64548

ENSR

ENSR Consulting and Engineering
35 Nagog Park
Acton, MA 01720
(508) 635-9500
FAX (508) 635-9180

November 30, 1993

ENSR Ref. No: 7218-001-210
ENSR Doc. No: 22-JMB-105

Mr. Clifford Crooke
Environmental Specialist
Government of the US Virgin Islands
Department of Planning and Natural Resources
Division of Environmental Protection
Suite 231, Nisky Center
St. Thomas, U.S.V.I 00802

RE: Assessment/Remediation Work Plan
Western Auto, St Thomas, USVI

Dear Mr. Crooke:

On behalf of Western Auto, ENSR Consulting and Engineering (ENSR) has prepared this work plan in response to requirements of the Department of Planning and Natural Resources (DPNR) to develop an assessment and remediation plan at the above referenced site. The objective of this work plan is to investigate the nature and extent of petroleum product that was observed, during removal of tanks, in the vicinity of the Western Auto store. A tank removal/closure plan was submitted by ENSR, dated August 1993 and subsequently approved by DPNR. The work outlined by this Assessment/Remediation Work Plan is afforded in the provision for additional sampling, Section 3.0 of the tank closure plan for this site. A description of the Western Auto site and the UST closure activities can be found in that plan.

1.0 INTRODUCTION

During the tank removal/closure work conducted in October 1993, two underground storage tanks (USTs) and a grease trap (oil/water separator) were removed from the ground. Many of the pertinent observations made during the work will be reported separately in the tank closure report. Further issues are addressed within the attached report of Phil Pimentel. The presence of an oily waste was observed within a gravel bed at a depth of approximately 1-1.5 feet below ground surface (bgs). Amongst other plumbing pipes a 4 inch diameter PVC pipe was also found within the gravel layer approximately 10 feet from but oriented parallel to the building, generally north to south. This pipe has a yet to be confirmed origin but is believed to be used to transport drainage water from under the old "Barkers" building within the Plaza to a cistern tank installed and operated by Four Winds Plaza. The pipe was inadvertently broken during tank excavation and it was observed to contain an oily product floating on the water which flowed from the pipe. Samples have been collected of this product and results are pending. This pipe was also observed to have two loose joints, one glued slip coupling, and another unglued slip coupling.

The work outlined by this plan proposes a method to attempt to identify the transport and source of the product discovered in the gravel and if possible within the pipe, to evaluate the possible source of oil product in the 4 inch diameter pipe, and determine the nature and extent of oil contamination. A plan for remediation of contaminated gravel/soil is also discussed.

2.0 BACKGROUND

Western Auto leases property on the Four Winds Plaza, and is in the business of selling automotive parts and accessories. Presently three service bays are used for installation of automotive parts and accessories. It is reported that in the late 1970's and early 1980's Western Auto performed the service of changing oil for its customers. We are informed that the Western Auto premises and the tanks and oil/water separator used by Western Auto were installed by the landlord.

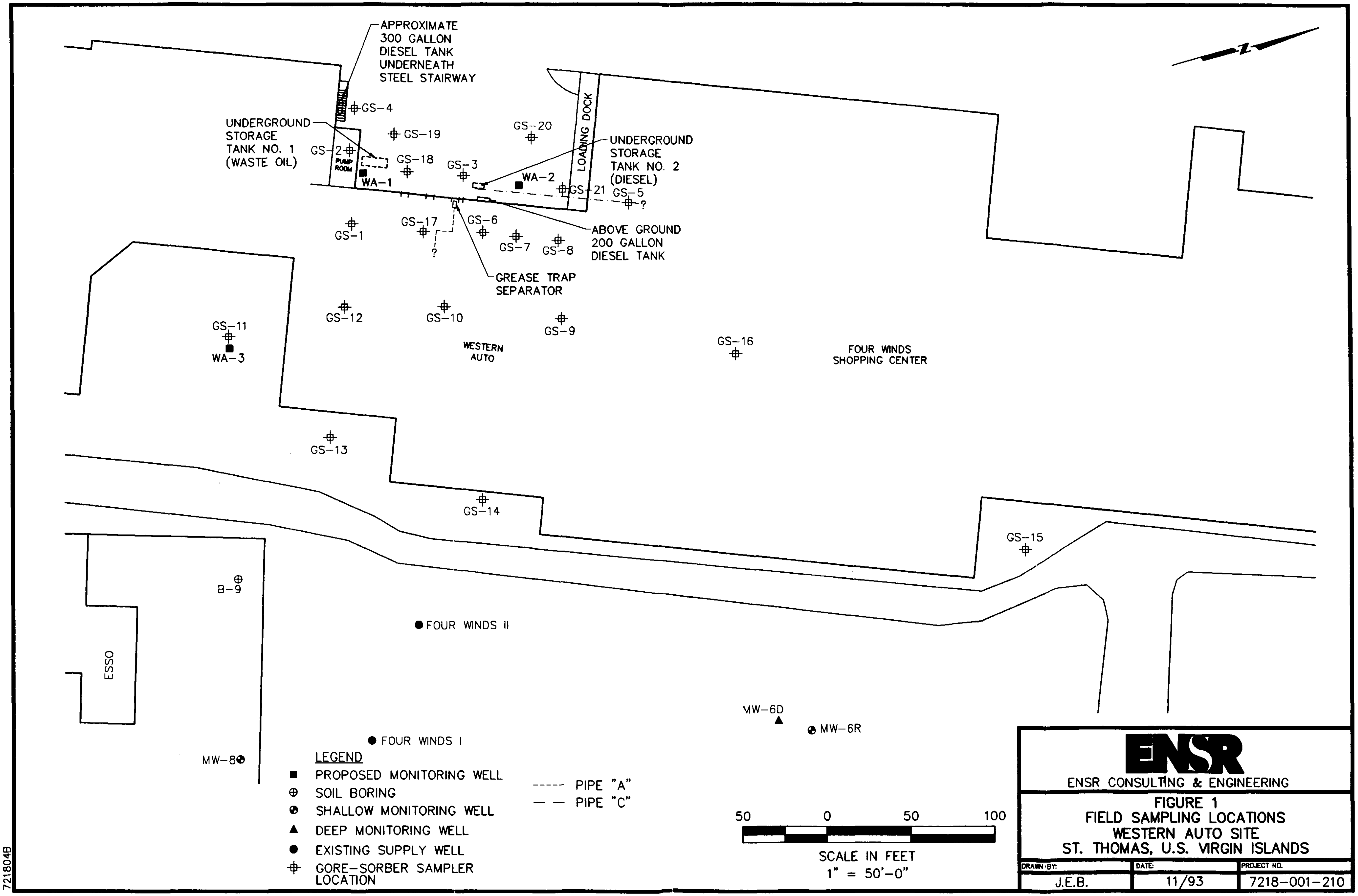
This work plan has been developed based upon field observations made during tank closure and removal activities. Data reviewed includes sampling results of the contents of the former UST's, soil and liquid sampling results by ENSR and Caribbean Hydro-Tech, Inc.. In addition to these data, two additional investigative activities were conducted as part of the UST closure program and outlined in a letter to DPNR dated November 12, 1993, a copy of which is attached. These tasks include; first, tracing underground plumbing piping to investigate potential source areas, and second, a soil screening survey to aid in investigating the distribution of oil in the subsurface. The results of these tasks will be utilized for site assessment information and in the developement of a final remediation plan.

The following factors have been considered in the formulation of the proposed Site Assessement/Remediation work plan:

- The waste oil tank was observed to contain three holes of less than 0.5-inch diameter. The diesel fuel tank was observed to be badly corroded with extensive pitting along with numerous holes. The grease trap (oil/water separator) was filled with cement and found to be intact with no apparent leaks or staining around the adjacent concrete floor.

- During the initial excavation of the waste oil tank a 4-inch diameter PVC pipe was broken and a mixture of water and a dark product was discharged from the pipe into the waste oil tank pit. The location of the pipe, labeled Pipe C, is depicted on Figure 1.

- During excavation of the diesel oil tank, contaminated soil was excavated to a depth of approximately 8 feet below ground surface (bgs).



APPROXIMATE 300 GALLON DIESEL TANK UNDERNEATH STEEL STAIRWAY
UNDERGROUND STORAGE TANK NO. 1 (WASTE OIL)
PUMP ROOM
UNDERGROUND STORAGE TANK NO. 2 (DIESEL)
LOADING DOCK
ABOVE GROUND 200 GALLON DIESEL TANK
GREASE TRAP SEPARATOR
GS-1
GS-2
GS-3
GS-4
GS-5
GS-6
GS-7
GS-8
GS-9
GS-10
GS-11
GS-12
GS-13
GS-14
GS-15
GS-16
GS-17
GS-18
GS-19
GS-20
GS-21
WA-1
WA-2
WA-3
WESTERN AUTO
FOUR WINDS SHOPPING CENTER
B-9
ESSO
FOUR WINDS II
FOUR WINDS I
MW-8
MW-6D
MW-6R
Z
LEGEND
PROPOSED MONITORING WELL
SOIL BORING
SHALLOW MONITORING WELL
DEEP MONITORING WELL
EXISTING SUPPLY WELL
GORE-SORBER SAMPLER LOCATION
PIPE "A"
PIPE "C"
50 0 50 100
SCALE IN FEET
1" = 50'-0"
ENSR
ENSR CONSULTING & ENGINEERING
FIGURE 1
FIELD SAMPLING LOCATIONS
WESTERN AUTO SITE
ST. THOMAS, U.S. VIRGIN ISLANDS
DRAWN BY: J.E.B.
DATE: 11/93
PROJECT NO. 7218-001-210
721804B

TUT 005 0267

- A total of approximately 100 cubic yards of contaminated soil and gravel was excavated from the area behind the Western Auto service bays. The soil is stockpiled in a polyethylene lined wooden containment box constructed onsite.

- Lithologies encountered during excavation of the diesel tank include native fill (silty clay), overlying a coarse gravel layer from a depth of approximately 0.5 to 5 feet bgs, and brown to green clay from a depth of 5 to 8 feet bgs.

3.0 GROUNDWATER MONITORING

3.1 Monitoring Well and Piezometer Installation

To evaluate if groundwater has been impacted and to determine the groundwater elevation and flow direction, ENSR proposes the installation, sampling and survey of three monitoring wells in the vicinity of the Western Auto store. The proposed locations of these wells are depicted on Figure 1. One monitoring well will be installed in the apparent downgradient immediate direction of the tanks (WA-1), another monitoring well will be located upgradient to the tanks (WA-2) and the third monitoring well (WA-3) will be located in the court yard area south and east of the former UST's approximately 150 feet in the apparent downgradient direction.

The field investigation will include the collection of a minimum of one soil sample per monitoring well location for laboratory analyses. These wells will be constructed to intersect the water table, and will be approximately 15 to 20 feet deep. The actual depth of each well will be determined in the field, based on conditions encountered during drilling.

The borings will be advanced using a air rotary or air hammer methods. Continuous split spoon soil samples will be obtained from the soil borings to refusal. The soil samples will be visually inspected and classified in the field by an ENSR geologist or environmental scientist. The samples will also be field screened for volatile organic compounds (VOC) with a photoionization detector (PID) using a headspace technique. Samples will be placed in appropriate laboratory prepared jars and labelled with the date, time, sample location, sample depth, and the name of the sampler. One soil sample will collected at each boring from the level of the water table for analysis for TPH (by GC/FID). Any sample collected which exhibits evidence of contamination (instruments, visual color, odors) will be submitted for laboratory analyses of BTEX and TPH.

The wells will be installed under the direct supervision of an ENSR geologist or environmental scientist. A double cased drilling method will be utilized to ensure that contamination is not carried downward and introduced into the bedrock unit. A 10-inch diameter boring will be advanced to the top of the bedrock elevation. Steel casing will be grouted into the borehole to effectively seal-off the overburden soils from the bedrock unit below. After allowing adequate time for the grout to set, drilling will proceed with a 6-inch diameter air rotary or air hammer system to a depth of no less than 10 feet below the groundwater surface.

The wells will be constructed of 4-inch I.D. flush joint PVC. A factory slotted No. 10 slot (0.01 inch), or other appropriately sized PVC screen will be installed at the water table. The screens will be sand packed to at least six inches above the top of the well screen, and a bentonite seal placed above the sand. The annuls will be grouted with a cement-bentonite grout to the ground surface. A steel protective casing with locking cap will be installed to prevent the introduction of any foreign material into the well.

The supervising ENSR geologist or environmental scientist will prepare the geologic columns and ensure that the well drilling and installation specifications are followed.

After completion of the installation, the wells will be developed until the pH, conductivity and temperature of the discharging groundwater stabilizes. The supervising geologist or environmental scientist will make the final field decision as to the completion of development. The wells will be allowed to stabilize to normal in-situ conditions, generally one week, prior to obtaining a groundwater sample.

The elevations and locations of the monitoring wells will be surveyed and groundwater elevation measurements obtained in order to verify the assumed groundwater gradient and flow direction.

Prior to installation of the monitoring wells ENSR will obtain the necessary well installation permit from DPNR.

3.2 Groundwater Sampling and Analyses

After completion of well development and groundwater stabilization, groundwater samples will be obtained by an ENSR geologist or environmental scientist from the newly installed wells. Prior to sampling, the depth to groundwater will be measured, and the well will be purged of three to five well volumes of water in accordance with the United States Environmental Protection Agency (USEPA) sampling guidelines. Temperature, specific conductance and pH readings will be taken repeatedly during well purging to ensure that a representative groundwater sample is collected. The initial sample will be collected using a disposable teflon bailer or equivalent.

ENSR

The groundwater sampling will be conducted in accordance with ENSR Standard Operating Procedures (SOP), a copy of which is included as an attachment. Samples will be placed in the appropriate laboratory prepared jars and labeled with the date, time, sample location, and name of the sampler. Chain-of-custody procedures will be followed during the sampling and shipping of samples. Samples will be submitted to the laboratory at the end of each field day.

One groundwater sample from each well will be submitted for analysis for Target Compound List (TCL) for Volatile Organic Compounds, Semivolatile Organic Compounds, and Total Petroleum Hydrocarbon (TPH) analyses by EPA Method Modified 8100. All samples will be analyzed by a certified laboratory. A normal laboratory tumaround time of three to four weeks has been assumed.

4.0 SOIL SAMPLING, EXTRACTION AND DISPOSAL

Based on DPNR's requirements, it is the intent of Western Auto to excavate and dispose of the contaminated gravel and soil, for which it may be responsible, to prevent potential migration to the groundwater. At this time the source of the product observed to be present within the gravel layer located in front of the Western Auto service bays is unknown. This contaminated material will be excavated and stockpiled with other contaminated material. The need for additional remediation of site soils beyond that which has been identified will be determined based upon the results of soil sampling results.

4.1 Soil Sampling

The results of the soil samples that have been collected as part of the tank removal work plan will guide the need for additional soil sampling. In addition, a soil screening survey has been conducted within the vicinity of the Western Auto store for the purpose of identifying appropriate locations for additional shallow soil sampling, if necessary. The survey consists of a grid of passive sorbent collection (Gore Sorbers) devices installed in the vicinity of the former UST's, former grease trap separator and the associated pipelines. The Gore-Sorber locations are depicted on Figure 1. Based upon the results of this survey additional soil samples will be collected to determine the extent of Total Petroleum Hydrocarbons (TPH) present in the soil surrounding the Western Auto site. The number of soil samples required to delineate the extent of contamination will vary based on the area identified by the screening survey. It is not possible to determine the sampling locations at this time. Prior to sampling, ENSR will prepare and submit a map, indicating soil sample locations, to DPNR prior to sample collection.

The soil sampling will be conducted in accordance with ENSR Standard Operating Procedures (SOP), a copy is included as an attachment. Samples will be placed in the appropriate laboratory prepared jars and labeled with the date, time, sample location, and name of the sampler. Chain-of-custody procedures will be followed during the sampling and shipping of samples. Samples will be submitted to the laboratory at the end of each field day.

4.1.1 Remediation Objective

At a minimum soil samples will be analyzed and compared against an established remediation objective for confirmation that remaining soil contains TPH concentrations less than the established remediation objective. It is proposed that a remediation objective of 50 ppm TPH, as determined by EPA Modified Method 8100 by GC/FID, be used for site soil. All soil/gravel with TPH levels above this threshold concentration will be excavated from the Western Auto site and stockpiled along with other contaminated soil for characterization.

4.1.2 Characterization of Stockpiled Soil and On-Site Drum Contents for Disposal

A total of approximately 100 cubic yards of contaminated soil is currently stockpiled on-site and will be characterized, along with any additional excavated soil and contents of on-site drums, for disposal or treatment. Characterization will be conducted as follows:

- Toxicity Characteristic Leaching Procedure (TCLP)- one composite sample will be prepared from a collection of 3 grid point locations within the soil pile. One composite sample of the liquid contents of the on-site drums will be collected.

- TPH - the soil containment box will be divided, for the purpose of establishing a sample grid, into 3 areas. A composite sample will be collected from 5 locations within each area for a total of 3 samples. A sample of the liquid contents of each on-site drum will be collected. The samples will be analyzed by a certified laboratory for TPH by EPA Modified Method 8100 by GC/FID.

Based upon the results of this characterization the following actions are proposed:

1) If the TCLP results are negative, and TPH results are less than 50 ppm; then the soil will be taken to a local landfill for disposal.

2) If the TCLP results are positive, then the soil will be disposed of in a RCRA subtitle C landfill.

3) If the TCLP results are negative, and TPH results are greater than 50 ppm; then the soil will be either transported off St. Thomas for disposal, or treated to less than 50 ppm and then disposed of at a local landfill.

The liquid/sludge contained in the on-site drums will be consolidated and then transported to an appropriate disposal (POTW/RCRA) facility located either on St. Thomas or the mainland.

5.0 REPORT

An interim report will be filed with the DPNR describing the results of the groundwater and soil sampling. The report will summarize and evaluate the results of the laboratory analysis, describe additional soil excavations performed and outline any additional remedial actions required (if any) for soil or groundwater at the Western Auto site.

For any material disposed of off the island of St. Thomas, ENSR will provide copies of each manifest to DPNR as part of the final report.

If there are any questions or comments, please contact Bill Sarriera at (809) 753-9509 or John Bierschenk at (508)635-9500.

Sincerely,

John Bierschenk
Senior Applications Engineer

William Sarriera
General Manager, Puerto Rico

cc: John Coon - Amerling & Burns
Bill Chapman - Coon & Stanford
Don Galya - ENSR
Line Kwan - USEPA Superfund Division

ATTACHMENT

PETROLEUM
INVENTORY
MANAGEMENT

205 Western Avenue
Augusta, Maine 04330
207-622-4192

REMOVAL REPORT OF TWO UNDERGROUND STORAGE TANKS AT FOUR WINDS PLAZA, ST. THOMAS, U.S. VIRGIN ISLANDS

John Coon, Esq. asked me to witness the excavation and removal of two underground storage tanks located at Western Auto, Four Winds Plaza, St. Thomas, U.S.Virgin Islands. The removals began the morning of the 19th of October 1993 and the following is my report on those events.

The ENSR Removal Plan specified the removal of a 2000 gallon waste oil tank and a 500 gallon diesel tank. The diesel tank supplied a back up generator and the waste oil tank was in service only during the period of time that Western Auto performed automotive oil changes. We are told that the diesel tank never performed properly and was replaced with an aboveground storage tank. The waste oil tank had been out of service since approximately 1982 when automotive oil change service was discontinued.

The waste oil tank removal was started first. The cement pad was removed and piping uncovered. Piping runs are discussed later in this report. After removing the cement pad there appeared to be natural soil for 18 inches (clay, rocks, and sand) and then about 12 inches of gravel. There was a black oily substance which seemed to be trapped in the gravel only. We found several discrepancies in the actual installation vs the original plans for the installation and since the removal plan was based on original plans there were changes to the removal plan.

Following is a description of what was found as it was uncovered:

The waste oil tank had a cement pad with a manway in the top. Inside the manway around the pipe appeared to be hard pack clay. The vent pipe and the drain oil pipe ran across the top of the tank over to the building and then up the side of the building. The fill pipe ran along the side of the vent pipe to the building and then under the foundation and up through the floor to a fill box inside the building. The fill pipe had a Y joint at the tank. The other side of this Y joint connected to a pipe that ran across the front of the building (work bay side) and at the other end of the building connected into an oil water separator.

During the excavation a 4" PCV pipe was uncovered approximately four feet away from the tank and parallel to the tank. The backhoe operator accidently put a hole in the pipe and that allowed water mixed with a black oily substance to flow out of the pipe. The water was not under pressure but rather seemed to be gravity fed. As we repaired the pipe, we saw not only water but globs of a black oily substance flowing through the pipe. This pipe was backfilled with gravel and as previously mentioned anywhere there is gravel there seems to be contamination. The contamination was underneath the pipe. I was told that this pipe led from an underground spring in the north to a cistern in the south.. This pipe had been capped at the cistern end. Four Winds employees at this time capped the pipe at the diesel excavation. In addition to the 4" pipe, we uncovered at 6" PVC pipe which ran parallel to the tank and was attached to roof drains. The roof drain pipes were ~~capped~~ at the roof. The 6" pipe had oil underneath it and the contamination appeared to be coming from under the building.

We further excavated the site exposing more of the tank. Approximately 18" below grade we found more gravel and black oily substance which seemed to be coming from under the building and from the north. I did not see any holes in the tank at this time. When the backhoe operator attempted to rock the tank so it could be tipped to the fill end in order to pump out what appeared to be oil and water in the tank the stress caused a hole in the side of the tank. This appeared to be a corrosion induced weak area. After the pump out of product, the tank was removed and I began my examination of the tank.

There were four point corrosion holes and numerous areas of point corrosion that had not completely penetrated the steel. The four holes and most of the point corrosion were limited to the end of the tank marked with the manufacturer's stamp. The manufacturer was Pelluso Iron Works,750 gallon tank, numbered 1966. The welds at both ends of the tank were solid. The bottom of the tank had a considerable amount of surface corrosion but no holes. The end of the tank opposite the manufacturers stamp had surface corrosion and a chip in the coating. I could not find any additional perforations.

Comparison of installation facts versus original installation specifications of the waste oil tank:

Fact: Buried in natural soil (clay, sand, rocks). Spec: Bury in sand.

Fact: Tank buried parallel to building. Spec: Bury at right angle to building.

Fact: 2" PVC oil drain pipe Spec: 2" galvanized oil drain pipe.

Fact: 2" PVC vent pipe. Spec: 1/2" galvanized vent pipe.

Fact: 4" PVC bushings in top of tank. Spec: 4" galvanized bushings in top.

Fact: Drain box attached to the wall, no floor drain. Spec: Floor drain inside bldg.

Fact: Oil water separator connected to tank. Spec: Do not connect floor drain to waste oil tank.

Fact: 750 gallon tank. Spec: 500 gallon tank.

In my opinion, this waste oil tank was improperly installed.

The diesel tank removal began with the removal of the concrete pad at the same time we removed the concrete from the front area of the work bays. The concrete all seemed to have been poured at the same time. As we began to uncover the tank we found four piping runs. All the piping had been cut, confirming that this tank had been out of service for some time.

At the south end of the tank in the first bung there was 2 1/2" black iron fill pipe that ran up through the concrete approximately two feet from the building and was cut off at the top of the concrete walkway. The second pipe appeared to be a one inch vent pipe made of PVC. The third pipe had a brass 90 degree elbow coming out of the tank. Laying on the ground next to the 90 degree elbow was a brass fitting on a piece of 1/2" copper tubing that was attached to a rubber hose. This went through a piece of PVC pipe and in turn attached to the copper tube that went into a black iron pipe that went through the concrete walkway and was cut off at the base of the building. At the fitting going into the tank there was a suction stub that went down into the tank and terminated approximately 4" from the bottom. The fourth and fifth bungs had nothing attached. It appeared that at one time the black iron pipe from the building to the top of the tank had two 1/4" copper lines coming out that appeared to have been attached at the tank. Bung 4 had a suction tube that went into the tank about 12 inches. Bung 5 did not have a suction stub.

As we further uncovered the tank, we encountered gravel with the black oily substance. There were two corrosion holes in the top of the tank. Upon removing the first bucket of soil on the north end of the tank, we found that the tank end was completely rusted and the tank was full of water and oil. The tank was pumped out and the excavation continued. Both ends of the tank were rusted to the point that I could look inside the tank. The tank was buried in natural soil using natural soil for backfill. The soil in this area is a combination of sand, clay, and rocks. I could not find any evidence that the tank had been isolated from the building or the back up generator. These two factors, improper backfill and isolation, were major causes of the deterioration of the tank. The 500 gallon tank, although UL listed, was constructed of a lighter gauge steel than the waste oil tank. In my opinion, this tank was improperly installed and improperly piped.

Signed: P. L. Pimentel Dated: October 29, 1993
Philip L. Pimentel

ENSR

ENSR Environmental Consulting
Mercantile Plaza Building
Suite 307B
Ponce de Leon Avenue
Hato Ray, Puerto Rico 00918
(809) 753-9509
(809) 753-9566/FAX

November 12, 1993

ENSR Ref. No: 7218-001-210
ENSR Doc. No: 22-JMB-103

Mr. Clifford Crooke
Environmental Specialist
Government of the US Virgin Islands
Department of Planning and Natural Resources
Division of Environmental Protection
Suite 231, Nisky Center
St. Thomas, U.S.V.I 00802

RE: Additional Activities for UST Closure
Western Auto, St Thomas, USVI

Dear Mr. Crooke:

The purpose of this letter is to inform the Department of Planning and Natural Resources (DPNR) that ENSR, on behalf of Western Auto, is planning to undertake two additional activities at the referenced site. The purpose of this work is to complete the underground storage tank (UST) closure plan which has been previously submitted to and approved by DPNR. This work should be considered as contingency work necessitated by observations made during the UST removal operation and is separate from site investigation/remediation work plan which Western Auto has agreed to provide to you by November 30, 1993. In order that DPNR is informed of the two activities to be performed they are described briefly below. It is anticipated that this work will be begun during the week of November 15.

Task 1: Underground line tracing: Two PVC pipelines were identified during the UST closure work that must be traced due to their association with the two UST's. The first pipe was the water discharge line connected to the oil/water separator, and the second is a 2-inch PVC pipe, of unidentified use, that was inadvertently severed by excavator during the waste oil tank removal. These pipes will be traced with an electronic device attached to the end of a sewer/drain cleaning snake. The device emits a signal that is detected by a hand-held receiver at the surface. The lines will be traced as far as feasible with this technique and based upon this information task 2 will be conducted.

Task 2: Soil screening: A grid of passive sorbent collection devices (sorber) will be installed in the vicinity of the former UST's, former oil/water separator, the pipelines (identified by task 1), and other potential source areas. This grid will be established on approximately a 30 foot spacing (total of between 15-20 sorbers) to provide adequate coverage, the results will

ENSR

assist in understanding the distribution of oil and aid in completion of the tank closure program. The sorbers will be installed with hand held tools, left in place for about one week and then removed and analyzed in a laboratory. These sensors will detect the presence of volatile and semivolatile compounds, the results will be expressed as relative concentrations and presented on a site map.

If you have any questions regarding these activities please contact us.

Sincerely,

John Bierschenk
Applications Engineer

John Bierschenk for
William Sarriera
General Manager

cc: John Coon - Amerling & Burns
Bill Chapman - Coon & Stanford
Don Galya - ENSR
Line Kwan - USEPA Superfund Division

ENSR STANDARD OPERATING PROCEDURE

Number: 7110 Date of Issue: 1st Quarter, 1984

Title: Surface Soil Sampling

Organizational Acceptance	Authorization	Date
Originator	Charles S Martin	3/2/84
Department Manager	Arthur S Fagan	3/2/84
Divisional Manager	Edgar Morse	3-2-84
Group Quality Assurance Officer	[illegible]	3/2/84
Other		

Revisions	Changes	Authorization	Date
1	Update	[illegible]	3/2/84
		CEM	3/2/84
		ASL	3/2/84
		Em	3-2-84

ENSR Consulting & Engineering

STANDARD OPERATING PROCEDURE

Title: Surface Soil Sampling

Date: 1st Qtr 1
Number: 7110
Revision: 1

1.0 General Applicability

This SOP describes the methods used for obtaining surface soil samples for physical analysis or quality/chemical analysis. This SOP also describes the procedures for using the various types of sampling equipment, which include shovels, trowels, and hand augers. The equipment may be constructed of special materials (for example, stainless steel, inert plactics) according to specific project requirements.

2.0 Equipment Descriptions:

2.1 shovel - long or short handle type. Used for penetrating the upper surface and/or obtaining soil samples directly.

2.2 trowel - basic garden variety, which resembles a small shovel. Constructed of steel or polypropylene (plastic)*. The blade of a trowel is generally flat and 5 to 6 inches in length. A scoop (blade has curved edges versus flat) may be substituted if necessary. Both can be purchased with volume calibrations.*

2.3 Hand auger - This tool consists basically of a short spiral-bladed metal rod (Auger) attached to a handle. Clockwise rotation of the T handle initiates the cutting process. Most of the loose soil is discharged upwards as the auger moves downwards. However, if the soil is cohesive some of it will stick to the auger flight providing a collectable sample at a measurable depth. Samples of surface soil can also be collected using a tube sampler which will be attached to the end of the auger rods and advanced into the soil to extract a sample.

3.0 Responsibilities

The project geologist/engineer will be responsible for the proper use and maintenance of all types of equipment used for obtaining surface soil samples; and the collection, labelling, handling and storage of all samples until further chain of custody procedures are undertaken.

4.0 Supporting Materials

- Sample containers/Labels
- Sample Logs/Boring Logs
- Decontamination materials (if required)*
- Field notebook
- Six-foot folding rule or tape measure for depth measurement

*Requirements for inert materials, decontamination, or calibrated sampling tools may be required depending upon the purpose of the sampling. These requirements will be detailed in a project-specific sampling plan.

0887J

STANDARD OPERATING PROCEDURE

Title: Surface Soil Sampling

Date: 1st Qtr 198
Number: 7110
Revision: 1

5.0 Method or Protocol

5.1 General Procedures

Specific sampling equipment and methodology will be dictated by the characteristics of the soil to be sampled, the type of soil samples required by the project and the analytical procedures to be employed. Soil samples obtained at the surface may be collected using a shovel or trowel. The type of analysis requested (e.g., grain-size distribution, physical, chemical) may require specific soil amounts or the use of specialized sampling equipment. Sampling to obtain uniform coverage within a specified area will require the use of an area grid. These considerations will be followed based upon specific project requirements defined in the project sampling plan.

A hand auger can be used to extract shallow soil samples up to three (3) feet below the surface. Representative samples will be collected directly from the auger flight as it is withdrawn from the ground, or from the tube sampler attached to the end of the rods and advanced into the soil.

The location of sample points will be determined on a project specific basis.

5.2 Standard Procedures

5.2.1 Select the specific sampling location. Construct a sampling grid if necessary. Remove all surface materials that are not to be included samples, for example, rocks, twigs, leaves.

5.2.2 Select type of sampler required to obtain the correct sample. At the surface, use a shovel, trowel or tube sampler; below surface, use a hand auger or tube sampler.

5.2.3 Obtain a sufficient quantity of soil for the desired chemical or physical analyses.

5.2.4 When using the hand auger, auger the hole to the required depth, then slowly remove the auger and collect the soil sample from the auger flight itself at the point corresponding to the required depth. Reinsert and continue augering if deeper samples are required. In addition, a tube sampler can be attached to the auger rods after augering to the desired depth, inserted into the open bore, and then advanced into the deposits at the base of the boring. If sampling is needed in sandy or non-cohesive soil, a shovel may be necessary to obtain samples.

5.2.5 Cap the sample container; attach label; seal container (if analysis for volatile chemical species is anticipated). Record all observations such as visual soil description in a field book or on a surface soil sample log. Complete chain of custody records. Utilize proper storage procedures (see SOP 7510).

5.2.6 Decontaminate the sampler between collection points. Decontamination procedures will be performed as identified in SOP 7600 Decontamination unless otherwise specified.

5.2.7 Initiate proper procedures for delivery of the samples to the designated laboratory. This includes packaging, and shipping with chain of custody forms (see SOP 7510).

6.0 Documentation

Various forms are required to ensure that adequate documentation is made of the sample collection activities. These forms include:

- field log books
- sample logs
- chain of custody forms
- shipping forms

The field book will be maintained as an overall log of all samples collected throughout the study. These documents will be retained in the appropriate project files.

ENSR **STANDARD OPERATING PROCEDURE**

Number: 7115 Date of Issue: 1st Quarter, 1984

Title: Subsurface Soil Sampling

Organizational Acceptance	Authorization	Date
Originator	Charles S Martin	3/2/84
Department Manager	Arthur S. [illegible]	3/2/84
Divisional Manager	[illegible]	3-2-84
Group Quality Assurance Officer	[illegible]	3/2/84
Other		

Revisions	Changes	Authorization	Date
1	Update	SMW	3/2/84
		CEM	3/2/84
		ASL	3/2/84
		EM	3-2-84
2	4.2.3 Use of recirculated water must be documented in field notebooks and logs.	SMW	10-15-86
		EM	10-15-86
	5.0 All field documentation must be completed ASAP to ensure traceability.	CEM	10-16-86
	Miscellaneous rewording and renumbering for clarification.		

1.0 General Applicability

This SOP describes the methods used in obtaining subsurface soil samples for identification of soil grain-size distributions, stratigraphic correlations, and chemical analysis (if required). Subsurface soil samples are obtained in conjunction with soil boring and monitoring-well installation programs and provide direct information as to the physical makeup of the subsurface environment. This SOP covers subsurface soil sampling by split-spoon only, as this is the means most often used for obtaining samples from unconsolidated deposits. (See also, SOP 7220 - Monitoring Well Construction).

2.0 Responsibilities

It shall be the responsibility of the contract driller to provide the necessary materials for obtaining subsurface soil samples. This includes the split-spoon sampler and sample containers (sized according to project requirements) as well as the appropriate boring logs. It is the contract driller's responsibility to maintain a complete set of boring logs for the record. Standard Penetration Tests (SPT) (ASTM: 1586-67) will be conducted by the contract driller if required by the project. Equipment decontamination shall also be the responsibility of the driller.

It shall be the responsibility of the project geologist/engineer to observe all activities pertaining to subsurface soil sampling to ensure that all the standard procedures are followed properly, and to record all pertinent data on a boring log. It is also the geologist/engineer's responsibility to indicate to the contract driller at what specific depth samples shall be collected. The geologist/engineer will maintain custody of all samples until they are shipped or delivered to their appropriate destination.

3.0 Supporting Materials

In addition to those materials provided by the contract driller, the geologist/engineer will provide:

- sample bottles and labels
- boring logs
- field notebook
- chain-of-custody forms and tape

4.0 Methods or Protocol for Use

4.1 General Procedures

The sampling depth interval is typically one (1) sample per every five (5) vertical feet with additional samples taken, at the discretion of the project geologist/engineer, when significant textural, visual or odor changes are encountered.

The following are the standard procedures to be used in advancing casing and obtaining soil samples.

Specific requirements described in a project's task plan may call for deviations in the standard procedures but these will be taken into account on a project by project basis. Any deviations from specified procedures will be recorded on the boring log or into a field notebook.

4.2 Standard Procedures - Advancing Casing

4.2.1 The casing shall be advanced to the required depth. All loose material within the casing shall be removed prior to sampling. The casing shall be advanced according to project requirements. Borings are typically advanced by two methods, drive-and-wash casing, and hollow-stem augering. The casing shall be of the flush joint or flush couple type and of sufficient size to allow for soil sampling, coring, and/or well installation. All casing sections shall be straight and free of any obstructions. Hollow-stem augers or solid flight augers with casing may be used according to specific project requirements as described in the project task plan. If hollow-stem augers are to be used, the bit shall be equipped with a plug device to be removed at the required sampling depth.

4.2.2 For those borings which encounter obstructions, the casing shall be advanced either past or through the obstruction by drilling, mechanically fracturing, or blasting (if required). If the obstruction is bedrock, a rock core shall be taken according to project requirements and following the standard procedures for rock coring (SOP # 7210).

4.2.3 The use of recirculated water shall not be permitted when casing is being driven, unless specified in the project task plan, directed and properly documented (in field notebook, logs) by the geologist/engineer.

4.2.4 If recirculated water is used all loose material within the casing shall be removed by washing to the required sampling depth using a minimum amount of water. Care shall be taken to limit recirculation of the wash water to those times when the water supply is extremely limited or unavailable.

4.3 Standard Procedures - Soil Sampling

4.3.1 Subsurface soil samples shall be obtained using a split-tube type sampler (split spoon) having a 2-inch O.D. with a corresponding 1 3/8-inch I.D. and a 18- or 24-inch long sample capacity. It shall be equipped with a ball check valve and may require a flap valve or basket-type retainer for loose-soil sampling. Sampling frequency will be as stated in Section 4.1, or as otherwise specified in the project task plan.

4.3.2 Sampling depth shall be independently determined by the inspecting geologist, and any discrepancies shall be resolved prior to obtaining the sample.

4.3.3 Samples shall be obtained using the standard penetration test (SPT), which allows for determination of resistance within the deposits. The sampler shall be driven using a 140-pound hammer with a vertical drop of 30-inches using 1 to 2 turns of the rope on the cathead. A certificate indicating exact weight may be required for documentation purposes. The number of hammer blows required for every 6 inches of penetration shall be recorded on the boring log.

4.3.4 The sampler shall be immediately opened upon removal from the casing. If the recovery is inadequate, another attempt shall be made before drilling progresses. Adequate recovery should be no less than 12 inches, not including any residual wash material brought up with the sample.

4.3.5 The sample shall be split if necessary, placed in the appropriate container, labelled, and placed in the storage box. The boring log and the sample container/label should contain the following information for each sample: site name, boring location, depth, blow counts, recovery, sample number and collection date. The type of material shall be indicated in the boring logs and will be described using the Unified Soil Classification System (ASTM: D2487-69 and D2488-69).

4.3.6 The sampler shall be cleaned with water between attempts in order to prevent cross-contamination. If further decontamination is required, SOP 7600 shall be consulted.

4.3.7 Proper procedures for delivery to the designated laboratory shall be initiated when all samples are collected. This includes packaging, shipping with sample logs, analysis request forms, and chain of custody forms.

5.0 Documentation

Various forms are required to ensure that adequate documentation of each sample is followed and will include:

- sample logs
- boring logs
- chain oC custody forms
- shipping forms

In addition, a field log book will be kept as an overall log of all samples collected throughout the study. All documents are retained in the appropriate project files idefinitely. It is important that all field documentation be as complete as possible to ensure traceability (QA/QC requirements).

Project ______ Site ______ **BORING** ______ Sh 1 of ____

Date Started ______ Completed ______ Ground Elevation ______

Total Depth ______ Location ______ Logged by ______

Casing I.D. ______ Contractor ______

Remarks ______

Elev. Feet	Depth Feet	Sample				Graphic Log	Sample Description	Equipment Installed
		Type & Number	Blows per 6 In.	Depth Range	Rec.			

ENSR

0886J

ENSR

STANDARD OPERATING PROCEDURE

Number: 7130 Date of Issue: March 12, 1984

Title: Ground-Water Sample Collection from Monitoring Wells

Organizational Acceptance	Authorization	Date
Originator	Christopher Carlo	3-13-84
Department Manager	[signature]	3/13/84
Divisional Manager	[signature]	3-13-84
Group Quality Assurance Officer	[signature]	3-13-84
Other		

Revisions	Changes	Authorization	Date
1	• Sect. 3.0 - Equipment checklists have been added.	JMW	9-5-86
	• Sect. 4.4 - The use of electronic sounding devices has been removed from procedures for obtaining water-level measurements.	CEM	9-11-86
	• Sect. 4.5 - Some unneccessary steps have been deleted from procedures for decontamination.		
	• Sect. 5.0 - The volume of ground water for purging wells has been changed from 4 to 10 volumes to 3 to 10 volumes.		
	• Sect. 6.2 - A more detailed description of bailing was added.		
	• Additional figures have been added.	Em	9-10-86
	• Miscellaneous rewording and renumbering for clarification.		

Title: Ground-Water Sample Collection from Monitoring Wells

1.0 Applicability

This Standard Operating Procedure (SOP) is concerned with the collection of valid and representative samples from ground-water monitoring wells. The scope of this document is limited to field operations and protocols applicable during ground-water sample collection.

2.0 Responsibilities

The site coordinator or his delegate will have the responsibility to oversee and ensure that all ground-water sampling is performed in accordance with the project-specific sampling program and this SOP. In addition, the site coordinator must ensure that all field workers are fully apprised of this SOP. The field team is responsible for proper sample handling as specified in SOP 7510, Handling and Storage of Samples.

3.0 Supporting Materials

The list below identifies the types of equipment which may be used for a range of ground water-sampling applications. From this list, a project-specific equipment list will be selected based upon project objectives, the depth to ground-water, purge volumes, analytical parameters and well construction. The types of sampling equipment are as follows:

- Purging/Sample Collection

  Bailers
  Centrifugal Pump
  Submersible Pump
  Peristaltic Pump

- Sample Preparation/Field Measurement

  pH Meter
  Specific Conductance Meter
  Filtration Apparatus
  Water-Level Measurement Equipment

Additional equipment to support sample collection and provide baseline worker safety will be required to some extent for each sampling task. The additional materials are separated into two primary groups: general equipment which is reusable for several samplings, and materials which are expendable.

- General

Project-specific sampling program
Deionized-water dispenser bottle
Methanol-dispenser bottle
Site-specific Health & Safety equipment (gloves, respirators, goggles)
Field data sheets and/or log book
Preservation solutions
Sample containers
Buckets and intermediate containers
Coolers
First-Aid kit

- Expendable Materials

Bailer Cord
Respirator Cartridges
Gloves
Water Filters
Chemical-free paper towels
Plastic sheets

Equipment checklists have been developed to aid in field trip organization and should be used in preparation for each trip.

4.0 Water-Level Measurement

4.1 Introduction

Prior to obtaining a water-level measurement, cut a slit in one side of the plastic sheet and slip it over and around the well, creating a clean surface onto which the sampling equipment can be positioned. This clean working area should be a minimum of eight feet square. Care will be taken not to kick, transfer, drop, or in any way let soil or other materials fall onto this sheet unless it comes from inside the well. Do not place meters, tools, equipment, etc. on the sheet unless they have been cleaned first with a clean rag.

After unlocking and/or opening a monitoring well, the first task will be to obtain a water-level measurement. Water-level measurements will be made using an electronic or mechanical device. Electronic measurement devices will be used in all wells wherein a clearly audible sound cannot be produced with a mechanical device.

4.2 Well Security

Unlock and/or open the monitoring well. Enter a description of condition of the security system and protective casing on the Ground-Water Sample Collection Record shown in Figure 1.

4.3 Measuring Point

Check for the measuring point for the well. The measuring point location should be clearly marked on the outermost casing or identified in previous sample collection records. If no measuring point can be determined, a measuring point should be established. Typically the top (highest point) of the protective or outermost well casing will be used as the measuring point. The measuring point location should be described on the Ground-Water Sample Collection Record and should be the same point used for all subsequent sampling efforts.

4.4. Measurement

To obtain a water-level measurement lower a clean steel, fiberglass tape into the monitoring well. Care must be taken to assure that the water-level measurement device hangs freely in the monitoring well and is not adhering to the wall of the well casing. The water-level measuring tape will be lowered into the well until the audible sound of the unit is detected or the light on an electronic sounder illuminates. At this time the precise measurement should be determined (to hundredth of a foot) by repeatedly raising and lowering the tape to converge on the exact measurement. The water-level measurement should be entered on the Ground-Water Sample Collection Record. As well point of measurement should be indicated; i.e., top of protective casing, top of pueriser, ground level.

4.5 Decontamination

The measurement device shall be decontaminated immediately after use with a methanol soaked towel. Generally only that portion of the tape which enters the water table should be cleaned. It is important that the measuring tape is never placed directly on the ground surface.

5.0 Purge-Volume Computation

All monitoring wells to be purged prior to sample collection. Depending upon the ease of purging, 3 to 10 volumes of ground water to be determined by hydrogeologing prior to sampling present in a well shall be withdrawn prior to sample collection or one volume if well can be purged dry. The volume of water present in each well shall be computed based on the length of water column and well casing diameter. The water volume shall be computed using Figure 2.

6.0 Well-Purging Methods

6.1 Introduction

Purging must be performed for all ground-water monitoring wells prior to sample collection in order to remove stagnant water from within the well casing and ensure that a representative sample is obtained. The following sections explain the proper procedures for purging and collecting water samples from monitoring wells.

Three general types of equipment are used for well purging: bailers, surface pumps, or down-well submersible pumps.

In all cases pH and/or specific conductance will be monitored during purging. Field parameter values will be entered on the Ground-Water Sample Collection Record along with the corresponding purge volume.

6.2 Bailing

In many cases bailing is the most convenient method for well purging. Bailers are constructed using a variety of materials; generally, PVC stainless steel, and Teflon®. Care must be taken to select a specific type of bailer that suits a study's particular needs. Teflon® bailers are generally most "inert" and are used most frequently. Keep in mind the diameter of each monitoring well so that the correct size bailers are taken to the site. It is preferable to use one bailer per well; however, field decontamination is a relatively simple task if required.

Bailing presents two potential problems with well purging. First, increased suspended solids may be present in samples as a result of the turbulence caused by raising and lowering the bailer through the water column. High solids concentrations may require that total suspended solids (TDS) and the chemical character of solids be evaluated during sample analyses. Second, bailing may not be feasible for wells which require that greater than twenty (20) gallons be removed during purging. Such bailing conditions mandate that long periods be spent during purging and sample collection or that centrifugal pumps be used. All ground-water collected from monitoring wells for subsequent volatile organic compound analyses shall be collected using bailers, regardless of the purge method.

6.3 Surface Pumping

Ground-water withdrawal using pumps located at the ground surface is commonly performed with centrifugal or peristaltic pumps.

All applications of surface pumping will be governed by the depth to the ground-water surface. Peristaltic and centrifugal pumps are limited to conditions where ground water need only be raised through approximately 20 feet of vertical distance. The lift potential of a surface pumping system will depend upon the net positive suction head of the pump and the friction losses associated with the particular suction line, as well as the relative percentage of suspended particulates.

Surface pumping can be used for many applications of well purging and ground-water sample collection. In all cases, pumping cannot be used for the collection of samples to be analyzed for volatile organic compounds (VOCs).

6.3.1 Peristaltic Pump

Peristaltic pumps provide a low rate of flow typically in the range of 0.02-0.2 gallons/min (75-750 ml/min). For this reason, peristaltic pumps are not particularly effective for well purging. Peristaltic pumps are suitable for purging situations where disturbance of the water column must be kept minimal for particularly sensitive analyses. Peristaltic pumps are most often used in conjunction with field filtering of samples and therefore can be used to obtain water samples for direct filtration at the wellhead.

6.3.2 Centrifugal Pump

Centrifugal pumps are designed to provide a high rate of pumping, in the range of 10-40 gallons per minute (gpm), depending on pump capacity. Discharge rates can also be regulated somewhat provided the pump has an adjustable throttle.

When centrifugal pumps are used, samples should be obtained from the suction (influent) line during pumping by an entrapment scheme as shown in Figure 3. Construction of this sampling scheme is relatively simple and will not be explained as part of this SOP. It is suggested that if samples cannot be obtained before going through the pump, that samples be obtained by using a bailer once pumping has ceased. Collecting samples from the pump discharge is not recommended.

6.3.3 Submersible Pump

Submersible pumps provide an effective means for well purging and in some cases sample collection. Submersible pumps are particularly useful for situations where the depth to water table is greater than twenty (20-30) feet and the depth or diameter of the well requires that a large purge volume be removed during purging.

ERT uses the Johnson-Keck pump model SP-81 which has a 1.75 inch diameter pump unit. The pump diameter restricts use to monitoring wells which have inside diameters equal to or greater than two (2) inches. As with other pump-type purge/sample collection methods, submersible pumps will not be used for the collection of samples for analyses of volatile organic compounds. Submersible pumps should never be used for well development as this will seriously damage the pump.

7.0 Sample Collection Procedures

7.1 Bailing

Obtain a clean/decontaminated bailer and a spool of polypropylene rope or equivalent bailer cord. Using the rope at the end of the spool tie a bowline knot or equivalent through the bailer loop. Test the knot for security and the bailer itself to ensure that all parts are intact prior to inserting the bailer into the well.

Remove the protective foil wrapping from the bailer, and lower the bailer to the bottom of the monitoring well and cut the cord at a proper length. Boiler rope should never touch the ground surface at any time during the purge routine.

Raise the bailer by grasping a section of cord using each hand alternately in a "rocking" action. This method requires that the samplers' hands be kept approximately 2-3 feet apart and that the bailer rope is alternately looped onto or off each hand as the bailer is raised and lowered.

Bailed ground water is poured from the bailer into a graduated bucket to measure the purged water volume.

For slowly recharging wells, the bailer is generally lowered to the bottom of the monitoring well and withdrawn slowly through the entire water column. Rapidly recharging wells should be purged by varying the level of bailer insertion to ensure that all stagnant water is removed. The water column should be allowed to recover to 70-90% of its static volume prior to collecting a sample. Water samples should be obtained from midpoint or lower within the water column.

Samples collected by bailing will be poured directly into sample containers from bailers which are full of fresh ground water. During sample collection, bailers will not be allowed to contact the sample containers.

7.2 Peristaltic Pump

Place a new suction and discharge line to the peristaltic pump. Silicon tubing must be used through the pump head. A second type of tubing may be attached to the silicon tubing to create the suction and discharge lines. Such connection is advantageous for the purpose of reducing tubing costs, but can only be done if airtight connections can be made. Tygon tubing will not be used when performing well purging or collecting samples for organic analysis. The suction line must be long enough to extend to the static ground-water surface and reach further should drawdown occur during pumping.

Measure the length of the suction line and lower it down the monitoring well until the end is in the upper 2-5 inches of the water column present in the well. Start the pump and direct the discharge into a graduated bucket.

Measure the pumping rate in gallons per minute by recording the time required to fill a selected volume of a bucket. Flow measurement shall be performed three times to obtain an average rate.

The pumping shall be monitored to assure continuous discharge. If drawdown causes the discharge to stop, the suction line will be lowered very slowly further down into the well until pumping restarts.

Measurements of pH and specific conductance will be made periodically during well purging. All readings will be entered on the Ground-Water Sample Collection Record.

Samples will be collected after the required purge volume has been withdrawn and the field parameters (pH and Specific Conductance) have stabilized.

When the sample bottles are prepared, each shall be filled directly from the discharge line of the peristaltic pump. Care will be taken to keep the pump discharge line from contacting the sample bottles. Ground-water samples requiring filtration prior to placement in sample containers, will be placed in intermediate containers for subsequent filtration or filtered directly using the peristatic pump.

At each monitoring point when use of the peristaltic pump is complete, all tubing including the suction line, pump head and discharge line must be disposed of. In some cases where sampling will be performed frequently at the same point, the peristaltic pump tubing may be retained between each use in a clean zip-lock plastic bag.

7.3 Centrifugal Pump

7.3.1 Direct Connection Method (Note: This method requires that the well casing be threaded at the top.)

Establish direct connection to the top of the monitoring well if possible using pipe connections, extensions, and elbows, with Teflon® tape wrapping on all threaded connections. If the centrifugal pump will subsequently be used for sample collection, a sample isolation chamber will be placed in the suction line configuration as shown in Figure 3.

Prime the pump by adding tap water to the pump housing until the housing begins to overflow.

Start the pump and direct the discharge into a graduated bucket or a bucket of known capacity (>2.5 gallons).

Start the pump and measure the pumping rate in gallons per minute by recording the time required to fill the graduated bucket. Flow measurement should be checked periodically to determine if pumping rates are continuous, fluctuating, or diminishing. If discharge stops, the pump will be throttled back to determine if pumping will restart at a lower rate. If pumping does not restart, the pump should be shut off to allow the well to recharge.

Measurements of pH and specific conductance will be made periodically during well purging. All readings will be entered on the Ground-Water Sample Collection Record. Samples will be collected after the required purge volume has been withdrawn and the field parameters (pH and Specific Conductance) have stabilized. Samples should be collected from an in-line discharge valve or with a bailer. The pump should be properly decontaminated between wells.

7.3.2 Down-Well Suction-Line Method

Lower a new suction line into the well. The suction line will have a total length great enough to extend to the water table and account for a minimum of five (5) feet of drawdown. Note should be made that drawdown may exceed the depth where pumping will terminate as a result of a limitation derived from suction-line conditions and the lift potential of the pump. All connections should be made using Teflon® ferrules and Teflon® thread wrapping tape. Run the pump as per Section 7.3.1.

At each monitoring well when use of a centrifugal pump is complete, all suction line tubing should be disposed of properly.

7.4 Submersible Pump

Prior to using a submersible pump, a check will be made of well diameter and alignment. A 1.75 inch diameter decontaminated cylindrical tube should be lowered to the bottom of each monitoring well to determine if the alignment or plumbness of a well is adequate to accommodate the submersible pump. All observations will be entered in the Ground-Water Sample Collection Record.

Slowly lower the submersible pump into the monitoring well taking notice of any roughness or restrictions within the riser.

Count the graduations on the pump discharge line and stop lowering when the stainless steel portion is below the uppermost section of the static water column within monitoring well. Secure the discharge line and power cord to the well casing.

Connect the power cord to the power source (i.e., rechargeable battery pack or auto battery monitor) and turn the pump on (forward mode). When running, the pump can usually be heard by listening near the well head.

Voltage and amperage meter readings on the pump discharge must be checked continuously. The voltage reading will decline slowly during the course of a field day representing the use of power from the battery. Amperage readings will vary depending upon the depth to water table. Amperage readings greater than 10 amps usually indicate a high solids content in the ground water which may cause pump clogging and serious damage. If a steady increase in amperage is observed, the pump should be shut off, allowed to stop, switched to the reverse mode, stopped again and then placed in forward mode. If high amperage readings persist, the pump should be withdrawn and checked using the large upright cylinder and tap water. Ground-water conditions such as high solids may require that an alternate purge/sample method be used.

Drawdown must also be monitored continuously by remaining near the well at all times and listening to the pump. When drawdown occurs, a metallic rotary sound will be heard as the pump intake becomes exposed and ceases to discharge water, but continues to run. The pump should be lowered immediately to continue pumping water within the uppermost section of the static water column. NOTE: The submersible pump cannot be allowed to run while not pumping for more than five seconds or the pump motor will burn out.

If drawdown continues to the extent that the well is pumped dry, the pump should be shut off and the well allowed to recharge. This on/off cycle may need to be repeated several times in order to purge the well properly.

Measurements of the pumping rate, pH, and specific conductance should be made periodically during well purging. All readings and respective purge volumes should be entered on the Ground-Water Sample Collection Record.

While pumping is on-going and when sample bottles are prepared, bottles will be filled directly from the discharge line of the pump taking care not to touch sample bottles to the discharge line.

At each monitoring well when use of the submersible pump is complete, the pump, discharge line and power cord shall be decontaminated according to the procedures contained in the SOP for Decontamination.

8.0 Sample Preparation

8.1 Introduction

Prior to sample transport or shipment, ground-water samples may require filtration and/or preservation dependent on the specific type of analysis required.

Specific preservation techniques are described in the EPA document, Handbook for Sampling and Sample Preservation of Water and Wastewater (EPA-600/4-82-029). The EPA manual and laboratory manager should be consulted during the planning stage of the project. Project-specific sampling plans shall be assembled using the approved procedures obtained from the EPA manual.

8.2 Filtration

Ground-water samples collected for dissolved metals analyses will be filtered prior to being placed in sample containers. Ground-water filtration will be performed using a peristaltic pump and a 0.45 micron, water filter. Typically the water filters are 142 mm in diameter and are usually placed in 142 mm polycarbonate housings.

The filtration of ground-water samples shall be performed either directly from the monitoring well or from intermediate sample containers such as decontaminated buckets. In either case, well purging shall be performed first. Fresh ground water shall then be filtered and discharged from the filtration apparatus directly into sample containers. For most dissolved metal analyses, pH adjustment of the sample is also required and shall be performed after filling the sample bottles. This is generally accomplished using laboratory supplied compounds such as sulfuric or nitric acid and sodium hydroxide.

9.0 Documentation

A number of different documents must be completed and maintained as a part of ground-water sampling effort. The documents provide a summary of the sample-collection procedures and conditions, shipment method, the analyses requested and the custody history. The list of documents is:

- Ground-water sample collection record
- Sample labels
- Chain of custody forms and tape
- Shipping receipts

Sample labels shall be completed at the time each sample is collected and will include the information listed below. A sample label is shown in Figure 4.

- Client or project name
- Sample number
- Designation (i.e., identification of sample point no.)
- Analysis
- Preservative (e.g., filtration, acidified pH<2 HNO_3)
- Sample-collection date
- Sampler's name

Figure 5 displays the chain of custody record used by ERT. The chain of custody form is the record sample collection and transfer of custody. Information such as the sample collection date and time of collection, sample identification and origination, client or project name shall be entered on each chain of custody record. In accordance with 40 CFR 261.4(d) the following information must accompany all ground water samples which are known to be non-hazardous and to which U.S. Department of Transportation and U.S. Post Office regulations do not apply. Such information is:

- sample collector's name, mailing address and telephone number,
- analytical laboratory's name, mailing address and telephone number,
- quantity of each sample,
- date of shipment, and
- description of sample.

The chain of custody forms provide a location for entry of the above-listed information.

10.0 References

EPA, Handbook for Sampling and Sample Preservation of Water and Wastewater EPA-600/4-82-029, September 1982.

Geotrans, Inc. RCRA Permit Writer's Manual, Ground-Water Protection prepared for U.S. EPA. Contract No. 68-01-6464, October 1983.

Code of Federal Regulations, Chapter 40 (Section 261.4(d).

Figure 1

ENSR

Well No. ______

GROUND WATER SAMPLE COLLECTION RECORD

Job No. __________ Date: __________

Location: ______________________________ Time: S ______

Weather Conds.: ______________________________ F ______

1. WATER LEVEL DATA: (from ToC) ToC Elevation (from LS) ______________
   a. Total Well Length (+ TC) __________ (known, meas.) Tape Corr. (TC) ______________
   b. Water Table Elev. (+ TC) __________ Well Dia. ______________
   c. Length of Water Column __________ (a-b)

2. WELL PURGING DATA:
   a. Purge Method ______________________________
   b. Required Purge Volume (@ ____ well volumes) ______________________________
   c. Field Testing: Equipment Used ______________________________

Volume Removed	T°	PH	Spec. Cond.	Color

3. Sample Collection: Method ______________________________

Container Type	Preservation	Analysis Req.

Comments: ______________________________

____

____

____

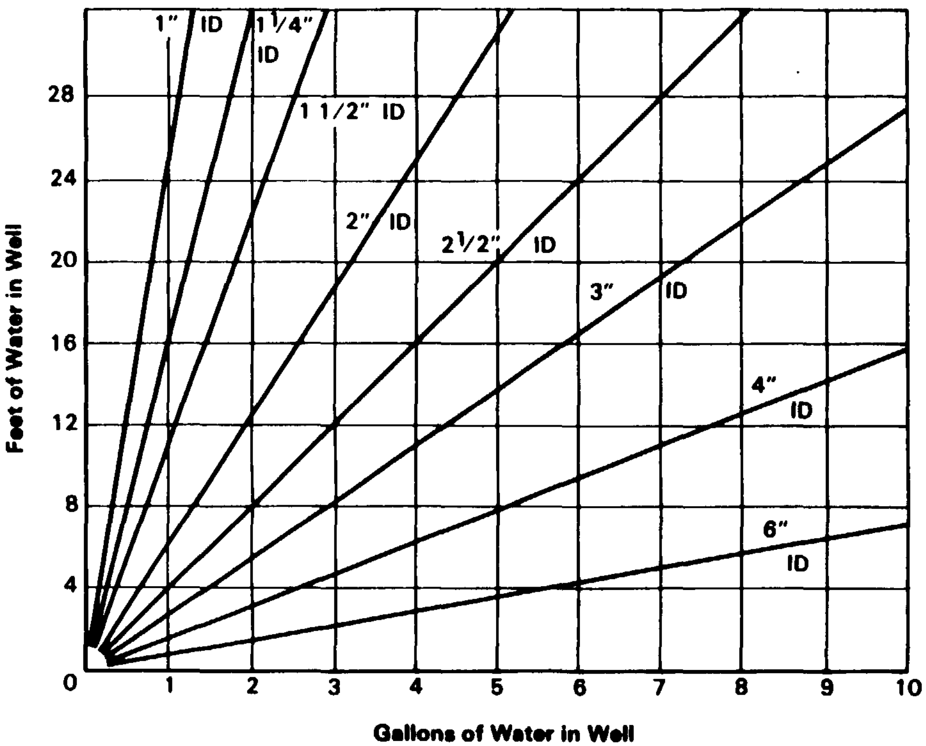
____

____

1995 12-84

8403004

0895J



(a) Graphical Explanation

Volume/Linear Ft. of Pipe		
ID(in)	Gal	Liter
1/4	0.003	0.010
3/8	0.006	0.022
1/2	0.010	0.039
3/4	0.023	0.087
1	0.041	0.154
2	0.163	0.618
3	0.367	1.39
4	0.653	2.47
6	1.47	5.56

(b) Volume Factors

Figure 2 Purge Volume Computation

8403003

0895J

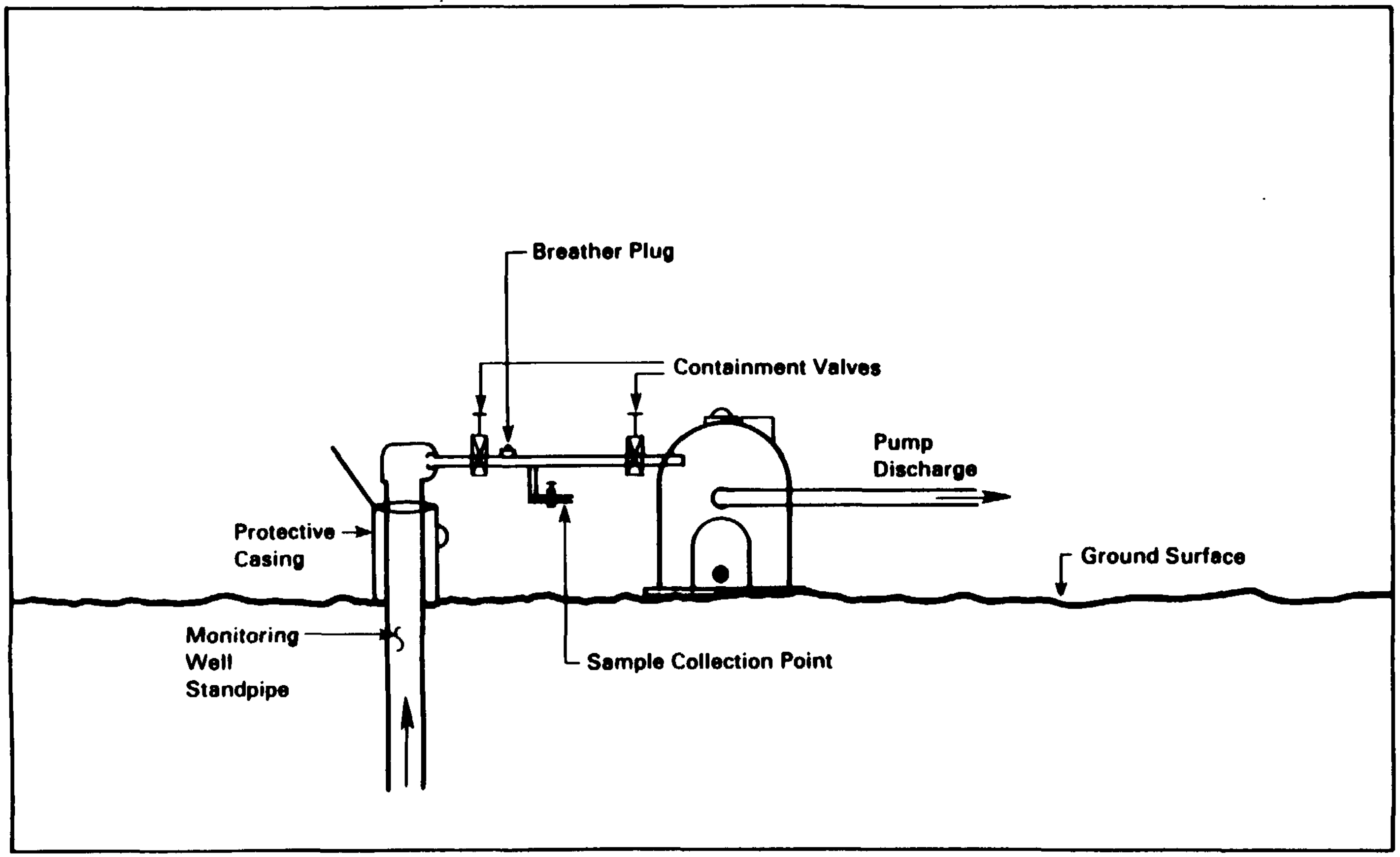


Figure 3 Down Well Suction Line Configuration

CLIENT ____________________
SAMPLE NO. ____________________
DESIGNATION ____________________
ANALYSIS ____________________
PRESERVATIVE ____________________
DATE __________ BY __________

Figure 4 Sample Container Label

0895J

CHAIN OF CUSTODY RECORD

Client/Project Name	Project Location	ANALYSES
Project No.	Field Logbook No.	
Sampler: (*Signature*)	Chain of Custody Tape No.	

Sample No./ Identification	Date	Time	Lab Sample Number	Type of Sample							REMARKS

Relinquished by: (*Signature*)	Date	Time	Received by: (*Signature*)	Date	Time
Relinquished by: (*Signature*)	Date	Time	Received by: (*Signature*)	Date	Time
Relinquished by: (*Signature*)	Date	Time	Received for Laboratory: (*Signature*)	Date	Time
Sample Disposal Method:			Disposed of by: (*Signature*)	Date	Time

SAMPLE COLLECTOR	ANALYTICAL LABORATORY	
		No.

1974-3-84

Figure 5 Sample Chain-of-Custody Record

TUT 005 0311

ENSR

ENSR Consulting and Engineering

Alabama	Florence	(205) 767-1210
Alaska	Anchorage	(907) 561-5700
California	Los Angeles	
	Camarillo	(805) 388-3775
	Newport Beach	(714) 476-0321
	San Francisco	(510) 865-1888
Colorado	Fort Collins	(303) 493-8878
Connecticut	Hartford	(203) 657-8910
Illinois	Chicago	(708) 887-1700
Massachusetts	Boston	(508) 635-9500
Minnesota	Minneapolis	(612) 924-0117
New Jersey	Mahwah	(201) 818-0900
	Mt. Laurel	(609) 234-5520
	Somerset	(908) 560-7323
North Carolina	Raleigh	(919) 571-0669
Pennsylvania	Pittsburgh	(412) 261-2910
South Carolina	Rock Hill	(803) 329-9690
Texas	Dallas	(214) 960-6855
	Houston	(713) 520-9900
Washington	Seattle	(206) 881-7700
Puerto Rico	San Juan	(809) 753-9509