

# Plan of Action

## **Naval Exchange Gas Station Underground Storage Tank (UST) Spill Investigation and Remedial Design Submarine Base New London Groton, Connecticut**

United States Department of the Navy  
Naval Facilities Engineering Command  
Northern Division

November 1989



**O'BRIEN & GERE**



**O'BRIEN & GERE**

November 29, 1989

Mr. Joseph McCarthy  
NAVAL FACILITIES ENGINEERING COMMAND  
Northern Division  
Building 77L, Naval Base  
Philadelphia, PA 19112-5094

Re: Submarine Base New London  
Groton, Connecticut

File: 1862.023

Dear Mr. McCarthy:

Enclosed are the requested copies of the Final Plan of Action (POA) for the Naval Exchange Gas Station Spill Investigation and Remedial Design for the Submarine Base New London, Groton, Connecticut. Five copies have also been forwarded to Mr. Jim Fitzpatrick at Submarine Base New London.

If you have any questions or require additional information, please call me at (617) 423-2919.

Very truly yours,

O'BRIEN & GERE ENGINEERS, INC.

Clay Wallace-Reilly  
Design Engineer

CW-R/brg:049

Enclosures

cc: E.P. Zimmerman  
R.G. Stromberg

NAVAL EXCHANGE GAS STATION UNDERGROUND STORAGE TANK (UST)  
SPILL INVESTIGATION AND REMEDIAL DESIGN

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PLAN OF ACTION

NAVAL EXCHANGE GAS STATION UNDERGROUND STORAGE TANK (UST)  
SPILL INVESTIGATION  
AND  
REMEDIAL DESIGN

SUBMARINE BASE NEW LONDON, GROTON, CONNECTICUT

NOVEMBER 1989

O'BRIEN & GERE ENGINEERS, INC.  
100 SUMMER STREET, SUITE 2904  
BOSTON, MASSACHUSETTS 02110

I. INTRODUCTION

The following Plan of Action (POA) has been developed for use in investigating the nature and extent of a gasoline release at the Naval Exchange Gas Station, Building 428, Submarine Base New London (SUBASENLON), Groton, Connecticut. Figure 1 illustrates the location of the Exchange Station on the base. On October 10, 1989, gasoline was discovered in storm sewers adjacent to the Naval Exchange Gas Station. Emergency testing of three underground gasoline storage tanks and pipelines beneath the facility was conducted on October 11, 1989. Figure 2 illustrates a detailed map of the Exchange Station and adjoining areas. A significant leak was discovered in a crash valve located in the south dispenser pump on the second island from Building No. 428. When the crash valve was closed, gas was observed to leak at rate of 2-4 ounces per minute. Originally, a crash valve at this site was observed by mechanical contractors to be malfunctioning on February 21, 1989. A new valve was installed and it appeared to function properly. This new valve which was removed on October 11 contained a crack in it's housing which facilitated the leak.

Available records also indicate that a capped vertical pipe at dispenser island No. 1 was also found to be leaking slightly on October 11. On October 13, this cap was replaced with a bleeder valve to allow air to be released from the system. All other pipes and tanks were determined to be tight based on hydrostatic testing by Pasquallini Inc.

After the leak was identified, a baffle and weir was installed in catch basin No. 4 to collect gasoline floating on the water surface. A small volume was collected during the period when vapors were noted.

The gasoline noted in the storm drains occurred at a time of low flow conditions. A period of heavy rainfall occurred immediately thereafter and very little or no gasoline was noted in the drains as observed through the catch basins shown on Figure 2. Most recent observations collected during a subsequent period of low flow indicated only minor sheens and vapors in the affected basins. Based on these observations and the recent piping work at the facility, it appears that the release occurred over a relatively short period of time before it was noticed. Station reconciliation records

indicate no loss greater than 0.5% over the past few months. No estimate of volume of lost product therefore could be made.

## II. PURPOSE

The purpose of this program is to characterize the extent of the gasoline release in the subsurface beneath the area of the exchange station and to define the mechanisms by which the gasoline is entering the stormwater drainage system. The nature of the data gathering phase of this program will be flexible and comprehensive enough to allow for modifications to the program as the field investigation proceeds. Additional investigations that appear to be needed, i.e. soil borings/wells beyond the agreed upon amount, will be indicated to NAVFAC personnel prior to implementation and additional investigative efforts will be performed during the same period. By incorporating additional data needs into the strategy of the field program, sufficient information can be developed to effectively screen and select an appropriate remedial plan of action.

## III. BACKGROUND CONDITIONS

The Naval Exchange Gas Station is located on the southern end of the base on a relatively flat terrace of the Thames River which flows by the naval base about 1,250 feet to the west. Surface topography around the station ranges in elevation from 22 to 26 feet (USGS mean seal level datum) and decreases toward catch basin number one on the southeastern side of the facility. Surface water runoff from paved portions of the station is directed toward the network of catch basins which traverse the station (Figure 2). Discharge from these basins is co-mingled with other surface drainage and blow off from an oil condensing unit prior to outfall at a boomed outlet at the Thames River.

Geographically, the station is located in an area which formally contained a lake between two outcrops of rock to the northeast and southwest. The lake, which was historically known as "Crystal Lake", was reportedly dredged and filled in with upland soils to create a level surface for development of the base. As a result, soils in the area contain an upper layer of fill which is variable in thickness and which overlies naturally occurring

fine sand, silt, and organic silt of the former lake bed. On-site, the fill thickness varies from a few feet to around 15 feet and is thicker around underground tanks and stormwater drain pipes. Additionally, the backfill used for these structures is probably of higher permeability than the fine grained, natural soils surrounding it. This is probably a contributing factor in the observation of gasoline in the stormwater sewers.

Ground water occurs in the natural soils and in portions of the fill at a depth of about 6 to 12 feet. This information was developed from a soil boring performed for the exchange station in the 1970's and monitoring wells recently installed for an environmental assessment immediately south of the station (Fuss and O'Neill, 1989). To the south of the exchange station in the area of the above-referenced study, ground water flow is northward toward the exchange station. From a review of the area geology, it is likely that ground water also converges toward the exchange station from the north, then continues westward toward the Thames River. Flow may be locally modified by more permeable trenches in the area.

#### IV. APPLICABLE REGULATIONS

According to underground storage tank regulations promulgated by the Connecticut DEP on November 1, 1985 (Conn. General Statute, Section 22A, 449d), and more importantly the most recent federal regulations promulgated in 1988 (40CFR 280.63), the owner/operator must assemble information concerning the release within 45 days. This plan of action is being developed in accordance with USEPA guidelines for evaluating the extent and environmental impact of the release. Procedures and methodologies used in the program are consistent with USEPA technical guidance documents.

The Connecticut DEP was notified of the release on October 11, 1989 (Corres, W.L. Mansfield) who indicated that an investigation and clean up are required to mitigate outfall of contaminants to the Thames River.

V. SCOPE OF WORK

A. Health and Safety Plan

A Health and Safety Plan (HASP) has been developed for implementation during any field activities. The Health and Safety Plan is presented in Appendix A. The plan specifies the protective equipment required for site investigators and visitors to minimize exposure to potentially hazardous materials. The plan also specifies contingency plans for dealing with emergencies and other potential site hazards. A brief toxicological assessment of chemicals used on-site relative to potential effects which they might present to site workers at concentrations expected to be encountered during field work is also presented.

The Health and Safety Plan is in accordance with OSHA 29 CFR 1910 regulations for hazardous waste operations and emergency response. Available information for volatile organic compounds potentially encountered during site activities is presented based upon known information.

B. Interim Sampling Results

An interim sampling effort was conducted prior to initiation of the drilling program to provide more substantive information regarding the point at which contaminants are entering the storm drain system. This information assisted in developing the amount and placement of borings and monitoring wells discussed in upcoming sections of this document.

Grab samples of surface water at four catch basins around the station were collected during low or "base flow" conditions on November 14, 1989 according to procedures in Appendix B. The catch basins sampled included No.'s 1, 4, 5 and 7 shown on Figure 3. Two inlets at catch basin No. 1 were sampled and were designated 1A and 1B. The purpose for collecting the samples during low flow conditions was to obtain water quality data at specific points representative of potential ground water infiltration

into the drains. Sampling during storm or high flow conditions would tend to mix and dilute the samples at each point.

The samples were observed for visual contamination (immiscible layers, sheens, etc.) and odors. This information was documented on a sampling log for each site (Appendix C). Samples were properly containerized, and shipped to Toxikon Environmental laboratories for analysis of volatile hydrocarbons (EPA Method 503.1) and total petroleum hydrocarbons by IR (EPA Method 418.1). The chain-of-custody form is presented in Appendix D. Laboratory analyses were scheduled for a four-day turnaround to facilitate incorporation of the data into the proposed plan of action. A quality assurance/control trip blank analyses for volatile hydrocarbons was also performed but at no extra charge by the laboratory.

Samples were collected by lowering a glass jar into the stream at each point. Oxygen levels noted in the basins during sampling were normal at 20 to 21%. No carbon dioxide or hydrogen sulfide was noted. Visual observations during sampling indicated clear water with no sheens or odors at the upstream basin (CB-7). At the two inlets in the next downstream basin (CB-1), strong gasoline odors with possible emulsified product was noted in basin 1B (downstream of the product loss area). No odors or sheens were noted in basin 1A from upstream basin No. 6. Slight sheens with very little or no odors were noted at two other downstream basins (CB-4 and 5).

Analytical results support visual observations and are presented in Appendix E and Figure 4. These results indicate non-detectable volatile or total petroleum hydrocarbons (TPH) concentrations in the upstream basin CB-7. Elevated concentrations of aromatic volatile hydrocarbons typical of those found in unleaded gasoline were detected in basin CB-1B downstream from the area of release. These compounds consisted of

benzene, trimethyl benzene, butylbenzene, toluene and xylenes. TPH values were detectable but somewhat less indicating that hydrocarbons present consisted almost wholly of those mentioned above.

Much lower but detectable volatile hydrocarbon concentrations were also noted in catch basin CB-1A and other downstream basins 4 and 5. No detectable TPH values were noted in these basins. These lower values represent a mixture of impacted influent in basin CB-1B and unimpacted influent in basin CB-1A. A quality assurance analysis of a trip blank indicated non-detectable concentrations.

The analytical results support the assumption that gasoline continues to infiltrate the storm drain between basins CB-7 and CB-1B at concentrations that require additional investigations.

C. Site Investigation

A soil and ground water sampling and analysis program has therefore been developed to obtain qualitative information at key locations around the area of loss. Three areas have been delineated to be investigated and are; the area of release, the 15,000 gallon storage tank, and backfill around the affected storm drain. Based upon information made available to date, it appears that the more permeable fill soils associated with the drainage lines and underground tanks affects the movement of gasoline and its presence in the catch basins. The area of product loss on dispenser island No. 2 is in close proximity to the drainage line connecting catch basins CB-7 and CB-1, and the 15,000 gallon underground storage tank which was back filled with pea gravel.

From available site information, the water table apparently occurs in the pea gravel and intersects the drainage line as it slopes toward catch basin No. CB-1. The pea gravel may be in contact with fill around the drainage line, particularly in the proximity of

catch basin No. CB-1. Product released at island No. 2 may have migrated vertically to the water table in the pea gravel and then horizontally toward the back filled drain which may act as a local sink for ground water. Product may have then moved along the drain backfill into catch basin CB-1 and possibly basins CB-4 and 5. The following program was developed to explore the presence of contamination at key locations around the tank, drainage line, and catch basins.

The drilling program will be comprehensive and as such, some final locations may be different than that indicated in this document.

1. Soil Sampling

Soil borings will be performed at up to four locations for collection of soil samples and subsequent well installations. The four locations (OBG-1 through OBG-4) are shown on Figure 3. Additional borings may be necessary based upon findings in the field. Prior to drilling, all subsurface utilities will be located by a NAVFAC representative and all final locations will be agreed upon by NAVFAC, O'Brien & Gere, and the drilling subcontractor. Each soil boring is anticipated to be continued to a depth of 17 feet ( $\pm$ ). Soil boring procedures are outlined in the protocol in Appendix F.

At some locations, pre-coring of asphalt or concrete may be required. Split spoon samples (method ASTM D-1586-84) will be collected at two foot intervals and will be visually logged and classified by an O'Brien and Gere hydrogeologist to evaluate the nature of the subsoils. Any evidence of visual staining will be carefully noted. Additionally, the soil samples will be placed in one/half pint containers to be field tested for total organic vapors by a photoionizer (HNU) calibrated to benzene equivalent. A summary of soil sample field analyses is shown in Table 1. Each splitspoon will be decontaminated between each sampling event

according to procedures in Appendix G. Additionally, all drilling equipment including augers, rods, and tools will be decontaminated in an approved area between each boring. Drilling equipment decontamination procedures are presented in Appendix H. All cleaning fluids from spoon decontamination will be stored in appropriately labelled drums for disposal by NAVFAC.

If any soil sample or samples in the unsaturated zone contains visual staining or total organic vapor concentrations above 5 ppm, the following analyses will be scheduled:

If organic vapor concentrations are noted with only minor staining (if any) then the unsaturated sample containing the highest organic vapor concentration in each boring will be submitted for analysis of volatile hydrocarbons (EPA Method 8010/8020) and total petroleum hydrocarbons by IR (EPA Method 418.1). A summary of soil sample laboratory analyses are shown in Table 1. Results of the TPH analysis will be reported on a dry weight basis.

If any of the soil samples discussed above contain oil saturated soil, then total petroleum hydrocarbon analyses will be performed by GC/FID methods to identify the type of oil. Up to two of these analyses have been estimated to be substituted for the IR methodology noted above. Quality assurance/control analyses for soils will be performed by routine lab analysis of matrix spikes and duplicates at no extra charge by the laboratory. By performing the above analyses, a determination will be made of the degree of soil contamination above the water table and if any other sources contribute to the contamination in the catch basins.

Additional soil samples will be collected from seven to eight feet below the water table and logged as described above. All soil cuttings will be screened with a photoionizer. Any cuttings

exhibiting visual contamination or in excess of 10 ppm (total organic vapors) will be segregated and contained in labelled drums.

2. Monitoring Well Installations and Development

Following completion of the soil borings, monitoring wells will be installed in the borehole to investigate the flow conditions in the water table aquifer, water quality, and the presence of any immiscible product layers. Each well will be installed in accordance with technical guidelines established by USEPA and will include a ten foot screen length sufficient to bracket the water table connected to a riser pipe. Well installation procedures are presented in the protocol in Appendix I. Each well will be covered by a locking flush mounted cover such that vehicular traffic is not interrupted.

Following installation, each well will be developed according to methods in Appendix J. Development water, if visually stained or odorous, will also be contained in approved D.O.T. drums for disposal by NAVFAC personnel. Otherwise, water will be allowed to drain to the catch basins.

3. Hydraulic Conductivity Testing

Immediately following development, in-situ, rising head tests will be performed to estimate the hydraulic conductivity of the water bearing soils in each well. If free product is present on the water surface, a product interface probe will be used to measure the apparent water surface. Information obtained from these tests will be evaluated using Hvorslev's method for bail tests in point piezometers (Ground Water, Freeze and Cherry, 1979 pp. 339-342). The procedures for conducting the tests and evaluating the data is presented in Appendix K.

4. Surface/Ground Water Sampling

A single round of sampling will be collected from the catch basins and the monitoring wells shown in Figure 3. Prior to collection of the samples, measurements of the water surface and thickness of immiscible product at each site will be collected. These measurements will be used later to evaluate the direction of flow in the ground water system and its relationship to flow in the catch basins.

a. Surface Water Sampling

A subsequent round of surface water samples will be collected from the same catch basins sampled during interim sampling, Figure 3. The purpose for this effort will be to compare any temporal changes in surface water quality from the previous round and to compare surface water quality to adjacent ground water quality in wells. Samples will undergo the same analyses as those indicated in Section VB. A summary of the surface-water-sample laboratory analyses are shown in Table 1. A detailed discussion of the surface water sampling methodologies is presented in Appendix B.

b. Ground Water Sampling

A round of ground water samples will be collected from up to four wells previously described. In collecting the samples, measurements of the water and free product (if any) will be collected first. Wells will then be purged to remove stagnant water and samples will be collected. A detailed discussion of ground water sampling methodologies is presented in Appendix L. All cleaning fluids will be contained in appropriately labelled drums.

Ground water samples will be field tested for pH, specific conductance, temperature, and dissolved oxygen. Samples will then be containerized and submitted for analysis of volatile hydrocarbons (EPA Method 503.1) and total petroleum hydrocarbons (EPA Method 418.1). A summary of the

ground water and free product samples field and laboratory analyses are shown in Table 1. If free phased floating product is noted in any well in a volume in which it can be collected, the product will be submitted for a GC petroleum scan to determine its constituents. Up to two product analyses have been included.

If significant free phase or dissolved phase contamination is observed in the drilling program such that a ground water recovery system appears appropriate, then samples for treatability parameters will also be collected. These parameters include: hardness, iron, manganese in addition to field tests noted above. Quality assurance/control analyses consisting of trip blanks for the sampling round will be performed by the analytical laboratory at no extra charge. Additionally, standard laboratory QA/QC procedures will be reviewed to validate data.

Dependent upon the findings developed from this effort, additional longer term monitoring/sampling may be required and will be discussed in the interim report.

5. Site Survey

A level survey will be performed of all reference points on catch basins and monitoring wells from which depth to water measurements were collected. The survey will be relative to a nearby bench mark or fixed datum (USGS mean sea level datum) and to the nearest 0.01 feet. Horizontal locations of monitoring wells will also be obtained and plotted on a site plan.

D. Qualitative Risk Evaluation

Following receipt of hydrologic and analytical data, an evaluation will be conducted to document the nature of the contaminant source and transport routes by which it may affect any human or environmental receptors. This evaluation should basically verify that no imminent hazard is present except for the surface water route which is

for this study will assist in further evaluating this route. The risk evaluation will also be used to direct the level of remediation if it is warranted.

E. Interim Report Preparation

Following completion of the field investigation and risk evaluation, a draft interim report of findings will be prepared for comment by NAVFAC personnel. The contents of the report will consist of the following:

1. A description of the methods used during the investigation (i.e. geophysical methods, soil borings, monitoring well construction, etc.).
2. A description of any deviations from the POA.
3. The results of the field investigation including site drawings indicating sample locations, geologic profiles, fence diagrams, underground utilities and groundwater contour maps.
4. The results of the sample analysis program including comparison and evaluation of the results with respect to established Federal, State and local regulatory standards or advisories.
5. Quantification of dissolved contaminant concentrations, free product layer thickness, residual soil contaminant concentrations and extent of contamination.
6. Estimates of ground water flow velocity and direction, assessment of plume migration, and an evaluation of potential fate of contaminants.
7. Site drawings with plume locations.

8. An estimate of total volume of free product available for recovery and an analysis of the feasibility of product recovery.
9. An evaluation of potential impact to humans on the environment.
10. An evaluation of the collected data for adequacy to determine whether enough information exists to enable the design of remedial measures. In the event the data is considered insufficient, O'Brien & Gere will provide an explanation as to why the POA was not adequate and provide an outline of the additional tasks presented in the conclusions and recommendations of the report.

F. Project Report Preparation

Upon completion of the field investigation and government acceptance of the Interim Report(s), O'Brien & Gere shall prepare the Project Report which shall include, but is not limited to:

1. The information developed for the Interim Report.
2. An alternative evaluation of the available remedial methods with a description of each method in terms of construction, effectiveness, efficiency and cost.
3. A recommendation for a cost effective solution to protect human health and the environment. The selected alternative shall reflect current Naval Facilities Engineering Command design criteria.

VI. PROJECT ORGANIZATION

Key individuals assigned to this project are shown on the project organization chart in Appendix M. Mr. Edward P. Zimmerman will be the overall Project Manager.

V. PROJECT SCHEDULE

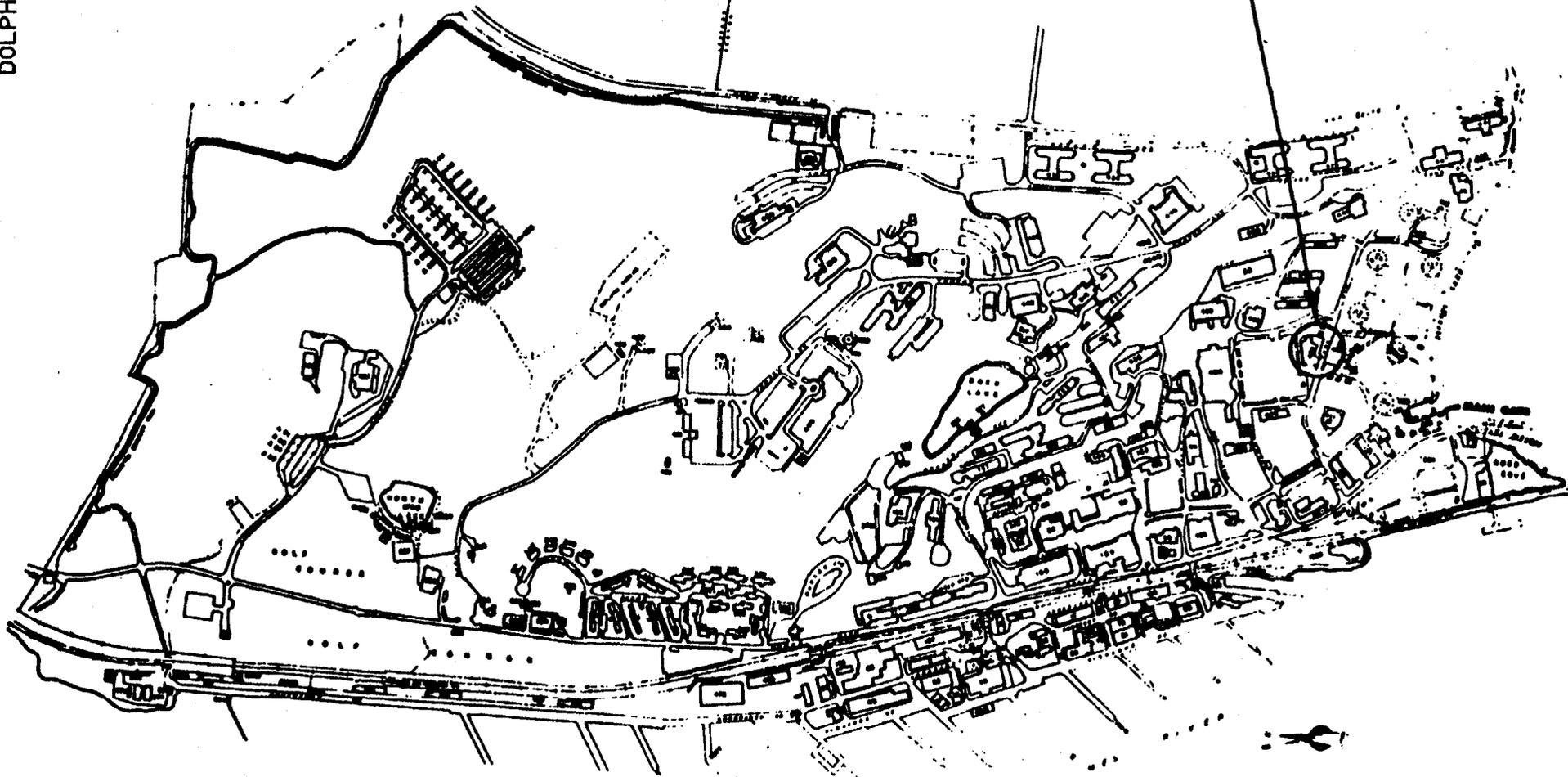
A project schedule is presented in Appendix N.

# Figures



DOLPHIN>LOCPL

PROJECT LOCATION



NOT TO SCALE



DEPARTMENT OF THE NAVY  
NAVAL FACILITIES ENGINEERING COMMAND

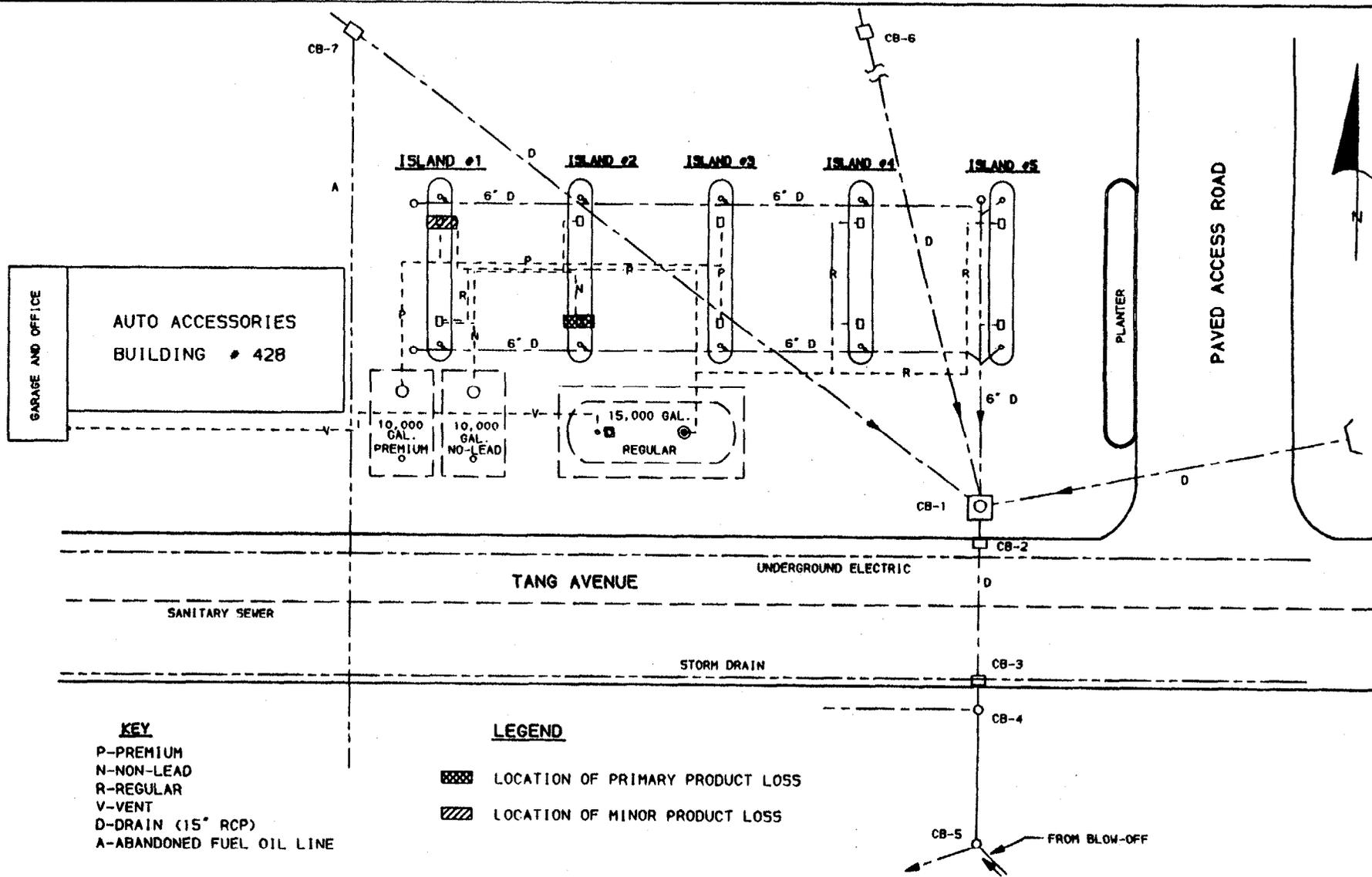
NAVAL SUBMARINE BASE NEW LONDON  
LOCATION PLAN  
GROTON, CONNECTICUT

"FILE NO."  
1062 0270

DATE  
NOVEMBER, 1960

1

DELPHI-WRITON-USEPL



**KEY**

- P-PREMIUM
- N-NON-LEAD
- R-REGULAR
- V-VENT
- D-DRAIN (15" RCP)
- A-ABANDONED FUEL OIL LINE

**LEGEND**

- LOCATION OF PRIMARY PRODUCT LOSS
- LOCATION OF MINOR PRODUCT LOSS

Scale: 1/16" = 1'	8	0	16
Drawn by: _____			
Check by: _____			

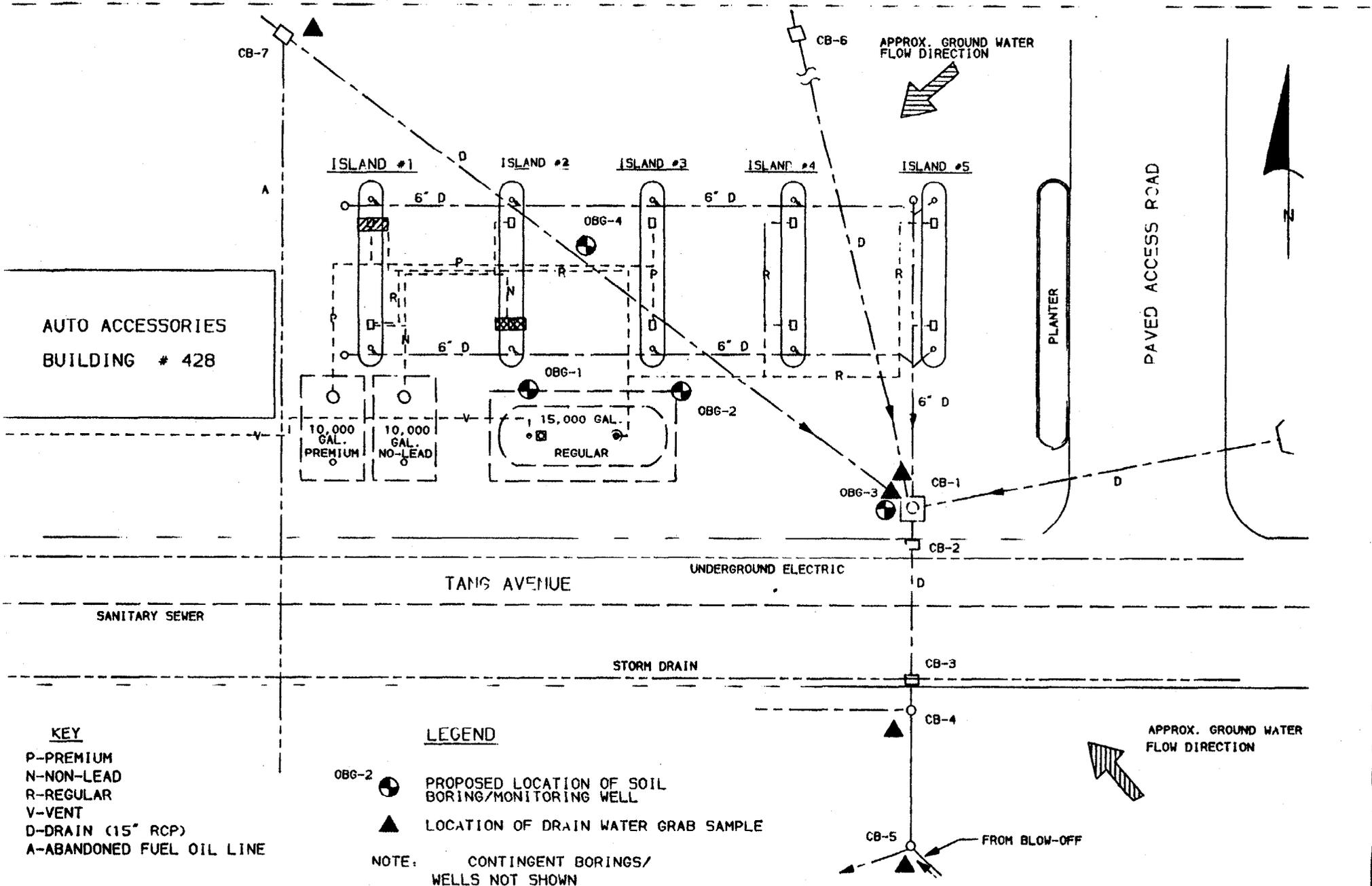
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DEPARTMENT OF THE NAVY  
NAVAL FACILITIES ENGINEERING COMMAND

NAVAL SUBMARINE BASE NEW LONDON  
NAVAL EXCHANGE STATION  
SITE PLAN  
GROTON, CONNECTICUT

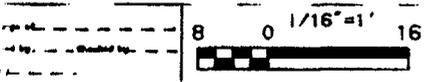
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DATE NOVEMBER, 1960



**KEY**  
 P-PREMIUM  
 N-NON-LEAD  
 R-REGULAR  
 V-VENT  
 D-DRAIN (15" RCP)  
 A-ABANDONED FUEL OIL LINE

**LEGEND**  
 OBG-2 PROPOSED LOCATION OF SOIL BORING/MONITORING WELL  
 ▲ LOCATION OF DRAIN WATER GRAB SAMPLE

NOTE: CONTINGENT BORINGS/WELLS NOT SHOWN



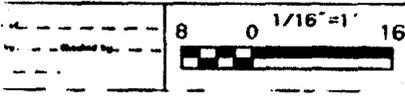
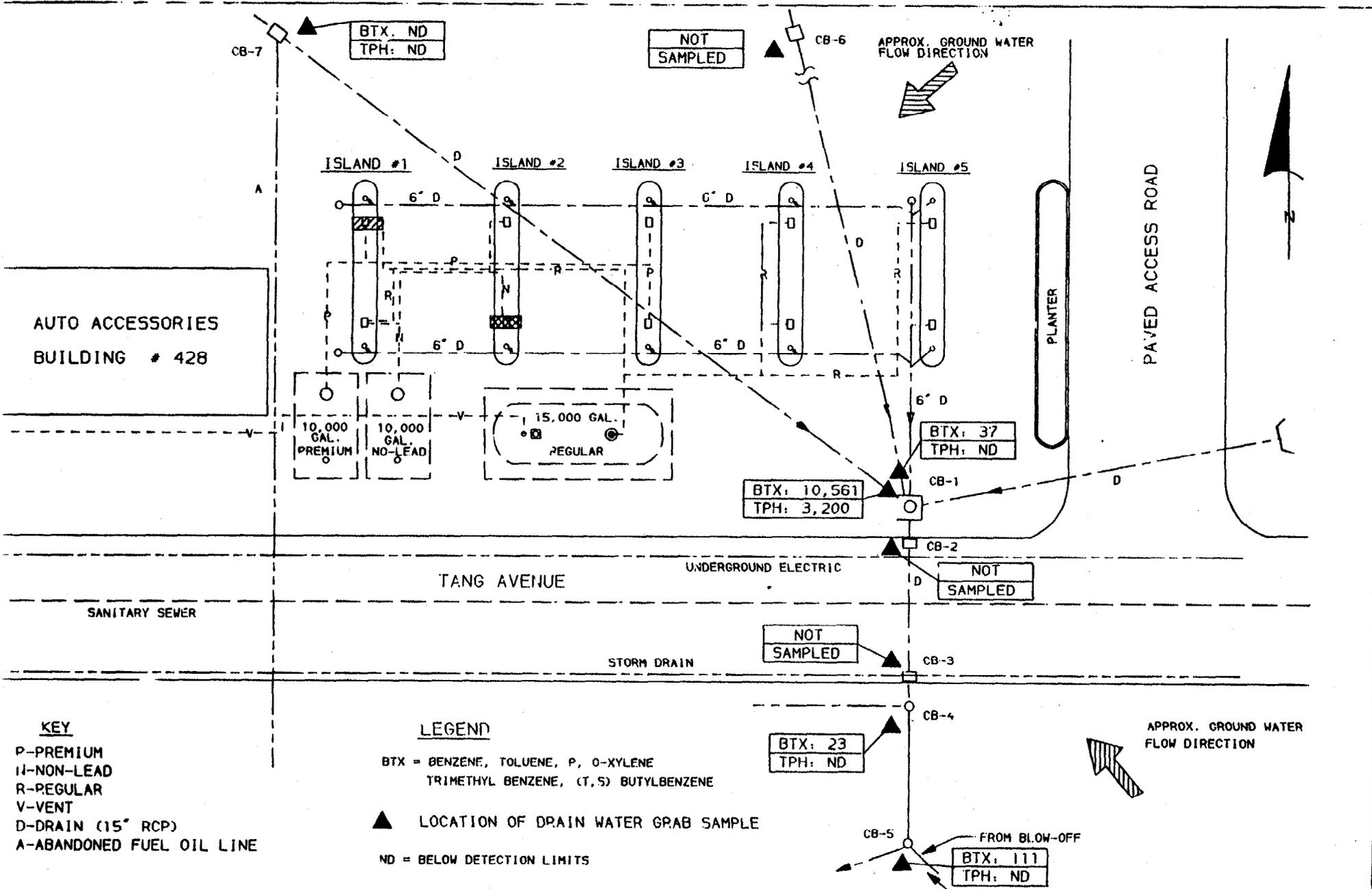
NO.	DATE	REVISION	INIT.

PROFESSIONAL ENGINEER  
 LICENSE NO. 10000  
 STATE OF CONNECTICUT

**DEPARTMENT OF THE NAVY**  
 NAVAL FACILITIES ENGINEERING COMMAND

NAVAL SUBMARINE BASE NEW LONDON  
 SOIL BORINGS/MONITORING WELL AND  
 SURFACE WATER SAMPLING LOCATIONS  
 GROTON, CONNECTICUT

FILE NO.  
 1662 0278  
 DATE  
 NOVEMBER, 1968



NO.	DATE	REVISION	INIT.

PHILLIPS, INC.  
 02718 11/1989

**DEPARTMENT OF THE NAVY**  
 NAVAL FACILITIES ENGINEERING COMMAND

NAVAL SUBMARINE BASE NEW LONDON  
 SURFACE WATER QUALITY RESULTS  
 NOVEMBER 14, 1989 (PP8)  
 GROTON, CONNECTICUT

FILE NO.  
 1862 0278  
 NOVEMBER, 1989

# Tables



TABLE 1  
SCHEDULE OF ANALYSES  
NAVAL EXCHANGE STATION SUBASENLON, GROTON, CONNECTICUT

MATRIX	FIELD ANALYSES		LABORATORY ANALYSES			NO. OF SAMPLES
	TYPE	AMOUNT	TYPE	EPA METHOD	IDENTIFICATION #	
Soil	Total Organic Vapors	Each Sample	Volatile Hydrocarbons	8010/8020	1 per boring (ORG 1-4)	4
			Total Petroleum Hydrocarbons	IR	1 per boring (ORG 1-4)	2
			Petroleum Scan	GC/FID	2 selected borings	2
			GA/GC (spikes & duplicates)	-	1 duplicate, 1 spike, total	2
Surface Water	-	-	Volatile Hydrocarbons	503.1	5 locations (2 rounds)	10
			Total Petroleum Hydrocarbons	418.1 (IR)	5 locations (2 rounds)	10
			GA/GC (trip blank)	503.1	1 per round	2
Ground Water	pH	4 (1 per well)	Volatile Hydrocarbons	503.1	1 per well (ORG 1-4)	4
	Specific Conductance	4 (1 per well)	Total Petroleum Hydrocarbons	418.1 (IR)	1 per well (ORG 1-4)	4
	Temperature	4 (1 per well)	GA/GC (trip blank)	503.1	1 per round	1
	Dissolved Oxygen	4 (1 per well)	*Hardness	130.1	2 selected wells	*2
*Iron			236.1	2 selected wells	*2	
*Manganese			243.1	2 selected wells	*2	
Petroleum Product	-	†	Petroleum Scan	GC/FID	wells with floating product	2

\* Note: Contingent analysis if groundwater remediation appears likely.

TABLE 2  
LABORATORY QA/QC  
NAVAL EXCHANGE STATION SUBASENLON, GROTON, CONNECTICUT

<u>METHOD</u>	<u>PRESERVATION</u>	<u>HOLDING TIME</u>	<u>CONTAINER</u>
EPA Method 503.1	Cool 4C	7 days until extr. 40 days until extr.	40ML vials(2)
EPA Method 418.1 TPH By IR	H <sub>2</sub> SO <sub>4</sub> pH 2	40 days after extr.	Glass
Petroleum Scan by GC/FID	Cool 4C	7 days until extr. 40 days until extr.	Glass Glass
EPA Method 602	Cool 4C	7 days until extr. 40 days until extr.	40ML vials(2)
EPA Method 130.1 for Hardness	HNO <sub>3</sub> pH 2	6 months	G,P
EPA Method 236.1 FOR IRON	HNO <sub>3</sub> pH 2	6 months	G,P
EPA Method 243.1 for Manganese	HNO <sub>3</sub> pH 2	6 months	G,P
EPA Method 8240 Volatile Organics	Cool 4C	7 days until extr.	40ML vials(2)

# Appendices



APPENDIX A

UNITED STATES DEPARTMENT OF THE NAVY  
NORTHERN DIVISION

NAVY EXCHANGE GAS STATION  
UST INVESTIGATION  
SUBMARINE BASE NEW LONDON, GROTON, CONNECTICUT  
UST INVESTIGATION AND REMEDIAL DESIGN EVALUATION  
HEALTH AND SAFETY PLAN

I. INTRODUCTION AND BACKGROUND INFORMATION

A. Certification

This document serves as the Site Health and Safety Plan for the site investigation measures being conducted by O'Brien & Gere Engineers, Inc. at the Navy Exchange gas station at Submarine Base New London (SUBASENLON), Groton, Connecticut.

All personnel (here defined as employees of O'Brien & Gere Engineers, Inc. employees of all subcontractors, respondents, all visitors and representatives from the EPA, state, local groups, media, etc.) will be required to follow procedures set forth in this plan.

Site Name: Navy Exchange Gas Station

Location: Submarine Base New London, Groton, Connecticut

Project Description: Monitoring well installation, soil borings and samplings, and surface water and ground water sampling.

B. Key Personnel

Project Manager: Edward P. Zimmerman, P.E.

On-Site Project Coordinators and Safety and Health Officers:

Rick G. Stromberg and/or Mark A. Randazzo

Naval Facilities Engineering Command Coordinator:

Joseph McCarthy

Off-Site Safety and Health Officer:

Mark A. McGowan, III, C.I.H.  
O'Brien & Gere Engineers, Inc.  
Syracuse, NY  
(315) 451-4700 X549

C. Summary of Site Hazards

Potential chemical hazards at the site are related to the presence of volatile organic compounds (VOC's) and bulk petroleum hydrocarbons in soils and ground water. These represent potential contact and inhalation hazards.

Since the work is scheduled for late November/December, there may be hazards associated with exposure to cold and/or wet weather. Another potential hazard is the hazard associated with the operation of heavy equipment in a work area.

Potential combustion hazards exist at the site due to the presence of gasoline vapors in concentrations greater than the lower explosive limit (LEL). The LEL was exceeded during testing by the SUBASENLON Fire Department and Safety Office during October 11-16, 1989. The gasoline vapor concentrations were below the LEL on October 24, 1989.

D. Project Description and Purpose

The objective of the work to be completed at the project site is to identify and quantify the extent of pollutant concentrations in the soil and ground water. Data retrieved will be used to develop alternative site remediations.

The field investigation will consist of the installation of ten soil borings and ten monitoring wells with soil samples being secured. This will be followed by the sampling of surface water and ground water.

## II. HAZARD EVALUATION

### A. Hazardous Material On-Site

Overall, the potential site concerns are represented by the presence of volatile organic carbons (VOC's) and petroleum resulting from the 10/10/89 gasoline leak.

These components may be found entrained in the soils and dissolved in the ground water, and could exist as a floating fraction on the ground water table. It should be noted that a sheen was noticed on the water in the weir installed in MHC 835. Figure 2 shows the location of MHC 835.

### C. Site Hazard Status

Overall, the potential site concerns are represented by the potential presence of volatile organic carbons and petroleum. It should be noted that the chemical compounds are not anticipated to be present in concentrations presenting an acute respiratory hazard to site personnel under the conditions anticipated for the work. Contact with contaminated soils and water is anticipated, and protective clothing to minimize contact and prevent the spread of contamination will be used.

Due to the presence of gasoline vapors above the lower explosive limit, the potential for explosions must be considered. A blower in MHC 835 will be operating to reduce gasoline vapor concentrations below the LEL while obtaining grab samples from the storm sewer surface waters. Sparkless equipment will be used on-site. Oxygen meters and explosimeters will be used while obtaining grab

samples from the storm sewers to ensure safe oxygen concentrations exist and the LEL is not being exceeded, respectively.

Other site hazards consist of inclement weather and dangers associated with heavy equipment. Extra layers of clothing and other proper safety equipment shall be worn as necessary and appropriate to the site conditions and as deemed necessary according to the on-site Health and Safety Officer.

D. Respiratory Protection

For initial site activities, no respiratory protection will be required. A monitoring program will be instituted during all surface disturbing activities using a TIP organic vapor detector. Readings will be taken every half-hour in order to monitor the presence of organic vapors. Visual inspections will also be performed to note unnatural soil conditions being exposed at the surface. In the event that either monitoring scheme indicate organic concentrations above specified action levels, the following responses should be implemented:

ACTION LEVELS

<u>Contaminant Total</u>	<u>Concentration</u>	<u>Location</u>	<u>Response</u>
Organics	1-5ppm Above Background	Active Work Area, Breathing Zone	Obtain a second sample within a time period of no less than 5 minutes but no more than 15 minutes, if the second sample reading exceeds 1ppm above background on-site workers wearing Level D shall upgrade to Level C protection.

Take appropriate action as directed by the Safety & Health Officer in accordance with the Health & Safety Plan.

<u>Contaminant Total</u>	<u>Concentration</u>	<u>Location</u>	<u>Response</u>
Organics	5-50ppm Above Background	Active Work Area, Breathing Zone	Obtain a second sample within a time period of no less than 5 minutes but no more than 15 minutes. If the second sample reading exceeds 5 ppm above background, sampling will be performed at 15 minute intervals until levels fall below 5ppm  Take appropriate action as directed by the Safety & Health Officer in accordance with the Safety & Health Officer Health & Safety Plan.
	50ppm (Above Background) for two successive readings within 15 minute period	Active Work Area, Breathing Zone	Active work area shall be shutdown and personnel evacuated up wind until conditions are favorable to Level C protection.

E. Contact Protection

1. Monitoring Well Installation & Test Pit Excavation

All personnel will have appropriate personal safety equipment and protective clothing; as specified for Level D as follows. Each individual will be properly trained in the use of this safety equipment before the start of field activities. Safety equipment and protective clothing shall be used as directed by the on-site Health and Safety Officer. Such equipment and clothing shall be cleaned and will be maintained in proper condition by project personnel.

Protective footwear and clothing will be required at all times during this investigation. Hard hats and necessary hearing protection (ear plugs or earmuffs) will be worn during operation of all heavy equipment. Protective glasses shall be worn when the potential for a splash or for flying particles exists due to site activities. The types of equipment and clothing to be worn as part of the various levels of protection are given below:

Level C Protection

- a) Full-face air purifying respirator equipped with organic vapor cartridges if air monitoring readings in the breathing zone are between 1 and 10ppm (all personnel requiring respiratory protection are fit tested with the respirator to be used in the field, and must be approved for use of a respirator following a pulmonary function test). If air monitoring reveals organic vapor concentrations between 10-50ppm, a full face respirator with organic vapor cartridges will be used.
- b) Chemical-resistant disposable coveralls, long sleeves, one piece with tape between suits and boots and gloves.
- c) Steel-toe boots with disposable rubber overboots.
- d) Nitrile gloves over warm work gloves.

Level D Protection

- a) Long sleeve work shirt and long pants (work pants or jeans).
- b) Steel-toe boots with rubber overboots.

c) Viton gloves over warm work gloves.

d) Coveralls to be cleaned or disposed of immediately following site work (cloth or chemical resistant).

F. Heat Stress/Cold Exposure

Precautions to be taken against heat stress due to the use of personal protection include:

- training in the recognition and treatment of the various forms of heat stress for all on-site personnel;
- access to adequate supplies of water for all workers;
- prudent work/rest scheduling;
- availability of a shaded rest area (to include the field vehicle);
- self-monitoring of pulse by all workers in Level C protective equipment. As a general guideline, a pulse of 110 beats per minute or greater, following a rest period, is a signal to shorten the next work cycle by a third.

Precaution to be taken against excessive cold exposure include:

- training of all on-site workers in the recognition and treatment of cold exposure;
- availability of a warm, dry rest area.
- extended or more frequent rest periods.

III. STANDARD OPERATING PROCEDURES

A. Health and Safety Management and Responsibilities

The on-site project coordinator(s) will implement the safety program, make sure proper clothing and supplies are available and maintained, and inform the workers of existing site conditions. The on-site coordinator(s) will be responsible for overseeing compliance with these protocols.

B. Requirements for Entry into Work Zones

Entry into the work area will be permitted only to those personnel wearing the required clothing and protective equipment. Persons not connected with the work being done on the site will not be permitted access to the work area. The work area will be a minimum of 50 ft. radius around the drill rig and marked off by flags, stakes or cones.

C. Monitoring/Action Levels

Monitoring will be conducted as previously discussed. A photoionization meter will monitor for organic vapor concentrations during the monitoring well installations.

<u>Instrument</u>	<u>Component Monitored</u>	<u>Safe Level</u>	<u>Respirator Protect.</u>
TIP II (Photoionization Meter)	Organic Vapor	1-10ppm	Full-face respirator protection with organic vapor cartridge
TIP II (Photoionization Meter)	Organic Vapor	10-50ppm	Full-face respirator protection with organic vapor cartridge

Daily monitoring results will be placed in the project file. Daily summaries of monitoring results will be recorded in the project log book.

D. Decontamination Procedures

Decontamination procedure for personnel wearing protective equipment are as follows.

1. Wash and rinse gloves and boots.
2. Remove overboots and overgloves. Remove coverall or tyvek and discard in plastic lined container.
3. Remove respirator (if worn) and place on plastic sheet for cleaning. Remove organic vapor cartridges and dispose of properly.
4. Wash hands and face. Decontamination waste waters will be collected and disposed of according to applicable regulations.

IV. CONTINGENCY PLAN

A. Introduction

A Contingency Plan has been developed in the event of an unplanned release of contaminants to the environmental or the development of an emergency situation during on-site operations. The Contingency Plan describes policies and procedures used to respond to emergency situations. Types of emergency situations which might arise include:

- major medical emergency
- liquid or solid hazardous materials spill
- severe inclement weather

When an emergency occurs, decisive action is required. Delays of minutes can create life threatening situations. A response needs to be immediate and accurate.

1. Emergency Response

The on-site project coordinator will be responsible for implementation of control over emergency situations. In an emergency this individual must be notified of the following essential information:

What happened:

- Type of incident
- When incident occurred
- Where incident occurred
- Cause of incident (to be verified by subsequent investigation)
- Extent of damage
- Extent of chemical release

Casualties:

- Victims (number, location, and condition)
- Treatment Administered
- Treatment Required
- Missing Personnel

After assessing the emergency, the on-site project coordinator, in conjunction with the project manager, will notify the appropriate emergency response personnel. The on-site project coordinator will alert on-site personnel as to the nature of the emergency and provide instructions regarding evacuation and/or rescue. In the event that evacuation is necessary, work should be stopped immediately and the site evacuated.

2. Emergency Communication

The following standard hand signals will be used in case a worker is unable to speak:

- Hand gripping throat - out of air, can't breathe.
  - Grip partner's wrist or place hands around waist - leave area immediately.
  - Index finger across throat and rolling of hands - stop work, leave area immediately.
  - Hands on top of head - need assistance.
  - Thumbs up - OK, I'm all right, I understand
  - Thumbs down - no, negative

B. Site Emergency Evacuation

In case of an emergency, all personnel should evacuate the site to an immediately adjacent area as instructed by the on-site coordinator.

It is the responsibility of the on-site project coordinator to inform all personnel entering the work site of potential hazard areas and the locations of project work areas.

The on-site project coordinator is responsible for controlling the entry of personnel into the Work Area and knowing the location of on-site personnel at all times.

In the event that an incident threatens the health or safety of the surrounding community, the public will be informed and emergency procedures will be coordinated with the appropriate off-site agencies. The on-site project coordinator in conjunction with the project manager will coordinate these efforts.

C. Medical/First Aid

Required medical treatment may range from bandaging minor cuts to providing life saving first aid and immediate medical transport. There should be at minimum one individual on-site at all times who is responsible for emergency first aid procedures. These persons should be identified as such for the information of others on-site.

(Should an injury occur, the transportation route to the nearest hospital is identified in Table 1 (i.e., Emergency Response Organization).

The following is a general description of first aid measures to be employed on the site. In cases of symptoms of chemical exposure, first aid treatment is to be followed by a full medical examination. The person(s) accompanying a victim to the hospital must be able to inform hospital personnel of the nature of the contamination of the site. If necessary, a copy of this Health and Safety Plan can be given to hospital personnel.

1. Inhalation

Symptoms: dizziness, nausea, lack of coordination, headache, irregular rapid breathing, coughing, choking, weakness, loss of consciousness, coma.

Treatment:

- a. Bring victim to fresh air. Rinse eyes or throat if irritated.
- b. Be prepared to administer CPR, only if CPR certified.
- c. Take victim to hospital.

2. Contact

Symptoms: Same as above. On skin, solvents may produce irritation, rash or burning. For eyes, symptoms may include redness, irritation, pain or impaired vision.

Treatment:

- a. Flush affected area with cool water for at least 5 minutes.
- b. Cover skin injuries with a clean dressing.
- c. If injury is severe, take victim to hospital. If not, seek other medical attention.
- d. Monitor victim for at least 48 hours.

3. Ingestion

Symptoms: Same as above, with stomach cramps.

- a. Take victim to hospital immediately.
- b. Do not induce vomiting.

D. Emergency Procedures

Emergency procedures which may be useful in the event of an emergency situation previously described are included below. While it is impossible to anticipate every emergency situation which might arise, the procedures deal with the significant components of most emergency situations.

1. Major Medical Emergency

A major medical emergency could arise from any number of situations. Swift, decisive action must take place to administer aid to injured personnel and prevent injury from spreading to additional personnel. The following procedure may be useful in effective handling of a medical emergency:

Remove injured personnel from hazard areas as soon as possible. Rescue personnel must be protected from the hazard. Discretion must be used in the method of movement (e.g., moving personnel with spinal injuries should only be done by trained personnel unless the situation is immediately life threatening). First aid should be administered as soon as victim is moved to safety. The appropriate Emergency Response Organization (e.g., Ambulance, Hospital) should be notified and utilized as necessary.

2. Severe Inclement Weather

On-site personnel should be updated on current weather forecasts. Preparations should be made ahead of time in the event of the forecast of severe inclement weather (i.e., heavy precipitation, high winds, frigid temperatures) to protect on-site facilities and ensure worker safety. On-site personnel should seek refuge in the facility whenever weather conditions compromise worker safety.

3. Emergency Decontamination Procedure

Immediate decontamination is to be done when it is an essential part of lifesaving first-aid, but should not be done if it would interfere with necessary medical treatment.

If decontamination can be done: wash, rinse, and/or cut off protective clothing and/or equipment. If decontamination cannot be done (only in a case of inhalation exposure), wrap the victim in blankets, plastic, or other barrier materials to reduce the potential for contamination of other personnel. In addition, emergency and off-site medical personnel. In addition, emergency and off-site medical personnel need to be alerted to specific decontamination procedures to follow.

E. Follow-Up Procedures

Before normal site activities are resumed, personnel must be fully prepared and equipped to handle another emergency. Any necessary emergency equipment must be recharged, refilled, or replaced. Government agencies, such as Occupational Safety and Health Administration (OSHA), Environmental Protection Agency (EPA), Department of Transportation (DOT) and state agencies, must be notified as appropriate.

An investigation of the incident needs to be conducted as soon as possible. The report may be used as training and information tools to prevent a future recurrence, as evidence in future legal action, for assessment of liability by insurance companies, and for review by government agencies. Therefore, the document needs to be accurate, objective, complete and authenticated (signed and dated).

With the direction of the "on-site" coordinator, all personnel entering the site must be informed about emergency procedures. Visitors need to be briefed on basic emergency procedures such as decontamination, emergency signals, and evacuation routes. Personnel without defined emergency response roles need to receive training which includes: hazard recognition, understanding of emergency procedures, knowledge of evacuation routes and how to report an emergency. Off-site emergency personnel who are potential first responders need to be informed about site-specific hazards, appropriate response techniques, site emergency procedures, and site decontamination procedures.

F. On-Site Emergency Equipment

The following emergency equipment will be on-site during field operations:

- Fire Extinguishers: Class ABC fire extinguisher(s) will be readily available on-site throughout the investigation. The fire extinguisher(s) will be kept with the field crew during any drilling activity.
- First Aid Kits: An industrial first aid kit with sufficient supplies for 5 people will be kept in the support area. Additionally, at least one individual First Aid/CPR qualified, will be on-site during project operations.
- Portable Eye Wash Kit: A portable eye wash kit will be readily available on-site throughout the investigation. The kit will be kept with the field crew during any drilling activity. Permanent eye wash facilities are also available for use on-site.

TABLE 1  
EMERGENCY RESPONSE ORGANIZATIONS

<u>Organization</u>	<u>Phone Number</u>
SUBASENLON Fire Department.....	3333
SUBASENLON Police Department.....	3444
Poison Control.....	1-800-343-2722
SUBASENLON Fire Department, Rescue Squad.....	3333
Lawrence Memorial Hospital 365 Montawk Avenue New London, CT.....	(203) 492-0711
Lawrence Memorial Hospital 365 Montawk Avenue New London, Ct.....	(203) 442-0711
O'Brien & Gere Engineers, Inc. (Thomas A. Jordan, Richard G. Stromberg, Mark A. Randazzo) 100 Summer Street Boston, MA.....	(617) 423-2919
Navy D.P.W. William Mansfield.....	(203) 449-4481
James Fitzpatrick.....	(203) 449-4486
NAVFAC Joseph McCarthy Philadelphia, PA.....	(215) 897-6280

**Directions to Lawrence Memorial Hospital:**

Left onto Crystal Lake Road and right onto Route 12 South to Route 95 South. Cross bridge over Thames River and take exit for Frontage Row. Follow signs to Coleman Street and take a left. At the end of Coleman Street, take a right onto Montawk Avenue. Hospital is on the right.

APPENDIX B

## SURFACE WATER SAMPLING PROTOCOL

When sampling from an open body of water (stream, culvert or pond) care must be exercised to collect a representative sample. The sample should cause as little disturbance to the water body as possible. Avoid taking a sample of water which shows evidence of sediment, debris or other material which may have been stirred up by the presence of the sampler.

### Surface Water Sampling

Surface water samples in the drains should be taken from point located in the middle of the culvert. The specific location will be determined in the field and should be adequate to accurately reflect a representative portion of the water body being sampled. A single sample, collected just below the surface at the stream's midpoint will be adequate for sampling and analyses purposes.

Samples should be taken while facing upstream, away from the influence of the sampler on stream flow. Samples should be collected from the downstream culvert first and proceed upstream so as not to affect subsequent samples.

Collection is accomplished by submerging a clean container at the sampling point to the depth required. For deep streams or ponds, a Kemmer, VanDorn or other sampler specifically designed for this purpose may be used. For shallow (i.e. less than three feet deep) locations, an inverted sample container may be carefully submerged by hand or nylon string and then slowly allowed to fill.

Samples should then be placed in the proper containers, preserved as necessary for the analyses to be run and stored in an insulated ice cooler at 4°C. All pertinent information should be recorded including sample data and location, sample identification and chain-of-custody forms.

Surface water sampling in storm drains will require two men since the storm sewers are confined spaces. The person descending into the manhole will be connected to rope and lanyard which will be monitored by the person outside the catch basin. Constant visual contact between the two individuals is required and the time in the storm sewer should be minimized. Due to the previous presence of volatile organic compounds in the storm sewer system, the person collecting samples should wear a full-face respirator with organic vapor cartridges.

APPENDIX C

**GROUNDWATER SAMPLING FIELD LOG**

Client NAVFAC GROTON, (EXCHANGE STATION) Job No. 1862-023  
 Sample Location NAVM EXCHANGE, GROTON CT. Well No. CB-1A  
 Sampled By MAPL. Date 11/14/89 Time 13:05  
 Weather Cloud 65° Sampled with Bailer GMS Pump     

**A. WATER TABLE**

Well depth (from top of standpipe)      Well elevation (top of standpipe)       
 Depth to water table (from top of standpipe)      Water table elevation       
 Length of water column (LWC)      (feet)  
 Volume of water in well - 2" diameter wells = 0.163 x (LWC) =      gallons  
 - 4" diameter wells = 0.653 x (LWC) =      gallons  
 - 6" diameter wells + 1.469 x (LWC) =      gallons

**B. PHYSICAL APPEARANCE AT START**

Color CLOR SLIGHT BROWN TONE Odor NO ODOR, GREEN IN MANNER Turbidity V. SLIGHT  
 Was an oil film or layer apparent? MUSTY ODOR, SLIGHT PATCHES OF SILT

**C. PREPARATION OF WELL FOR SAMPLING**

Amount of water removed before sampling      gallons  
 Did well go dry?     

**D. PHYSICAL APPEARANCE DURING SAMPLING**

Color SAME Odor      Turbidity       
 Was an oil film, or layer apparent?     

**E. WELL SAMPLING**

	<u>Analysis</u>	<u>Bottle No.</u>	<u>Special Sampling Instructions</u>
1.	<u>2 VIALS</u>	<u>EPA MENDO 503.1</u>	<u>O<sub>2</sub> = 19.8%</u>
2.	<u>1 JAR</u>	<u>" 418</u>	<u>H<sub>2</sub>S = 0%</u>
3.			<u>CO<sub>2</sub> = 0%</u>
4.			
5.			

**F. CONDUCTIVITY**

     PH     

**G. COMMENTS**





Client NAVFAC GYTON (EXCHANGE STATION) Job No. 1862-023  
 Sample Location CB-5 Well No. CB-5  
 Sampled By MAC Date 11/14 Time 1235  
 Weather CLOUDY 70° Sampled with Bailer GRAB Pump ✓

**A. WATER TABLE**

Well depth (from top of standpipe) 10' IN DRAIN Well elevation (top of standpipe) ✓

Depth to water table (from top of standpipe) \_\_\_\_\_ Water table elevation ✓

Length of water column (LWC) \_\_\_\_\_ (feet)

Volume of water in well - 2" diameter wells = 0.163 x (LWC) = \_\_\_\_\_ gallons  
 - 4" diameter wells = 0.653 x (LWC) = \_\_\_\_\_ gallons  
 - 6" diameter wells = 1.469 x (LWC) = \_\_\_\_\_ gallons

**B. PHYSICAL APPEARANCE AT START**

Color CLEAR (SLIGHT GREEN ON POURING) Odor NONE Turbidity NONE

Was an oil film or layer apparent? SLIGHT GREEN WATER FLOWING AT 10-30 GPM

**C. PREPARATION OF WELL FOR SAMPLING**

Amount of water removed before sampling NONE gallons

Did well go dry? ✓

**D. PHYSICAL APPEARANCE DURING SAMPLING**

Color SAME Odor ✓ Turbidity ✓

Was an oil film, or layer apparent? ✓

**E. WELL SAMPLING**

	<u>Analysis</u>	<u>Bottle No.</u>	<u>Special Sampling Instructions</u>
1.	<u>1 VIAL 503.1</u>	<u>O<sub>2</sub> = 20%</u>	
2.	<u>1 VIAL 418</u>	<u>H<sub>2</sub>S = 0%</u>	
3.		<u>CO<sub>2</sub> = 0%</u>	
4.			
5.			

**F. CONDUCTIVITY**

\_\_\_\_\_ PH ✓

**G. COMMENTS**

GROUNDWATER SAMPLING FIELD LOG

Client NAVFAC EXCHANGE GASTON CT. Job No. 1562-023

Sample Location CB-7 SEE PLAN Well No. CB-7

Sampled By MAR Date 11/14/89 Time 1330

Weather Clear 65° Sampled with Bailer WAB Pump

**A. WATER TABLE**

Well depth (from top of standpipe)        Well elevation (top of standpipe)       

Depth to water table (from top of standpipe)        Water table elevation       

Length of water column (LWC)        (feet)

Volume of water in well - 2" diameter wells = 0.163 x (LWC) =        gallons  
- 4" diameter wells = 0.653 x (LWC) =        gallons  
- 6" diameter wells + 1.469 x (LWC) =        gallons

**B. PHYSICAL APPEARANCE AT START**

Color clear NO SHEEN Odor NO ODOR Turbidity NONE

Was an oil film or layer apparent? Flow very low

**C. PREPARATION OF WELL FOR SAMPLING**

Amount of water removed before sampling        gallons

Did well go dry?       

**D. PHYSICAL APPEARANCE DURING SAMPLING**

Color SAME Odor        Turbidity       

Was an oil film, or layer apparent?       

**E. WELL SAMPLING**

	<u>Analysis</u>	<u>Bottle No.</u>	<u>Special Sampling Instructions</u>
1.	<u>2 VIALS GPAS03.1</u>	<u>O<sub>2</sub> = 20.8 %</u>	
2.	<u>1 JAR AIR.</u>	<u>H<sub>2</sub>S = 0 %</u>	
3.		<u>CO<sub>2</sub> = 0 %</u>	
4.			
5.			

**F. CONDUCTIVITY**

       PH       

**G. COMMENTS**

APPENDIX D



APPENDIX E

Page 1  
Received: 11/15/89

TOXIKOM CORP.

REPORT

Work Order # 89-11-144

11/20/89 12:30:22

REPORT O'BRIEN & GERE  
TO 100 SUMMER ST., SUITE 2904  
BOSTON, MA 02110

PREPARED TOXIKOM CORPORATION  
BY 225 WILDWOOD AVE.  
WOBURN, MA 01801

*Lawrence D. Dami*  
CERTIFIED BY

ATTEN PAUL STEINBURG

ATTEN PAUL LEZBERG  
PHONE (617) 933-6903

CONTACT JIM

CLIENT O'BRIEN GERE SAMPLES 6  
COMPANY O'BRIEN & GERE  
FACILITY \_\_\_\_\_

DEQE MASS. CERT. STATUS: TRACE METALS, FLUORIDE, CORROSIVITY  
SERIES, SODIUM, T. COLIFORM(MF), METALS, MINERALS, VOLATILE  
HALOCARBONS & AROMATIC, CYANIDE, PHENOLICS, F. COLIFORM(MF)  
STD. PLATE COUNT, NUTRIENTS, PESTICIDES, O & G, TRIHALOMETHANE

WORK ID NONE  
TAKEN \_\_\_\_\_  
TRANS \_\_\_\_\_  
TYPE WATER  
P.O. # \_\_\_\_\_  
INVOICE under separate cover

Q.A. MANAGER: Michael J. Buh.

SAMPLE IDENTIFICATION

TEST CODES and NAMES used on this report

01 CB-1A  
02 CB-1B  
03 CB-4  
04 CB-5  
05 CB-7  
06 TRIP BLANK

503 VOLATILE HALOCARBONS  
TPH IR TPH BY IR

Received: 11/15/89

Results by Sample

SAMPLE ID <u>CB-1A</u>	SAMPLE # <u>01</u> FRACTIONS: <u>A</u>
Date & Time Collected <u>11/14/89 13:05:00</u> Category <u>WATER</u>	
TPH_IR <u>ND</u>	
mg/L,DL=1.0	

Received: 11/15/89

## Results by Sample

SAMPLE ID CB-1AFRACTION 01ATEST CODE 503NAME VOLATILE HALOCARBONSDate & Time Collected 11/14/89 13:05:00Category WATER

	RESULT	LIMIT	UNITS = ug/L
Benzene	<u>17</u>	<u>0.50</u>	Notes and Definitions for this Report:  EXTRACTED: _____ DATE RUN: <u>11/17/89</u> ANALYST: <u>JJS</u> INSTRUMENT: <u>LSC 2000</u> DIL. FACTOR: <u>1</u>  ND = not detected at detection limit
Trichloroethene	<u>ND</u>	<u>0.50</u>	
Toluene	<u>18</u>	<u>0.50</u>	
Tetrachloroethene	<u>ND</u>	<u>0.50</u>	
Chlorobenzene	<u>ND</u>	<u>0.50</u>	
Ethylbenzene	<u>ND</u>	<u>0.50</u>	
p-Xylene	<u>2</u>	<u>0.50</u>	
o-Xylene	<u>ND</u>	<u>0.50</u>	
Stryene	<u>ND</u>	<u>0.50</u>	
Isopropylbenzene	<u>ND</u>	<u>0.50</u>	
Bromobenzene	<u>ND</u>	<u>0.50</u>	
N-Propylbenzene	<u>ND</u>	<u>0.50</u>	
2-Chlorotoluene	<u>ND</u>	<u>0.50</u>	
m-Xylene	<u>ND</u>	<u>0.50</u>	
4-Chlorotoluene	<u>ND</u>	<u>0.50</u>	
1,3,5-Trimethylbenzene	<u>ND</u>	<u>0.50</u>	
T-Butylbenzene	<u>ND</u>	<u>0.50</u>	
1,2,4-Trimethylbenzene	<u>ND</u>	<u>0.50</u>	
S-Butylbenzene	<u>ND</u>	<u>0.50</u>	
1,3-Dichlorobenzene	<u>ND</u>	<u>0.50</u>	
1,4-Dichlorobenzene	<u>ND</u>	<u>0.50</u>	
4-Isopropyltoluene	<u>ND</u>	<u>0.50</u>	
1,2-Dichlorobenzene	<u>ND</u>	<u>0.50</u>	
N-Butylbenzene	<u>ND</u>	<u>0.50</u>	
1,2,4-Trichlorobenzene	<u>ND</u>	<u>0.50</u>	
Napthalene	<u>ND</u>	<u>0.50</u>	
Hexachlorobutadiene	<u>ND</u>	<u>0.50</u>	
1,2,3-Trichlorobenzene	<u>ND</u>	<u>0.50</u>	

SAMPLE ID <u>CB-1B</u>	SAMPLE # <u>02</u> FRACTIONS: <u>A</u>
	Date & Time Collected <u>11/14/89 13:15:00</u> Category <u>WATER</u>
TPH_IR <u>3.2</u> mg/L,DL=1.0	

SAMPLE ID CB-1B FRACTION 02A TEST CODE 503 NAME VOLATILE HALOCARBONS  
Date & Time Collected 11/14/89 13:15:00 Category WATER

	RESULT	LIMIT	UNITS = ug/L
Benzene	<u>4850</u>	<u>0.50</u>	Notes and Definitions for this Report:  EXTRACTED: _____ DATE RUN: <u>11/17/89</u> ANALYST: <u>JJS</u> INSTRUMENT: <u>LSC 2000</u> DIL. FACTOR: <u>50</u>  ND = not detected at detection limit
Trichloroethene	<u>ND</u>	<u>0.50</u>	
Toluene	<u>3680</u>	<u>0.50</u>	
Tetrachloroethene	<u>ND</u>	<u>0.50</u>	
Chlorobenzene	<u>ND</u>	<u>0.50</u>	
Ethylbenzene	<u>ND</u>	<u>0.50</u>	
p-Xylene	<u>633</u>	<u>0.50</u>	
o-Xylene	<u>217</u>	<u>0.50</u>	
Stryene	<u>ND</u>	<u>0.50</u>	
Isopropylbenzene	<u>ND</u>	<u>0.50</u>	
Bromobenzene	<u>ND</u>	<u>0.50</u>	
N-Propylbenzene	<u>ND</u>	<u>0.50</u>	
2-Chlorotoluene	<u>ND</u>	<u>0.50</u>	
m-Xylene	<u>ND</u>	<u>0.50</u>	
4-Chlorotoluene	<u>ND</u>	<u>0.50</u>	
1,3,5-Trimethylbenzene	<u>351</u>	<u>0.50</u>	
T-Butylbenzene	<u>225</u>	<u>0.50</u>	
1,2,4-Trimethylbenzene	<u>ND</u>	<u>0.50</u>	
S-Butylbenzene	<u>605</u>	<u>0.50</u>	
1,3-Dichlorobenzene	<u>ND</u>	<u>0.50</u>	
1,4-Dichlorobenzene	<u>ND</u>	<u>0.50</u>	
4-Isopropyltoluene	<u>ND</u>	<u>0.50</u>	
1,2-Dichlorobenzene	<u>ND</u>	<u>0.50</u>	
N-Butylbenzene	<u>ND</u>	<u>0.50</u>	
1,2,4-Trichlorobenzene	<u>ND</u>	<u>0.50</u>	
Napthalene	<u>ND</u>	<u>0.50</u>	
Hexachlorobutadiene	<u>ND</u>	<u>0.50</u>	
1,2,3-Trichlorobenzene	<u>ND</u>	<u>0.50</u>	

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TOXIKOM CORP. REPORT  
Results by Sample

Work Order # 89-11-144

SAMPLE ID <u>CB-4</u>	SAMPLE # <u>03</u> FRACTIONS: <u>A</u>
Date & Time Collected <u>11/14/89 12:50:00</u> Category <u>WATER</u>	
TPH IR <u>ND</u>	
mg/L, DL=1.0	

SAMPLE ID CB-4 FRACTION 03A TEST CODE 503 NAME VOLATILE HALOCARBONS  
Date & Time Collected 11/14/89 12:50:00 Category WATER

RESULT LIMIT UNITS = ug/L

Benzene	<u>20</u>	<u>0.50</u>
Trichloroethene	<u>ND</u>	<u>0.50</u>
Toluene	<u>ND</u>	<u>0.50</u>
Tetrachloroethene	<u>ND</u>	<u>0.50</u>
Chlorobenzene	<u>ND</u>	<u>0.50</u>
Ethylbenzene	<u>ND</u>	<u>0.50</u>
p-Xylene	<u>ND</u>	<u>0.50</u>
o-Xylene	<u>3</u>	<u>0.50</u>
Stryene	<u>ND</u>	<u>0.50</u>
Isopropylbenzene	<u>ND</u>	<u>0.50</u>
Bromobenzene	<u>ND</u>	<u>0.50</u>
N-Propylbenzene	<u>ND</u>	<u>0.50</u>
2-Chlorotoluene	<u>ND</u>	<u>0.50</u>
m-Xylene	<u>ND</u>	<u>0.50</u>
4-Chlorotoluene	<u>ND</u>	<u>0.50</u>
1,3,5-Trimethylbenzene	<u>ND</u>	<u>0.50</u>
T-Butylbenzene	<u>ND</u>	<u>0.50</u>
1,2,4-Trimethylbenzene	<u>ND</u>	<u>0.50</u>
S-Butylbenzene	<u>ND</u>	<u>0.50</u>
1,3-Dichlorobenzene	<u>ND</u>	<u>0.50</u>
1,4-Dichlorobenzene	<u>ND</u>	<u>0.50</u>
4-Isopropyltoluene	<u>ND</u>	<u>0.50</u>
1,2-Dichlorobenzene	<u>ND</u>	<u>0.50</u>
N-Butylbenzene	<u>ND</u>	<u>0.50</u>
1,2,4-Trichlorobenzene	<u>ND</u>	<u>0.50</u>
Napthalene	<u>ND</u>	<u>0.50</u>
Hexachlorobutadiene	<u>ND</u>	<u>0.50</u>
1,2,3-Trichlorobenzene	<u>ND</u>	<u>0.50</u>

Notes and Definitions for this Report:

EXTRACTED: \_\_\_\_\_  
DATE RUN: 11/17/89  
ANALYST: JJS  
INSTRUMENT: LSC 2000  
DIL. FACTOR: 1

ND = not detected at detection limit

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TOXIKON CORP.                      REPORT  
Results by Sample

Work Order # 89-11-144

SAMPLE ID <u>CB-5</u>	SAMPLE # <u>04</u> FRACTIONS: <u>A</u>
Date & Time Collected <u>11/14/89 12:35:00</u> Category <u>WATER</u>	
TPH IR <u>ND</u>	
mg/L, DL=1.0	

SAMPLE ID CB-5 FRACTION 04A TEST CODE 503 NAME VOLATILE HALOCARBONS  
Date & Time Collected 11/14/89 12:35:00 Category WATER

	RESULT	LIMIT	UNITS = ug/L
Benzene	<u>52</u>	<u>0.50</u>	Notes and Definitions for this Report:  EXTRACTED: _____ DATE RUN: <u>11/17/89</u> ANALYST: <u>JJS</u> INSTRUMENT: <u>LSC 2000</u> DIL. FACTOR: <u>1</u>  ND = not detected at detection limit
Trichloroethene	<u>ND</u>	<u>0.50</u>	
Toluene	<u>16</u>	<u>0.50</u>	
Tetrachloroethene	<u>ND</u>	<u>0.50</u>	
Chlorobenzene	<u>ND</u>	<u>0.50</u>	
Ethylbenzene	<u>ND</u>	<u>0.50</u>	
p-Xylene	<u>12</u>	<u>0.50</u>	
o-Xylene	<u>6</u>	<u>0.50</u>	
Stryene	<u>ND</u>	<u>0.50</u>	
Isopropylbenzene	<u>ND</u>	<u>0.50</u>	
Bromobenzene	<u>ND</u>	<u>0.50</u>	
N-Propylbenzene	<u>ND</u>	<u>0.50</u>	
2-Chlorotoluene	<u>ND</u>	<u>0.50</u>	
m-Xylene	<u>ND</u>	<u>0.50</u>	
4-Chlorotoluene	<u>ND</u>	<u>0.50</u>	
1,3,5-Trimethylbenzene	<u>8</u>	<u>0.50</u>	
T-Butylbenzene	<u>7</u>	<u>0.50</u>	
1,2,4-Trimethylbenzene	<u>ND</u>	<u>0.50</u>	
S-Butylbenzene	<u>10</u>	<u>0.50</u>	
1,3-Dichlorobenzene	<u>ND</u>	<u>0.50</u>	
1,4-Dichlorobenzene	<u>ND</u>	<u>0.50</u>	
4-Isopropyltoluene	<u>ND</u>	<u>0.50</u>	
1,2-Dichlorobenzene	<u>ND</u>	<u>0.50</u>	
N-Butylbenzene	<u>ND</u>	<u>0.50</u>	
1,2,4-Trichlorobenzene	<u>ND</u>	<u>0.50</u>	
Napthalene	<u>ND</u>	<u>0.50</u>	
Hexachlorobutadiene	<u>ND</u>	<u>0.50</u>	
1,2,3-Trichlorobenzene	<u>ND</u>	<u>0.50</u>	

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TOXIKON CORP.                      REPORT  
Results by Sample

Work Order # 89-11-144

SAMPLE ID <u>CB-7</u>	SAMPLE # <u>05</u> FRACTIONS: <u>A</u>
Date & Time Collected <u>11/14/89 13:30:00</u> Category <u>WATER</u>	
TPH_IR <u>ND</u>	
mg/L, DL=1.0	

SAMPLE ID CB-7 FRACTION 05A TEST CODE 503 NAME VOLATILE HALOCARBONS  
Date & Time Collected 11/14/89 13:30:00 Category WATER

	RESULT	LIMIT	UNITS = ug/L
Benzene	<u>ND</u>	<u>0.50</u>	Notes and Definitions for this Report:  EXTRACTED: _____ DATE RUN: <u>11/17/89</u> ANALYST: <u>JJS</u> INSTRUMENT: <u>LSC 2000</u> DIL. FACTOR: <u>1</u>  ND = not detected at detection limit
Trichloroethene	<u>ND</u>	<u>0.50</u>	
Toluene	<u>ND</u>	<u>0.50</u>	
Tetrachloroethene	<u>ND</u>	<u>0.50</u>	
Chlorobenzene	<u>ND</u>	<u>0.50</u>	
Ethylbenzene	<u>ND</u>	<u>0.50</u>	
p-Xylene	<u>ND</u>	<u>0.50</u>	
o-Xylene	<u>ND</u>	<u>0.50</u>	
Styrene	<u>ND</u>	<u>0.50</u>	
Isopropylbenzene	<u>ND</u>	<u>0.50</u>	
Bromobenzene	<u>ND</u>	<u>0.50</u>	
N-Propylbenzene	<u>ND</u>	<u>0.50</u>	
2-Chlorotoluene	<u>ND</u>	<u>0.50</u>	
m-Xylene	<u>ND</u>	<u>0.50</u>	
4-Chlorotoluene	<u>ND</u>	<u>0.50</u>	
1,3,5-Trimethylbenzene	<u>ND</u>	<u>0.50</u>	
T-Butylbenzene	<u>ND</u>	<u>0.50</u>	
1,2,4-Trimethylbenzene	<u>ND</u>	<u>0.50</u>	
S-Butylbenzene	<u>ND</u>	<u>0.50</u>	
1,3-Dichlorobenzene	<u>ND</u>	<u>0.50</u>	
1,4-Dichlorobenzene	<u>ND</u>	<u>0.50</u>	
4-Isopropyltoluene	<u>ND</u>	<u>0.50</u>	
1,2-Dichlorobenzene	<u>ND</u>	<u>0.50</u>	
N-Butylbenzene	<u>ND</u>	<u>0.50</u>	
1,2,4-Trichlorobenzene	<u>ND</u>	<u>0.50</u>	
Napthalene	<u>ND</u>	<u>0.50</u>	
Hexachlorobutadiene	<u>ND</u>	<u>0.50</u>	
1,2,3-Trichlorobenzene	<u>ND</u>	<u>0.50</u>	

SAMPLE ID TRIP BLANK FRACTION 06A TEST CODE 503 NAME VOLATILE HALOCARBONS  
Date & Time Collected 11/14/89 Category WATER

RESULT LIMIT UNITS = ug/L

Benzene	<u>ND</u>	<u>0.50</u>
Trichloroethene	<u>ND</u>	<u>0.50</u>
Toluene	<u>ND</u>	<u>0.50</u>
Tetrachloroethene	<u>ND</u>	<u>0.50</u>
Chlorobenzene	<u>ND</u>	<u>0.50</u>
Ethylbenzene	<u>ND</u>	<u>0.50</u>
p-Xylene	<u>ND</u>	<u>0.50</u>
o-Xylene	<u>ND</u>	<u>0.50</u>
Stryene	<u>ND</u>	<u>0.50</u>
Isopropylbenzene	<u>ND</u>	<u>0.50</u>
Bromobenzene	<u>ND</u>	<u>0.50</u>
N-Propylbenzene	<u>ND</u>	<u>0.50</u>
2-Chlorotoluene	<u>ND</u>	<u>0.50</u>
m-Xylene	<u>ND</u>	<u>0.50</u>
4-Chlorotoluene	<u>ND</u>	<u>0.50</u>
1,3,5-Trimethylbenzene	<u>ND</u>	<u>0.50</u>
T-Butylbenzene	<u>ND</u>	<u>0.50</u>
1,2,4-Trimethylbenzene	<u>ND</u>	<u>0.50</u>
S-Butylbenzene	<u>ND</u>	<u>0.50</u>
1,3-Dichlorobenzene	<u>ND</u>	<u>0.50</u>
1,4-Dichlorobenzene	<u>ND</u>	<u>0.50</u>
4-Isopropyltoluene	<u>ND</u>	<u>0.50</u>
1,2-Dichlorobenzene	<u>ND</u>	<u>0.50</u>
N-Butylbenzene	<u>ND</u>	<u>0.50</u>
1,2,4-Trichlorobenzene	<u>ND</u>	<u>0.50</u>
Napthalene	<u>ND</u>	<u>0.50</u>
Hexachlorobutadiene	<u>ND</u>	<u>0.50</u>
1,2,3-Trichlorobenzene	<u>ND</u>	<u>0.50</u>

Notes and Definitions for this Report:

EXTRACTED: \_\_\_\_\_  
DATE RUN: 11/17/89  
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DIL. FACTOR: 1

ND = not detected at detection limit

Received: 11/15/89

Test Methodology

TEST CODE 503 NAME VOLATILE HALOCARBONS

EPA Method: 503

Reference: Test Methods for Evaluating Solid Waste: Physical/Chemical  
Methods. EPA SW-846 (Third Edition) 1986.  
Office of Solid Waste, USEPA.

TEST CODE TPH IR NAME TPH BY IR

EPA METHOD: 418.1 for water sample.

Reference: Methods for Chemical Analysis of Water and Wastes.  
EPA 600/4-79-020 (Revised, March 1983). EPA/EMSL, Cincinnati, OH.

EPA METHOD: 9071 for soil sample.

Reference: Test Methods for Evaluating Solid Waste: Physical/Chemical Methods.  
EPA SW-846 (Third Edition) 1986. Office of Solid Waste, USEPA.

APPENDIX F

## SOIL BORING PROTOCOL

### I. Drilling/Sampling Procedures

Prior to initiating drilling, all locations will be cleared of above ground and underground utilities. All appropriate health and safety precautions will be followed in accordance with those presented in the Health and Safety Plan.

Test borings shall be completed using conventional hollow stem auger drilling methods to a depth specified by the supervising geologist/engineer. The minimum inside diameter of the augers shall be 4-1/4 inches. Pre-coring of concrete may be required at some locations.

Samples of the encountered subsurface materials shall be collected continuously employing ASTM Method D-1586-84/Split Barrel Sampling using either a standard 2 ft. long, 2 in. outside diameter split spoon sampler with a 140 lb. hammer or a 3 in. outside diameter sampler with a 300 lb. hammer. Upon retrieval of the sampling barrel, the collected sample shall be placed in glass jars, labelled, retained on site and stored by O'Brien & Gere for possible testing. If laboratory soil samples are to be analyzed samples shall be placed in the laboratory sample containers as specified by the supervising hydrogeologist, labeled and placed on ice. Chain of custody procedures will be practiced following procedures outlined in Appendix H.

A geologist will be on site during the drilling operations to fully describe each soil sample including 1) Soil type, 2) color, 3) percent recovery, 4) moisture content, 5) odor and 6) miscellaneous observations such as organic content, free product. The supervising geologist will be responsible for retaining a representative portion of each sample in a one pint glass jar labelled with 1) site, 2) boring number 3) interval sample/interval preserved, 4) date, and 5) time of sample collection.

The drilling contractor will be responsible for obtaining accurate and representative samples, informing the supervising geologist of changes in drilling pressure, keeping a separate general log of soils encountered including blow counts (i.e. the number of blows from a soil sampling drive weight (140 pounds) required to drive the split spoon sampler in 6-inch increments and installing monitoring wells to levels directed by the supervising geologist following specifications further outlined in this protocol.

To prevent cross contamination of soil samples, the split spoon samplers will be cleaned between samples and the drilling equipment (i.e. augers, casing and rods) will be decontaminated between borings. (Appendix C and D).

Those soil borings which are not to be converted to monitor wells will be backfilled by filling the borehole with a cement/bentonite mixture of suitable consistency.

APPENDIX G

## SAMPLING EQUIPMENT DECONTAMINATION PROTOCOL

All sampling spoons, pans, spatulas, etc. that come in contact with soils will be cleaned between each event by a control water/phosphate free detergent wash, control water rinse, hexane rinse and a final distilled water rinse. All cleaning fluids will be contained in approved D.O.T. drums, labelled and stored temporarily on-side for disposal by NAVFAC personnel.

All field testing equipment such as temperature, specific conductance probes, containers, etc. shall be cleaned between each test by detergent/control water swabbing, hexane rinse, and distilled water rinse.

All ground water purging and sampling equipment (bailers) will be cleaned by a phosphate free detergent/control water wash, control water rinse, hexane rinse, and distilled water rinse. All fluids will be contained as noted above.

APPENDIX H

## DRILLING EQUIPMENT DECONTAMINATION PROTOCOL

All drilling equipment and associated tools including augers, drill rods, wrenches and any other equipment or tools that have come in contact with contaminated materials shall be decontaminated between each boring. The decontamination procedure shall be to use a high pressure steam cleaner to remove soils and volatile organics from the equipment. If petroleum product is encountered, a soapy water wash will be performed first followed by high pressure steam cleaning. The water used for this procedure shall come from a controlled source, preferably a municipal drinking supply.

The decontamination will also be performed at the completion of the drilling program prior to removing the equipment from the site.

It is preferred that a decontamination station be set up on site. This station would have a supply of controlled source water and electricity. All equipment will be placed on metal racks or wooden pallets above a plastic-lined cradle to contain sediment. Wash water will be released to the surface drains if no product is encountered. If product is found, wash water will be contained and stored in labelled drums for disposal by NAVFAC.

APPENDIX I

## MONITORING WELL INSTALLATION PROTOCOLS

The borings in which the wells will be placed shall be advanced using a minimum 4 1/4 inch hollow stem auger. Wells are anticipated to be installed to a depth of 17 to 20 feet or 10 feet below the water table.

All monitoring wells will be constructed to bracket the top of the water table using 10 feet of 2 inch I.D., 0.020 inch slotted flush jointed PVC screen attached to 2 inch I.D. PVC flush jointed riser pipe. A washed, graded silica sand pack will be placed around the well screen annulus. A two foot thick bentonite seal will be placed above the sand pack. A thick bentonite/cement grout will then be tremmied or poured from the top of the bentonite seal to near the ground surface. A flush-mounted locking protective steel casing will then be cemented into place over the PVC to prevent accidental damage and unauthorized access.

APPENDIX J

## WELL DEVELOPMENT PROTOCOL

All monitoring wells will be developed or cleared of all fine grained materials and sediments that have settled in or around the well during installation to insure the screen is transmitting representative portions of the ground water. The development will be by one of three methods, air surging, pumping or bailing ground water from the well until it yields, relatively sediment free water.

Air surging will consist of a clean polypropylene tubing extended to the screen portion of the well, attached to an air compressor and allowed to surge until ground water clears. Clean polypropylene tubing will be used for each well developed by this method.

Ground water samples for laboratory analyses will not be collected until at least one day has elapsed since air surging development.

In pumping or bailing, a decontaminated pump or bailer will be used following procedures outlined in the Decontamination protocol and subsequently decontaminated after each use. Ground water will be pumped from the bottom of the well using a decontaminated stainless steel submersible pump or centrifugal pump or bailed using a stainless steel bailer. Clean plastic will be placed on the ground to avoid surface contamination and new polypropylene rope on the bailer will be used for each well. Pumping or bailing will cease when the ground water yields sediment free water.

Development water will be placed into 55-gallon drums and secured on site for appropriate disposal by NAVFAC.

APPENDIX K

## IN-SITU HYDRAULIC CONDUCTIVITY TESTING PROTOCOL (UNCONFINED AQUIFERS)

This type of test will be used to evaluate the hydraulic conductivity of an unconfined, unconsolidated aquifer in the immediate area of a monitoring well. The goal of the test will be to create a sufficient head difference between the aquifer and the well such that inflow to that well over a certain time interval is representative of aquifer hydraulic conductivity.

The test will be performed by removing a volume of water from the well by use of a clean pump or bailer. If a sufficient difference in head is obtained by this method (at least 10-25% of the length of water column in the well) then recovery data can be collected. In this case, the subsequent rise of the water level in the well with time will be measured by a cleaned measuring device until the head difference approaches zero (rapid recovery) and at least 75% of the original head difference (slow recovery). Measurements shall be collected at frequent time intervals at the start of the test and increased appropriately according to the rate of recovery in the well.

If no significant drawdown is anticipated or can be obtained by this method, an Enviro-Labs Model DL-120-MCP pressure transducer system or equivalent will be utilized. All equipment will be pre-cleaned by an appropriate method prior to use in the well. The test will involve pre-insertion of a pressure transducer into the well followed by insertion of a suitably sized, tapered teflon<sup>R</sup> rod into the well in order to create a positive flow potential from the well into the aquifer. Following measurement by the transducing system, the teflon rod will be removed in order to create a negative flow potential. These tests will be performed at least two times to evaluate the repeatability of response.

Data from the foregoing tests will be evaluated using Hvorslev's graphic analysis of piezometer recovery data (Ground Water Freeze and Cherry, 1979 pp 339-342, after Hvorslev M.J., "Time Lag and Soil Permeability in Ground Water Observations", 1951). The data will be plotted on a logarithmic scale including the ratio of recovered head to original head versus time. The time lag which represents the time for complete equalization of the head difference if the original inflow is maintained will be developed following evaluation of the resulting straight line plot. This value together with the length of screen, screen diameter including sand pack, and riser diameter will be used in Hvorslev's equation to develop the hydraulic conductivity(k) in cm/sec.

APPENDIX L

## GROUND WATER SAMPLING PROTOCOL

The following procedures will be used to obtain representative ground water samples. To obtain representative ground water samples from wells containing only a few gallons of ground water, the bailing procedure is effective (2" I.D. wells). To purge wells containing more than a few gallons, the pumping procedure is generally more rapid. Each of these procedures is explained in detail below.

### Sampling Procedures (BAILER)

1. Identify the well and record the location on the Ground Water Sampling Field Log (copy attached).
2. Put on a new pair of disposable gloves.
3. Cut a slit in the center of a plastic sheet, and slip it over the well creating a clean surface onto which the sampling equipment can be positioned.
4. Using an electric well probe, measure the depth to the water table. Record this information in the Ground Water Sampling Field Log. Depth measurements will be taken before sampling starts so that this data is collected over the shortest period possible. This will allow for less data variability due to time.
5. Clean the well depth probe and wash it with detergent and rinse it with distilled water after use.
6. Compute the volume of water in the well, and record this volume on the Ground Water Sampling Field Log.
7. Attach enough polypropylene rope to a stainless steel bailer to reach the bottom of the well, and lower the bailer slowly into the well making certain to submerge it only far enough to fill one-half full.
8. Pull the bailer out of the well keeping the polypropylene rope on the plastic sheet or entirely off the ground if it is too windy to place a plastic sheet. Empty the boiler into a glass container and observe the physical appearance of the ground water.
9. Record the physical appearance of the ground water on the Ground Water Sampling Field Log.
10. Attach the polypropylene rope to a clean, stainless steel bailer, lower the bailer to the bottom of the well, and agitate the bailer up and down to resuspend any material settled in the well.
11. Initiate bailing the well from the well bottom making certain to keep the polypropylene rope on the plastic sheet. All ground

water should be poured from the bailer into a graduated pail to measure the quantity of water removed from the well.

12. Continue bailing the well throughout the water column and from the bottom until a sufficient volume of ground water in the well has been removed, or until the well is bailed dry. If the well is bailed dry, allow sufficient time for the well to recover before proceeding with the next step. Record this information on the Ground Water Sampling Field Log.
13. Remove the sampling bottles from their transport containers, and prepare the bottles for receiving samples. Inspect all labels to insure proper sample identification. Sample bottles should be kept cool with their caps on until they are ready to receive samples. Arrange the sampling containers to allow for convenient filling. Always fill the containers labeled "volatiles" (40 ml VOA bottles) first.
14. To minimize further agitation of the water in the well, initiate sampling by lowering the stainless steel bailer slowly into the well making certain to submerge it only far enough to fill it completely.
15. If the sample bottle cannot be filled quickly, keep them cool with the caps on until they are filled. The vials labeled "volatiles" analysis should be filled from one bailer then securely capped. Carefully fill the 40 ml VOA vials to minimize agitation. This is usually done by pouring the sample into a tilted VOA vial. Cap the VOA vial, turn it upside down, and check for air bubbles. If properly filled, there should be no visible air bubbles. Return each sample bottle to its proper transport container. Samples must not be allowed to freeze.
16. Record the physical appearance of the ground water observed during sampling on the Ground Water Sampling Field Log. Collect a final sample and measure pH, temperature and specific conductance.
17. Begin the Chain of Custody Record.
18. Clean the bailer according to methods in the Sampling Equipment Protocol. Store the bailer in a clean, dry place.
19. Replace the well cap, and lock the well protection assembly before leaving the well location.
20. Place the polypropylene rope, gloves, and plastic sheeting into a plastic bag for disposal.

### Purging Procedures (PUMP)

1. Identify the well and record the location on the Ground Water Sampling Field Log (copy attached).
2. Put on a new pair of disposable gloves.
3. Cut a slit in the center of a plastic sheet, and slip it over the well creating a clean surface onto which the sampling equipment can be positioned.
4. Using an electric well probe, measure the depth to the water table. Record this information in the Ground Water Sampling Field Log. As previously mentioned, all depth to water table and well depth measurements will be taken for all wells before sampling begins.
5. Clean the well depth probe and rinse it with distilled water after use.
6. Compute the volume of water in the well, and record this volume on the Ground Water Sampling Field Log.
7. Attach enough polypropylene rope to a stainless steel bailer to reach just below the surface of the water table, and lower the bailer slowly into the well making certain to submerge it only far enough to fill it one-half full.
8. Pull the bailer out of the well keeping the polypropylene rope on the plastic sheet. Empty the bailer into a glass container and observe the physical appearance of the ground water.
9. Record the physical appearance of the ground water on the Ground Water Sampling Field Log.
10. Prepare the pump for operation. Connect the dedicated polyethylene tubing to a delrin foot valve.
11. Lower the pump to the top of the water level in the well and pump the ground water into a graduated pail. Pumping should continue until sufficient well volumes have been removed or the well is pumped dry. If the well is pumped dry, allow sufficient time for the well to recover before proceeding with Step 13. Record this information on the Ground Water Sampling Field Log.
12. Remove the sampling bottles from their transport containers, and prepare the bottles for receiving samples. Inspect all labels to insure proper sample identification. Sample bottles should be kept cool with their caps on until they are ready to receive samples. Arrange the sampling containers to allow for

convenient filling. Always fill the vials labelled "volatiles" (40 ml VOA vials) first.

13. Samples should be collected by a stainless steel bailer. To minimize agitation of the water in the well, initiate sampling using a gentle bailing action.
14. If the sample bottle cannot be filled quickly, keep them cool with the caps on until they are filled. Return each sample bottle to its proper transport container. Samples must not be allowed to freeze.
15. Record the physical appearance of the ground water observed during sampling on the Ground Water Sampling Field Log. Collect a final sample and measure pH, temperature and specific conductance.
16. Begin the Chain of Custody Record.
17. Clean the bailer by methods described in the Equipment Cleaning Protocol. Store the bailer in a clean, dry place. Decontaminate the purge pump following the above method or by pumping a minimum of 5 volumes of potable water.
18. Replace the well cap, and lock the well protection assembly before leaving the well location.
19. Place the polypropylene rope, gloves, and plastic sheet into a plastic bag for disposal.

## GROUND WATER SAMPLING PROTOCOL

### Sampling Procedures (Well With Product)

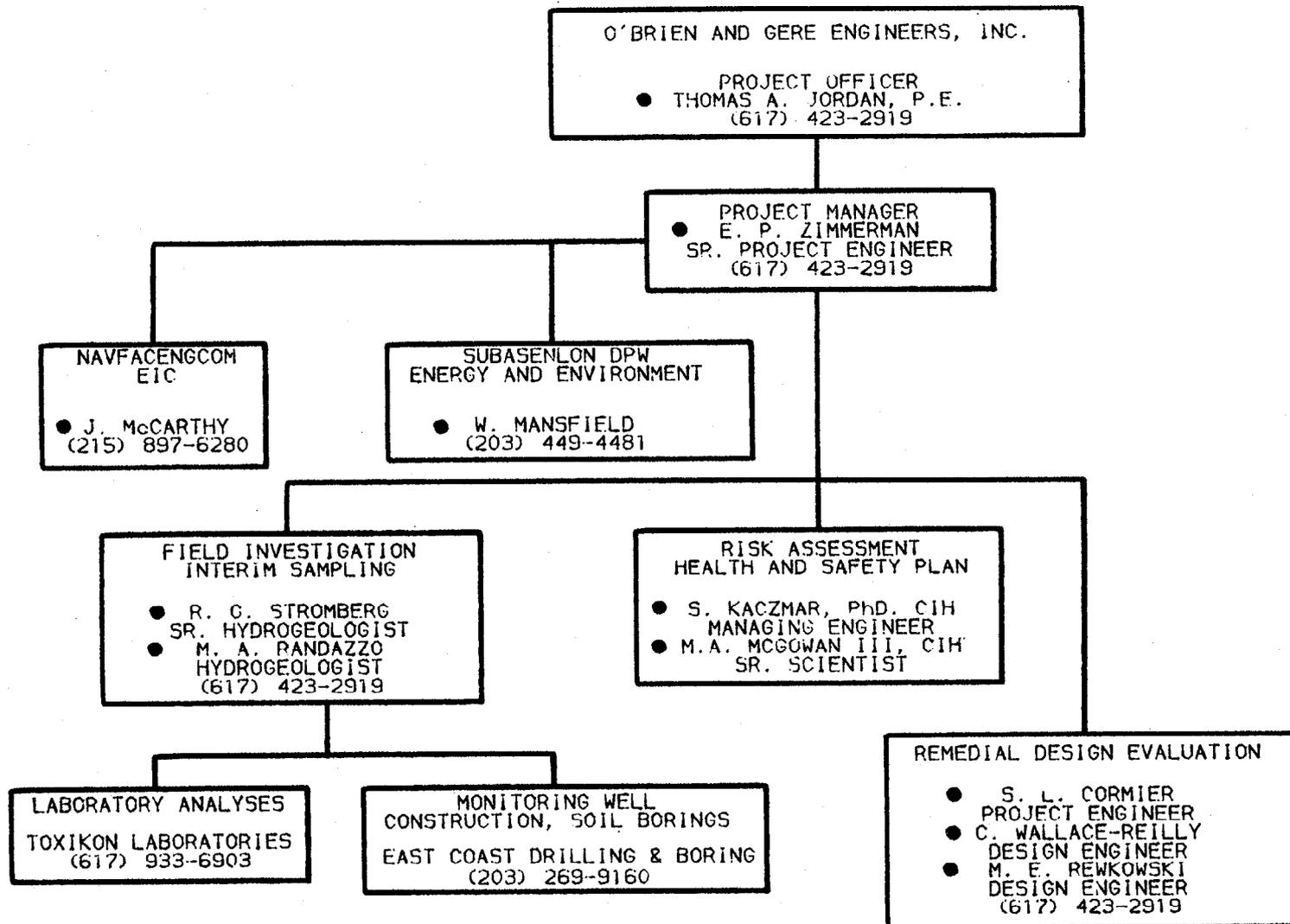
1. Identify the well and record the location on the Ground Water Sampling Field Log (copy attached).
2. Put on a pair of clean gloves or new disposable gloves. The gloves shall be cleaned using Methanol followed by a clean water rinse.
3. Cut a slit in the center of plastic sheet, and slip it over the well creating a clean surface onto which the sampling equipment can be positioned. In the event that it is not practical to use plastic sheeting (winter), the new polypropylene rope will be kept from touching the ground surface.
4. Using a clean electronic well probe, measure the depth to the water table and the bottom of the well (if not previously measured) from the top of the protective casing or a surveyors mark. If free phased product is present use an oil-water interface probe or a clear bottom loading bailer to determine the thickness of the product. The electronic well probe will be cleaned using a detergent wash and distilled water rinse followed by a hexane rinse and distilled water rinse.
5. Compute the volume of water in the well, and record this volume on the Ground Water Sampling Field Log.
6. Attach enough new polypropylene rope to a clean bottom loading stainless steel bailer to reach the bottom of the well.
7. Lower the bailer slowly into the well making certain to submerge it only far enough to fill one-half full. The purpose of this is to recover for observation any oil film, if one is present on the water table.
8. Pull the bailer out of the well keeping the polypropylene rope on the plastic sheeting or off the ground. Empty the ground water from the bailer into a clean glass container and records its appearance on the Ground Water Sampling Field Log.
9. With the intake area protected, install a foot valve and tygon tubing assembly in the well such that the intake is below the water table. Remove the intake protections and begin purging. All ground water should be poured from the bailer into a graduated pail to measure the quantity of water removed from the well. Ground water will be contained.

10. Continue pumping the well until 3 well volumes have been removed, or until the well is pumped dry to the intake areas. If the well is pumped dry, allow sufficient time for the well to recover before proceeding with the next step. Ph and specific conductance readings shall be taken prior to the collection of the actual sample. Record this information on the Ground Water Sampling Field Log.
11. Remove the sampling bottles from their transport containers, and prepare the bottles for receiving samples. Inspect all labels to insure proper sample identification. Arrange the sampling containers to allow for convenient filling.
12. Collect samples from the pump discharge. The vials labeled "volatiles" should be filled from one bailer then securely capped. The vial should be turned upside down, and checked for air bubbles. If properly filled there should be no visible air bubbles. Place each container in a cooler and chill to 4 C. Samples must not be allowed to freeze.
13. After the last sample has been collected record the physical appearance of the ground water observed during sampling on the Ground Water Sampling Log.
14. Begin Chain of Custody Record.
15. Replace the well cap, and lock the protection assembly before leaving the well location.
16. Place the polypropylene rope, gloves, etc into a plastic bag for disposal.

APPENDIX M

NAVFACENGCOM  
NORTHERN DIVISION  
SUBMARINE BASE NEW LONDON  
GROTON, CONNECTICUT

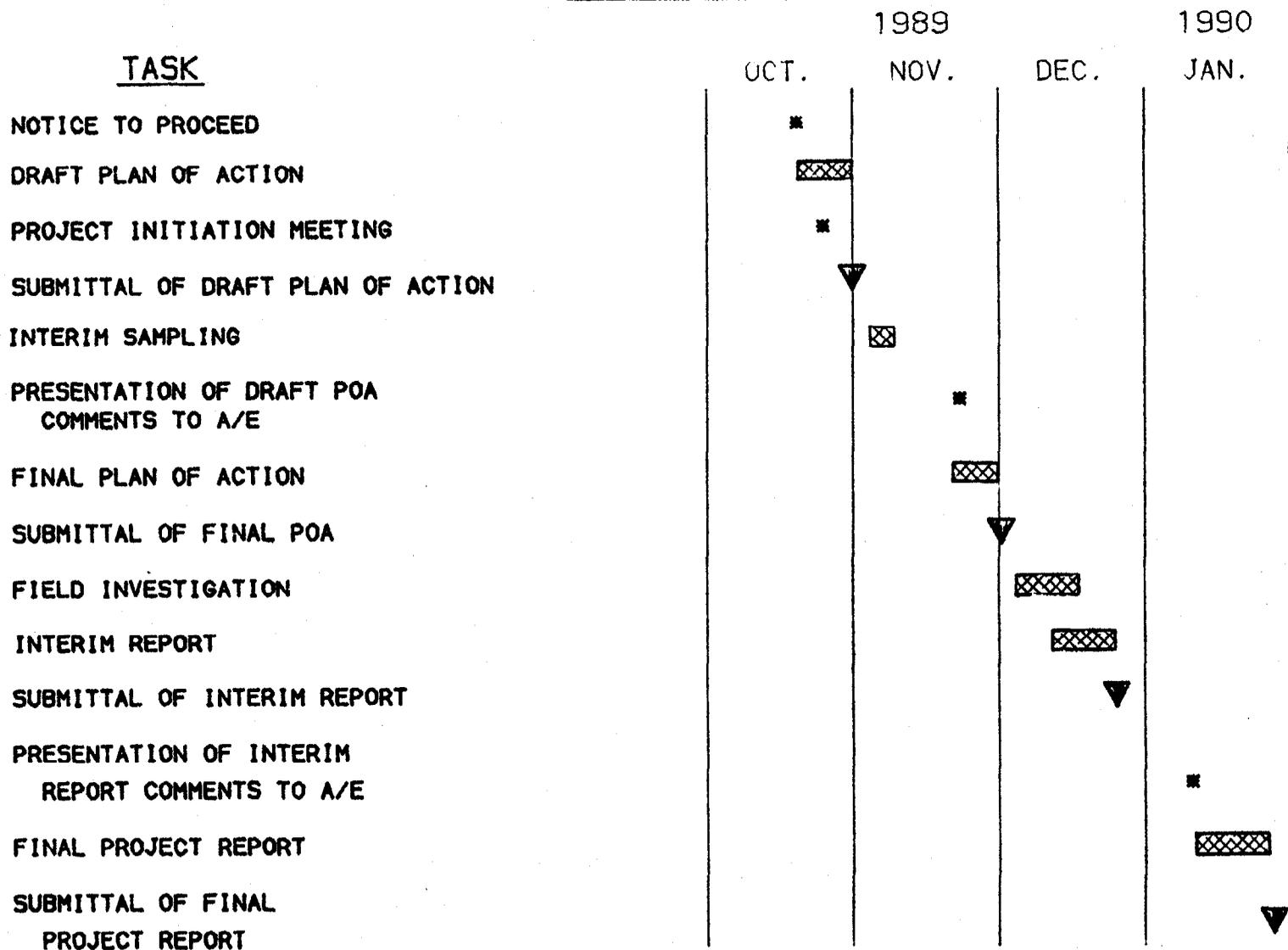
UST INVESTIGATION & REMEDIAL EVALUATION  
**PROJECT ORGANIZATION CHART**



APPENDIX N

NAVFACENGCOM  
 SUBMARINE BASE NEW LONDON  
 GROTON, CONNECTICUT  
 LUST INVESTIGATION AND REMEDIAL DESIGN EVALUATION

PROJECT SCHEDULE



▼ DELIVERY DATE

\* MEETING WITH SUBMARINE BASE AT NEW LONDON

APPENDIX O

## QUALITY ASSURANCE/QUALITY CONTROL

The analytical chemistry quality assurance objectives of the Quality Assurance Program are to provide analytical data of known quality and to be able to defend the quality of that data. Data quality is assessed by precision, accuracy, completeness, representativeness, and comparability. The analytical chemistry protocols used for the analyses contain detailed descriptions of the quality control measures to be employed. The routine analysis of replicate and spiked samples provides precision and accuracy data for assessing the validity of the analytical results. QA objectives for accuracy and precision of the procedures used in the analytical laboratory have been established by management based on historical data and published performance data. Routine QA/QC controls are in accordance with the EPA recommended protocols. Specific QA/QC requirements can be designed on a per project basis.

### KEY STAFF DUTIES AND RESPONSIBILITIES

Scientific Director - The director designates program managers or project managers as required by the specific project. He assures that there is a quality assurance unit and must assure that personnel, resources, facilities, equipment, materials, methodologies, etc. are available in the laboratory for all scheduled work. It is the overall responsibility of the director to ensure that personnel clearly understand the work and are technically qualified.

Division Manager - Responsible for the conduct of all work performed in the division (analytical chemistry) and its overall operation. All of the laboratory supervisors report to the manager relative to the operations of each department. The manager is responsible for the review and release of the final data package to client. The division manager reports directly to the scientific director.

Quality Assurance Manager - Responsible for the integral operational and proper execution of the QA/QC guidelines by each analyst within the laboratory. The QA manager's role is one of active monitoring and review. Additionally this manager tracks the QA goals and trends within the various subdisciplines of the laboratory. The QA manager reports directly to the scientific director.

To review Toxikon's Organizational Chart and list of equipment please see Attachments.

### SAMPLE CONTAINERS AND HOLDING TIME

Toxikon provides laboratory glassware for sampling. The glassware is routinely prepared in accordance with the EPA

recommended protocol for the type of testing desired. The glassware is carefully packed and shipping by surface mail or courier to the requesting party. Samples are shipped back to Toxikon via courier or express overnight delivery for analyses. Toxikon follows the EPA recommended sample holding and storage times/conditions as published. More stringent time frames for extraction and/or analyses may apply depending on the contract requirements.

#### SAMPLE CUSTODY PROCEDURES

Proper procedures pertaining to the sample custody and security of sample handling as it is received at the lab and as the samples travel throughout the laboratory for analysis are indicated as follows. The Sample Custodian or his/her designee serves as the Sample Receipt Officer (SRO). The SRO is responsible for receiving all test samples and executing the following steps:

Compare the test sample(s) received with appropriate packing slip, chain of custody, purchase order, authorization letter, Toxikon quotation or other available documents describing the test sample(s) or test procedure(s). The client is immediately notified of damaged, incomplete or incorrect sample shipments.

Each project is assigned a Toxikon number which is derived from the current year, the current month and the next sequential unused project number up to 999.

The Toxikon sample ID number is derived from the Toxikon project number. A sequential numerical suffix - .1, .2, etc. is added to the project number for each sample. For example, two samples received for testing under project number 8803005, would be referred to as samples 8803005.1 and 8803005.2.

After inspection of the test sample (s), each project is logged into the Master Project Log Book and into the Chain of Custody Record. A copy of Toxikon's Chain of Custody is attached.

#### COMPILATION OF COMPLETED DATA PACKAGE

Once all analyses, reviews, and reports have been completed, a data package review is conducted by the laboratory supervisor and quality assurance manager. This procedure is conducted to ensure that all documents including logbook pages, sample receipt, chain of custody reports, chromatographic charts, computer printouts, raw data summaries, correspondence, and any other written documents having reference to the Project are compiled and placed in locked files for the current year. A copy of the report is made and kept with the raw data.

Additionally, before filing the project, the data manager will cross check the information on sample labels, custody records, lab bench sheets, personal and instrument logs and other relevant

data to ensure that data pertaining to each particular sample or project is consistent throughout the project file.

When an analysis or series of analyses for a particular client is completed, the laboratory supervisor conducts a technical review of the raw data and draft report. This consists of a review of the appropriate data by the supervisors who will performance a series of checklists.

The preparation, drafting and review of a final report for analytical chemistry is conducted as follows:.

Once all of the analyses for a given study are complete and each analyses has been reviewed by the appropriate Laboratory Supervisor, the Laboratory Manager reviews the file to make certain that the generated data are complete, on the proper forms, and appropriately documented. On a daily basis projects in the "in process file" are checked for completion. Having been checked for completion, the project file is then forwarded to Data Management Personnel who bring all the data into one concise report format.

Once approved by the Laboratory Supervisor as correct, the report is returned to the Laboratory Supervisor for review. If any errors should be found by the Laboratory Manager, appropriate steps are followed.

The QA review follows and the test data is checked for appropriate QA compliance and errors. If necessary, a report is revised and an analysis would be repeated if QA advised the Scientific Director of a questionable result, and if it is agreed upon by the Director. Any revised reports are then returned to the Laboratory Manager for finalization of the report and signatures.

When a report is finalized and signed off by the Laboratory Manager and Quality Assurance, it is then forwarded to the Accounting Department for billing. A typed bill is prepared and the original bill and report are mailed to the appropriate person(s).

#### TURNAROUND TIME AND TERMS AND CONDITION FOR PAYMENT

Toxikon's standard turnaround time for analyses is 10-14 working days. An exception to this is for the analyses of volatile organics, such as 601, 602, 624, 8010, 8020, 8030, 8240 which is avialable within a 5-7 day turnaround without surcharge. Toxikon also offers Priority Turnaround service at a surcharge as requested.

Net terms are 30 days. Past due balances are subject up to 1.5% surcharge per month. 18% per year.