where VOC methods are analyzed simultaneously, such as 601/602, only one (1) trip blank is required per cooler.

3 Duplicate samples are collected for all VOC samples.

6.3.9 Volatile Organic Compound Sampling

Water samples to be analyzed for volatile organic compounds are collected in pre-labeled 40-ml vials. Prior to leaving the lab, 200 $\mu\ell$ of concentrated HCl is added to each vial. Then Teflon®-silicone septums, Teflon® side to sample, are placed in the caps and the caps screwed into place.

The sampler should check the water to be sampled for chlorine. This is done with starch iodide paper. If no chlorine is found, the vials may be filled. If residual chlorine is present, the following sampling and preservation procedure should be followed:

1. Add one crystal of sodium thiosulfate ($Na_2S_2O_3$) to each vial.
2. Fill the vial to 90% with sample.
3. Add one (1) drop of HCL.
4. Finish filling the vial with sample and cap immediately.

In filling the vial, the sample is poured slowly down the inside wall of the vial until a convex meniscus is formed. Care should be used minimize turbulence. The cap is then applied to the bottle with the Teflon® side of the septum contacting the sample. Some overflow is lost and air space in the bottle should be eliminated. Check for air bubbles by inverting the vial and tapping against the heel of the hand. This will dislodge bubbles hidden in the cap. If any bubbles are present, repeat the procedure. If unsuccessful after three attempts, discard the vial and begin the procedure again with a new vial and septum. At a minimum, duplicate samples should always be collected from each location.

Soil samples for volatile organics analysis should be sampled using tradional core sampling methods. Once the core sample is collected, additional samples should be taken using an Encore™sampler, either 5g or 25g, capped, sealed, and immediately cooled. The holding time for this method is 48 hours. Alternatively, weigh 5g of sample into a pre-weighed vial (with a teflon lined screw cap) containing, 5ml sodium bisulfate solution and a magnetic stir bar, cap, and then ice to 4°C. The holding time for this method is 14 days.

Unless specifically allowed by the regulatory authority, VOC samples (liquid or solid) should never be mixed or composited.

6.3.10 Oil and Grease Sampling

Aqueous samples collected for oil and grease analyses must be collected as discrete grabs. Sample containers should not be rinsed with sample water prior to sample collection. Oil and grease samples should be collected directly in the sample container. Intermediate vessels should only be used where it is impossible to collect the sample directly into the sample container. Only Teflon® beakers should be used for this purpose. Samples should be taken from well mixed areas.

6.3.11 Cyanide Sampling

Cyanide is a very reactive and unstable compound and should be analyzed as soon as possible after collection. Samples shall be collected in polyethylene or glass containers and shall be pretreated and preserved in the manner specified in the following paragraphs.

6.3.11.1 Test for Oxidizing Agents

1. Test the sample with KI-starch indicator paper.
2. Add a few crystals of ascorbic acid and test until negative.
3. Add an additional 0.6 grams of ascorbic acid for each liter sampled to remove residual chlorine.
4. Preserve the pretreated sample by to a pH > 12.0 with NaOH and cool to 4°C. Verify the pH of the samples as per Section 6.12.1.
5. Equipment blanks must be handled in the same manner as described in steps 1 through 4.

6.3.11.2 Test for Sulfide

1. Test the sample for sulfide using the Hach comparator kit.
2. If sulfide is not removed by the procedure below, the sample must be preserved with NaOH to pH > 12.0 and analyzed by the laboratory within 24 hours.
3. Sulfide should be removed by filtering visible particulate. Retain the filter (filter #1).
4. Remove the sulfide by adding lead carbonate powder to the filtrate to cause the sulfide to precipitate out.
5. Test the filtrate for the presence of sulfide. If sulfides are present, repeat steps 1 and 4 until no sulfides are shown present.
6. The precipitate can now be filtered from the sample and this filter can be discarded.
7. The sample is then reconstituted by adding the sediment collected on filter #1 back to the filtrate.

8. Preserve the pretreated sample by to a pH > 12.0 with NaOH and cool to 4°C. Verify the pH of the samples as per Section 6.12.1.

9. Equipment blanks must be handled in the same manner as described in steps 1 through 9.

6.3.12 Biomonitoring Sampling

Aqueous samples collected for Bioassay can be collected in either glass or HDPE plastic. There is no required preservation for this type of sample and the required volume varies independently with each type of test. The samples can be held for a maximum of 36 hours from the time of collection. Grab and composite sample protocols are utilized for acute and chronic bioassays and are chosen according to the permit requirements. Samples should be collected with minimum aeration during collection and the container should be filled with no headspace.

6.3.13 Procedures for Identifying Potentially Hazardous Samples

Any sample either known, or thought, to be hazardous shall be identified as such on the chain of custody. Information explaining the hazard, i.e., corrosive, flammable, poison, etc., shall also be listed.

6.3.14 Collection of Auxiliary Data

All auxiliary data shall be entered in the field records. Auxiliary data relative to a particular sampling location should be recorded concurrent with the sample event. Matrix specific auxiliary data are discussed later in this section.

6.3.15 Time Records

All records of time shall be kept using local time in the military (24 hour) time format and shall be recorded to the nearest minute.

6.3.16 References

ESC maintains copies of the various sampling references in the sample equipment room. Pertinent pages of these documents may be photocopied and taken to the field during sampling investigations. A bibliography of references used in the development of this section is presented in Section 6.15.

6.4 ANCILLARY EQUIPMENT AND SUPPLIES

The equipment used to collect samples and conduct necessary purging activities is listed in subsequent sections for each type of sample. However, Section 6.4.1 lists some of the ancillary field equipment and instruments that may also be required.

6.4.1 Ancillary equipment and supplies

Flow Measurement:	ISCO Continuous Flow Meters 3230, 3210, 2870; Flo-Poke pipe insert
Personal Protective Equipment:	Hard Hats, Face Shields, Half- and Full-Face Respirators, Rubber and Latex Gloves, Tyvex protective coveralls, rubber boots, safety glasses
Field Instruments:	Water Level Indicator, Continuous Recording pH Meter, Portable pH/Temperature Meters, Hach DR-100 Chlorine Analyzer, Hach CEL/700 Portable Laboratory, HYDROLAB Water Quality Continuous Data Logger, HNU Photo Ionization Detector (PID), YSI Field Dissolved Oxygen/Temperature Meter w/ Submersible Probe, Portable Field Specific Conductance Meter, Hach 2100P Portable Turbidimeter
Confined Space Entry:	Gas monitor (CO, H_2S, LEL), Ventilation Blower, Rescue & Retrieval Tripod System
Chemical Supplies & Reagents:	Deionized Water, Tap Water, Liquinox Detergent, Isopropanol, Nitric Acid, Hydrochloric Acid, Sulfuric Acid, Sodium Hydroxide, Ascorbic acid, Sodium Thiosulfate, Ascorbic Acid, Zinc Acetate, pH calibration buffers (4.0, 7.0, and 10.0), Hach Sulfide Kit, lead carbonate powder, Specific Conductance Standard, Turbidity Standards
Tools:	Pipe Wrench, Bung Wrench, Crowbar, Hammer, Assorted Screwdrivers, Tape Measures, Channel Lock Pliers, Vise Grip Pliers, Duct Tape, Vinyl Pull Ties
Miscellaneous:	Cellular Phones, Pagers, Walkie Talkies, 12 Volt Batteries, Flashlights, Extension Cords, Brushes, Plastic sheeting, Fire extinguishers, Water Squeeze Bottles, First Aid Kit, lengths of rigid PVC conduit, aquatic sampling nets (Wildco)

6.5 WASTEWATER SAMPLING

6.5.1 Sampling Equipment

Type	Use	Materials	Permissible Parameter Groups
Continuous Wastewater Samplers-Peristaltic Pump	Sampling	Tygon & silicon rubber tubing; glass or plastic sample container	All parameter groups except oil & grease, extractable organics, and VOCs
	Sampling	Teflon® tubing; glass sample container	All parameter groups except VOCs

6.5.2 General Considerations

The procedures used by ESC are generally those outlined in the NPDES Compliance Inspection Manual. Additional guidance is given in the EPA Handbook for Monitoring Industrial Wastewater. Some important considerations for obtaining a representative wastewater sample include:

- The sample should be collected where the wastewater is well mixed.
- Samples should not be collected directly from the surface or from the bottom of the wastestream.
- In sampling from wide conduits, cross-sectional sampling should be considered.
- If manual compositing is employed, the individual sample bottles must be thoroughly mixed before pouring the individual aliquot into the composite container.

6.5.3 Sampling Site Selection

Wastewater samples should be collected at the location specified in the NPDES or sewer use permit if such exists. If the specified sampling location proves unacceptable, the project manager shall select an appropriate location based upon the site specific conditions. An attempt should be made to contact the regulating authorities for their approval. The potential for this type of problem highlights the need for a site inspection prior to the time scheduled for a sampling event.

6.5.3.1 Influent

Influent wastewaters should be sampled at points of high turbulence and mixing. These points are: (1) the upflow siphon following a comminutor (in absence of grit chamber); (2) the upflow distribution box following pumping from main plant wet well; (3) aerated grit chamber; (4) flume throat; or (5) pump wet well when the pump is operating. Raw wastewater samples should be collected upstream of sidestream returns.

6.5.3.2 Effluent

Effluent samples should be collected at the site specified in the permit or, if no site is specified, at the most representative site downstream from all entering wastewater streams prior to final discharge.

6.5.3.3 Pond and Lagoon Sampling

Composite samples of pond and lagoon effluent are preferred over grabs due to the potential for ponds and lagoons to short circuit their projected flow paths. However, if dye studies or facility data indicate a homogeneous discharge, grab samples may be taken.

6.5.4 Sampling Techniques: General

The choice of a flow-proportional or time-proportional composite sampling program depends upon the variability of flow, equipment availability, sampling point configuration and accessibility. Flow metered sampling is necessary for complete wastewater characterization and should be utilized where possible. Otherwise a time-proportional composite sample is acceptable.

A time-proportional composite sample consists of aliquots collected at constant time intervals and can be collected either manually or with an automatic sampler.

A flow-proportional composite sample consists of aliquots collected automatically at constant flow intervals with an automatic sampler and a flow measuring device. Prior to flow-proportional sampling, the flow measuring system (primary flow device, totalizer, and recorder) should be examined. The sampler may have to install flow measurement instrumentation if automatic sampling is to be used.

6.5.5 Use of Automatic Samplers

6.5.5.1 General

Automatic samplers are used when several points are to be sampled at frequent intervals, with limited personnel, or when a continuous sample is required. Automatic samplers used by ESC must meet the following requirements:

- Must be properly cleaned to avoid cross-contamination from prior sampling events.
- No plastic or metal parts shall come into contact with the sample when parameters to be analyzed could be impacted by these materials.
- Must be able to provide adequate refrigeration. Commercially available ice is placed in the sampler base and packed around the container approximately half way up the sample container.
- Must be able to collect a large enough sample for all required analyses. Composite sample containers (glass or plastic) hold up to 10 liters.
- A minimum of 100 milliliters should be collected each time the sampler is activated.
- Should provide a lift of at least 20 feet and be adjustable so that sample volume is not a function of pumping head.
- Pumping velocity must be adequate to transport solids without settling.
- The intake line must be purged a minimum of one time before each sample is collected.
- The minimum inside diameter of the intake line should be 1/4 inch.
- Have a power source adequate to operate the sampler for 48 hours at 15-minute sampling intervals.
- Facility electrical outlets may be used if available.
- Facility automatic samplers may be used for conventional parameters if they meet ESC QA/QC criteria.

Specific operating instructions, capabilities, capacities, and other pertinent information for automatic samplers presently used by ESC are included in the respective operating manuals and are not presented here.

All data relative to the actual use of automatic equipment on a specific job is recorded on a ESC FIELD SET-UP AND SAMPLE COLLECTION DATA SHEET and submitted to the laboratory and project manager at log-in. This data sheet is part of the permanent chain of custody.

6.5.5.2 Equipment Installation

6.5.5.2.1 Conventional Sampling

Automatic samplers may be used to collect time-proportional composite or flow-proportional composite samples. In the flow-proportional mode, the samplers are activated by a compatible flow meter. Flow-proportional samples can also be collected using a discrete sampler and a flow recorder and manually compositing the individual aliquots in flow-proportional amounts.

Installation procedures include cutting and installing the proper length of tubing, positioning it in the wastewater stream, and sampler programming. All new tubing (Dow® Corning Medical Grade Silastic, or equal, in the pump and Tygon®, or equal, in the sample train) will be used for each sampler installation.

For a time-proportional composite, the sampler should be programmed to collect 100 ml samples at 15-minute intervals into a refrigerated 10 liter plastic or glass jug, as appropriate for the particular parameters being analyzed.

For a flow-proportional composite, the sampler should be programmed to collect a minimum of 100 mls for each sample interval. The sampling interval should be based on the flow of the waste stream.

6.5.5.3 Automatic Sampler Maintenance, Calibration, and Quality Control

To ensure proper operation of automatic samplers, the procedures outlined in this section shall be used to maintain and calibrate ESC automatic samplers. Any variance from these procedures will be documented.

Proper sampler operation will be checked by ESC personnel prior to each sampling event. This includes checking operation through three cycles of purge-pump-purge;

checking desiccant and replacing if necessary; checking charge date on NiCad batteries to be used; and repairing or replacing any damaged items.

Prior to initiating sampling, the purge-pump-purge cycle shall be checked at least once. The sample volume will be calibrated using a graduated cylinder at least twice, and the flow pacer that activates the sampler shall be checked to be sure it operates properly.

Upon return from a field trip, the sampler shall be examined for damage. The operation will be checked and any required repairs will be made and documented. The sampler will then be cleaned as outlined in Section 6.10.

6.5.6 Manual Sampling

Manual sampling is normally used for collecting grab samples and for immediate in-situ field analyses. Manual sampling may also be used when it is necessary to evaluate unusual waste stream conditions. If possible, manually collected samples should be collected in the actual sample container that will be submitted to the laboratory. This minimizes the possibility of contamination from an intermediate collection container.

Manual samples are collected by (1) submerging the container neck first into the water; (2) inverting the bottle so that the neck is upright and pointing into the direction of wastewater flow; (3) quickly returning the sample container to the surface; (4) shake to rinse. Pour the contents out downstream of sample location; (5) collect sample as described in steps 1, 2, and 3; pour out a few mls of sample downstream of sample collection. This allows for addition of preservatives and sample expansion.

Exceptions to the above procedure occur when preservatives are present in the sampling container or when oil & grease, microbiological, and/or VOC analyses are needed. In these cases, sample shall be collected directly into the container with no pre-rinsing.

If the water or wastewater stream cannot be physically or safely reached, an intermediate collection container may be used. This container must be properly cleaned (Section 6.10) and made of an acceptable material. A separate collection container should be used at each sampling station to prevent cross-contamination between stations. The sample is collected by lowering a properly cleaned Teflon®, plastic, or glass collection vessel into the waste stream. The intermediate vessel may be lowered by hand, pole or rope.

6.5.7 Special Sample Collection Procedures

6.5.7.1 Trace Organic Compounds and Metals

Due to the ability to detect trace organic compounds and metals in extremely low concentrations, care must be taken to avoid contamination of the sample. All containers, composite bottles, tubing, etc., used in sample collection for trace organic compounds and metals analyses should be prepared as described in Section 6.10.

Personnel handling the sample should wear a new pair of disposable latex gloves with each set of samples collected to prevent cross-contamination. A more detailed discussion is given in Section 6.3.6 under special precautions for trace contaminant sampling.

FIGURE 6.1

ENVIRONMENTAL SCIENCE CORPORATION
FIELD SAMPLING SET-UP AND COLLECTION DATA SHEET

SET-UP DATA

Client: _____ Regulating authority _____

Date & Time: Set-up ___/___/___@_____ Tear-down ___/___/___@_____ By _____

Primary device _____ Level: On _____ft. Off _____ft. Flow: On _____GPM Off _____GPM

Sampler type _____ Head ____ft. Tubing length ____ft. Power Source: AC ____ Battery ____
Sampler base filled with ice _____ Pump tubing in centering screen _____ Composite bottle in position ____

Flowmeter type _____ Sample Vol/Mode: Time ____ml/____min. Flow ____ml/____gal.
Flowmeter configured ___ Sampler enable on ___ Report generation on ___ Totalizer zeroed ___ Started _____
Flowmeter/Sampler synchronization: Flowmeter to pulse every _____Gal; Sampler to collect every _____pulse(s)
Flowmeter coupled to sampler ____ Ultrasonic installed properly ____ Bubbler tubing installed properly ___

Sampler configured ____ Calibrated to pull _____ml Started ____ First sample pulled at _____
Initial watermeter reading _____Gal\ft ^{3} Initial flowmeter reading _____Gal

Answer all questions with a check for yes or an X for not applicable

COLLECTION DATA

Final watermeter reading _____Gal\ft ^{3} Final flowmeter reading _____Gal

Initial watermeter reading _____Gal\ft ^{3} Initial flowmeter reading _____Gal

Total 24-hour flow _____ft ^{3} Total 24-hour flow _____Gal(7.48 X ft ^{3} = Gal)

Composite volume collected _____(approx. liters) Number of samples collected _____(Given by sampler)

All composite sample bottles filled and preserved _____ All grab sample bottles filled and preserved _____
pH meter calibrated with: pH 4 ____ pH 7 ____ pH 10 ____ Conductivity meter cal at 1,000 micromho/cm _____

D.O. meter air calibrated to _____ppm _____°C Electronic Thermometer cal to _____°C on ___/___/___

On site: pH _____S.U. Temperature _____°C Conductivity _____micromho/cm Dissolved Oxygen _____ppm

Answer all questions with a check for yes or an X for not applicable

MISCELLANEOUS INFORMATION

Photo or Diagram of location and placement of equipment on back if required

I, _____, certify all of the above information to be correct and accurate to the best of my knowledge.

6.5.7.2 Bacterial Analysis

Samples for bacterial analysis will always be collected directly into the prepared glass or plastic sample bottle. The sample bottle should be kept closed until actual filling and never rinsed with sample. When the container is opened, care should be taken not to contaminate the cap or the inside of the bottle. The bottle should be held near the base and plunged, neck downward, below the surface and turned until the neck points upward and upstream. The bottle should be filled to within one-inch of the top and capped immediately.

Section 6.13 presents preservation procedures and holding times. As holding times are limited to 6 hours for microbiological analyses, special arrangements may be required to ensure that these samples reach a laboratory within this period.

6.5.7.3 Immiscible Liquids/Oil and Grease

Oil and grease may be present in wastewater as a surface film, emulsion, solution, or a combination of these forms. A representative sample for oil and grease analysis is difficult to collect. The sampler must carefully evaluate the location of the sampling point to find and area of greatest mixing. Quiescent areas should be avoided.

Because losses of oil and grease will occur on sampling equipment, collection by composite sampler is impractical. Intermediate sampling vessels should not be used if possible. If intermediate collection vessels are required they should be made of Teflon® and be rinsed with sample three times before transferring any sample to the sample container. Sample containers, however, should never be rinsed.

6.5.7.4 Volatile Organic Compounds Analyses

Water samples to be analyzed for volatile organic compounds are collected in 40-ml prepreserved (200$\mu\ell$ of concentrated HCl) vials with screw caps. Teflon®-silicone septums are placed in the caps in the laboratory prior to the sampling event. The Teflon® side must be facing the sample side.

Sampling containers with preservatives are prelabeled prior to any field activities to reduce the chances of confusion during sampling activities. A complete list of sample preservatives, containers, holding times, and volumes is found in Section 6.12.

The sampler should check the water to be sampled for chlorine. This is done with starch iodide paper. If no chlorine is found, the vials may be filled. If residual

chlorine is present, the sampling and preservation procedures listed in Section 6.3.9 of this manual.

6.5.8 Auxiliary Data Collection

While conducting wastewater sampling, the following information may also be gathered:

- Field measurements -- pH, DO, conductivity, temperature (see Section 9.6 for standard field analytical techniques)
- Flows associated with the samples collected -- continuous flows with composite samples and instantaneous flows with grab samples
- Diagrams and/or written descriptions of the sample locations
- Photographs of pertinent wastewater-associated equipment, such as flow measuring devices, treatment units, etc.
- Completion of applicable forms required during specific investigations.

All observations, measurements, diagrams, etc., will be entered in field logbooks or attached thereto.

6.6 SURFACE WATER AND SEDIMENT SAMPLING

6.6.1 Equipment

Equipment Type	Use	Material	Permissible Parameter Groups
Surface Water Sampling			
Kemmerer Sampler	Depth sampling	PVC	All parameter groups except extractable organics, VOCs, and oil & grease
Automatic Samplers	Sampling	Teflon®	All parameter groups except VOCs, oil & grease, & micro
	Sampling	PVC	All parameter groups except extractable organics, VOCs, oil & grease, and micro
Sample Collection Container	Sampling	Stainless steel	All parameter groups
Bailers	Sampling	Teflon®	All parameter groups
	Sampling	PVC	All parameter groups except extractable organics, VOCs, and oil & grease
Sediment Sampling			
Hand Augers	Sampling	Carbon Steel	Demands, nutrients, and extractable organics (for hard packed soils only)
Sediment Core Sampler	Sampling	Stainless Steel, Teflon®	All parameter groups
Encore™	Sampling	Teflon®	VOC Sediment/soil
Scoops	Sampling	Teflon® coated	All parameter groups
Mixing Bowl	Compositing	Glass	All parameter groups except VOCs
Spoons, spatula	Sampling, compositing	Stainless Steel	All parameter groups

6.6.2 General

Selection of surface water sampling locations for water quality studies are determined by the objective of the study and waterway type. Factors that impact and alter water quality and characteristics (dams, bridges, discharges, etc.), must be considered. Accessibility to a sample site is also important.

6.6.3 Sample Site Selection

Fresh water environments are commonly divided into two types: (1) rivers, streams, and creeks; and (2) lakes, ponds, and impoundments. Since these waterways differ considerably in general characteristics, site selection must be adapted to each.

Prior to conducting a sampling event, an initial survey should be conducted to locate prime sampling points. Bridges and piers provide ready access to sampling points across a body of water. However, they should only be used when at acceptable locations and are found not to be detrimentally impacting stream characteristics.

If wading for water samples must be done, caution should be used to avoid disturbing bottom deposits which could result in increased sediment in the sample. Wadeable areas may be best for sediment sampling.

6.6.3.1 Rivers, Streams, and Creeks

Sampling sites should be located in areas possessing the greatest degree of cross-sectional homogeneity. Such points are easily found directly downstream of a riffle or rapid. These locations are also good for sediment sampling. In the absence of turbulent areas, a site that is clear of immediate point sources, such as tributaries and effluent discharges, may be used.

Typical sediment deposition areas are located at the inside of river bends and downstream of islands or other obstructions. Sites immediately upstream or downstream from the confluence of two streams or rivers should be avoided due to inadequate mixing of the combining flows. Also, backflow can upset normal flow patterns.

Great attention should be given to site selection along a stream reach:

- Sites should be spaced at intervals based on time-of-water-travel. Sampling sites may be located about one-half day time-of-water-travel for the first three days downstream of a waste source for the first six sites and then approximately one day for the remaining distance.

- If the study data is to be compared to previous study data, the same sampling sites should be used.

- Sites should be located at marked physical changes in the stream channel.

- Site locations should isolate major discharges as well as major tributaries.

Dams and weirs usually create quiet, deep pools in river reaches that would otherwise be swift and shallow. When times of travel through them are long, sites should be established within them.

Some structures, such as dams, permit overflow that may cause significant reaeration of oxygen deficient water. Sites should be located short distances upstream and downstream of these structures to measure the rapid, artificial increase in dissolved oxygen (DO), which is not representative of natural reaeration.

A minimum of three sites should be located between any two points of major change in a stream, even if the time-of-travel between the points of change is short. Major changes include, but are not limited to, a waste discharge, a tributary inflow, or a significant change in channel characteristics. Sampling three sites is also important when testing rates of change of unstable constituents. Results from two of three sites will usually support each other and indicate the true pattern of water quality in the sampled zone. If the effects of certain discharges or tributary streams of interest, sites should be located both upstream and downstream of these points.

Due to the tendency of the influent from a waste discharge or tributary to slowly mix, cross-channel, with the main stream, it is nearly impossible to measure their effect immediately downstream of the source. Thus, samples from quarter points may miss the wastes and only indicate the quality of water above the waste source. Conversely, samples taken directly in the stream portion containing the wastes would indicate excessive effects of the wastes with respect to the river as a whole.

Tributaries should be sampled as near the mouth as possible. Often, these may be entered from the main stream for sampling by boat. Care should be taken to avoid collecting water from the main stream that may flow back into the tributary as a result of density differences created by temperature, salinity, or turbidity differences.

Actual sampling locations will vary with the size and amount of turbulence in the stream or river. Generally, with streams less than 20 feet wide, well mixed areas and sampling sites are readily found. In such areas, a single grab sample taken at mid-depth at the center of the channel is adequate. A sediment sample can also be collected at the center of the channel. For slightly larger streams, at least one vertical composite should be taken from mid-stream. It should be composed of at least one sub-surface, mid-depth, and above the bottom sample. DO, pH, temperature, conductivity, etc. should be measured on each aliquot of the vertical composite. Several locations should be sampled across the channel width on the larger rivers. Vertical composites across the channel width should be located proportional to flow, i.e., closer together toward mid-channel where flow is greater and less toward the banks where the flow proportionally lower. The number of vertical composites and depths sampled for each area shall be determined by the field crew. They should base their decisions utilizing two considerations.

1. The larger the number of subsamples, the more nearly the composite sample will represent the water body.

2. Taking subsamples is time consuming and expensive, and increases the chance of contamination.

A number of sediment samples should be collected along a cross-section of a river or stream to adequately characterize the bed material. The normal procedure is to sample at quarter points along the cross-section of the site. When the sampling technique or equipment requires that the samples be extruded or transferred at the site, they can be combined into a single composite sample. However, samples of dissimilar composition should not be combined. They should be kept separate for analysis in the laboratory. To ensure representative samples, coring tubes are employed. The quantity of each subsample that is composited shall be recorded.

6.6.3.2 Lakes, Ponds, and Impoundments

Lakes, ponds, and impoundments have a much greater tendency to stratify than rivers and streams. This lack of mixing requires that more samples be obtained from the different strata. Occasionally, extreme turbidity differences occur vertically where a highly turbid river enters a lake. This stratification is caused by temperature differences where the cooler, heavier river water flows beneath the warmer lake water. A temperature profile of the water column and visual observation of lake samples can detect these layers. Each layer of the stratified water column should be sampled.

The number of sampling sites on a lake, pond, or impoundment is determined by the objectives of the investigation dimensions of the basin. In small bodies of water, a single vertical composite at the deepest point may be sufficient. DO, pH, temperature, etc., is to be conducted on each vertical composite aliquot. In naturally formed ponds, the deepest point is usually near the center; in impoundments, the deepest point is usually near the dam.

In lakes and larger impoundments, several vertical subsamples should be composited to form a single sample. These vertical sampling locations should be along a transect or grid. Here too, the number of vertical subsamples and sample depths for each area shall be determined by the field crew. In some cases, separate composites of epilimnetic and hypolimnetic zones may be required. Additional separate composite samples may be needed to adequately represent water quality in a lake possessing an irregular shape or numerous bays and coves, . Additional samples should always be taken where discharges, tributaries, agriculture, and other such factors are suspected of influencing water quality.

When collecting sediment samples in lakes, pond, and reservoirs, the sample site should be as near as possible to the center of water mass, especially for impoundments of rivers or streams. Generally, coarser grained sediments are deposited at the headwaters of a reservoir, and the finer sediments are near the center. The shape, inflow pattern, bathymetry, and circulation affect the location of sediment sampling sites in large bodies of water.

6.6.3.3 Control Sites

The collection of samples from control sites is necessary to compile a basis of comparison of water quality. A control site above the point of interest is as important as the sites below, and must be chosen with equal care. Two or three sites above the waste inflow may be necessary to establish the rate at which any unstable material is changing. The time of travel between the sites should be sufficient to permit accurate measurement of the change in the material under consideration.

6.6.4 Sampling Equipment and Techniques

6.6.4.1 General

Any equipment or sampling techniques used to collect a sample must not alter the integrity of the sample and must be capable of providing a representative sample.

6.6.4.2 Water Sampling Equipment/Techniques

The physical location of the collector will dictate the type of equipment needed to collect samples. Surface water samples may be collected directly into the sample container when possible. Pre-preserved sample containers shall never be used as intermediate collection containers. Samples collected in this manner shall use the methods specified in Section 6.5.6 of this manual. If wading into the stream is required, care should be taken not to disturb bottom deposits which could be collected and bias the sample. Also, the sample should be collected directly into the sample bottle and **upcurrent** of the wader. If wading is not possible or the sample must be collected from more than one depth, additional sampling equipment may be used. If sampling from a power boat, samples must be collected upwind and upstream of the motor.

6.6.4.2.1 Sampling Procedure Using a Teflon® or PVC Bailer

If data requirements of surface water sampling do not necessitate sampling from a strictly discrete interval of the water column, Teflon® or PVC constructed bailers can be used for sampling. The type bailer used is dependent on the analytical requirements. A closed top bailer utilizing a bottom check valve will be sufficient for many surface water studies. Water is continually displaced through the bailer as

it is lowered down through the water column until the specified depth is attained. At this point, the bailer is retrieved back to the surface. There is the possibility of contamination to the bailer as it is lowered through the upper water layers. Also, this method may not be successful in situations where strong currents are found or where a discrete sample at a specified depth is needed.

If depth specific, discrete samples are needed, and the parameters do not require Teflon® coated sampling equipment, a standard Kemmerer sampler may be used. A plastic bucket can also be used to collect surface samples if parameters to be analyzed do not preclude its use. The bucket shall always be rinsed twice with the sample water prior to collection and the rinse water be disposed of downstream from the sample collection point. All field equipment will be cleaned using standard cleaning procedures.

6.6.4.2.2 Sampling Procedure Using a Kemmerer Sampler

Due to the PVC construction of the Kemmerer sampler, it shall not be used to collect samples for extractable organics, VOCs, and/or oil & grease analysis. The general collection procedure is as follows:

1. Securely attach a suitable line to the Kemmerer bottle.
2. Lock stoppers located at each end of the bottle on the open position. This allows the water to be drawn around the bottom end seal and into the cylinder at the specified depth.
3. The bottle is now in the set position. A separate "messenger" is required to activate the trip mechanism which releases the stopper and closes the bottle.
4. When the bottle is lowered to the desired depth, the messenger is dropped. This unlocks the trip mechanism and forces the closing of both end seals.
5. Raise the sampler, open one of the end seal, and carefully transfer the sample to the appropriate sample container.

6.6.4.2.3 Sampling Procedures Using Sample Collection Containers

In most cases, sample collection containers are used to collect surface water from easily accessible sampling points. This means that the sample is collected manually, always upstream of the sampling person's position. An extension may be added to the container to make the sampling point more accessible for manual sampling. Extensions can be constructed of aluminum, PVC, steel, or any other suitable material. The sample container is normally attached to the extension using a clamp, vinyl pull ties, or duct tape. Samples collected in this way are done so in the following manner:

1. Place the inverted sample container into the water and lower to the desired depth. Never use a pre-preserved container as an intermediate sample collection device.
2. Reinvert the container with the mouth facing into the direction of flow and at the appropriate depth to collect the desired sample.
3. Carefully raise the container to the surface and transfer to the appropriate container.

6.6.4.3 Sediment Sampling Equipment/Techniques

A variety of methods can be used to collect sediment samples from a streambed. ESC utilizes corers and scoops. Precautions must be taken to ensure that the sample collected is representative of the streambed. These methods are discussed in the following paragraphs.

6.6.4.3.1 Sediment Core Samplers

Core sampling is used to collect vertical columns of sediment from the stream or lake bed. Many types of coring devices are available for use depending on the depth of water from which the sample is obtained, the type of bottom material, and the length of the core to be collected. Some devices are weight or gravity driven while others are simple hand push tubes. These devices minimize the loss of fine particles and should always be used when collecting sediment samples from flowing waters.

Coring devices are particularly useful in pollutant monitoring because the shock wave created by sampler descent is minimized and the fines at the sediment-water interface are only slightly disturbed. The sample can be withdrawn primarily intact removing only the layers of interest. Core liners manufactured of Teflon® or plastic can be purchased. These liners reduce the possibility of contamination and can be delivered to the laboratory in the tube they were collected in. Coring devices sample small surface areas and small sample sizes and often require repetitive sampling to obtain a sufficient amount of sample. This is the primary disadvantage to these devices but they are recommended in the sampling of sediments for trace organic compounds or for metals analyses.

When sampling sediments in wadeable water, the direct use of a core liner is recommended. Stainless steel push tubes are also used because they provide a better cutting edge and higher tensile strength than Teflon® or plastic. One advantage to using the Teflon® or plastic tubes is the elimination of possible metals contamination of the sample from the core barrels or cutting heads. The length of the corer tube should correspond to the desired depth of the layer being sampled. In general, soft sediments adhere better to the inside of the tube and a larger diameter

tube can be used. Coarser sediments require the use of a smaller diameter tube of two inches or less to prevent the sample from falling out of the tube. The inside bottom wall of the tube can be filed down to allow easier entry into the substrate.

When samples are obtained by wading, caution should be used to minimize disturbance in the area sampled. Core tubes are pushed directly down into softer substrates until four inches or less of the tube is above the sediment-water interface. A slight rotation of the tube may be necessary to facilitate ease of entry into harder substrates and reduce compaction of the sample. The tube is then capped and slowly extracted and the bottom of the corer is capped before it is pulled above the water surface.

Subsampling is performed for VOC sample collection using an Encore™ sampling device. This device is used to collect soil/sediment samples, while preventing container headspace. Once the core sample is collected, additional samples should be taken using an Encore™sampler, either 5g or 25g, capped, sealed, and immediately cooled to 4°C. The holding time for this method is 48 hours. Alternatively, weigh 5g of sample into a pre-weighed vial (with a teflon lined screw cap) containing, 5ml sodium bisulfate solution and a magnetic stir bar, cap, and then ice to 4°C. The holding time for this method is 14 days.

6.6.4.3.2 Scooping Samples

The easiest and quickest way to collect a sediment sample in wadeable water is with a Teflon® coated scoop or stainless steel spoon. This type of sampling should be limited to quiescent (i.e., non-flowing) waters such as lakes or reservoirs.

6.6.4.3.3 Mixing

As specified in Section 6.3.7., sediment samples collected for chemical analysis should be thoroughly mixed (except for volatile organic compounds analysis) before being placed in the sample containers.

6.6.5 Special Sample Collection Techniques

6.6.5.1 Trace Organic Compounds and Metals

Samples for trace pollutant analyses in surface water should be collected by dipping the sample containers directly into the water . Sometimes samples are to split for enforcement or quality control purposes. A sufficient volume for all sample containers should be collected in a large glass container and then, while mixing, be alternately dispensed into the appropriate sample bottles. This cannot be done for volatile organic compound samples.

Only Teflon® or stainless steel should be used in sediment sampling for trace contaminant analyses. Teflon® coring tubes are the preferred technique.

6.6.5.2 Bacterial Analysis

Samples for bacteriological examination must be collected in sterilized bottles and protected against contamination. The sample is preferably collected directly into the sample bottle. This is done by holding the bottle near the base and plunging, neck downward, below the surface. The container is then turned with the neck pointed slightly upward and the mouth directed toward the current. The bottle is filled to about 1/2 inch from the top and recapped immediately. While the bottle is open, extreme care should be used to protect both the bottle and stopper against contamination. The 1/2 inch air space is left in the bottle to facilitate subsequent shaking in the laboratory.

If sampling with an intermediate sampling device (i.e., bailer), the device shall be thoroughly rinsed with sample water prior to collecting the sample. This is the reason microbiological samples are among the final samples collected from a sampling location. Begin pouring sample out of the sampling device before collecting into the sterilized container. Continue pouring sample out of the device, place the container under the flowing stream, and fill the container to 1/2 inch from the top. Flow should remain continuous before and during the filling process.

When sampling from a bridge, the sterilized sample bottle can be weighted and lowered to the water on a rope. Collectors must be careful not to dislodge debris from the bridge that could fall into the bottle.

6.6.6 Auxiliary Data Collection

A field log book will be used to record data pertinent to the sampling activities. This data shall describe all sampling locations and techniques, list photographs taken, visual observations, etc. Visual observations of sample site conditions, weather and overall stream conditions, recorded during the investigation can be valuable in interpreting water quality study results.

6.6.7 Split and Duplicate Sample Collection

The splitting of samples is utilized to measure any variability between laboratories and are collected as subsamples of a single sample. This is unlike duplicate samples which are collected to measure any variability in the sampling and analytical methods of an individual lab. Duplicate samples are collected in close succession as subsamples of a single sample.

6.6.7.1 Split Sample Collection

Split samples are collected as follows:

1. Sample must be collected in a properly cleaned container composed of acceptable materials. Sample should be more than twice the volume required for one sample.

2. Add appropriate preservative where required.

3. Mix thoroughly.

4. Alternately, decant sample into subsample containers in increments of approximately 10 percent of total subsample volume until full.

5. Seal the sample containers with appropriate, airtight caps.

6. Label each sample container with a field number and complete a chain of custody.

NOTE: Volatile organic samples shall not be collected in this manner. Samples for VOC's must be collected as simultaneous, discrete grab samples.

6.6.7.2 Duplicate Sample Collection

1. Collect two samples in rapid succession.

2. Preserve where required.

3. Mix thoroughly.

4. Seal the sample containers with appropriate, airtight caps.

5. Label each sample container with a field number and complete a chain of custody.

6.7 GROUNDWATER AND DRINKING WATER SAMPLING

6.7.1 Groundwater and Drinking Water Sampling Equipment

Equipment type	Purpose	Component(s)	Allowable Parameter Groups
Bailers (disposable and non-disposable)	Purging	Teflon® & SS	All parameter groups
	Sampling	Teflon®	All parameter groups
Peristaltic Pump [1]	Purging[2]	Tygon Tubing	All parameter groups except organics ,voc's, & extractables
	Purging	Teflon®	All parameter groups
		Silastic Rubber	All parameter groups except except organics, voc's, & extractables
ISCO Bladder Pump [3]	Sampling	Stainless Steel, Teflon® & Silicone-Rubber	All parameter groups except except organics, voc's, & extractables

1 New or dedicated tubing must be used at individual monitoring well sites.
2 If sample is not collected immediately after evacuation, tubing shall be withdrawn from the well prior to pump being turned off to prevent backflowing into the well.
3 Pump will be cleaned after each use.

6.7.2 General Groundwater Sampling

Groundwater sampling is necessary for a number of purposes. This includes, but is not limited to, evaluating potable or industrial water sources, mapping contaminant plume movement at a land disposal or spill site, RCRA compliance monitoring (landfills), or examining a site where groundwater contamination may have or may be occurring.

Normally, groundwater is sampled from a permanent monitoring well. However, this does not exclude collection of samples from a sinkhole, pit, or other drilling or digging site where groundwater is present.

Monitoring wells are not always at the optimum location to collect samples for the purpose they are needed. In these situations, additional wells may need to be drilled. Experienced, knowledgeable individuals (hydrologists, geologists) are needed to site the well and oversee its installation so that representative samples of the groundwater can be collected.

ESC utilizes the procedures being reviewed in this section. Further guidance is available in the RCRA Groundwater Monitoring Technical Enforcement Guidance Document (TEGD); ESC field personnel will at a minimum meet, and when possible exceed, the requirements of this document.

6.7.3 Measurement of Well Water Level and Stagnant Water Volume Calculation

The sampling and analysis plan provide for measurement of standing water levels in each well prior to each sampling event. Field measurements will include depth to standing water surface and total depth of the well. This data will then be utilized to calculate the volume of stagnant water in the well and provide a check on the integrity of the well (e.g., siltation problems). The measurement should be taken to 0.01 foot when possible. A battery powered level sensor will be used to measure depth to the surface of the groundwater. Equipment shall be constructed of inert materials and will be cleaned per sample equipment cleaning procedures prior to use at another well. Field data will be recorded on the Monitoring Well Data Sheet (Figure 6.2).

6.7.3.1 Procedure For Water Level Measurement

1. Clear debris from area around well (lay plastic sheathing around well pad as an option).

2. Remove protective casing lid.

3. Open monitoring well lid.

4. Lower the clean water level indicator probe down into the well. A beep will sound upon contact with the water surface. False readings can be made from the wetted side of the well so it will be necessary to check the level several times until a consistent reading is achieved. Record the distance (to the nearest 0.01 ft.) from the top of the well casing to the water surface on the Monitoring Well Data Sheet.

5. Continue to lower the probe until it reaches the well bottom. Record the distance (to the nearest 0.01 ft) from the top of the well casing to the bottom of the well on the Monitoring Well Data Sheet.

6. All water level and well depth measurements shall be made from the top of the well casing unless specified otherwise by the project manager or DER.

7. The wetted depth is obtained by subtracting total well depth from the surface level depth.

6.7.3.2 Calculating Water Volume

Total volume of standing water in a well is calculated by the following formula:

$$V = \pi r^2 h \times 7.48 \text{ gallons/ft}^3$$

where;

V	=	volume of standing water in the well (gallons)
r	=	radius of well (ft)
h	=	depth of water column in the well (ft)
π	=	3.14
7.48	=	conversion factor

6.7.4 Well Evacuation: Wells Without In-Place Plumbing

Water standing in a well may not be representative of actual groundwater conditions. The standing water in a well should be removed to allow representative formation water to supplant the stagnant water. The evacuation method depends on the hydraulic characteristics of the well but the following general rules apply.

The total amount of water purged must be recorded. Therefore, the volume must be measured during the purging operation. This may be determined by:

1. Collecting the water in a graduated or known volume container (i.e., bucket);

2. Calculate the volume based on the pump rate. pump rate may not be constant and field personnel should be aware of this;

3. Record the time that the actual purging begins in the field record.

Purging is considered complete if any one of the following criteria is satisfied:

1. Three well volumes are purged and field parameters (pH, temperature, conductivity) stabilize within 5% in consecutive readings at least 5 minutes apart. If field parameters have not stabilized after 5 well volumes, the purging is considered complete and sampling can begin.

2. Five well volumes are purged with no monitoring of field parameters.

3. At least one fully dry purge. A second dry purge may be necessary in some situations.

FIGURE 6.2
MONITORING WELL DATA SHEET

Site location: _____

ESC Project name/#: _____

Well Number	Depth to water surface (ft)	Depth to bottom of well (ft)	Length of water column (ft)	Volume of water evacuated (gal)	Time/date

Well Number	Temperature (°F)	pH (S.U.)	Conductivity (Tmho/cm)	Time/Date

Well casing material / diameter: _____

Sampled by / signature: _____

NOTES / CALCULATIONS: _____

Except for low recovery wells, all wells shall be sampled within 6 hours of purging. Low recovery wells may be sampled as soon as sufficient sample matrix is available or up to 10 hours after purging. Wells that do not recover sufficiently within 10 hours should not be sampled.

Purging equipment includes Teflon® or stainless steel bailers or a peristaltic pump. Any fuel-powered pumping units shall be placed downwind of any sampling site. If purging equipment is reused, it shall be cleaned following standard procedures. Disposable latex gloves shall be worn by sampling personnel and changed prior to starting work at each sampling site.

If bailed water is determined to be hazardous, it should be disposed of in an appropriate manner.

The Florida Department of Environmental Regulation requires that during purging of the well, the purging device should be placed just below the surface of the water level and be lowered with the falling water level. For high yield wells, three casing volumes should be evacuated prior to collecting samples. Purging should be conducted at a rate to minimize agitation of the recharge water. Conductivity, pH, and temperature during purging is necessary to monitor variability of the groundwater. **Samples should be collected within 6 hours of purging high yield wells.**

Low-yield wells (incapable of yielding three casing volumes) should be evacuated to dryness at a rate that does not cause turbulence. When the well recovers sufficiently, the first sample should be tested for pH, temperature, and conductivity. When recovery exceeds two hours, the sample should be collected as soon as sufficient volume is available. **If recovery is longer than 10 hours, the well should not be tested.** The project manager may wish to review available information to determine if obtaining a representative sample is possible.

6.7.4.1 Procedure for Well Evacuation: Teflon® Bailer

1. Clear the area around the well pad; cover with plastic if necessary.
2. Slowly lower the bailer to the water surface and remove it when full.
3. Reel or pull bailer to the surface using precaution to not allow the lanyard (cable or string) to touch the ground.
4. Use the bailer volume and number of bails removed to determine volume of water removed. Hazardous material should be poured into a container for later disposal.
5. Repeat steps 2 and 3 until 1.5 well volumes have been removed.

6. Begin monitoring for pH, temperature, and conductivity. Record on Monitoring Well Data Sheet. Discard the sample into the collection pail. Purge until the change between samples of each parameter is less than 5 percent.

7. Continue until at least three well volumes have been evacuated and the parameters pH, temperature, and conductivity are within 5 percent, or until a low yield well has been evacuated to dryness.

8. Record date and time the well was purged on the Monitoring Well Data Sheet.

NOTE: For wells sampled in the State of Florida, three well volumes will be purged prior to pH, temperature, and conductivity screening. Following evacuation of three well volumes, purge water will be screened for these parameters at regular intervals until two consecutive measurements are within 5 percent. The intervals may be time-based (at least 5 min) or represent a portion of the well volume (at least 0.5 well volume)

Compliance with more stringent local, State, or Regional guidelines will be maintained where required.

6.7.4.2 Procedure for Well Evacuation: Peristaltic Pump

1. Clean area around the well pad.

2. Install the appropriate length of Tygon or Teflon® tubing into the pump mechanism.

3. Insert the uncontaminated sampling end of the tubing into the well surface.

4. Connect the pump to power supply.

5. Operate the pump at a rate which does not cause excessive agitation of the replacement water.

6. Determine the pump flow rate.

7. Purge until 1.5 well volumes have been evacuated.

8. Collect samples at a rate of one per well volume evacuated. Monitor these samples for pH, temperature, and conductivity. Record these measurements on the Monitoring Well Data Sheet. Monitor until the difference in each parameter is less than 5 percent.

9. Continue purging until three well volumes have been evacuated and the parameters pH, temperature, and conductivity are within 5 percent, or until a low yield well has been evacuated to dryness.

10. Record the date and time the well was purged on the Well Sampling Field Data Sheet.

6.7.5 Purging Techniques: Wells With In-Place Plumbing

6.7.5.1 General

The volume to be purged is dependent on whether the pumps are running continuously or intermittently and how close to the source samples can be collected. If storage/pressure tanks are present, a volume must be purged to totally exchange the volume of water in the tank.

6.7.5.2 Continuously Running Pumps

For continuously running pumps, the well should be purged by opening the valve and allowing it to flush for 15 minutes if the well volume is unknown. If the sample is collected after a holding tank, the volume of the tank should also be purged.

6.7.5.3 Intermittently Running Pumps

Wells shall be purged at maximum rate for at least 15 minutes. Monitoring of field parameters will continue until two consecutive measurements within 5 percent are measured at 5-minute intervals.

6.7.6 Sample Withdrawal

Technique for withdrawal is dependent on the parameters to be analyzed. To collect a representative sample and minimize the possibility of sample contamination:

- Use Teflon® or stainless steel sampling devices when organics are a concern.

- Use dedicated tubing or samplers for each well. If a dedicated sampler is not available, clean the sampler between sampling events. Analyze equipment blanks to ensure cross-contamination has not occurred.

The preferred sample collection order is as follows (decreasing volatility):

1. Volatile organic compounds (VOCs)

2. Extractable Organics (includes Total Recoverable Petroleum Hydrocarbons [TRPH], Oil & Grease, Pesticides and Herbicides)
3. Total metals
4. Dissolved metals
5. Microbiological
6. Inorganics (includes Nutrients, demands, and Physical Properties)
7. Radionuclides

The following items are acceptable sampling devices for all parameters:

- A gas-operated, Teflon® or stainless steel squeeze pump (also referred to as a bladder pump with adjustable flow control) should be dedicated or completely cleaned between sampling events. If it is dedicated, the protocols on its use, flow rates and use of flow controls should be discussed.

- A Teflon® bailer with check valves and a bottom emptying device. Dedicated or disposable bailers should not be cleaned between purging and sampling operations.

ESC generally supplies sampling devices for wells sampled by ESC. However, some clients have wells equipped with dedicated sampling devices. All dedicated equipment will be cleaned between sampling events with the exception of dedicated pump systems or dedicated pipes that are never removed. ESC will evaluate the device and the project manager shall approve/disapprove of the dedicated device prior to sampling.

If sampling includes dissolved parameters, samples shall be filtered in the field in the following manner:

1. Use a one piece, molded, in-line high capacity disposable 1.0 micron filter when collecting samples for dissolved trace metals analysis. Use a 0.45 micron filter when sampling for all other (i.e., orthophosphorous, silica, etc.) dissolved parameters.

2. Filter material should be non-contaminating synthetic fibers.

3. Filter should be placed on the positive pressure side of the peristaltic pump.

4. If well is deeper than 25 feet, a submersible bladder pump may be necessary to bring the sample to the surface. Samples shall not be collected in an intermediate container.

5. At least one filtered equipment blank using deionized water must be collected and analyzed.

6. The sample shall be preserved as required following filtration.

7. Unfiltered samples will be collected in conjunction with filtered samples.

NOTE: Filtered samples will be collected only at the request of DER and will not be collected for turbid samples only.

6.7.6.1 Sample Removal: With In-Place Plumbing

Samples should be collected following purging from a valve or tap as near to the well as possible, and ahead of all screens, aerators, filters, etc. Collected shall be directly into the containers. Flow rate should not exceed 500 ml/min.

6.7.6.2 Sample Removal: Without In-Place Plumbing

1. Following purging, collect the sample and pour it directly from the bailer into the sample container. If a peristaltic pump is used, pump the directly into the container. Collect the samples in order of decreasing volatilization sensitivity.

2. Measure the conductivity, pH, and temperature of the samples, and record the results on the Monitoring Well Data Sheet.

3. If a bailer is not dedicated, clean equipment using standard procedures. Collect blanks at a rate of one per type of equipment field cleaned. If a piece of equipment is cleaned more than twenty times, collect blanks at a rate of 10 percent. An equipment blank must be taken and preserved for each analyte method group.

4. If a bailer is used to collect samples, replace the bailer string. Take precautions not to allow the string to touch the ground. Dispose of the used string properly. If Teflon® or stainless steel cable is used, clean according to standard procedures and do not let it touch the ground.

5. Replace the well cap and close and lock the protective casing lid.

6.7.7 Split and Duplicate Sample Collection

Split samples measure variability between analysts, methods, and/or laboratories and are obtained as subsamples of a single sample. Duplicate samples measure variability inherent in the collection method or waste stream and are obtained during the same sampling event.

6.7.7.1 Split Sample Collection

1. Collect sufficient sample in a container constructed of appropriate materials.
2. Preserve as necessary.
3. Mix well.
4. Alternately decant 10% of the sample volume into each container and mix well.
5. Continue until each container is filled with an adequate sample volume.
6. Seal the containers, assign a field number, and complete the chain of custody.

6.7.7.2 Duplicate Sample Collection

1. Collect two samples in rapid succession into separate containers.
2. Preserve as necessary.
3. Mix well.
4. Seal the containers, assign a field number, and complete the chain of custody.

6.7.8 Drinking Water Sampling

6.7.8.1 General Concerns

Containers and preservatives must be selected prior to sampling.

- Containers and preservatives shall comply with Tables 6.1, 6.3, and 6.4.
- It is recommended that the appropriate preservative be added to the container by the laboratory.

6.7.8.2 Sampling Drinking Water Wells

1. Purging and sampling should be from a spigot closest to the well head.

- The spigot should be before the holding tank and filters. If this is not possible, the holding tank must also be purged.
- All aerators and filters should be removed if possible.

2. Depending on the running schedule of the well and the placement of the pressure tank, the system will be purged as described in Section 6.7.5.

3. If volume of the pressure tank is not known, the well is purged for at least 15 minutes at maximum rate.

4. The flow is reduced to approximately 500 ml/minute.

5. Sample containers with no preservatives:

- The interior of the cap or the container should not come in contact with anything.
- The sample container is rinsed and the water is discarded.
- Containers are not rinsed if collecting for oil and grease, total recoverable hydrocarbons, volatile organics (including trihalomethanes) or microbiologicals.
- The container should be tilted to minimize agitation.

6. Sample containers with preservatives:

- The above protocol is followed but **DO NOT** rinse the container.
- The open end of the container should be held away from the face while filling.
- The container should be gently tipped several times to mix the preservatives.

7. Place the bottle in a plastic bag and cool to 4° C.

6.7.8.3 Sampling Drinking Water for the Lead/Copper Rule

1. The sampling point is dependent on if the sample is being taken to monitor compliance with Drinking Water Regulations for Lead and Copper. If so, the sample must be taken from a cold water tap in the kitchen or bathroom of residential housing or from an interior tap where water is used for consumption in a non-residential building.

2. Samples must be collected after the water has stood in the pipes for at least six hours.

3. THE SYSTEM SHOULD NOT BE FLUSHED.

4. The first flush should be collected immediately into the sample container. DO NOT RINSE THE CONTAINER PRIOR TO COLLECTING THE SAMPLE.

5. The container should be tilted to minimize agitation.

6. If the container contains preservative, hold the open end away from the face.

7. Add preservative as needed.

8. Replace cap and gently tip the container several times to mix the preservatives.

9. Place in a plastic sample bag.

6.7.8.4 Drinking Water Supply Sampling

1. When sampling for compliance, the sampling point is normally designated by permit or the municipality.

2. Each sample shall have stood in the line for at least six hours. Samples shall be collected in one of the following ways:

   a. At the tap, after flushing the volume of water between the tap and the lead service line. The volume of water shall be calculated based upon the inner diameter and length of the pipe between the tap and the service line.
   b. By tapping directly into the service line.
   c. In a single-family residence, allow the water to run until a significant temperature change indicates water standing in the service line is being sampled.

3. The flow shall be reduced to less than 500 ml/min before collecting samples.

4. Test for the presence of residual chlorine using starch iodide paper or a Hach DR-100 chlorine analyzer.

5. If residual chlorine is present and the parameter being analyzed requires removal of chlorine, collect the sample in the appropriate sample container(s) using the required preservatives.

   a. Add 0.008% $Na_2S_2O_3$ or 100 mg of $Na_2S_2O_3$ per 1 liter of sample water directly into the sample container.
   b. After replacing the cap, tip the container several times to mix the preservative.

6.8 SOIL SAMPLING

Soil samples are preserved as per Section 6.12. When compositing subsamples, the quantity of each subsample used shall be measured and recorded in the field log book.

6.8.1 Sampling Equipment

Type	Use	Materials	Allowable Parameter Groups
Hand Auger (Bucket type)	Sampling	PVC	All parameter groups except VOC's, extractables and organics
Encore™ Sampler	VOC soil subsampling	Teflon	VOC's only
Split Spoons	Sampling	Carbon Steel	All parameter groups
Trowel, Spatula	Sampling and Compositing*	Chrome-Plated Steel	All parameter groups
Spoons	Sampling and Compositing*	Stainless Steel	All parameter groups
Shovel	Sampling	Carbon Steel	All parameter groups
Mixing Pan	Compositing*	Pyrex & Aluminum	All parameter groups except metals in aluminum pan

[1] Carbon steel & Chrome-plated steel tools may be used for collecting soils where trace metal concentrations are not a concern. When these tools are used, samples should be taken from soils not in contact with the tool surface.

* Compositing is not suitable for VOC's

6.8.2 Hand Auger Sampling Procedure

This procedure is used in when only relatively shallow samples are required or in instances where use of heavy equipment is not justified. The hand auger may be used to collect samples of soils or other materials at various depths by adding extensions as necessary.

1. Remove surface debris from the location of the sampling hole using a clean shovel or spoon.

2. Disturbed portions of soil should be discarded and not taken as part of the sample.

3. Using a clean auger, drill to the desired sample depth. Confirm depths using a tape measure or other appropriate device.

4. Use a clean planer auger to clean and level the bottom of the boring.

5. All grab samples should be mixed thoroughly prior to containerization (except VOCs).

6. Using a clean auger, extract the desired sample. Subsampling is performed for VOC sample collection using an Encore™ sampling device. Once the core sample is collected, additional samples should be taken using an Encore™sampler, either 5g or 25g, capped, sealed, and immediately cooled to 4°C. The holding time for this method is 48 hours. Alternatively, weigh 5g of sample into a pre-weighed vial (with a teflon lined screw cap) containing, 5ml sodium bisulfate solution and a magnetic stir bar, cap, and then ice to 4°C. The holding time for this method is 14 days.

7. If less than the collected volume of material is desired or if multiple containers are required, subsampling shall be conducted. The collected material shall be placed in a clean mixing pan and thoroughly mixed using a clean, stainless steel spoon. The mixed material will then be quartered, removed and recombined before samples are collected.

For clay soils, aliquots representative of the entire sample should be removed from the auger using stainless steel spoons. Samples for chemical analyses shall not be collected from auger flights or cuttings from hollow stem auger flights. Samples used for vapor meter determinations will not be used for trace contaminant analyses.

8. Samples should then be labeled. The depth range from which the samples were taken should be included in the sample description.

9. Repeat steps (2) through (6) as necessary to obtain samples at all desired depths.

10. When preparing composite samples, the quantity of each subsample shall be measured and recorded in the field log book.

6.8.3 Split and Duplicate Sample Collection

Split samples measure variability between analysts, methods, and laboratories and are taken as subsamples from a single sample. Duplicate samples are collected simultaneously to measure variability inherent in the sampling method. True split samples are difficult to collect for soils, sediment and sludges under field conditions. Split samples for these materials are therefore considered duplicate samples.

The collection procedure is as follows:

1. Collect the appropriate volume of sample into a clean disk constructed of a non-reactive material.

2. Mix the material with a clean utensil and separate into 4 to 10 equal portions.

3. Alternate placing a portion of the subdivided material into each container.

4. Repeat until each container is filled.

5. Assign each container a field sample number and complete the chain of custody.

6.9 WASTE SAMPLING

6.9.1 Sampling Equipment

Type	Use	Materials	Allowable Parameter Groups [1]
Shovel	Sampling	Carbon Steel	All parameter groups except metals
Split Spoons	Sampling	Carbon Steel	All parameter groups except metals
Trowel, Spatula	Sampling and Compositing*	Stainless Steel	All parameter groups
Spoon	Sampling and Compositing*	Stainless Steel	All parameter groups
Drum Pump	Sampling	Polypropylene	All parameter groups
Mixing pan	Compositing*	Pyrex or aluminum	All parameter groups except metals in aluminum pan
Coliwasa	Sampling	Glass	All parameter groups

[1]Carbon steel tools may be used for collecting wastes when trace metal concentrations are not a concern.
*Compositing is not suitable for VOC's

6.9.2 General

This section discusses the collection of samples from drums, tank trucks, and storage tanks, and samples from waste piles and landfills. Sampling of closed containers is considered a hazardous operation by all ESC personnel.

6.9.2.1 Specific Quality Control Procedures for Sampling Equipment

Sampling equipment used during waste sampling must be cleaned as specified in Section 6.10 of this manual before being returned from the field to minimize contamination.

Contaminated disposable equipment must be disposed of as specified in the sampling plan.

All field equipment shall be cleaned and repaired before being stored at the conclusion of a field study. Special decontamination procedures may be necessary in some instances and will be developed on a case-by-case basis. Any deviation from standard cleaning procedures and all field repairs shall be documented in field logbooks. Equipment that has not been properly cleaned must be tagged and labeled.

6.9.2.2 Collection of Supplementary Information

The collection of supplementary data is important when collecting waste samples. Any field analyses shall be recorded in field logbooks. Sketches of sampling locations and layout shall be documented in the logbooks. Photographs shall be used extensively.

6.9.3 Open and Closed Container Sampling

6.9.3.1 General

When sampling containers, open containers should be sampled first since they generally present less hazard than closed containers. Closed containers must be considered as extremely hazardous. Because of the dangers involved with container sampling, the sampling of drums or other containers containing either unknown materials or known hazardous materials shall be considered a hazardous duty assignment.

One problem with container sampling is stratification and/or phase separation. Care must be taken to ensure that the sample collected is representative. If only one layer or phase is sampled, this should be noted when interpreting analytical results.

If no stratification is present, representative samples may be composited by depth. When a drum or cylindrical container is standing vertically, depth compositing provides a good quantitative estimate of the containers contents. In other cases where containers are tipped, horizontal, deformed, etc., and stratification may not be present, vertical compositing will at least provide a qualitative sample.

6.9.3.2 Sampling Equipment

The following equipment is available for use in collecting waste samples: barrel bung wrenches, adjustable wrenches, etc.; coliwasa samplers for drum sampling; and peristaltic pumps for liquid waste sampling from containers.

6.9.3.3 Sampling Techniques

Containers containing unknown materials or known hazardous materials shall be opened using only spark proof opening devices from a grounded container.

The coliwasa sampler is a single use glass sampler, consisting of an outer glass tube with one end tapered, and a separate inner glass tube with a small bulb on one end. The outer tube is slowly lowered into the drum, tapered end first. Slowly lowering the tube allows the liquid phases in the drum to remain in equilibrium. The inner glass tube is inserted into the outer tube. After both inner and outer tubes are inserted into the drum to be sampled, the inner tube bulb end is pressed gently against the tapered end of the outer tube, forming a seal. Both tubes are withdrawn from the drum and the ends of the tubes are held over the sample container.

Drum samples can also be collected using a length of glass tube (1/2-inch or less inside diameter). The tube is inserted into the drum as far as possible and the open end is sealed to hold the sample in the tube. The sample is then placed in the appropriate container. Sample volumes shall be the absolute minimum required.

Tank truck and storage tank samples may be collected from access ports on top of these tanks or trucks using the above techniques. Tank trucks are often compartmentalized, and each compartment should be sampled. Sampling from discharge valves is not recommended due to stratification possibilities and possibilities of sticking or broken valves. If the investigator must sample from a discharge valve, the valving arrangement of the particular tank truck being sampled must be clearly understood to ensure that the contents of the compartments of interest are sampled. The investigator must realize that samples obtained from valves may not yield representative samples.

If stratification or phase separation of waste samples is suspected, the sample collected should be representative of container contents. Samples should be depth composited when possible and number and types of layers shall be noted when interpreting analytical results.

6.9.4 Waste Piles and Landfills

6.9.4.1 General

Waste piles consist of sludges and other solid waste, liquid waste mixed with soil, slag, or any type of waste mixed with construction debris, household garbage, etc. The sampling personnel must be aware that landfills were not and are often still not selective in the types of materials accepted. Sampling at landfills could involve sampling operations that are potentially dangerous to sampling personnel.

6.9.4.2 Sampling Locations

Sampling locations should be selected that will yield a representative sample of the waste. Exceptions are situations in which representative samples cannot be collected safely or when the team is purposely determining worst case scenarios.

6.9.4.2.1 Waste Piles

A representative sample from a small waste pile can be obtained by collecting a single sample. Collecting representative samples from large waste piles requires a statistical approach in selecting both the numbers of samples and sample location. A discussion of statistical methods is outlined in the Test Methods for Evaluating Solid Waste (SW-846) issued by the EPA Office of Solid Waste and Emergency Response.

6.9.4.2.2 Landfills

Representative samples from landfills are difficult to due to the heterogeneous nature of the wastes. A statistical approach should be used in selecting both the number of samples and the sample location. Statistical methods are given in Test Methods for Evaluating Solid Waste (SW-846) issued by the EPA Office of Solid Waste and Emergency Response. Landfills often generate leachate at one or more locations downgradient of the fill material which can provide some insight of the materials in a landfill that are migrating via groundwater.

6.9.4.3 Sampling Techniques

All samples collected should be placed into a Pyrex® or aluminum mixing pan and mixed thoroughly. Samples for volatile organic compounds analyses must not be mixed or composited. Stainless steel spoons or scoops should be used to clear away surface materials before samples are collected. Near surface samples can then be collected with a clean stainless steel spoon. Depth samples can be collected by digging to the desired depth with a carbon steel shovel or scoop and removing the sample with a stainless steel spoon.

6.10 STANDARD CLEANING PROCEDURES

6.10.1 General

6.10.1.1 Introduction

Procedures outlined in this section are used by ESC personnel in cleaning field equipment prior to use. Ideally, a sufficient amount of clean equipment is carried to the field so that the project can be conducted without the need for field cleaning. This will not always be the case. ESC's policy regarding cleaning field equipment is as follows:

1. Equipment to be used in the field must be thoroughly cleaned in a controlled environment using prescribed procedures. This minimizes the potential for contaminants being transferred to equipment, vehicles, and the laboratory.

2. All equipment will be rinsed immediately with tap water after use, even if it is to be field cleaned for other sites.

3. If equipment is used only once (i.e., not cleaned in the field), it will be tagged in the field and transported separate from clean equipment and labeled as dirty or contaminated equipment.

4. All cleaning procedures shall be documented. In-field decontamination shall be documented in the field records. These records will specify the type of equipment cleaned and the specific protocols that are used. In-house cleaning records must identify the type of equipment, date it was cleaned, SOP used, and person that cleaned it.

5. Unless justified through documentation (i.e., company written protocols and analytical records) and historic data (i.e., absence of analytes of interest in equipment blanks), the protocols in Sections 6.10.1.2 through 6.10.7.9 shall be followed without modification.

6. All field sampling equipment shall be pre-cleaned in-house prior to arrival on-site unless otherwise justified.

6.10.1.2 Cleaning Materials

Laboratory detergent is a phosphate-free, laboratory detergent such as Liquinox®. The use of any other detergent is noted in field logbooks and summary reports.

10% nitric acid solution shall be made from reagent-grade nitric acid and deionized water.

Standard cleaning solvent used will be pesticide-grade isopropanol. Other solvents (acetone and/or hexane) may be substituted as necessary. The use of other solvents must be documented in field logbooks and summary reports.

Tap water may be used from any potable water system. Untreated water is not an acceptable substitute for tap water.

Deionized water is tap water that has been passed through a deionizing resin column and should contain no inorganic compounds at or above analytical detection limits. Organic-free water is tap water that has been de-ionized and treated with activated carbon. Organic-free water should contain no detectable levels of organic compounds, and less than 5 ug/l of VOCs.

Analyte-free water is water in which all the analytes of interest and all interferences are below the method detection limits. Analyte-free water is always used for blank preparation and for the final in-house decontamination rinse.

Substitution of a higher grade water (i.e., deionized or organic-free water for tap water) is permitted and need not be recorded. Solvent, nitric acid, detergent, and rinse water used to clean equipment shall not be reused.

6.10.1.3 Marking Clean Equipment

Equipment that is cleaned by these methods shall be marked with the date and time that the equipment was cleaned.

6.10.1.4 Marking Contaminated or Damaged Field Equipment

Field equipment that needs repair will be tagged and repairs or symptoms noted on the tag. Field equipment which needs cleaning **will not** be stored with clean equipment. All wrapped equipment not used in the field may be placed back in stock after equipment is inspected to ensure that contamination has not taken place.

6.10.1.5 Decontamination of Equipment Used With Toxic or Hazardous Waste

Equipment used to collect hazardous or toxic wastes or materials from hazardous waste sites, RCRA facilities, or in-process waste streams shall be decontaminated prior to leaving the site. This decontamination procedure shall consist of washing with laboratory detergent and rinsing with tap water. More stringent procedures may be required depending on the waste sampled.

If equipment is heavily contaminated, an acetone or acetone/hexane/acetone pre-rinse may be necessary prior to regular decontamination procedures. It is not recommended that this type of cleaning be performed in the field.

6.10.1.6 Disposal of Cleaning Materials

See Section 6.14.

6.10.1.7 Safety Procedures For Cleaning Operations

All applicable safety procedures shall be followed during cleaning operations. The following precautions shall be taken during cleaning operations:

- Safety glasses or goggles, gloves, and protective clothing will be worn during all cleaning operations.

- Solvent rinsing operations will be conducted under a hood or in an open, well ventilated area.

- No eating, smoking, drinking, chewing, or hand to mouth contact shall be permitted during cleaning operations.

6.10.1.8 Storage of Field Equipment

All clean field equipment shall be stored in a designated, contaminant-free area.

6.10.2 Quality Control Procedures for Cleaning

6.10.2.1 General

This section establishes quality control methods to monitor the effectiveness of the equipment cleaning procedures. The results of these methods will be monitored by the ESC Quality Assurance Officer (QAO). All quality control procedures are recorded in a logbook and maintained in a quality assurance file. If contamination problems are detected, the ESC QAO shall determine the cause(s) of the problem(s) and take immediate corrective action.

6.10.2.2 Rinse Water

The quality of water used shall be monitored once per quarter by placing water in standard, precleaned, sample containers and submitting them to the ESC laboratory

for analysis. Organic-free water will also be submitted for analyses of the various organic compounds.

6.10.3 Procedures for Cleaning Teflon® or Glass Equipment Used in the Collection of Samples for Trace Organic Compounds and/or Metals Analyses

1. Equipment will be washed with laboratory detergent and hot water using a brush to remove any particulate matter or surface film. If oil, grease, or other hard to remove materials are on the equipment, an acetone/hexane/acetone pre-wash and/or steam cleaning may be necessary.

2. Rinse the equipment with hot tap water.

3. Rinse equipment with a 10 percent nitric acid solution. If nitrogen containing compounds are of concern, hydrochloric acid must be used as a substitute or subsequent equipment rinse. If necessary, the equipment can be soaked in fresh nitric acid solution.

4. Rinse equipment with tap water.

5. Rinse equipment with deionized water.

6. Rinse equipment twice with solvent and allow to dry.

7. If equipment cannot be cleaned effectively, discard of properly.

8. Wrap equipment in aluminum foil. Seal in plastic and date.

6.10.4 Procedures for Cleaning Stainless Steel or Metal Sampling Equipment Used in Trace Organic and/or Metals Sample Collection

1. Equipment will be washed with laboratory detergent and hot water using a brush to remove any particulate matter or surface film. If oil, grease, or other hard to remove materials are on the equipment, a acetone/hexane/acetone pre-wash and/or steam cleaning may be necessary.

2. Rinse equipment with hot tap water.

3. Rinse equipment with deionized water.

4. Rinse equipment twice with solvent and allow to dry.

5. If equipment cannot be cleaned effectively, discard of properly.

6. Wrap equipment in aluminum foil. Seal in plastic and date.

6.10.5 Cleaning Procedures for Automatic Sampling Equipment

6.10.5.1 General

All automatic wastewater samplers will be cleaned as follows:

- The exterior and accessible interior portions of automatic samplers will be washed with Liquinox and rinsed with tap water.

- The electronics casing will be cleaned with a clean damp cloth.

- All vinyl sample tubing will be discarded after each use.

- Teflon® tubing will be cleaned using procedures found in Section 6.10.6.2

- Silastic pump tubing will be cleaned and re-used after each use if possible. Tubing will be cleaned using cleaning procedures specified in Section 6.10.6.1 of this document. Tubing shall be checked on a regular basis and will be changed if it has become discolored or has lost its elasticity.

6.10.5.2 Reusable Glass Composite Sample Containers

1. If containers are used to collect samples that contain hard to remove materials (i.e., oil and grease) it is rinsed as necessary with reagent grade acetone prior to the detergent wash. If material cannot be removed, the container is discarded.

2. Wash containers thoroughly with hot tap water and Liquinox and rinse thoroughly with hot tap water.

3. If metals are to be sampled, rinse with 10% nitric acid. If nutrients are to be sampled, follow with a 10% hydrochloric acid rinse.

4. Rinse thoroughly with tap water.

5. Rinse thoroughly with DI water.

6. If organics are to be sampled, rinse twice with isopropanol and allow to air dry for 24 hours or more. Cap the container with the decontaminated Teflon® lined lid.

7. After use, rinse with tap water in the field and cover to prevent drying of material onto the interior surface.

8. Containers that have a visible scale, film, or discoloration after cleaning or that were used at a chemical manufacturing facility should be properly discarded at the conclusion of the sampling activities.

6.10.5.3 Reusable Plastic Composite Sample Containers

1. Wash containers with hot tap water and laboratory detergent, using a bottle brush to remove particulate matter and surface film.

2. Rinse containers with hot tap water.

3. Rinse containers with 10 percent nitric acid. If nitrogen containing compounds are of concern, hydrochloric acid must be used as a substitute or subsequent equipment rinse.

4. Rinse containers with tap water.

5. Rinse containers with deionized water.

6. Cap with aluminum foil.

7. Plastic sample containers used at facilities that produce toxic compounds will be properly disposed of at the conclusion of the sampling activities. Containers that have a visible film, scale, or other discoloration remaining after cleaning will be discarded.

6.10.5.4 Plastic Sequential Sample Bottles for Automatic Sampler Base

1. Rinse bottles in field with potable or de-ionized water when possible.

2. Wash in dishwasher at wash cycle, using laboratory detergent cycle, followed by tap and deionized water rinse cycles. Alternatively, handwash using the same procedures.

3. Rinse with 10 percent nitric acid. If nitrogen containing compounds are of concern, hydrochloric acid must be used as a substitute or subsequent equipment rinse.

4. Rinse with tap water.

5. Replace bottles in sampler base; cover with aluminum foil before storing.

6.10.6 Cleaning Procedures for Sampling Tubing

6.10.6.1 Silastic Rubber Pump Tubing Used In Automatic Samplers

Silastic pump tubing used in automatic samplers need not be replaced in pumps where the sample does not contact the tubing, where the sampler is being used solely for purging purposes (i.e., not being used to collect samples). Tubing must be changed on a regular basis if used for sampling purposes and should be cleaned in the following manner:

1. Flush tubing with laboratory grade detergent and hot tap water
2. Rinse thoroughly with hot tap water
3. Rinse thoroughly with DI water
4. If used to collect metals samples, the tubing shall be flushed with 1+5 nitric acid, followed by a thorough rinsing with DI water
5. Install the tubing in the automatic wastewater sampler
6. Cap both ends with aluminum foil or equivalent

Tubing should always be replaced at automatic sampler manufacturer's recommended frequencies. If tubing cannot be adequately cleaned, it shall be discarded.

6.10.6.2 Teflon® Tubing

New Teflon® tubing shall be pre-cleaned as follows:

1. Rinse outside of the tubing with pesticide-grade solvent.
2. Flush interior of the tubing with pesticide-grade solvent.
3. Let dry overnight in drying oven or equivalent.
4. Wrap tubing in aluminum foil and seal in plastic.

Reused tubing shall be transported to the field in pre-cut and pre-cleaned sections. Field cleaning of Teflon® is not recommended. The following steps describe in-house cleaning procedures:

1. Exterior of tubing must be cleaned first by soaking in hot, soapy water in a stainless steel or non-contaminating sink. Particulate may be removed with a brush.

2. Clean inside of tubing ends with a small bottle brush.

3. Rinse surfaces and ends with tap water.

4. Rinse surfaces and ends with nitric acid, tap water, isopropanol, and analyte-free water.

5. Place on fresh aluminum foil, connect all sections with Teflon® couplings.

6. Cleaning configuration:
   a. Cleaning solutions are placed in a clean, 2-liter glass jar.
   b. Place one end of tubing in the solution, the other in the **INFLUENT** end of a peristaltic pump.
   c. Effluent from the pump can be recycled through the glass cleaning solution jar. All cleaning solutions can be recycled EXCEPT the final isopropanol and analyte-free water rinses.

7. The above configuration is used as follows:
   a. Pump generous amounts of hot, soapy water through the tubing.
   b. Follow this with tap water, 10% nitric acid, tap water, isopropanol, and analyte-free water.
   c. The nitric acid and isopropanol rinses should be allowed to remain in the tubing for 15 minutes with the pump shut off then continue with subsequent rinses
   d. Leave any couplings in and connect of cover the remaining ends.

8. After cleaning the interior, rinse the exterior with analyte-free water.

9. The cleaned lengths are wrapped in aluminum foil and stored in a clean, dry area until use.

6.10.7 Field Equipment Cleaning Procedures

6.10.7.1 General

It is the responsibility of field personnel to properly clean equipment in the field. The following procedures shall be observed when cleaning equipment in the field.

6.10.7.2 Conventional Equipment Use

Remove deposits with a brush if necessary. If only inorganic anions are of interest, equipment should be rinsed with analyte-free water and with the sample at the next sampling location prior to collection. Clean equipment for the collection of samples for organic compounds or trace inorganic analyses according to Section 6.10.7.3.

6.10.7.3 Equipment Used to Collect Organic Compounds and Trace Metals Samples

1. Clean with tap water and laboratory detergent. If necessary, use a brush to remove particulate and surface films.

2. Rinse with tap water.

3. Rinse with 10 to 15 percent nitric acid solution followed by 10 percent hydrochloric acid rinse (unless equipment is made of metal).

4. Rinse with tap water.

5. Rinse with deionized water.

6. Rinse twice with solvent.

7. Rinse with organic-free water and allow to air dry.

8. If organic-free water is unavailable, let air dry. Do not rinse with deionized or distilled water.

9. Wrap with aluminum foil or plastic.

6.10.7.4 Teflon®, Glass, Stainless Steel or Metal Equipment Used to Collect Samples for Metal Analyses

1. Remove particulate matter and surface films. Clean with laboratory detergent and tap water.

2. Rinse with tap water.

3. 10 percent nitric acid solution (skip 3 and 4 if equipment is made of metal and/or stainless steel).

4. Rinse with tap water.

5. Rinse with deionized water.

6. Let air dry.

6.10.7.5 Instruments Used to Measure Groundwater Levels

1. Wash with laboratory detergent and tap water.

2. Rinse with tap water.

3. Rinse with deionized water.

4. Allow to dry.

6.10.7.6 Field Filtration Apparatus

1. A new, disposable filtration unit will be used for each site. Filter pore size will be dependent on parameter being monitored as per Section 6.7.6.

2. The peristaltic pump is cleaned as described in Section 6.10.7.7.

3. Silastic pump tubing will be cleaned as described in Section 6.10.6.1.

4. If Teflon® tubing is used, it will be cleaned as described in Section 6.10.6.2.

5. Other tubing types must be cleaned following the appropriate regimen described in Section 6.10.6. In general, non-Teflon® type tubing (e.g., HDPE) will not be re-used.

6.10.7.7 Flow Meters, Above Ground Pumps, Bladder Pumps and Other Field Instrumentation

The exterior of equipment such as flow meters should be washed with a mild detergent and rinsed with tap water before storage. The interior of such equipment may be wiped with a damp cloth.

Other field instrumentation should be wiped with a clean, damp cloth. Meter probes should be rinsed with deionized water before storage.

Equipment desiccant should be checked and replaced as necessary.

Peristaltic pumps used for purging must be free of oil and grease on the exterior. Peristaltic pumps used for sampling must be cleaned on the outside with Liquinox and rinsed with tap water followed by DI water.

6.10.7.8 In-Field Decontamination For Submersible Purging Pump and Tubing

ESC uses the submersible bladder pump listed in Section 6.7.1 only for purging and not for sample collection. The pump and tubing shall be decontaminated between wells in the following manner:

1. Interior of the pump and tubing shall be thoroughly flushed with a soapy water solution.

2. Wipe or scrub the exterior of the pump and tubing as necessary with the appropriate soap solution.

3. Rinse exterior and interior of pump and tubing thoroughly with tap water followed by a deionized water rinse.

4. Allow remaining water to drain from tubing and pump and allow to air dry as long as possible in a contaminant free area as long as possible before purging the next well.

6.10.7.9 Shipping Containers

All reusable shipping containers shall be washed with laboratory detergent, rinsed with tap water, and air dried before storage or re-use. Extremely contaminated shipping containers shall be cleaned as thoroughly as possible and properly disposed.

6.10.7.10 Analyte Free Water Containers

Analyte-free water containers can be made of glass, Teflon®, polypropylene, or high density polyethylene (HDPE). Inert glass or Teflon® are recommended for holding organic-free sources of water. Polypropylene can be used when organics are not analytes of concern. HDPE is not normally recommended but is acceptable for use. Water should not be stored in these containers for extended periods. Containers of water should only be used for a single event and should be disposed of at the end of the sampling day. The procedure for cleaning analyte-free water containers is as follows:

1. For new containers, follow instructions in Section 6.10.3 of this manual. Delete the solvent rinse if containers are made of plastic.

2. Cap with Teflon® film, aluminum foil, or the Teflon® lined bottle cap (aluminum foil or Teflon® film may also be used as a cap liner).

If water is being stored in reused containers, the following cleaning procedures should be followed:

1. After emptying, cap the container.

2. Wash exterior of the container with Liquinox and rinse with DI water.

3. Rinse the interior twice with isopropanol unless the container is made of plastic.

4. Rinse the interior thoroughly with analyte-free water.

5. Invert and allow to dry.

6. Fill the container with analyte-free water and cap with aluminum foil, Teflon® film, or a Teflon® lined bottle cap.

7. Water shall not be stored prior to a sampling event for more than 3 days.

6.10.7.11 Vehicles

Field vehicles used by ESC personnel should be washed at the conclusion of each field sampling event. This should reduce the risk of contamination due to transport on a vehicle. When vehicles are used at hazardous waste sites or on studies where pesticides, herbicides, organic compounds, or other toxic materials are known or suspected to be present, a thorough interior and exterior cleaning is mandatory at the conclusion of the site visit.

Vehicles are equipped with trash containers. ESC personnel are responsible for cleanliness of each vehicle.

6.11 SAMPLE HISTORY

Sample chronology is recorded and kept on the ESC chain of custody, field log books and laboratory notebooks. These are discussed in detail in Section 7.0.

6.12 SAMPLE CONTAINERS, PRESERVATION METHODS AND HOLDING TIMES

6.12.1 General Considerations

The following Section contains information regarding sample containers, preservation methods, and holding times. Refer to SW-846, Table II-1 and Chapter 3, Page 3 for solid waste and RCRA projects and 40 CFR Part 136, Table II for water and wastewater projects.

The provisions of 40 CFR Part 136, Table II shall take precedence over requirements given in any approved method when sampling in the State of Florida for water and wastewater.

Proper sample preservation is the responsibility of the sampling team and it is their responsibility to assure that all samples are preserved according to 40 CFR Part 136. For the purposes of this manual, "immediately" will be defined as within 15 minutes.

Sample preservation is accomplished either by obtaining prepreserved containers from an acceptable source or by adding preservatives in the field.

It is the responsibility of the field team accepting prepreserved containers to make sure that the proper preservatives are used and desired results are achieved. The laboratory shall also supply additional preservatives from the same source in suitable containers.

6.12.2 Sample Preservation

The following protocols apply for sample containers preserved in the field after sample has been added:

1. Preservatives shall be at least reagent grade or higher. The acid for metals shall be suitable for trace metals analyses.

2. Fresh preservatives shall be obtained prior to each sampling event. Remaining preservatives that are not sealed must be discarded in an acceptable manner.

3. Preservatives are transported in pre-measured glass ampules and added directly to the sample.

4. A corresponding amount of preservative shall be added to associated equipment blanks.

5. The pH is checked on all pH preserved samples with the exception of VOC, oil and grease, and TRPH.

Effectiveness of pH adjustment is made in the following manner:

1. Narrow range pH paper is used to test a small aliquot of the preserved sample.

2. A small portion of sample is placed into a container, checked with pH paper, and compared against color chart.

3. Discard the aliquot properly, but do not pour back into the sample container.

4. If pH is acceptable, document in field log and prepare for transport to laboratory.

If pH is unacceptable, continue to add additional preservative in measured increments using the methods described above until an acceptable pH has been reached. Record the total amount of preservative used in the field log. Always use additional preservative from the same source as the initial preservation attempt.

In some cases, an extra dummy sample can be used to test pH preservation on. Content should be suitably discarded.

If equipment blanks or field blanks are used, the maximum amount of preservative that was used to preserve any single sample in the set shall be added to the equipment or field blank.

Samples which need to be preserved at 4°C shall be cooled. The cooler shall be checked to ensure that the ice has not melted. A temperature surrogate bottle will be placed in each

cooler to verify that required sample preservation temperature is maintained within acceptable limits.

6.12.3 Sample Containers

ESC does not clean and re-use sample containers. ESC purchases all sample collection containers from two commercial vendors as precleaned containers. All sampling containers are discarded after use. Cleaning grades of all containers must meet EPA analyte specific requirements.

Nalgene Corporation is a major supplier of sample bottles to ESC and provides written certification that containers do not contain analytes of concern above method detection levels. ICHEM is the other major provider of sample containers to ESC. They do not provide a written certification but ESC does monitor the quality of the containers by performing analyses for each parameter group on sample container equipment blanks on each new lot of bottles.

ESC maintains records for these containers (lot numbers, certification statements, date of receipt, etc.) and intended uses are documented.

6.12.4 Field Reagent Handling

Reagents, cleaning materials, and preservatives that are maintained by a field team will be stored transported and handled in such a way as to prevent and/or minimize contamination. The following storage and use protocols will be observed:

1. Chemicals will be stored in-house and transported to the field segregated according to reactivity.

2. Acids are stored in an acid storage cabinet and solvents are stored in a vented, explosion proof solvent storage cabinet.

3. All chemicals transported to the field are stored in bottles and packed to avoid breakage.

4. When reagents are transferred from an original container, the transport container must be pre-cleaned and of compatible material as the original container.

5. Chemicals shall be separated from sample containers and samples to avoid reaction and possible contamination.

6. Analyte free water shall be segregated from solvents to prevent contamination.

6.12.4.1 Reagent and Standard Storage

Chemical	Method of Storage
Nitric acid	Stored separately from other acids in original glass container in vented cabinet.
Sulfuric acid	See above
Hydrochloric acid	See above
Isopropanol	Stored in original glass container in vented and explosion proof solvent storage cabinet.
pH calibration buffers, turbidity standards, conductivity standards	Stored in cabinet designated for standard and reagent storage. Stored in temperature controlled area of laboratory.
Sodium hydroxide	Stored in original container in designated cabinet in laboratory.
Sodium thiosulfate, zinc acetate, ascorbic acid, lead acetate	Stored in original containers in designated area of laboratory. Reagent solutions made fresh prior to use.

6.12.5 Sample Transport

In the majority of situations, samples will be delivered directly to the laboratory by the field sampling team or field courier following standard chain of custody protocols. Samples will be preserved immediately (i.e., within 15 minutes) and packed with ice prior to transport. The field team will relinquish custody to the log-in sample custodian upon arrival at the laboratory.

Certain situations will require that the field sampling team ship samples to the laboratory utilizing common carrier (UPS, FEDEX). If samples are sent by common carrier, all documentation (transmittal form, chain of custody, field data, analyses request, etc.) shall be placed in a ziplock bag and placed inside the sample container. The container is then sealed closed and sent to the laboratory in the required time frame to meet requirements of time-sensitive analyses (BOD, hexavalent chromium).

6.12.6 Biomonitoring Sampling

Preservation and Sample Volume

Aqueous samples collected for Bioassay can be collected in either glass or HDPE plastic. There is no required chemical preservation for this type of sample but the sample must be kept at 4 degrees C. The required volume varies independently with each type of test but the minimum collected is 250 ml. The samples can be held for a maximum of 36 hours from the time of collection.

Sample Collection

Grab sample protocols are utilized for acute bioassay unless otherwise specified in permit requirements. Composite sampling protocols are utilized for chronic bioassays unless otherwise specified in permit requirements. (Actual sampling protocols are discussed in detail throughout section 6.0) ESC field collection personnel are required to collect all bioassay samples by completely filling the sample bottle and leaving no headspace. It is important that bottles be filled completely to reduce possible aeration that may reduce the toxic properties of the sample. If a client chooses to collect the samples a trained ESC field collection person will explain in detail the importance of reducing aeration by filling the sample bottle completely.

6.12.6.1 Biomonitoring Sampling Containers

All bioassay glassware are cleaned using the following protocol (DER QA #90-04):

- soak for 15 minutes in hot tap water with detergent and scrub
- rinse thoroughly with hot tap water
- rinse thoroughly with dilute nitric acid (10%)
- rinse thoroughly with deionized water
- rinse thoroughly with pesticide grade acetone
- rinse well with deionized water then rinse with dilution water

New glassware will be cleaned according to the same procedure as listed above except the first step will be preceded by soaking the glassware overnight in 10% HNO_3. Sample collection containers used for automatic sampling devices are cleaned according to the same protocol listed above.

ESC does not reuse sample transport containers. All bottles used for sample transport are new.

TABLE 6.1
PRESERVATION, HOLDING TIME AND SAMPLE CONTAINERS
(SOLID WASTE AND SOIL SAMPLES)

PARAMETER	PRESERVATIVE	HOLDING TIME	CONTAINER(S)
Metals	Cool, 4°C	* 6 Months	Plastic, glass
Volatile Organic Compounds in Water	Cool, 4°C	14 Days	Glass, Teflon®-lined septum
Volatile Organic Compounds in Soil/Solid	Cool, 4°C (If using vials, then Sodium Bisulfate is used)	48 hours (using Encore™ sampler) 14 Days (using pre-weighed, preserved, vials)	Encore™ Sampler or Pre-weighed glass vials (Teflon®-lined septum) with magnetic stir bar
Semi-volatiles, non-volatile organics	Cool, 4°C	14 Days until extraction, 40 days after extraction	Glass, Teflon®-lined cap
Solids	Cool, 4°C	7 Days	Plastic, glass
Cyanides	Cool, 4°C	14 Days	Glass
Oil and Grease	Cool, 4°C	28 Days	Glass, Teflon®-lined cap

* Maximum holding time for mercury is 28 days.

TABLE 6.2
WASTEWATER SAMPLING AND TESTING
(OTHER PARAMETERS)

Parameter	Container[1]	Preservation[2,3]	Maximum Holding Time[4]	Required Sample Volume
Biomonitoring				
Biomonitoring Acute and Chronic	P, G	Cool, 4°C	36 hours	Determined by test requirements. Minimum 250 mls.
Bacteriological				
Coliform, Fecal and Total Fecal Streptococci	P, G	Cool, 4°C, 0.008% $Na_2S_2O_3$[5]	6 hours	150 mls
Inorganics				
Acidity	P, G	Cool, 4°C	14 days	250 mls
Alkalinity	P, G	Cool, 4°C	14 days	250 mls
Ammonia	P, G	Cool, 4°C, H_2SO_4 to pH <2	28 days	500 mls Distilled-1000 mls
Biochemical Oxygen Demand	P, G	Cool, 4°C	48 hours	2000 mls
Bromide	P, G	None Required	28 days	200 mls
Biochemical Oxygen Demand, Carbonaceous	P, G	Cool, 4°C	48 hours	2000 mls
Chemical Oxygen Demand	P, G	Cool, 4°C, H_2SO_4 to pH <2	28 days	100 mls
Chloride	P, G	None Required	28 days	200 mls
Chlorine, Total Residual	P, G	None Required	Analyze Immediately	200 mls
Color	P, G	Cool, 4°C	48 hours	250 mls
Cyanide, Total and Amenable to Chlorination	P, G	Cool, 4°C, NaOH to pH >12, 0.6 g/l ascorbic acid[5]	14 days[6]	2000 mls

TABLE 6.2 (continued)
WASTEWATER SAMPLING AND TESTING
(OTHER PARAMETERS)

Parameter	Container[1]	Preservation[2,3]	Maximum Holding Time[4]	Required Sample Volume
Inorganics (continued)				
Fluoride	P	None Required	28 days	100 mls
Hardness	P, G	HNO_3 to pH <2, H_2SO_4 to pH <2	6 months	100 mls
Hydrogen Ion (pH)	P, G	None Required	Analyze Immediately	100 mls
Kjeldahl and Organic Nitrogen	P, G	Cool, 4°C, H_2SO_4 to pH <2	28 days	500 mls
Chromium VI	P, G	Cool, 4°C	24 hours	500 mls
Mercury[7]	P, G	HNO_3 to pH <2	28 days	500 mls
Metals[7], except Chromium VI and Mercury	P, G	HNO_3 to pH <2	6 months	1000 mls
Nitrate	P, G	Cool, 4°C	48 hours	500 mls
Nitrate-Nitrite	P, G	Cool, 4°C, H_2SO_4 to pH <2	28 days	500 mls
Nitrite	P, G	Cool, 4°C	48 hours	200 mls
Oil and Grease	G	Cool, 4°C, HCl or H_2SO_4 to pH <2	28 days	1000 mls
Organic Carbon	P, G	Cool, 4°C, HCl or H_2SO_4 to pH <2	28 days	100 mls
Orthophosphate	P, G	Filter Immediately, Cool, 4°C	48 hours	200 mls
Oxygen, Dissolved Probe	G Bottle and Top	None Required	Analyze Immediately	Not Applicable
Phenols	G only	Cool, 4°C, H_2SO_4 to pH <2	28 days	1000 mls
Phosphorus (elemental)	G	Cool, 4°C	48 hours	2000 mls

TABLE 6.2 (continued)
WASTEWATER SAMPLING AND TESTING
(OTHER PARAMETERS)

Parameter	Container[1]	Preservation[2,3]	Maximum Holding Time[4]	Optimum Sample Volume
Inorganics (continued)				
Phosphorus, Total	P, G	Cool, 4° C, H_2SO_4 to pH <2	28 days	500 mls
Residue, Total	P, G	Cool, 4°C	7 days	500 mls
Residue, Filterable	P, G	Cool, 4°C	7 days	500 mls
Residue, Nonfilterable (TSS)	P, G	Cool, 4°C	7 days	500 mls
Residue, Settleable	P, G	Cool, 4°C	48 hours	1000 mls
Residue, Volatile	P, G	Cool, 4°C	7 days	500 mls
Specific Conductance	P, G	Cool, 4°C	28 days	500 mls
Sulfate	P, G	Cool, 4°C	28 days	500 mls
Sulfide	P, G	Cool, 4°C, add zinc acetate plus NaOH to pH >9	7 days	300 mls
Sulfite	P, G	None Required	Analyze Immediately	250 mls
Surfactants	P, G	Cool, 4°C	48 hours	500 mls
Temperature	P, G	None Required	Analyze Immediately	Not Applicable
Turbidity	P, G	Cool, 4°C	48 hours	200 mls
Organics[8]				
Volatile Halocarbons	G, Teflon®-lined septum	Cool, 4°C, 0.008% $Na_2S_2O_3$[5]	14 days	2 x 40 mls
Volatile Aromatic Hydrocarbons	G, Teflon®-lined septum	Cool, 4°C, 0.008% $Na_2S_2O_3$[5], HCl to pH 2[9]	14 days	2 x 40 mls
Acrolein and Acrylonitrile	G, Teflon®-lined septum	Cool, 4°C, 0.008% $Na_2S_2O_3$[5]. Adjust pH to 4-5[10]	14 days	2 x 40 mls

TABLE 6.2 (continued)
WASTEWATER SAMPLING AND TESTING
(OTHER PARAMETERS)

Parameter	Container[1]	Preservation[2,3]	Maximum Holding Time[4]	Optimum Sample Volume
Organics[8] (continued)				
Phenols[11]	G, Teflon®-lined cap	Cool, 4 °C, 0.008% $Na_2S_2O_3$[5]	7 days until extraction. 40 days after extraction	3000 mls
Benzidines[11]	G, Teflon®-lined cap	Cool, 4 °C, 0.008% $Na_2S_2O_3$[5]	7 days until extraction[13]	3000 mls
Phthalate esters[11]	G, Teflon®-lined cap	Cool, 4 °C	7 days until extraction. 40 days after extraction	3000 mls
Nitrosamines[11, 14]	G, Teflon®-lined cap	Cool, 4 °C, store in dark, 0.008% $Na_2S_2O_3$[5].	7 days until extraction. 40 days after extraction	3000 mls
PCBs[11], Acrylonitrile	G, Teflon®-lined cap	Cool, 4 °C	7 days until extraction. 40 days after extraction	3000 mls
Nitroaromatics and Isophorone[11]	G, Teflon®-lined cap	Cool, 4 °C, 0.008% $Na_2S_2O_3$[5], store in dark	7 days until extraction. 40 days after extraction	3000 mls
Polynuclear Aromatic Hydrocarbons[11]	G, Teflon®-lined cap	Cool, 4 °C, 0.008% $Na_2S_2O_3$[5], store in dark	7 days until extraction. 40 days after extraction	3000 mls
Haloethers[11]	G, Teflon®-lined cap	Cool, 4 °C, 0.008% $Na_2S_2O_3$[5]	7 days until extraction. 40 days after extraction	3000 mls
Chlorinated Hydrocarbons[11]	G, Teflon®-lined cap	Cool, 4 °C	7 days until extraction. 40 days after extraction	3000 mls

TABLE 6.2 (continued)
WASTEWATER SAMPLING AND TESTING
(OTHER PARAMETERS)

Parameter	Container[1]	Preservation[2,3]	Maximum Holding Time[4]	Optimum Sample Volume
TCDD[11]	G, Teflon®-lined cap	Cool, 4 °C, 0.008% $Na_2S_2O_3$[5]	7 days until extraction. 40 days after extraction	3000 mls
Pesticides[11]	G, Teflon®-lined cap	Cool, 4 °C, pH 5-9[15]	7 days until extraction. 40 days after extraction	2000 mls
Radiological Tests: Alpha, beta and Radium	P, G	HNO_3 to pH <2	6 months	3000 mls

NOTES:

[1] Polyethylene (P) or Glass (G).

[2] Sample preservation should be performed immediately upon sample collection. If using an automatic sampler, preserve by maintaining at 4 deg. C until compositing and sample splitting is completed.

[3] Samples shipped by common carrier or sent through the United States Mail must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). For the preservation requirements of Table II, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid (HCl) in water solutions at concentrations of 0.04% by weight or less (pH about 1.96 or greater); Nitric acid (HNO_3) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid (H_2SO_4) in water solutions at concentrations of 0.35% by weight or less (pH about 1.15 or greater); and Sodium hydroxide (NaOH) in water solutions at concentrations of 0.080% by weight or less (pH about 12.30 or less).

[4] Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid for analytical and regulatory purposes.

TABLE 6.2 (continued)
WASTEWATER SAMPLING AND TESTING
(OTHER PARAMETERS)

[5] Only to be used in the presence of residual chlorine.

[6] Maximum holding time is 24 hours when sulfide is present. Optionally all samples may be tested with lead acetate paper befor e pH adjustment in order to determine if sulfide is present. If sulfide is present, it can be removed by the addition of cadmium nitrate powder until a negative spot test is obtained. The sample is filtered and pH adjusted to 12.

[7] Dissolved metals samples should be filtered immediately on-site before adding preservative.

[8] Applies to samples to be analyzed by GC, LC, or GC/MS for specific compounds.

[9] Sample receiving no pH adjustment must be analyzed within seven days after collection.

[10] pH adjustment is not required if acrolein will not be measured.

[11] When the extractable analytes of concern fall within a single chemical category, the specified preservative and maximum holding times should be observed for sample integrity. When the analytes of concern fall within two or more chemical categories, the sample may be preserved by cooling to 4 ° C, reducing residual chlorine, storing in the dark, and adjusting the pH to 6-9; samples preserved in this manner may be held for seven days before extraction and for forty days after extraction.

[12] 1,2-diphenylhydrazine is likely to be present, adjust the pH of the sample to 4.0 plus or minus 0.2.

[13] Extracts may be stored up to seven days before analysis if stored in an oxidant-free atmosphere.

[14] For the analysis of diphenylnitrosamine, add 0.008% $Na_2S_2O_3$ and adjust pH to 7-10 with NaOH within 24 hours of sampling.

[15] The pH adjustment may be performed upon receipt at the laboratory and may be omitted if the samples are extracted within 72 hours of collection. For the analysis of aldrin, add 0.008% $Na_2S_2O_3$.

6.12.7 Sample Container Packing Procedures

ESC routinely sends sample containers to clients. Standard operating procedure determines the containers needed for the requested tests. A sample request form is completed to document what is needed, the destination, the date prepared and the initials of the preparer. Containers are prepared, with appropriate preservatives, labels, and custody seals, and organized for the client's convenience in a cooler. The cooler also contains a temperature blank, chain of custody, a return address label, and applicable instructions. The cooler is bound with packaging tape (and a custody seal if requested) and shipped UPS.

6.13 SAMPLE DISPATCH

Samples collected during field investigations or in response to a hazardous materials incident must be classified by the project manager, prior to shipping, as either environmental or hazardous material samples. The shipment of samples designated as environmental samples are not regulated by the U.S. Department of Transportation.

Samples collected from certain process streams, drums, bulk storage tanks, soil, sediment, or water samples from suspected areas of high contamination may need to be shipped as hazardous. These regulations are promulgated by the US-DOT and described in the Code of Federal Regulations (49 CFR 171 through 177). The guidance for complying with US-DOT regulations in shipping environmental laboratory samples is given in the "National Guidance Package for Compliance with Department of Transportation Regulations in the Shipment of Environmental Laboratory Samples."

6.13.1 Shipment of Environmental Samples

Shipping receipts are maintained at the ESC laboratory. The shipment of preserved sample containers or bottles of preservatives (i.e., NaOH pellets, HCl, etc.) which are designated as hazardous under the US-DOT, Hazardous Materials Table, 49 CFR 171.101, must be shipped pursuant to the appropriate US-DOT regulations.

Samples packaged for shipment by ESC shall be segregated by sample type, preservation requirements, and potential contaminant level. During sampling events in which large numbers of samples will be collected, samples will also be segregated by analyses to be conducted. If multiple sites are to be sampled, or if specific and separate areas of interest can be identified, samples will be further segregated for packaging prior to shipment.

Environmental samples shall be packed prior to shipment using the following procedures:

1. Select a cooler (clean and strong). Line the cooler with a large heavy duty plastic bag.

2. Allow sufficient headspace (except VOC's or others with zero headspace requirements) to compensate for any pressure and temperature changes.

3. Be sure the lids on all bottles are tight.

4. Place all bottles in appropriately sized polyethylene bags.

5. Place VOC vials in foam material transport sleeves.

6. Place foam padding in the bottom of the cooler and then place the bottles in the cooler with sufficient space to allow for the addition of more foam between the bottles.

7. Put ice on top of and/or between the samples.

8. Place chain of custody in a baggie and into the cooler. Close the cooler and securely tape the top of the cooler shut. The chain of custody seals should be affixed to the top and sides of the cooler so that the cooler cannot be opened without breaking the seal.

9. The shipping containers must be marked "THIS END UP". The name and address of the shipper shall be placed on the outside of the container. Labels used in the shipment of hazardous materials are not permitted to be on the outside of the container used to transport environmental samples and shall not be used.

6.14 INVESTIGATION WASTE

6.14.1 General

Field surveys conducted by ESC may generate waste materials. Some of these waste materials may be hazardous wastes which must be properly disposed in accordance with EPA regulations.

6.14.1.1 Types of Investigation Derived Wastes (IDW)

Materials which may fall under the IDW category are:

- Personnel protective equipment (PPE)
- Disposable sampling equipment (DE)
- Soil cuttings
- Groundwater obtained through well purging

- Spent cleaning and decontamination fluids

- Spent calibration standards

6.14.1.2 Managing Nonhazardous IDW

Disposal of nonhazardous IDW should be addressed prior to initiating work at a site. Facility personnel should be consulted and wastes handled in an appropriate manner as directed by the client.

For development and purge water generated in the State of Florida, specific disposal requirements apply. The water shall be contained on-site in temporary storage until it is characterized. Appropriate disposal and/or treatment methods will then be determined. Possible disposal options are:

- Direct discharge on-site to infiltrate the same or a more contaminated source

- Transportation to an off-site facility

In no case shall the water be discharged into any surface water unless permitted.

6.14.1.3 Management of Hazardous IDW

Disposal of hazardous or suspected hazardous IDW (as defined in 40 CFR 261.30-261.33 or displaying the characteristics of ignitability, corrosivity, reactivity, or TC toxicity) must be specified in the sampling plan. Hazardous IDW must be disposed in compliance with USEPA regulations. If appropriate, these wastes may be taken to a facility waste treatment system. These wastes may also be disposed of in the source area from which they originated, if state regulations allow this.

If on-site disposal is not feasible, appropriate tests must be conducted to determine if the waste is hazardous. If yes, they must be properly contained and labeled. They may be stored on the site for a maximum of 90 days before they must be manifested and shipped to a permitted treatment or disposal facility. Weak acids and bases may be neutralized in lieu of disposal as hazardous wastes. Neutralized wastewaters may be flushed into a sanitary sewer.

If possible, arrangements for proper containerization, labeling, transportation, and disposal/treatment of IDW should be anticipated beforehand.

Investigation derived wastes should be kept to a minimum. Most of the routine studies conducted by ESC should not produce any IDW that are hazardous. Many of the above PPE and DE wastes can be deposited in municipal dumpsters if care is taken to keep them segregated from hazardous waste contaminated materials. Disposable equipment can often be cleaned to render it nonhazardous, as can some PPE, such as splash suits. The volume of spent solvent waste produced during equipment decontamination can be reduced or eliminated by applying only the minimum amount of solvent necessary.

6.15 SAMPLING BIBLIOGRAPHY

Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual, February 1, 1991, US EPA Region IV, Environmental Services Division.

RCRA Ground-Water Monitoring Technical Enforcement Guidance Document (GPO #5500000260-6), US EPA, September 1986.

Test Methods for Evaluating Solid Waste, SW-846, Third Edition, Office of Solid and Emergency Response, US EPA, November 1986.

Methods for the Determination of Organic Compounds in Drinking Water, EPA/600/4-88/039, December 1988.

Florida Department of Environmental Regulation (DER) Quality Assurance Section (QAS) Guidance Documents:
#89-01Equipment Material Construction, revised April 7, 1989
#89-02Field QC Blanks, revised April 28, 1989
#89-03Teflon/Stainless Steel Bladder Pumps, revised May 10, 1988
#89-04Field Cleaning Procedures, revised August 10, 1989
DER Manual for Preparing Quality Assurance Plans, DER-QA-001/90, revised September 30, 1992.

NPDES Compliance Inspection Manual, United States Environmental Protection Agency, Enforcement Division, Office of Water Enforcement and Permits, EN-338, 1988.

Handbook for Monitoring Industrial Wastewater, United States Environmental Protection Agency, Technology Transfer, 1973.

EPA Primary Drinking Water Regulations, 40 CFR 141.

Rapid Bioassessment Protocols For Use in Streams and Rivers, United States Environmental Protection Agency, Office of Water, EPA/444/4-89-001, May 1989.

Environmental Sampling and Analysis: A Practical Guide. Lawrence H. Keith, Ph.D., 1991. Lewis Publishers.

7.0 SAMPLE CUSTODY

An important part of any sampling/analytical plan is ensuring sample integrity from collection to data reporting. Figure 7.1 is a flow diagram that represents the sample custody process. All records and documentation required to track a sample from point of origin through disposal should be available. The documentation of the life of the sample is referred to as "chain of custody." Formal chain of custody (COC) starts when the sample containers are requested. Such documentation includes container/shipping logs, COC forms, field notebooks, field sample labels and custody seals, laboratory sample log book, sample extraction and digestion prep books, analytical workbooks and instrument logs, QC data associated with the sample set, and the final report. Examples of these documents are presented in Figures 7.2 through 7.10.

Legal COC involves all of the above, but actually begins in the laboratory with container preparation. A log book is maintained with the sample kit contents. When the sample containers are prepared for collection purposes they are cleaned per EPA protocols and stored in areas exclusively for that type of cleaning procedure. When a kit is prepared for delivery to the field a Shipping Checklist/Manifest Form is filled out stating the number and type of bottles, required preservatives, date prepared, date sent, and person preparing kit. A copy of the Shipping Checklist/Manifest Form is kept with the customer request form and bound in a log book. This log is a permanent part of the COC documentation. The Shipping Checklist/Manifest Form will be sent with the COC and must be kept with the COC at all times. The Shipping Checklist/Manifest Form requires the signature of the person receiving the sample kit, as well as, the date and time of receipt. The person receiving the sample kit thus verifies that the sample kit contents are correct and have been delivered to the appropriate person. The COC/Shipping Checklist will also represent the number of bottles sent to the client and the person preparing the kit to be sent. The sample kit is sealed, with the COC/Shipping Checklist inside, by the person involved with preparation and will remain sealed until the kit is opened for collection in the field. The individual receiving the containers, for field use, signs the COC. Containers are sent to the field in a portable cooler. COC forms and sample container labels identify the tests, dates, times, and individuals who remove samples. Each person responsible for the possession of samples prior to delivery to the lab must document where (with limited access) and the time span he was entrusted with the samples. All shipping records are kept in a log book.

The COC will represent all persons who have the sample in their custody at a given time. Common carriers will be designated on the COC by the client when the sample is shipped back to the laboratory.

7.1 BIOMONITORING CUSTODY PROCEDURES

Batch cultures are identified by date set up or date received. The hatch date is recorded for each batch. For *Ceriodaphnia dubia*, fresh batch cultures are set up on a daily basis Monday through Friday using newly hatched neonates less than 24 hours old. In addition, brood trays are set up daily in order to guarantee organisms of the right age to use in bioassays. Condition of cultures is monitored daily and documented in the daily log. The number of organisms used is recorded in the daily log. The *C. dubia* brood trays are transferred into fresh water and fed daily. Young are harvested daily and third generation neonates less than 24 hours old are used for batch cultures, brood trays, and tests.

For *Pimephales promelas*, organisms less than 48 hours old are obtained from a commercial supplier and are used immediately for chronic bioassays. The date of the batch culture is recorded and batches are maintained for two weeks after receipt to use in acute tests. Batch cultures are monitored and fed daily. The condition of the cultures is documented in the daily log. The number of organisms used is recorded in the daily log. Excess food and waste are removed from the batch cultures as needed and fresh water is added. Cultures are aerated as needed to maintain adequate D.O. levels.

FIGURE 7.1

CHAIN OF CUSTODY PROCESS

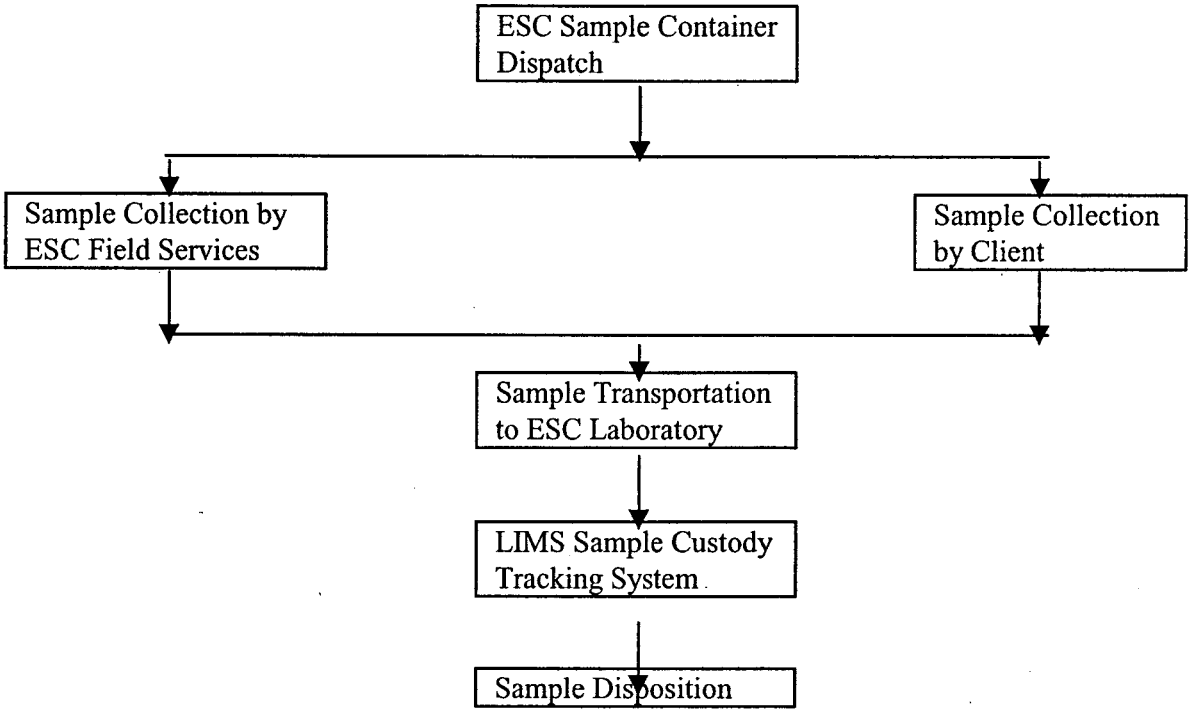


FIGURE 7.2
INDIVIDUAL CONTAINER LOG
EXAMPLE
(Contents will vary depending on client kit requirements)

Batch ID: 2995

ENVIRONMENTAL SCIENCE CORP.
Shipping Batch Detail Report

Date: 7/15/98
Page: 3

CLIENT:
TSR: 610

ORDER#	FREQUENCY	TYPE	DESCRIPTION	SHIP DT	# OF KITS
1892	Annually	Standing	Liquid Sludge	8/ 1/98	1

PROJECT:
INDUSTRY:

PROJ ID: Annual Sludge - SOUR
SITE ID:

COMMENTS: order created by bd 7-5-96

LOCATION: Sludge Digester

PACKING LIST: ANALYSES REQUIRED	QTY	CONTAINER/PRESERVATIVE
BNA's	1 -	1L-Gls Amb, NaThio
Class "B" Fecal Coliform	7 -	125ml-HDPE, NaThio
Cyanide	1 -	250ml-HDPE, NaOH
Kjeldahl Nitrogen, TKN...	1 -	250ml-HDPE, H2SO4
Metals/GFAA	1 -	500ml-HDPE, Add HNO3
NO3, NO2	1 -	125ml-HDPE No Pres
Pest/PCB	1 -	1L-Gls Amb, No Pres
SOUR, TS	1 -	1L-HDPE No Pres
Total Phenol by 4AAP	1 -	250ml-Gls Amb, H2SO4
VOC's GC	2 -	40ml-Gls Amb, HCl
TOTAL CNTRS:	17	

OUTBOUND METHOD OF SHIPMENT	RETURN METHOD OF SHIPMENT	PAID BY
UPS Ground	**Customer's Preferred Method**	**Customer**

SHIPPING AUDIT TRAIL DATE SHIPPED:_____ CARRIER:_____ # PIECES: _____
COOLER#:_____ SIZE: _____ COLOR:_____ INITIALS:_____

FIGURE 7.3
CHAIN OF CUSTODY
GENERAL EXAMPLE
(Required Analysis will be printed by ESC or Client)

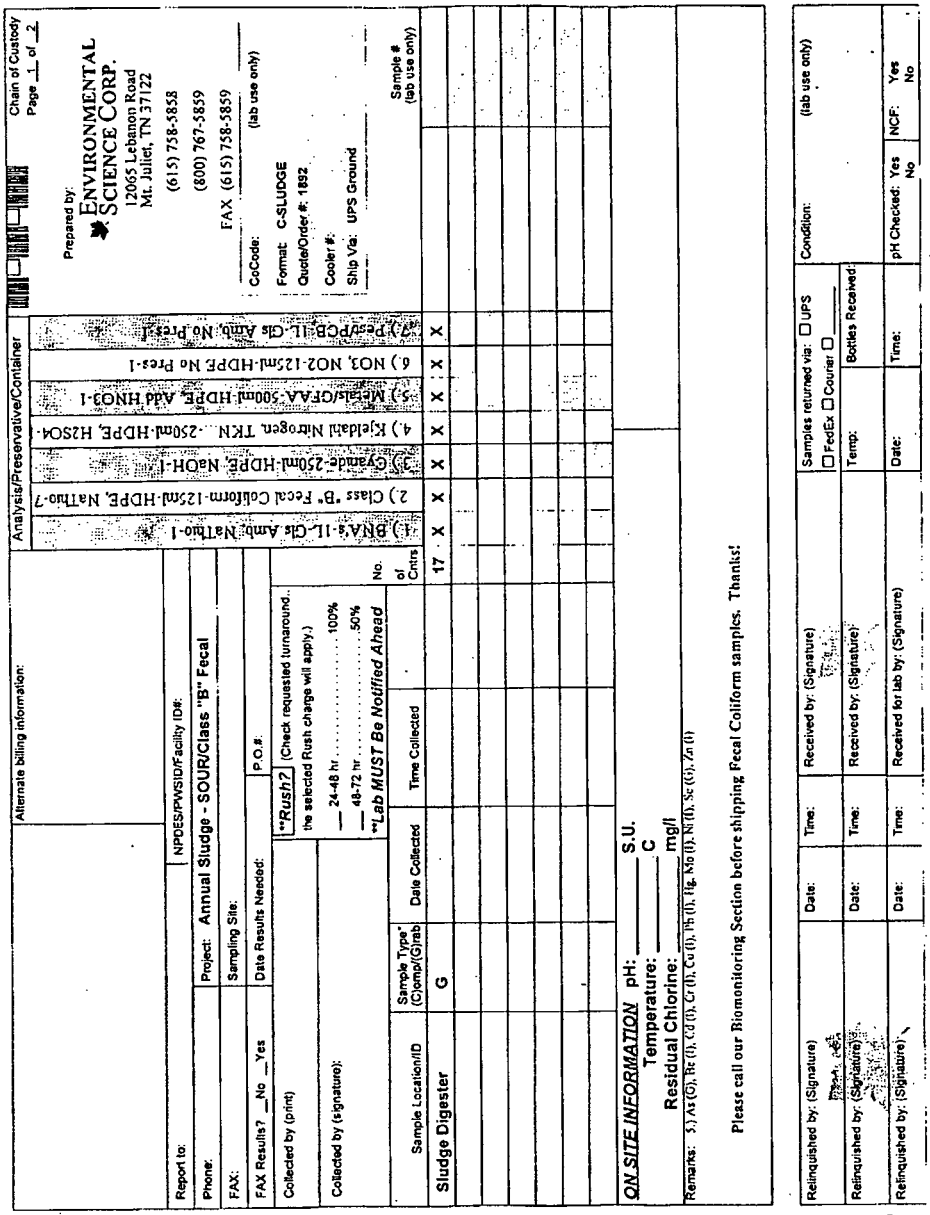


FIGURE 7.4

SAMPLE CONTAINER LABEL

ABC WASTEWATER PLANT

Prepared by Environmental Science Corp.

Project: Annual Sludge - SOUR/Class "B" Fecal

Proj #: 57243

Sample Location/ID: Sludge Digester

Analysis Req'd: Class "B" Fecal Coliform

NaThio Preservative Included

GRAB Date:_____ Time:_____

FIGURE 7.5

SAMPLE CONTAINER CUSTODY SEAL

CUSTODY SEAL

Date:_____

Signature:_____

I-CHEM

Chemists In The Container Business™

FIGURE 7.6

SAMPLE LOGIN LABEL

EMERMFG L99999-01 "BARCODE HERE"
Emerald Manufacturing Corp.
Outfall Manhole-quarterly

Coll. Date/Time: 07/22/98 1400 TN L99999-01

Sample #1 1L=Amb-NoPres

SV625 999999

FIGURE 7.7

EXAMPLE LOG BOOK PAGE
(example only)

Log Record for 07/22/98

Sample #	Cocode	Client/Description	Collection Point	Collector	Date Coll.
18293-98-1	EMERMFG	Emerald Manufacturing Wastewater	Influent Day 3	Tim Wells	07/22/98
18293-98-1	EMERMFG	Emerald Manufacturing Wastewater	Influent Day 3	Tim Wells	07/22/98
18293-98-1	EMERMFG	Emerald Manufacturing Wastewater	Influent Day 3	Tim Wells	07/22/98
18293-98-1	EMERMFG	Emerald Manufacturing Wastewater	Influent Day 3	Tim Wells	07/22/98
18293-98-1	EMERMFG	Emerald Manufacturing Wastewater	Influent Day 3	Tim Wells	07/22/98

FIGURE 7.8

EXAMPLE LAB PREPARATION SHEET

Date : 07/22/98 Environmental Science Corporation Page: 1
Time : 14:29 RUN WORKSHEET LISTING RUNWK23

RUN HEADER INFORMATION

Run # : P67087
Date Created : 06/15/98
By Analyst # : 380 _____
EPA Method :

SELECTION CRITERIA

Test Group : EA TPH-GC High
Status : 10 Ready for Prep
Test Abr. : * ALL COMPOUNDS *
Updated by : MORGAN_J

Comments :

$	CLIENT	SAMPLE#	*	METHOD	MX	RUSH?	DATE DUE	NOTE T	NOTE L	DATE COLL'D	EXPIRATION DATE	TEST PARAMETERS	UNITS	ACTION DATE	#	%
UNITS: % Rec.																
	ENV	13399-98-1		DRO	SS	S	06/18/98			06/08/98	06/15/98	TPH-GC High	% Rec.	06/15/98	#	
	ENV	13400-98-1		DRO	SS	S	06/18/98			06/08/98	06/15/98	TPH-GC High	% Rec.	06/15/98	#	
	ENV	13401-98-1		DRO	SS	S	06/18/98			06/08/98	06/15/98	TPH-GC High	% Rec.	06/15/98	#	
	ENV	13402-98-1		DRO	SS	S	06/18/98			06/08/98	06/15/98	TPH-GC High	% Rec.	06/15/98	#	
	ENG	13690-98-1		DRO	SS	S	06/19/98			06/11/98	06/18/98	TPH-GC High	% Rec.	06/18/98	#	
	ENG	13256-98-1		8270B	SS	S	06/16/98			06/08/98	06/15/98	BNA's	% Rec.	06/15/98	#	
	ENG	13261-98-1		8270B	SS	S	06/16/98			06/08/98	06/15/98	BNA's	% Rec.	06/15/98	#	
	DEC	13311-98-1*		8270B	LS	Y	06/15/98			06/09/98	06/16/98	BNA's	% Rec.	06/15/98	#	
	AGR	13509-98-1		625	GW	Y	06/16/98			06/10/98	06/17/98	BNA's	% Rec.	06/16/98	#	
	AGR	13510-98-1		625	GW	Y	06/16/98			06/10/98	06/17/98	BNA's	% Rec.	06/16/98	#	
	AGR	13512-98-1		625	GW	Y	06/16/98			06/10/98	06/17/98	BNA's	% Rec.	06/16/98	#	
	AGR	13513-98-1		625	GW	Y	06/16/98			06/10/98	06/17/98	BNA's	% Rec.	06/16/98	#	
	AGR	13516-98-1		625	GW	Y	06/16/98			06/10/98	06/17/98	BNA's	% Rec.	06/16/98	#	
	AGR	13517-98-1		625	GW	Y	06/16/98			06/10/98	06/17/98	BNA's	% Rec.	06/16/98	#	
	AGR	13518-98-1		625	GW	Y	06/16/98	T		06/10/98	06/17/98	BNA's	% Rec.	06/16/98	#	
	AGR	13520-98-1		625	GW	Y	06/16/98			06/10/98	06/17/98	BNA's	% Rec.	06/16/98	#	
	AGR	13525-98-1		625	GW	Y	06/16/98			06/10/98	06/17/98	BNA's	% Rec.	06/16/98	#	
	AGR	13526-98-1		625	GW	Y	06/16/98			06/10/98	06/17/98	BNA's	% Rec.	06/16/98	#	
	PPM	13549-98-1		8270B	WS	Y	06/17/98			06/11/98	06/18/98	BNA's	% Rec.	06/17/98	#	
	ENG	13689-98-1		8270B	SS	S	06/19/98			06/11/98	06/18/98	BNA's	% Rec.	06/18/98	#	
	ENG	13691-98-1		8270B	SS	S	06/19/98			06/11/98	06/18/98	BNA's	% Rec.	06/18/98	#	
	FER	13727-98-1		8270B	WW	S	06/22/98			06/11/98	06/18/98	BNA's	% Rec.	06/18/98	#	
	TER	13581-98-1		EPH	SS	Y	06/15/98			06/11/98	06/18/98	Ext Petroleum Hydrocarb	% Rec.	06/15/98	#	
	TER	13666-98-1		EPH	SS	Y	06/16/98			06/11/98	06/18/98	Ext Petroleum Hydrocarb	% Rec.	06/16/98	#	
	GRI	13645-98-1		EPH	SS	S	06/17/98			06/11/98	06/18/98	Ext Petroleum Hydrocarb	% Rec.	06/17/98	#	
	DIL	13442-98-1		EPH	SS	S	06/18/98			/ /	/ /	Ext Petroleum Hydrocarb	% Rec.	06/18/98	#	
	DIL	13443-98-1		EPH	SS	S	06/18/98			/ /	/ /	Ext Petroleum Hydrocarb	% Rec.	06/18/98	#	
	TER	13580-98-1		EPH	SS	S	06/19/98			06/11/98	06/18/98	Ext Petroleum Hydrocarb	% Rec.	06/18/98	#	

T - General info L - Special lab info $ - Special Calib. need # - Expires on/before today
% - Expires over the weekend
* TCLP Extract or THMP

FIGURE 7.9

EXAMPLE LAB ASSIGNMENT/WORKSHEETS

Date : 07/22/98 Environmental Science Corporation Page: 1
Time : 14:27 LABORATORY BENCH SHEET runwk152

RUN HEADER INFORMATION

Run # : A68328
Date Created : 07/15/98
By Analyst # : 485 _____
EPA Method : 350.1
Phase Code : 20
Comments :

SELECTION CRITERIA

Test Group : * ALL GROUPS *
Status : 15 Ready for Analysis
Test Abr. : NH3 Ammonia Nitrogen
Updated by : MORGAN_J

Date Analyzed: _____ Instrument : Lachat
Time Analyzed: _____
Calib. Date : _____ Calib. Corr : _____

Cocode	Sample #	Method	Weight (g)	Direct Readout	Report	
RIC	16267-98-1 . WW	350.1				mg/l
RIC	16269-98-1 . WW	350.1				mg/l
LIN	16367-98-1 . WW	350.1				mg/l
	16403-98-1 . WW	350.1				mg/l
JOH	16404-98-1 . WW	350.1				mg/l
HER	16405-98-1 . SW	350.1				mg/l
HER	16406-98-1 . SW	350.1				mg/l
KIN	16407-98-1 . WW	350.1				mg/l
BAR	16408-98-1 . WW	350.1				mg/l

Quality Control: Reviewed by _____ Date _____

	Blank (1/20)				
TV=	ICV (1/Run)				
Lot#					
TV=	LCS (1/20)				
TV=	MS (1/10) #_____				
	_____ Dup. (1/10) #_____				
TV=	CCV (1/10)				

FIGURE 7.10

EXAMPLE FINAL CLIENT REPORT

ENVIRONMENTAL
SCIENCE CORP.

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Nashville 641-6050
FAX (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

REPORT OF ANALYSIS

Mr. James Dowdy
Aerostar Consultants
PO Box 1112
Mt. Juliet TN 37122

April 3, 1998
Sample # : 06982-98-1

Sample Description : Sludge - Industrial Survey

Sample Location: I-1-06950
Date/Time collected: 03/24/98 0900
Collected by : Jim Dowdy

Parameter	Result (Wet Wt.)	Result (Dry Wt.)	Units	Method	Date Analyzed
Solids, Total	20		%	160.3	03/26/98
Antimony	240	1,200	mg/kg	6010A	04/03/98
Arsenic	< 4.7	< 24	mg/kg	6010A	04/02/98
Barium	2.7	14	mg/kg	6010A	04/02/98
Cadmium	120	600	mg/kg	6010A	04/02/98
Chromium	28	140	mg/kg	6010A	04/02/98
Lead	260	1,300	mg/kg	6010A	04/02/98
Mercury	0.055	0.28	mg/kg	7470A	03/27/98
Molybdenum	280	1,400	mg/kg	6010A	04/02/98
Selenium	< 4.7	< 24	mg/kg	6010A	04/02/98
Silver	< 1.2	< 6.0	mg/kg	6010A	04/02/98
Zinc	3,700	19,000	mg/kg	6010A	04/02/98

Judy Morgan
ESC Representative

Please review all information in this report for accuracy and completeness.
Contact our office within 10 days if there are any questions.

FIGURE 7.11

EXAMPLE FINAL CLIENT REPORT

ENVIRONMENTAL
SCIENCE CORP.

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Nashville 641-6050
FAX (615) 758-5859
Tax I.D. 62-0814289
Est. 1970

REPORT OF ANALYSIS
FL #E87487

Mr. James Dowdy
Aerostar Consultants
PO Box 1112
Mt. Juliet TN 37122

April 3, 1998
Sample # : 06982-98-1

Date Received: March 25, 1998
Description : Sludge - Industrial Survey

Sample Location: I-1-06950
Collection Date/Time : 03/24/98 0900
Collected by : Jim Dowdy

Parameter	Result	Q	Units	Method	Date Prepped	Date Analyzed
Solids, Total	20		%	160.3		03/26/98
Antimony	240		mg/kg	6010A	04/02/98	04/03/98
Arsenic	4.7	U	mg/kg	6010A	04/01/98	04/02/98
Barium	2.7		mg/kg	6010A	04/01/98	04/02/98
Cadmium	120		mg/kg	6010A	04/01/98	04/02/98
Chromium	28		mg/kg	6010A	04/01/98	04/02/98
Lead	260		mg/kg	6010A	04/01/98	04/02/98
Mercury	0.055		mg/kg	7470A	03/26/98	03/27/98
Molybdenum	280		mg/kg	6010A	04/01/98	04/02/98
Selenium	4.7	U	mg/kg	6010A	04/01/98	04/02/98
Silver	1.2	U	mg/kg	6010A	04/01/98	04/02/98
Zinc	3,700		mg/kg	6010A	04/01/98	04/02/98

Judy Morgan
ESC Representative

Please review all information in this report for accuracy and completeness. Contact our office within 10 days if there are any questions.

Data Qualifiers:
U - Indicates less than detect.

7.2 FIELD SAMPLING (Refer also to Section 6.0 for field sampling and documentation procedures.)

ESC field personnel collect samples when requested by the client. (Some clients prefer to collect their own samples even though they may use sample containers prepared by ESC.) ESC's sampling personnel, as designated by the Environmental Monitoring Manager, is responsible for sample custody. This person is responsible for keeping the field notebook, inspecting the custody seal on containers received from the laboratory, assigning field identification numbers to the appropriate containers, ensuring correct sampling procedures are used, completing COC forms, and return shipping to the laboratory. Section 4.0 details the responsibilities of each person associated with sampling/analytical events.

In general, the field identification labeling system is determined on a case by case basis and depends on the number and variety of samples and method of sample collection. Efforts are made to use labels and descriptions that will provide meaningful information to both the sampling personnel and the client. For example, samples collected from a series of wells would be numbered to reflect the position and depth of the sample relative to a diagram of the sampling site. If a sample was collected from a certain point in a process, the name of the process may be used. The field identification number or site number and the sample description are entered on the COC in the Sample location/ID column and into the Laboratory Information Management System (LIMS) database in the Client Identification and Sample Description fields; they are shown on the final report.

All sample labels will contain the following information: Client name, project name or ID, site ID, sampling point, time collected, and date collected. The project ID number will be a unique ID number that will be associated with the client overseeing the project. Clients are designated in the ESC LIMS by a unique name referred to as a COCODE. The COCODE will always precede the project ID so that ESC personnel can easily relate a project ID to a particular client. As samples are logged in, they are assigned a unique sequential number. NO login number can be used twice. When the samples are logged in, all field label information will be entered. All sample information can be accessed by entering the LIMS and viewing the sample login number. ESC has the capability to access all samples with the same project ID and print a summary of the samples. All field information can be reviewed in the field notebook by date, COCODE, and project ID/name.

All graphs, topography maps, aerial photos, regular photographs, and other related ancillary records will contain the same information as the sample container labels discussed in the above paragraph. This information will be filed in the client file and kept as reference records.

Field notebooks are an essential part of the COC. Every detail concerning the sampling event must be documented. All documentation must be written with waterproof ink. All

records are signed and dated by the individuals responsible for making the entry. Errors made during the documentation process are deleted by a single line with the initials of the person who corrected it and the date made.

Crucial information to be recorded in the field notebook includes:

- Project identification by client name and ESC sample number.
- Site identification including address.
- Purpose of project sampling.
- Sample location and site ID
- Date and time of sample collection.
- Names of individual(s) collecting and documenting each sample.
- Names of all individuals present at the time of collection.
- Sample container description, including container identification number, material of construction, preservation and pH check, temperatures stored, headspace checked, etc.
- Pertinent field conditions, including weather, site, traffic, other events, problems, etc.
- Custody of precleaned sample containers must be documented on the container log which is maintained by the shipping coordinator. A copy of the individual container log will be included as an attachment to the COC with each kit prepared and shipped.
- Record sampling sequence: by location, by order in which containers are filled according to the limitations of the tests to be performed.
- Specific sampling equipment used for the collection of each individual sample or sample group (Unique equipment identification numbers can be used.)
- Specific decontamination procedure used prior to the use of specific sampling equipment for each sample.
- Calculations and reasons for the determination of the number of trip, field, and equipment blanks and field duplicates to take based on the number of samples, test groups, coolers, and transportation considerations.

- Documentation of blank(s) collection with the same protocol (e.g., when, where) required for samples. Special attention to the source of deionized water is critical.

- If field tests are performed, all measurements, calibrations, standards readings, and duplicates are recorded in individual test field workbooks to be reviewed, and approved or rejected, by the lab supervisor. Approved results can be entered in the field notebooks and on lab reports, sampling data sheets, and other appropriate reports.

- When sampling soils or sediments the field notes and sample label will reflect the depth at which the samples were taken. The method and equipment used to perform the drilling or boring will be noted in the field notes.

- When sampling monitoring wells, the field notes (whether in notebooks or on standard forms) must also document:

    - Well casing composition and diameter
    - Water table depth
    - Well depth
    - Calculations to determine the volume of water to be purged
    - The total volume of water purged and how accomplished
    - The date and time well was purged, beginning to end
    - Use of fuel-powered units, bailers, etc.
    - Drilling or boring method and type of drilling mud used.

- For wells with in-place plumbing, the field notes must also record:

    - Plumbing and tap material construction
    - Flowrate at which well was purged
    - Total time period well was allowed to purge
    - Flowrate at time sample was collected.

- When collecting surface water samples, the field notes must include the depth at which the sample was taken and the type of sampling equipment used. It is important to note the method of equipment decontamination employed and whether fuel-powered or motorized units were used.

- When water samples are collected over a period of time, it is necessary to indicate the following information in the field notes:

    - Beginning and ending time and date
    - Specific equipment used (manual or automatic)

- Equipment decontamination before and after use
- The conditions of the sampling location
- Safety precautions taken.

- Drum sampling documentation should include the type and physical condition of the drum, a description of the contents in detail, and observations about the immediate surrounding area. If the contents are stratified, layer description and how sampled must be provided. Notes should also be made concerning any labels present on the exterior of the drum.

All field records will include the signature of the person(s) responsible for the collection of the samples.

COC forms are completed and returned with the samples collected by ESC personnel. COC forms are also made available to (or completed for) clients collecting their own samples. If samples are shipped, all shipping paperwork become a permanent part of the COC. A copy of the COC is retained; in the login files, with a copy of the final report in the lab project files. The original is returned to the client with the final report. The COC will be signed by the sampling personnel in the space referred to as "Collected by:".

A sample label is affixed to the side of each sample container before or at the time of sample collection. Pertinent information on the label includes a unique field identification number, sample description, date and time the sample was collected, the name of the person collecting, and any comments or warnings.

7.3 LABORATORY OPERATIONS

The Sample Administrator is responsible for sample login and assessing sample container integrity, documentation, and identification. Samples are inspected and noted for temperature, pH using narrow-range pH paper, headspace, container material, and volume levels. If the samples are not appropriately preserved, the problem is noted on a sample nonconformance form, the sampler is notified, and, if the lab is instructed to proceed, proper preservation is performed. The sample nonconformance sheet will become a permanent part of the COC. Samples which require refrigeration are placed in the laboratory cooler immediately after login. If login personnel have a large sample load to check in, incoming coolers will be placed in a holding cooler until sample capacity allows timely logging in of samples. If extractions are necessary, the laboratory supervisor is notified, via daily management reports, to ensure that holding times are not exceeded for samples, extracts, or digestates.

ESC receives samples for analysis for a variety of reasons, such as planning, estimating, process control, treatability as well as permit compliance reporting, site investigation, and remediation. When a general idea or evaluation is the goal of the testing, analysis of

improperly preserved or collected samples may proceed provided that the client is notified. In this instance the chemist is notified and the proper documentation is placed onto the final report. Where the analytical results are to be used for official purposes, samples are rejected under the following conditions:

- If there is insufficient sample volume,
- If the preservation and container requirements were not followed correctly,
- If there is headspace in a sample collected for volatiles analysis
- If the COC is incomplete or filled out in pencil,
- If the holding time for the desired test has expired,
- If the integrity of the sample container or custody seal has been violated.
- If the temperature is outside of the EPA stated requirement of 4°C +/-2°.

If there is any problem with the sample, the details are documented on the sample nonconformance form/COC; then, the sampler or client is notified. If the client insists on proceeding with analyses, even though he has full knowledge of the invalidity of the sample, a footnote detailing the problem is added in the LIMS and it is also noted on the nonconformance form. The TSR, affected chemists, and reporting personnel are also notified.

When samples are logged in, the information entered into the LIMS includes sample description, date and time collected and by whom, field ID, project ID, collection point, date and time received and by whom, type of container and preservative, sample type, due date, and remarks. Each sample is assigned a unique and consecutive log number. A separate log number will be assigned to each bottle concerning a single collection point. The LIMS generates each log number. After a sample is logged in and fixed with a specific, seven-digit number, the LIMS login screen automatically presents the next consecutive number for logging in the subsequent sample. Log numbers are not available for reuse, although descriptive information, as well as sample specific comments can be modified until the final report is issued. A sample label with the log number is printed by the LIMS and affixed to the sample. The label represents the sample ID number and is clearly marked with preservative and requested analysis. Duplicate samples will be logged with a separate login ID. The login person will initial and date the COC and record the sample numbers assigned onto the COC. The LIMS provides documentation on the person authorized to enter sample log information.

On a daily basis log book pages are printed from the LIMS for inclusion in a hard-copy log book. Each page will contain a sample by sample summary of what has been received and logged. One copy of the COC is placed in a COC file, one copy is given to the sample collector if requested, and the other copies are made as necessary in each area of the sample process. The original copy of the COC is forwarded to the reporting personnel to be reviewed and included with the final report, and one copy is returned with samples requiring controlled disposal. Other copies are retained with a copy of the final report in

the client files.

Samples, extracts, and digestates have specific storage locations arranged in log number order unless rush analysis is required. Access to these areas is limited to authorized personnel. Samples are stored either in the cooler or in ambient-temperature storage, according to EPA preservation guidance. Extracts, digestates, and standards are stored as follows:

- Organic extractions for pesticides and PCBs are stored in glass vials in a designated refrigerator in the semivolatile GC lab.
- Organic extractions for semivolatiles are stored in glass vials in a designated refrigerator in the semivolatile GC/MS lab.
- TCLP extractions for metals only and metal digestates are stored in glass vials in the metals lab. Excess TCLP extract for metals only is stored in a plastic container in the ambient-temperature holding area.
- TCLP extracts for semivolatile, pesticide, and herbicide analysis are stored on designated sample shelves in the cooler. After the extraction, the extract is stored in a designated refrigerator in the semivolatile GC/MS lab.
- Zero headspace extracts and samples for volatiles are stored in VOA vials and segregated in a designated cooler.
- Volatile standards are stored in a designated freezer in the VOC lab.
- Pesticide and PCB standards are stored in a designated refrigerator in the semivolatile GC lab.
- Semivolatile standards are stored in a designated freezer in the semivolatile GC/MS lab.

Intralab sample distribution and tracking procedures involve the following steps after login, sample rejection criteria check, and sample storage:

1. The first check is holding time. The LIMS specialist is trained to recognize those tests with immediate, 24-hour, and 48-hour holding times. If one of those tests is requested, the LIMS specialist notifies the TSR or supervisor verbally and via email, and by noting it and the due date in the computer that holding time is critical. All analysts are trained to assess incoming samples for holding time situations. If a sample has a holding time limitation a due date is determined to ensure that the extraction or analysis is completed in time. In the event that a holding time is exceeded, the analyst/chemist gives an explanation to his/her supervisor. A footnote

will be added to the benchsheet which will then be carried on to reporting. The final report will bear the explanation in the form of a footnote.

2. The sample container displays the following information once it has been released from sample login to the laboratory: the original sample container label and the sample login label showing the sample log number. If the sample requires special DOT labeling, the label will remain with the sample through receiving and disposal. If the sampling personnel notes any special handling or precautions due to the nature of the sample, it is noted on the sample label. The login person will at that time make a note in the LIMS to make sure that all departments have the information. The importance of sample label review is stressed to all chemists/analysts and sample handling personnel. When a sample is obtained for analysis the chemist records in the appropriate prep book or benchsheet the log number, the date removed, his initials, and the volume or mass of sample removed. Samples are mixed prior to taking sub-samples for analysis.

3. The LIMS keeps track of samples and their corresponding log numbers to be analyzed. A prep book is maintained by the analysts that are responsible for sample prep, whether organic or inorganic. The analyst will ask the LIMS to generate a prep sheet for a specific prep code. The LIMS will provide all samples assigned to that prep code and print a worksheet to record the required information. ESC currently maintains the following prep books: metal digestions, organic extractions (by method), and GC and GC/MS injection logs. The chemist preparing the samples, dates and initials the entry, records any nonstandard procedure (e.g., an aliquot for metal digestion other than 100 mls for a water sample) or unusual observation, and which samples are spiked or duplicated. The organic extract prep book contains all details concerning the extraction procedure. When a preparation is complete, the chemist assigned to complete the analysis is notified and the prepped sample is placed in the appropriate holding area. Each extract is labeled to provide the following information: date prepped, amount prepped (volume/weight), dilutions, concentrations, etc. The various prep books, test workbooks, and injection logs document every manipulation of the sample through receipt, preparation, and analysis.

4. Each chemist has assigned analytical procedures that they are responsible for. Before beginning analysis they request a laboratory run preview sheet from the LIMS and receive a printed page for the specific analysis in the form of a benchsheet. This run preview sheet lists all sample log numbers, sample type, and due dates relating to the samples that are ready for analysis at the time requested. At that time the analyst can then select "all" or choose certain samples. Once the samples have been selected they are assigned to a unique run number and are then printed to a run benchsheet. The benchsheet provides all necessary information to complete the analysis such as: date and initials, flask numbers, standards, instrument readings, response factors, aliquots,

dilutions, final results, and all QC spike and duplicate information. When all data is recorded and the calculations are complete, a second chemist (usually a senior chemist) will then perform a second analytical review. If all calculations and other performance objectives pass QC criteria, the second analyst dates and initials the worksheet and gives it to the laboratory supervisor who will release the worksheet to reporting. A data entry specialist will then enter the results into the LIMS. The entered results are reviewed for transcription errors against the original worksheet by a chemist. If the lab supervisor or senior chemist rejects the work, he discusses the corrective action measures with the analyst.

5. Laboratory notebooks and related documentation are an essential part of the analytical procedure. Every detail concerning the sample analysis must be documented. All documentation must be written with permanent/waterproof ink. All records are signed and dated by the individuals responsible for making the entry. Errors made during the documentation process are deleted by a single line with the initials of the person who corrected it and the date made.
6. When a chemist completes the preparation or analysis of a sample, he returns the sample container to the sample custodian.
7. When all of the tests on a sample number are complete, the LIMS notifies the data entry specialist that the results are ready for review. Reporting will print out an approval report which will be given to the Technical Service Representative (TSR). The TSR will review the sample results for discrepancies. If discrepancies are found reruns may be requested. If the rerun finds the same result, the results are approved. If the rerun finds a wrong result, the lab support manager enters the correct result. The TSR will give the final approval on the report and will indicate approval by signature and date.
8. Samples are retained for one to two months at minimum. They remain in the primary storage areas until the shelves become too crowded for ease of operation. Samples containing preservative but had a non-detect on the analyte of interest are neutralized and disposed of through the sewer system. Nonhazardous solids are disposed of in the commercial waste container. All other waste is disposed of in accordance with Section 8.
9. All records are retained by ESC. As paperwork for the various log books and workbooks accumulates, older pages are removed and bound for storage in banker's boxes. A log of numbered boxes and their contents is maintained. The boxes are stored in the lab for two to six months and then removed to the records storage warehouse for a minimum of 10 years.

Final reports and related paperwork are stored in numerical order in the reporting area. All reports on active clients projects stay in the main file area for one year and will be

archived after completing six months of the succeeding year.

When samples or extracts are transferred to another lab, a COC accompanies the sample. The COC contains the following required information: collection date and time, field identification number, ESC log number, number and type of container, date of sample preparation, and the requested analysis. A copy of the COC and the sub-contract lab report is filed for permanent record. A subcontracted analysis log records date sent, where sent, log number, test requested, price, date report received, and date invoice received.

7.4 LABORATORY INFORMATION MANAGEMENT SYSTEM (LIMS)

1. *Security System.* The LIMS is a computerized database for data management. Most analytical computations are currently done outside the LIMS. Access to the system is protected by coded password, and different stations can be allowed different levels of access:

   Level 1. Login, lookup sample status, generate worksheets. General access, every station has access.

   Level 2. Enter data, proofread and change data. The data entry person has access to this level.

   Level 3. Review and validate data, generate reports. Access is limited to the TSR, lab supervisors and QAO. Once data is approved in the LIMS, it cannot be altered. Only the status of the sample may be changed to either "reported" or "invoiced."

2. *Records* routinely printed from LIMS are:

   a. Login summary - includes all information on sample and requested tests
   b. Lab preparation preview and bench sheets for digestions, extractions
   c. Lab assignment/benchsheets to generate work assignments and record test data
   d. Data approval reports
   e. Final reports for clients
   g. QA summary

All paper records are retained by ESC. As the pages become historical (prior to the current working range of log numbers), they are removed from the log book, prep book, or workbook in sequential order and permanently bound for storage in banker's boxes. A log of numbered boxes and their contents is maintained by the lab administrative assistant. They are cross-referenced by project number and sample log number.

3. *Data* is available on electronic media.

4. *Revisions* to the LIMS software are documented within the code. Each revision will indicate the change in function, programmers initials, and date of change. Programming has limited access and is accessible only by approved individuals through the use of passwords.

5. *Data entry* is verified by a four-step system:

   a. Raw data is first approved by the section supervisor.
   b. The data entry portion of the LIMS can only be accessed by authorized individuals.
   c. Each group of entered data is then proofread by the data entry person and another data entry specialist.
   d. When all results for a sample are complete, a report is printed and examined by a Technical Service Representative for final approval.

6. *Backup* on the system occurs at noon and is transferred onto tape at night. If the system should crash, data loss would be restricted to a 12-hour span and can be reconstructed from sample custody sheets and lab workbooks.

7. All calculations performed by the LIMS are approved and submitted by the Laboratory Supervisors. Each calculation is tested parallel to manual calculations to ensure proper function.

8. *Automatic Data Transfer* – Data is transferred electronically from instrumentation directly to the LIMS. Once the data has been transferred, it undergoes a screen review. The data is then printed and reviewed again. If data needs to be changed, it will be changed by a data entry specialist and a hardcopy will be printed of the final data.

9. Section 12.5 describes LIMS data storage.

7.4.1 Auxiliary Computer and Software Used to Generate and Validate Data

7.4.1.1 General

Several instruments have their own dedicated single computer and manufacturer-designed software to run them. Instruction manuals and other documentation provided by each company are maintained. We receive updates as they become available from the manufacturer. All raw and filtered data are stored on media (with uniquely titled data files on floppy discs) and all associated printouts and paper work is filed. The original raw data is not accessed again unless it is subjected to uncertainty.

Creation of any method or analyte files necessary to run the appropriate analyses is the responsibility of the group leader. The lab supervisor verifies that the compounds, wavelengths, retention time windows, calculational criteria, and other relevant parameters are correctly input into the specific method file. Analysts may only use the method files that have been specifically generated by the group leader. Table 7.1 represents software maintained for data reduction.

7.5 SAMPLE TRANSPORTATION

When a sample is received into the laboratory, the method of transportation is recorded onto the COC. ESC routinely uses FED-EX, UPS, USPS, and AIRBORNE. Locally collected samples are sometimes carried in by the client collection personnel or by ESC courier. When ESC is involved in the actual sample collection, the samples are packed and iced on site and transported by ESC field personnel. When samples required expeditious analyses, Corporate Express or similar services may be used to transport samples same day.

TABLE 7.1

SPECIFIC INSTRUMENTATION SOFTWARE

Instrument	Software	Use
PE 4100ZL Furnace AA	PE GEM/2 ver 7.21 reports ver 2.4	Calibration, calculation, qc review, diagnostics, data storage
PE ELAN 6100	PE - ICP Winlab	Calibration, calculation, qc review, diagnostics, data storage
Leeman Labs ICP	Leeman 1000	Calibration, calculation, qc review, diagnostics, data storage
Perkin Elmer Optima DV	PE - ICP Winlab	Calibration, calculation, qc review, diagnostics, data storage
Ion Chromatographs	Dionex	Calibration, calculation data storage
Hewlett Packard GC/MS HP 5972 MSD 5890 series II+ GC	HP Chemstation HPG1034C	Calibration, calculation data storage, mass spectral library
Gas Chromatographs	HP Chemstation	Calibration, calculation data storage
Lachat Quikchem AE autoanalyzer	AE Software	Calibration, calculation, qc review, diagnostics, data storage

* All purchased software that is used in conjunction with software specific instruments is guaranteed by the supplier to function as required. All troubleshooting or software upgrades and revisions are performed by the supplier of the software.

8.0 ANALYTICAL PROCEDURES

Only approved EPA procedures are used. The following list is an example of the methodology ESC is proficient in: Methods for Chemical Analysis of Water and Wastes (March 1983), 40 CFR Part 136 listed methods, Standard Methods, ASTM, NIOSH, or SW-846, Test Methods for Evaluating Solid Wastes (3rd edition). The methods are listed in Section 5.0.

8.1 GLASSWARE

8.1.1 General

Routine laboratory glassware is washed in a non-phosphate detergent and warm tap water. Before washing all writing and large deposits of grease are removed with acetone. Glassware is then rinsed with: tap water, "No Chromix" solution, tap water, and deionized (DI) water. Glassware is stored in designated drawers or on shelves, inverted if possible. All glassware is rinsed with the required solvent, prior to use. DI water is then used as a precaution against airborne contamination.

8.1.2 Metals Glassware

Glassware involved in metals preparation is washed with soap and water, rinsed in 1+1 nitric acid and rinsed in DI water. Through digestion blanks, it has been determined that chromic acid washing is unnecessary. Glassware with visible gummy deposits remaining after washing is disposed of properly. All metals glassware is given another DI water rinse immediately prior to use. Metals glassware is segregated from all other glassware.

8.1.3 Phosphate Glassware

Glassware involved in phosphate analysis is marked and segregated. All labels and markings are removed from the glassware prior to washing. The glassware is then washed using hot water and a non-phosphorus detergent. It is then rinsed thoroughly in hot water followed by a rinse in DI water. It is rinsed in 1:1 HCL followed by a final rinse of DI water. If the phosphate glassware has not been used recently, it is the responsibility of the analyst to rinse the glassware with warm 1+9 hydrochloric acid prior to use.

8.1.4 Nutrients and Minerals Glassware

All labels and markings are removed from the glassware prior to washing. The glassware is then washed using hot water and detergent. It is then rinsed thoroughly in hot water followed by a rinse in DI water. It is rinsed in 1:1 HCL followed by a final rinse of DI water. Immediately prior to use, the ammonia glassware is rinsed in DI water. Routine blanks are run on ammonia glassware to ensure that the detergent is contaminant free.

8.1.5 Non-Metals (CN, BOD, COD) Glassware

All labels and markings are removed prior to washing. The glassware is soaked in hot soapy water followed by a thorough rinse with hot tap water. A final rinse of DI water is then performed. At times BOD glassware will require the use of NO-CHROMIX to thoroughly clean analysis bottles.

8.1.6 Volatile Organics Glassware

All VOA vials are purchased specifically for volatiles analysis and only used once. They are stored in the original carton with screw cap lids tightly fastened. All vials are stored in a contaminant-free environment. All glassware used for volatile organic compound analysis (volumetric flasks, syringes, etc.) is segregated from other laboratory glassware. Standard cleaning procedures involve rinsing three times with methanol. Volatiles spargers are kept on the autosampler at all times. Between runs, spargers are cleaned with three rinses of distilled water. When a highly contaminated sample is purged in a particular sparger, a blank is run in that sparger before another sample can be placed in it. If the sparger is found to be contaminated it is removed from the autosampler and cleaned with soap and water and a methanol rinse followed by heating to drive off any remaining volatile contaminants. The sparger is then put back in place where blank analysis is performed. If the blank proves to be contaminant free it is then ready for sample analysis.

8.1.7 Extractable Organic Glassware

Extractable organic glassware is maintained by the extraction room personnel. The glassware is exposed to routine cleaning procedures, it is then solvent rinsed in the following order: methanol, acetone, and then methylene chloride. The glassware is rinsed at the beginning of analysis by the required solvent for that particular extraction protocol.

8.1.8 Biomonitoring Glassware

All bioassay glassware are cleaned using the following protocol (DER QA #90-04):

*soak for 15 minutes in hot tap water with detergent and scrub rinse thoroughly with hot tap water * rinse thoroughly with dilute nitric acid (10%) * rinse thoroughly with deionized water * rinse thoroughly with pesticide grade acetone * rinse well with deionized water *rinse with dilution water

New glassware will be cleaned according to the same procedure as listed above except the first step will be preceded by soaking the glassware overnight in 10% HNO_3.

While each section of the laboratory requires unique cleaning procedures, NO procedure includes baking Class A volumetric glassware.

8.2 BIOMONITORING ANALYTICAL PROCEDURES

At a minimum, the following physical and chemical parameters are analyzed for each sample received (see Section 5 for method numbers):

- Temperature - recorded daily.
- pH - initial and final measurements recorded
- D.O. - initial and final measurements recorded
- Specific Conductance
- Alkalinity
- Hardness
- Total Residual Chlorine

8.2.1 Feeding Regime

- 7-Day Fathead Minnow Larval Survival and Growth Test - test organisms are fed 0.15 mL newly-hatched brine shrimp (*Artemia*) twice daily.

- 3-Brood *Ceriodaphnia dubia* Survival and Reproduction Test - test organisms are fed 0.1 mL of Yeast, Cereal leaves, Trout chow (YCT) and 0.1 mL *Selenastrum capricornutum* algal suspension once daily.

- 24 and 48 Hour Acute Toxicity Tests - organisms are fed prior to introduction into sample but are not fed for the duration of the test.

- 96-Hour Acute Toxicity Tests - tests usually run concurrently with chronic bioassays using the same feeding regime.

8.3 REAGENT STORAGE AND WASTE DISPOSAL

8.3.1 All chemicals are at least ACS reagent-grade or better. Each chemical container displays the following information: date received, date opened, and the expiration date. All reagent solutions prepared in house contain the following information: date prepared, analyst initials, expiration date, and reagent name. In house reagents are also recorded with the same information in a reagent prep book specific to that method. Purchased reagent solutions are dated when received, opened, and expiration. All chemicals are disposed of on their expiration date. Reagents requiring refrigeration are stored in the area of use in a suitable refrigerated storage area that is separate from sample storage. Reagents and standards used for volatile organics analysis are not stored with samples; volatile standards are stored in a separate refrigerator. Section 9.2 describes specific storage for organics standards.

Item	Reagent Storage
Acids	Designated acid storage cabinets, in original container.
Organic Reagents	Stored in flammables cabinet on separate air system from volatiles analysis.
Liquid Bases	Stored in designated cabinet, away from acids.
Solid Reagents	General cabinet storage.
Refrigerated Aqueous Liquid Reagents and Refrigerated Aqueous Standards	Stored in walk-in cooler on designated shelves, away from samples.
Stable Standard Solutions	Storage cabinet designated for standards.

8.3.2 Sample and reagent/solvent disposal is handled in different ways according to toxicity. Solvents, reagents, samples, and wastes are segregated according to base/acid, reactive/nonreactive, flammable/nonflammable, hazardous/nonhazardous, etc. Samples are grouped together relating to these categories and are treated in batches. Samples that have been disposed of are recorded in the daily login record. Chemical materials that are deemed hazardous that cannot be treated to a nonhazardous state are lab-packed and disposed of according to proper protocols as established by a licensed waste hauler. When the latter procedure is used, a copy of the waste manifest is retained and kept in an appropriate file. Table 8.1 lists waste disposal methods for various test byproducts.

NOTE: ESC's sample disposal policy is founded on RCRA [40 CFR Part 261.4 (d)] and CWA [40 CFR Part 403 (Pretreatment)]. Part 261.4 (Figure 8.1) excludes a sample of waste while it is a sample; however, once no longer fitting the description of a sample, it becomes a waste again.

TABLE 8.1
CHEMICAL WASTE DISPOSAL

PARAMETER	TEST PRODUCTS	WASTE CLASSIFICATION	DISPOSAL METHOD
Acidity	slightly alkaline water	none	neutralize-sanitary sewer
Alkalinity	slightly acidic	none	neutralize-sanitary sewer
BOD, 5-day	sewage	none	sanitary sewer
Boron	small quantity isopropanol	none	sanitary sewer
COD	acid waste, Hg, Ag, Cr+6	corrosive, toxic	ampoules are saved for lab packing
Chloride	dilute mercuric chloride	toxic	precip. Hg, sanitary sewer
Conductivity	none		
Cyanide, Total	acidic waste	corrosive	neutralize-sanitary sewer
Cyanide, Amenable	acidic waste	corrosive	neutralize-sanitary sewer
Flashpoint	none		
Fluoride, Electrode	neutral waste solution	none	sanitary sewer
Hardness, Total	pH 10.0 alkaline waste	none	neutralize-sanitary sewer
Methylene Blue Active Substances	chloroform	toxic solvent	evaporate in hood
Nitrogen-Ammonia	alkaline liquids	corrosive	neutralize-sanitary sewer
Nitrogen-Total Kjeldahl	Hg in alkaline liquid	corrosive toxic	precipitate, neutralize, aspirate to sanitary sewer
Nitrogen-Nitrate, Nitrite	mild alkaline waste	none	sanitary sewer
Oil & Grease and Petroleum/Mineral Oil & Grease	Freon	non-toxic solvent	recycle
PH	sewerage	none	sanitary sewer
Phenols	slightly alkaline, non-amenable CN-	none	aspirate to sanitary sewer--waste is monitored for CN
Phosphate-Total and Ortho	combined reagent	listed	water aspirate-sanitary sewer
Solids, Total (% solids)	none		
Solids, Total Dissolved	none		
Solids, Total Suspended	none		
Sulfate	barium sulfate solution	toxic	precipitate-filter: sanitary sewer
Turbidity	none	none	none
Metals	acids, metal solutions	corrosive, toxic	high toxic metal standards are precipitated, neutralized--sanitary sewer
Volatile Organics	small quantity of volatiles standards	toxic solvents	treatment
Extractable Organics	solvents, standards	toxic semivolatiles, solvents	treatment, lab pack residue

FIGURE 8.1

40 CFR PART 261-IDENTIFICATION AND LISTING OF HAZARDOUS WASTE

Subpart A-General Sec.

Sec.261.4 Exclusions.

(d) **Samples.** (1) Except as provided in paragraph (d)(2) of this section, a sample of solid waste or a sample of water, soil, or air, which is collected for the sole purpose of testing to determine its characteristics or composition, is not subject to any requirements of this part or parts 262 through 268 or part 270 or part 124 of this chapter or to the notification requirements of section 3010 of RCRA, when:

(i) The sample is being transported to a laboratory for the purpose of testing; or
(ii) The sample is being transported back to the sample collector after testing; or
(iii) The sample is being stored by the sample collector before transport to a laboratory for testing; or
(iv) The sample is being stored in a laboratory before testing; or
(v) The sample is being stored in a laboratory after testing but before it is returned to the sample collector; or
(vi) The sample is being stored temporarily in the laboratory after testing for a specific purpose (for example, until conclusion of a court case or enforcement action where further testing of the sample may be necessary).

(2) In order to qualify for the exemption in paragraphs (d)(1) (i) and (ii) of this section, a sample collector shipping samples to a laboratory and a laboratory returning samples to a collector must:

(i) Comply with U.S. Department of Transportation (DOT), U.S. Postal Service (USPS), or any other applicable shipping requirements; or

(ii) Comply with the following requirements if the sample collector determines that DOT, USPS, or other shipping requirements do not apply to the shipment of the sample:

(A) Assure that the following information accompanies the sample:
(1) The sample collector's name, mailing address, and telephone number;
(2) The laboratory's name, mailing address, and telephone number;
(3) The quantity of the sample;
(4) The date of shipment; and
(5) A description of the sample.
(B) Package the sample so that it does not leak, spill, or vaporize from its packaging.

(3) This exemption does not apply if the laboratory determines that the waste is hazardous but the laboratory is no longer meeting any of the conditions stated in paragraph (d)(1) of this section.

8.3.4 Upon receipt and login, each sample is coded by sample matrix type. The codes divide samples into the following groups: wastewater, cake sludge, soil, drinking water, and miscellaneous. As the laboratory supervisor reviews the data the method of disposal is also determined. If a sample is unusually concentrated, it is recorded on a laboratory disposition form, Figure 8.2. The sample is segregated and placed in holding area. The project manager is notified if samples are to be returned to the client.

FIGURE 8.2
SAMPLE DISPOSITION FORM EXAMPLE

Date	Sample Number	Matrix Type	Disposal Method	Remarks

Approved by: _____ Date: _____

9.0 CALIBRATION PROCEDURES AND FREQUENCY

9.1 INSTRUMENT LIST

See Table 9.1 for major pieces of ESC laboratory equipment and Table 9.2 for major pieces of field equipment.

TABLE 9.1
LABORATORY EQUIPMENT LIST: MAJOR ITEMS

Item	Manufacturer	Model	Location
Analytical Balance Class "I" weights (3 sets)	Mettler Mettler Troemner	AT261 Delta Range AT200 AG204 Delta Range	Bioassay Wet Lab Wet Lab Wet Lab, Bioassay, Floater
Autoanalyzer	Lachat Lachat	Quikchem 8000 Quikchem 8000	Wet Lab
Automatic Concentrators	(4) Zymark	Turbovap II	Extraction Lab
Centrifuge	Beckman	Spinchron R	Wet Lab
Cold Room 11' X 19'	FridgAmerica		Main Building
Conductivity Meter	Hanna	HI9033	Wet Lab
Distillation Unit - Cyanide	(3) Kontes Glass Co.	Model Cal 3200	Wet Lab
Distillation Unit - Phenol	Westco Scientific	Model EASY-DIST	Wet Lab
Flash Point Tester	Koehler	Pensky-Martens K16200	Wet Lab
Gas Chromatograph	(4) Hewlett Packard (1) Hewlett Packard (3) Hewlett Packard Detectors	5890 Series II 5890 6890 (2) FID, (3)ECD/ECD,	Semi-Volatiles

Item	Manufacturer	Model	Location
		FID/FID, ECD, NPD/NPD	
Gas Chromatograph	(5) Hewlett Packard (1) Hewlett Packard	5890 Series II 5890	Volatiles
	Detectors	PID/FID	
Purge and Trap, Autosampler	(8) Tekmar (2) Tekmar (2) Tekmar (14) Varian (2) PTS/EST	LSC-2000 3100 3000 Archon Encon	
Gas Chromatograph/Mass Spectrometer	(2) Hewlett Packard (1) Hewlett Packard (4) Hewlett Packard	5890 GC/5972 MSD 5890 GC/5971 MSD 6890 GC/5973MSD	Semi-Volatiles
Gas Chromatograph/Mass Spectrometer	(3) Hewlett Packard (2) Hewlett Packard (3) Hewlett Packard	5890 GC/5972 MSD 5890 GC/5971 MSD 6890 GC/5973MSD	Volatiles
Autosampler	(14) Varian	Archon	
High Performance Liquid Chromatography	Agilent	1100 Series	Semi-Vol Lab
High Intensity Ultrasonic Processor	(8) Tekmar		Extraction Lab
Hot Plate	Thermolyne Fisher	Type 2200	Wet Lab
Hydrogen Generator	Whatman		Volitiles
Inductively Coupled			Metals Lab

Item	Manufacturer	Model	Location
Plasma Sequential with tandem autosampler Trace Analyzer - Simultaneous with autosampler	Leeman Labs Perkin Elmer	Plasma Spec 1000 Optima 3000DV Optima 3300DV Optima 4300DV	
Inductively Coupled Plasma ICP Mass Spectrometer Autosampler	Perkin Elmer Perkin Elmer	ELAN 6100 AS-91	Metals Lab
Ion Chromatograph	Dionex Dionex	DX500	Wet Lab
Karl Fischer Titrator	Fisher		Wet Lab
Mercury Auto Analyzer Prep station	Perkin Elmer Prep Station	FIMS 400 AS-91 FIMS 400 AS-90	Metals Prep Lab
Microwave	CEM	(3) MDS 2100 (4) MARS	Metals Prep Lab
Muffle Furnace	Blue M		Wet Lab
Oven - Drying	Fisher Fisher Equatherm	Isotemp 655G Isotemp 655G D1576	Wet Lab
pH Meter	Orion	410A	Wet Lab
Refrigerated Recirculator	VWR VWR		Wet Lab
Specific Ion Meter	Orion	EA940	Wet Lab

Item	Manufacturer	Model	Location
Spectrophotometer (UV/Vis)	Hach	DR 4000U	Wet Lab
TCLP Extraction Unit	Environmental Express	(1) 6 Position (2) 12 Position (1) 10 Position (12) Teflon Vessels	Wet Lab
Total Organic Carbon Analyzer	OI Analytical	Model 700	Wet Lab
Total Organic Carbon Analyzer	Shimadzu	5000A	Wet Lab
Turbidimeter	Hach	2100A	Wet Lab
Water Bath	Blue M	MW1140A-1	Wet Lab
Zero Headspace Extractor Vessel	Environmental Express	(12) Vessels	Wet Lab
BIOMONITORING LABORATORY			
pH Meter	Cole-Parmer	5996-50	Bioassay
Conductivity Meter	Orion	135	Bioassay
Water Bath	VWR Scientific	1295PC	Bioassay
Water Purifier	US Filter	Purelab Plus D56235	Bioassay
Incubator	Lindberg Blue		Bioassay
Incubator	Blue M		Bioassay
Incubator	VWR	2020	Bioassay
Incubator	VWR	2030	Bioassay
Incubator	Fisher	307	Bioassay

Item	Manufacturer	Model	Location
Incubator	Precision Sci.	818	Bioassay
Incubator (3)	Precision Sci.	818	Bioassay
Incubator	Precision Sci.	818	Bioassay
Stereoscope	Olympus	SZH-ILLD	Bioassay
Stereoscope	Olympus	SZH-ILLD	Bioassay
Microscope	Olympus	CHT	Bioassay
Refrigerator	True		Bioassay
Analytical Balance Class "I" weights (1set)	Mettler Troemner	AT261 Delta Range	Bioassay Bioassay
Dissolved Oxygen Meter	YSI	Model 50B	Bioassay

NOTE: ESC has all associated glassware, heaters, stirrers, etc. for use with the above equipment.

TABLE 9.2
FIELD EQUIPMENT LIST: MAJOR ITEMS

Item	Materials of Construction (if applicable)	Quantity	Manufacturer	Model
Exotox Gas Monitor (CO, H_2S, O_2, Explosive)		1	Neotronics	400FH
Gas Monitor		1	Industrial Scientific	HMX 271
HNU Photoionization detector		2	HNU	101
Bailer and Accessories	Teflon	2	Norwell	
Water Level Indicator	Stainless steel and rubber	1	Slope Indicator	51453
Continuous pH Meter recorder		1	Cole-Parmer	5654-40
Conductivity Meter		1	VWR Scientific	2052
Field pH Meter		1 2	Orion Cambridge Scientific	230A
Fluorometer		1	Turner Designs	10-00R
Field Analysis (Wet Chemistry)		1	HACH	CL700
Field Analysis (Residual Chlorine)		1	HACH	DR100
Flow Meter		2 2 1	Instrumentation Specialties Co. (ISCO)	3230 3210 2870
Automatic Water Sampler with: 9 NiCad Batteries 9 AC Power Packs	HDPP Plastic or Glass Containers; Silicone Tubing	2 1 3 2 1	American Sigma Instrumentation Specialties Co. (ISCO)	1350 2700-S&C 2710 C 3700-S&C 3710 C
Turbidimeter		1	HACH	2100P

9.2 STANDARD RECEIPT AND TRACEABILITY

When standards are received, they are assigned a unique number as follows: "ESCxxxx." The number is recorded in a logbook with other important information concerning supplier, expiration date, description, and volume. The number is then placed on the standard and the Certificate of Analysis. The Certificate of Analysis is kept on file in numerical order for future reference. The standards are dated upon opening. Table 9.3 lists standard sources, receipt, and preparation information. Standards for all field tests are currently prepared in the laboratory exactly as indicated in Table 9.3. The field personnel obtain these standards from the lab and the standards are NIST traceable.

TABLE 9.3
STANDARD SOURCES, RECEIPT, AND PREPARATION

Instrument Group	Standard Source	How Received*	Source Storage	Preparation from Source	Lab Stock Storage	Preparation Frequency
ICP and ICP/MS (All metals)	Commercial source	1000ppm	Room temp.			Annual/ Expiration Date
				Intermediate Stock	1% HNO_3	Every 4 months
				Working Standards	1% HNO_3	Every 2 Days
IC (Chloride, Nitrate, Nitrite, Bromide, Sulfate, Fluoride)	Commercial source	Varies	4°C		4°C	6 months or sooner if check samples reveal a problem
				Working Standards as needed per analyte		Midpoint standard prepared weekly or sooner if necessary
pH Meter	Commercial source	pH 4.0 Buffer pH 7.0 Buffer pH 10.0 Buffer	Room temp.	No prep required	NA	Annual/ Expiration date
Turbidimeter	Commercial source Hach	Gelex	Room temp.	No prep required	NA	Checked daily against Formazin standards

*All compounds are at least NIST traceable.

TABLE 9.3 (continued)
STANDARD SOURCES, RECEIPT, AND PREPARATION

Instrument Group	Standard Source	How Received	Source Storage	Preparation from Source	Lab Stock Storage	Preparation Frequency
Specific Conductivity Meter	Commercial source	ACS Certified KCl	Room temp.	Working Standard (0.01M)	Room temp.	As needed
VIS Spectrophoto-meter						
COD	Prepared in Lab	Acid grade KHP	Desiccator	Stock solution (10,000 ppm)	4°C	When absorbance of curve changes or check samples are out of control
Cyanide Autoanalyzer	Prepared in Lab	KCN	Reagent shelf	Stock solution (1,000 ppm)	4°C	6 months. Working dilutions prepared daily as needed.
MBAS	Prepared in Lab	LAS reference material	4°C	1,000 mg/ml Working standards	4°C wet stored	6 months or when check standards are out of control. Prepared fresh.
Nitrite-Nitrate autoanalyzer	Prepared in Lab	ACS grade KNO_3	Reagent shelf	Stock solution (1000 ppm)	4°C	When absorbance of curve changes or check samples are out of control
Phenols autoanalyzer	Prepared in Lab	ACS Certified Phenol	Reagent shelf	Stock solution (1,000 ppm)	4°C	Every month. Working solutions prepared daily as needed.
Phosphate	Prepared in Lab	KH_2PO_4	Reagent shelf	Stock solution (50 ppm as P)	Room temp.	When absorbance of curve changes or check samples are out of control. Working solutions prepared daily as needed.
Sulfate	Prepared in Lab	Anhydrous Na_2SO_4	Reagent shelf	Stock solution (100 ppm)	Room temp.	When visible microbiological growth or check samples are out of control

TABLE 9.3 (continued)
STANDARD SOURCES, RECEIPT, AND PREPARATION

Instrument Group	Standard Source	How Received	Source Storage	Preparation from Source	Lab Stock Storage	Preparation Frequency
Volatile Organic Compounds	Commercial source	100 ppm	4°C away from samples, solvents		4°C away from samples solvent	3 months (gases); 6 months (all others) or sooner if check samples reveal a problem
				Working Standards (2-40 ppb)		Prepared from stock, stored in zero headspace vials, kept for 1 week and verified ever 12 hours
Pesticides/PCBs	Commercial source	2000 ppm	4°C			
				Intermediate	4°C	6 months
				Working Standards	4°C	As needed
Semivolatile Organic Compounds	Commercial source	2000 ppm	4°C		4°C	6 months or sooner if check samples reveal a problem
				Working Standards (20, 40, 60, 80, 100 ppm)		Midpoint standard prepared weekly or sooner if necessary
Titrametric						
Alkalinity, Acidity	Lab preparation from neat chemicals	Acidi-metric standard grade KHP	Room temp.	0.0500 N	4°C	6 months
Hardness	Lab preparation	Chelometric Std. $CaCO_3$	Room temp.	1 mg/ml as $CaCO_3$	Room temp.	Annually or when check samples are out of control
BOD	Lab preparation	as dry glucose and glutamic acid	desiccator	150 mg of each/liter	Not stored	Made fresh with each batch of BODs
Autoanalyzer						
Fluoride	Lab preparation	ACS grade KF	Room temp.	100 ppm stock solution	Room temp.	1 year or as needed when reference standard fails
				Dilute standards	Not stored	Prepared fresh daily
Ammonia-Nitrogen and Total Kjeldahl Nitrogen	Lab preparation	ACS grade NH_4Cl	Room temp.	1,000 ppm stock standard	Room temp.	Annually or when check standards are out of control
				Working Standards	Not stored	Prepared fresh as needed

9.3 STANDARD SOURCES AND PREPARATION

When standards are prepared in-house, they are weighed on an analytical balance, calibrated against Class "I" weights, diluted in Class "A" glassware, and compared against an external reference standard. The standard is marked with concentration, then signed and dated by the analyst, and placed in the appropriate storage area.

A standard log is kept with each analysis book, indicating date of preparation, which standard (by lot number, if applicable) used, the amount used to form solution, when it was made and expiration date or the recommended holding time. Reagents are recorded in the same manner as standards. Reagents that are prepared on a daily basis are recorded directly onto the raw data sheet. The analyst preparing the reagent will initial and date the raw data sheet.

All dilutions of stock standards are prepared in Class "A" volumetric glassware. If the intermediate or working standards are to be saved and used again after the immediate analysis, the standard container is marked with concentration, date, source standard, expiration, and the analyst's initials.

All purchased stock standards are kept in a designated area within the appropriate section. Each chemical is marked in relation to date received, date opened, and expiration date.

Table 9.3 presents details regarding standard sources, preparation procedures, and frequencies. Table 9.4 lists concentrations for calibration standards for each test.

9.3.1 Biomonitoring Reference and Source Materials

Reference Toxicant

The reference toxicant used at ESC is potassium chloride. Acute and chronic reference toxicant tests are performed at a minimum of once monthly and upper and lower control limits have been established. In respect to FDER related samples ESC will perform acute and chronic reference toxicant tests for all in-house cultures done with each batch of purchased organisms.

Source of Biological Organisms:

The primary source for all bioassay species is:

Aquatic Biosystems Inc.
2821 Remington Street
Fort Collins, CO 80525

The source for their organisms is documented on each packing slip received. ESC accepts the packing slip as documentation and verification by the supplier with regards to the taxanomic identification of the bioassay species. The packing slips for bioassay test organisms are kept on file.

A preserved species from each newly received batch is archived.

TABLE 9.4
CALIBRATION STANDARD CONCENTRATIONS
Wet Chemistry

Analysis	Calibration Standard
Alkalinity, Acidity- titrimetric	Primary standard grade Na_2CO_3.
Alkalinity - Methyl orange Autoanalyzer	Primary standard grade Na_2CO_3: 10, 30, 50,100, 300 mg/l.
BOD	D.O.-Barometric pressure/temp., Glucose and Glutamic acid reference standard.
Bromate IC	Low Range – 5.0, 10, 20, 30, 50, 100 ug/L High Range – 10, 20, 50, 100, 200, 400, 600 ug/L
Bromide IC	Low Range – 5.0, 10, 20, 30, 50, 100 ug/L High Range – 10, 20, 50, 100, 200, 400, 600 ug/L
Chlorate IC	Low Range – 5.0, 10, 20, 30, 50, 100 ug/L High Range – 10, 20, 50, 100, 200, 400, 600 ug/L
Chloride autoanalyzer	NaCl standard: 20, 40, 60, 80, 100 mg/l (high) 1, 2, 5, 10 mg/l (low)
Chloride IC	1.0 – 10 mg/L
Chlorate IC	Low Range – 5.0, 10, 20, 30, 50, 100 ug/L High Range – 10, 20, 50, 100, 200, 400, 600 ug/L
Conductivity	Standard KCl solution: 1413
Cyanides	Blank, 0.002 - 0.80 ppm. Distill one standard as check with each batch, alternate high and low.
COD	KHP (Potassium hydrogen phthalate) standards 20 - 1000 mg/l.
Chromium - hexavalent	Blank, 0.01, 0.02, 0.05, 0.10, 0.25, 0.50, 1.0 mg/l
Fluoride – autoanalyzer	NaF calibration standard: 0.10, 0.20, 0.50, 1.5, 2.5 mg/l.
Fluoride – IC	NaF calibration standard: 0.1 – 10.0 mg/l.
Hardness	$CaCO_3$, chelometric standard.
MBAS	LAS reference material: 0.05, 0.075, 0.10, 0.125, 0.25, 0.75, 1.0, 1.25, 1.5 mg/L
Mercury	Blank, 0.2 - 0.010 ug/l.
Nitrogen-Ammonia – autoanalyzer	Calibration standards: 0.1, 0.2, 0.4, 1.00, 2.00, 8.0, 20.0 mg/l
Nitrogen-Ammonia - ion selective	Probe calibration standards: 1.0, 4.0, 20.0, 40.0 mg/l
Nitrogen-Nitrate, Nitrite – autoanalyzer	Blank, 0.1, 0.50, 1.00 5.0, 10.0, 20.0 mg/l.
Nitrogen-Nitrate – IC	Blank, 0.1 - 20.0 mg/l.
Nitrogen-Nitrite – IC	Blank, 0.1 - 20.0 mg/l.
Nitrogen-Total Kjeldahl – ion Selective	Calibration standards: 0.50 - 40.0 mg/l

Analysis	Calibration Standard
Nitrogen-Total Kjeldahl – autoanalyzer	Calibration standards: 0.1 - 20.0 mg/l
Oil & Grease	Gravimetric reference standard is Wesson oil.
Orthophosphate, Total Phosphate	Blank, 0.025, 0.25, 0.50, 0.75, 1.0 mg/l diluted from standard KH_2PO_4
PH	Buffers 4.0, 7.0, 10
Phenols (chloroform ext.)	Blank 0.02, 0.04, 0.08, 0.20, 0.40, 1.0, 2.0 mg/l. Distill one standard with each batch, alternate high and low.
Solids	Gravimetric balance calibrated charts, checked with Class "I" weights in range of sample tare weights.
Sulfate	Blank, 10.0 - 1000 mg/l
Sulfate – IC	Blank, 1.0 - 100 mg/l
Sulfide	Iodine/Thiosulfate back titration, $K_2Cr_2O_7$ primary standard; Na_2S reference standard
Sulfite	Titration

TABLE 9.4 (continued)
CALIBRATION STANDARD CONCENTRATIONS
Metals Analysis

HIGH LEVEL	ICP (mg/l)	ICP/MS (mg/l)
Aluminum	0.10 - 100	0.001 – 0.10
Barium	0.002 - 10	0.001 – 0.10
Beryllium	0.002 - 10	0.001 – 0.10
Cadmium	0.002 - 10	0.001 – 0.10
Calcium	0.10 - 100	0.001 – 0.10
Chromium	0.002 - 10	0.001 – 0.10
Cobalt	0.002 - 10	0.001 – 0.10
Copper	0.002 - 10	0.001 – 0.10
Iron	0.020 - 100	0.001 – 0.10
Lead	0.005 - 10	0.001 – 0.10
Magnesium	0.10 - 100	0.001 – 0.10
Manganese	0.010 - 10	0.001 – 0.10
Molybdenum	0.002 - 10	0.001 – 0.10
Nickel	0.002 - 10	0.001 – 0.10
Potassium	0.10 - 100	0.001 – 0.10
Silver	0.002 - 10	0.001 – 0.10
Sodium	0.10 - 100	0.001 – 0.10
Zinc	0.010 - 10	0.001 – 0.10
LOW LEVEL		
Antimony	0.002 - 10	0.001 – 0.10
Arsenic	0.005 - 10	0.001 – 0.10
Cadmium	0.002 - 10	0.001 – 0.10
Lead	0.005 - 10	0.001 – 0.10
Selenium	0.002 - 10	0.001 – 0.10
Thallium	0.002 - 10	0.001 – 0.10
Vanadium	0.002 - 10	0.001 – 0.10

TABLE 9.4 (continued)
CALIBRATION STANDARD CONCENTRATIONS

ORGANIC COMPOUNDS	GC/MS	GC
VOC's	GW/WW 1.0, 2., 5.0, 10, 15, 20, 25, 30, 40,50,µg/l DW 0.5, 1, 2, 4, 5, 6, 8, 10, 20,40,50,100 µg/l	
Semi-Volatiles (8270C,625)	WW 20, 50, 80, 120, 160 µg/ml	WW
PCB's (8081A, 608)	WW 20, 40, 60, 80, 100 µg/ml	DW listed individually WW listed individually
PESTICIDES	GC Wastewater	GC Drinking Water
Alpha-BHC	0.01, 0.02, 0.05, 0.10, 0.20, 0.30, 0.04, µg/ml	same as WW
Gamma-BHC	0.01, 0.02, 0.05, 0.10, 0.20, 0.30, 0.04, µg/ml	same as WW
Beta-BHC	0.01, 0.02, 0.05, 0.10, 0.20, 0.30, 0.04, µg/ml	same as WW
Delta-BHc	0.01, 0.02, 0.05, 0.10, 0.20, 0.30, 0.04, µg/ml	same as WW
Heptachlor	0.01, 0.02, 0.05, 0.10, 0.20, 0.30, 0.04, µg/ml	same as WW
Aldrin	0.01, 0.02, 0.05, 0.10, 0.20, 0.30, 0.04, µg/ml	same as WW
Heptachlor epoxide	0.01, 0.02, 0.05, 0.10, 0.20, 0.30, 0.04, µg/ml	same as WW
Endosulfan I	0.01, 0.02, 0.05, 0.10, 0.20, 0.30, 0.04, µg/ml	same as WW
4,4-DDE	0.01, 0.02, 0.05, 0.10, 0.20, 0.30, 0.04, µg/ml	same as WW
Dieldrin	0.01, 0.02, 0.05, 0.10, 0.20, 0.30, 0.04, µg/ml	same as WW
Methoxychlor	0.01, 0.02, 0.05, 0.10, 0.20, 0.30, 0.04, µg/ml	same as WW
Endrin	0.01, 0.02, 0.05, 0.10, 0.20, 0.30, 0.04, µg/ml	same as WW
4,4-DDD	0.01, 0.02, 0.05, 0.10, 0.20, 0.30, 0.04, µg/ml	same as WW
4,4-DDT	0.01, 0.02, 0.05, 0.10, 0.20, 0.30, 0.04, µg/ml	same as WW
Endosulfan II	0.01, 0.02, 0.05, 0.10, 0.20, 0.30, 0.04, µg/ml	same as WW
Endrin Aldehyde	0.01, 0.02, 0.05, 0.10, 0.20, 0.30, 0.04, µg/ml	same as WW
Endosulfan Sulfate	0.01, 0.02, 0.05, 0.10, 0.20, 0.30, 0.04, µg/ml	same as WW
Chlordane	0.01, 0.02, 0.05, 0.10, 0.20, 0.30, 0.04, µg/ml	same as WW
Toxaphene	0.20, 0.50, 1.0, 2.0 µg/ml	same as WW
PCB arochlor 1016	0.2, 0.5, 1.0, 2.0, 5.0 µg/ml	same as WW
PCB arochlor's 1221, 1232, 1242, 1248, 1254, 1260	0.5, 1.0, 1.5, 2.0 4.0 µg/ml	same as WW

ORGANIC COMPOUNDS	GC/MS	GC/Other
Herbicides	Confirmation only	0.05, 0.1, 0.2, 0.5, 1.0, 2.0,µg/l
EPHTN		10000, 6000, 4000, 2000, 1000, 400, 200, 100 ug/L
DRO, OA2 , 8015Mod		10000, 6000, 3000, 2000, 1000, 400, 200, 100 ug/L
MADEP EPH		400, 200, 100, 50, 25, 5, 1 ug/L
PAH's 8310, 610		*HPLC* 0.01, 0.05, 0.1, 0.5, 1.0, 5.0, 10, 20 ug/L
EDB, DBCP. TCP 8011, 504.1		0.01, 0.02, 0.05, 0.10, 0.25, 0.5 ug/l
THAA's 552.2		2.0 – 200 ug/L
BTEX/GRO		0.5, 5,10, 20,25,50,100,150,200mg/l
MADEP VPH		5.0, 10, 25, 50, 100, 250, 500, 750 ug/L
BTEX,/OA1		0.5, 5,10, 20,25,50,100,150,200ug/l

9.4 INSTRUMENT CALIBRATION (Analytical and Biomonitoring Laboratories)

9.4.1 Calibration of Laboratory Equipment/Instrumentation (See Table 9.5.)

If method calibration requirements for a particular procedure are more stringent than those listed here, they will be followed when that particular method is run.

9.4.1.1 Balances

All laboratory balances are calibrated daily and routine maintenance is provided semi-annually under a service contract. Balances are checked daily with Class "I" weights traceable to NIST to ensure accurate performance within the range of use. The balances are also calibrated and checked by an outside source semi-annually. The weights are stored in an environment where a desicant is used to control moisture. All calibrations are recorded in a designated laboratory logbook.

9.4.1.2 pH Meters and Probes (Laboratory and Biomonitoring)

pH meters and probes are calibrated at each use using two certified pH buffers (one has a pH value of 7). This calibration is checked initially with a buffer of a third value. The calibration is checked every tenth sample to ensure continuing calibration. All calibrations are recorded in logbooks designated for each individual meter. Temperature correction is performed either automatically by the instrument or manually depending upon the instrument used.

9.4.1.3 Automatic pipettes

Automatic pipettes are calibrated monthly using deionized water and an analytical balance. They are also sent out semi-annually for calibration and maintenance.

9.4.1.4 Thermometers (Laboratory and Biomonitoring)

Calibration of thermometers is performed annually using an NIST-certified thermometer. The certified thermometer is checked at ice point at least annually. The thermometers are also calibrated and checked by an outside source semi-annually.

9.4.1.5 DO Meter (Laboratory and Biomonitoring)

The Dissolved Oxygen meter is calibrated daily or before use according to manufacturer's specifications. Using the recorded temperature and barometric pressure the meter is calibrated to the air saturation of dissolved oxygen using a conversion chart provided by the manufacturer. Calibration of each meter is recorded in a separate logbook. The DO Meter is checked annually against the Winkler titration method.

9.4.1.6 Specific Conductivity Meter (Laboratory and Biomonitoring)

The conductivity meter is calibrated daily or before use according to manufacturer's specifications. Potassium chloride with a conductivity value of 1413 umhos/cm is used as the calibration standard. Potassium chloride solution is prepared in the laboratory using analytical reagent grade KCl and deionized water. Temperature correction is performed either automatically by the instrument or manually depending upon the instrument used. Calibration of each meter is recorded in separate daily logbooks.

9.4.1.7 PE FIAS Mercury Analyzer

Calibration of the PE FIAS Mercury Analyzer is achieved by using 5 standards. All results are calculated using software based on the peak area of the sample. A reference or ICV is run initially and at least every tenth sample and if out of control, recalibration occurs and samples are rerun.

TABLE 9.5
INSTRUMENT CALIBRATION

Instrument (Analysis)	Calibration Type	Number of Standards	Type of Curve	Acceptance/ Rejection Criteria	Frequency
pH Meter*	Initial	2 (buffers) 1 reference buffer	Logarithmic	Third pH of a different value buffer must read within 0.2 units of true value	Daily as used
	Continuing	1 buffer (may be any certified buffer)		Buffer solution must read within 0.1 units of true value	Every 10th sample; Field**
Conductivity Meter*	Initial	1	1 point	Calculation of cell constant between 0.95 - 1.05	Daily as used
	Continuing	1		Must be within 5% of true value	Every 10th sample Field**
Turbidimeter*	Initial	1 1 reference of different value	Linear	Formazin-confirmed Gelex standards in appropriate range. Check with second standard must be within 5%	Daily as used
	Continuing	1 (high- level)		Must be within 5% of true value	Every 10th sample Field**
Dissolved Oxygen	Initial	Winkler titration Reference - air calibration	Linear	Check titration against air calibration-- must be ±0.2 mg/l	Daily as used
	Continuing	Check standard DO bottle		±0.1 mg/l	Every 10th sample Field**
UV/VIS Spec.	Initial	3 - 5 calibration standards	Linear	Calibration Curve must have a correlation of 0.9990 or better	Daily as used
		1 laboratory control standard		Must be within +/- 15% of the calibration curve.	Daily as used
	Continuing	1 mid-level reference std.		Must be within lab-generated control limits	Every 10th sample
Specific Ion Meter	Initial	5	Logarithmic	Slope within tolerance of instrument, checked with a third standard of a different value	Daily as used
		1 laboratory control standard		Laboratory control standard must be within control limits	Daily as used
	Continuing	1 reference standard		Check standards must be within control limits	Every 10th sample

Note: ESC defines a "laboratory control standard" as a standard of a different value and from a different source than those sta ndards used for calibration (calibration standard).
*This equipment is also calibrated and used in the field.
**Field equipment must be checked every 4 hours and at the end of the day.

TABLE 9.5 (continued)
INSTRUMENT CALIBRATION

Instrument (Analysis)	Calibration Type	Number of Standards	Type of Curve	Acceptance/ Rejection Criteria	Frequency
ICP & ICPMS	Initial	3 - 5	Linear	6010B, 6020 & 200.8 ICV must be within +/- 10%; 200.7 ICV must be within +/-5%	Daily as used
		1 laboratory control standard		LCS must be within the generated control limits or for 200.7 +/-15%, 200.8 +/-30%, 6010B &6020 +/-10%, whichever is tighter	
	Continuing	1 mid-level ref. std.		Must be within 10%	Every 10th sample
Total Organic Halogen Analyzer	Initial	3-5 calibration standards	Linear	Calibration Curve must have a correlation of 0.9990 or better	Daily as used
		1 laboratory control standard		Laboratory control standard must agree within +/- 15% of calibration curve	Daily as used
	Continuing	1 mid-level reference std.		Must be within lab-generated control limits	Every 10th sample
Total Organic Carbon Analyzer	Initial	1 calibration standards	Linear	Calibration Curve must have a correlation of 0.9990 or better	Daily as used
		1 laboratory control standard		Laboratory control standard must agree within +/- 15% of calibration curve	Daily as used
	Continuing	1 mid-level reference std.		Must be within lab-generated control limits	Every 10th sample
Fourier Transform Infra Red	Initial	3 - 5 calibration standards	Linear	Calibration Curve must have a correlation of 0.9990 or better	Daily as used
		1 laboratory control standard		Laboratory control standard must agree within +/- 15% of calibration curve	Daily as used
	Continuing	1 mid-level reference std.		Must be within lab-generated control limits	Every 10th sample
Gas Chromatograph (Volatile Organic Compounds)	Initial	5	Linear	Must be less than 10% RSD for 601/602, less than 20%RSD for 8021B, and less than 20% difference for 8015B	As needed
		1 laboratory control standard		Laboratory control standard must agree within +/- 30% of calibration curve for SW-846 and within method req. for 601/602	Daily as used
	Daily	1 (mid-level)		Must be less than or equal to 15 RSD	Daily
	Continuing	1 mid-level reference		Must be less than or equal to 15 RSD of daily	Every 10th sample

TABLE 9.5 (continued)
INSTRUMENT CALIBRATION

Instrument (Analysis)	Calibration Type	Number of Standards	Type of Curve	Acceptance/ Rejection Criteria	Frequency
Ion Chromotograph	Initial	5 calibration stds	LR	Correlation must be 0.999_ or greater	As needed
	Daily	1 laboratory control standard		Must be within 10%	Daily
	Continuing	1/10		Must be within 10% of the initial calibration curve.	Beginning and every 10.
Gas Chromatograph (Pesticides/PCBs)	Initial	3 - 5 calibration stds	Avg. RF	Must be less than 20% RSD (8081A) and 10% RSD (608)	As needed
	Daily	1 laboratory control standard		Must be within method criteria	Daily
	Continuing	1/10		Must be within 15% of the initial calibration curve.	Beginning and every 10.
GC/MS Semivolatiles	Initial	3 - 5 calibration stds	Avg. RF	Must be less than 30% RSD (8270C) and 35% RSD (625)	As needed
	Daily	1 laboratory control standard		Must be less than 30 RSD (8270C CCC's) and 20 RSD (625)	Daily
	Continuing	Tune every 12 hours		Must pass established method tuning criteria	every 12 hours
GC/MS Volatiles	Initial	3 - 5 calibration stds	Avg. RF	Must be less than 15 %RSD (8260B CCC's) and 35 %RSD (624)	As needed
	Daily	1 laboratory control standard		Must meet method established criteria (624) and 30 RSD (8260B)	Daily
	Continuing	Tune every 12 hours		Must pass established method tuning criteria	every 12 hours

Note: ESC defines a "laboratory control standard" as a standard of a different value and from a different source than those standards used for calibration (calibration standard).

9.4.1.8 Inductively Coupled Plasma (200.7, 200.8, 6010B, 6020)

The PE Optima 3000DV and PE ELAN 6100 ICPMS are calibrated using 5 standards. A new calibration curve is run daily. All calculations are performed by software using computerized linear regression. Reference checks or ICV's are performed every tenth sample and if out of control, recalibration occurs and samples are rerun. Duplicate and spike analysis are performed on 10% of the samples.

9.4.1.9 Gas Chromatograph: Volatile Organics

(a) 601/602
The gas chromatograph is calibrated using the internal standard procedure. A standard curve is prepared using a minimum of three concentration levels for each compound of interest.

The calibration standards are tabulated according to peak height or area responses against concentration for each compound and response factors are calculated. If the response factors are < 10 % RSD over the working range, the average RF can be used for calculations. Alternatively, the results can be used to plot a calibration curve of response ratios (Area/Ref. Area) vs (Amt./Ref Amt.).

The working calibration curve or response factors are verified on each working day by the analysis of a Quality Control Check Standard. The responses must meet the criteria found in Table 2 of the 601/602 methods. If the responses do not meet these criteria, the analysis must be repeated using a new calibration standard. If the standard still does not meet the criteria, a new calibration curve is prepared.

(b) 8021B/8015B
The gas chromatograph is calibrated using the internal standard procedure. A standard curve is prepared using a minimum of five concentration levels for each compound of interest.

The calibration standards are tabulated according to peak height or area responses against concentration for each compound and response factors are calculated. If the response factors are < 20 % RSD over the working range, the average RF can be used for calculations. Alternatively, the results can be used to plot a calibration curve of response ratios (Area/Ref. Area) vs (Amt./Ref Amt.).

The working calibration curve or response factors are verified on each working day by the analysis of one or more calibration standards. If the response of any analyte varies from the predicted response by more than 15 RSD, the analysis must be repeated using a new calibration standard. If the standard still does not meet the criteria, a new calibration curve is prepared.

9.4.1.10 Gas Chromatograph: Extractable Organics

(a) 608

The gas chromatograph is calibrated using the external standard procedure. A standard curve is prepared using a minimum of three concentration levels for each compound of interest.

The calibration standards are tabulated according to peak height or area responses against concentration for each compound and response factors are calculated. If the response factors are < 10 % RSD over the working range, the average RF can be used for calculations. Alternatively, the results can be used to plot a calibration curve of response ratios (Area/Ref. Area) vs (Amt./Ref Amt.).

The working calibration curve is verified on each working day by the analysis of a midpoint check standard. If the response for any analyte varies from the predicted response by more than +/- 15% the analysis must be repeated using fresh standard. If the standard still does not meet the criteria, a new calibration curve is prepared.

During the processing of samples, check standard is analyzed after every tenth sample to demonstrate that the measurement system is still in control. If the standard fails, a new curve is prepared and all affected samples are reanalyzed. When sample responses exceed the range of the standard curve, the sample is diluted and reanalyzed.

(b) 8081A

The gas chromatograph is calibrated using the external standard procedure. A standard curve is prepared using a minimum of five concentration levels for each compound of interest.

The calibration standards are tabulated according to peak height or area responses against concentration for each compound and response factors are calculated. If the response factors are < 20 % RSD over the working range, the average RF can be used for calculations. Alternatively, the results can be used to plot a calibration curve of response ratios (Area/Ref. Area) vs (Amt./Ref Amt.).

The working calibration curve or response factors are verified on each working day by the analysis of one or more calibration standards. If the response of any analyte varies from the predicted response by more than +/- 15%, the analysis must be repeated using a new calibration standard. If the standard still does not meet the criteria, a new calibration curve is prepared.

During the processing of samples, a continuing calibration check standard is analyzed after every tenth sample to demonstrate that the measurement system is still in control. If the response of any analyte varies more than +/- 15% from the

predicted value, a new calibration curve is prepared and all affected samples are reanalyzed. When sample responses exceed the range of the standard curve, the sample is diluted and reanalyzed.

9.4.1.11 High Pressure Liquid Chromatography (HPLC) – PAH's

The HPLC is calibrated using the external standard procedure. A standard curve is prepared using a minimum of three standards.

9.4.1.12 Gas Chromatograph/Mass Spectrometer (GC/MS): Semivolatile Organics

The GC/MS is calibrated using the internal standard procedure. A standard curve is prepared using a minimum of three standards for method 625 and five standards for method 8270C.

The calibration standards are tabulated according to peak height or area against mass injected. The results can be used to prepare a calibration curve. Alternatively, if the ratio of response to amount injected is a constant over the working range(15% RSD all compounds except the CCC's which must be <30%RSD for 8270CB; 35% RSD for 625),linearity through the origin can be assumed and the average RF can be used in place of a calibration curve. The initial curve is then checked by a QC check. All compounds must be within +/- 20%.

For GC/MS methods, daily instrument tuning is checked against decafluorotriphenylphosphine (DFTPP). The results of the tune check must meet the following EPA ion abundance criteria before any samples are analyzed:

Mass	Ion Abundance Criteria
51	30.0 - 60.0% of mass 198
68	Less than 2.0% of mass 69
69	Mass 69 relative abundance
70	Less than 2.0% of mass 69
127	40.0 - 60.0% of mass 198
197	Less than 1.0% of mass 198
197	Base peak, 100% relative abundance
199	5.0 - 9.0% of mass 198
275	10.0 - 30.0% of mass 198
365	Greater than 1.00% of mass 198
441	Present, but less than mass 443
442	Greater than 40.0% of mass 198
443	17.0 - 23.0% of mass 442

Mass calibration is performed daily using PFTBA (Perfluorotributylamine).

Daily calibration is accomplished for method 8270C by a DFTPP tuning, a mid-level calibration standard analysis, and confirmation of calibration check compounds (CCCs) and system performance check compounds (SPCCs) prior to analysis of any samples. The daily calibration validation must be met every 12 hours. The DFTPP tune must meet the EPA ion abundance criteria. The SPCCs must have a minimum response factor of 0.050. The CCCs must be within 20%difference from initial calibration.

Daily calibration is accomplished for method 625 by a DFTPP tuning and a mid-level standard analysis. The DFTPP tune must meet the EPA ion abundance criteria and the standard must be within 20 % of predicted response.

9.4.1.13 Gas Chromatography/Mass Spectrometry (GC/MS): Volatile Organics

The GC/MS is calibrated using the internal standard procedure. A standard curve is prepared using a minimum of 3 standards for method 624 and 5 standards for method 8260B.

The calibration standards are tabulated according to peak height or area against mass injected. The results can be used to prepare a calibration curve. Alternatively, if the ratio of response to amount injected is constant over the working range (30 %RSD for continuing calibration checks (CCC's) for method 8260B and 35 %RSD for method 624, linearity through the origin can be assumed and the average RF can be used in place of a calibration curve. The minimum acceptable average RF for system performance check compounds (SPCC's) in method 8260B should be 0.300 (0.250 for Bromoform). The initial curve is then checked by a QC check standard. All compounds must be within 20 %difference from initial calibration.

For GC/MS methods, daily instrument tuning is checked against bromofluorobenzene (BFB). The results of the tune check must meet the following EPA ion abundance criteria before any samples are analyzed:

Mass	Ion Abundance Criteria
50	15 to 40% of mass 95
75	30 to 60% of mass 95
95	base peak, 100% relative abundance
96	5 to 9% of mass 95
173	0% to less than 2% of mass 174
174	greater than 50% of mass 95
175	5 to 9% of mass 174
176	greater than 95% but less than 101% of mass 174
177	5 to 9% of mass 176

Mass calibration is performed daily using PFTBA (Perfluorotributylamine).

Daily calibration is accomplished for method 8260B by a BFB tuning, a mid-level calibration standard analysis, and confirmation of CCC's and SPCC's prior to the analysis of any samples. The daily calibration validation must be met every 12 hours. The BFB tune must meet ion abundance criteria. The SPCC's must have a minimum RF of 0.300 (0.250 for bromoform). The CCC's must be <20 %Diff.

Daily calibration is accomplished for method 624 by a BFB tuning and analysis of a QC check standard. The BFB tune must meet EPA ion abundance criteria. The QC check standard must meet the criteria found in table 5 of the method.

9.4.1.14 Total Organic Carbon Analyzer (TOC)

The TOC is calibrated using 3 standards. Linear regression is used to determine concentration of each sample.

A laboratory control standard (LCS) is used to determine that the calibration curve is functioning properly. The LCS must perform within +/-15%. A blank sample is run after each sample to be analyzed. The calibration range is 1.0mg/l to 50 mg/l.

9.4.1.15 Total Organic Halogen Analyzer (TOX)

The TOX is calibrated using 5 standards. Linear regression is used to determine concentration of each sample.

A laboratory control standard (LCS) is used to determine that the calibration curve is functioning properly. The LCS must perform within +/-15%. A blank sample is run after each sample to be analyzed. The calibration range is 0.050mg/l to 0.500mg/l.

9.4.1.16 Infra Red (IR)

The IR is calibrated using at least 5 standards. A standard curve is prepared and linear regression is used to determine concentration of each sample.

A laboratory control standard (LCS) is used to determine that the calibration curve is functioning properly. The LCS must perform within +/-15%. A blank sample is run after each sample to be analyzed. The calibration range is 0.10mg/l to 10 mg/l for water and 1.0mg/l to 10mg/l for soil.

9.4.2 Acceptance or Rejection of Calibration Curves

The initial calibration curve is compared with previous curves for the same analyte. The curve is checked for linearity, and response must be plus/minus 10% from the previous curves. (Cyanide has been found to vary outside of the 10% when new reagents are made and is therefore an exception to this control criteria). All new standard curves are immediately checked with a secondary or laboratory control standard from a separate source that those used for calibration. All curves are visually reviewed to ensure that acceptable correlation represents linearity. Calibration curves may be rejected for nonlinearity, abnormal sensitivity, or poor response of the laboratory control standard.

Specific criteria for each instrument are outlined in Table 9.5.

Continuing calibration is performed every tenth sample. If a check standard does not perform within established criteria then the instrument will undergo evaluation to determine the problem. Once the problem is corrected all samples between the last in control sample and the out of control check will be rerun.

9.4.3 Calibration Data Storage

All calibration data and graphs generated for wet chemistry are kept in a calibration notebook with the following information: date prepared, calibration concentrations, correlation, and analyst initials. The analyst reviews the calibration and evaluates it against acceptance criteria before placing it in the calibration notebook. Data on initial and continuing reference standards, as well as matrix spikes and duplicates, are entered in the QC box generated on each analysis page. If a test allows the use of a previously established calibration curve then the calibration check standard is reviewed against acceptance criteria and if acceptable analysis will proceed. In this situation the calibration date is referenced so that the curve can be easily reviewed again if necessary.

All calibration data generated by the Leeman ICP are printed out in a summary of the raw data file. It is filed by date analyzed in a ICP raw data file. A magnetic copy of each day's calibration is also stored on floppy disc and stored by date of analysis.

Volatile organics calibration date are recorded and integrated using the HP GCEnviroquant software. Pesticide/PCB calibration is recorded and integrated by using HP GCEnviroquant. Calibration data from the semivolatile analysis, in addition to the initial and daily calibration, includes GC/MS autotunes, DFTPP reports and surrogate recovery reports. Hard copy records of initial calibration and daily calibration are stored with chromatograms and integrated with sample data by date analyzed or sample log number. A magnetic copy of each day's calibration is also made on compact disc and stored by date of analysis.

9.5 STANDARDIZATION OF TITRATION SOLUTIONS

Table 9.6 indicates the standardization procedures and frequency of laboratory solutions used for titrations.

TABLE 9.6
STANDARDIZATION OF TITRATION SOLUTIONS

Solution	Primary Standard	Frequency
0.0200 N NaOH	0.050 N KHP	Daily as needed
0.0200 N H_2SO_4	Freshly prepared and standardized NaOH (from KHP standard)	6 months or with each new batch
0.0141 N $Hg(NO_3)_2$	Standard NaCl solution 500 ug Cl/ml	Daily as used
0.0100 M EDTA	Standard $CaCO_3$ solution 1 mg $CaCO_3$/liter	Daily as used

9.6 CALIBRATION OF FIELD INSTRUMENTS

All field calibrations are performed in the field prior to use of the instrument, unless extremely adverse conditions prevail. Deviations from the above procedure would be noted, along with an explanation.

All field analyses are recorded on analysis books similar to those used in the lab. The details of the standards used and the values obtained during calibration are recorded here, dated, and initialed by the analyst if it passes the acceptance criteria. The acceptance criteria for a field analysis are identical to those for the same analysis when performed in the lab.

Protocols and documentation procedures for receiving, preparing and using standards that are used for field measurements are the same as laboratory protocols. See Table 9.3 for standard sources receipt, preparation, and storage.

9.6.1 Operation of the field pH Meter

This meter is a portable, pH, temperature and mV microprocessor with push button calibration. This instrument is used mostly in groundwater and wastewater sampling. Prior to field use. The pH meter is adjusted for temperature automatically.

Calibration instructions should be taken from the pH meter users manual. Each different model of pH meters must be calibrated according to their instructions; however, criteria for when to recalibrate and how to check calibration will remain the same.

pH Calibration - The instrument must be calibrated before each use. Calibration should be checked after every 10 samples or after a maximum time of 4 hours, or after meter has been shut off or after one hour has elapsed since the last measurement, with a single pH 7.0 buffer. If readings are off by more than 0.1 pH unit, the instrument must be recalibrated.

The instrument can be calibrated with a pH 7.00 and with pH 4.00 or pH 10.00 standard technical buffers. If measuring solutions between 0 and 7 pH (acid to neutral), use pH 7.00 and pH 4.00 buffers. If measurements will be between 7 and 14 pH (neutral to base), use pH 7.00 and pH 10.00 buffers. All calibrations must be checked with a third buffer of a different pH value than the two used to calibrate the instrument. All information regarding the calibration of the instrument must be documented in the field pH notebook.

9.6.2 Field Conductivity Meter Calibration (Follow standard laboratory QC guidelines)

The conductivity meter is adjusted manually in the field using a field thermometer that is calibrated annually against a NIST certified thermometer.

> **NOTE**: Conductivity probe should be stored **wet** in deionized water. If probe has been stored dry, submerge it in deionized water for 24 hours prior to use. Storing the probe wet prevents the absorption of contaminants from the last solution measured from drying into the platinizing area of the probe. Contaminants absorbed by the platinizing area will be reabsorbed into the new test solution and cause a bias in the result obtained. Evidence of this problem will be a drift in the reading after the probe has been in solution for a period of time.

Standardization

Prior to the first measurement, a factor must be developed to correct the readings for the variation in the probe and meter by using a standard solution of potassium chloride (KCl) available from the lab. Rinse the probe thoroughly with standard solution and position probe in solution at least one quarter of an inch (1/4") from container sides and bottom. Next, measure temperature and conductivity as described in the following two sections.

The correction factor is defined as the Standard solution reading for this temperature (readings are listed by temperature on the standard solution bottle or the attached chart, Table 9.7) divided by Measured conductivity of standard solution

For example:

$$\frac{\text{1300 umhos at 21 C}}{\text{1274 umhos at 21 C}} \quad \frac{\text{Per Table}}{\text{Measured}} = 1.02 \text{ correction factor or cell constant}$$

TABLE 9.7

CONDUCTIVITY OF STANDARD SOLUTION AT VARIOUS TEMPERATURES

TEMPERATURE °C	CONDUCTIVITY µmhos/cm
15	1141.5
16	1167.5
17	1193.6
18	1219.9
19	1246.4
20	1273.0
21	1299.7
22	1326.6
23	1353.6
24	1380.8
25	1408.1
26	1436.5
27	1263.2
28	1490.9
29	1518.7
30	1546.7

9.6.3 Field Temperature

Field temperature is recorded using a working field thermometer. The field thermometers are calibrated annually against a NIST certified thermometer.

9.6.4 Automatic Samplers

Automatic samplers are calibrated for correct volume before each use. A graduated cylinder is used to calibrate for collecting the correct volume of sample.

9.6.5 DO Meter

The Dissolved Oxygen meter is calibrated daily or before use according to manufacturer's specifications. Using the recorded temperature and barometric pressure the meter is calibrated to the air saturation of dissolved oxygen using a conversion chart provided by the manufacturer. Calibration of each meter is recorded in a separate logbook. The DO Meter is checked annually against the Winkler titration method.

9.6.6 Turbidity Meter

The Turbidity meter is calibrated daily or before use according to manufacturer's specifications. The meter is calibrated using sealed standards supplied by the manufacturer. The meter is allowed to warm up for 15 minutes prior to use. The turbidimeter is then set on the "1" scale and calibrated with a low standard (i.e.,. 0.67). The meter is then set on the "10" scale and calibrated with a higher standard (i.e.,. 7.2). The scale is usually set back to the one scale for sample determinations. If samples are higher than the calibration standards, the instrument is recalibrated using standards that encompass the range of the samples. The turbidimeter source is cleaned and checked according to the performance of the instrument. Calibration of each meter is recorded in a separate logbook.

10.0 PREVENTATIVE MAINTENANCE

ESC's preventative maintenance program provides guidelines used to ensure that every effort is made to keep equipment well maintained and prepared for the next project. Small pieces of equipment is usually kept in duplicate and spare parts are kept in stock. ESC maintains service contracts on major laboratory equipment, thus in the event of failure, repairs can be made within a few days. If analyses are scheduled and it appears equipment will be down for a longer period, ESC will arrange for analyses to be performed by another qualified lab. This action would only be taken if analyses had to be completed by a specified date or if sample holding times would be exceeded. This situation is not common, since for many tests, holding time is extended once digestion or extraction has been performed. The following table shows laboratory downtimes in 2000.

Instrument	Critical Uses	Number of Equipment Down- times in 2000	Maximum Down- time Duration in 2000
ICPMS	Metals	0	0 days
Leeman ICP	Na, K, Mg	1	1 day
PE ICP	Metals	2	2 days
PE ICP	Metals	1	2 days
TOC	TOC	2	3 days
Lachat	Spectrophotometric	1	1 week
IC	Anions	0	0 days
HP GC's	PCBs injectable organics	0 1	1 day
GC/MS	Base/neutral and acid (BNA) Semivolatiles, Pesticide Confirmations	2	2-3 days
GC/MS	Volatiles	3	1-2 days

All of the above equipment have a maintenance log that is a bound laboratory notebook. The logbook is updated and signed when maintenance tasks are performed (i.e., new rings, column or septum change, etc.). Each GC/MS has an operational journal where daily instrument response, tuning, and operational comments are recorded. These journals are updated and signed when maintenance technician's are assigned to perform the following tasks:

- monitor laboratory devices such as air compressors, vacuum pumps, heaters, etc., to ensure that they are properly lubricated and in good working condition.

- monitor on a daily basis: general lab QC areas, such as BOD incubators, temperature, drying ovens, desiccators, deionized water, sample cooler temperature, etc., and record appropriate parameters in correlating QC logbooks.

Chemist's are assigned to perform the following tasks:

- Monitor the supply and quality of purchased chemicals, reagents and glassware, and keep inventory at established levels. All chemicals are dated in relation to receipt and date opened.

General:

- Reagents made in the lab are tagged with the date made and concentration at that date or any subsequent date, if restandardization is necessary.

- Deionized water is checked daily and maintained at a minimum of one mega ohm resistance. The results are recorded in the lab deionized water notebook.

- The balance(s) is monitored daily, and serviced and calibrated by an outside source annually. The balance must weigh a 1.0000 gram Class "S" weight to ±0.0003 gm, and larger weights to ±0.0005 gm.

- The spectrophotometer band width and wavelength calibration are checked for proper optical alignment and cleaned twice annually.

- pH meters are checked daily to make sure batteries are good. The probes are stored in pH 4.0 buffer when not in use. The probes are cleaned/reconditioned if it becomes difficult to calibrate within the linear tolerances of the instrument. If calibration does not improve, the probes are replaced.

- The conductivity meter has a cell and battery which are checked prior to each use.

- All ICP's are currently under a service contract. Preventative maintenance under the contract is performed annually. A daily maintenance log is kept that records the following information: pump tubing, torch alignment, nebulizer clean/adjust, o-ring check/ replace, and cooling water. Every two weeks the pump rollers are cleaned and lubricated. After 40-50 hours of operation, we clean the HG nebulizer, spray chamber and torch. On a monthly basis the data disk is backed up, water lines are reversed, and the fan filters on the power supply are checked and cleaned. On a quarterly basis, the water circulator is cleaned and water is replaced with fresh DI water.

- For all GCs, septa are replaced when the standard response factor and/or retention time become inconsistent. Individual columns are replaced if the separation criteria for the standard test being run are unacceptable when the checks of gas flow and temperature are normal.

- The GC/MS system condition is verified daily by DFTPP or BFB tuning. If all established tune criteria are met, then proper system operation is indicated. If high mass resolution becomes poor, the ion source is examined and cleaned. The septa and liner is replaced frequently in order to maintain injection port inertness. Vacuum pump oil is replaced every six months. All carrier gases are ultra high purity. The chromatographic column is replaced when method QC criteria cannot be maintained.

- Field equipment is cleaned in the field. Repairs and maintenance are reported and performed in-house. If repairs cannot be performed in-house, the manufacturer is notified and an authorized service center is contacted.

10.1 BIOMONITORING EQUIPMENT AND AMBIENT MONITORING

10.1.1 Temperature and Balances

Temperature monitoring is performed and recorded on a daily basis and adjustments are made as necessary on the following pieces of equipment:

1. Equatherm Oven - 102° C ± 2°
2. White-Westinghouse Refrigerator - 4° C ± 2°
3. Precision Model 818 Incubator - 25° C ± 2°

All working thermometers are compared weekly to a NIST thermometer. The NIST thermometer is calibrated annually.

All testing and culturing is maintained in incubators in which temperature is constant and the photo period is on a 16-hour light/8-hour dark cycle.

The analytical balance is calibrated daily or before use using class "S" weights. The calibration is recorded in a daily logbook. The class "S" weights are calibrated annually against NIST standards by external contract.

10.1.2 Species Maintenance

The amount of food added to culture vessels will depend upon the number of organisms within a given culture. As standard procedure, *Ceriodaphnia dubia* batch cultures are fed 7 mL of YCT and 4 mL algal suspension twice weekly. *Pimephales promelas* batch cultures are fed 4 mL newly-hatched brine shrimp daily. Feeding schedules are documented in the daily logbook.

Maintenance of in-house cultures:
Ceriodaphnia dubia batch cultures are prepared fresh weekly using newly-hatched neonates from isolation trays. One liter glass beakers that have been properly cleaned are used as batch culture vessels.

Pimephales promelas batch cultures are cleaned twice weekly by siphoning off the excess food and waste from the bottom of the culture vessel and renewing the water. When possible, the shipping container serves as the culture vessel for the minnows. Cultures are aerated as needed to maintain adequate dissolved oxygen.

The water used for culturing is moderately hard synthetic fresh water prepared by

dissolving 1.2g $CaSO_4 \cdot 2H_20$, 1.2g $MgSO_4$, 1.92g $NaHCO_3$, 0.08g KCl into 20 Liters of deionized water and aerating for 24 hours. The physical and chemical parameters for each new tank of water prepared are recorded and should fall within the following acceptable range:

1. pH - 7.8 to 8.2 units
2. D.O. - greater than 80% saturation in mg/L
3. Specific Conductance - 280 to 350 micromhos/cm
4. Alkalinity - 60 to 80 mg $CaCO_3$/L
5. Hardness - 70 to 100 mg $CaCO_3$/L
6. Total Residual Chlorine - <0.1 mg/L

All deionized water is tested weekly and reviewed for the following analyte groups: VOC's, Pesticides/PCB's, Metals, Nutrients, and Minerals.

All brewers yeast purchased is at least food grade and has passed FDA standards.

All new lots of trout chow will be tested for pesticides, metals, and PCB's.

10.1.3 Incubator lights

All incubators are monitored at least twice monthly for proper light intensity. Light intensity must be maintained at 100 foot-candles. If the light intensity varies by more than 10 percent, the incubator will be taken out of use until the problem is corrected.

Table 10.1 presents laboratory equipment preventative maintenance in more detail.

Table 10.2 presents this information for field equipment.

TABLE 10.1
PREVENTATIVE MAINTENANCE
FOR LABORATORY EQUIPMENT

INSTRUMENT	P. M. DESCRIPTION	FREQUENCY
pH Meters ORION SA720 Cole-Parmer 5996-50 (Biomonitoring)	•Reference junction & electrode replacement •Probe stored in KCl •Other	As needed At all times when not in use As described in the manufacturer's O & M manual
Conductivity Meter YSI 33 Cole-Parmer 1481-60 (Biomonitoring)	•Check batteries •Check probe cables •Clean probe •Replace or replatinize probe	Daily (or prior to each use) As needed Daily Poor response not corrected by above
Dissolved Oxygen Meter YSI Model 50B (Biomonitoring)	•Check batteries •Check probe cables •Clean probe •Replace probe membrane if necessary	Daily (or prior to each use) As needed Daily Poor response not corrected by above
Analytical Balances - Sartorius 2442 OHAUS Galaxy 3160 & 160 Mettler AT200	•Check with Class "S" weights •Service/Calibration (semiannual contract maintenance and calibration check)	Daily-tolerance 1 gm - ±0.0003 gm 10 gm - ±0.0005 gm Semiannually
Walk-in refrigerator (FridgAmerica) Sample Refrigerator (White Westinghouse) (Biomonitoring) Drying oven (Fisher/Isotemp) Drying oven (Equatherm) (Biomonitoring) Muffle furnace (Blue M) Incubator (Fisher, Thermolyne) Incubator (Precision) (Biomonitoring)	•Maintenance service	As needed - determined by daily temperature performance checks
Gas Chromatographs (All)	•Replace septa •Replace column	When RT and RF show inconsistency When separation begins to degrade
Purge and Trap Tekmar LSC 2000, D 2000, ALS 2016	•Leak check spargers •Change traps	Quarterly As needed

TABLE 10.1 (continued)
PREVENTATIVE MAINTENANCE
FOR LABORATORY EQUIPMENT

INSTRUMENT	P. M. DESCRIPTION	FREQUENCY
Specific Ion Meter (Orion EA940) Electrodes (Orion) Ammonia Fluoride	•Check batteries and cables •Replace electrolyte, membranes •Reference probe stored in D.I. water •Sensing probe tip protected per instructions •Replace S. I. electrode	Daily As needed - a corrective action At all times when not in use At all times when not in use Unidentifiable slope error on drift
Turbidimeter Hach 2100A	•Illumination lamp or window (alignment and/or replacement)	Erratic or poor response
Karl Fischer Titrator	•Fill main drying tube with fresh silica gel •Close off air holes with filter •"Blank" out fresh solvent	As silica gel color indicates When not in use Immediately prior to use

TABLE 10.1 (continued)
PREVENTATIVE MAINTENANCE
FOR LABORATORY EQUIPMENT

INSTRUMENT	P. M. DESCRIPTION	FREQUENCY
Inductively Coupled Plasma	•Maintain manufacturer's service contract •Pump tubing, torch alignment, o-ring •Cooling water •Pump rollers •Nebulizer	Renew each year Check daily and adjust/change as needed Clean and replace water quarterly Clean and lubricate every 2 weeks Clean every 40 - 50 hours
TOC	•Maintain manufacturer's service contract	Renew each year
Gas Chromatograph Detectors: FID ECD PID Hall (HECD)	 Change Quartz jet; clean; replace flame tip Bake off or Refoil and clean if bake off is not adequate; Perform wipe leakage test annually Change or clean lamp Change Nickel tubes/clean cell; change solvent; replace resin	 As needed - when deterioration is noticeable As needed - when deterioration is noticeable As needed - when deterioration is noticeable As needed - when deterioration is noticeable
Mercury Analyzer	•Calibrate and check sensitivity with previous data •Response factor problems, check tubing for leaks, particularly in pump head, and check cell for fogging •Replace desiccant in tube •Check rotometer for airflow, if inadequate, replace flex tubing in pump lead	Daily with use As needed With each use As needed

TABLE 10.1 (continued)
PREVENTATIVE MAINTENANCE
FOR LABORATORY EQUIPMENT

INSTRUMENT	P. M. DESCRIPTION	FREQUENCY
Infrared Spectrophotomer Foxboro Miran 1A	•Optics alignment or replacement	As needed when response begins to deteriorate
Lachat Autoanalyzer	•Check pump tubes, change valve flares	At least 1 per month
Flash Point Tester Penskey Martens	•Check thermometer vs. certified traceable •Check fuel level, refill •Clean cup thoroughly	Once each year As needed Between each test and after use
Water Bath Blue M MW1140A-1	•Check thermometer vs. N.B.S. •Remove from service when not maintaining temperature and send off for repair or replace	Once each year As needed
High Intensity Ultrasonic Processor Tekmar	Check tuning criteria	Daily with use
Archon Autosampler and PTA 30 Autosampler	•Monitor the Daily QC, including internal standards for changes or failure.	Daily with use
Gas Chromatograph/Mass Spectrometer Hewlett Packard GC/5972 MSD	•Autotune Report •Clean ion source •Replace septum and liner •Replace vacuum pump oil	Inspected daily As needed to maintain high mass resolution As needed to maintain injection port inert Every 6 months

TABLE 10.2
PREVENTATIVE MAINTENANCE FOR FIELD EQUIPMENT

EQUIPMENT	ACTIVITY	FREQUENCY
ISCO Flow Recorders	•Replace silica gel •Cleaning •Operation/calibration	When gel turns pink Prior to return from job site Each use
ISCO Samplers	•Replace silica gel •Cleaning •Replace pump tubing	When gel turns pink Prior to return from job site Once per year, or when cracking appears
Full-face and Half-face Respirators	•Clean •Check seals •Check fit	After each use Before each use Every 6 months
Exotox	•Check sensors •Calibrate •Charge batteries	Each use Each use Each project
Organic Vapor Monitor	•Calibrate •Charge batteries	Each use Each project
Mille Tripod	•Check cable and winch	Each use

11.0 FIELD AND LABORATORY QUALITY CONTROL CHECKS

11.1 FIELD CHECKS

Blanks collected in the field are considered to be specific quality control for a set of samples. Analytical data that is consequential from the blanks is used to assess the integrity of field sampling and cleaning operations. This data can be used to confirm the use of contaminant-free sample containers, preservative solutions reagents, and equipment cleaning. Potential on-site contamination, personnel sample collection technique accuracy, and problems that may occur in sample storage and transportation may also be revealed. Field blanks are treated in the same manner as regular samples: preserved with the same reagents, stored and transported in the same containers with samples, etc. For soil or solid samples, deionized water is used for blanks in similar containers.

11.1.1 Field Blanks

The purpose of field blanks is to evaluate the purity of preservation or additive reagents. Field blanks also represent the collection techniques, general sample containers to be filled, and the effects of on-site environmental conditions and possible contaminants. Field blanks are prepared at sampling locations by filling sample containers with DI water, adding appropriate preservatives or additives, sealing the containers, and completing all paperwork required for the samples. Blanks are stored in the same shipping containers with the samples for transportation back to the lab.

Field blanks are collected at a rate of one blank per parameter group per day, or 5% of the samples in the parameter group, whichever is greater.

11.1.2 Equipment Blanks

Equipment blanks help measure the effectiveness of precleaning and field cleaning of equipment. They are used to evaluate sources of contamination that may also be found in a trip blank. Equipment blanks shall be collected according to the frequency shown in Table 11.1. Equipment blanks shall be prepared by rinsing the equipment with analyte-free water in the same manner as used for sample collection. The equipment blank is placed in the appropriate containers with required preservatives, if any. Blanks must be taken and preserved, where required, for each method group. The blanks shall be stored in the same shipping containers as samples for transportation back to the lab.

11.1.3 Trip Blanks

Trip blanks are used when sampling for volatile organic compounds to evaluate the cleanliness of the sample container, purity of the blank source water, and the exposure of the sample to contaminants during storage and transportation to and from the laboratory. Trip blanks are prepared by the laboratory providing the containers prior to entering the field environment. The trip blanks are filled with analyte-free water plus any appropriate

preservatives. The containers are sealed, labeled, and transported to the field in the same coolers or boxes with the sample containers to be used for sample collection. Trip blanks are not opened in the field. The trip blanks must be handled in the same manner as the samples being collect and will be transferred (if required) with other samples for storage and transportation to the laboratory. If additional blanks (field and equipment) are necessary the same source water as the trip blanks shall be used. One trip blank per parameter group per cooler shall be used in the sampling event.

Example:

Number of Ice Chests	Analyses Required	Number of Trip Blanks
2	VOC's and THM's	4 trip blanks
1	8240 VOC's and 602 VOC's	2 trip blanks
3	8240 VOC's	3 trip blanks

TABLE 11.1
EQUIPMENT BLANK COLLECTION PROCEDURE
FOR EACH TYPE OF SAMPLING EQUIPMENT

No. of Samples	Precleaned Equipment Blank Per Parameter Group Prior to Sample Collection	Field-Cleaned Equipment Blanks Per Parameter Group
Less than 10	1 equipment blank if no field cleaning on site; OR	1 equipment blank for field-cleaned equipment
Greater than 10	1, or 5% of equipment sets, whichever is greater	1, or 5% of equipment sets cleaned, whichever is greater

NOTE: Equipment blanks must accompany samples in the same container used for transportation.

11.1.4 Field Duplicates

Field duplicates are collected for each analyte group to be analyzed and are needed whenever five or more samples are to be collected. If more than ten samples are to be collected, the field duplication rate is 10%.

11.1.5 Field QC Check Samples

All field instruments are calibrated at the beginning of each sampling day. Calibration is checked every 10 samples or at maximum intervals of 4 hours. Calibration is verified at the end of the day. Recalibration is required if the QC check samples do not meet calibration criteria. The pH meter is evaluated every ten samples using a buffer different than the ones used to calibrate the meter. The conductivity meter is evaluated by measuring the performance of a standard and must not vary by more than 5% from the true value after applying the cell constant.

11.1.6 Field Duplicate Analysis

All analyses run in the field have duplicates performed at a rate of 10% of the total samples.

NOTE: In the state of Florida, field duplicate analyses are not required. Continuing calibration through the analysis of a standard at intervals of four hours or less will be used to verify calibration every four hours and at the end of the day.

11.2 LABORATORY CHECKS

One blank is carried through each step of the analytical procedure for each batch of samples. A batch of samples is a single group of 20 or less samples, on which the analysis or preparation is completed on a single day. Blanks are prepared for each preparation method and matrix (i.e., solids assay, dissolved metals, TCLP extraction, etc.).

The basic types of QC checks run in the laboratory include:

1. sample reagent blanks
2. initial calibration standard to verify calibration (for ongoing calibration)
3. laboratory control sample* to verify a new curve or ongoing calibration
4. continuing reference standard checks from a secondary source
5. continuing calibration standard (1-2 times the practical concentration limit) to confirm calibration curves and method detection limits
6. sample matrix spikes and spike duplicates
7. sample duplicates
8. surrogate standards
9. internal standards

* Laboratory control sample is a standard that is purchased from a secondary source. The purpose of the reference standard is to verify that the primary standard has been properly diluted or has not shown any degradation.

All PQL's are verified daily by using a calibration standard at a level of 1 to 2 times the stated PQL.

11.2.1 Batch QC Criteria

Batches are defined as sets of 1 - 20 samples. Batch analysis must include the following: 1 method blank, 1 Laboratory Control Sample (LCS), 1 Initial Calibration Verification (ICV), 1 Matrix Spike/Spike Duplicate (MS/MSD), 1 Continuing Calibration Verification (CCV) every 10 samples, 1 CCV at end of run.

11.2.2 Protocols

If more stringent QC protocols are required than those outlined above for any method or project, then these protocols will be followed.

If blind QC check sample data are unacceptable, and such information impacts certification the laboratory will immediately order another check sample to ensure ongoing proficiency of that analyte.

11.2.3 Inter-Laboratory Quality Control

- Reference samples are ordered from Environmental Resource Associates and Analytical Products Group. Samples are purchased to evaluate Water Supply Methods, Water Pollution Methods, and Solid Waste Methods.

- Blind QC check samples are purchased at least semi-annually from either Environmental Resource Associates or Analytical Products Group as an external source for the use of performance evaluation. These samples are supplied to ESC without the true concentration values. Two levels are analyzed. ESC reviews the results as an overall check on internal QC procedures.

- Blind field duplicates are collected at least annually to evaluate field collection and laboratory precision

- The laboratory participates in various performance evaluation and method studies available from individual states

- Split samples are sometimes sent to outside laboratories to confirm analytical results.

11.3 PROCEDURES FOR ASSESSING DATA PRECISION, ACCURACY, AND COMPLETENESS

The following procedures apply to all analytes measured, unless more stringent QC has been specified. All field measurements must meet the same QC criteria as those run in the lab.

11.3.1 Use and Preparation of QC Samples.

Reference standards, generated from reference materials (usually EPA QA samples), are used to check calibration throughout the analytical run.

Sample matrix spikes are prepared with actual samples before digestion, extraction, etc. A separate matrix spike chart is kept for each type of sample (i.e., water, solid, TCLP extract, personnel filter, etc.). Sample duplicate analyses are also initiated prior to digestion, extraction, etc. Duplicate spikes are used to generate precision data on samples which most often are nondetectable.

Table 11.2 lists methods used to generate precision and accuracy targets.

TABLE 11.2
METHODS USED TO GENERATE PRECISION AND ACCURACY TARGETS

Method	Purpose	Method References
Reference Standards (Laboratory Control Samples - LCS)	Accuracy	All tests
Matrix Spikes	Accuracy	All quantitative wet chemistry tests. All Metals and Organics.
Duplicate Matrix Spikes	Precision and Accuracy	All quantitative wet chemistry tests. All Metals and Organics.
Sample Duplicates	Precision	All tests.

11.3.2 QC Charts

When an analyst or field technician completes a reference standard check, a duplicate, or a matrix spike recovery, the result is calculated and entered on the appropriate QC chart (Figure 11.1) in the front of the analysis book and initialed by the analyst. A rough x-bar or duplicate QC graph, with mean, warning and control limits, is available above the tabulation. The analyst plots each point on this graph. If the results are out of control limits, the analyst notes this problem for appropriate corrective action from an established list of corrective action codes.

The data entry specialist gathers data directly from the benchsheet and enters it into the computer LIMS. The data is then brought into a spreadsheet and the charts are plotted and evaluated by the computer. New charts are generated as needed. New limits are calculated annually from the data that has been entered into the database/spreadsheet.

11.3.3 Accuracy

11.3.3.1 Accuracy: Reference Standards.

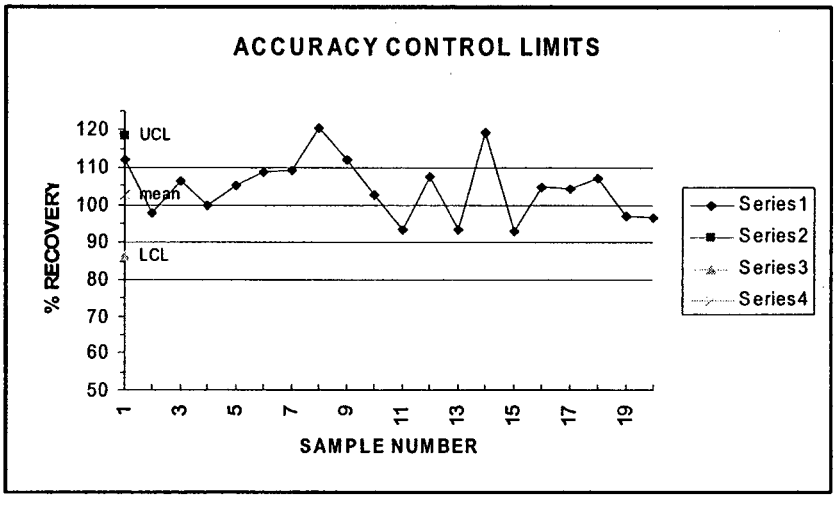
Reference standards are run every tenth sample. X-bar control charts are generated using the last 20 data points, based upon percent recovery.

$$\textit{Percent Recovery} = \frac{\textit{Observed Concentration}}{\textit{True Concentration}} \times 100$$

Warning limits are set at plus/minus two standard deviations from the arithmetic mean. Control limits are plus/minus three standard deviations. For reference standards, these limits typically do not vary much from year to year; they are shown in Table 5.1.

FIGURE 11.1
PRECISION AND ACCURACY CHARTS

Analysis: Lead LCS - Optima



ACCURACY CONTROL LIMIT CALCULATION

AVERAGE P=	102.62	RSD=	8.04
UCL=	118.70	UWL=	110.66
LCL=	86.53	LWL=	94.57

Analysis: Lead LCS - Optima

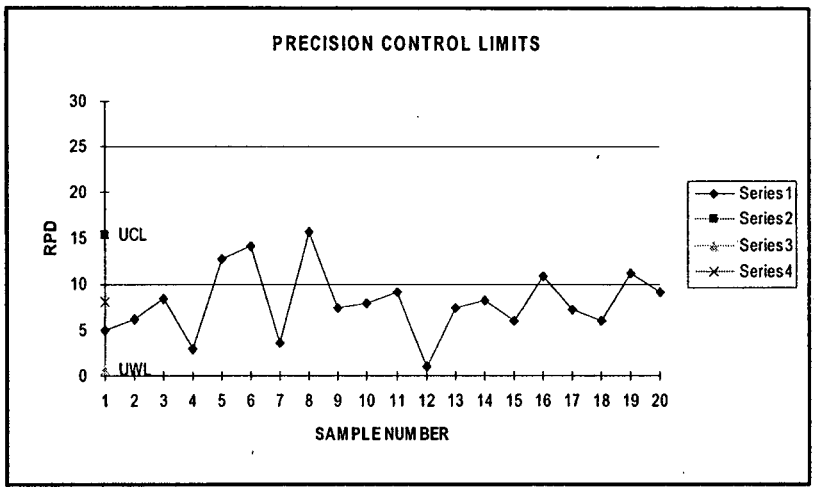
	Sample ID	Date Analyzed	Run Number	PERCENT RECOVERY
1	LCS 3015	4/6/1998	A69280	112
2	LCS 3015	4/10/1998	A69393	97.7
3	LCS 3015	4/11/1998	A69462	106.4
4	LCS 3015	4/14/1998	A69650	99.8
5	LCS 3015	4/14/1998	A69650	105
6	LCS 3015	4/21/1998	A69692	108.6
7	LCS 3015	4/21/1998	A69692	109
8	LCS 3015	5/1/1998	A69732	120.7
9	LCS 3015	5/1/1998	A69732	112
10	LCS 3015	5/1/1998	A69732	102.9
11	LCS 3015	5/1/1998	A69732	93.5
12	LCS 3015	5/2/1998	A70546	107.7
13	LCS 3015	5/4/1998	A70606	93.49
14	LCS 3015	5/5/1998	A70710	119.5
15	LCS 3015	5/11/1998	A70916	92.8
16	LCS 3015	5/14/1998	A71132	104.9
17	LCS 3015	5/14/1998	A71248	104.2
18	LCS 3015	5/14/1998	A71183	107.2
19	LCS 3015	5/25/1998	A71419	96.9
20	LCS 3015	5/25/1998	A71419	96.62

	Outliers				CA
6		4/17/1998	A69783	70	*

*evaluate MS against limits

FIGURE 11.1 (continued)
PRECISION AND ACCURACY CHARTS

Analysis: Lead LCS - Optima



PRECISION CONTROL LIMIT CALCULATION

AVERAGE	8.03	RSD=	3.671813
UCL=	15.37362595	UWL=	11.701813
LCL=	0.686374049	LWL=	4.358187

	Sample ID	Date Analyzed	Run Number	RPD
1	23056	4/6/1998	A69280	5
2	23245	4/11/1998	A69462	6.2
3	24982	4/14/1998	A69650	8.4
4	24982	4/14/1998	A69650	12.8
5	25104	4/21/1998	A69692	2.9
6	25222	5/1/1998	A69732	14.1
7	25258	5/1/1998	A69732	3.6
8	25371	5/2/1998	A70546	15.7
9	25511	5/4/1998	A70606	7.4
10	27204	5/5/1998	A70710	7.9
11	28736	5/11/1998	A70916	9.2
12	29901	5/12/1998	A71132	1
13	29982	5/12/1998	A71248	7.5
14	29997	5/12/1998	A71183	8.3
15	32093	5/14/1998	A71419	6.1
16	32174	5/14/1998	A71419	10.9
17	33426	5/15/1998	A72036	7.2
18	33712	5/18/1998	A73924	6.1
19	33979	5/19/1998	A73988	11.2
20	34062	5/20/98	A74011	9.1

11.3.3.2 Accuracy: Spiked Samples

Spiked samples are run on ten percent of all samples, starting with sample preparation. Spiked samples are entered onto similar QC charts with the percent recovery being calculated by the following equation:

$$\%\ Spike\ Recovery\ =\ \frac{Spiked\ sample\ value\ -\ inital\ sample\ value}{Concentration\ of\ spike}\ X\ 100$$

The spike concentration should be two to five times the initial concentration of the unspiked sample, but not so large as to exceed the range of the analysis, nor so small as to be significantly affected by normal data variability.

Warning limits are set at plus/minus two standard deviations from the arithmetic mean. Control limits are plus/minus three standard deviations. Control limits are calculated annually or sooner if trends occur. At least 20 points of data will be used to recalculate statistics. Typical accuracy limits are given for each parameter in Table 5.2

11.3.4 Precision

Precision is assessed through the use of duplicate samples, which constitute approximately 10% of all samples run. The relative percent difference (RPD) is calculated as follows:

$$RPD\ =\ \frac{(Duplicate\ 1\ -\ Duplicate\ 2)}{\frac{(Duplicate\ 1\ +\ Duplicate\ 2)}{2}}\ X\ 100$$

Upper warning and control limits are set when necessary. Warning limits are set at plus/minus two standard deviations from the arithmetic mean. Control limits are plus/minus three standard deviations. Control limits are calculated annually or sooner if trends occur. At least 20 points of data will be used to recalculate statistics. Typical precision limits for each analytical parameter are given in Table 5.2.

11.3.5 Method Detection Limit

All detection limits are comparable to those established by the EPA and are never lower than recommended detection limits. To determine whether the EPA detection limit is being achieved, a MDL study is performed according to 40 CFR Part 136 Appendix B. The standard deviation of seven standards at or near the expected detection limit is calculated. The method detection limit (MDL) is calculated as follows:

$$MDL = 3.14S$$ (Note: 3.14 is the Students t value for n – 1)

where S=standard deviation. If the MDL is higher than the EPA-method-suggested MDL, the calculated value is used for reporting.

MDLs are recalculated on an annual basis or sooner if a dramatic change has occurred in preparatory methods, analytical methods, or equipment.

The practical quantification limit (PQL) is defined as 2 - 10 times the standard deviation calculated in the MDL method listed above. The final PQL is determined based on the matrix, method, and analyst experience. PQL's are verified daily using a calibration standard at a level equal to the established PQL.

12.0 DATA REDUCTION, VALIDATION, AND REPORTING

12.1 DATA REDUCTION FOR FIELD MEASUREMENTS

pH, conductivity and turbidity data are measured in the field and the results are entered into field log books. The information that is recorded in these books is similar to the laboratory bench sheets which include calibration information, reference checks and temperature readings. The field personnel will initial, date, record data, and record other environmental conditions on these sheets as well. Field data is reviewed by the Environmental Monitoring Manager in the same manner as lab data. The data is reviewed to ensure that calculations are correct and all pertinent information is present. pH and turbidity results are direct read-out from the instrument. Conductivity measurements must be corrected for the cell constant and temperature as shown in Section 9.6.3.

12.1.1 Water Sampling Data

Field sampling equipment that performs tasks such as flow measurement involves data reduction. Automatic samplers and flow meters have preprogrammed equations that are applied appropriately depending on the type of primary device being used. Instantaneous flow can be determined by measuring the head height through the critical section of the device and calculating the flow by the appropriate device-specific equation. The flow versus head height tables in ISCO Open Channel Flow Measurement Handbook (Third Edition) or equivalent can also be used to perform this calculation.

12.2 LABORATORY DATA REDUCTION

The majority of data reduction is completed by the analyst performing the test in one of the following ways:

- Manual calculation, as represented on the bench sheet.
- Input of raw data for computer processing.
- Direct acquisition of raw data by computer.

If data requires manual calculation the analyst has the responsibility of recording all steps involved directly on the bench sheet. Each bench sheet must be completed in a manner so that at any given time during review the calculations are easily reproduced by the person checking the raw data. All pertinent information will be included such as: response factors, dilution factors, and calibration constants. The analyst signs and dates

each page of calculations in ink. A second analyst is required to review all data. The second analyst will initial and date the worksheet. The work sheets are bound in chronological order in a laboratory workbook designated for each analysis.

A summary of equations used in the calculations is in Table 12.1.

If data is input and processed using a computer, a hard copy of the input and output is reviewed to ensure that no discrepancies exist. The data is signed by the person entering the data and reviewing the data. The samples analyzed shall be evident. The data is identified by date analyzed or sample log number; in addition, a disc or tape backup is archived. Data files are uniquely identified by log number/parameter or date analyzed.

If data is directly acquired from instrumentation and processed, the analyst reviews the following for exactness: sample log numbers, calibration constants, response factors, reporting units, and established numerical values used for detection limits (if a value is reported as less than the MDL). The analyst signs and dates the resulting output.

Data that is directly acquired from instrumentation such as strip charts, chromatograms, etc. are identified with the following information:

- Date of analysis and initials of analyst
- Initials of review analyst
- Instrument Identification
- Type of analysis

Instrument run logs can be cross referenced by date to access information on instrument conditions.

TABLE 12.1
DATA REDUCTION FORMULAS

PARAMETER	FORMULA
Acidity, Alkalinity	$\frac{\text{mls titrant x normality titrant x 50,000}}{\text{mls sample}}$
BOD, 5-day	$\frac{\text{Initial D.O. - Final D.O. - CF}}{\text{\% Dilution Sample}}$ Calculations are performed by computer software
Boron, COD, Sulfate	Concentration from curve x dilution factor
Nitrogen-Nitrate, Nitrite, Nitrogen-Nitrite, Ortho and Total Phosphate, Phenols, Chloride	Calculated by computer software as provided by Lachat Corp.
Fluoride**, Nitrogen-Ammonia**, Nitrogen-Total Kjeldahl**	Calculated by computer software as provided by Lachat Corp.
Anions	Calculated by computer software as provided by Dionex.
Chloride, titrimetric	$\frac{\text{(ml titrant for sample - ml titrant for blank) x Normality of titrant x 35,450}}{\text{ml sample}}$
Conductivity*, pH, Turbidity,	Directly read from instrument
Cyanide, Total and Amenable	$\frac{\mu\text{g from standard curve x ml total volume absorbing solution}}{\text{ml volume sample x ml volume of absorbing solution colored}}$ Calculated by software as provided by Lachat Corp.
Oil and Grease	$\frac{\text{(mg weight of residue + tared flask) - mg tared flask) - mg in blank x 1000}}{\text{mls sample}}$
Solids, Total and Total Dissolved	$\frac{\text{((mg wt of dried residue + dish) - mg wt of dish) x 1000}}{\text{mls sample}}$
Solids, Total Suspended	$\frac{\text{((mg wt of dried residue + filter) - mg wt of filter) x 1000}}{\text{mls sample}}$
Atomic Absorption (Furnace)	Directly read from instrument after being calculated by computer software. Requires initial set-up in element file by group leader and vol (or wt.) and dilution by operator.
Inductively Coupled Plasma	Calculated by computer software as provided by Leeman Labs
GC-Volatiles, Pesticides/PCBs	$\frac{\text{response for sample analyte x mg of standard x ul of total extract*** x dilution}}{\text{response for external standard x ul volume injected*** x ml volume sample (or g wt.)****}}$ Calculations performed by HP Enviroquant
GC/MS-Semivolatiles	$\frac{\text{response for sample analyte x mg of ISTD added to extract x dilution}}{\text{response for ISTD x response factor x ml volume extracted (or g wt.)****}}$ Response Factor = $\frac{\text{response for analyte to be measured x } \mu\text{g/l of ISTD}}{\text{response for ISTD x mg/l of analyte to be measured}}$ Calculations performed by HP Enviroquant

*Requires adjustment for temperature.
**Requires adjustment for dilution.
***For purge and trap volatiles not applicable and therefore = 1
****Applies to solid analysis.

12.3 BIOMONITORING DATA REDUCTION AND REPORTING

All calculations are performed according to the EPA methods manual. When applicable EPA software is used to perform Dunnett's procedure and probit analysis. All formulas are chosen appropriately depending on the conditions and outcome of each individual test. Due to the complexity of each formula please see EPA/600/4-89/001 for formulas pertaining to Chronic Toxicity tests and EPA/600/4-90/027 for formulas pertaining to Acute Toxicity tests.

12.4 DATA VALIDATION

12.4.1 Chain of Custody Review

One of the first steps in the validation process is review of the chain of custody (COC). The COC is reviewed first when the sample arrives. It is checked for completeness as well as time accountability. If the COC is complete and accurate it will then be processed through the system. If any irregularity is found, a non-conformance sheet is filled out, with the TSR sign-off, etc. The samples are released for analysis upon approval of the COC.

12.4.2 Field Data

Field data must meet all calibration and continuing calibration requirements. All field data is reviewed for accuracy and completeness. The field data must be approved before it can be entered onto a report. Recorded field data is reviewed by the Environmental Monitoring Manager. Field QC criteria is explained in detail in Section 13.0.

12.4.3 Laboratory Analysis, QC, and Data Review

After the COC has been reviewed and the sample has been logged in the laboratory will then perform all required analyses. The Lab Supervisors are responsible for ensuring that all samples are run within holding time. At the beginning of each analysis or sample preparation the analyst is responsible for making sure that all laboratory ID numbers on the sample bottles match those listed on the benchsheet or logbook. Sample transfer from bottle to container is periodically spot checked by a qualified senior analyst. Upon completion of the analysis the analyst will recheck all QC checks and calculations and give the bench sheet to another analyst who will review the calculations and make sure all portions of the benchsheet have been completed. The review person will then initial and date the benchsheet. The Extraction laboratory supervisor is responsible for reviewing all extraction logs. The extraction logs are reviewed for sample prep method as well as sample extraction date versus holding time. The laboratory supervisor for each section of the laboratory is responsible for reviewing instrument run logs and benchsheets to ensure

that the samples are being run within holding time. The lab supervisor or group leader will perform a final review before the data is approved for input into the computer. This review will include performance of the various blanks and precision and accuracy QC to determine if the set is within quality control criteria. If the data is not approved during the final review process it will be given a pending status and be returned to the laboratory. Pending data will be reviewed for corrective action and may require only recalculation or may result in reanalysis.

12.4.4 Final Report Review

After reviewed data is entered in the LIMS, the input is reviewed against the raw data by a second person for exactness. The input is initialed and dated. The client reports are then prepared for review by the assigned Technical Service Representative (TSR). The report is reviewed for correlation between related parameters as well as possible trends. The TSR will review related supporting documentation such as chain of custody records, field documents, etc.. All field documents will be reviewed and approved before the final review. Field data that does not pass established criteria will not be processed through the final report review. The Environmental Monitoring Manager will be responsible for any corrective actions necessary concerning field results.

Laboratory result values that appear anomalous will be sent back to the laboratory for a second review of the raw data. If there is no apparent reason for the anomaly the sample will be reanalyzed. If the sample holding time has expired it will be reanalyzed and flagged. If the client desires, a new sample will be collected and evaluated. The chain of custody is also reviewed for a final time to ensure that all project objectives have been met. The LIMS will footnote any parameters that may exceed established limits as provided by the client. When the LIMS notes that a limit has been exceeded, the Technical Service Representative is notified and the client is contacted.

12.4.5 Data Packages and Validation

Data packages are provided when requested by the client. They range from QC summaries to "CLP-like" packages with raw data. The QC data forms are generated by the analyst performing the analysis or the QA Manager. It is then input into the computer by a QC entry specialist (QCES). The QCES then puts all pertinent data together to form a package. The entire package must undergo three weeks of review before it is released. At a minimum, the three levels are: 1) Primary analyst; 2) Section Supervisor or Senior analyst; 3) QA Manager/President. Once the reviews are complete, the package is logged, copied, and shipped.

DATA REDUCTION AND VALIDATION FLOW SCHEMATIC

Activity	Responsibility
Review of COC	Initially by Login personnel and again by Technical Service Rep.
Data Production and Reduction	Chemist, Analyst
Review of laboratory QC	Chemist, Analyst
Checking of Data Production and Reduction	Technical Service Rep., Lab Supervisor or Group Leader, QAO
Approval of Field QC and data	Environmental Monitoring Manager
Data Entry to LIMS	Data Entry Specialist
Review of input LIMS data	Chemist, Analyst
Sample Number Draft Report Generation	Data Entry Specialist or Administrative Assistant
Draft Report Review and Approval	Technical Service Representative (TSR)
Final Review and Approval	Technical Service Representative (TSR)

12.5 DATA REPORTING

Laboratory reports issued to the client for regulatory work, shall include, at a minimum, the following information:

- Laboratory name, address and phone number
- Client name and/or site name
- Comprehensive Quality Assurance Plan number issued by the FDER
- Client or field identification number
- Method number for each sample analyses
- Analytical result for each analysis with applicable Data Qualifier as outlined in Table 12.2
- Date of sample preparation (when required)
- Time of sample preparation if the holding time is less than 48 hours
- Date of sample analysis
- Time of sample analysis if the holding time specified is less than 48 hours
- Date and time of sample collection from the Chain of Custody form (Figure 7.3)
- Identification of all laboratories providing analytical results in the report, including the appropriate laboratory certification numbers from all certifying agencies, the appropriate Comprehensive Quality Assurance Plan numbers issued by the FDER (where required), and identification of which analytical results were provided by each laboratory. The "S" qualifier will be used when analyses have been subcontracted.
- Individual report statements: "The reported analytical results relate only to the sample submitted." and "This report shall not be reproduced, except in full, without written approval from ESC.".
- Laboratory certification numbers as assigned by each certifying agency.

An example of a final client report is presented in Figure 7.12.

TABLE 12.2
DATA QUALIFIER CODES

The following codes shall be used when reporting data values that either meet the specified description outlined below or do not meet the quality control criteria of the laboratory:

A	**ALC** (EPA) - Aldol Condensation: Labels a suspected Aldol Condensation product for TIC's
B	**FBK** (EPA) - The indicated compound was found in the associated method blank as well as the laboratory sample.
C	**CBC** (EPA) - Cannot be calculated: The analytical result cannot be calculated because an operand value is qualified. Identifies analytes whose internal standard is not found.
D	**LTL** (EPA) - Less than lower calibration limit: Actual value is known to be less than the lower calibration range due to dilution.
E	**GTL** (EPA) - Greater than upper calibration limit: Actual value is known to be greater than the upper calibration range
F	**SRN** (EPA)- Diluted: The indicated analysis results were generated from a dilution of the same sample. The detection limit is elevated in order to reflect the necessary dilution.
G	**SRS** (EPA) - Secondary Dilution: The indicated analysis results were generated from a secondary dilution of the same sample. The sample had to undergo serial dilution.
H	**RIN** (EPA) - Re-Analyzed: The indicated analytical results were generated from a reinjection of the same sample extract or aliquot. This may occur if the initial injection resulted in diminished ability to achieve complete identification of the analyte of concern.
I	(ESC) Not analyzed due to interference. (Sample reacted with method reagent or could not be analyzed due to interferences that could not be corrected)
J	(EPA) Estimated value. This code shall be used in the following instances: **1.** surrogate recovery limits have been exceeded; **2.** no known quality control criteria exists for the component; **3.** the reported value failed to meet the established quality control criteria for precision **4.** the reported value failed to meet the established quality control criteria for accuracy **5.** the sample matrix interfered with the ability to make any accurate determination; spike value is unacceptably high **6.** the sample matrix interfered with the ability to make any accurate determination; spike value is unacceptably low **7.** the data is questionable because of improper laboratory or field protocols (e.g. composite sample was collected instead of a grab

sample).
8. the internal standard associated with this data responded abnormally low. The data is likely to show a high bias concerning the result.
9. the internal standard associated with this data responded abnormally high. The data is likely to show a low bias concerning the result.

NOTE: a "J" value shall be accompanied by justification for its use.

K **REX** (EPA) - Re-prepared: The indicated analytical results were generated from a re-extraction or preparation of the sample. The initial sample failed to exhibit acceptable response to the initial extraction/preparation.

L (ESC) Sample Pretreatment: The sample reaction impaired the ability to analyze the sample using normal method requirements. The sample required treatment outside of method protocol in order to determine the analytical result.

M **AVG** (EPA) - Average Value: Used to report a range of values; e.g., relative response factors

N **PRE** (EPA) - Presumptive evidence of presence of material. This qualifier shall be used if:
8. the component has been tentatively identified based on mass spectral library search;
9. there is an indication that the analyte is present, but quality control requirements for confirmation were not met (i.e. presence of analyte was not confirmed by alternate procedures).

O (ESC) Sample diluted due to interferences that impaired the ability to make an accurate analytical determination. The detection limit is elevated in order to reflect the necessary dilution.

P **NRP** (EPA) - Non-Reproducible: Results of two or more injections are not comparable

Q (ESC) Sample held beyond the accepted holding time. This code shall be used if the value is derived from a sample that was prepared or analyzed after the approved holding time restrictions for sample preparation or analysis.

R **REJ** (EPA) - Rejected: Results have been rejected by the laboratory and should not be used. Some or all of the quality control data for the analyte were outside of criteria, and the presence or absence of the analyte cannot be determined from the data.

S Subcontracted (ESC) – This analysis was performed by a subcontractor, chosen to meet the project requirements
Note: This qualifier will be followed by a numeric designation, which will identify the laboratory chosen for sub-contract.

U **BDL** (EPA) - Below Detectable Limits: Indicates that the compound was analyzed for but not detected. This shall be used to indicate that the specified component was not detected. The value associated with the qualifier shall be the laboratory method detection limit. Unless requested by the client, less than the method detection limit values shall not be reported.

W (ESC) The laboratory analysis was from a sample collected in an improper container

X (ESC) Metals

Y (ESC) The laboratory analysis was from an unpreserved or improperly preserved sample. The data may not be accurate.

Z (ESC) Too many colonies were present (TNTC), the numeric value represents the filtration volume.

QUALIFIER REPORT INFORMATION

ESC recognizes and utilizes sample and result qualifiers as set forth by the EPA Contract Laboratory Program. We firmly believe that information pertaining to sample analysis should be made available to the ESC client. In addition to the EPA qualifiers adopted by ESC, we have implemented ESC qualifiers to provide more information pertaining to our analytical results. Each qualifier is designated in the qualifier explanation as either EPA or ESC.

Definitions:

Accuracy - The relationship of the observed value of a known sample to the true value of the known sample. Represented by percent recovery and relevant to samples such as: control samples, matrix spike recoveries, surrogate recoveries, etc.

Precision - The agreement between a set of samples or between duplicate samples. Relates to how close together the results are and is represented by Relative Percent Difference (RPD).

Surrogate - Organic compounds that are similar in chemical composition, extraction, and chromatography to analytes of interest. The surrogates are used to determine the probable response of the group of analytes that are chemically related to the surrogate compound. Surrogates are added to the sample and carried through all stages of preparation and analyses.

Tentatively Identified Compound (TIC) - Compounds detected in samples that are not target compounds, internal standards, system monitoring compounds, or surrogates.

12.6 DATA STORAGE

All manually generated data are stored in specific laboratory analysis workbooks. Annually the data are moved to archive where they are stored by date and parameter. Computerized data are also stored in hard copy form in files labeled by date and method. Computerized date are also stored on disc or tape according to analysis and date analyzed. Each analysis workbooks is separate and contain all data relating to the test including standard and reagent logs, calibration curves/data, QC charts/limits, SOP, and completed analysis sheets. These workbooks are filed by analysis and date analyzed. All other logbooks such as field analysis workbooks, GC and GC/MS chromatograms, extraction logs, digestion logs, and injection logs are filed in the same manner. All final results are entered into the LIMS system.

The LIMS facilitates access to any finished data and sample information by client code, sample number, and parameter run number. Furthermore, any data pertaining to a sample or client can be obtained. The LIMS also contains the information contained on the COC such as sample description, time and date collected, person collecting the sample, container type, preservative, sample receipt data, finished/approved analytical data, analyst, etc. The LIMS is backed up daily on tape. The back up tape is kept in off-site storage. While all LIMS data are accessible, data must be at least one year old before it is removed from the active system.

All GC/MS data is archived on compact disk by dated data files that can be indexed by log number. Original raw data files can never be edited.

All ICP, AA, and GC volatiles data are archived on a separate server that is used only for data files. The data is accessed from the date analyzed (which can be obtained from the LIMS system). The data server is backed up daily. Original raw data files can never be edited.

All files, whether originally from a computer or not, are stored also as printed hard copy. When data points have been invalidated, notations, a brief explanation, and corrective actions are dated and initialed on the hard copy of the raw data. All data is stored as hard copies and on electronic media. All records are kept for a minimum of 10 years.

Hard copies of all reports are stored according to client code in the data processing area or an off-site warehouse. These reports include chain of custody forms, a copy of the final approved printed report, and any other associated documents. Samples that require subcontract work will also have a copy of the subcontract report in the client file. All data are stored for a minimum of 10 years.

12.7 KEY PERSONNEL

See Organization Chart in Section 4.0.

Chemist/Analyst:

- Performs the analyses
- Verifies detail and accuracy
- Records pertinent information in laboratory notebooks
- Stores all data (files and discs)
- Updates QC charts
- Prepares and completes benchsheets for review

Laboratory Group Leader, Supervisor, or Manager

The laboratory group leader or supervisor reviews raw data, checking calculations for correctness, calibration factors, instrument logs, and extraction logs. The laboratory manager reviews the final report with all supporting documentation.

Laboratory QA Officer (QAO)

The QAO routinely reviews QA/QC policies for all analyses to ensure that the data is evaluated within method requirements. The QAO is also responsible for assessing data that is out of compliance and ensuring that corrective action measures are taken. The QAO also assesses the effectiveness of any necessary corrective actions.

LIMS Specialist

The LIMS specialist tracks internal sample custody, computerizes data, and stores it in the LIMS system. Data and final reports are also stored as hard copies in a central file that is arranged by sample ID number.

13.0 CORRECTIVE ACTION

The Environmental Science Corporation quality assurance program is a compilation of well defined, continuous activities which are an intricate part of daily routine of all laboratory and sampling operations. All necessary corrective actions for this program are documented by numerical codes specifically related to a particular test type.

13.1 CRITERIA FOR INITIATING CORRECTIVE ACTION

Control limits have been established for each type of analysis. When these control limits are exceeded, corrective action must be taken. These limits are listed for precision and accuracy in Table 5.1. Calculated sample spike control limits are also used.

General Limits for Corrective Action:

Balance:	Class "S" weights outside 1.0000 plus/minus 0.0003 gm.
DI water:	Conductivity less than 1 umhos.
BOD Incubator:	Temperature outside 20.0 plus/minus 1.0 degrees C.
Biomonitoring Incubator:	Temperature outside 25.0 plus/minus 2.0 degrees C. Photoperiod schedule not set properly (16hr light/8hour dark)
Limits for pH:	Third point of initial calibration must be plus/minus 0.2 pH units of true value. Periodic calibration checks must be plus/minus 0.1 pH units or else recalibration or other corrective action must occur. Replacement or rejection of pH probes is necessary if slope calibration is less than 54 mV (temperature compensation knob greater than 0 degrees C at room temperature for 4.00 or 10.00 buffer).
Limits for conductivity:	Periodic KCl check must be plus/minus 5% of correct reading.
Limits for turbidity:	Periodic standard check must be plus/minus 5% of true reading.
Limits for Dissolved Oxygen:	Membrane must remain intact, air free, and particle free. Reading must correlate annually to Winkler titration.

13.2 INDIVIDUALS RESPONSIBLE FOR INITIATING CORRECTIVE ACTION

ESC recognizes that the data supplied by the professional staff must be dependable. The QAO continually monitors the quality assurance program to ensure that this goal is achieved. Each professional analyst is responsible for initiating corrective actions in their areas of expertise. Corrective action approval is administered by the QAO and laboratory supervisor.

13.3 REQUIRED CORRECTIVE ACTION

ESC's quality assurance program is a program applied to all samples and requires no lead time or startup effort. Designated corrective actions are as follows.

13.3.1 Laboratory QC Criteria and Appropriate Corrective Actions

If the analytical method contains acceptance/rejection criteria and it is more stringent than those controls generated by the laboratory the method criteria will take precedence.

13.3.1.1 Calibration Verification Criteria Are Not Met: Inorganic Analysis

Rejection Criteria - See Table 9.5.

Corrective Action - If a standard curve linearity is not acceptable and/or the absorbance for specific standard(s) is not analogous to historic data, the instrument settings, nebulizer, etc. are examined to ensure that nothing has been altered, clogged, etc. The working standards will be made fresh, intermediate dilutions will be rechecked and the instrument will be recalibrated. If a problem persists, the group supervisor or QAO is notified for further action.

If the initial reference check sample is out of control, the instrument is recalibrated and the check sample is rerun. If the problem continues the check sample is remade. If the problem still exists then the standards and reagent blank and remade. If the problem persists, the group supervisor or QAO is notified for further action.

13.3.1.2 Calibration Verification Criteria Are Not Met: Organic Analysis

Rejection Criteria - See Table 9.5.

Corrective Action - New calibration curve is not linear, or does not have adequate sensitivity: detector checked for fouling, standards rediluted, recalibrated.

Daily midpoint check is out of control: instrument setting checked, column and septum checked for leaks, the midpoint standard remade and rerun. If still out, supervisor called to initiate complete recalibration proceedings.

Reference check standard is out of control: this is used to evaluate if calibration is in control. Remake reference check standard; if still out, a new stock standard is obtained, instrument recalibrated, and check standard rerun.

13.3.1.3 Out Of Control Sample Blanks

Rejection Criteria - Sample blank reading is more than twice the background absorbance or more than twice the MDL.

Corrective Action - Sample blanks are rerun and response is assessed. Standard curves and samples are evaluated for any obvious contamination that is isolated or uniform throughout the run. If necessary, reagents are remade. Analyses are not started until the problem is identified and solved. If samples have already been partially prepared or analyzed, the group leader or QAO will be consulted to determine if data needs to be rejected or if samples need to be reprepped.

13.3.1.4 Out Of Control Reference Standards (QC Check Standards)

Rejection Criteria - If the performance is outside of lab-generated control limits (three times the accuracy standard deviation listed in Table 5.1)

Corrective Action - Instrument settings are checked, recalibration is performed, reference standard is rerun and samples affected since the last in control reference standard are rechecked. If an out of control situation still exists, standards, reference standards, and blanks are examined. The group leader, lab supervisor, or QAO will be consulted for further action.

13.3.1.5 Out Of Control Matrix Spike Samples

Rejection Criteria - If sample is outside of lab-generated control limits from accuracy charts on matrix spike samples from a similar matrix (i.e., water, solid, etc.)

Corrective Action - Spiking technique is assessed to ascertain if the sample has been spiked correctly. The sample is respiked and rerun, along with several other similar samples in subset. If an out of control situation persists, a sample matrix interference is indicated. Samples to be analyzed by standard additions are prepared (if not already), and the group leader, lab supervisor, or QAO is notified.

13.3.1.6 Out Of Control Duplicate Samples

Rejection Criteria - Lab-generated maximum RPD limit (as listed under precision in Table 5.1)

Corrective Action - Instrument and samples checked to see if precision variance is likely (i.e., high suspended solids content, high viscosity, etc.). They are rerun in duplicate and samples just before and just after the duplicated sample are rechecked. If problem still exists, lab supervisor or QAO is notified to review the analytical techniques.

13.3.1.7 Out Of Control Matrix Spike Duplicates

These QC samples can be out of control for either accuracy, precision, or both. The appropriate corrective actions listed for either matrix spikes, duplicate samples, or both are followed.

NOTE: Some samples cannot be duplicated. This is the case for wipe samples, filters, and some water samples. When possible, sampling personnel should collect duplicate samples.

Analysis-specific corrective action lists are available for each type of analysis performed by ESC. Examples of corrective actions for some tests are shown in Table 13.1.

TABLE 13.1
EXAMPLES OF CORRECTIVE ACTIONS

QC Activity	Acceptance Criteria	Recommended Corrective Action
Analysis - Flame Metals		
Initial Calibration	Slope of no individual point is >5% of average _____	Rerun calibration standards, make fresh standards from stock. Check instrument settings.
Standard Validation	±10 RPD	Obtain fresh QC check. Check for dilution errors in initial calibration.
Calibration Blank	<MDL	Reanalyze blank, remake fresh blank
Continuing Calibration Standard	±10 RPD	Rerun standard, recalibrate and repeat sample from last in control check
Sample Blank	<2 x MDL	Reanalyze blank, reanalyze blank with no digestion but with reagents added. Redigest blank and/or sample set if necessary.
Spike or Duplicate	Established Control Limits	Reanalyze if spike problem. Ensure proper spike concentration, determine cause, if necessary redigest set.
Analysis - Graphite Furnace Metals		
Initial Calibration	±10% of expected value	Rerun calibration standards, make fresh standards from intermediate. Check matrix modifiers, change graphite tube.
Standard Validation	±20 RPD or lab general limits whichever is higher	Reanalyze, obtain fresh QC check.
Calibration Blank	<MDL	Reanalyze blank, remake fresh blank
Continuing Calibration Standard	±20 RPD	Rerun standard, recalibrate and repeat sample from last in control check
Method Blank	<2 x MDL	Reanalyze blank, reanalyze blank with no digestion but with reagents added. Redigest blank and/or sample set if necessary.
Spike or Duplicate	Established Control Limits	Reanalyze if spike problem. Ensure proper spike concentration, determine cause, if necessary redigest set.
Analysis - Spectrophotometric		
Initial Instrument Blank	<MDL Response	Prepare check blank, if same response determine problem and reprocess set
Initial Calibration Standards	Slope of no individual point is >5% of average	Reanalyze standards, check dilutions, remake fresh standard from stock, check wavelength
QC Check Standard	±15 RPD or Established Control Limits, whichever is higher	Reanalyze check, obtain fresh check standard, reanalyze new calibration standards
Continuing Calibration Standard	±10 RPD	Rerun standard, make fresh standard, check wavelength settings
Sample Blank	<2 x MDL	Reanalyze blank, check wavelength setting, if positive determine source and reprocess set.

13.3.2 Field QC Samples That Require Corrective Actions

This section covers corrective actions that can be performed in the laboratory. Since some field QC data is not available until long after the samples have been collected, the Technical Service Representative must put the severity of these QC problems in perspective when decisions are made about the validity of the data. He/she in conjunction with the QAO or lab supervisor may or may not decide whether the project goals have been compromised.

13.3.2.1 Duplicate Analyses, Reference Standards, and Initial Calibration Checks Performed in Field

Rejection Criteria and Corrective Action are the same as for a similar lab analysis.

13.3.2.2 Out of Control Trip Blanks

Rejection Criteria - Greater than two times MDL.

Corrective Action - Sample seal should have been noted if violated before analysis. Rerun and compare to lab sample blank to see if problem is in the reagents. Check a similar sample container for contamination, to determine if isolated or chronic. Assess other samples stored with the trip blank during transport. If problem is still undetermined, notify QAO who will determine the effect on data validation.

13.3.2.3 Out of Control Field Blanks

Rejection Criteria - Greater than three times MDL.

Corrective Action - Check instrument, rerun samples. If still not in control, notify the lab support manager because the problem may be due preservative purity or collection container contamination.

13.3.2.4 Out of Control Equipment Blanks

Rejection Criteria - Three times MDL.

Corrective Action - Check instrument and rerun samples. If problem still exists, notify lab support manager because equipment blanks monitor the effectiveness of field cleaning of equipment. Resampling may be necessary.

13.3.2.5 System Audit Deficiencies

Any procedural deficiencies uncovered in a systems audit will initiate corrective actions. A formal audit will reveal such deficiencies, and a copy of the audit is sent to the affected departments along with suggestions for corrective action.

13.3.2.6 Out of Control Field Duplicates (samples collected in duplicate in the field for in-lab analysis)

Rejection Criteria - The same precision requirements as a lab duplicate as listed in Table 5.1.

Corrective Action - In addition to the usual actions specified for an in-lab duplicate, the sampling container, sampling procedure, preservation, and transport will be examined (if the problem was determined to be non-lab-induced) for the possibilities of bias or contamination of one or both samples.

13.4 BIOMONITORING CORRECTIVE ACTION

All instrumentation monitoring is mentioned in section 13.1.

Acute Toxicity Tests: If more than 90% mortality occurs in the control organisms within the specified time frame of the test, that test will be considered invalid and must be repeated using fresh control water.

3-Brood *Ceriodaphnia dubia* Survival and Reproduction Test: If more than 90% mortality occurs in the control organisms within 96 hours or more than 80% mortality occurs in the test organisms in the 3-brood period (approx. 7 days), that test will be considered invalid and must be repeated using fresh control water. Additionally, if the average number of young produced in the control is less than 15 per organism, that test will be considered invalid and must be repeated using fresh control water.

7-Day *Pimephales promelas* Larval Survival and Growth Test: If more than 90% mortality occurs in the control organisms within 96 hours or more than 80% mortality occurs in the test organisms in 7 days, that test will be considered invalid and must be repeated using fresh control water. Additionally, if the average weight of the control minnows is less than 0.2500 mg per replicate, that test will be considered invalid and must be repeated using fresh control water.

Reference Toxicant:
If reference toxicant test results fail to meet ESC in-house established criteria, the test is deemed invalid and must be repeated using organisms from a new batch. No test will be performed using organisms that fail to meet reference toxicant criteria.

13.5 EXTERNAL SOURCES THAT MAY INITIATE CORRECTIVE ACTION

Table 14.1 lists the current federal and state agencies that perform audits on ESC and the analytes used for the performance evaluation that may initiate corrective actions. In addition, the following types of samples may also initiate corrective action: split samples sent to another qualified laboratory, monthly blind field duplicates, quarterly purchased round robin samples, and periodic internal blind samples.

13.6 INTERNAL PROBLEMS, CORRECTIVE ACTION, AND REQUIRED NOTIFICATIONS

Each analyst is trained to recognize analytical deficiencies and initiate appropriate corrective action. The analyst verbally notifies his supervisor and will discuss appropriate measures that may be necessary to correct the problem. The analytical method and SOP may be reviewed and compared. Problems are documented on corrective action forms. Notification of unresolved analytical QC problems is included in a final report to the lab supervisor and QAO.

Affected sections will receive notification of any procedural deficiencies revealed by a systems audit report. It will contain suggestions for corrective action that are explained on a corrective action form. When corrective actions are initiated, the affected parties should indicate what actions were taken and initial and return his copy of the systems audit and all corresponding corrective action forms.

13.7 FIELD ANALYSIS CORRECTIVE ACTION

These analyses are currently performed in the field: pH, conductivity, and turbidity. None of these tests require corrective action limits different from those listed in Section 13.1.

13.8 REASONABLE CORRECTIVE ACTION

ESC will implement any reasonable corrective action deemed necessary by the regulatory QA officers. Regulatory QA Officers include the following: FL DEP, NC DENR, WV DEP, TN DOH, A2LA, CA ELAP, UT DOH, AIHA, DOE, and all other regulatory bodies affiliated with reciprocity based state certification.

13.9 CORRECTIVE ACTION DOCUMENTS

Corrective Action Documents that are implemented by the QA Department are kept in the QA Office. These documents include the following: Corrective Action resulting from both internal and external audits, Corrective Action resulting from performance evaluation, Corrective Action as deemed necessary by the QA Manager.

Corrective Action resulting from analytical failure is kept with the analytical data and is recorded on the benchsheet or raw data. The department supervisor is responsible for making sure that suitable measures have been taken to ensure that the problem is identified and corrected.

Corrective Action involving sample receiving is recorded on a Nonconformance form (as mentioned in section 7.0) and is then filed with the original Chain of Custody.

14.0 PERFORMANCE AND SYSTEM AUDITS

ESC participates in both internal and external audits. The two types of evaluations that are conducted regularly are system and performance audits. System audits are used to determine if each section of the system (both laboratory and field) uses the appropriate equipment and that proper protocols have been followed. The determination is a result of qualitative review audits which includes thorough review of each section (including log-in, sample prep, sample extraction, etc.). Performance audits are used to determine proper technique and the accuracy of measurements. This is assessed by the use of blind, split and spike sample analyses.

The laboratory QAO is responsible for conducting audits. System audits are performed annually (more often if required) using a checklist as a guide. For system audits, each section and protocol in the system is reviewed (field activities, proper documentation, sample custody, sample log-in, sample preparation, etc.). If a nonconformance situation occurs then corrective action is necessary. Corrective action involves identifying the problem and may require modifications to the procedures. Most corrective actions are completed within two weeks or less. Performance audits require evaluation of control and blind results. On a quarterly basis control charts, documentation of results, and corrective actions are evaluated as part of the performance audit. An example of supplementary information gathered during a performance audit is shown in Figure 14.1.

Performance audits may also consist of the following:

- The laboratory participates in various performance evaluation and method studies available from USEPA approved providers. WP (Water Pollution) Study, WS (Water Supply) and Matrix PE's (soil and UST) are analyzed at least annually. ESC purchases WS and Matrix PE's from Environmental Resource Associates (ERA) and WP PE's from Analytical Products Group (APG).

- Blind QC check samples are purchased periodically from an approved USEPA provider for the use of performance evaluation. These samples are supplied to ESC without the true concentration values. Two levels are analyzed. ESC reviews the results as an overall check on internal QC procedures.

- Blind field duplicates are collected periodically to evaluate field collection and laboratory precision

- ESC also participates in PE studies supplied by the American Industrial Hygiene Association (AIHA). AIHA provides PE's for Proficiency Analytical Testing.

- Split samples are sometimes sent to outside laboratories to confirm analytical results.

FIGURE 14.1
PERFORMANCE AUDIT

Sample No.: _____ Date submitted: _____

Analyte	RESULT MEAN/TV	% REC.	ACCEPT.	DUP 1	DUP 2	RPD	COMMENTS

14.1 EXTERNAL AUDITS

ESC agrees to on-site system audits from external organizations. ESC has participated in various systems and performance audits, which are listed in Table 14.1.

SDWA

The ESC laboratory (EPA No. TN003) is certified by the State of Tennessee under the Safe Drinking Water Act. The State of Tennessee routinely audits the ESC laboratory procedures, quality control and methods and has found the laboratory practices to be consistent with EPA requirements. ESC is also audited under the Safe Drinking Water Act by Arizona, North Carolina, Florida, NELAP, and the A2LA. ESC maintains several other DW certifications which have been received through reciprocity.

CWA/RCRA

ESC is also certified for wastewater and solid waste through audits by the following states/organizations: A2LA, Arizona, California, Utah, West Virginia, North Carolina, and Florida (NELAP). In addition to the EPA Water Pollution studies, ESC is required to analyze additional blind samples for West Virginia. The ESC laboratory is also routinely audited by the Metropolitan Government of Nashville and Davidson County and certified for wastewater sampling and analysis. ESC participates in WP Studies, DMR QA program, and Matrix PE studies.

TABLE 14.1
CURRENT EXTERNAL AUDITS OF ESC LABORATORY

Agency	Performance Evaluation	Analyte	On-Site Inspection and Systems Audit	Frequency (PE Samples)
American Association for Laboratory Accreditation	Yes	SDWA, Wastewater; wet chemistry, organics, aquatic toxicity, and metals RCRA: organics, wet chemistry, and metals	Yes	Semiannually
American Industrial Hygiene Association	Yes	ELLAP, IHLAP (Lead, Organics)	Yes	Quarterly or more often
Arizona	Yes	WW and RCRA: organics, wet chemistry, and metals	Yes	Semiannually
California	Yes	NPDES & RCRA metals	Yes	Semiannually
Department of Energy	Yes	DW organics, wet chemistry, and metals	Yes	Semiannually
EPA DMR-QA Performance Evaluation Samples	Yes	Cadmium, chromium, copper, lead, nickel, zinc, iron, cyanide, pH, total suspended solids, BOD, oil and grease, TKN, total phenol, and ammonia	No	Yearly or more often*
Louisiana	Yes	WW and RCRA: organics, wet chemistry, and metals	Yes	Semiannually
MATRIX EPA Performance Evaluation Samples	Yes	RCRA/UST	Yes by certifying states	Semiannually
Metro Nashville Sewer Discharge Permits	No	organics, metals, wet chemistry Accepts TN SDWA	Yes	Annual DMR Study
NC State	Yes	Drinking Water Wastewater; wet chemistry, organics, and metals RCRA: organics, wet chemistry, and metals	Yes	Yearly or semiannually
NELAP (FL State)	Yes	DW organics, WW and RCRA: organics, wet chemistry, and metals	Yes	Semiannually
TN State	Yes	As, Se, Cd, Pb, Hg, Ag, Ba, Cr plus other SDWA-related parameters, Volatile Organics	Yes	Yearly or semiannually
Utah State	Yes	Wastewater; wet chemistry, organics, and metals RCRA: organics, wet chemistry, and metals	Yes	Yearly or semiannually

Agency	Performance Evaluation	Analyte	On-Site Inspection and Systems Audit	Frequency (PE Samples)
WP EPA Performance Evaluation Samples	Yes	All	Yes by certifying states	Semiannually
WS EPA Performance Evaluation Samples	Yes	All	Yes by certifying states	Semiannually
WV State	Yes	Wastewater and RCRA: organics, wet chemistry, and metals	Yes	semiannually

*PE samples can be both more frequent and include different parameters since the NPDES permits dictate the type of samples needed for analysis.

15.0 QUALITY ASSURANCE REPORTS

15.1 QC Data

Quality Control (QC) data are reviewed at the time of analysis. Each department has a printout of established control limits. When QC samples are analyzed the percent recovery is evaluated to ensure that the values are within control criteria. All QC is recorded in a designated location at the bottom of each benchsheet. As described in section 7.2 the analyst requests a run preview sheet from the LIMS and prints out the benchsheet based on this information. The benchsheet will display all samples assigned to that run. When the analysis is complete and all QC has been approved, the benchsheet goes to a data entry specialist who will enter all results and QC data.

The QC data is entered by the different matrices, precision, and accuracy. The data is then transferred by analyte and matrix where it can then be displayed as a graph. The graph is printed out on a monthly basis for review by the department supervisor. The QC will be evaluated for increasing/decreasing trends, changes in average recovery, and overall performance. If a deficiency is cited, the QAO is notified and corrective action is discussed.

All limits are calculated on an annual basis or sooner if trends develop or operating system changes.

15.2 Internal Reports

As mentioned in Section 14.0, the laboratory QAO conducts the ESC laboratory internal audits. An internal QA report is generated for each audit. Copies of this report are submitted to the ESC president and the ESC laboratory supervisors.

15.3 External Reports

External QA reports, in some cases, are generated on an as-needed basis. For example, outliers in the EPA Water Pollution Study must be explained. If no outliers appear, then no corrective action report is required.

15.4 Florida Certification

For the state of Florida, copies of both internal and external QA reports will be submitted to DER QAS according to Appendix D in the DER QA manual. If no project audits were performed, and no significant QA/QC problems occurred, then a letter stating these facts will be submitted in lieu of a QA report. QA reports will be formatted in accordance with Appendix D, DER-QA-001/90 and contain all the information described in that document. It will also include ESC's assessment of the MDLs. In general, the QA report will contain the following:

- Periodic assessment of measurement data accuracy and precision (including MDLs)
- Results of all performance and/or system audits
- Significant QA/QC problems with their recommended corrective actions
- Outcome of any corrective action taken
- Other information required in Appendix D, DER-QA-001/90.

15.5 Quality Assurance System Review

Annually, the QAO, CEO, President, and Department Managers have a quality system review meeting. This meeting is designed to discuss the quality system and to determine if any changes need to be made to the current process. If any changes are deemed necessary, assignments will be made to the appropriate department manager. In general all system changes must be completed within 30 days of assignment. A response must be made directly to the President.

15.6 Quality Assurance Plan Review

The QAP undergoes review as deemed necessary. The QAP is a living document that may undergo change at any time. ESC requires at least an annual review of the QAP. If changes are made, approval by the individual department managers, CEO, President, and QAO is necessary.

16.0 DOCUMENT CONTROL AND INTERNAL POLICY

16.1 Document Control

All Standard Operating Procedures, QA Manuals, and Safety Plans are written in a format that incorporates the document name, date revised, pages included, and section. Deviations from SOP's and Quality documents are not allowed without the permission of the QA Manager. In the event that a deviation is requested, the circumstance is considered and the procedure is evaluated for necessary change and allowance. The QA Manual, SOP's, Safety Plan, and other controlled documents are maintained electronically on a protected directory. The only staff with access rights are the QA personnel and the IT Director. Electronic copies of current and previous versions of all controlled documents are maintained on the computer network system. They are stored with the same security settings as the most recent version. The documents are archived to tape storage with regular back-up of the entire system.

16.1.1 QA Procedures

Certain printed documents that have been developed for quality assurance are distributed using an ID number that is assigned and maintained by the QA Manager. The following documents are released both internally and externally using the assignment system:

- Quality Assurance Manual
- Standard Operating Procedures
- Quality Control Summaries
- Safety Plan

16.1.2 Logbooks

All bound logbooks are distributed using an ID number that is assigned and maintained by the QA Manager. The ID number represents the department, intended use, and the date effective.

16.2 Internal Policy

16.2.1 All staffmembers employed by ESC are given a Company Policy Manual that defines expectations and policies of ESC. The policies that are addressed in this manual cover a wide array of subjects. No deviations from the company policy will be permitted without the written permission of the President.

The Policy Manual is designed to inform all employees of the corporate

expectations. The manual also addresses professional expectations. Professional expectations include confidentiality, work/professional ethics, and discipline.

16.2.2 Client Complaints

All client concerns are addressed by the Technical Service Representatives. If further resolution is required, it will be handled by the QA Manager and/or the Lab Director. See SOP # 020302 *Client Complaint Resolution Procedure.*

16.2.3 Training and Education

All training and education requirements are outlined in SOP# 030205 *Technical Training and Personnel Qualifications*. Training requirements for safety and health are listed in Table 3-1 of the *Chemical Hygiene and Laboratory Safety Plan.*

Educational/training courses are provided where required by the position.

16.2.4 Technical Service Representatives (TSR)

The client service department is structured in order to ensure that each client and their projects have individual service. The TSR's are assigned to clients based on client regulatory needs. It is the responsibility of the TSR to ensure that all project requirements, related to laboratory work requested by the client, are being met and that all certification requirements have been checked and verified.

16.2.5 Materials Procurement and Control

All materials and supplies that are purchased for analytical purposes are procured from quality approved vendors. The various department managers are responsible for ordering supplies/chemicals that meet the method stated requirements. See SOP # 030210 *Materials Procurement for Analytical Processes.*

THE AMERICAN
ASSOCIATION
FOR LABORATORY
ACCREDITATION

ACCREDITED LABORATORY

A2LA has accredited

ENVIRONMENTAL SCIENCE CORPORATION
Mt. Juliet, TN

for technical competence in the field of

Environmental Testing

The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO/IEC Guide 25-1990 "General Requirements for the Competence of Calibration and Testing Laboratories" (equivalent to relevant requirements of the ISO 9000 series of standards) and any additional program requirements in the identified field of testing.

Presented this 22nd day of September, 1999.

President
For the Accreditation Council
Certificate Number 1461.01
Valid to November 30, 2001

For tests or types of tests to which this accreditation applies, please refer to the laboratory's Environmental Scope of Accreditation.

UNITED STATES DEPARTMENT OF AGRICULTURE

Animal and Plant Health Inspection Service

Plant Protection and Quarantine

Soil Permit

Permit Number: S-4868

Issued To:

Environmental Science Corporation
(Dewey R. Klahn)
12065 Lebanon Road
Mt. Juliet, Tennessee 37122

TELEPHONE: (615) 758-5858

Under the authority of the Federal Plant Pest Act of May 23, 1957, permission is hereby granted to the facility/individual named above subject to the following conditions:

1. Valid for shipments of soil not heat treated at the port of entry, only if a compliance agreement (PPQ Form 519) has been completed and signed.
2. To be shipped in sturdy, leakproof, containers.
3. To be released without treatment at the port of entry.
4. To be used only for laboratory analysis, and only in the facility of the permittee at the Environmental Science Corporation, located in Mt. Juliet, Tennessee.
5. No use of soil for growing purposes is authorized, including the isolation or culture of organisms imported in soil.
6. All unconsumed soil, containers, and effluent is to be autoclaved, incinerated, or heat treated by the permittee at the conclusion of the project as approved and prescribed by Plant Protection and Quarantine.
7. This permit authorizes shipments from all foreign sources, including Guam, Hawaii, Puerto Rico, and the U.S. Virgin Islands through any U.S. port of entry staffed by Plant Protection and Quarantine.

SEPTEMBER 30, 2001
Expiration Date

Deborah M. Knott
Approving Official DEBORAH M. KNOTT

PPQ FORM 525B (8/94)

The Alabama Department of Environmental Management

certifies that

Environmental Science Corporation

Having met Department laboratory certification criteria, is approved to conduct Drinking Water analyses for the following:

Inorganics, Total Trihalomethanes, Volatile Organic Chemicals and Synthetic Organic Chemicals by GC/GCMS

Effective October 9, 1999 through September 30, 2000

Alabama Department of Environmental Management

Laboratory Number **40660**

Arizona Department of Health Services

ENVIRONMENTAL LABORATORY LICENSE

Issued to:

Laboratory Director: PAULETTE G. LANKFORD,PH.D
Owner/Representative: PAT A. SCHUL

ENVIRONMENTAL SCIENCE CORPORATION

AZ0612

is in compliance with Environmental Laboratory's applicable standards for the State of Arizona and maintains on file a List of Parameters for which the laboratory is certified to perform analysis.

PERIOD OF LICENSURE FROM: 06/26/2000 TO 06/26/2001

GREAT SEAL OF THE STATE OF ARIZONA 1912

Wynand H. Nimmo, M.T., Chief
Office of Laboratory Licensure,
Certification & Training

State of Arkansas

Department of Environmental Quality
Laboratory Certification Program

Be it known that **Environmental Science Corporation**
Mt. Juliet, Tennessee
has earned certification by this Department for the period of

May 28, 1999 to May 28, 2000

The following parameters are certified:

Ammonia	TSS	Nickel
BOD	Boron	Potassium
Chloride	Cadmium	Sodium
COD	Calcium	Zinc
Nitrate	Chromium	Semi-volatile Organics
Nitrite	Copper	TPHC
Oil & Grease	Iron	Volatile Organics
pH	Lead	Acute Toxicity
TDS	Magnesium	Chronic Toxicity
TKN	Manganese	
Total Solids	Mercury	

May 28, 1999
Date

Jeffrey M. Rush
Quality Assurance Officer

STATE OF CALIFORNIA
DEPARTMENT OF HEALTH SERVICES

ENVIRONMENTAL LABORATORY CERTIFICATION

is hereby granted to

ENVIRONMENTAL SCIENCE CORPORATION

12065 LEBANON ROAD

MT JUILIET, TENNESSEE

to conduct analyses of environmental samples as specified in the "List of Approved Fields of Testing and Analytes" which accompanies this Certificate.

This Certificate is granted in accordance with provisions of Section 1010, et seq. (New Section 100825) of the Health and Safety Code.

Certificate No.: 2327

Expiration Date: 10/31/2002

Issued on: 10/01/2000

at Berkeley, California,
subject to forfeiture or revocation.

George C. Kulasingam, Ph.D.
Manager
Environmental Laboratory Accreditation Program

DELAWARE HEALTH
AND SOCIAL SERVICES

DIVISION OF PUBLIC HEALTH

CERTIFICATE OF APPROVAL FOR DRINKING WATER ANALYSIS

issued to

Environmental Science Corp.

located at

12065 Lebanon Road
Mt. Juliet, Tennessee 37122-2605

is granted approval for reciprocity enforcement purposes under
the Safe Drinking Water Act
for the following parameters

FULL CERTIFICATION:

Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Thallium, Nitrate, Nitrite, Pesticides (All), Herbicides (All), Carbamates(All), Organic Disinfection By-products, Total Trihalomethanes, VOC-1, VOC-2, VOC-4, TDS, Alkalinity, Sodium, Sulfate, Cyanide

PROVISIONAL CERTIFICATION:

Certificate Number: TN003

Date of Issue: October 23, 1995

Expiration Date: September 19, 1998

Mahadeo P. Verma, Ph.D., MPH, HCLD
DIRECTOR OF LABORATORIES

Edward G. Hallock
PROGRAM MANAGER
OFFICE OF DRINKING WATER

FLORIDA DEPARTMENT OF

HEALTH

State of Florida, Department of Health
Bureau of Laboratories

This is to certify that

E87487

Environmental Science Corporation - TN
12065 Lebanon Rd.
Mt. Juliet, TN 37122

has complied with Florida Administrative Code 64E-1, for the examination of Environmental samples in the following categories:

SDWA - Primary Inorganic, Secondary Inorganic, Synthetic Organic Contaminants, Other Regulated Group I Unregulated Contaminants; CWA - Metals, General Chemistry, Volatile Organics, Extractable Organics, Pesticides-Herbicides-PCB's, Whole Effluent Toxicity; RCRA - Metals, General Chemistry, Volatile Organics, Extractable Organics, Pesticides-Herbicides-PCB's**********

Continued certification is contingent upon successful on-going compliance with the NELAC Standards and FAC Rule 64E-1 regulations. Specific methods and analytes certified are on file at the Bureau of Laboratories, P. O. Box 210, Jacksonville, Florida 32231. Clients and customers are urged to verify with this agency the laboratory's certification status in Florida for particular methods and analytes.

EFFECTIVE JULY 1, 2000 **THROUGH JUNE 30, 2001**

GREAT SEAL OF THE STATE OF FLORIDA
IN GOD WE TRUST

Ming S. Chan, Ph.D.
Chief, Bureau of Laboratories
Florida Department of Health
DH Form 1629, 3/98

NON - TRANSFEABLE 487 -- 305
Previous SDW 87554

STATE OF GEORGIA
DEPARTMENT OF NATURAL RESOURCES
LABORATORY CERTIFICATION BY RECIPROCITY

In accordance with the "Rules for Safe Drinking Water" and the U.S. Environmental Protection Agency "Procedures for Laboratory Certification",

ENVIRONMENTAL SCIENCE CORP. - MT. JULIET, TENNESSEE

Water Laboratory is hereby granted
CERTIFICATION
for the analyses of water samples for Chemical Parameters

This certification is valid in the State of Georgia, effective this 25th day of January 2000. This certification is contingent upon continued certification by the State of Tennessee for all parameters listed on the attached document. This certification is non-transferrable.

CERTIFICATION EXPIRES September 19, 2001.
CERTIFICATION NUMBER: 923

Laboratory Certification Officer
Compliance and Enforcement Unit
Drinking Water Compliance Program
Water Resources Branch, EPD

Program Manager,
Drinking Water Compliance Program
Water Resources Branch, EPD

January 25, 2000

ENVIRONMENTAL SCIENCE CORP.- MT. JULIET, TENNESSEE
CERTIFICATION NUMBER - 904

METALS: Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Ni, Hg, Se, Tl

NITRATE/NITRITE/FLUORIDE: Nitrate as N, Nitrite as N, Fluoride

INSECTICIDES: Alachlor, Atrazine, Chlordane, Endrin, Heptachlor, Hexachlorobenzene, Hexachlorocyclopentadiene, Lindane, Methoxychlor, Simazine, Toxaphene,

HERBICIDES: 2,4-D; 2,4,5-TP(Silvex); Dalapon; Dinoseb; Pentachlorophenol; Picloram

POLYCHLORINATED BIPHENYLS (PCB's): Decachlorobiphenyl

TRIHALOMETHANES: Total THM's

VOLATILE ORGANICS: Benzene; Bromoform; Bromobenzene; Bromochloromethane; Bromodichloromethane; Bromomethane; N-Butylbenzene; Sec-Butylbenzene; Tert-Butylbenzene; Carbon Tetrachloride; Chlorobenzene; Chlorodibromomethane; Chloroethane, Chloroform; Chloromethane; Chlorotoluene; 2- Chlorotoluene; 1,2-Dibromo-3-chloropropane; Dibromomethane; 1,3-Dichlorobenzene; 1,4-Dichlorobenzene; Dichlorodifuoromethane; 1,2-Dichloroethane; 1,1-Dichloroethylene; Trans 1,2-Dichloroethylene; Dichloromethane; 1,2-Dichloropropane; 1,3-Dichloropropane; 2,2-Dichloropropane; 1,1-Dichloropropene; Cis 1,3-Dichloropropane; Trans-1,3-Dichloropropene; Ethylbenzene; Ethylenedibromide (EDB); Fluorotrichloromethane; Hexachlorobutadiene; Isapropylbenzene; 4-Isopropyltoluene; N-Propylbenzene; Styrene; Tetrachloroethylene; 1,1,1,2-Tetrachloroethene; Toluene; 1,2,3-Trichlorobenzene 1,2,4-Trichlorobenzene; 1,1,1-Trichloroethane; 1,1,2-Trichloroethane; Trichloroethylene; 1,2,3-Trichloropropane; 1,2,4-Trimethylbenzene; 1,3,5-Trimethylbenzene; Total Xylenes; Vinyl chloride

MISCELLANEOUS ANALYTES: Alkalinity, Calcium, Corrosivity, Cyanide, pH, Sodium, Total Filterable Residue

State of Idaho
DEPARTMENT OF HEALTH AND WELFARE
Division of Health

BUREAU OF LABORATORIES

2220 Old Penitentiary Rd
Boise, Idaho 83712
(208) 334-2235

PHILIP E. BATT
Governor
LINDA L. CABALLERO
Director
RICHARD H. SCHULTZ
Administrator

DRINKING WATER LABORATORY CERTIFICATION

Environmental Science Corp.
12065 Lebanon Road
Mt. Juliet, TN 37122-2508

Issued: October 16, 1998
Expiration: October 31, 1999
(or until list revised)

List of Analytes	Status[1]	Methods
Inorganic Chemicals		
Antimony	C	200.9
Arsenic	C	200.9
Barium	C	200.9
Beryllium	C	200.7
Cadmium	C	200.7
Chromium	C	200.7
Copper	C	200.7
Lead	C	200.9
Mercury	C	245.1
Nickel	C	200.7
Selenium	C	200.9
Sodium	C	200.7
Thallium	C	200.9
Cyanide	C	335.3
Fluoride	C	340.2
Nitrate	C	353.2
Nitrite	C	353.2
Volatile Organic Chemicals		
Dibromochloropropane	C	504.1
Ethylene Dibromide	C	504.1
Total Trihalomethanes	C	502.2
VOCs	C	502.2
Vinyl Chloride	C	502.2
Synthetic Organic Chemicals		
Pesticides		
Alachlor	C	507
Atrazine	C	507
Chlordane	C	508
Endrin	P	508
Lindane	P	508
Heptachlor	P	508
Heptachlor Epoxide	P	508
Hexachlorobenzene	C	508
Hexachlorocyclopentadiene	C	508
Methoxychlor	C	508
Simazine	C	507
Toxaphene	C	508
Herbicides		
2,4-D	C	515.1
2,4,5-TP	C	515.1
Dalapon	C	515.1
Dinoseb	C	515.1
Pentachlorophenol	C	515.1
Pichloram	C	515.1
Carbamates		
Carbofuran	*	531.1
Oxamyl	*	531.1
Miscellaneous		
Adipates	*	525.2
Phthalates	*	525.2
Polynuclear Aromatic Hyd.	*	525.2, 550.1
Polychlorinated Biphenyls	*	508A
Diquat	*	549.1
Endothall	*	548.1
Glyphosate	*	547

1) c=certified n=not certified p=provisionally certified *=certification not requested

Frank L. O'Bannon
Governor

Richard D. Feldman, M.D.
State Health Commissioner

Indiana State Department of Health

An Equal Opportunity Employer

CERTIFIED MAIL NO. Z 349840210
RETURN RECEIPT REQUESTED

October 7, 1998

Judith R. Morgan
Environmental Science Corp.
12065 Lebanon Road
Mt. Juliet, Tennessee 37122-2508

Dear Ms. Morgan:

The Laboratory Improvement Section, Environmental Laboratory Division, Laboratory Resource Center, Indiana State Department of Health, has reviewed your request to become a certified laboratory for chemical analyses of drinking water in the state of Indiana, pursuant to the requirements under the Safe Drinking Water Act (SDWA) 42 U.S.C. 300f et seq., the National Primary Drinking Water Regulations (NPDWR) 40 CFR 141 and 142, and the Indiana Primary Drinking Water Regulations (IPDWR) 327 IAC 8-2. Your submittal package contained certification information for the state of Tennessee and copies of performance evaluation (PE) reports for the most current USEPA Water Supply (WS) studies from NERL-Ci.

Based on Indiana's policy of approving laboratories that are certified for drinking water analyses by states whose programs are approved by USEPA, and based on the results of the WS studies provided, the ISDH issues the following determination, pursuant to IC 4-21.5-3-5:

- The laboratory is hereby granted full certification for: *antimony, arsenic, barium, beryllium, cadmium, chromium, cyanide, fluoride, mercury, nickel, selenium, thallium, copper, lead, nitrate, nitrite, the regulated volatile organic compounds, vinyl chloride, total trihalomethanes, 2,4-D, 2,4,5-TP, alachlor, atrazine, chlordane, dalapon, dinoseb, endrin, heptachlor, heptachlor epoxide, hexachlorobenzene, hexachlorocyclopentadiene, lindane, methoxychlor, PCB (as decachlorobiphenyl), pentachlorophenol, picloram, simazine and toxaphene* (as indicated on the Tennessee certification letter or certificate).

- The laboratory has been assigned laboratory number C-TN-01 This number is to be used on all reports used for compliance monitoring of public water supplies to the Indiana Department of Environmental Management.

The expiration of Indiana certification will be the date that the laboratory's Tennessee certification expires (September 19, 2001). The status of Indiana certification will be reviewed, and if necessary downgraded, by Indiana, when: (1) an on-site evaluation by Tennessee is completed

and the report is submitted by Tennessee to the certification officer, or (2) the laboratory does not successfully analyze two (2) WS PE samples in one year.

In addition, the laboratory is required to provide the certification officer with the following documents, as they become available: (1) any change in certification status or expiration date of the Tennessee certificate, and (2) reports of USEPA WS PE sample analysis.

If you wish to seek review or stay of the effectiveness of this determination, pursuant to IC 4-21.5-3-7, you are required to submit, in writing, a petition, on or before October 26, 1998, to:

Office of the Secretary
Indiana State Department of Health
2 North Meridian Street
Indianapolis, IN 46204

The petition for review or stay must include facts demonstrating that:

- The petitioner is a person to whom the determination is specifically directed;
- The petitioner is aggrieved or adversely affected by the agency determination; or,
- The petitioner is entitled to review under any law.

Questions concerning the certification status granted by this letter should be directed to Philip Zillinger, Chemistry Laboratory Certification Officer, Laboratory Improvement Section, 317/233-8071

Dated at Indianapolis, Indiana, this 7th day of October, 1998.

Sincerely,

Arthur L. Logsdon
Assistant Commissioner
Consumer Regulatory Services Commission

A copy of this letter was sent on the above date, postage prepaid first class mail, to:

Stacy Jones
Indiana Department of Environmental Management
Drinking Water Branch
P.O. Box 7148
Indianapolis, IN 46207-7148

STATE OF KANSAS

DEPARTMENT OF HEALTH AND ENVIRONMENT

CERTIFICATE

This is to certify that Certificate No. ***E-10277***

for: ***ENVIRONMENTAL SCIENCE CORPORATION***
12065 LEBANON ROAD
MT JULIET, TN 37122-0938

has been approved in accordance with K.S.A. 65-1,109a for performing solids or hazardous waste analyses for the parameters listed on the attached form.

EFFECTIVE DATE: ***03/27/2000***

EXPIRATION DATE: ***04/30/2001***

Secretary
Department of Health and Environment

Aurora Shields
Jack R. McKenzie

Environmental Laboratory Certification Officers

STATE OF KANSAS

DEPARTMENT OF HEALTH AND ENVIRONMENT

CERTIFICATE

This is to certify that Certificate No. ***E-10277***

for:

ENVIRONMENTAL SCIENCE CORPORATION
12065 LEBANON ROAD
MT JULIET, TN 37122-0938

has been approved in accordance with K.S.A. 65-1,109a for performing wastewater analyses for the parameters listed on the attached form.

EFFECTIVE DATE: ***03/27/2000***

EXPIRATION DATE: ***04/30/2001***

Secretary
Department of Health and Environment

Environmental Laboratory Certification Officers

Commonwealth of Kentucky

Department for Environmental Protection

Division of Environmental Services

Certificate of Laboratory Certification

for the Chemical Analysis of Drinking Water

in accordance with 401 KAR Chapter 8, issued to:

Environmental Sciences Corp.
P.O. Box 938, 12065 Lebanon Road
Mt. Juliet, Tennessee 37122

for the analytes listed on the most current certified parameter list.

Gleason L. Wheatley

Scott Bryan

Certification Officers

Laboratory ID # 90010

Expires December 31, 1999

RONALD B. MCCLOUD
SECRETARY

PAUL E. PATTON
GOVERNOR

CABINET FOR PUBLIC PROTECTION AND REGULATION
OFFICE OF THE PETROLEUM STORAGE TANK ENVIRONMENTAL ASSURANCE FUND

September 30, 1999

Ms. Judith R. Morgan
Environmental Science Corporation
12065 Lebanon Road
Mt. Juliet, TN 37122-2065

RE: Certification of Laboratory - No. 0016

Dear Ms. Morgan:

Your company's application for laboratory certification was received by this office on September 30, 1999. The necessary documentation from the American Association for Laboratory Accreditation (A2LA) confirming that your company's laboratory meets the A2LA-Kentucky Underground Storage Tank Laboratory Accreditation Program requirements was provided to this office on September 30, 1999.

Based on the documentation provided, ENVIRONMENTAL SCIENCE CORP. is hereby granted certification to perform analytical testing related to Kentucky's Underground Storage Tank Program. U.S. EPA test methods approved under this certification include SW846 6010B, 6020, 7471A, 8015B, 8021B, 8260B, 8270C and 9070. The granting of this certification is authorized under KRS 224.60-130(2)(a) and 415 KAR 1:140.

You are advised that your company's certification can be revoked or suspended for those reasons specified in 415 KAR 1:140, Section 4(1). You are further advised that a company certification must be renewed every two (2) years in accordance with 415 KAR 1:140, Section 3, which in your company's case, will be September 30, 2001. It is suggested that a renewal application be submitted to this office at least 60 days prior to the expiration date.

EDUCATION PAYS

911 LEAWOOD DRIVE
FRANKFORT, KY 40601
(502) 564-5981 FAX (502) 564-5047

Your interest in the Fund is appreciated, and we congratulate your company in achieving certification. If you have any questions or if we can be of further assistance, please let us know.

Sincerely,

Robert E. Nickel
Executive Director

cc: David Waldner
Tim Barrett
David Wicker
Mike Blanton
Lori Terry, USTB
Teresa C. Adams, A2LA

Attachments (2)

The Commonwealth of Massachusetts

Department of Environmental Protection

Division of Environmental Analysis
Senator William X. Wall Experiment Station

certifies

M-TN003

ENVIRONMENTAL SCIENCE CORPORATION
12065 LEBANON RD
MOUNT JULIET, TN 37122-0000

Laboratory Director: PAULETTE GLAZENER LANKGURD

for the analysis of POTABLE WATER (CHEMISTRY)
NON POTABLE WATER (CHEMISTRY)

pursuant to 310 CMR 42.00

This certificate supersedes all previous Massachusetts certificates issued to this laboratory. The laboratory is regulated by and shall be responsible for being in compliance with Massachusetts regulations at 310 CMR 42.00.

This certificate is valid only when accompanied by the latest dated Certified Parameter List as issued by the Massachusetts D.E.P. Contact the Division of Environmental Analysis to verify the current certification status of the laboratory.

Certification is no guarantee of the validity of the data. This certification is subject to unannounced laboratory inspections.

Issued: 02 AUG 2000

Expires: 30 JUN 2001

Oscar C. Jacobs

Director, Division of Environmental Analysis

MISSISSIPPI
STATE DEPARTMENT OF
HEALTH

2423 North State Street
Post Office Box 1700
Jackson, Mississippi
39215-1700

601/960-7400
601/960-7948 FAX

F.E. Thompson, Jr., MD, MPH
State Health Officer

September 30, 1998

Mrs. Judy Morgan
Environmental Science Corp.
12065 Lebanon Road
Mt. Juliet, TN 37112

Dear Mrs. Morgan:

This is to acknowledge receipt of your laboratory's certificate of certification renewal.

Mississippi's policy of reciprocal certification renewal is based on renewals of certification extended by the state in which the laboratory is located. Mississippi recognizes the annual certification renewal issued by the state of Tennessee to Environmental Science Corporation Laboratory.

Sincerely,

Sammie Malone

Sammie P. Malone
Senior Chemical Certification Officer

SM:fl

STATE OF NEVADA
HEALTH DIVISION
BUREAU OF LICENSURE AND CERTIFICATION

ENVIRONMENTAL LABORATORY SERVICES

LABORATORY CERTIFICATION PROGRAM

The environmental laboratory listed on this Certificate has met the quality requirements as specified by the Nevada Administrative Code 445A and is hereby certified to conduct the analyses of water for the contaminants listed on their accepted parameter list(s) effective dates:

July 1, 2000 through June 30, 2001.

ENVIRONMENTAL SCIENCE CORP
12065 LEBANON ROAD
MT. JULIET, TN 37122

CERTIFICATE No. TN-03-2000-44

Jack Ruckman 8/18/00

Jack Ruckman, Ph.D. — Date
Laboratory Certification Officer

Don LaFara 8-17-00

Mr. Donald E. LaFara Jr. — Date
Laboratory Certification Officer

STATE OF NORTH CAROLINA DEPARTMENT OF THE
ENVIRONMENT AND NATURAL RESOURCES

DIVISION OF WATER QUALITY
LABORATORY CERTIFICATION PROGRAM

In accordance with the provisions of N.C.G.S. 143-215.3 (a) (1), 143-215.3 (a)(10) and NCAC 2H.0800:

ENVIRONMENTAL SCIENCE CORPORATION

Is hereby certified to perform environmental analysis as listed on Attachment I and report monitoring data to DWQ for compliance with NPDES effluent, surface water, groundwater, and pretreatment regulations.

By reference 15A NCAC 2H .0800 is made a part of this certificate.

This certificate does not guarantee validity of data generated, but indicates the methodology, equipment, quality control procedures, records, and proficiency of the laboratory have been examined and found to be acceptable.

This certificate shall be valid until December 31, 2000

Certificate No. 375

James W Meyer
for Bernard E. Sims, PhD

NORTH DAKOTA STATE DEPARTMENT OF HEALTH
AND CONSOLIDATED LABORATORIES

RECIPROCAL CERTIFICATION

Environmental Science Corp. - Mt. Juliet, Tennessee
meets acceptable standards for the performance of the following procedures:

All drinking water parameters for which they retain certification from the State of Tennessee Department of Health

Director, Division of Chemistry

Certification Officer

This certificate remains the property of the North Dakota State Department of Health and Consolidated Laboratories, and may be removed for cause, at any time by the department.

Certificate Number: R-140

Expiration Date: September 19, 2001

Date of Issue: September 29, 1998

State of Rhode Island and Providence Plantations

DEPARTMENT OF HEALTH

Audit № 411

License No. 221

This is to certify that ENVIRONMENTAL SCIENCE CORPORATION
12065 LEBANON ROAD
MT. JULIET, TN 37122
is licensed to operate a

Analytical Laboratory

Environmental Science Corporation

in conformity with Chapter 39 of Title 23 of the General Laws of Rhode Island, as amended.

It has demonstrated its proficiency in the performance of the following One categories of laboratory tests:

Chemical

Inorganic Chemistry		Organic Chemistry
Surface Water	Soil	Surface Water
Wastewater/Sewage	Paint	Wastewater/Sewage
Potable Water	Wipes	Potable Water

Patricia A. Nolan, MD, MPH
Director of Health

Expires, ~~XXXXXXXX~~ See Current Licensure Letter

ISSUED 1 March 2000

South Carolina Department of Health and Environmental Control

Environmental Laboratory Certification Program

In accordance with the provisions of Regulation 61-81, entitled "State Environmental Laboratory Certification Regulation,"

ENVIRONMENTAL SCIENCE CORP. (84004)
P. O. BOX 938
MT. JULIET, TN 37122

is hereby certified to perform analyses as documented on the attached parameter list(s). This certification does not guarantee validity of data generated, but indicates the laboratory's adherence to prescribed methodology, quality control, records keeping, and reporting procedures. This certificate is the property of S.C. DHEC and must be surrendered upon demand. This certificate is non-transferable and is valid only for the parameters and methodology listed on the attached parameter lists(s).

Certifying Authority: NC
Date of Issue: 01/29/1998
Date of Expiration: 12/31/2000
Certificate Number: 84004001

R. Wayne Davis
Director
Office of Environmental Laboratory Certification

4A-1459 (8/96)

D H E C

PROMOTE PROTECT PROSPER

South Carolina Department of Health and Environmental Control

Environmental Laboratory Certification Program

In accordance with the provisions of Regulation 61 - 81, entitled "State Environmental Laboratory Certification Regulation,"

ENVIRONMENTAL SCIENCE CORP. (84004)
12065 LEBANON ROAD
MT. JULIET, TN 37122-2508

is hereby certified to perform analyses as documented on the attached parameter list(s). This certification does not guarantee validity of data generated, but indicates the laboratory's adherence to prescribed methodology, quality control, records keeping, and reporting procedures. This certificate is the property of S.C. DHEC and must be surrendered upon demand. This certificate is non-transferable and is valid only for the parameters and methodology listed on the attached parameter list(s).

Laboratory Director: PAULETTE G. LANKFORD
Certifying Authority: WV
Date of Issue: 08/08/2000
Date of Expiration: 02/28/2001
Certificate Number: 84004002

R. Wayne Davis

Director
Office of Environmental Laboratory Certification

CR-000509 8/99

State of Tennessee

Department of Health

Division of Laboratory Services

Certifies That

ENVIRONMENTAL SCIENCE CORPORATION

Having Met the Requirements of the Regulations for the Certification of Laboratories Analyzing Drinking Water is hereby Approved as a

State Certified Laboratory

To perform the Analyses as Indicated on the Certified Parameter List For the Public Water Systems of Tennessee

Laboratory ID Number 02006 Effective Through 9/19/2001

Laboratory Certification Officer
Laboratory Services

This certification is subject to performance on E.P.A. Performance Evaluation Samples, laboratory inspections and payment of annual fees.

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
Division of Underground Storage Tanks
4th Floor L&C Tower, 401 Church Street
Nashville, TN 37243-1541

October 1, 1998

Ms. Judith Morgan
Environmental Science & Corp.
12065 Lebanon Road
Mt. Juliet, TN. 37112-

RE: **UST LABORATORY APPROVAL**
Environmental Science & Corp.
Mt. Juliet, TN Laboratory

Dear Ms. Morgan:

The Tennessee Division of Underground Storage Tanks (the "Division") has received your updated Tennessee Laboratory Certification (September 25, 1998 letter). Your Mt. Juliet, TN laboratory will remain on our list of Tennessee UST Approved Laboratories for BTX and TPH analyses.

You must submit proper documentation of your laboratory's ability to perform BTX and TPH analyses at least thirty (30) days before your current approval expires. Failure to maintain laboratory approval will result in the REJECTION of sample analyses from your laboratory by the Division. Your laboratory's approval for BTX analysis expires on **October 1, 2001** and your laboratory's approval for TPH analysis expires on **October 1, 2001.**

If you have any questions or comments please call me at (615) 532-0945.

Sincerely,

Michael Langreck/sjp

Michael F. Langreck
EPS 7
TN Division of Underground Storage Tanks

MFL/sjp

CC: All UST Field Offices

State of Vermont

Department of Fish and Wildlife
Department of Forests, Parks and Recreation
Department of Environmental Conservation
State Geologist
RELAY SERVICE FOR THE HEARING IMPAIRED
1-800-253-0191 TDD>Voice
1-800-253-0195 Voice>TDD

AGENCY OF NATURAL RESOURCES
Department of Environmental Conservation
WATER SUPPLY DIVISION
The Old Pantry Building
103 South Main Street
Waterbury, VT 05671-0403
TELEPHONE (802) 241-3400
FACSIMILE (802) 241-3284

October 5, 1998

Ms. Judith R. Morgan, M.S.
Environmental Science Corporation
12065 Lebanon Road
Mt. Juliet, TN 37122-2605

Re: Acceptance of Analytical Results

Dear Ms. Morgan:

Thank you for sending me your current laboratory certification information.

Based on my review, we can accept results for the analytes marked with an (X) on the accompanying pages until September 19, 2001. On or before September 19, 2001, you will need to resubmit documentation showing your current certification status for these analytes.

This acceptance is conditional on the following:

a) You report to our office, within one week, any changes in your Certification for the State of Tennessee that would decertify your laboratory for any of the analytes identified in this letter, and

b) Should you choose to subcontract to other labs for additional services, the laboratory and analytes must be acceptable by our office, and all results must be submitted to our office on forms from the lab conducting the analysis.

Please review this listing and contact me at 802-241-3405 if you have any questions.

Sincerely,

Jean M. Nicolai

Jean M. Nicolai,
Chief, Compliance and Certification

cc: Jay Rutherford, P.E. Director

Vermont Approved Laboratory Chemical List and Test Methods Date 10/5/98

Laboratory Name ENVIRONMENTAL SCIENCE CORPORATION State TN

1. Microbiological (40 CFR 141.21)

___ Total Coliform Bacteria and Fecal Coliform
Method(s) Used: _____

2. Turbidity (40 CFR 141.73) ___

3. Inorganics - Primary (40 CFR 141.62 and Water Supply Rule)

		MCL (mg/l), unless otherwise noted
X	1. Fluoride	4.0
___	2. Asbestos*	7 million fibers/liter (longer than 10 um)
X	3. Barium	2
X	4. Cadmium	0.005
X	5. Chromium	0.1
X	6. Mercury	0.002
X	7. Nitrate	10.0
X	8. Nitrite	1.0
X	9. Total nitrate & nitrite	10.0
X	10. Selenium	0.05
X	11. Antimony	0.006
X	12. Beryllium	0.004
X	13. Cyanide	0.2
X	14. Nickel	0.1 (Vermont Health Advisory)
X	15. Thallium	0.002
X	16. Arsenic	0.05

Inorganic Contaminants- Unregulated

X Sulfate

Secondary Inorganics (40 CFR Part 143 and Water Supply Rule)

	MCL (mg/l), unless otherwise noted
___ Aluminum	0.05 to 0.2
___ Chloride	250
___ Color	15 color units
___ Corrosivity	Non-corrosive
X Fluoride	2.0
___ Foaming agents	0.5
___ Iron	0.3
___ Manganese	0.05
___ Odor	3 threshold odor number
X pH	6.5 - 8.5
___ Silver	0.1
X Sodium	250
___ Sulfate	250
___ TDS	500
___ Zinc	5.0

7. Synthetic Organic Contaminants [CFR 141.61 (c)]

SOC-A EPA Method 504

Regulated

___ Ethylene dibromide (EDB)[t]

SOC-B EPA Methods 531.1 or 6610

Regulated

___ Carbofuran
___ Oxamyl (Vydate)

Unregulated

___ 3-Hydroxycarbofuran
___ Aldicarb
___ Aldicarb Sulfoxide
___ Aldicarb Sulfone
___ Carbaryl
___ Methomyl

SOC-C EPA Methods 515.1 or 515.2 or 555

Regulated

_X_ 2,4,D
_X_ 2,4,5-TP (Silvex)
_X_ Dinoseb
_X_ Pentachlorophenol
_X_ Picloram

Unregulated

___ Dicamba

SOC-D EPA Methods 525.1 + 507 + 508, or 525.2

Regulated

_X_ Alachlor
_X_ Atrazine
___ Benzo(a)pyrene
_X_ Chlordane
___ Di(2-ethylhexyl)adipate
___ Di(2-ethylhexyl)phthalate
_X_ Endrin
_X_ Heptachlor
_X_ Heptachlor epoxide
_X_ Hexachlorobenzene
_X_ Hexachlorocyclopentadiene
_X_ Lindane
_X_ Methoxychlor
_X_ Polychlorinated biphenyls (PCBs)[screen]

Commonwealth of Virginia
Department of General Services
Division of Consolidated Laboratory Services

Certifies That

ENVIRONMENTAL SCIENCE CORPORATION

Having Duly Met the Requirements of the
Regulations for the Certification of Laboratories Analyzing Drinking Water
Is hereby Approved as a

Certified Drinking Water Laboratory

To Perform the Analyses as indicated on the Annual Certified Parameter List
Which must accompany this to be valid.

Laboratory ID Number 00109 Effective July 2000 Through June 2001

Virginia Laboratory Officer
Safe Drinking Water Program

This certification is subject to unannounced laboratory inspections.
Conspicuously display in the laboratory with the annual certified parameter list.

This laboratory has met the minimum requirements for certification to analyze drinking water.
THIS CERTIFICATION DOES NOT GUARANTEE ACCURATE RESULTS.

Certificate Not Transferable

Surrender upon Revocation

West Virginia Division of Environmental Protection
Office of Water Resources

ENVIRONMENTAL SCIENCE CORPORATION

Is hereby certified to perform wastewater analyses (as listed on Attachment I) for the purpose of determining compliance with the requirements of the State's natural resources and environmental programs or when required by an order issued by the Division.

This certificate does not guarantee validity of data generated, but indicates the methodology, equipment, quality control procedures, records, and proficiency of the laboratory have been examined and found to be acceptable.

233
Certificate Number

11-30-95
Date Issued

Don E Caldwell
Quality Assurance Officer

Barbara E Taylor
Chief

This certificate is the property of the Division of Environmental Protection

The American Industrial Hygiene Association

is proud to acknowledge that

Environmental Science Corporation

Mt. Juliet, TN

has fulfilled the requirements for and has been formally recognized by AIHA and is technically competent to perform the analyses listed in the following

SCOPE OF ACCREDITATION

INDUSTRIAL HYGIENE
Originally Accredited: 08/18/95

- _X_ Metals
- ___ Asbestos PCM
- _X_ Organic Solvents
- ___ Silica
- ___ Asbestos PLM
- _X_ Diffusive Samples

ENVIRONMENTAL LEAD
Originally Accredited: 10/30/95

- _X_ Paint Chips
- _X_ Dust Wipes
- ___ Air
- _X_ Soil

ENVIRONMENTAL MICROBIOLOGY

- ___ Bacteria
- ___ Fungi

The above named laboratory agrees to perform all analyses listed above in the scope of accreditation according to applicable policy requirements and acknowledges that continued accreditation is dependent on successful participation in the appropriate proficiency testing programs. This laboratory may be contacted to verify the current scope of accreditation, proficiency testing performance and accreditation status. Accreditation by AIHA is not a guarantee of the validity of the data generated by the laboratory.

Laboratory # 9227
Certificate # 535

Accreditation Expires: 10/01/01

Christine A. Kearney
Christine A. Kearney
Chair, Analytical Accreditation Board

James C. Rock
James C. Rock, Ph.D., PE, CIH
President, AIHA

LITHO IN U.S.A.

CONTRACTOR QUALITY CONTROL PLAN
for the
WATER DISTRIBUTION SYSTEM AND DISTRIBUTION POINTS FORMER FIRE TRAINING AREA AT MARSHALL ARMY AIRFIELD FT. RILEY, KS
JULY 2002

DACW41-95-D-0022
DELIVERY ORDER 0012

Prepared for

U.S. ARMY ENGINEERING DISTRICT,
KANSAS CITY
ATTN: RICK VAN SAUN
601 E. 12th St.
Kansas City, MO 64106-2896

Prepared by

BAY WEST, INC.
10620 Widmer
Lenexa, KS 66215

Philip Dula
Project Manager
QA/QC Manager

July 2002

BW970236

Table of Contents

1.0 GENERAL

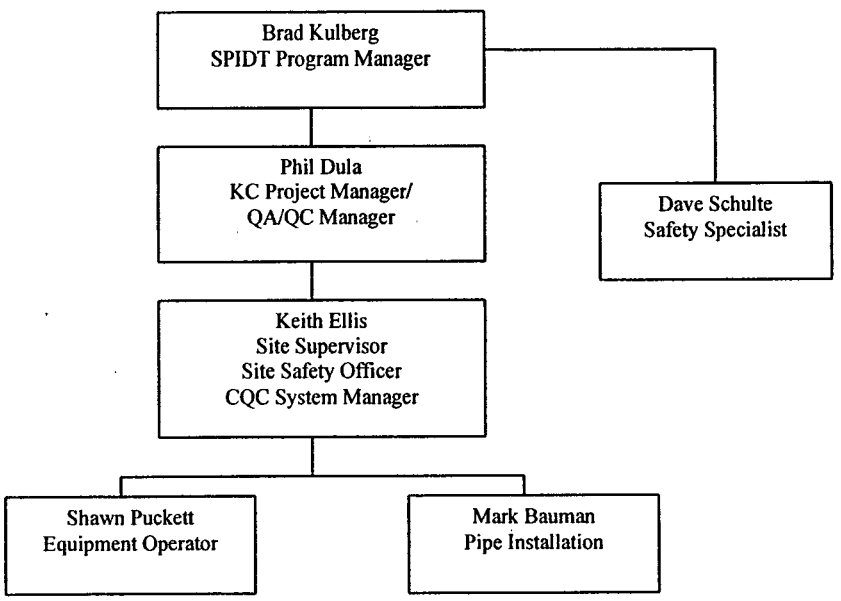
Bay West, Inc. (Bay West) has prepared this Contractor Quality Control Plan (CQCP) in accordance with Section 01330 of the redesign submittal for this project. The objective of this CQCP is to establish the project quality control systems to ensure that all activities conform to the project specifications.

Bay West is responsible for quality control of all activities related to the performance of the Contract. Bay West will implement an effective system of quality control. The system will cover both onsite and offsite construction operations. This system consists of the CQCP, Operational Procedures, Training, and a defined Quality Control Organization. The CQCP will define the procedures and organization required for the project. As deficiencies are identified in the plan, modifications will be made.

2.0 QUALITY CONTROL ORGANIZATION/RESPONSIBILITIES AND AUTHORITIES OF QC PERSONNEL

Bay West is committed to providing quality services for this project. The project Contractor Quality Control (CQC) includes using a three-phase control system for all aspects of the work, procedures for scheduling, reviewing, certifying, and managing submittals, control, verification, and acceptance testing procedures, reporting procedures, a list of the definable features of the work, and procedures for tracking construction deficiencies from identification through acceptable corrective action.

It is Bay West's policy to allocate personnel with appropriate training and authority to develop, refine, and implement our quality systems. A CQC System Manager and sufficient number of additional qualified personnel have been assigned to the project to ensure contract compliance (CQC organization). The CQC organization will be at the site at all times during progress of the work and will have complete authority to take any action necessary to ensure compliance with the contract. The project CQC Organization chart is presented in the following.



2.1 Responsibilities and Authorities of the Project CQC Organization

Name	Project Responsibility	CQC System Responsibility
Phil Dula	Project Manager	QA/QC Manager
Keith Ellis	Site Safety Supervisor	CQC Manager System Manager
Shawn Puckett	Equipment Operator	

Quality Assurance/Quality Control (QA/QC) Manager. Phil Dula, the QA/QC Manager is responsible for development, oversight, and management of the QA/QC program for this project. As the Project Manager and the QA/QC Manager he will ensure corporate and project QA/QC compliance.

Project Manager. Phil Dula, the Project Manager has developed the project work plans and will communicate regularly with the on-site staff. The Project Manager coordinates closely with engineering and support staff resources to plan and execute construction activities in accordance with required CQC requirements.

Alternate CQC System Manager. Keith Ellis the Site Supervisor will serve as the CQC System Manager (CQCSM). The CQC System Manager will be responsible for overall management of CQC, have the authority to act in all CQC matters, and be held responsible for the quality of work on the project. This CQC System Manager will be on the site at all times during construction. The CQC System Manager will direct all onsite activities, implement the site-specific CQCP, stop work if does not comply with specified quality or is unsafe, and enforce/resolve stop work orders.

When Keith Ellis is away from the site for a short period, Shawn Puckett will be assigned Mr. Ellis's CQC duties.

The Bay West will maintain the CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff, the Bay West will revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer's Representative (COR) for acceptance.

3.0 SUBMITTALS

Bay West will comply with submittal procedures. These include procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, suppliers, and purchasing agents. The Bay West is responsible to review the specifications, contract drawings, and provide timely submittals. One of the following Bay West employees will be responsible for reviewing submittals prior to submission:

Brad Kulberg
Phil Dula

Because of the time critical nature of this project submittals will be made 7 days in advance of commencing work to allow the Government time to review and comment. This is an accelerated schedule. Bay West had prepared and submitted project plans in less than one week from reciept of Notice to Proceed (NTP).All phases of Quality Control will require completions of submittals. The submittal register will be updated and reviewed to assure that all the required documentation has been completed. The CQC organization shall be responsible for certifying that all submittals are in compliance with the Contract requirements.

Prior to submittal, all items shall be checked and approved by the CQC System Manager and each item of the submittal shall be stamped, signed, and dated. Each respective transmittal form (ENG Form 4025) shall be signed and dated certifying that the accompanying submittal complies with the Contract requirements. Bay West will maintain a complete and up-to-date file of all submittals/items onsite for use by both the Contractor and the Government.

3.1 Submittal Control

All Submittals will be addressed and delivered to the following address:

Mr. Rick Van Saun
U.S. Army Corps of Engineers
Kansas City District
601 E 12th Street
Kansas City, MO 64106-2896

Submittals for Government Approval (GA) will consist of nine (9) copies; submittals For Information Only (FIO) will consist of five (5) copies.

3.1.1 Submittal Register (Eng Form 4288)

Bay West will approve all items listed on the submittal register. The ENG Form 4288 will be used. A submittal register will be created by annotating Form 4288. The register will become the scheduling document and will be updated to control submittals throughout the life of the contract. The submittal register will be updated and submitted monthly with pay estimates.

3.1.2 Disapproved Submittals

Bay West will make all corrections required by the COR and promptly furnish a corrected submittal in the format and number of copies specified for the initial submittal. If Bay West considers any correction indicated on the submittals to constitute a change to the contract, written notice, as required under the Contract Clause entitled "Changes," shall be given to the COR.

3.1.3 Transmittal Form (Eng Form 4025)

Transmittal Form 4025 will be used for submitting both Government Approved (GA) and For Information Only (FIO) submittals. Transmittal numbers will be assigned sequentially. These forms shall be filled in completely prior to submittal.

4.0 CONTROL, VERIFICATION, AND ACCEPTANCE TESTING PROCEDURES

This Section includes the control, verification, and acceptance testing procedures for each specific test to be performed including the test name, test frequency, and person responsible for each test.

4.1 Required Tests

Well Filter Pack Conformity with Well Screen Specifications
Specification Section Redesign Submittal: – 02521, Section 1.3.3.3
Responsible Party – Layne Western
Material Testing Lab – Layne Western
Testing Frequency – One test per well (2)
Method – ASTM D422
Quality Criteria – Filter pack material selected for the well screen interval shall conform to the specifications for the selected screen slot size. Based on well information in the site area it is anticipated that the screen slot size will be 0.010 inch of continious wrap design. The selected filter pack is anticipated to be a well rounded, siliceous sand, free of clay that will not pass thorough the well screen slot size > 0.010 inch.

Chemical Analysis of Water Samples
Specification Section – Sampling Analysis Plan and Section 02521of the Redesign Submittal
Responsible Party – Bay West
Material Testing Lab – Environmental Service Corporation
Testing Frequency – One sample per well, distribution points for potable water (spigots) development water tanks, decontamination water tanks and QA/QC samples at the 10% frequency.
Methods: EPA-SW 8260 for volatile organics and EPA 6010 for lead.
Quality Criteria –Chemical analysis will be completed in accordance with all Federal, KDHE, and USACE regulations.

Compaction Testing for Backfilled Pipe Trenches
Specification Section – Redesign Submittal 02316
Responsible Party – Bay West
Surface Smoothness Testing – Kaw Valley Engineering
Testing Frequency – 1 test per every 500 feet
2 additional test at Racetrack crossing
1 moisture density every 1500 cy
Method – ASTM 1557 ASTM D 2922
Quality Criteria – 90% laboratory maximum for cohesive or 95% laboratory maximum for cohesionless material.

Concrete Slab Foundation for Shed and Truck Fill Station
Specification Section – 02754
Responsible Party – Bay West
Surface Smoothness Testing – Bay West
Grade Control – Bay West
Material Testing Lab – Kaw Valley Engineering
Testing Frequency – Four cylinders from the same batch shall be fabricated, cured and tested for compressive strength. One cylinder at 7-days, two cylinders at 28 days, and the last cylinder at 56 days if either of the 28-day cylinders are below specification.
Method – ASTM C 31, ASTM C 33, ASTM C 39, ASTM C 231, ASTM C 143
Quality Criteria –. Compressive strength of 4,000 psi at 28 days.

Well Disinfection and Anaylsis
Specification Section – Redesign Submittal 02510
Responsible Party – Bay West/Layne Western
Testing Lab – Environmental Science Corp
Method – EPA-SW 9132 Total Coliform
Quality Criteria – Before acceptance of potable water operation the distribution system and wells will be disinfected per AWWA C651. 3 water samples will be collected from each system (Racetrack Replacement Wells and M-1 Replacement Well). System will not be approved per use until KDHE requirements are met and acceptable bacteriological results are obtained.

HDPE Piping Test
Specification Section – Redesign Submittal 15400 and 02510, and Technical Bulletin 802 Appendix 9 of the CQCP.
Responsible Party – Bay West/Don's Mechanical
Testing Frequency – 3 hour test
Method – Technical Bulletin 82 Chevron Phillips Chemical Company
Quality Criteria – The installed piping and system connections will be free of leakage as demonstrated by a 2 hour test hydrostatic as 200 PSI. Piping installation will not be certified as leak free if the following equation:
L=0.0001351ND (P raised to 0.5 power)

L= Allowable leakage in gallons per hour
N= Number of joints in the length of pipeline tested
D= Nominal diameter of the pipe in inches
P= Average test pressure during the leakage test, in psi gauage

Should any test of pipe disclose leakage greater than that calculated by the above formula, the defective joints shall be located and repaired until the leakage is within the specified allowance, without additional cost to the Government.

Water Well Pump Tests
Specification Section – Redesign Submittal 02521
Responsible Party – Layne Western
Pump Tests – Layne Western
Testing Frequency – 1 per well (2)
Method – Step Draw Down Pump Test
Quality Criteria – The Racetrack Replacement Well is specified to supply 116 GPM. The M-1 Replacement Well is specified to supply 12 GPM.

5.0 QUALITY CONTROL METHODS

Contractor Quality Control is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract for each definable feature of the work. Bay West has identified the following definable features of work under this contract:

- ✓ Well Installations
- ✓ Well Abandonments
- ✓ Installation of Water Distribution Systems

The CQC System Manager will perform three phases of control for each definable feature of work. The three phases of control include preparatory, initial, and follow-up. Preparatory phase control will be used to establish quality prior to mobilization and commencement of site activities and delivery of materials. Initial phase control will verify that all necessary procedures have been instituted to ensure conformance with the project plans. Follow-up phase control will include daily checks and documentation of Contract requirements to ensure that quality work will be produced throughout the duration of the project.

The CQC System Manager is responsible for the preparatory, initial and final inspections. The CQC System Manager will conduct the preparatory inspection meeting. The appropriate foreman, field staff, and subcontractors will attend the meeting. The Government will be notified at least 48 hours in advance of the preparatory and initial phase meetings. The notification will include the meeting time and designated location. Results of the preparatory phase and initial phase inspections will be documented by the CQC System Manager and attached to the daily CQC report.

The procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation are discussed below:

5.1 Preparatory Phase

This phase will include the preparation of all preliminary documents relating to the definable features of the work. These documents include the Work Plan, Site Safety and Health Plan, Sampling and Analysis Plan, and Contractor Quality Control Plan. Work cannot begin on a definable feature of work until the preparatory phase inspection is completed. The Preparatory Inspection Checklist included in Appendix 2 will be completed. The following activities will also be performed during the preparatory phase:

- ✓ Review of Contract Specifications
- ✓ Review of Regulations
- ✓ Obtain approval for all pre-work submittals
- ✓ A check to ensure that all materials and/or equipment have been tested, submitted, and approved.
- ✓ Perform a physical check of materials and equipment on site and compare against the project requirements.
- ✓ Examination of the work area to assure that all preliminary work has been completed and is in compliance with the Contract.
- ✓ A review of the appropriate activity hazard analysis to assure safety requirements are met.

5.2 Initial Phase

This phase shall be accomplished at the beginning of a definable feature of work. The following shall be accomplished:

- ✓ A check of work to ensure that it is in full compliance with Contract requirements, including the review of the preparatory meeting minutes.
- ✓ Verify the adequacy of controls to ensure full Contract compliance. Verify the required control inspection and testing.
- ✓ Establish level of workmanship and verify that it meets minimum acceptable workmanship standards.
- ✓ Resolve all differences.
- ✓ Check safety activities to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker and document on the daily report.
- ✓ The Government shall be notified at least 24 hours in advance of beginning the initial phase. Separate minutes of this phase shall be prepared by the CQC System Manager and attached to the daily report.
- ✓ The initial phase will be repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met. All orientation will be documented on the daily report.

The Initial Inspection Checklist is included in Appendix 3.

5.3 Additional Preparatory and Initial Phases

Additional preparatory and initial work phases will be conducted on the same definable features of work if the quality of on-going work is unacceptable, if there are changes in the applicable

CQC staff, onsite production supervision or work crew, if work on a definable feature is resumed after a substantial period of inactivity, or if other problems develop.

5.4 Follow-up Phase

Daily checks shall be performed to assure control activities providing continued compliance with contract requirements, until completion of the particular feature of work. The checks shall be made a matter of record in the CQC documentation. Final follow-up checks shall be conducted and all deficiencies corrected prior to the start of additional features of work that may be affected by the deficient work.

5.5 Documentation

Bay West will maintain current records providing factual evidence that the required quality control activities and/or tests have been performed. These records shall include the work of subcontractors and suppliers and will be recorded on the Report of Operations forms(see Appendix 4). The Report of Operations form includes, as a minimum, the following information:

a. Contractor/subcontractor and their area of responsibility
b. Operating equipment with hours worked, idle, or down for repair.
c. Work performed each day, giving location, description, and by whom.
d. Test and/or control activities performed with results and references to specifications/drawings requirements. The control phase will be identified (Preparatory, Initial, Follow-up). Deficiencies will be noted along with corrective action. Deficiencies and correction of deficiencies are also tracked on the Contractor Deficiency Log (see Appendix 6).
e. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.
f. Submittals reviewed, with contract reference, by whom, and action taken.
g. Off-site surveillance activities, including actions taken.
h. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
i. Instructions given/received and conflicts in plans and/or specifications.
j. Verification statement.

These records will indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in the work and workmanship comply with the Contract. The original and one copy of these records in report form shall be furnished to the COR daily within 24 hours (1 working day) after the date covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, one report shall be prepared and submitted for every 7 days of no work and on the last day of a no-work period. All calendar days shall be accounted for throughout the life of the contract. The first report following a day of no work shall be for that day only. Reports shall be signed and dated by the CQC System Manager. The report from the CQC System Manager shall include copies of test reports and copies of reports prepared by all subordinate quality control personnel.

6.0 COMPLETION INSPECTIONS

This section describes the procedures for tracking construction deficiencies from identification through acceptable corrective action, and the verification procedures that establish the identified deficiencies have been corrected.

6.1 Punch-Out Inspection

Near the completion of all work or any increment thereof established by a completion time or stated elsewhere in the specifications, the CQC System Manager will conduct an inspection of the work. The CQC System Manager will develop a punch list of items that do not conform to the approved drawings and specifications. The punch list of deficiencies will be included in the CQC documentation, and will include the estimated date by which the deficiencies will be corrected.

The CQC System Manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected. Once this is accomplished, Bay West will notify the Government that the facility is ready for the Government Pre-Final inspection.

6.2 Pre-Final Inspection

Bay West's CQC System Manager, plus other primary management persons, and the Contracting Officer's Representative, and other required Government personnel will attend the pre-final inspection. The Government will perform this inspection to verify that work is complete. A final acceptance inspection punch list will be developed as a result of this inspection. Bay West will correct all items on the punch list or have them scheduled for completion well in advance of notifying the Contracting Officer that Bay West is ready for the final acceptance inspection.

6.3 Final Acceptance Inspection

Bay West will advise the Contracting Officer at least 14 days in advance of the date they will be ready for the final acceptance inspection. Bay West will provide documentation to assure the COR that they have corrected all items on the final acceptance inspection punch list, and all remaining work will be completed and acceptable by the final acceptance inspection date.

6.4 Notification of Noncompliance

The COR will notify Bay West of any detected noncompliance with the foregoing requirements. Bay West will take immediate corrective action after receipt of such notice. Such notice, when delivered to Bay West at the work site, shall be deemed sufficient for the purpose of notification. If Bay West fails or refuses to comply promptly, the COR may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by Bay West.

6.5 Quality Assurance Comments

During the course of the Contract, Bay West will receive various Quality Assurance comments from the Government that will reflect corrections needed to site activities or reflect outstanding or future items needing attention. Bay West will acknowledge receipt of these comments by on the Daily Report, and shall also reflect on his Daily Report when these items are specifically completed or corrected to permit Government verification.

Appendix 1

Submittal Register

SUBMITTAL REGISTER																								CONTRACT NO. DACW41-95-D-0022
TITLE AND LOCATION OFF-POST ALTERNATE WATER SUPPLY, FORMER FIRE TRAINING AREA, FORT RILEY, KANSAS														CONTRACTOR BayWest										SPECIFICATION SECTION 02316
				TYPE OF SUBMITTAL										CLASSI-FICATION			CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION		
TRANSMITTAL NUMBER	ITEM NUMBER	SPECIFICATION	PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	DATA	DRAWINGS	INSTRUCTIONS	SCHEDULES	STATEMENTS	REPORTS	CERTIFICATES	SAMPLES	RECORDS	INFORMATION ONLY	GOVERNMENT APPROVAL	REVIEWER	SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	CODE	DATE	SUBMITTO GOVERNMENT	CODE	DATE	REMARKS
a	b	c		d	e	f	g	h	i	j	k	l	m	n	o	p*	q	r	s	t	u	v	w	x	y
		1.3		Field Density Tests						x				FIO		RE									
		1.3		Testing of Backfill Materials						x				FIO		RE									

ENG FORM 4288, (KCD ELECTRONIC VERSION, Feb, 94) *EP=ENG DIV, EP-D GL=ENG DIV, EP-GL RE=RESIDENT ENG AE=ARCHITECT/ENG FIRM

SUBMITTAL REGISTER																								CONTRACT NO. DACW41-95-D-0022
TITLE AND LOCATION OFF-POST ALTERNATE WATER SUPPLY, FORMER FIRE TRAINING AREA, FORT RILEY, KANSAS												CONTRACTOR BayWest												SPECIFICATION SECTION 02510
				TYPE OF SUBMITTAL										CLASSI-FICATION			CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION		
TRANSMITTAL NUMBER	ITEM NUMBER	SPECIFICATION PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	DATA	DRAWINGS	INSTRUCTIONS	SCHEDULES	STATEMENTS	REPORTS	CERTIFICATES	SAMPLES	RECORDS	INFORMATION ONLY	GOVERNMENT APPROVAL	REVIEWER	SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	CODE	DATE	SUBMITTAL TO GOVERNMENT	CODE	DATE	REMARKS
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p*	q	r	s	t	u	v	w	x	y
		1.4	Manufacturer's Data	x										GA	PE									Incomplete submittals will be rejected.
		1.4	Satisfactory Installation					x						FIO	RE									
		1.4	Bacteriological Disinfection						x					FIO	RE									

ENG FORM 4288, (KCD ELECTRONIC VERSION, Feb, 94) *EP=ENG DIV, EP-D GL=ENG DIV, EP-GL RE=RESIDENT ENG AE=ARCHITECT/ENG FIRM

SUBMITTAL REGISTER

CONTRACT NO. DACW41-95-D-0022

TITLE AND LOCATION

OFF-POST ALTERNATE WATER SUPPLY, FORMER FIRE TRAINING AREA, FORT RILEY, KANSAS

CONTRACTOR

BayWest

SPECIFICATION SECTION 02521

TRANSMITTAL NUMBER	ITEM NUMBER	SPECIFICATION PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	TYPE OF SUBMITTAL: DATA	DRAWINGS	INSTRUCTIONS	SCHEDULES	STATEMENTS	REPORTS	CERTIFICATES	SAMPLES	RECORDS	CLASSIFICATION: INFORMATION ONLY	GOVERNMENT APPROVAL	REVIEWER	CONTRACTOR SCHEDULE DATES: SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	CONTRACTOR ACTION: CODE	DATE	SUBMIT TO GOVERNMENT	GOVERNMENT ACTION: CODE	DATE	REMARKS
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p*	q	r	s	t	u	v	w	x	y
		1.3.2.1	Work Plan	x										GA	PE									
		1.3.2.2	Test Reports						x					GA	PE									
		1.3.2.3	Records									x		GA	PE									

ENG FORM 4288, (KCD ELECTRONIC VERSION, Feb, 94) *EP=ENG DIV, EP-D GL=ENG DIV, EP-GL RE=RESIDENT ENG AE=ARCHITECT/ENG FIRM

CONTRACTOR:
Bay West, Inc.
CONTRACT NUMBER

TRANSMITTAL NUMBER _____
ITEM NUMBER _____
SPECIFICATION SECTION _____
PARAGRAPH NUMBER _____
_____ APPROVED AS SUBMITTED
_____ APPROVED WITH CORRECTIONS AS NOTED
SIGNATURE: _____
TITLE: _____
DATE: _____

Appendix 2

Preparatory Inspection Checklist

PREPARATORY PHASE CHECKLIST

Contract No:_____ Date:_____
Definable Feature:_____
Spec. Section:_____
Government Rep Notified:_____ Hours in Advance Yes_____ No_____

I. Personnel Present.

	Name	Position	Company/Government
1.			
2.			
3.			
4.			
5.			
6.			
7.			

(List additional personnel on reverse side)

II. Submittals.

1. Review submittals and/or submittal log 4288. Have all submittals been approved? Yes_____ No_____

If No, what items have not been submitted?

a._____
b._____
c._____

2. Are all materials on hand? Yes_____ No_____

a._____
b._____
c._____

3. Check approved submittals against delivered material. (This should be done as material arrives).

Comments:

_____
_____

III. Material Storage.

Are materials stored properly? Yes_____ No _____
If No, what action is taken?

_____
_____

IV. Specifications.

1. Review each paragraph of specifications.

_____
_____
_____

2. Discuss procedure for accomplishing the work.

_____
_____
_____

3. Clarify any differences.

_____
_____
_____

V. Preliminary Work.
Ensure preliminary work is correct.
If not, what action is taken?

_____

VI. Testing

1. Identify test to be performed, frequency, and by whom.

_____
2. When required?_____
3. Where required?_____
4. Review Testing Plan_____
5. Has test facilities been approved?_____

VII. Safety

1. Review applicable portion of EM 385-1-1.

_____
_____

2. Activity Hazard Analysis approved? Yes_____ NO_____

VIII. Corp of Engineers comments during meeting.

CQC System Manager

Appendix 3

Initial Inspection Checklist

INITIAL PHASE CHECKLIST

Contract No:_____ Date:_____
Definable Feature:_____

Government Rep Notified:_____ Hours in Advance Yes_____ No_____

I. Personnel Present.

	Name	Position	Company/Government
1.			
2.			
3.			
4.			
5.			
6.			
7.			

(List additional personnel on reverse side)

II. Identify full compliance with procedures identified at preparatory. Coordinate plans, specifications, and submittals. Comments:

_____
_____
_____
_____
_____

III. Preliminary Work. Ensure preliminary work is complete and correct. If not, what action is taken?

_____
_____
_____
_____
_____

IV. Establish Level of Workmanship.

1. Where is work located?_____
2. Is a sample panel required? Yes_____ No_____
3. Will the initial work be considered as a sample? Yes_____ NO_____
   (If yes, maintain in present condition as long as possible).

V. Resolve any Differences.

Comments:_____

_____

_____

_____

_____

Review job conditions using EM 385-1-1 and job hazard analysis.

Comment:_____

_____

_____

_____

_____

Appendix 4

Daily Report of Operations

CONSTRUCTION QUALITY CONTROL MANAGEMENT REPORT

Contractor Production

Contractor's Name
Bay West

Daily report No: Date:
Contract No:

Project Title & Location:

Weather		Precipitation		In.	Temp		Min.		Max.

1. Contract/Subcontractors and Area of Responsibility:

NUMBER	TRADE	HOURS	EMPLOYER	LOCATION/DECRIPTION OF WORK

2. Operating Plant or Equipment. (Not hand tools)

Plant/Equipment	Date of Arrival/Departure	Date of Safety Check	Hours Used	Hours Idle	Hours Repair

CQC Report

1. Work performed today: (Indicate location and description of work preformed by prime and/or subcontractors by letter in table above.)

2. Results of control activities: (Indicate whether P- Preparatory, I-Initial, or F-Follow-up Phase. When a P or I meeting is conducted, complete attachment 1-A or 1-B, respectively. When network analysis system is used, identify work by use of I-J numbers)

3. Test performed as required by plans and/or specifications:

8. Remarks: (Instructions received or given. Conflict (s) in Plans and/or Specifications)

Contractor's Verification: On behalf of the Contractor, I certify this report is complete and correct, and all materials and equipment used and work preformed during this reporting period are in compliance with the contract plans and specifications, to the best of my knowledge, except as noted above.

CQC System Manager

Appendix 5

Contractor Deficiency Log

Contractor Deficiency Log
Ft Riley Alternate Water Supply
DACW41-95-D-0022 DO# 0012

No.	Deficiency Identification	QC Rep	QA Rep	Corrective Action	Scheduled Corrective Action Date	Correction Verified	Verification Date

Appendix 6

Resumes and Certifications

Bradley Kulberg

SPIDT Program Manager

Mr. Kulberg is a project manager for Bay West's Remediation services. His responsibilities include cost estimating, remedial project management, and proposal preparation. He coordinates field activities and personnel for hazardous waste remediation projects, UST removals and installations, and construction site activities, and supervises cost estimating for remediation projects. His 12 years of environmental experience include both project management and field work, and specific experience in proposal development. His key experience includes the following:

Statistics

Years Experience: 12
Education: BS, Electrical Engineering
Certifications:
- 40-hour OSHA-trained for hazardous waste site and emergency response work
- 8-hour OSHA-trained to supervise personnel at hazardous waste sites
- Certified UST Contractor, MN

- **PCB Excavation/Disposal, Brooklyn Park Dump Superfund Site, Minnesota, and Continental Steel Superfund Site, Kokomo, Indiana, Maecorp, 1987.** Mr. Kulberg was an on-site waste disposal coordinator at these sites. Maecorp was the prime contractor working under the EPA Region V ERCS contract. Duties included scheduling and tracking transportation and disposal services for over 1,200 tons of bulk PCB-contaminated soil from each site. The Kokomo site involved transportation via railroad gondola cars. Qualified to supervise personnel at hazardous waste sites according to OSHA 1910.120 *Management and Supervisor Training.*

- **Small Project Indefinite Delivery Type (SPIDT) Contract for Environmental Services, U.S. Army Corps of Engineers, Kansas City District, 1995-98.** Mr. Kulberg serves as Project Manager for various delivery orders (DOs) under this multi-DO contract. DOs completed to date have included waste characterization, consolidation, and containerization; excavation and debris disposal; stream bank stabilization; AST upgrades; soil vapor surveys; and transformer removal.

- **Landfill Excavation, Fort Snelling National Cemetery, Minnesota, U.S. Army Corps of Engineers, St. Paul District, 1995.** Mr. Kulberg prepared the proposal and cost estimate for this project, and served as project manager during its execution. This project involved the remediation of a landfill which contained hazardous waste. Approximately 13,000 cubic yards of material were excavated. Mr. Kulberg also submitted a value engineering proposal which saved the customer $7,000 on the total cost of the project.

- **Bioremediation, Duluth International Airport, Minnesota, EETCO for the Minnesota Air National Guard, 1995.** Mr. Kulberg prepared the cost estimate for this project which included the design of a ground water treatment and soil remediation system; Bay West provided these systems as well as a bioremediation system.

- **Drum Location/Identification, Lemberger Superfund Site, Whitelawn, Wisconsin, Confidential PRP Group, 1989.** As project manager for this site, Mr. Kulberg was involved from the proposal, startup, and initial remediation phases of this project, which included the location and identification of 1,300 buried drums and compressed gas cylinders.

- **Drum Excavation, Willow Drum Superfund Site, Detroit, Michigan, Confidential PRP Group, 1988.** Mr. Kulberg served as project manager at this site, where 2,000 drums of flammable hazardous waste and 7,000 gallons of bulk flammable, chlorinated sludge were present. All waste streams were characterized, transported, and disposed of in less than 60 days after mobilization.

PHILIP DULA, CPG, CHMM
Kansas City Office Manager
Project Manager

Education/Dates:
- MBA/1999
- MS Geology/1982
- BA Biology/1977

Special Qualifications/Training/Registrations:
- Certified Professional Geologist (CPG), MO, AR
- Certified Hazardous Materials Manager (CHMM)
- 40-Hour OSHA Training
- 8-Hour OSHA Supervisor Training

Years Experience: 20
Location: Lenexa, KS

Mr. Dula has 20 years experience in environmental investigation and remediation. His technical expertise is in the initial evaluation of site environmental problems and the development and implementation of cost-effective methods of remediation. Through his experience, he has overseen the completion and/or implementation of more than $20M of environmental services under both cost reimbursable and firm fixed price contracts. He has managed programs and projects for the USACE and US EPA Regions VI and VII, including an ARCS contract. He has completed environmental projects in 12 states throughout the Midwest, Southeast, and Northeast. He is knowledgeable in Federal, State, and/or local laws, regulations, and guidance documents, including US EPA, DOT, OSHA regulations.

In addition to his environmental consulting career experience Mr. Dula spent 5 –years with the Pennzoil Exploration Company as an Exploration Geologist and Geophysicist.

PROJECT EXPERIENCE:

- *Tank Demolition, Former Olathe Naval Air Station, USACE Kansas City District, Gardner, KS.* Mr. Dula managed the demolition of two 250,000-gallon, reinforced concrete, aircraft fuel underground storage tanks from this site.
- *UST Removal Contract, USACE - Kansas City District, KS, MO, NE, IA.* Mr. Dula managed UST removals and closures at several sites throughout the 4-state area. The largest project, which took place at Forbes Field, Topeka, KS, involved removing 54 fuel oil tanks. Other sites included minuteman missile sites. Work also included building demolition and abatement of asbestos associated with older boilers.
- *Environmental SPIDT Contract, USACE - Kansas City District, Various Sites, NE, IA, MO, KS.* Mr. Dula serves as Program Manager for various task orders (TOs) under this multi-TO contract. Bay West was awarded this contract in 1995, and has performed 18 TOs to date, including excavation and debris disposal; stream bank stabilization; AST upgrades; soil vapor surveys; UST removals, and PCB transformer removal.
- *ARCS Contract Site Assessment, US EPA Region VII.* As project manager, Mr. Dula directed completion of 60 preliminary assessments, 28 RCRA facility assessments, 42 site investigations, 45 site inspection prioritization's, and 5 fully documented HRS packages. He directed a pilot study to implement SACM principles on 4 inactive lead-mining sites.
- Tinker AFB, Oklahoma City, OK, Tank Removals. As Program Manager Mr. Dula directed the removal of 4 chemical tanks each with a capacity of 80 cubic yards. These tanks contained alum, lime, and urea that were formerly used in the facility's industrial wastewater treatment plant (IWWTP). Bay West emptied and decontaminated the tanks and then dismantled the tanks for disposal to a steel recycler. The tanks were located on the second floor of the IWWTP building and therefore their removal required Bay West to perform structural improvements to ensure the building's structural integrity was maintained. Bay West also removed 400 linear feet of associated piping, and coordinated disposal of the tanks, piping, chemicals, and rinsate waters. Bay West received a contract modification/change order to remove an additional 60 cubic yard AST containing soda ash at the IWWTP. Bay West utilized a crane to lift and lower the tank after emptying and decontaminating the AST.

ecology and environment, inc.

Acknowledges that

Phillip Dula

has successfully completed the

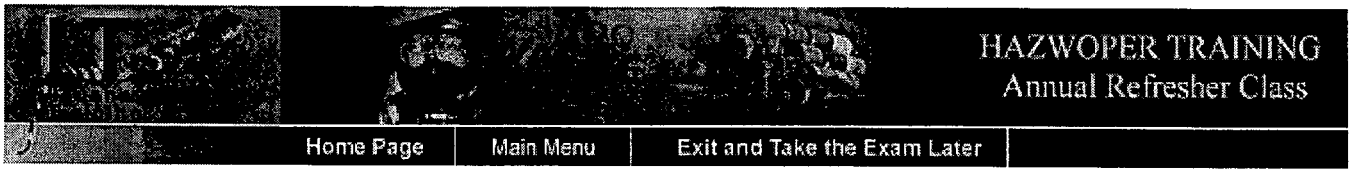
40-HOUR BASIC HEALTH AND SAFETY TRAINING COURSE

Thomas L. Smith
THOMAS L. SMITH
TRAINING MANAGER

Douglas P. Schuessler
DOUGLAS P. SCHUESSLER
TRAINING COORDINATOR

April 10, 1987
DATE

This course has been approved by the United States Environmental Protection Agency for workers on hazardous waste sites.



Certificate of Completion

Congratulations, Philip Dula! You have completed the HAZWOPER Annual Update Refresher Course. Your score is shown below the certificates on this page. To print your certificate use your browser's print function or press CTRL + P.

Certificate of Training
IT HAZWOPER Refresher Training Course

Iguana Training certifies that

Philip Dula

has successfully completed the

8-Hour Health and Safety
Training Refresher for
Hazardous Waste Site Operations
in accordance with 29 CFR 1910.120.

on Thursday, July 05, 2001.

Training Director

Friday, July 05, 2002
Expiration Date

Iguana Training
3150 Richards Road, Suite 100, Bellevue, WA 98005-4446

Suitable for Framing--Enlarge to 150% on your copy machine.

Certificate of Training
IT HAZWOPER Refresher Training Course
Iguana Training certifies that
Philip Dula
has successfully completed the
8-Hour Health and Safety Training Refresher for Hazardous Waste Site Operations in accordance with 29 CFR 1910.120.
on Thursday, July 05, 2001.

Training Director

Friday, July 05, 2002
Expiration Date

Iguana Training
3150 Richards Road, Suite 100, Bellevue, WA 98005-4446

Wallet Copy--Keep this with you.

MARK BAUMAN
Field Technician/Environmental Sampler

Education/Dates:

Special Qualifications/Training/Registrations:
- 40-Hour OSHA Training
- 8-Hour OSHA Supervisor Training
- Confined Space Certification

Years Experience:
General Construction 15
Environmental 5

Location: Hastings, NE

Mr. Bauman has over 20 years of experience in the areas of construction, the operation and maintenance of environmental remediation systems, and environmental sampling. He has participated in environmental investigations serving as site supervisor, field technician, heavy equipment operator, and environmental sampling equipment operator. Mr. Bauman was responsible for performing the oversight of the construction of seven Soil Vapor Extraction Systems at the Hastings, NE Superfund site, the Far-Mar-Co site in Hastings NE, and the Grand Island, NE Superfund site. In addition to his involvement with the construction of these systems he performed the O&M for these systems. Mr. Bauman also performed demobilization of five Hastings, NE SVE systems. Most recently Mr. Bauman has completed the installation of a ground water treatment system at the Badger Army Ammunition Plant (BAAP) located in Baraboo, WI and as an equipment operator and pipe fitter at the Twin City Army Ammunition Plant (TCAAP) in St. Paul, MN.

PROJECT EXPERIENCE:

Hastings East Industrial Park OU8 SVE System Construction, Start-up, O&M, and Shut Down Former Blaine Naval Ammunition Depot Federal Superfund Site, Hastings, NE. March 1997-March 2000

Mr. Bauman participated in the construction, start-up, and completion of O&M activities at the Hastings OU8 site. The remedial system consisted of five SVE systems installed in areas where past heavy chlorinated solvent usage resulted in contaminated groundwater and soils. The systems were designed to operated between 700 and 3,300 scfm. O&M activities consisted of:

- field screening all SVE wells on a 3-day cycle using photoionization detectors,
- monitoring of a remote telemetry system,
- collection of more than 250 vapor samples for laboratory analysis with 24-hour turn around time, change out of approximately 80,000 pounds of granular-activated carbon,
- bi-monthly operations reports which included plots of PID readings, temperature, and pressure for all 136 wells, plots of flow rates for all 104 extraction wells, and the estimated cumulative mass of contaminates removed.
- Performance of more than 48,000 hours of systems operation over a 26-month period.
- Clean-up criteria were met as of November 1999, and the system was dismantled in March 2000. Mr. Bauman performed single-handedly the demobilization effort at the site.

OU1/OU2 SVE System Construction, Start-up and O&M Cleburn Street Superfund Site, Grand Island, NE September 1998-February 2000.

Mr. Bauman was part of a team that 'managed the completion of construction activities of a dual phase 120 gpm vacuum extraction system designed to remediate groundwater and soil contaminated by chlorinated hydrocarbons. Water was treated with via an 8-tray aeration system. The VE system operated at a rate of 1,300 scfm. He assisted in the start-upof the system and performed all O&M of the system for a contracted period of 17 months. Mr. Bauman was responsible for performing bi- weekly site visits to monitor system performance, record operating data, preparation of field documentation, and the performance of routine maintenance. Mr. Bauman provided assistance in the preparation of monthly reports to the EPA Region VII.

OU1/OU2 SVE System Construction, Start-up and O&M Far-Mar-Co CERCLA Site, Hastings, NE June 1998- to Present

Mr. Bauman was part of a team that managed the completion of construction activities of a vacuum extraction system designed to remediate groundwater and soil contaminated by chlorinated hydrocarbons. This system has a treatment capacity of 690 SCFM and included 17 extraction wells and 18 vadose monitoring wells. He assisted in the start-up of the system and performed all O&M of the system since June 1998. O&M activities are ongoing. Mr. Bauman is responsible for performing weekly site visits to monitor system performance, record operating data, preparation of field documentation, and the performance of routine maintenance. In several instances he was responsible for performing major system repairs in the field minimizing system downtime. Mr. Bauman also provided assistance in the preparation of monthly reports to the EPA Region VII.

Twin City Army Ammunition Plan Superfund Site, St. Paul, MN August 2001-November 2001

Mr. Bauman was responsible for operating a Volva A40 to haul backfill for Sites 129-3, 129-15, and Site C. He also ran a track loader at area sites 129-15. Mr. Bauman also performed site restoration at both sites including re-vegetating the site per USACE requirements. In addition Mr. Bauman installed the plumbing for 3 groundwater extraction wells to the Conex building at site C for discharge of groundwater. This task included the installation of 100 feet of 3-inch HDPE piping for the discharge of groundwater.

Badger Army Ammunition Plant Superfund Site, Baraboo, WI Fall 2000 and Spring 2001

Mr Bauman assisted in the two phase construction of a groundwater treatment system at BAAP. This system was an innovative design as it was a dual system utilizing SVE and bioremediation. Primary duties included the installation of all pipe runs and 18 vadose monitoring wells. This past year Mr. Bauman was involved with the startup of the dredging operation at BAAP, Gruber's Grove Bay Area . Mr. Bauman performed the installation of the header line for the dredge lay down area.

Certificate of Training
IT HAZWOPER Refresher Training Course

Iguana Training certifies that

Mark D. Bauman

has successfully completed the

Health and Safety
Training Refresher for
Hazardous Waste Site Operations.

on Thursday, July 12, 2001.

Training Director

Friday, July 12, 2002
Expiration Date

Iguana Training
3150 Richards Road, Suite 100, Bellevue, WA 98005-4446

KEITH ELLIS
Site Supervisor/SSHO/CQCSM

Education/Dates:

Special Qualifications/Training/Registrations:
- 40-Hour OSHA Training
- 8-Hour OSHA Supervisor Training
- 8-Hour OSHA Train-the-Trainer for hazardous waste site training
- OSHA Excavation & Trenching Training
- Confined Space Entry
- Asbestos Inspector Training (AHERA Regulations, TSCA Title II and the State of Missouri)
- Hazard Awareness and Remediation Class, Weapons of Mass Destruction
- U.S. Army Corps of Engineers Construction Quality Management for Contractors
- Licensed to Remove, Install & Test Underground Storage Tanks in Kansas.

Years Experience: 24
Location: Lenexa, KS

Mr. Ellis has 22 years industrial experience and 13 years environmental experience serving as site supervisor, field technician, and equipment operator. He is trained to operate heavy equipment including backhoes, trackhoes, loaders, and dozers. He has participated in sampling programs for water and sludge from surface impoundments, subsurface soils, surface water and ground water. His background includes working as industrial hygiene technician at Tinker Air Force Base, Oklahoma City, serving as a health and safety/remediation technician for Foster Wheeler Environmental Services, and working as both a commercial driver and aviation structural mechanic.

PROJECT EXPERIENCE:

- *Health & Safety/Engineering Oversight, St. Louis Airport (SLAP) FUSRAP Site, MO* - Mr. Ellis was Bay West's site safety & health officer at the SLAP project site. Work involved the cleanup of a FUSRAP/Superfund site. Mr. Ellis performed hazard evaluation and monitoring, tailgate safety meetings and coordination with the safety & health manager. This project is under Bay West's TERC with Stone & Webster and the Omaha District.

- *Health & Safety Officer, Badger Army Ammunition Plant, Baraboo, WI* - Mr. Ellis was Bay West's site safety & health officer at the project site. Work involved the dredging of a grovers bay site. Mr. Ellis performed hazard evaluation and monitoring, tailgate safety meetings and coordination with the safety & health manager. This project is under Bay West's TERC with Stone & Webster and the Omaha District.

- *Process Assessment Program, Tinker Air Force Base, OK.* Mr. Ellis served as industrial hygiene technician, conducting surveys and interviewing base personnel for information related to confined-space evaluations, chemical inventories, heat/cold stress, radio frequency emitters, microwaves, radioactive sources, respiratory protection, and safe work areas. Data entry is performed and a report is generated with a cost estimate for future IH evaluations.

- *Health & Safety Oversight/Equipment Operation, Various Sites.* Mr. Ellis performed health and safety services for various companies, utilizing his health and safety expertise. He was responsible for monitoring, sampling, and documentation of soils, water, and excavated materials. Mr. Ellis monitored the excavation of soils using backhoes, trackhoes, and track loader for health and safety compliance. He was responsible for collection of ground water data for RCRA quarterly sampling events; surface and subsurface soil investigations; geological logging of ground water monitoring well installation; slug testing, and documentation of these activities. Mr. Ellis also conducted monitoring for the presence of toxic substances using photoionizer detector and LEL/Oxygen monitor.

- *Drum Investigation, US Naval Air Station, Bermuda.* Mr. Ellis was responsible for identification and packaging of unknown hazardous waste. Drums and the surrounding area were monitored utilizing the photoionizer detector, LEL/Oxygen meter and rad meter.

- *Site Remediation, Municipal Property, Raytown, MO.* Mr. Ellis performed backhoe trenching and monitoring excavated drums with a photoionization

detector and SENSIDYNE-HAZCAT KIT for chemical identification at this site. He also collected soil and water samples during the site characterization visit. Looking for buried transformers. . .

- *Amoco GW Sampling, Sugar Creek, MO, slug testing, to ID contaminated plume, site investigation. . . field tech. . .*

- *Lead Abatement, National Guard Firing Ranges, MO & IA* – Mr. Ellis served as SSHO for the decontamination three fire ranges contaminated with lead. He monitored the lead decontamination activities, including the health & safety of the subcontractor, ensured the filtration systems were working properly, and coordinated proper waste disposal.

- *Radiological Site Remediation, St. Louis Airport (SLAP) FUSRAP Site, MO* - Mr. Ellis performed SSHO activities related to the cleanup of radiological-contaminated soil. He performed hazard evaluation and monitoring, tailgate safety meetings, inspection & maintenance of respirators and other safety equipment, and coordination with the safety & health manager. He also assisted in the preparation of a site drug & alcohol policy.

- *Lead-Contaminated Soil Cleanup, Bureau of Mines, MO* – Mr. Ellis performed SSHO activities related to the excavation of 500 cy of lead-contaminated soil.

- *Drum Investigation, US Naval Air Station, Bermuda.* Mr. Ellis was responsible for identification and packaging of unknown hazardous waste. Drums and the surrounding area were monitored utilizing the photoionizer detector, LEL/Oxygen meter and rad meter.

- *Site Remediation, Raytown, MO.* Mr. Ellis performed backhoe trenching and monitoring excavated drums with a photoionization detector and SENSIDYNE-HAZCAT KIT for chemical identification at this site. He also collected soil and water samples during the site characterization visit. Looking for buried transformers. . .

- *Process Assessment Program, Tinker Air Force Base, OK.* Mr. Ellis served as industrial hygiene technician, conducting surveys and interviewing base personnel for information related to confined-space evaluations, chemical inventories, heat/cold stress, radio frequency emitters, microwaves, radioactive sources, respiratory protection, and safe work areas. Data entry is performed and a report is generated with a cost estimate for future IH evaluations.

- *Site Remediation, USACE Kansas City District, Rolla University, MO.* Mr. Ellis served as environmental technician during the excavation of approximately 500 cubic yards of lead-contaminated soil at a former foundry/research site. He performed sampling and equipment operation. This project was performed for the U.S. Army Corps of Engineers, Kansas City District, under Bay West's Small Project Indefinite Delivery Type (SPIDT) contract.

M·E·T·A

Mayhew Environmental Training Associates

INCORPORATED

This is to certify that

Keith M. Ellis

attended a

Hazard Awareness and Remediation Class

associated with

Weapons of Mass Destruction

on 12/18/01, in EAGAN, MN

Certificate # 7ME12187301HB002

Dr. Robert Kellam, PE, CIH

Instructor

President

U.S. ARMY CORPS OF ENGINEERS

PROFESSIONAL DEVELOPMENT SUPPORT CENTER
HUNTSVILLE, ALABAMA

CERTIFICATE

This is to certify that

Keith Ellis

has completed the Corps of Engineers Training Course

CONSTRUCTION QUALITY MANAGEMENT FOR CONTRACTORS

Given at Omaha (Location) By Omaha (Instructional District) 01/24/02 (Date)

Facilitator Alan Kreisler

THIS CERTIFICATE EXPIRES FIVE YEARS FROM DATE OF ISSUE

Chief, ~~USACE~~ Professional Development Support Center

ENVIRONMENTAL & SAFETY
CERTIFICATE OF COMPLETION

PRESENTED TO

KEITH M. ELLIS

For
Attendance and Completion
of a

8 HOUR ANNUAL HAZARDOUS
WASTE OPERATIONS COURSE

(29CFR1910.120)

ENVIRONMENTAL & SAFETY
7501 Hawthorne
Raytown, MO 64138

Stephen P. Catlin 1-25-02
Course Instructor **Date**

No. 0501

ENVIRONMENTAL & SAFETY
CERTIFICATE OF COMPLETION

PRESENTED TO

KEITH M. ELLIS

For
Attendance and Completion
of a

8 HOUR ANNUAL REFRESHER
HAZARDOUS WASTE OPERATIONS COURSE

(29CFR1910.120)

ENVIRONMENTAL & SAFETY
7501 Hawthorne
Raytown, MO 64138

Stephen P. Catlin 1-5-01
Course Instructor **Date**

ENVIRONMENTAL & SAFETY
CERTIFICATE OF COMPLETION

PRESENTED TO

KEITH ELLIS

For
Attendance and Completion
of a

8 HOUR ANNUAL REFRESHER
HAZARDOUS WASTE OPERATIONS COURSE

(29CFR1910.120)

ENVIRONMENTAL & SAFETY
7501 Hawthorne
Raytown, MO 64138

Stephen P. Catlin
Course Instructor

1-15-00
Date

No. ES12999

E & S

CERTIFICATE OF COMPLETION

PRESENTED TO

KEITH M. ELLIS

For
Attendance and Completion
of a

8 HOUR ANNUAL REFRESHER
HAZARDOUS WASTE OPERATIONS COURSE

(29CFR1910.120)

Environmental and Safety
9205 E. 69th Terr.
Raytown, MO 64133

Stephen P Loutin — 1-24-99

Course Instructor — **Date**

No. ES1018

E & S

CERTIFICATE OF COMPLETION

PRESENTED TO

KEITH M. ELLIS

For
Attendance and Completion
of a

8 HOUR ANNUAL REFRESHER
HAZARDOUS WASTE OPERATIONS COURSE

(29CFR1910.120)

Environmental and Safety
7503 Hawthorne
Raytown, MO 64138

Stephen P. Cathin
Course Instructor

12-27-97
Date

CERTIFICATE OF COMPLETION

Presented To

Keith Ellis

(SSN# - 496-68-6956)

OSHA 29 CFR 1910.120 (e)

For Successful Completion of the 8 Hour Hazardous Waste Site

Refresher Course On

1/2/97

(Date)

Trainer

President

ENVIROKLEAN

NO. EH1132

E & S

CERTIFICATE OF COMPLETION

PRESENTED TO

KEITH M. ELLIS

For
Attendance and Completion
of a

8 HOUR ANNUAL REFRESHER
HAZARDOUS WASTE OPERATIONS COURSE

(29CFR1910.120)

Environmental and Safety
7503 Hawthorne
Raytown, MO 64138

Stephen P Cadin — 9-23-96

Course Instructor — **Date**

No. E1613

E & S

CERTIFICATE OF COMPLETION

PRESENTED TO

KEITH M. ELLIS

For
Attendance and Completion
of a

8 HOUR ANNUAL REFRESHER
HAZARDOUS WASTE OPERATIONS COURSE

(29CFR1910.120)

Environmental and Safety
10036 Bennington Ave
Kansas City, MO 64134

Stephen P Gatlin
Course Instructor

9-14-95
Date

No. CS694

ENVIRONMENTAL & SAFETY

CERTIFICATE OF COMPLETION

PRESENTED TO

KEITH M. ELLIS

For
Attendance and Completion
of a

CONFINED SPACE ENTRY

(29CFR1910.146)

Environmental and Safety
10036 Bennington
Kansas City, MO 64134

Stephen P. Catlin
Course Instructor

6-17-94
Date

No. E1536

E&S

CERTIFICATE OF COMPLETION

PRESENTED TO

KEITH M. ELLIS

For
Attendance and Completion
of a

8 HOUR ANNUAL REFRESHER HAZARDOUS WASTE OPERATIONS COURSE

(29CFR1910.120 and 29CFR1910.121)

Environmental and Safety
10036 Bennington
Kansas City, MO 64134

Stephen P Coetin
Course Instructor

10-11-94
Date

No. 080893

CERTIFICATE OF COMPLETION

PRESENTED TO

KEITH M. ELLIS

For
Attendance and Completion
of a

8 HOUR ANNUAL REFRESHER
HAZARDOUS WASTE OPERATIONS COURSE

(29CFR1910.120 and 29CFR1910.121)

Foster Wheeler Environmental Services
8 Peach Tree Hill Road
Livingston, New Jersey 07039

Dr. John J. Borris, NRCC,CIH
Course Director

8/19/93
Date

No. TT081092-1

CERTIFICATE OF COMPLETION

PRESENTED TO

KEITH M. ELLIS 496-68-6956

For
Attendance and Completion
of a

TRAIN - THE - TRAINER COURSE FOR HAZARDOUS WASTE OPERATIONS

(29CFR1910.120 and 29CFR1910.121)

Foster Wheeler Enviresponse, Inc.
8 Peach Tree Hill Road
Livingston, New Jersey 07039

Dr. John J. Borris, NRCC,CIH
Course Director

10/30/92
Date

No. S081092-2

CERTIFICATE OF COMPLETION

PRESENTED TO

KEITH M. ELLIS 496-68-6956

For
Attendance and Completion
of a

8 HOUR SUPERVISORY/MANAGEMENT
Hazardous Waste Operations Course
(29 CFR1910.120 AND 29CFR1910.121)

Foster Wheeler Enviresponse, Inc.
8 Peach Tree Hill Road
Livingston, New Jersey 07039

Dr. John J. Borris, NRCC,CIH
Course Director

10/29/92
Date

No. 081092-7

CERTIFICATE OF COMPLETION

PRESENTED TO

KEITH M. ELLIS 496-68-6956

For
Attendance and Completion
of a

8 HOUR ANNUAL REFRESHER HAZARDOUS WASTE OPERATIONS COURSE

(29CFR1910.120 and 29CFR1910.121)

Foster Wheeler Enviresponse, Inc.
8 Peach Tree Hill Road
Livingston, New Jersey 07039

Dr. John J. Borris, NRCC,CIH
Course Director

10/28/92
Date

N.J.K. Associates, Inc.

Certificate of Completion

Presented to:

Keith M. Ellis
OSHA 29 CFR 1910.120(e)

for successful completion of the
8-Hour Hazardous Waste Site Refresher Course

October 21, 1991

Nancy J. Kepko
President

Department of the Navy

This is to certify that

KEITH M. ELLIS

has

COMPLETED

HAZARDOUS WASTE FACILITY OPERATOR'S REVIEW SEMINAR

(8 HOURS)

given at

NAVAL AIR STATION MEMPHIS

9 MARCH 19 90

Diane R. Lancaster

DIANE R. LANCASTER

ENVIRONMENTAL PROTECTION SPECIALIST

OPNAV 12410/10 (7-83) S/N 0107-LF-124-1050

Department of the Navy

This is to certify that

AMS2 KEITH ELLIS

has

COMPLETED THE HAZARDOUS WASTE
FACILITY OPERATOR COURSE

given at

NAVAL AIR STATION MEMPHIS

CWO3 K. IVERSON
ENVIRONMENTAL PROGRAMS OFFICER

DIANE LANCASTER
HAZARDOUS WASTE COORDINATOR

MARCH 30 19 89

OPNAV 12410/10 (7-83) S/N 0107-LF-124-1050

Department of the Navy

This is to certify that

Keith M. Ellis

has

Completed The Hazardous Waste
Facilities Operators Course

given at

Naval Air Station Memphis

February 15-19 19 88

R S Barr
LT R.S. Barr, USN
Assistant Public Works Officer

Jimmie S. Black, Training Coordinator
Environmental Programs Division

OPNAV 12410/10 (7-83) S/N 0107-LF-124-1050

Certificate of Completion

This card confirms that

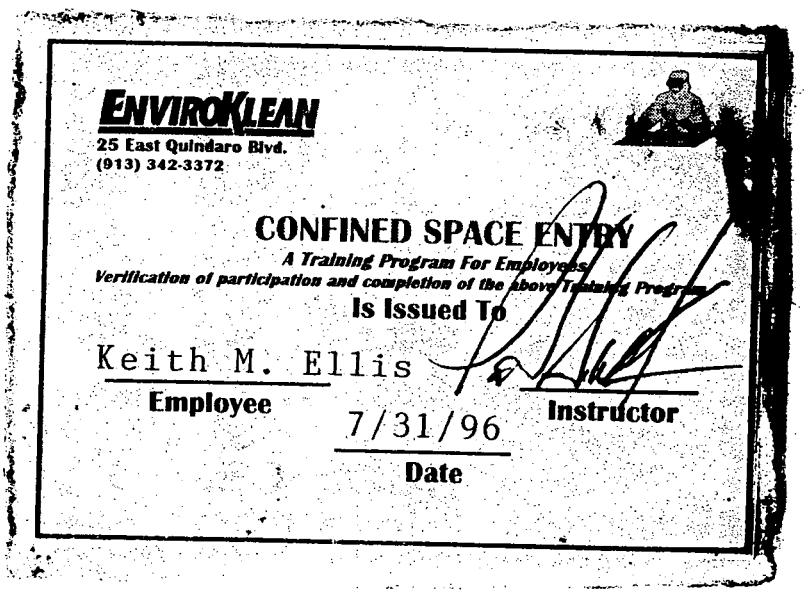
KEITH ELLIS

has completed the
NUCA Competent Person Training Program

on DECEMBER 12, 1992

Instructor Dale Garlen

Issued by
The National Utility Contractors Association



ENVIROKLEAN
25 East Quindaro Blvd.
(913) 342-3372

CONFINED SPACE ENTRY
A Training Program For Employees
Verification of participation and completion of the above Training Program
Is Issued To

Keith M. Ellis
Employee

7/31/96
Date

Instructor

Certificate of Attendance

Keith Ellis

ATTENDED THE TECHNICAL SEMINAR

"STORM WATER MANAGEMENT"

PRESENTED BY

JOHN R. WHITWOOD, DISTRICT MANAGER
ADVANCED DRAINAGE SYSTEMS, INC.
And
CLINTON DUNN, P.E.
INDUSTRIAL SALES COMPANY

THE SEMINAR IS A ONE HOUR PRESENTATION ON FLEXIBLE PIPE SOLUTIONS AND INSTALLATION MEETING THE CONTINUING EDUCATION CRITERIA FOR PROFESSIONAL ENGINEERS

FEBRUARY 27, 2002

JOHN R. WHITWOOD
ADVANCED DRAINAGE SYSTEMS, INC.

Certificate of Attendance

Keith Ellis

Attended the Technical Seminar

HIGH DENSITY POLYETHYLENE PIPE SEMINAR
BUTT AND SIDEWALL FUSION PRESENTATION

Presented By
Noel Mock, Regional Manager & Jim Craig, National Sales Manager
McElroy Manufacturing, Inc.
and
Larry Schneider
Industrial Sales Company

The seminar is a one hour presentation on Butt and Sidewall Fusion procedures, meeting the continuing education criteria for professional engineers.
February 27, 2002

Ron Hurley

Industrial Sales Company, Inc.

Certificate of Attendance

Keith Ellis

Attended the Technical Seminar

HIGH DENSITY POLYETHYLENE PIPE SEMINAR
HDPE PRESSURE PIPE PRESENTATION

Presented By
Kevin Deal, Municipal and Industrial Territory Manager
Performance Pipe
and
Ron Hardy
Industrial Sales Company

The seminar is a one hour presentation on HDPE pipe design and installation, meeting the continuing education criteria for professional engineers.
February 27, 2002

Ron Hardy
Industrial Sales Company, Inc.

SHAWN PUCKETT
Equipment Operator

Education/Dates:

Special Qualifications/Training/Registrations:
- 40-Hour OSHA Training
- 8-Hour OSHA Supervisor Training
- Confined Space Entry
- DOT Class A CDL

Years Experience: 10
Location: Lenexa, KS

Mr. Puckett has 10 years industrial and environmental experience serving as Site Supervisor, equipment operator, and field technician. He is trained to operate heavy equipment including Backhoe, Trackhoe, and Loaders. He also operates Vacuum trucks, Jetter Trucks, and dump trucks. He has participated in all industrial aspects of power plant operations. His background includes working as Site Supervisor and Equipment Operator for various Environmental Services, and working as a commercial driver.

PROJECT EXPERIENCE:

- *Site Supervisor.* Mr. Puckett was site supervisor for the cleanup of various emergency response incidents. Work involved the cleanup of contaminated soils, removal of hazardous and toxic chemicals from train derailments or plant incidents. Mr. Puckett performed hazard evaluation and monitoring, and coordination with the safety & health manager.
- *Equipment operation.* Mr. Puckett performed duties as an equipment operator for various companies, using Vacuum trucks, and Jetter trucks, performed various tasks as cleaning piping, storm drains, and operations at power plants, duties also included emergency response.
- *UST Removal.* Mr. Puckett served as Supervisor, equipment operator for UST closure projects the project involved excavation and disposal of contaminated soils, Confined Space Entry and monitoring for LEL/02, and tank destruction.
- *PCB Cleanup.* Mr. Puckett served as an equipment operator, environmental technician during the excavation of PCB and TCE contaminated soil at a former transformer refurbishing plant, implemented vapor extraction system throughout holding containers to lower TCE levels.
- *Installation of Control Vaults.* Mr. Puckett supervised and coordinated the installation of control vaults for fiber optic lines throughout new communities for local telecommunication company.
- *Lab Packaging.* Mr. Puckett was responsible for segregation and packaging of hazardous chemicals for various companies, containers were properly marked and labeled for shipment.
- *Tank Cleaning.* Mr. Puckett was responsible for oversight of AST cleaning, supervised confined space entry, and all aspects of interior cleaning and product removal.

NO. ES6037

E & S

CERTIFICATE OF COMPLETION

PRESENTED TO

SHAWN PUCKETT

For
Attendance and Completion
of a

40 HOUR
HAZARDOUS WASTE OPERATIONS COURSE

(29CFR1910.120)

Environmental and Safety
7503 Hawthorne
Raytown, MO 64138

Keith M Ellis
Course Instructor

11-22-96
Date

ENVIROKLEAN
25 East Quindaro Blvd.
(913) 342-3372

CONFINED SPACE ENTRY

A Training Program For Employees

Verification of participation and completion of the above Training Program
Is Issued To

Shawn Puckett
Employee

5/6/96
Date

Instructor

TRAINING AND DATE COMPLETED

- [X] **Entrant Training**
  Date: 5/6/96
- [X] **Attendant Training**
  Date: 5/6/96
- [X] **Supervisor Training**
  Date: 5/6/96
- [ ] **Rescue Training**
  Date:
- [ ] **Other**
  Date:

ENVIROKLEAN

Shawn Puckett

Has received 40 Hours
Initial Training
Required under 29CFR 1910.120

11/22/96

Certification Date **Certifier's Signature**

ENVIROKLEAN

25 East Quindaro Blvd.
Kansas City, KS 66115
(913) 342-3372

512-74-4064

Social Security
29 CFR 1910.120

CERTIFICATE OF COMPLETION

Presented To

Shawn Puckett

(SSN# - 512-74-4064)

For Confined Space Entry Training

29CFR 1910.146

5/6/96

(Date)

Trainer

President

ENVIROKLEAN

Appendix 7

HDPE Pipeline Testing

CPChem
PERFORMANCE PIPE

Technical Note 802 - Leak Testing

www.performancepipe.com

Leak Testing

Leak tests may be used to find leaks in a newly constructed or newly modified piping system, or in established systems where an apparent loss of integrity has been experienced. If they exist, leaks typically occur at joints or connections in the system.

Leak tests do not verify pressure rating or potential long-term performance. The system design and the pressure ratings of the installed components are the sole determinants of system pressure rating and long-term performance.

Fuel gas piping systems should be tested in accordance with applicable codes and regulations and pipeline operator procedures.

Safety

Safety is of paramount importance. Leak tests can apply high stress to untried joints and parts in the system. Failure can occur by leaking or by catastrophic rupture that can cause sudden, violent movement. In some cases, leakage may immediately precede catastrophic rupture.

WARNING – Death or serious injury can result from failure at a joint or connection during pressure leak testing. Keep all persons a safe distance away during testing. The test section is to be supervised at all times during the test.

Ensure that all piping is restrained against possible movement from catastrophic failure at a joint or connection. When pressurized, faulty joints or connections may separate suddenly causing violent and dangerous movement of piping or parts. Correctly made joints do not leak. Leakage at a joint or connection may immediately precede catastrophic failure. Never approach or attempt to repair or stop leaks while the test section is pressurized. Always depressurize the test section before making repairs.

Restrain Against Movement

Before applying pressure, all piping and all components in the test section must be restrained against movement. This means that if piping or parts separate during the test, they cannot move enough to cause damage or injury. ***Never conduct leak tests on unrestrained piping.***

- Heat fusion joints must be properly cooled before testing.
- Mechanical connections must be completely installed and tightened per manufacturer's instructions.
- If backfill provides restraint, it must be properly placed and compacted. Joints and connections may be exposed for inspection.
- Ensure that all connections to test equipment are secure. Disconnect or isolate all low pressure filling lines and all other parts that are not to be subjected to test pressure. Restrain, isolate or remove expansion joints before leak testing.

Test Section

Testing may be conducted on the full system or in sections. Test section length is determined by the

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capacity of the testing equipment. Lower capacity pressurizing or filling equipment may not be capable of completing the test within permissible time limits. If so, higher capacity test equipment or a shorter test section is in order.

Before applying test pressure, allow time for the test fluid and the test section to equalize to a common temperature.

Test Pressure

For pressure piping systems that include polyethylene pipe or fittings:

- The maximum permissible test pressure is measured at the lowest elevation in the test section.
- The maximum permissible test pressure is 150% of the system design operating pressure when the test section is all polyethylene pressure piping.
- The maximum permissible test pressure is the pressure rating of the lowest pressure rated, non-polyethylene part in the system when the system contains non-polyethylene parts.

Do not subject lower pressure rated, non-polyethylene parts or devices to pressures above their pressure rating. Lower pressure rated parts may be removed or isolated from the test section to avoid damage or failure. Vent isolated parts or equipment to atmosphere.

All thermoplastic pipes have reduced strength at elevated temperature. Test pressure must be reduced when the test section is at elevated temperature from service conditions or from environmental conditions such as being warmed by the sun. Multiply the test pressure by the Table 1 multiplier to determine the allowable elevated temperature test pressure.

Table 1 Elevated Temperature Multiplier

Test Section Temperature °F (°C)	= 80 (= 27)†	= 90 (= 32)	=100 (= 38)	=110 (= 43)	= 120 (= 49)	= 130 (= 54)	= 140 (= 60)‡
Multiplier	1.00	0.90	0.80	0.75	0.65	0.60	0.50

† Use the 80°F (27°C) multiplier for 80°F (27°C) and lower temperatures. ‡ The maximum service temperature for Performance Pipe PE pressure piping is 140°F (60°C).

Test Duration

When testing at pressures above system design pressure up to 150% of the system design pressure, the maximum test duration is eight (8) hours including time to pressurize, time for initial expansion, time at test pressure, and time to depressurize the test section. If the test is not completed due to leakage, equipment failure, or for any other reason, depressurize the test section completely, and allow it to relax for at least eight (8) hours before pressurizing the test section again.

CAUTION – Testing at excessive pressure or for excessive time may damage the piping system.

When testing at system design pressure or less, test duration including time to pressurize, time for initial expansion, time at test pressure and time to depressurize should be limited to a practical time period given that the test section is not to be left unsupervised at any time during leak testing.

Test Fluid

Hydrostatic Testing

The recommended and strongly preferred test fluid is water or another safe test liquid. The test fluid

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should meet appropriate industry standards for safety and quality so that the environment, system, test equipment, and disposal (if necessary) are not adversely affected.

Pneumatic Testing

Using compressed air or a compressed non-toxic, non-flammable gas as a test fluid is very strongly discouraged for safety reasons. If failure occurs when using compressed gas, the failure releases the energy applied to stress the piping system, and the energy applied to compress the gas. Such failure can be explosive and extremely dangerous. Pneumatic testing is more dangerous than hydrostatic testing because failure during hydrostatic testing releases less energy.

WARNING – Death or serious injury. Failure during a compressed gas (pneumatic) leak test can be explosive. Additional safety precautions to protect persons are required. Keep all persons a safe distance away from the test section during tests. The test section is to be supervised at all times during the test.

Never use pneumatic testing as a substitute for hydrostatic testing.

Do not conduct pneumatic tests unless the Owner and the Owner's Project Engineer both specify pneumatic testing and approve its use. Pneumatic tests should not be considered unless one of the following conditions exists:

- When the piping system is so designed that it cannot be filled with a liquid.
- When traces of a liquid will compromise the piping system or its intended use.
- When the system is to be low-pressure air tested using ASTM F 1417 *Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air.*

Leak Testing Procedures

This publication covers several hydrostatic and pneumatic leak-testing procedures, and all of these procedures include the information from the beginning of this publication. Read all of this publication before conducting any leak test.

Hydrostatic Leak Testing

This hydrostatic leak test procedure consists of filling, an initial expansion phase, a test phase, and depressurizing. There are two alternatives for the test phase.

Filling

Fill the restrained test section completely with test liquid.

WARNING – Ensure that there is no air trapped in the test section. Failure with entrapped air can result in explosive release. Use equipment vents at high points to remove air.

Initial Expansion Phase

Gradually pressurize the test section to test pressure, and maintain test pressure for three (3) hours. During the initial expansion phase, polyethylene pipe will expand slightly. Additional test liquid will be required to maintain pressure. It is not necessary to monitor the amount of water added during the initial expansion phase.

Test Phase – Alternate 1

Immediately following the initial expansion phase, reduce test pressure by 10 psi, and stop adding test liquid. If test pressure remains steady (within 5% of the target value) for one (1) hour, no leakage is

indicated.

Test Phase – Alternate 2

This alternative is applicable when the test pressure is 150% of the system design pressure. Immediately following the initial expansion phase, monitor the amount of make-up water required to maintain test pressure for one (1), or two (2), or three (3) hours. If the amount of make-up water needed to maintain test pressure does not exceed the amount in Table 2, no leakage is indicated.

Table 2 Test Phase – Alternate 2 – Make-Up Water Allowance

	Make-Up Water Allowance for Test Phase – Alternate 2, (U.S. Gal/100 ft of pipe)		
Nominal Pipe size (in.)	*1-Hour Test*	*2-Hour Test*	*3-Hour Test*
1-1/4	0.06	0.10	0.16
1-1/2	0.07	0.10	0.17
2	0.07	0.11	0.19
3	0.10	0.15	0.25
4	0.13	0.25	0.40
5-3/8	0.19	0.38	0.58
5	0.21	0.41	0.62
6	0.3	0.6	0.9
7-1/8	0.4	0.7	1.0
8	0.5	1.0	1.5
10	0.8	1.3	2.1
12	1.1	2.3	3.4
13-3/8	1.2	2.5	3.7
14	1.4	2.8	4.2
16	1.7	3.3	5.0
18	2.0	4.3	6.5
20	2.8	5.5	8.0
22	3.5	7.0	10.5
24	4.5	8.9	13.3
26	5.0	10.0	15.0
28	5.5	11.1	16.8
30	6.3	12.7	19.2
32	7.0	14.3	21.5
34	8.0	16.2	24.3
36	9.0	18.0	27.0
42	12.0	23.1	35.3
48	15.0	27.0	43.0
54	22.0	31.4	51.7

Depressurizing

At the conclusion of the test, carefully depressurize the test section by the controlled release of test liquid. The test liquid may need to be drained and its disposal may be subject to regulations.

Compressed Gas (Pneumatic) Leak Testing

WARNING – Death or serious injury. Failure during a compressed gas (pneumatic) leak test can be explosive. Additional safety precautions to protect persons are required. Keep all persons a safe distance away from the test section during tests. The test section is to be supervised at all times during the test.

Never use pneumatic testing as a substitute for hydrostatic testing.

High Pressure Procedure

For any test pressure up to 150% of the system design pressure, the pressure in the test section should be gradually increased to not more than one-half of the test pressure, and then increased in small increments until the test pressure is reached. Maintain test pressure for ten (10) to sixty (60) minutes, reduce test pressure to the system design pressure, and hold system design pressure for such time as necessary to examine the system for leaks.
Leaks may be detected by applying soap and water solutions (avoid detergents) or leak detecting liquids to joints and connections, preferably before pressurizing. Bubbles indicate leakage. After leak testing, all soap and water solutions or leak detecting liquids are rinsed off with clean water.
At the conclusion of the test, carefully depressurize the test section by the controlled release of gas from the test section.

Low Pressure Procedure

For gravity flow and low or intermittent pressure applications such as sewer and odor control, leak testing in accordance with ASTM F 1417 is recommended. See the *Performance Pipe DCS Dual Containment System Design Manual* for information about testing dual containment systems.

Other Leak Tests

Initial Service Leak Testing

An initial service leak test may be acceptable when other types of tests are not practical, or when leak tightness can be demonstrated by normal service, or when an opportunity is afforded by performing initial service tests of other equipment. An initial service leak test may apply to systems where isolation or temporary closures are impractical, or where checking out pumps and other equipment allows the system to be examined for leakage prior to full-scale operations.

The piping system should be gradually brought up to normal operating pressure, and held at normal operating pressure for at least ten (10) minutes. During this time, joints and connections may be examined for leakage.

At the conclusion of the test, carefully depressurize the test section by the controlled release of fluid from the test section.

Systems that are Not Suitable for Pressure Leak Testing

Some systems may not be suitable for pressure leak testing. These systems may not be designed or intended for internal pressure such as vacuum systems, or they may contain parts that cannot be isolated, or temporary closures to isolate the test section may not be practical.

Systems that are not suitable for pressure leak testing should not be pressure tested, but should be carefully inspected during and after installation. Inspections such as visual examination of joint appearance, mechanical checks of bolts and joint tightness, and other relevant examinations should be performed.

PERFORMANCE PIPE, a division of Chevron Phillips Chemical Company LP
PO Box 269006
Plano, TX 75026-9006
Phone: 800-527-0662
www.performancepipe.com

July 2001 Supercedes all previous publications

29th July 2 test holes

Site Safety and Health Plan:

Signature: It is understood that Mr. Kerr does not currently work for Bay West. Update signature page to include signature by current CIH or CSP.

1.3: Of the major activities identified in Section 4.0 of the Work Plan, well abandonment is not adequately addressed in this plan. Include additional language in this paragraph and also in the Activity Hazard Analysis.

2.1: Sites regulated under OSHA HAZWOPER, require use of a Certified Industrial Hygienist (CIH) or Certified Safety Professional (CSP), as per ER 385-192 Appendix C (C-2)(b)(4), to write, review and implement SSHPs.

General: The plan does not address site control. Procedures are a listed minimum requirement for SSHPs as per 1910.120 (b)(4)(ii)(F). Include discussion of site control measures that will be used at the site.

5.3: The paragraph indicates that protective systems will be utilized during trenching. Depending on soil conditions, their use may not be required where the depth does not exceed 4 feet. Trenched greater than 4' in depth are considered to be confined spaces. A minimum element of a SSHP includes a discussion of confined space issues (1910.120 (b)(4)(ii)(I). Clarify when protective systems are required and include a discussion of confined space issues.

7.2: Include the location at which VOC concentration will measured and the duration of time at sustained levels is incurred before it triggers required action.

Sampling and Analysis Plan:

General: The requirement for a trip blank and a temperature blank are not addressed in the sampling instructions.

3.3 Define TAT in the acronym list.

3.5 Add a discussion of how the samples will be taken. If the samples will be taken from a water supply system, state at what points the samples will be taken. How long will the system be flushed prior to taking a sample. When sampling VOAs flow should be less then 100 ml/min. VOAs require that there be no headspace in the vial. A table should be made showing sample number, location and QA/QC samples to be taken.

3.5 If the piping system is going to have PVC pipe, a plan should be in place to insure that the cleaning solvents, glue and Vinyl Chloride left in the pipe is properly flushed before the samples are taken.

3.6.3 Temperature should be maintained at $4^{\circ}C \pm 2^{0}$, this is more precise than "approximately $4^{0}C$".

3.6.4 Ice used to cool the sample during shipping should be double bagged. The samples should be sealed in bags as well.

3.6.4 Make reference to Appendix B section 6.13.1. Add the requirements for custody seals to the text.

3.6.5 Refer to Appendix A section 1.3 and Appendix B section 7.

3.6.5 Original CoC should be sealed in a bag and taped to the inside of the lid.

3.6.5 A statement indicating that the temperature of the cooler will be taken immediately upon opening is needed.

4.3 In the precision section, the RPD limit apply to all spiked samples not just those greater then five times the RL.

4.3 Refer to Appendix B Table 5.2 for the recovery limits and the RPD requirements.

4.3 Insert the equation into the section on Completeness. Give the completeness goal of 98% in the text.

4.3 Sensitivity is established by the Minimum Detectable Limit (MDL) not the Reporting Limit. Samples between the MDL and RL should be reported with a J code.

4.4.1 Sample should be collected directly into the sample container not transferred from a collection vessel.

4.4.1 See comment #5.

4.4.1 Refer to Appendix A section 2.0 for shipping procedures.

4.4.2 In the section on split samples the text needs to be more clear that the split samples are being analyzed by the USACE QA laboratory.

4.4.2 Split samples and duplicate samples need to be taken from the same sampling point. This gives 3 results, providing a way to determine which sample was wrong if a discrepancy evolves.

4.4.2 Text needs to be added to the text explaining that VOC samples are not "thoroughly mixed" but are taken directly into the sample container with a minimum of disturbance.

4.9 Data validation will be performed using the USACE CENWK EC-EF Data Quality Evaluation Guidance. This should be reflected in the text.

4.9.2 Text needs to be added to the document indicating that an MS/MSD analysis is required for each batch of samples run.

4.13 Text needs to be added to the document indicating that corrective actions are required whenever LCS, LCSD, MS or MSD are outside the acceptable recovery range or when the RPD is above the stipulated value.

4.13 The USACE PM and Chemist should be contacted whenever any corrective action decisions will be made.

4.13 By the time that the CQCSM has reviewed the data the holding time will be expended. Corrective actions, if taken, need to be performed within the sample holding time.

4.14 Notification of the USACE PM and Chemist is required whenever QC issues arise.

Table 4-2 cis-1,2-Dichloroethene is incorrectly included in the table as cis-1,2-Dichloroethane; trans-1,2-Dichloroethene is incorrectly included in the table as trans-1,2-Dichloroethane.

Appd. A 1.2 These are blind duplicates. The samples should be numbered such that it is not possible to discern which sample has been duplicated. Time and sampling site information should also not give clues as to which sample has been duplicated.

Appd. A 2.0 The address to the USACE ECB lab should be added as:

Attn. Ms. Laura Percifield
USACE ECB Laboratory
420 S. 18th St.
Omaha, NE 68102

PRECONSTRUCTION CONFERENCE AGENDA
Water Distribution and Well Installation
Fort Riley, Kansas

CONTRACT NUMBER: DACW41-95-D-0022 D.O. 0012
CONTRACTOR: Bay West, Inc.
CONTRACT AMOUNT: $279,466.80

Mentioned $112K to be billed ASAP Done by 16 Aug

1. OPENING REMARKS

   a. Introduction

   b. Purpose

   c. Government Organization
      (1) Contracting Officer (CO)
      (2) Administrative Contracting Officer (ACO)
      (3) Area Engineer & Resident Engineer
      (4) Project Engineer
      (5) Office Engineer and Quality Assurance Staff
      (6) Address and Phone Numbers of Area Engineer

      Address: Fort Riley Area Office
               P.O. Box 2189
               Fort Riley, Kansas 66442
        Phone: (785) 239-6461
          FAX: (785) 784-2105

2. Commencement, Completion of Work, (SC-1), Liquidated Damages (SC-2)

   Duration of Contract:
   Liquidated Damages:
   NTP Acknowledged:
   Original Contract Completion:

3. SAFETY

   a. Accident Prevention (EM385-1-1, Table 1-1)

   b. Safety Program
      (1) Supervisor Meetings (EM 385-1-1)

      (2) Employee Meetings (EM 385-1-1)

   c. Accident Prevention Pre-Work Plans
      (1) Safety Manual EM 385-1-1
      (2) Hard Hats
      (3) GFCI
      (4) Crane Safety
      (5) Compliance with OSHA

   d. Man-Hour Exposure Reports (Form Number 1254) and Injury Log

   e. Hazardous Material Identification & Material Safety Data

   f. Unexpected Hazardous Substances

4. Quality Control

   a. Coordination Meeting

   b. Material and Workmanship

   c. Superintendence by the Contractor

   d. Permits and Responsibilities

   e. Inspection of Construction

   f. Warranty of Construction

5. Local Policies/Regulations

   a. Availability and Use of Utility Services

   b. Identification of Employees

6. Administrative Work

   a. Project Record Drawings & Surveys

   b. Purchase Orders

   c. Kansas Sales and Use Tax Corps to supply to Phil Dula

   d. Required Insurance

   e. Payrolls and Wage Determinations

   f. Subcontracting Information (SF 1413)

   g. Measurement and Payment
      Payment to Subcontractors

   h. Project Schedules

   i. Identification of Contractor Correspondence

7. Miscellaneous

   a. Differing Site Conditions

   b. Modifications Proposals - Price Breakdown

   c. Changes (20-day Notice Clause)

   d. Equipment Ownership & Operating Expense Schedule

e. Value Engineering

f. Time Extension for Unusually Severe Weather

g. Performance of Work by Contractor

h. Contractor Performance Appraisal
   (1) Quality Control
   (2) Effectiveness of Management
   (3) Timeliness of Construction
   (4) Compliance with Labor Standards
   (5) Compliance with Safety Standards

8. General Discussion

Fort Riley Review Comments for
Water Distribution System Off-Post FFTA-MAAF
Revised System Design and Scope of Work
April 2002

Scope of Work

Objective

1. The stated objective indicates that two off-post water supply wells will be installed, however, there is no discussion of the procedures necessary to complete installation of the M-1 Replacement Well in the *Description of Work* section, only plugging and abandonment of the existing M-1 well is discussed. Please clarify and/or modify to address M-1.

Description of Work

Section 3.3

2. This section mentions the re-designed distribution system will provide water service to the old house structure; it may be useful to indicate that the old house structure was identified as a concession stand [one of three: old house, pit area, and grandstand area] per Mr. Thompson during the 17 December 2001 site visit.

Section 3.4

3. In this section, the casing is incorrectly identified as "casting".

4. This section includes brief mention of equipment removal from well R-4, however, it may be useful to expand the discussion regarding decontamination and disposal procedures for the removed casing and any liquid derived waste.

Section 3.6

5. Discussion of the new standpipe is included, however, the section does not mention the utilization of the standpipe as a water truck station nor the location change from the existing station (from the western portion of track to the eastern portion) as identified on the *Site Plan* figure.

Section 3.8

6. This section states that a shelter will be provided, however, there is no further discussion of the shelter nor any detail in the technical drawings and specifications.

7. Indication that the 525-gallon capacity pressure tank will be "newly" installed should be included to avoid confusion with the hydro-pneumatic tank identified as existing on the *Existing Conditions* figure.

Section 5 - Project Management

8. The point-of-contact information should be revised. Richard Shields and Oral Saulters are the POCs for the Fort Riley Directorate of Environment and Safety.

Section 6 - Report

9. This section indicates that the project completion report will be submitted in twelve (12) copies for the Draft and seventeen (17) for the Final. The number of copies planned for

submittal does not match the number identified in Section 4 *Document Distribution* [nine (9) and thirteen (13)], please clarify.

10. This section does not identify the submittal of a Work plan as identified in section 1.3.2.1 of the Specifications (Section 02521 *Water Well Construction*).

Plans and Detail Drawings

11. The *Existing Conditions* figure (C-1.1) does not identify the following: 1) Well R-4 on the figure, 2) two of the three concession stands (old house structure nor pit area, only the grandstand concession stand is included), 3) the pipelines from well R-1 to the grandstand concession stand and the pipelines from R-1 to the pit area tank.

12. The *Site Plan* figure (C-3.1) does not include the pipeline from the pit area tank to the grandstand concession stand.

13. The *Details* technical drawing (C-6.1) does not include any specifications/details for the new tank nor the shelter.

14. The *Details* technical drawing (C-6.1) does not include the diameter for either of the replacement wells (specified to be 5-inch inside diameter for M-1 Replacement and 8-inch inside diameter for the Racetrack Replacement) as identified in section 1.3.9.2 *Well Design* (Section 02521 *Water Well Construction*) of the specifications (page 02521-5).

Specifications

15. Section 01330 *Submittal Procedures*, section 3.5.1 *Procedures* (page 01330-3) indicates that five (5) copies of all submittals shall be submitted for approval. This does not agree with the number of copies identified in sections 4 *Document Distribution* and 6 *Report* (see comment 9 above).

16. Section 02510 *Water Supply Systems*, section 1.3 *Related Equipment*, "related" is misspelled (page 02510-3).

17. Section 02521 *Water Well Construction*, section 3.9 *Abandonment and Plugging of the Existing Well* (page 02521-11), only three well are identified for plugging and abandonment procedures (M-1, R-1, and R-2), however, procedures for R-3 and R-4 should be incorporated.

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July 11, 2002

United States Army Corps of Engineers
Kansas City District
ATTN: CENWK-PM-ED/Mr. Rick Van Saun
601 East 12th Street
Kansas City, MO 64105-2896

RE: Work Plan, Site Safety and Health Plan, Sampling and Analysis Plan, and Contractor Quality Control Plan for Contract No. DACW41-95-D-0022, Delivery Order No. 0012. Water Distribution and Well Installation, Off-Post Near the Former Fire Training Area, Marshall Army Airfield, Ft. Riley, Kansas

Dear Mr. Van Saun:

Please find enclosed six copies of the referenced submittal. Three copies will be hand delivered to the USACE Resident Engineer, Alan Gerth on July 12, 2002. As discussed during negotiations we utilized the existing USACE approved SSHP for this project but did add health and safety information regarding Lyme Disease and Heat Stress as Attachments 8 and 9. As discussed during negotiations as well, due to the time critical project schedule for this project we would appreciate USACE approval by July 16, 2002 as plans are in place to conduct the Pre-Construction Meeting at Ft Riley on July 17, 2002 and initiate site activities. Any required revisions can be addressed via an addendum to these plans.

If you require any additional information or have questions regarding this submittal please call me at (913) 663-2915.

Sincerely

Philip Dula P.G., CHMM
Kansas City Office Manager

Enclosures:
Work Plan, SSHP, SAP, &CQCP
Transmittal Form 4288

Cc:
Alan Gerth

SUBMITTAL REGISTER																							CONTRACT NO. DACW41-95-D-0022
TITLE AND LOCATION OFF-POST ALTERNATE WATER SUPPLY, FORMER FIRE TRAINING AREA, FORT RILEY, KANSAS												CONTRACTOR BayWest											SPECIFICATION SECTION 02521
				TYPE OF SUBMITTAL										CLASSI-FICATION			CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION		
TRANSMITTAL NUMBER	ITEM NUMBER	SPECIFICATION PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	DATA	DRAWINGS	INSTRUCTIONS	SCHEDULES	STATEMENTS	REPORTS	CERTIFICATES	SAMPLES	RECORDS	INFORMATION ONLY	GOVERNMENT APPROVAL	REVIEWER	SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	CODE	DATE	SUBMIT TO GOVERNMENT	CODE	DATE	REMARKS
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p*	q	r	s	t	u	v	w	x	y
1		1.3.2.1	Work Plan	x										GA	PE	7/12/02	7/16/02	7/16/02						
		1.3.2.2	Test Reports						x					GA	PE									
		1.3.2.3	Records									x		GA	PE									

ENG FORM 4288, (KCD ELECTRONIC VERSION, Feb, 94) *EP=ENG DIV, EP-D GL=ENG DIV, EP-GL RE=RESIDENT ENG AE=ARCHITECT/ENG FIRM

SUBMITTAL REGISTER																								CONTRACT NO. DACW41-95-D-0022
TITLE AND LOCATION OFF-POST ALTERNATE WATER SUPPLY, FORMER FIRE TRAINING AREA, FORT RILEY, KANSAS													CONTRACTOR BayWest											SPECIFICATION SECTION 02510
				TYPE OF SUBMITTAL									CLASSI-FICATION			CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION			
TRANSMITTAL NUMBER	ITEM NUMBER	SPECIFICATION PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	DATA	DRAWINGS	INSTRUCTIONS	SCHEDULES	STATEMENTS	REPORTS	CERTIFICATES	SAMPLES	RECORDS	INFORMATION ONLY	GOVERNMENT APPROVAL	REVIEWER	SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	CODE	DATE	SUBMITTAL TO GOVERNMENT	CODE	DATE	REMARKS
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p*	q	r	s	t	u	v	w	x	y
/		1.4	Manufacturer's Data	x										GA	PE	7/12/02	7/16/02	7/22/02						Incomplete submittals will be rejected.
		1.4	Satisfactory Installation					x						FIO	RE									
		1.4	Bacteriological Disinfection						x					FIO	RE									

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SUBMITTAL REGISTER																							CONTRACT NO. DACW41-95-D-0022
TITLE AND LOCATION OFF-POST ALTERNATE WATER SUPPLY, FORMER FIRE TRAINING AREA, FORT RILEY, KANSAS													CONTRACTOR BayWest										SPECIFICATION SECTION 02316
				TYPE OF SUBMITTAL									CLASSI-FICATION			CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION		
TRANSMITTAL NUMBER	ITEM NUMBER	SPECIFICATION PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	DATA	DRAWINGS	INSTRUCTIONS	SCHEDULES	STATEMENTS	REPORTS	CERTIFICATES	SAMPLES	RECORDS	INFORMATION ONLY	GOVERNMENT APPROVAL	REVIEWER	SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	CODE	DATE	SUBMIT TO GOVERNMENT	CODE	DATE	REMARKS
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p*	q	r	s	t	u	v	w	x	y
		1.3	Field Density Tests						x				FIO		RE									
		1.3	Testing of Backfill Materials						x				FIO		RE									

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