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SITE INVESTIGATION AND SOIL BORINGS REPORT

REMEDIATION OF CONTAMINATED SOIL/GROUND WATER NAVAL SUBMARINE BASE NEW LONDON/GROTON, CONNECTICUT

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1.0 SITE INVESTIGATION REPORT AND SOIL BORINGS REPORT

1.1 Project Objective and Approach

The purposes of site investigations conducted at the NEX service station and Dolphin Mart were to collect geologic and engineering data necessary to develop conceptual strategies and design parameters to remediate soil and ground water contamination delineated by previous environmental investigations.

HRP's approach to achieving these objectives consisted of three basic tasks:

1. review of existing data;
2. collection of remedial design data; and
3. evaluation of remedial alternatives and determination of conceptual remediation strategies and design parameters.

The remainder of this section presents the results of each of these tasks for the NEX service station and Dolphin Mart convenience store.

1.2 NEX Service Station

The specific objectives of site investigations conducted at the NEX (Figure 1) included:

1. review of background data;
2. assessment of current site conditions; and
3. determination of the feasibility of air sparging and soil vapor extraction as remedial alternatives.

The objectives were achieved by reviewing available reports, performing an inspection of site conditions, conducting air sparging and soil vapor extraction pilot tests, and evaluating the pilot test results.

Previous Investigation and Background

Previous site investigations were conducted by O'Brien & Gere (OBG) and ERM in 1989-90 and 1992, respectively. The investigations identified the site history, local lithology, hydrogeology, and reasonably delineated the extent of soil and ground water contamination.

The soil and ground water analysis results compiled by this work identified two contaminant sources. These sources included:

1. the historical underground storage tank locations located at the west side of the facility; and

2. the active underground storage tank area located at the east side of the site.

Historically, gasoline and diesel fuel were dispensed from underground storage tanks located at the western end of the site. These tanks were taken out of service in the mid 1960s, but were not removed from the ground until recently (November 1993). Soil and ground water data collected from OBG-9 and ERM-14 indicate historical releases of petroleum product occurred in this area. Soil contamination was detected at concentrations up to 70 parts per million (ppm) BTEX (Benzene, Toluene, Ethyl Benzene, Xylene) at OBG-9 and ERM-14. The soil contamination was determined to lie within a 90 foot X 40 foot area defined by soil samples collected at wells OBG-7, OBG-8, ERM-13, ERM-14, ERM-15, and ERM-18. The soil contamination was identified within soils 2-3 feet above the water table. The presence of soil contamination in this zone is likely the result of contaminant transport by the fluctuating ground water table which mobilizes the lighter than water petroleum constituents.

A ground water contaminant plume was also identified in this area. The plume is centered in the area of OBG-9 and ERM-14, and extends towards the

south. The extent of the ground water contaminant plume is delineated by wells ERM-5, ERM-7, ERM-15 and ERM-18 (Figure 10).

The second contaminant source, on the eastern portion of the site, was initially identified in 1989 after gasoline was observed in a nearby catch basin. The cause of the release was attributed to the failure of a crash valve in the area of the active underground storage tanks. Gasoline product was determined to be limited to wells installed within the tank graves (OBG-1, OBG-2). Soil contamination at concentrations up to 290 ppm BTEX was identified in a 90 ft. X 40 ft. area centered around OBG-1, OBG-2, OBG-5 and OBG-6. The limits of soil contamination were identified by soil samples collected from wells OBG-3, OBG-4, OBG-8, ERM-16 and ERM-17. A ground water contamination plume was identified to extend from OBG-1, OBG-2, OBG-4, OBG-5, and OBG-6 to the south. The extent of ground water contamination was defined by wells OBG-3, OBG-7, OBG-8, ERM-9, ERM-12, ERM-16, and ERM-17 (Figure 10).

The ground water quality of the site area is designated class GB/GA by the Connecticut Department of Environmental Protection (CT DEP). Public water service was available to the area and no sensitive receptors of the contamination were identified. For these reasons, the objectives of remediation of soil and ground water contamination at the NEX were determined to be:

1. treatment of the contamination sources;
2. removal of free product; and
3. monitoring.

Geological and Hydrogeological Setting

The site is situated within an area formerly occupied by Crystal Lake. The lake was drained and dredged in the 1940s before being filled in and further developed. The topography of the site area is characterized by nearly level land with an elevation of 22 to 26 ft. above mean sea level (a.m.s.l.).

The site geology has been described as a variable depth of artificial fill covering stratified drift, and crystalline bedrock (Figure 2). The fill was found to be present below the topsoil and pavement and extend to depths between 4 and 16 feet. The underlying stratified drift is primarily fine sands with silt and clays. Coarser materials were found with increasing depth. The underlying bedrock was determined to be the Mamacoke Formation of the Waterford Group. The Mamacoke Formation is described as a biotite gneiss.

The site hydrogeology is characterized by a relatively shallow ground water table observed at depths of 8-9 feet below grade. The stratigraphy of the site suggests that ground water occurs as an unconfined aquifer. The hydraulic conductivity was found to vary from about 0.1 to 6 feet/day. Ground water flow is to the south, but flow patterns could be complicated as a result of the draining, dredging, and filling of former Crystal Lake. Ground water gradients vary from 0.008 ft./ft. in the north to 0.02 ft./ft. in the south.

Site Inspection

HRP inspected the site to locate site features, prepare base maps, and assess the condition of site wells on October 6, 1993.

Based upon this site visit, the site plan (Figure 1) was prepared. The plan identifies significant site features including buildings, roads, tanks, wells, utilities, etc.

During the site visit the following monitor wells were located, accessed, and inspected.

OBG-1	ERM-5	ERM-15
OBG-2	ERM-6	ERM-16
OBG-3	ERM-7	ERM-17
OBG-4	ERM-8	ERM-18
OBG-5	ERM-10	ERM-19
OBG-6	ERM-11	
OBG-7	ERM-12	
OBG-8	ERM-13	
OBG-9	ERM-14	

With the exception of wells OBG-1, OBG-3, and OBG-8, all wells were found in reasonably good condition. Wells OBG-1, OBG-3, OBG-8, and ERM-11 were in need of repair to handways, casing, and concrete, respectively. One well, ERM-9, could not be located and was presumed to have been destroyed.

Floating product (gasoline) was observed in wells OBG-1, OBG-2, OBG-9, and ERM-17 during inspection. The product thickness was generally 0.1 inches or less at wells OBG-1, OBG-2, and OBG-9. As much as 1 inch of product was observed at ERM-17, but the product was not believed to be a result of releases at the service station.

Ground water depth measurements were also collected at the time of inspection. The data was used to confirm ground water flow directions and gradients (Figure 3). The ground water data was consistent with previous data for the area compiled by ERM.

Remedial Testing

Pilot tests were conducted in October and November 1993 to assess the feasibility and determine the design criteria for an air sparging (AS) and soil vapor extraction (SVE) remedial alternative. One air sparging point, one soil vapor extraction (SVE-1) well, and four observation probes (P1, P2, P3, P4)

were installed at the locations shown on Figure 1, before the pilot test was conducted. Each observation probe consisted of two monitor points completed in the borehole. The A probe was completed below the water table (10 feet below grade), whereas the B probe was completed above the water table (7.5 feet below grade). The sparging point, SVE well, and observation probes were installed using a truck-mounted hollow stem auger drill rig on October 18, 19, and 21, 1993. The drill logs and construction details of these points are included in Appendix A.

The pilot test was conducted on October 27, 28, and November 1, 1993. The purpose of the pilot test was to determine 1) the area treated by sparging at different air injection pressures and flowrates; and 2) the optimal operational pressure and flowrate for remedial system design.

The pilot test procedures which were used to accomplish these objectives are described in Appendix B. The injection pressure to the sparge point was provided by an 11.5 HP gasoline powered air compressor. An electric 1.5 HP regenerative blower provided the vacuum to the vapor extraction well.

Air Sparging Test

During the air sparging phase of the test, compressed air was injected below the water table via the sparge point AS-1 at the pressures and flowrates listed below.

Injection Pressure (PSI)	Flowrate (scfm)
10	1-2
15	5

Measurements including depth to water, dissolved oxygen, explosivity, oxygen levels, total organic halogen (TOX), along with soil gas samples were collected from each observation probe before, during, and after sparging at each

pressure level. The soil gas samples were analyzed on-site for selected volatile organics (VOCs) using a portable field gas chromatograph (GC - Photovac Model 10S55).

The area treated by sparging at the different pressure levels was determined by comparing all data collected at that pressure level. This process included identifying 1) the extent of the ground water mound created, and 2) changes in VOC concentrations, TOX, dissolved oxygen, oxygen levels, and explosivity which could be attributed to sparging. This comparison of data was accomplished using the graphs attached in Appendix C.

In general, the affects of sparging were observed at all the probes regardless of the pressure levels. TOX concentrations were also observed to increase above initial levels at all probes. The explosivity measurements also showed increases at all A probes (completed below the water table). The oxygen levels at all B probes (completed above the water table) dropped significantly. Water elevations also increased at all A probe locations. No significant changes to dissolved oxygen levels were noted at any of the probes at the different pressure levels. In addition, the concentration of selected volatile organics as determined by analysis of soil gas samples by field GC were observed to change erratically.

The changes in concentrations of TOX, explosivity, and oxygen levels reflect the positive remediating effects of sparging. These data are summarized in Table 1. The data collected indicates that each pressure level treated a circular area with a radius of at least 20 ft. around the sparge point AS-1.

TABLE NO. 1: SUMMARY OF SPARGING RESULTS AT NEX										
		TOX (ppm)			Explosivity (%)			Oxygen Levels (%)		
Probe I.D.	Distance from AS-1 (ft.)	Initial	@ 10psi 1-2 cfm	@ 15 psi 5 cfm	Initial	@ 10 psi 1-2 cfm	@ 15 psi 5 cfm	Initial	@ 10 psi 1-2 cfm	@ 15 psi 5 cfm
P1a	5	27	639	246	3	21	0	22.2	21.9	22.1
P2a	20	59	112	540	1	69	61	22.2	17.9	18.0
P3a	5	16	487	424	1	40	27	22.2	21.6	21.4
P4a	10	15	469	417	1	100	24	22.2	20.8	20.5
P1b	5	18	>1000	>1000	1	21	0	22.2	1.0	1.8
P2b	20	68	>1000	>1000	2	-44	4	22.2	2.6	1.7
P3b	5	16	0	790	1	30	13	22.2	2.5	1.2
P4b	10	17	830	—	6	100	8	22.2	2.3	2.7

The optimal air injection pressure and flowrate was determined by comparing the changes in TOX, VOC, and explosivity produced during injection at the three different pressure levels. This comparison was performed graphically using the graphs attached in Appendix C. In most cases, the greatest change was noted to occur at the lowest pressure level of 10 psi and flowrate (1-2 cfm). Increases in pressure and flowrates above this level produced only slight increases (and in some cases decreases) in TOX, VOC and explosivity readings above the levels observed at the 10 psi injection rate. Therefore, the injection of air at pressures above 10 psi does not appear to provide a significant additional benefit.

SVE Test

During the SVE test, contaminant vapors were withdrawn from SVE-1 under a vacuum pressure of 60 in. (H_2O) and a flowrate of about 24.5 scfm for approximately 1.5 hours. Under these flow conditions, vacuum readings were detected at every B probe location at the levels listed below.

Probe I.D.	Distance from SVE-1 (ft)	Vacuum (in H_2O)
P-1b	5	0.55
P-2b	10	0.30
P-3b	12	1.65
P-4b	18	0.325

Vacuum readings were recorded at 5 second intervals at each probe from the initiation of venting until vacuum levels were nearly stabilized. Vacuum data collected from P-4 was used to evaluate the intrinsic permeability of the native materials. The intrinsic permeability was determined to be 1.8×10^{-6} cm^2 (Appendix C). The radius of influence was also determined using vacuum data from P-4. The radius was estimated at about 35 feet (Appendix C).

Soil gas samples were collected from each probe before and during the SVE test. The samples were analyzed with a field GC for selected volatile organics (VOCs). The concentration of VOCs decreased from initial levels after about 30 minutes of venting. The VOC results are shown in Table 2.

A vapor sample of air discharged from the blower was collected after 30 minutes of venting. The sample was analyzed for selected volatile organics with a field GC. Contaminant emission rates were also estimated using the discharge rate of the blower (24.5 scfm) and the discharge sampling results. The results are summarized below and attached in Appendix C.

	Discharge Sample Results (ppb)	**Emission Rate (lb/hr)**
Benzene	1630	4.6×10^{-4}
Trichloroethylene	3840	1.8×10^{-3}
Toluene	5120	1.8×10^{-3}

Combined AS/SVE Test

During the combined test compressed air was injected into AS-1 at a pressure of 20 psi and a flowrate of 9 scfm. Contaminated soil vapors were withdrawn from SVE-1 at a flowrate of 24.5 scfm and a vacuum of 60 in H_2O.

The performance of the combined test was evaluated through the comparison of VOC, TOX, explosivity, and oxygen percentage data collected before venting began, after 30 minutes of venting, and after 60 minutes of sparging and venting.

VOC concentration changes during the different sampling periods reflected the effectiveness of the combined sparging and venting. The remaining parameters did not vary or varied only slightly and were not as useful in performance evaluation of the combined effects of sparging and venting. The VOC concentrations are presented in Table 3.

TABLE NO. 2: SUMMARY OF VOC RESULTS DURING SVE TEST AT NEX (ppb)							
		Benzene		Trichloroethylene		Toluene	
Probe I.D.	Distance from SVE-1 (ft.)	Initial	After Venting	Initial	After Venting	Initial	After Venting
P1a	5	910	56	2,780	374	2,800	310
P2a	10	1,280	360	11,770	704	7,250	623
P3a	12	ND	653	1,330	3,308	980	557
P4a	18	610	32	7,830	1,054	7,610	714
P1b	5	19,500	326	33,900	1,664	37,900	486
P2b	10	8,200	340	17,300	ND	41,700	6,900
P3b	12	ND	60	ND	122	5,900	468
P4b	18	ND	384	10,400	3,572	15,400	1,850
		Tetrachloroethylene		Ethyl Benzene		M Xylene	
Probe I.D.	Distance from SVE-1 (ft.)	Initial	After Venting	Initial	After Venting	Initial	After Venting
P1a	5	ND	107	ND	28	6,540	429
P2a	10	2,720	327	280	83	12,550	1,030
P3a	12	ND	188	ND	45	ND	1,718
P4a	18	2,060	ND	430	54	16,100	2,578
P1b	5	15,100	286	ND	4	112,200	654
P2b	10	ND	ND	ND	920	62,400	40,300
P3b	12	ND	50	13,400	42	ND	1,426
P4b	18	ND	156	ND	496	26,600	8,600

TABLE NO. 3: SUMMARY OF VOC CONCENTRATIONS FROM COMBINED AS/SVE TEST AT NEX (ppb)

Probe I.D.	Distance from AS-1 (SVE-1)(ft.)	Benzene			Trichloroethylene			Toluene		
		Initial	During Venting	During Venting & Sparging	Initial	During Venting	During Venting & Sparging	Initial	During Venting	During Venting & Sparging
P1a	5 (5)	910	56	30	2,780	374	120	2,800	310	120
P2a	20 (10)	1,280	360	1,170	11,770	704	3,090	7,250	623	5,000
P3a	5 (12)	ND	653	1,030	1,330	3,308	6,206	980	557	1,736
P4a	10 (18)	610	32	5,750	7,830	1,054	1,860	7,610	714	5,200
P1b	5 (5)	19,500	326	56	33,900	1,664	284	37,900	486	190
P2b	20 (10)	8,200	340	206	17,300	ND	146	41,700	6,900	1,210
P3b	5 (12)	ND	60	12	ND	122	56	5,900	468	170
P4b	10 (18)	ND	384	264	10,400	3,572	1,788	15,400	1,850	1,098

Probe I.D.	Distance from AS-1 (SVE-1)(ft.)	Tetrachloroethylene			Ethyl Benzene			M Xylene		
		Initial	During Venting	During Venting & Sparging	Initial	During Venting	During Venting & Sparging	Initial	During Venting	During Venting & Sparging
P1a	5 (5)	ND	107	ND	ND	28	ND	6,540	429	478
P2a	20 (10)	2,720	327	1,330	280	83	790	12,550	1,030	25,040
P3a	5 (12)	ND	188	232	ND	45	40	ND	1,718	1,924
P4a	10 (18)	2,060	ND	3,000	430	54	290	16,100	2,578	6,690
P1b	5 (5)	15,100	286	ND	ND	4	ND	112,200	654	678
P2b	20 (10)	ND	ND	68	ND	920	420	62,400	40,300	4,674
P3b	5 (12)	ND	50	ND	13,400	42	14	ND	1,426	680
P4b	10 (18)	ND	156	100	ND	496	154	26,600	8,600	2,968

The VOC concentrations observed at each probe declined after venting had continued for approximately 30 minutes. VOC concentrations were noted to generally increase at the A probe locations when sparging began and venting continued. The increase of concentrations at A probe reflects the removal of contaminants from the ground water by sparging. VOC concentrations at B probe continued to decline, reflecting the ability of the soil vapor extraction to control the movement of contaminant vapors in the unsaturated zone. The increase in VOC concentration was most noticeable in the blower discharge for venting. The VOC concentration in the vent discharge before sparging and during sparging are listed below.

	Vent Discharge Concentration Before Sparging (ppb)	Emission Rate Before Sparging (lbs/hr)	Vent Discharge Concentration During Sparging (ppb)	Emission Rate (lbs/hr)
Benzene	1,630	4.6×10^{-4}	5,750	1.7×10^{-3}
Trichloroethylene	3,840	1.8×10^{-3}	6,860	3.4×10^{-3}
Toluene	5,120	1.8×10^{-3}	5,200	1.8×10^{-3}
Tetrachloroethylene	----	----	3,000	1.8×10^{-3}
Ethyl Benzene	170	1×10^{-4}	290	1.1×10^{-4}
M-Xylene	----	----	6,690	2.7×10^{-3}

The changes in VOC concentration and emission rates recorded before and during sparging while venting was performed best reflect the effectiveness of the combined use of sparging and SVE as a remedial alternative. In general, the emission rate of the venting increased 1.5 to 4 times when combined with air sparging. This reflects the efficiency of this alternative through the increase in the contaminant mass removal rate.

Conceptual Remedial Strategy

Based upon the results of the pilot test, the combined use of air sparging and soil vapor extraction is a viable remedial alternative for this site. The combined air sparging and SVE system (AS/SVE) can be used to remediate

both ground water contaminant plumes identified on-site. To be most effective the AS/SVE system should cover the area bounded by wells ERM-13, ERM-16, ERM-8, ERM-5, OBG-8 (western plume) and OBG-3, OBG-4, ERM-16, ERM-17 (eastern plume). The air sparging wells should be installed to depths of about 30 feet below grade and constructed in a manner similar to AS-1 (Appendix A). The air sparging wells should be installed at a spacing of about 40 feet on center. The optimal air requirements of each air sparging point are 1-2 cfm at a pressure of 10 psi.

The venting system should cover the same area. Each vent point should be installed at a depth of about 8 feet below grade and constructed in a manner similar to SVE-1 (Appendix A). The vent points should be installed at a spacing of about 70 feet on center. The vacuum requirements of each point are 24.5 cfm at a vacuum pressure of 60 in. (H_2O).

1.3 Dolphin Mart

The specific objectives of site investigations conducted at the Dolphin Mart (Figure 4) included:

1. review of background data;
2. assessment of current site conditions;
3. further delineation of site ground water contamination;
4. determination of the feasibility of air sparging as a remedial alternative; and
5. assessment of ground water recovery as a contaminant plume control option.

The objectives were achieved through review of available reports, site inspection of existing conditions, installation and sampling of two additional ground water monitoring wells, conduct of an air sparging pilot test and aquifer

pump test, evaluation of air sparging pilot test and pump test results, and ground water modeling of various plume control options.

Previous Investigations and Site Background

Previous site investigations were conducted by Wehran Engineering, O'Brien & Gere (OBG), and ERM in 1987, 1989, and 1992, respectively. The investigations identified local lithology, site history, hydrogeology, and limited delineation of the extent of soil and ground water contamination.

The soil and ground water analysis results reported by these investigations identified a historical contamination source resulting from former use of the site as a gasoline service station. Records indicate that the site operated as a gasoline service station until October 1985. In October 1985 a release of gasoline/diesel fuel was reported to CT-DEP. Subsequent tank tightness tanks revealed that all four former 10,000 gallon underground storage tanks (USTs) had leaked.

The four USTs and surrounding contaminated soil were removed between 1985 and 1987. During subsequent site investigations eight ground water monitor wells were installed to identify ground water and soil contamination. Surface water sampling was also conducted to identify the potential impact to an unnamed intermittent stream west of the contamination source area.

Soil contamination by lead and total petroleum hydrocarbons (TPH) was detected in shallow soil samples collected above the water table. The majority of the soil contamination (at low concentrations) appeared related to fluctuating contaminated ground water. However, soils contaminated by TPH and lead detected in WE-1 (up to 5000 ppm TPH) are associated with a historical diesel tank located in that area. Removal and disposal of this soil in this area (approxi-

mately 800 cubic yards, Drawing C-2) was recommended, but has not yet been performed.

Ground water contamination by gasoline constituents (benzene, toluene, ethyl benzene, xylene: BTEX) was detected in all wells except WE-1. BTEX was detected at concentrations up to 12,200 ppb near the center of the identified ground water contaminant plume (wells WE-4, WE-5, WE-6, OBG-8). The extent of the ground water contaminant plume was not fully defined. The approximate extent of the plume to the south-southwest was identified by well OBG-9 which showed minor levels of BTEX (2.7 ppb). The eastern and western limits of ground water contamination remained undefined as a result of elevated BTEX (33.5 - 550 ppb) and MTBE (130 - 55 ppb) detected at wells WE-3 and WE-4, respectively.

The ground water quality of the site area has been designated class GAA by CT-DEP. Due to the class GAA designation and the location of the site within the watershed for nearby public water supply reservoirs, it was determined that site remediation should:

1. treat contamination to non-detectable levels; and
2. contain the ground water contamination plume.

Geological and Hydrogeological Setting

The site is located in a former swampy area which was apparently filled in for development purposes. The site building and paving cover approximately 90% of the site area. A 70 acre swamp which drains into Beaver Dam Brook borders the site to the south and west. The site topography is nearly level (95-103 ft. a.m.s.l.) with little vertical relief.

The site stratigraphy consists of a thin fill layer (1-6 ft.) which mantles a lenticular organic, clayey silt (3 - 10 ft.). A fluvial sand was identified below the silt layer. A lodgement till was observed above bedrock at some locations (Figure 2). The thickness of overburden was variable, approximately 8 to 17 feet at the site. The bedrock was identified as the Mamacoke Formation of the Waterford Group, and consists of a granite gneiss.

Site hydrogeology was described as an unconfined aquifer with a variable saturated thickness (5 to 14 feet). Site hydraulic conductivities were estimated by slug tests to range from 0.3 to 2.48 ft./day. Site ground water was determined to flow to the southwest towards the swampy area.

Site Inspection

HRP inspected the site to locate site features, prepare base maps, and assess the condition of site wells on October 6, 1993.

Based upon this site visit, the site plan (Figure 4) was prepared. The plan identifies significant site features including buildings, roads, wells, utilities, etc.

During the site visit, the following monitor wells were located, accessed, and inspected.

WE-1A	WE-5
WE-2S	WE-6
WE-2D	OBG-8A
WE-3	OBG-9A
WE-4	OBG-9

The majority of the wells were in fair condition. Monitor wells WE-8A and OBG-9A need repair to handways and concrete collars. Monitor well OBG-9 was silted and well WE-1A was dry, indicating that the ground water table was below the bottom elevation of the well at the time of inspection.

No floating petroleum product was observed at any of the site monitor wells.

Additional Investigation

Two additional monitor wells (HRP-10 and HRP-11, Figure 4) were installed on October 14, 1993. The monitor wells were located to better define the extent of the ground water plume to the east and west.

The monitor wells were installed using hollow stem auger drilling techniques and were constructed using 2 inch diameter PVC well materials. The drill logs and construction diagrams are attached in Appendix D. Soil samples were collected using split-spoons to confirm site stratigraphy. Soil descriptions verified the soil types previously identified.

The two monitor wells (HRP-10, HRP-11) were developed and sampled along with remaining site wells in October 22, 1993. A ground water sample was also collected from P1b, an observation point installed for the air sparging pilot test. Well WE-1A was not sampled since no ground water was observed at this location. The ground water samples were submitted to a State certified laboratory for analysis for aromatic volatile organics (EPA Method 602), TPH (EPA Method 418.1), and MTBE. The ground water analysis results are summarized below and attached in Appendix E.

	Contaminant Concentration (ppb)					
Well I.D.	Benzene	Toluene	Ethyl Benzene	Xylene	MTBE	TPH
WE-2S	BDL	BDL	BDL	BDL	2	BDL
WE-2D	3	1	1	BDL	BDL	BDL
WE-3	6	BDL	BDL	2	83	BDL
WE-4	431	47	398	673	BDL	BDL
WE-4 duplicate	406	41	4	649	77	BDL
WE-5	478	26	3	2,232	57	BDL
WE-6	BDL	BDL	BDL	12	2	BDL
OBG-8A	56	8	53	136	BDL	BDL
OBG-9A	BDL	BDL	BDL	BDL	2	BDL

	Contaminant Concentration (ppb)					
Well I.D.	Benzene	Toluene	Ethyl Benzene	Xylene	MTBE	TPH
HRP-10	815	79	826	2,374	BDL	5
HRP-11	BDL	BDL	BDL	4	BDL	BDL
P1b	203	12	134	529	BDL	BDL

Notes: BDL = Below Detectable Level

Ground water elevation data was also collected from the site wells. The ground water elevations identify a southerly ground water flow direction (Figure 5). The average ground water gradient was 0.0075 ft./ft. The ground water analysis results combined with the ground water elevation data identify a BTEX ground water contaminant plume which extends from the former tank area to the south (Figure 11). The longitudinal axis of the plume extends from the source area (former tank area) and bisects the area between WE-4 and HRP-10. This region defines the central portion of the contaminant plume where contaminant concentrations would be expected to be highest. The western limits of the contaminant plume are approximately delineated by wells WE-2S, WE-2D, WE-3 and HRP-11. The southern extremity is defined by OBG-9A. The eastern limit extends beyond HRP-10.

The contaminant plume extent and ground water flow directions defined by this investigation are somewhat dissimilar to previous results. However, the consistency between the longitudinal axis of the contaminant plume and the direction of ground water flow confirm the validity of data collected as part of this investigation.

Remedial Testing

Pilot tests were conducted on-site in November 1993 to determine the feasibility of air sparging and identify various plume containment strategies. One air sparing point (AS-1), four observation probes (P1, P2, P3, P4), and a

horizontal soil vapor extraction well (SVE-1) were installed at the locations shown on Figure 4 to conduct the air sparing pilot test. The observation probes consisted of three monitor points installed in each borehole. The A probes were completed beneath the silt layer. The B probes were completed within the silt, and C probes were completed above the water table. The sparge point and observation probes were installed with a hollow stem auger drill rig on October 14, and 15, 1993. The horizontal SVE well was installed on October 26, 1993.

An eight inch diameter recovery well was installed adjacent to WE-6 (Figure 4) using a dual rotary rig. The well was pumped at a rate of about 1.43 gallons per minute (gpm) during the aquifer pump test.

The results of the pilot test and pump test are presented below.

Air Sparging and Soil Vapor Extraction Pilot Test

The pilot test was conducted on November 2, 4, and 23, 1993. The purpose of the pilot test was to determine:

1. the area treated by sparing at selected air injection pressures and flowrates;
2. the optimal operational pressure and flowrate for remedial design;
3. the area treated by soil vapor extraction using a specified vacuum and resulting flowrate; and
4. the feasibility of applying the combination of air sparging and soil vapor extraction to a setting characterized by a shallow water table and fine grain sediments.

The procedures to achieve these objectives are presented in Appendix B. A gasoline powered 11.5 HP air compressor provided compressed air to this sparge point. An electric 1.5 HP regenerative blower supplied a vacuum to the vapor extraction well.

Air Sparging Test

Compressed air was injected into the base of the site aquifer at the two pressure levels listed below.

Injection Pressure (psi)	Flowrate (cfm)
5	7 - 8
3	4

The air injection pressure was limited to levels only slightly higher than the critical pressure necessary to induce sparging. Higher pressures of 5 psi and greater were observed to create excessive mounding and force ground water out of pavement cracks and around well seals.

Measurements including depth to water, dissolved oxygen, explosivity, TOX, and oxygen levels were collected from each observation probe before, during, and after the test. Soil gas samples were also collected and analyzed for selected volatile organics with a field gas chromatograph (Photovac Model 10S55).

The shallow depth to ground water complicated the collection of TOX, explosivity, oxygen levels and soil gas analysis data. Dissolved oxygen data collected from the observation probes and surrounding monitor wells WE-6 and WE-4 best identified the area treated by air sparging. The water level data identified the extent of the ground water mound induced by sparging. The dissolved oxygen and water level data is attached in Appendix F and summarized in Table 4.

TABLE NO. 4: SUMMARY OF AIR SPARGING DATA FROM THE DOLPHIN MART					
		Dissolved Oxygen (ppm)		Depth to Ground Water (ft.)	
Probe I.D.	Distance from AS-1 (ft.)	Initial	After 4.5 hrs. of Sparging	Initial	After 2 hrs. of Sparging
P1a	5	3.1	3.0	3.8	0.21
P2a	10	1.95	7.5	3.68	0
P3a	10	2.4	5	3.32	0
P4a	20	3.2	2.5	2.96	1.44
P1b	5	2.4	3.0	3.87	0.69
P2b	10	no measurement	6.11	3.58	0
P3b	10	2	7.4	3.36	0
P4b	20	2.8	3.5	2.92	1.44
WE-4	35	1.25	9	4.18	3.11
WE-6	17	1.75	9.8	3.75	2.33

The areas surrounding the sparge point AS-1 which showed an increase in dissolved oxygen are believed to represent the area treated by sparging. All probes with the exception of P1a,b and P4a,b show significant increases in dissolved oxygen. The absence of changes in dissolved oxygen at P1a,b and P4a,b may be representative of the heterogeneous nature of the site aquifer materials. Based upon the test results, a circular area centered about AS-1 with a radius of about 35 feet is conservatively estimated to be the area treated by sparging during the test.

SVE Test

A horizontal soil vapor extraction well (SVE-1, Figure 4) was installed using a backhoe. A 40 foot long by 1.5 foot wide and 3 foot deep trench was excavated through the pavement. SVE-1 was constructed of 40 foot length 2-inch diameter PVC well screen set at a depth of 3 feet below grade. The well screen was packed in coarse sand and sealed with bentonite and plastic sheeting. Compacted subgrade and asphalt was placed at surface grade.

During initial SVE tests ground water and excessive moisture was removed via SVE-1 during venting. Therefore, a 10 gallon moisture separator was added to the testing equipment to remove extracted ground water and protect the vacuum blower during subsequent tests.

A vacuum pressure of 50 in. (H_2O) was applied to SVE-1 during the test. Contaminated soil vapors were extracted at a rate of about 25 scfm. Vacuum pressure of 0.75 in. (H_2O) was recorded at P1c approximately 5 feet away from SVE-1. Using an intrinsic permeability estimated from the hydraulic conductivity at WE-4 (6×10^{-8} cm^2) a radius of influence of SVE-1 was determined. The radius of influence was estimated to be 7.5 - 10 feet.

Samples of the contaminated vapors exhausted from SVE-1 during the test were collected for analysis for selected volatile organics with the field GC. Three discharge samples were collected during two hours of venting. No BTEX was detected in the discharge samples during venting. This is likely the result of the removal of contaminated soil by previous excavation. BTEX remains within the ground water as detected in site ground water samples. The discharge analysis results are presented in Table No. 5.

Combined AS/SVE Test

Compressed air was injected at 3 psi and 4 scfm and soil gas extracted from SVE-1 at a rate of 25 cfm under a vacuum of 50 in. (H_2O) during the combined air sparging/SVE test. Throughout the test ground water was removed from the moisture trap at a rate of about 0.2 gpm.

Discharge samples collected from the SVE system and analyzed for selected VOCs with a field GC identify the benefits produced by air sparging. As expected, the contaminant emission rates increased above the levels observed during venting alone. The emission rates during the combined sparging/venting test are summarized in Table No. 6.

Aquifer Pump Test

A short term aquifer pump test was performed beginning November 15, 1993 and ending November 22, 1993. The objectives of this test were to:

1. estimate hydraulic conductivity, transmissivity and storativity of aquifer materials;
2. record the aquifer response to a controlled stress; and
3. evaluate the ability of the recovery well to control the identified ground water contaminant plume.

TABLE NO. 5: SUMMARY OF SVE DISCHARGE DATA AT THE DOLPHIN MART						
Time Since Venting Began (min.)	1,1,1-Trichloroethane		Trichloroethylene		Tetrachloroethylene	
	Conc. (ppb)	Emission Rate (lb/hr)	Conc. (ppb)	Emission Rate (lb/hr)	Conc. (ppb)	Emission Rate (lb/hr)
45	515	2.6×10^{-4}	165	8.3×10^{-5}	----	----
105	19,630	1×10^{-2}	1,550	7.8×10^{-4}	17	1×10^{-5}
120	22,400	1.1×10^{-2}	1,524	7.7×10^{-4}	13	8.3×10^{-6}

TABLE NO. 6: SUMMARY OF EMISSION RATES OBSERVED DURING COMBINEDAS/SVE TEST AT THE DOLPHIN MART

	1,1,1 Trichloroethane		Trichloroethylene		Tetrachloroethylene		Benzene	
	Conc. (ppb)	Emission Rate (lb/hr)	Conc. (ppb)	Emission Rate (lb/hr)	Conc. (ppb)	Emission Rate (lb/hr)	Conc. (ppb)	Emission Rate (lb/hr)
Venting Alone	22,400	1.1×10^{-2}	1,550	7.8×10^{-4}	17	1×10^{-5}	—	—
Sparging & Venting	107,900	5.5×10^{-2}	1,627	8.1×10^{-4}	100	6×10^{-5}	317	9.5×10^{-5}

	Toluene		Ethyl Benzene		Xylene	
	Conc. (ppb)	Emission Rate (lb/hr)	Conc. (ppb)	Emission Rate (lb/hr)	Conc. (ppb)	Emission Rate (lb/hr)
Venting Alone	—	—	—	—	—	—
Sparging & Venting	3,198	1×10^{-3}	154	6×10^{-5}	1,275	5×10^{-3}

In order to conduct the test, an eight inch diameter recovery well was installed adjacent to WE-6 on November 4, 1993. The well was completed at a bottom depth of 15 feet below grade and was constructed of a 5 foot length of continuous slot PVC well screen surrounded by an engineered gravel pack. Eight inch diameter PVC well casing was threaded to the top of the well screen. The annular space above the sand pack was sealed with bentonite. The recovery well design criteria are attached in Appendix G.

A step test was conducted on November 15, 1993. During the test the well was pumped at rates of 0.5 gpm, 1 gpm, 2 gpm, and 5 gpm. The well was unable to sustain the 5 gpm discharge for more than 9 minutes. Based upon the results of the test, the maximum discharge rate that could be maintained by the well was estimated to range between 1.5 and 2 gpm. For this reason, a discharge rate of 1.5 gpm was chosen for the pump test.

The pump test began November 16, 1993 at an average pumping rate of 1.43 gpm. Pumping continued for three days. During this time drawdown was recorded at logarithmic intervals with automated data logger and pressure transducer at the recovery well RW-1; monitor wells WE-4, WE-5, and WE-6; and observation probe P3b. In addition, ground water elevation data was collected from all site wells once daily for each day of the test.

The pumping phase of the test was terminated November 19, 1993. Ground water levels recovered to the static position within several hours. Periodic monitoring via the data logger continued until November 22, 1993.

Drawdown Analysis

Drawdown data collected from wells RW-1, WE-4, WE-5, WE-6, and P3b were adjusted to account for ground water fluctuation trends observed before,

during, and after the test. The adjusted drawdown curves were evaluated to identify appropriate analysis methods. Log-log drawdown plots were prepared and analyzed using Neuman's curve fitting method for unconfined aquifers (Kruseman, 1990). The corrected drawdown, hydraulic conductivities, and storativities are listed in Table No. 7. The graphs and mathematical calculations are attached in Appendix H. Hydraulic conductivities ranged from 1 ft./day to 14.7 ft./day. The geometric mean was 5 ft./day. Storativity values ranged from .0002 to .0057. The geometric mean was 0.001.

Distance - drawdown analysis (Driscoll, 1986) of data collected after 3 days of pumping was also used to estimate hydraulic conductivity, storativity, and determine the radius of influence. The results of this analysis are included in Appendix H. The hydraulic conductivity, storativity, and radius of influence were estimated at 8.75 ft./d, 0.14, and 70 feet, respectively.

The geometry of the capture zone during pumping was determined using the culmination point method (Kruseman, 1990). The width of the capture zone was estimated to be about 650 ft. The distance to the stagnation point was calculated at about 105 feet. The calculations are attached in Appendix H. Based upon these results, a single well is capable of containing the site contaminant plume at low discharge rates. However, RW-1 is not positioned at a location where it could be used to contain the entire plume without assistance from an additional well.

Contaminated ground water generated by the pump test was treated with a mobile treatment system. Treatment included gravity settling, filtration, and aeration. Treated ground water was discharged to the Town of Groton's sanitary sewer with approval from CT-DEP and the Town of Groton (Appendix I).

TABLE NO. 7 SUMMARY OF AQUIFER PUMP TEST RESULTS				
Well I.D.	Distance from RW-1 (ft.)	Corrected Drawdown (ft.)	Hydraulic Conductivity (ft/d)	Storativity
RW-1	---	2.9	1.1	---
WE-6	5	1.39	2.4	.0055
P3b	20	0.56	6.9	.0057
WE-4	57	0.22	14.7	.0012
WE-5	86	0.39	13	.0002

Samples of the treated effluent were collected twice during the test. A sample of the raw water was also collected. The samples were submitted to a State-certified laboratory for analysis for aromatic organics (EPA Method 602), halogenated volatile organics (EPA Method 601), MTBE, and TPH (EPA Method 418.1). The analysis results are summarized in Table No. 8 and attached in Appendix I.

Ground Water Modeling

An analytical ground water model, *Quickflow*, was used in conjunction with the aquifer pump test results to evaluate several options to contain the ground water contaminant plume. Due to increased mass contaminant removal efficiencies identified by the sparging test and the removal of ground water via the SVE vent during the pilot test, the model effort focused on utilizing the ability of the SVE system to provide containment of the contaminant plume through the removal of contaminated ground water during soil vapor extraction.

An analytical ground water flow model representing HRP's conceptual model of site hydrogeology was constructed using the hydraulic conductivity and storativity data collected from the pump test, site stratigraphic data collected during drilling, and site landform information. The site hydrogeologic system was modeled as an unconfined aquifer with a uniform saturated thickness of 11 feet, a uniform hydraulic conductivity of 5 ft./day, and storativity of .001. Aquifer recharge was restricted to the swamp west of the site. Site ground water discharged to the swamp south of the site.

TABLE NO. 8: SUMMARY OF GROUND WATER DISCHARGE ANALYSIS RESULTS				
	Contaminant Concentration (ppb)			
Sample I.D.	**Benzene**	**Toluene**	**Ethyl Benzene**	**Xylene**
Treated Discharge 11/17/93	61	154	33	408
Treated Discharge 11/19/93	133	418	71	856
Raw Water 11/19/93	200	866	BDL	1,711

Using the above parameters, the model was used to simulate steady-state ambient ground water flow (Figure 6). Ground water flow predicted by the model closely resembled ground water flow observed on-site (Figure 5).

The pumping well (RW-1) was then added to the model and pumped at a rate of 1.43 gpm. The predicted ground water flow induced by pumping (Figure 7) closely matches the ground water flow observed during the pump test (Figure 8).

Since the ground water flow predicted by the model provided a reasonable representation of observed site ground water flow under two different hydrogeologic stresses (ambient and pumping), the model was used to predict additional ground water flow patterns utilizing a horizontal soil vapor extraction system to withdraw ground water. The predictions indicate that the SVE system could be used to control the ground water contaminant plume. Given current information, the SVE system should be designed to cover much of the paved area to the west and south of the site building. Ground water removal at a rate of about 3.5 gpm (distributed throughout the SVE system) would be sufficient to create a capture zone large enough to control the contaminant plume (Figure 9). Additional model predictions suggest that the maximum discharge rate of the SVE system should be about 15 gpm. At this flowrate (15 gpm) the majority of the site aquifer would be dewatered in the area of the SVE system.

Conceptual Remedial Strategy

Remediation of soil and ground water at the Dolphin Mart is complicated by the fine grained soils present on-site and the shallow depth to ground water (1.5 - 5 ft.). The remedial options considered for the site included:

1. ground water recovery;

2. ground water recovery and soil vapor extraction; and

3. air sparging, soil vapor extraction, and ground water recovery.

Although ground water recovery would provide containment of the contaminant plume at a minimal pumping rate (1.5 gpm), it was not considered a viable alternative due to the low contaminant mass removal rate anticipated by the system. Ground water recovery and soil vapor extraction (SVE) would provide control of the contaminant plume and increase the contaminant mass removal rate. The increase in contaminant mass removal rates would result from the SVE treatment of contaminated soils. However, the contaminant mass removal rate from the ground water would remain low. Therefore, this alternative was not further pursued.

The combined use of air sparging, SVE, and ground water recovery would increase the contaminant mass removal rates from both the contaminated soils and ground water, and provide plume control. Therefore, this alternative was selected.

Air sparging and SVE pilot tests indicated that the air sparging can be expected to increase the contaminant mass removal rate of the SVE system by a factor up to 5. However, the SVE system is expected to withdraw ground water due to the shallow depth of ground water and mounding induced by sparging. Since the SVE system is expected to withdraw ground water, the conceptual plan for remediation utilizes this removal of ground water via SVE to provide hydraulic control of the contaminant plume.

The site remediation system should be designed so that air sparging and SVE treat the area of highest contamination which appears to be restricted to the paved area to the west and south of the building. Based upon air sparging pilot

test results, sparge points should be placed about 60 feet apart. Compressed air requirements would be 3 psi at a flowrate of 4 cfm. The sparge points should be constructed of 1-inch diameter solid and slotted PVC materials similar to AS-1. A slot size of 0.010 inches is recommended. The SVE system should consist of 2-inch diameter PVC well screen (0.010 inch slots) placed horizontally in trenches spaced 20 feet apart. The vacuum requirements for the system are 50 in. (H_2O) vacuum and an air flowrate of 25 scfm per 40 feet of linear trench.

Hydraulic plume control will be provided by the removal of ground water via the SVE system. A ground water withdrawal rate of about 3.5 gpm is anticipated to be sufficient to create a capture zone large enough to contain the contaminant plume. The ground water and air streams would be separated by a moisture trap. Ground water would be drained from the pot and discharged to the sanitary sewer under an approved discharge permit. The recovered soil vapors would be expelled by the blowers and treated before discharge to the atmosphere.

2.0 SUMMARY

Air sparging is a ground water remedial alternative in which compressed air is injected below the ground water table and beneath a contaminated zone. Air sparging is useful in removing dissolved and residual phase volatile contaminants from ground water. Bubbling air passing through the contaminated zone creates a concentration gradient causing a transfer of contaminant mass from the dissolved and residual phases into the vapor phase of the air bubble. The air bubbles, laden with contaminated vapors, rise above the water table by simple buoyancy where they are removed by soil vapor extraction. Air sparging technology has been found to be an efficient means to remove contamination of ground water by volatile compounds due to the high contaminant mass removal rates in comparison to alternate remedial options. The injection of compressed air may also enhance biologic activity which can also be beneficial to the biodegradation of some contaminants. Air sparging, however, is not capable of providing hydraulic control of ground water contaminant plume migration.

An air sparging pilot test is conducted to evaluate the feasibility of this technology and determine the engineering criteria to design a full scale system. The pilot test consists of a series of tests which are designed to identify:

1. the bubble zone surrounding the sparge point at various air injection pressures and flowrates;
2. the radius of influence of a soil vapor extraction (SVE) well for a given vacuum and flowrate;
3. the anticipated combined performance of the air sparging and SVE system; and
4. the air and vacuum requirements of the combined system.

2.1 Pilot Test Configuration

To conduct a pilot test it is necessary to install at a minimum 1 air sparge point, 1 SVE well, and a number of observation probes. The spacing between

the sparge point and SVE well will depend upon site constraints, however, they should be spaced within the influence area of each other. The sparge point should consist of a short well screen length completed below the contaminant plume. The SVE well should be completed in the unsaturated zone. Observation probes should be located within and outside the anticipated influence areas of the air sparging and SVE wells.

Observation probes can consist of several small diameter PVC well screens which are nested vertically within a single borehole. The probes should be completed within the areas of hydrogeologic interest. This would include positions above and below the water table in addition to stratigraphic layers of significance.

2.2 Data Monitoring Requirements

The data used to evaluate the bubble zone, SVE radius of influence, and performance of air sparging include:

water levels
dissolved oxygen
vacuum pressure
positive pressure
soil gas contaminant concentrations (PID and/or field GC)
total halogen (TOX)
oxygen levels
explosivity (LEL)

These data should be collected before, during, and after all phases of the pilot test. The objectives of the pilot test will be achieved through the identification of changes to the monitoring data collected throughout the test.

2.3. Pilot Test Procedures

The pilot test consists of three phases:

1. SVE test
2. air sparging test
3. combined air sparging and SVE test

The phases are conducted successively, and then repeated for different air injection pressures and flowrates.

SVE Test

The monitoring data should be collected at the beginning of this phase to establish initial conditions. The data should be collected from each observation probe and other locations deemed appropriate (i.e. nearby monitor wells). A vacuum blower will then be connected to the SVE well. Since the blower may create significant vacuums, all fittings must be ferncote fittings or cemented tight. The blower will be operated for approximately 1 hour. During this time period the following data will be collected:

1. stabilized vacuum levels from all probes and the SVE well;
2. the air flowrate discharged by the blower measured every 15 minutes;
3. gas samples collected from the blower discharge every 15 minutes and analyzed by PID and/or GC.

After the blower has operated for one hour the blower will be shut down and pressure levels allowed to return to atmospheric levels. Time related vacuum drawdown and recovery data will then be collected from each observation probe. The blower will be turned on and the vacuum will be recorded at 5 second intervals until the vacuum nearly stabilizes (about 2 minutes). The blower will be turned off and the vacuum recovery will be recorded at 5 sec. intervals until atmospheric levels are reached. This process is repeated at all observation probes.

Air Sparging Test

After the collection of vacuum data, the monitoring data should be collected from all observation probes to document initial conditions prior to the

sparge test. Compressed air will be injected into the sparge point for approximately one hour. The monitoring data will be collected from all observation probes at intervals of approximately 20 minutes. In addition, the air injection pressure and flowrate will be recorded at 15 minute intervals.

Combined SVE and Air Sparing Test

Turn the vacuum blower back on and continue to inject compressed air into the sparge point. The combined system should be allowed to operate for as long as time permits (generally 4 hours). During this time, the monitoring data will be collected from all probes and neighboring wells at 30 minute intervals. In addition, the following data should also be collected:

1. air injection pressure & flowrate at 15 minute intervals;
2. blower vacuum pressure and flowrate at 15 minute intervals; and
3. vapor samples of the blower discharge should be collected and analyzed every hour.

After the hour of continued sparging and venting, the systems will be shutdown. Additional monitoring data will be collected 1 hour after sparging has stopped.

The following procedure should be repeated at different pressure levels and flowrates to identify the optimal operational levels.

3.0 REFERENCES

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Ground Water and Wells, Driscoll, Fletcher, Johnson Division, St. Paul, MN, 1986.

Naval Exchange Gas Station Underground Storage Tank (UST) Spill Investigation, O'Brien & Gere, October 1990.

Site Investigation of Leaking Underground Fuel Storage Tanks - Nautilus Park, Wehran Engineering Corp. Project No. 04360, November 1987.

APPENDIX A

Nex Drill Logs

Soil Sampling Log
KENNEDY & SONS TEST BORING, INC.

Sub–Surface Exploration
P.O. Box 735
Naugatuck, Connecticut 06770
Bus. (203) 723-0686

DATE START	10/19/93
DATE FINISHED	10/19/93
WEIGHT OF HAMMER	140
HEIGHT OF FALL	30"
SAMPLER O.D.	2"
SAMPLER I.D.	1 5/8"
TYPE OF RIG	CME 55

GROUND WATER OBSERVATIONS

DATE	TIME	DEPTH

ESPECIALLY COMPILED FOR
HRP Associates, Inc.
167 New Britain Ave.
Plainville, CT 06062

SHEET	1 OF 1
PROJ. NO.	NAV 0028 FE
LOCATION	NEX Groton, CT
OFFSET	
GROUND ELEVATION	
HOLE NO.	P-1

TYPE	CASING	SAMPLER	CORE	BARREL
	HSA	SS		
SIZE I.D.	2 1/4"	1 5/8"		

SAMPLE NO. DEPTHS ELEV.FT.	BLOWS PER 6 IN. ON SAMPLER FROM – TO 0–6	6–12	12–18	18–24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	REC
0'-2'	17	9	9	12			Black top.	1	2.0	12"
							6" of fine to medium brown sand w/coarse sand, pebbles and very fine sand, then 6" of dark brown denser fine to medium sand w/very fine sand and trace pebbles, some gravel and broken rock. SP			
6'-7'	6						Abandoned hole due to anomalous reaction of spoon to hammer "strange bouncing"	2	6"	
							Moved hole Backfilled w/cuttings and sealed at grade			

Proportions used: trace = 0.10%, little = 10.20%, some = 20.35%, and 35.50%

DRILLER: Bill Kennedy
FOREMAN: Mike Kennedy
ENGINEER: Jennifer Convey

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON
TP = TUBE PUT

COHESIONLESS DENSITY
0 – 10 LOOSE
10 – 30 MED. COMP.
30 – 50 DENSE
50 + VERY DENSE

TOTAL FOOTAGE:
Earth Boring ft
Rock Coring ft
Hole No. P-1

Soil Sampling Log
KENNEDY & SONS TEST BORING, INC.

Sub–Surface Exploration
P.O. Box 735
Naugatuck, Connecticut 06770
Bus. (203) 723-0686

TE START	10/19/93
E FINISHED	10/19/93
IGHT OF HAMMER	140
FALL	30"
GROUND WATER OBSERVATIONS	
DATE	
TIME	
DEPTH	
MPLER O.D.	2"
I.D.	1 5/8"
OF RIG	CME 55

ESPECIALLY COMPILED FOR
HRP Associates, Inc.
167 New Britain Ave.
Plainville, CT 06062

SHEET	1 OF 1
PROJ. NO	NAV 0028 FE
LOCATION	NEX Groton, CT
OFFSET	
GROUND ELEVATION	
HOLE NO.	R-1
TYPE	CASING: HSA; SAMPLER: SS; CORE; BARR
SIZE I.D.	2 1/4"; 1 5/8"

SAMPLE NO. DEPTHS ELEV.FT.	BLOWS PER 6 IN. ON SAMPLER FROM – TO 0–6	6–12	12–18	18–24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV	FIELD IDENTIFICATION OF SOILS / REMARKS	SAMPLE NO.	PEN	REC
							0-2 taken from first attempt. Moved hole 3' southeast. Strong odor from hole and cuttings.			
-7'	11	4	6	3			Moist gray very fine to medium sand w/trace coarse sand and silt, some odor. SW	2	2.0	
)'- -2'	7	8	9	13			Wet 2" dark brown very fine to medium silty sand w/wood, then unevenly layered light brown and orangey-brown medium to coarse sand w/very fine sand and gravel, trace silt, very strong odor. SW	3	2.0	20'
							Set deep point A at 11' 1 1/2' sand bentonite to almost 6' thin layer sand			
							Set shallow point B at 6' sand to 4 1/2' bentonite to surface			
							Materials used: 125 lbs. bentonite 400 lbs. sand 1 bag portland cement			

Proportions used: trace = 0.10%, little = 10.20%, some = 20.35%, and 35.50%

LER: Bill Kennedy
:R: Mike Kennedy
ENGINEER
DRILLER/INSPECTOR: Jennifer Convey

SAMPLE TYPE
C - CORED W - WASHED
DS - SPLIT SPOON
UP - UNDISTURBED PISTON
TP - TEST PIT

COHESIONLESS DENSITY
0 - 10 LOOSE
10 - 30 MED COMP
30 - 50 DENSE
50 - VERY DENSE

TOTAL FOOTAGE
Earth Boring ft
Rock Coring ft
Total ft

ATE START	10/18/93
TE FINISHED	10/18/93
EIGHT OF HAMMER	140
FALL	30"
GROUND WATER OBSERVATIONS	DATE / TIME / DEPTH
AMPLER O.D.	2"
I.D.	1 5/8"
E OF RIG	CME 55

Soil Sampling Log
KENNEDY & SONS TEST BORING, INC.

Sub–Surface Exploration
P.O. Box 735
Naugatuck, Connecticut 06770
Bus. (203) 723-0686

ESPECIALLY COMPILED FOR
HRP Associates, Inc.
167 New Britain Ave.
Plainville, CT 06062

SHEET	1 OF 1
PROJ. NO	NAV 0028 FE
LOCATION	NEX Groton, CT
OFFSET	
GROUND ELEVATION	
HOLE NO.	P-2
TYPE	CASING HSA / SAMPLER SS / CORE / BAR
SIZE I.D.	2 1/4" / 1 5/8"

SAMPLE NO. DEPTHS ELEV.FT.	BLOWS PER 6 IN. ON SAMPLER FROM – TO 0–6	6–12	12–18	18–24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV	FIELD IDENTIFICATION OF SOILS / REMARKS	SAMPLE NO.	PEN	RE
0'-2'	7	9	16	15			Black top.	1	2.0	12
							Medium brown fine to medium sand w/gravel and broken rock. SW			
2'-4'	13	7	12	12			Same as sample #1 w/dark brown very fine to medium sand. SW	2	2.0	12
'-6'	11	4	5	6			Medium brown very fine to medium sand w/broken rock, wet at 5', medium brown fine sand w/very fine to medium sand and black mottles and gravel, broken rock - moderate strong odor. SW	3	2.0	14
'-8'	9	7	7	7			Medium brown very fine to medium sand w/dark brown /black mottles and some gravel. SW	4	2.0	20
'- 0'	3	9	5	7			Wet medium brown very fine to medium sand 1" at top -black, decreases to fine w/depth - strong odor throughout. SW	5	2.0	15
							Set deep point A at 10' 1 1/2' sand bentonite thin layer sand			
							Set shallow point B at 6' 1 1/2' sand bentonite to surface thin concrete collar w/handway			
							Material used: HRP - handway 150 lbs. sand 200 lbs. bentonite			

Proportions used: trace = 0.10%, little = 10.20%, some = 20.35%, and 35.50%

LLER Bill Kennedy
PER Mike Kennedy
S ENGINEER
LOGGER/INSPECTOR Jennifer Convey

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UD = UNDISTURBED PISTON
TP = TUBE PIT

COHESIONLESS DENSITY
0 - 10 LOOSE
10 - 30 MED. COMP.
30 - 50 DENSE
50 - VERY DENSE

TOTAL FOOTAGE
Earth Boring ft
Rock Coring ft
Hole No. P-2

Soil Sampling Log
KENNEDY & SONS TEST BORING, INC.

Sub–Surface Exploration
P.O. Box 735
Naugatuck, Connecticut 06770
Bus. (203) 723-0686

TE START	10/19/93
FINISHED	10/19/93
IGHT OF HAMMER	140
ALL	30"
GROUND WATER OBSERVATIONS	DATE / TIME / DEPTH
MPLER O.D.	2"
I.D.	1 5/8"
OF RIG	CME 55

ESPECIALLY COMPILED FOR
HRP Associates, Inc.
167 New Britain Ave.
Plainville, CT 06062

SHEET	1 OF 1
PROJ. NO.	NAV 0028 FE
LOCATION	NEX Groton, CT
OFFSET	
GROUND ELEVATION	
HOLE NO.	P-3
TYPE	CASING HSA / SAMPLER SS / CORE / BARR
SIZE I.D.	2 1/4" / 1 5/8"

SAMPLE NO. / DEPTHS ELEV.FT.	BLOWS PER 6 IN. ON SAMPLER FROM – TO 0–6	6–12	12–18	18–24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV	FIELD IDENTIFICATION OF SOILS / REMARKS	SAMPLE NO.	PEN	REC
-2'	2	9	13	9			6" of topsoil and sod, then broken rock, then fine to meidum light brown sand. SW.	1	2.0	18"
'-7'	11	7	6	4			2" gray moist very fine to medium sand w/trace coarse sand and silt, then 1.5" of micaceous black dense layer, then same sand as before - very strong odor. SW	2	2.0	10"
'- .2'	9	8	8	9			3" of same gray material as 5'-7', then unevenly layered, light brown and orangey brown medium to coarse sand w/very fine sand, gravel, trace silt, - very strong odor. SW	3	2.0	10"
							Set deep point A at 11' 1 1/2' sand bentonite to 6' thin layer of sand			
							Set shallow point B at 6' 1 1/2' sand bentonite to surface			
							Material used: 150 lbs. bentonite 150 lbs. sand			

Proportions used: trace = 0.10%, little = 10.20%, some = 20.35%, and 35.50%

LER. Bill Kennedy
R Mike Kennedy
ENGINEER Jennifer Convey

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON
TP = TEST PIT

CORE BORING DENSITY
0-10 LOOSE
10-30 MED. COMP.
30-50 DENSE
50-VERY DENSE

TOTAL FOOTAGE
Earth Boring ft
Rock Coring ft
Total No. P-3

TE START 10/19/93 TE FINISHED 10/19/93	**Soil Sampling Log** **KENNEDY & SONS TEST BORING, INC.** Sub–Surface Exploration P.O. Box 735 Naugatuck, Connecticut 06770 Bus. (203) 723-0686	SHEET 1 OF 1 PROJ. NO NAV 0028 F	
IGHT OF HAMMER 140 FALL 30"		LOCATION NEX Groton, CT OFFSET	
GROUND WATER OBSERVATIONS DATE TIME DEPTH	ESPECIALLY COMPILED FOR HRP Associates, Inc. 167 New Britain Ave. Plainville, CT 06062	GROUND ELEVATION HOLE NO. P-4	
MPLER O.D. 2" I.D. 1 5/8"		TYPE CASING HSA SAMPLER SS CORE BAR	
OF RIG CME 55		SIZE I.D. 2 1/4" 1 5/8"	

SAMPLE NO. PTHS EV.FT.	BLOWS PER 6 IN. ON SAMPLER FROM – TO 0–6	6–12	12–18	18–24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	REC
0'-2'	3	4	5	14			Sod and top soil.	1	2.0	12
2'-7'	9	9	-	-			Gray moist very fine to medium sand w/trace coarse sand and silt, very strong odor - S.S. bounced on wood at 6.0' SW	2	1.0	12
10'-12'	30	10	8	8			Wet, dark gray very fine to coarse sand w/pebbles and silt, very strong odor. SW	3	2.0	3
							Set deep point A at 11' 1 1/2' sand bentonite to 6' thin layer sand			
							Set shallow point B at 6' 1 1/2' sand bentonite to surface			
							150 lbs. sand 200 lbs. bentonite			

Proportions used: trace = 0.10%, little = 10.20%, some = 20.35%, and 35.50%

LLER: Bill Kennedy
ER: Mike Kennedy
ENGINEER
LOG INSPECTOR Jennifer Convey

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON
TP = TEST PIT

CONSIONLESS DENSITY
6 10 LOOSE
10 30 MED DENSE
30 50 DENSE
50 VERY DENSE

TOTAL FOOTAGE
Earth Boring ft
Rock Coring ft
Total No. P-4

Soil Sampling Log
KENNEDY & SONS TEST BORING, INC.

Sub–Surface Exploration
P.O. Box 735
Naugatuck, Connecticut 06770
Bus. (203) 723-0686

TE START 10/19/93
TE FINISHED 10/19/93

IGHT OF HAMMER 140
FALL 30"

GROUND WATER OBSERVATIONS

DATE	TIME	DEPTH

MPLER O.D. 2" I.D. 1 5/8"

OF RIG CME 55

ESPECIALLY COMPILED FOR
HRP Associates, Inc.
167 New Britain Ave.
Plainville, CT 06062

SHEET 1 OF 1
PROJ NO. NAV 0028 FE

LOCATION NEX
Groton, CT

OFFSET

GROUND ELEVATION
HOLE NO. SVE - 1

	CASING	SAMPLER	CORE	BAR-
TYPE	HSA	SS		
SIZE I.D.	2 1/4"	1 5/8"		

SAMPLE NO. DEPTHS ELEV.FT.	BLOWS PER 6 IN. ON SAMPLER FROM – TO 0–6	6–12	12–18	18–24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	REC
'-2'	12	12	8	7			Black top. 8" fine to medium brown sand w/coarse sand and pebbles and very fine sand, then 6" dark brown denser fine to medium sand w/very fine sand and trace pebbles, some gravel. SW	1	2.0	14
'-7'	5	5	3	3			Dark brown fine to medium sand w/gravel - some odor. SW Water at 8' Set well at 7.5' sand to 1' above screen 2" PVC grout to surface/ 1 bag portland cement 200 lbs. sand 50 lbs. bentonite	2	2.0	6'

Proportions used: trace = 0.10%, little = 10.20%, some = 20.35%, and 35.50%

LER: Bill Kennedy
ER: Mike Kennedy
ENGINEER
ING INSPECTOR Jennifer Convey

SAMPLE TYPE
C - CORED W - WASHED
SS - SPLIT SPOON
UP - UNDISTURBED PISTON
TP - TEST PIT
[illegible]

DIMENSIONLESS DENSITY
0 - 10 LOOSE
10 - 30 MED. COMP
30 - 50 DENSE
50 - VERY DENSE

TOTAL FOOTAGE
Earth Boring FT
Rock Coring FT
Total SVE

Soil Sampling Log
KENNEDY & SONS TEST BORING, INC.

Sub–Surface Exploration
P.O. Box 735
Naugatuck, Connecticut 06770
Bus. (203) 723-0686

TE START	10/21/93
E FINISHED	10/21/93
EIGHT OF HAMMER	140
FALL	30"
GROUND WATER OBSERVATIONS	DATE / TIME / DEPTH
AMPLER O.D.	2"
I.D.	1 5/8"
E OF RIG	CME 55

ESPECIALLY COMPILED FOR
HRP Associates, Inc.
167 New Britain Ave.
Plainville, CT 06062

SHEET	1 OF 2
PROJ NO.	NAV 0028 FE
LOCATION	NEX Groton, CT
OFFSET	
GROUND ELEVATION	
HOLE NO.	AS-1
TYPE	CASING HSA / SAMPLER SS / CORE / BAR
SIZE I.D.	2 1/4" / 1 5/8"

SAMPLE NO. DEPTHS ELEV.FT.	BLOWS PER 6 IN. ON SAMPLER FROM – TO 0–6	6–12	12–18	18–24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	RE
'-2'	10	9	8	6			Black top. 5" of light brown fine to medium sand w/broken rock and gravel, then dark brown very fine to medium sand w/gravel. SW	1	2.0	10
5'-7'	7	15	7	6			2.5" medium light brown very fine to medium sand w/gravel, then extremely micaceous sand or mottled rock - moderate odor. SW	2	2.0	5
10'-2'	6	9	11	11			2" Dark brown organic silt w/sand, then 8" unevenly layered grayish tan, light brown and orangey very fine to medium sand w/coarse sand, then 2 layers black very fine to medium sand 1.25" each darkest at top, fade to orangey brown with 3/4", 1/2" between layers - strong odor throughout especially in black layers - then some tan-orangey brown sand SM	3	2.0	18
15'-17'	10	14	13	10			Wet light brown very fine to medium sand, slight moderate odor. SW	4	2.0	24'
0'-22'	9	8	8	8			Wet light brown very fine to medium sand, no odors, trace silt. SW	5	2.0	24'
5'-27'	8	8	8	10			Very fine to medium light brown sand w/increasing silt content w/depth. SW	6	2.0	24'

Proportions used: trace = 0.10%, little = 10.20%, some = 20.35%, and 35.50%

LER: Bill Kennedy
PER: Brian Kennedy
ENGINEER: Jennifer Convey

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON
TP = TEST PIT

COHESIONLESS DENSITY
0–10 LOOSE
10–30 MED DENSE
30–50 DENSE
50+ VERY DENSE

TOTAL FOOTAGE
Earth Boring FT
Rock Coring FT
Hole No. AS

Soil Sampling Log
KENNEDY & SONS TEST BORING, INC.

Sub–Surface Exploration
P.O. Box 735
Naugatuck, Connecticut 06770
Bus. (203) 723-0686

ESPECIALLY COMPILED FOR
HRP Associates, Inc.
167 New Britain Ave.
Plainville, CT 06062

TE START	10/21/93
TE FINISHED	10/21/93
IGHT OF HAMMER	140
FALL	30"
GROUND WATER OBSERVATIONS	
DATE	
TIME	
DEPTH	
MPLER O.D.	2"
I.D.	1 5/8"
OF RIG	CME 55

SHEET	2 OF 2
PROJ NO.	NAV 0028 FE
LOCATION	NEX Groton, CT
OFFSET	
GROUND ELEVATION	
HOLE NO.	AS
TYPE	CASING HSA / SAMPLER SS / CORE / BAF
SIZE I.D.	2 1/4" / 1 5/8"

SAMPLE NO. PTHS EV.FT.	BLOWS PER 6 IN. ON SAMPLER FROM – TO 0–6	6–12	12–18	18–24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	RE
							Augered to 30' Set point A 30' 2' sand 2' bentonite grout to surface			
							Materials used: 50 lbs. sand 25 lbs. bentonite 2 bags portland cement			

Proportions used: trace = 0.10%, little = 10.20%, some = 20.35%, and 35.50%

LER Bill Kennedy
PER Brian Kennedy
ENGINEER
INSPECTOR Jennifer Convey

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON
TP = TEST PIT

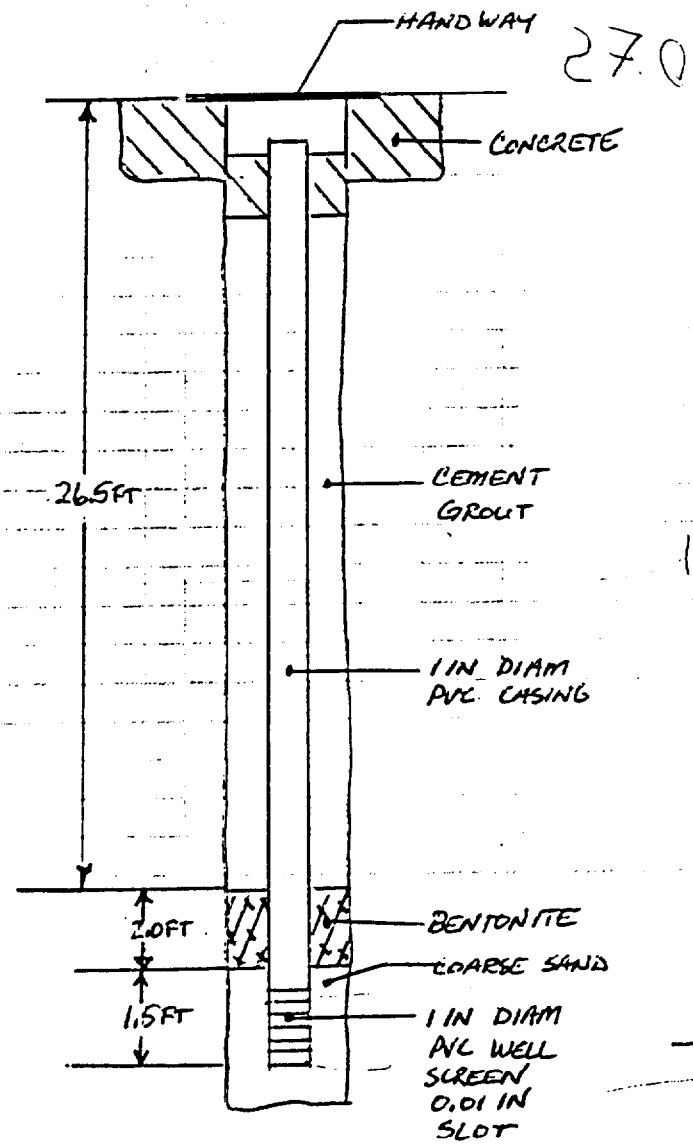
GRANULAR DENSITY
0 – 10 LOOSE
10 – 30 MED. COMP.
30 – 50 DENSE
50 + VERY DENSE

TOTAL FOOTAGE
Earth Boring Ft.
Rock Coring Ft.
Hole No. AS

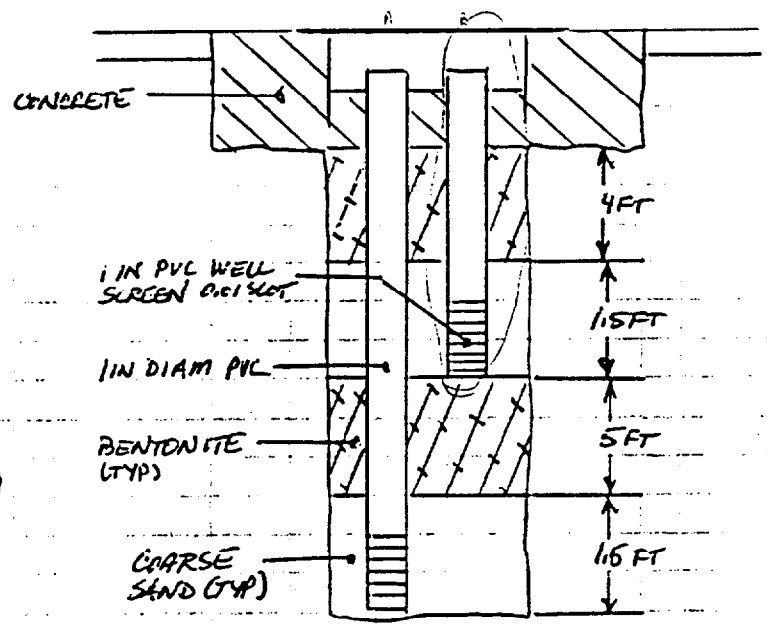
HRP
ASSOCIATES, INC.
New Britain Avenue
Plainville, CT 06062
(203) 793-6899
FAX: (203) 793-6871

PROJECT TITLE NEX			
PROJECT NUMBER NAV0028.FE			
SUBJECT TYPICAL AS AND OBSERVATION PROBE COMPLETION			
DESIGNED BPW	DATE 12/10/93	CHECKED	DATE

AIR SPARGING POINT



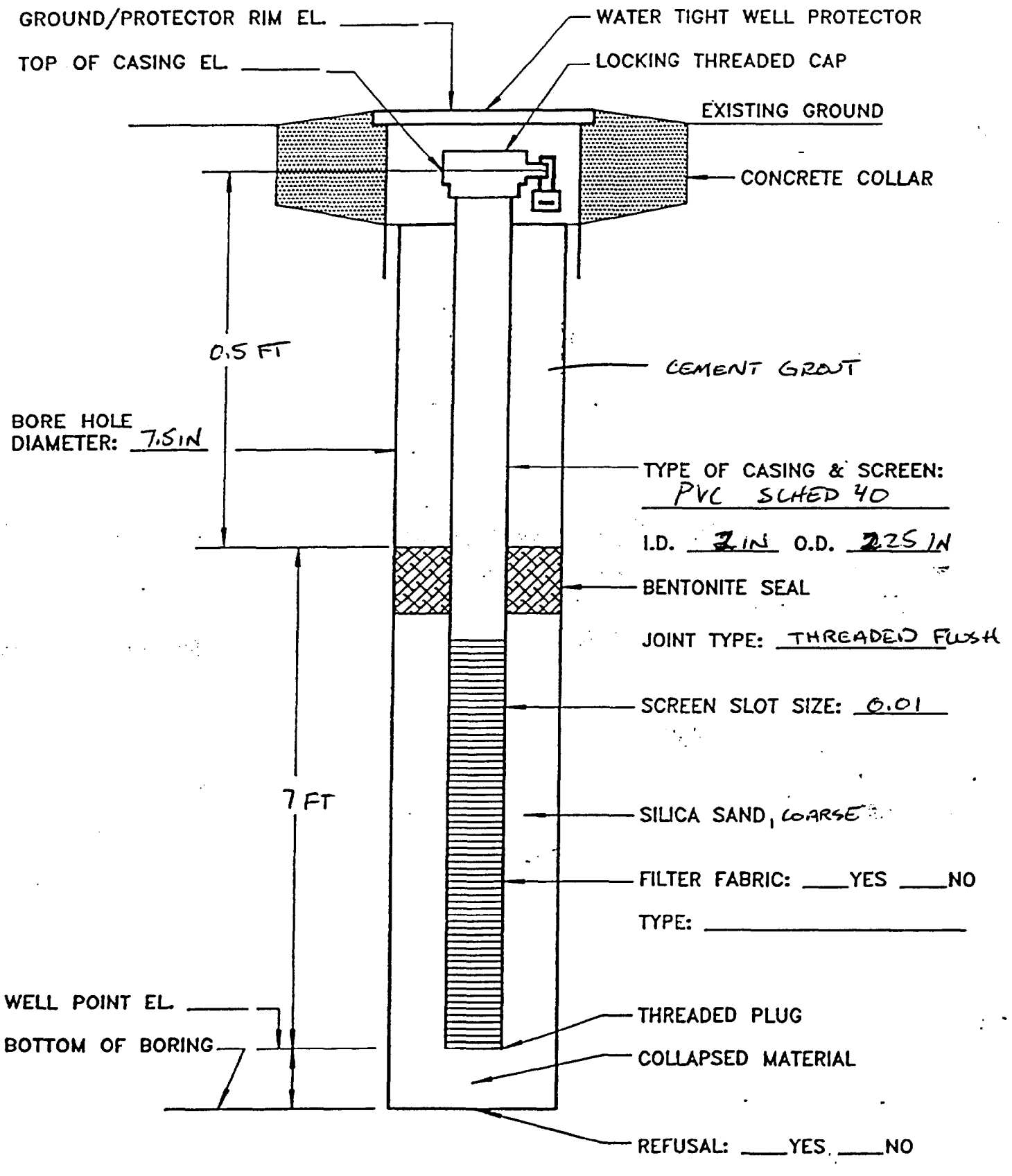
OBSERVATION PROBE (TYP)



10.9

-3-

MONITOR WELL INSTALLATION DETAIL
FOR WELL IN UNCONSOLIDATED DEPOSIT



SVE-1

APPENDIX B

AS/SVE Test Procedures

1. *Summary*

Air sparging is a ground water remedial alternative in which compressed air is injected below the ground water table and beneath a contaminated zone. Air sparging is useful in removing dissolved and residual phase volatile contaminants from ground water. Bubbling air passing through the contaminated zone creates a concentration gradient causing a transfer of contaminant mass from the dissolved and residual phases into the vapor phase of the air bubble. The air bubbles, laden with contaminated vapors, rise above the water table by simple buoyancy where they are removed by soil vapor extraction. Air sparging technology has been found to be an efficient means to remove contamination of ground water by volatile compounds due to the high contaminant mass removal rates in comparison to alternate remedial options. The injection of compressed air may also enhance biologic activity which can also be beneficial to the biodegradation of some contaminants. Air sparging, however, is not capable of providing hydraulic control of ground water contaminant plume migration.

An air sparging pilot test is conducted to evaluate the feasibility of this technology and determine the engineering criteria to design a full scale system. The pilot test consists of a series of tests which are designed to identify:

1. the bubble zone surrounding the sparge point at various air injection pressures and flowrates;
2. the radius of influence of a soil vapor extraction (SVE) well for a given vacuum and flowrate;
3. the anticipated combined performance of the air sparging and SVE system; and
4. the air and vacuum requirements of the combined system.

2. *Pilot Test Configuration*

To conduct a pilot test it is necessary to install at a minimum 1 air sparge point, 1 SVE well, and a number of observation probes. The spacing between the sparge

point and SVE well will depend upon site constraints, however, they should be spaced within the influence area of each other. The sparge point should consist of a short well screen length completed below the contaminant plume. The SVE well should be completed in the unsaturated zone. Observation probes should be located within and outside the anticipated influence areas of the air sparging and SVE wells.

Observation probes can consist of several small diameter PVC well screens which are nested vertically within a single borehole. The probes should be completed within the areas of hydrogeologic interest. This would include positions above and below the water table in addition to stratigraphic layers of significance.

3. *Data Monitoring Requirements*

The data used to evaluate the bubble zone, SVE radius of influence, and performance of air sparging include:

- water levels
- dissolved oxygen
- vacuum pressure
- positive pressure
- soil gas contaminant concentrations (PID and/or field GC)
- total halogen (TOX)
- oxygen levels
- explosivity (LEL)

These data should be collected before, during, and after all phases of the pilot test. The objectives of the pilot test will be achieved through the identification of changes to the monitoring data collected throughout the test.

4. *Pilot Test Procedures*

The pilot test consists of three phases:

1. SVE test
2. air sparging test
3. combined air sparging and SVE test

The phases are conducted successively, and then repeated for different air injection pressures and flowrates.

SVE Test

The monitoring data should be collected at the beginning of this phase to establish initial conditions. The data should be collected from each observation probe and other locations deemed appropriate (i.e. nearby monitor wells). A vacuum blower will then be connected to the SVE well. Since the blower may create significant vacuums, all fittings must be ferncote fittings or cemented tight. The blower will be operated for approximately 1 hour. During this time period the following data will be collected:

1. stabilized vacuum levels from all probes and the SVE well;
2. the air flowrate discharged by the blower measured every 15 minutes;
3. gas samples collected from the blower discharge every 15 minutes and analyzed by PID and/or GC.

After the blower has operated for one hour the blower will be shut down and pressure levels allowed to return to atmospheric levels. Time related vacuum drawdown and recovery data will then be collected from each observation probe. The blower will be turned on and the vacuum will be recorded at 5 second intervals until the vacuum nearly stabilizes (about 2 minutes). The blower will be turned off and the vacuum recovery will be recorded at 5 sec. intervals until atmospheric levels are reached. This process is repeated at all observation probes.

Air Sparging Test

After the collection of vacuum data, the monitoring data should be collected from all observation probes to document initial conditions prior to the sparge test. Compressed air will be injected into the sparge point for approximately one hour. The monitoring data will be collected from all observation probes at intervals of approximately 20 minutes. In addition, the air injection pressure and flowrate will be recorded at 15 minute intervals.

Combined SVE and Air Sparing Test

Turn the vacuum blower back on and continue to inject compressed air into the sparge point. The combined system should be allowed to operate for as long as time permits (generally 4 hours). During this time, the monitoring data will be collected from all probes and neighboring wells at 30 minute intervals. In addition, the following data should also be collected:

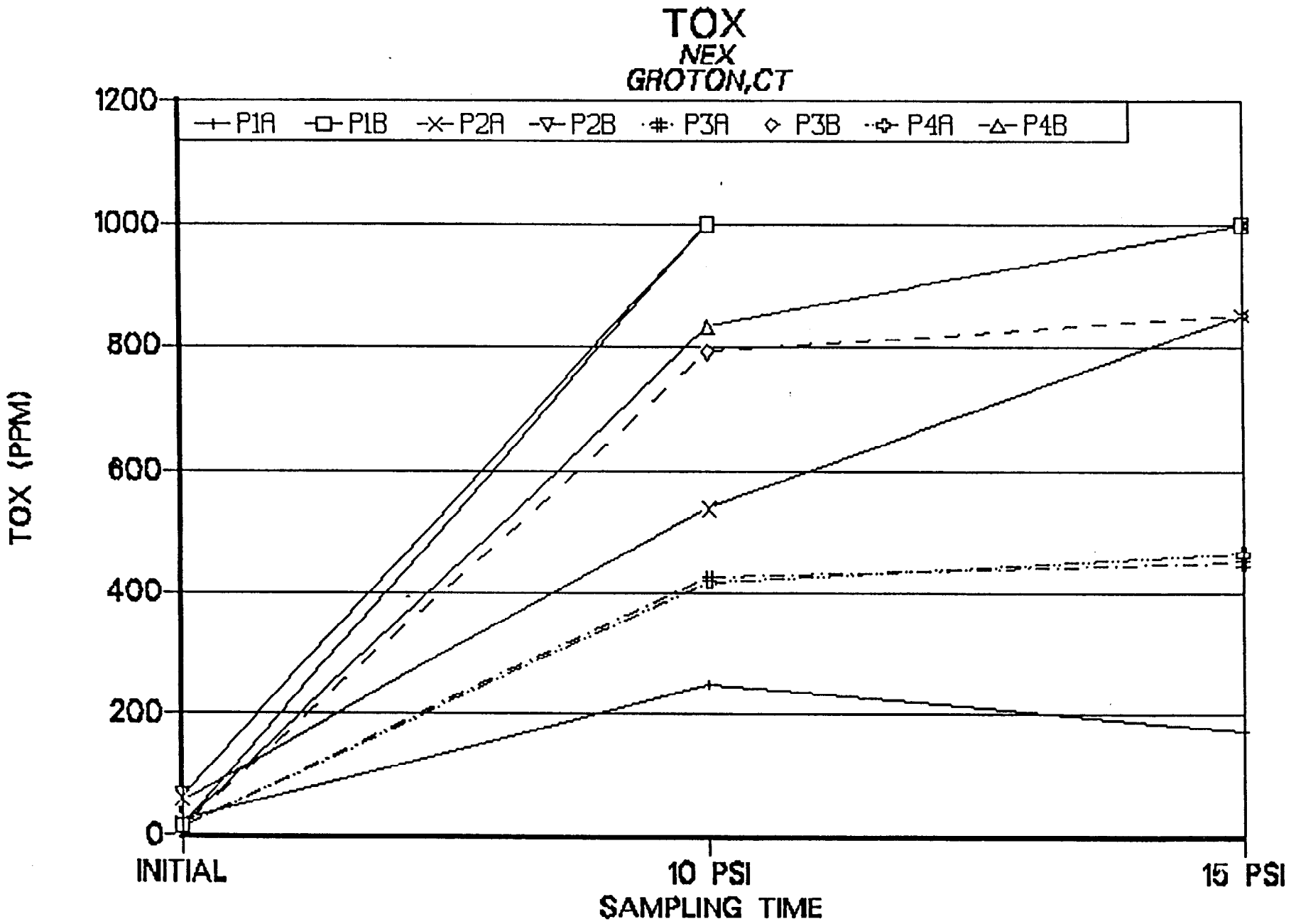
1. air injection pressure & flowrate at 15 minute intervals;
2. blower vacuum pressure and flowrate at 15 minute intervals; and
3. vapor samples of the blower discharge should be collected and analyzed every hour.

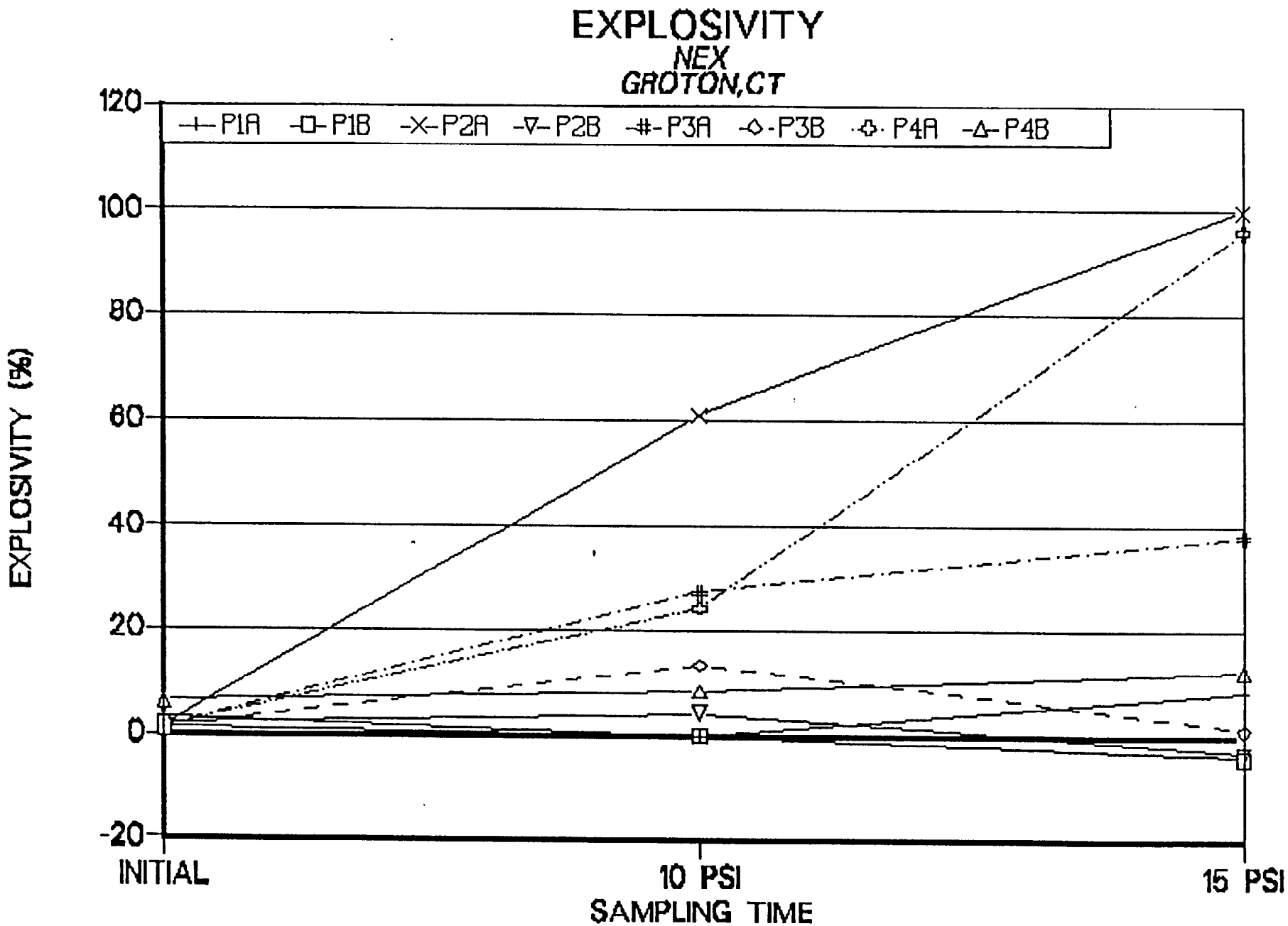
After the hour of continued sparging and venting, the systems will be shutdown. Additional monitoring data will be collected 1 hour after sparging has stopped.

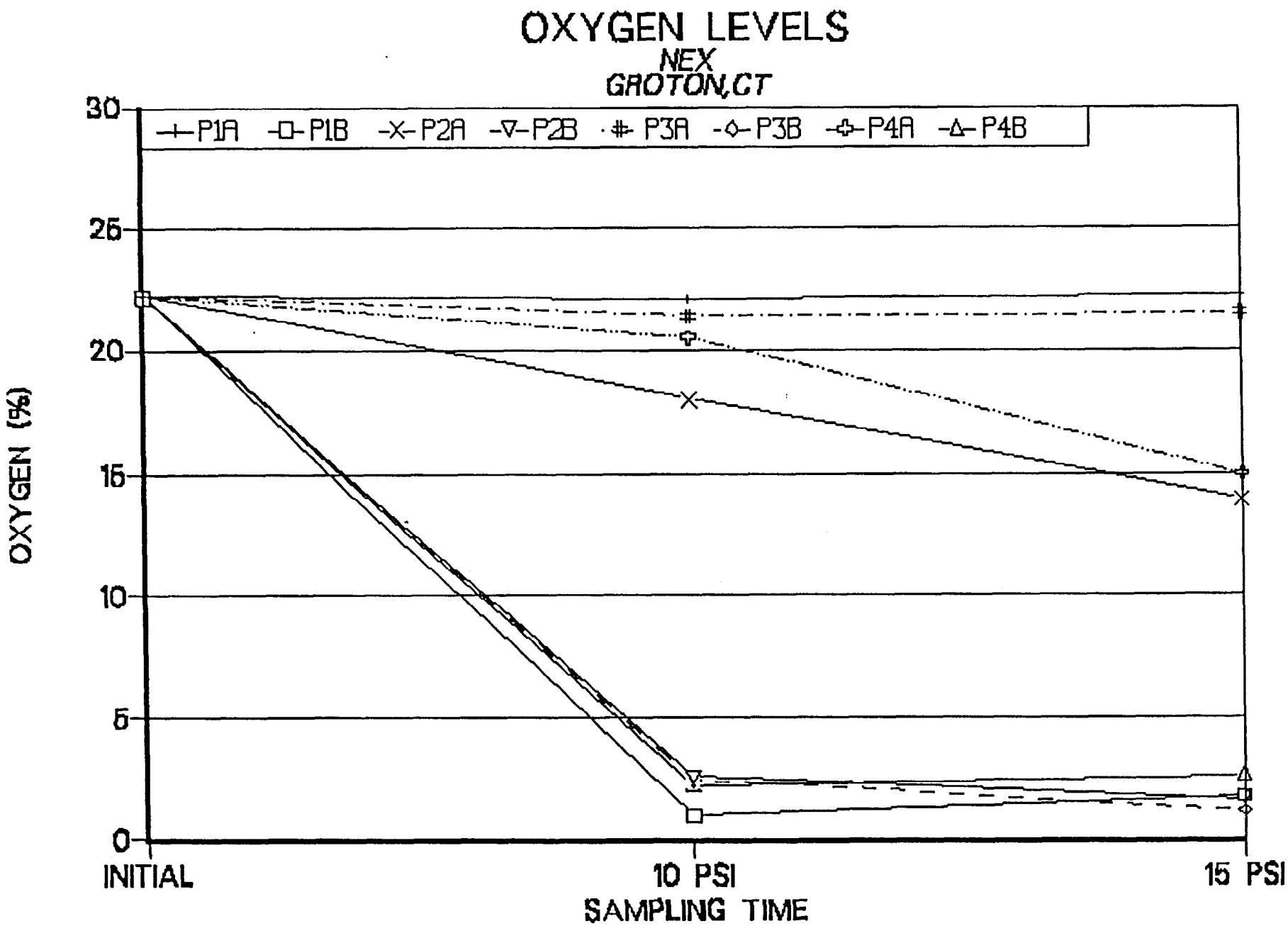
The following procedure should be repeated at different pressure levels and flowrates to identify the optimal operational levels.

APPENDIX C

NEX AS/SVE Data

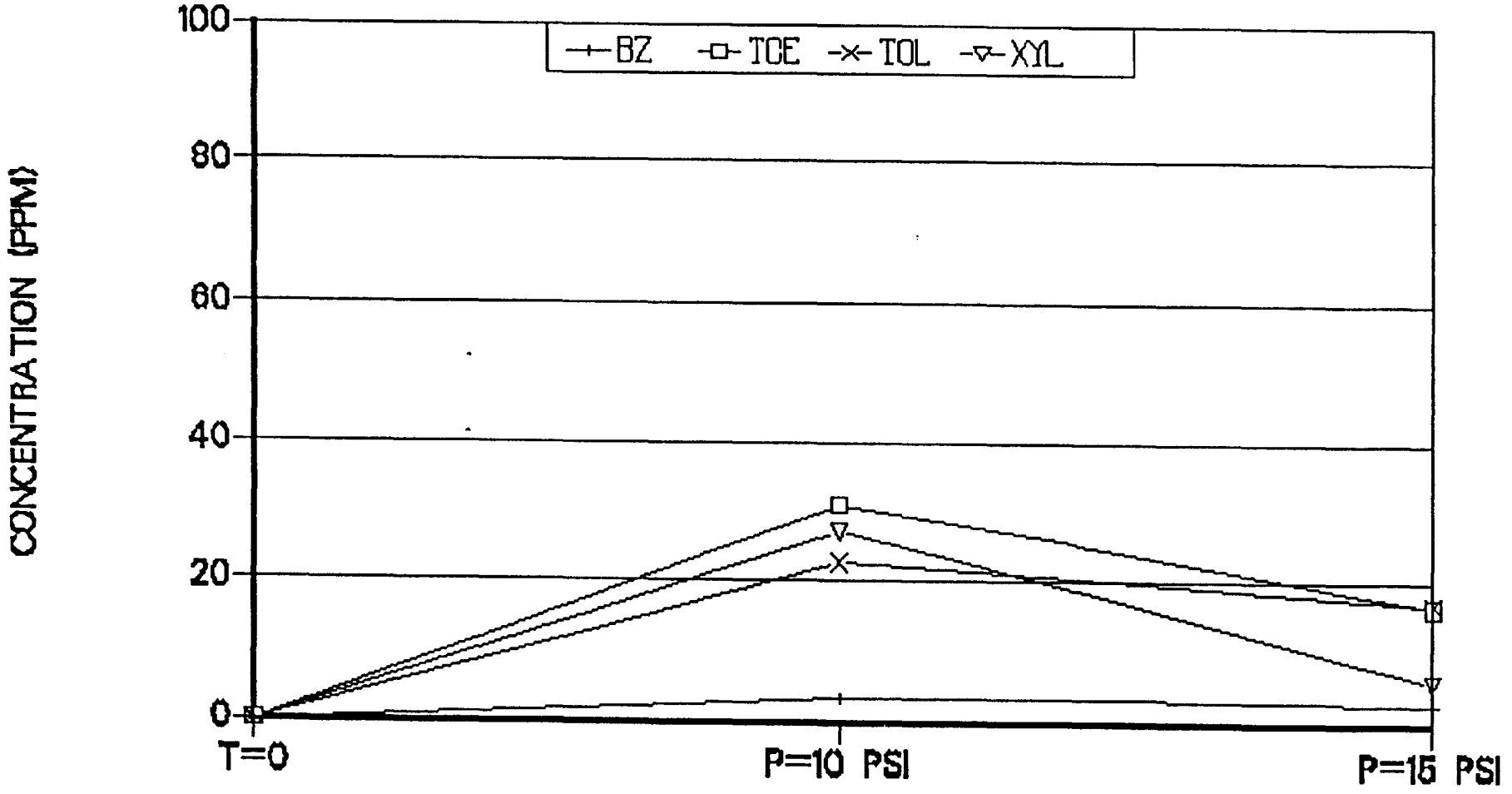

TOX
NEX
GROTON,CT
P1A
P1B
P2A
P2B
P3A
P3B
P4A
P4B
1200
1000
800
600
400
200
0
TOX (PPM)
INITIAL
10 PSI
15 PSI
SAMPLING TIME


EXPLOSIVITY
NEX
GROTON,CT
P1A
P1B
P2A
P2B
P3A
P3B
P4A
P4B
120
100
80
60
40
20
0
-20
EXPLOSIVITY (%)
INITIAL
10 PSI
15 PSI
SAMPLING TIME


OXYGEN LEVELS
NEX
GROTON,CT
P1A
P1B
P2A
P2B
P3A
P3B
P4A
P4B
30
25
20
15
10
5
0
OXYGEN (%)
INITIAL
10 PSI
15 PSI
SAMPLING TIME

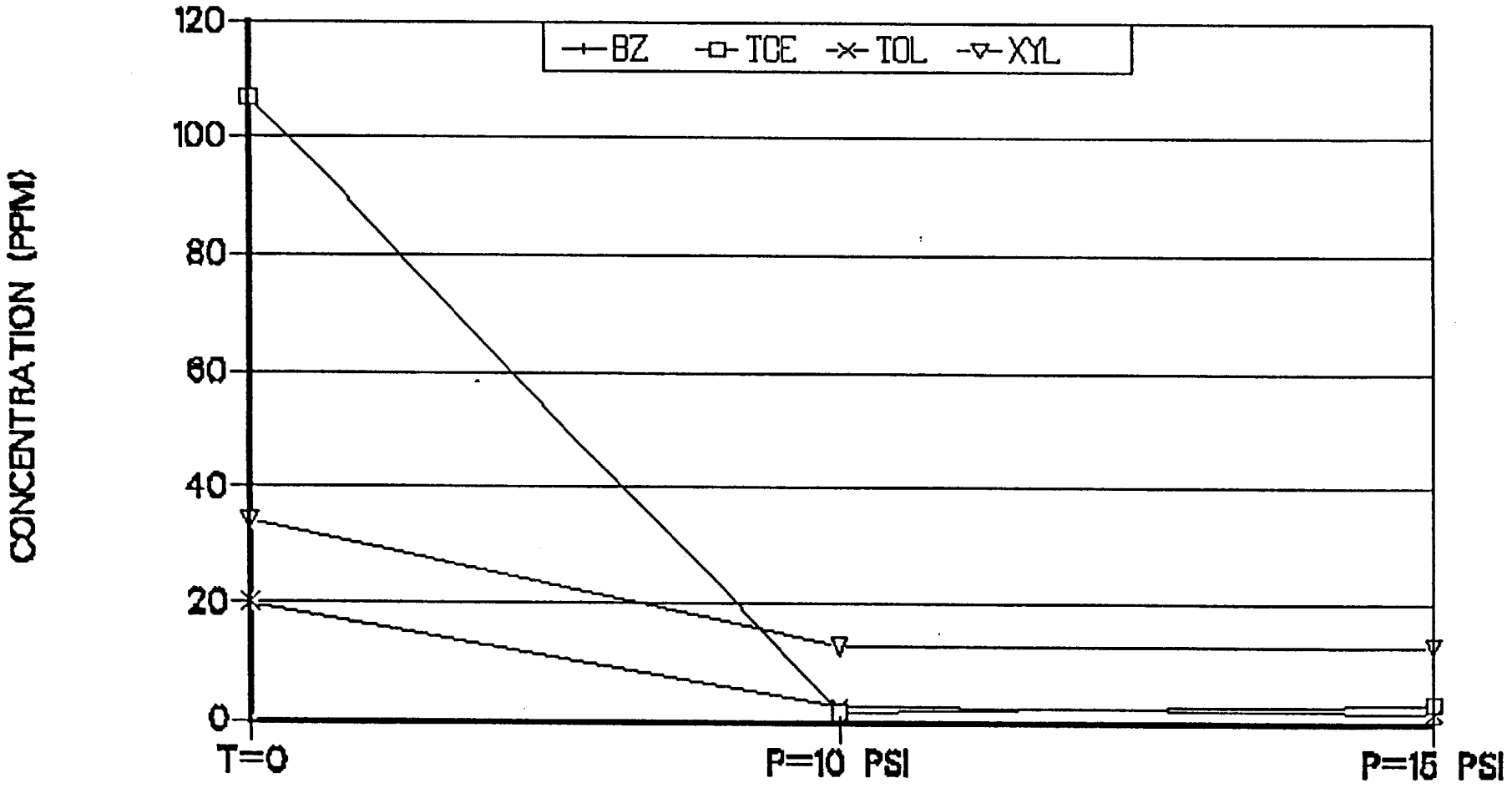
PROBE 4B CONCENTRATION CHANGES

NEX



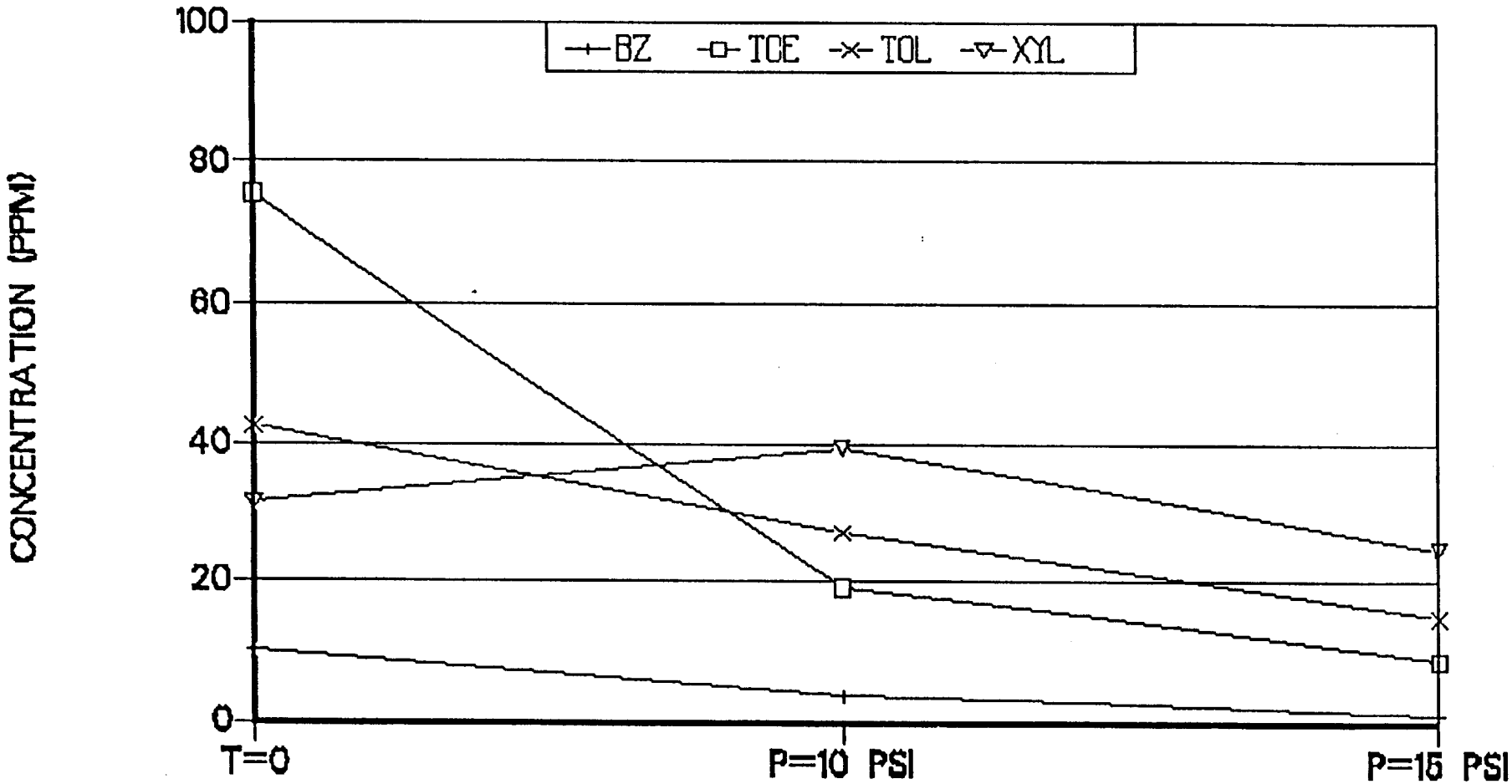
PROBE 4A CONCENTRATION CHANGES

NEX



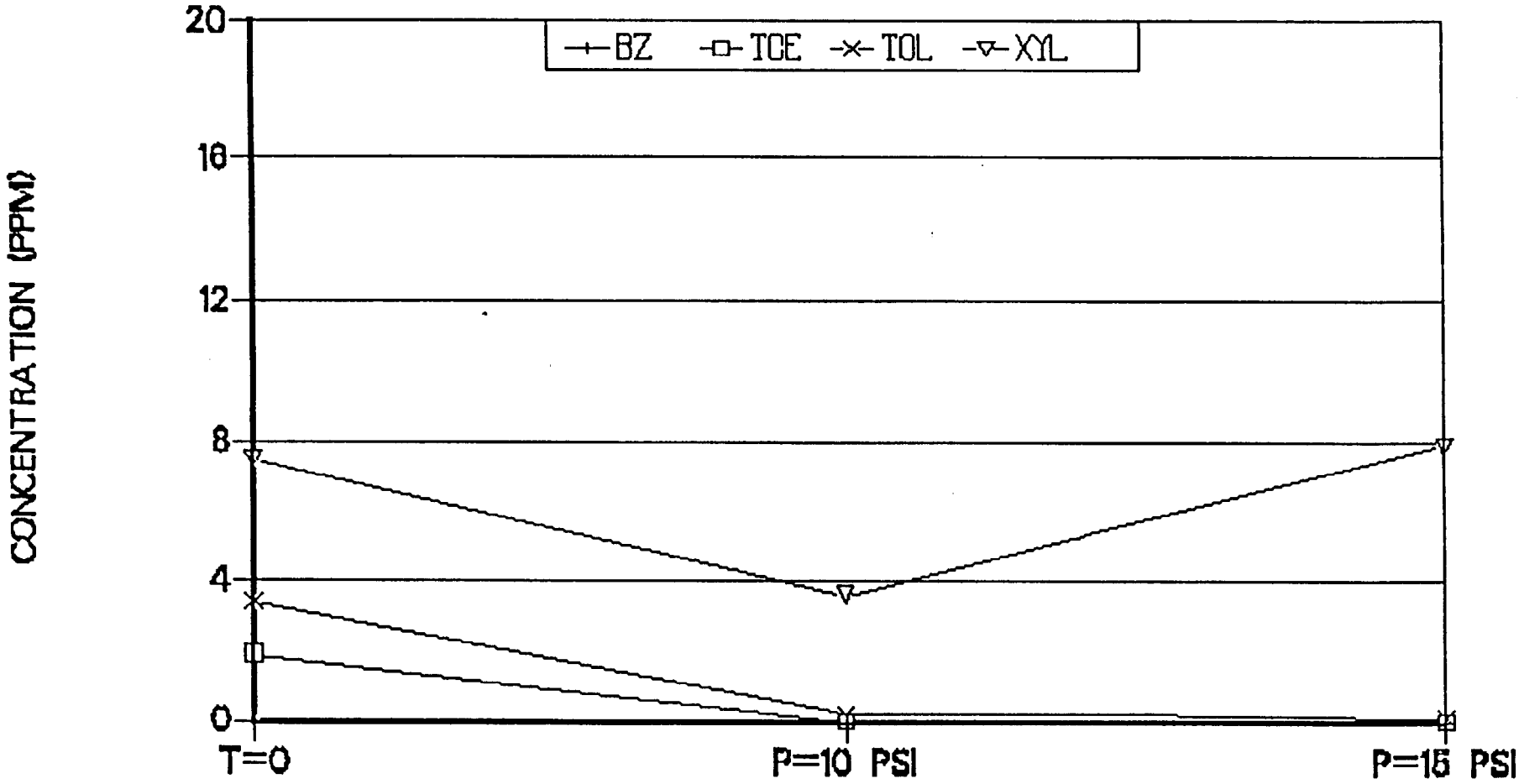
PROBE 3B CONCENTRATION CHANGES

NEX



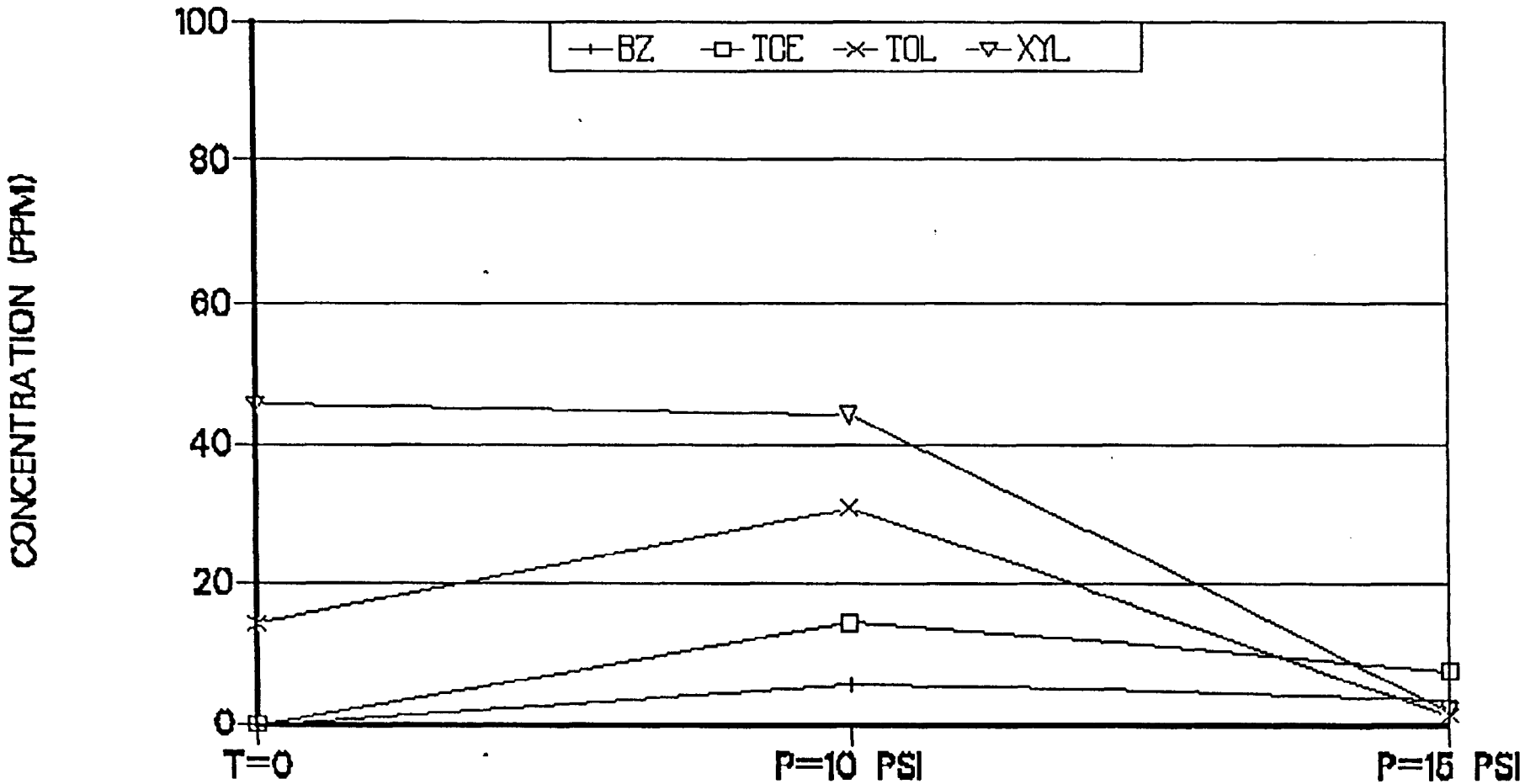
PROBE 3A CONCENTRATION CHANGES

NEX



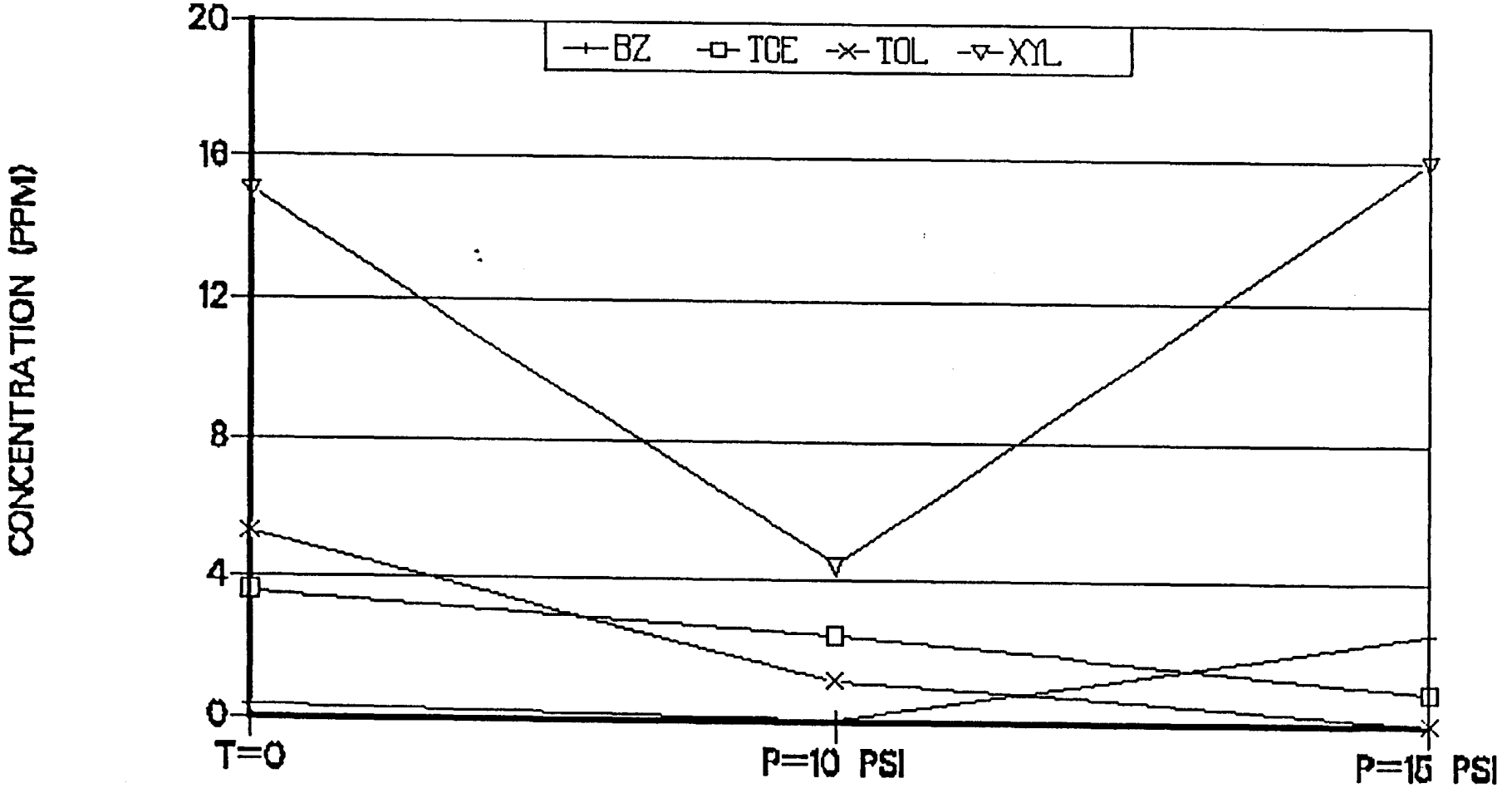
PROBE 2B CONCENTRATION CHANGES

NEX



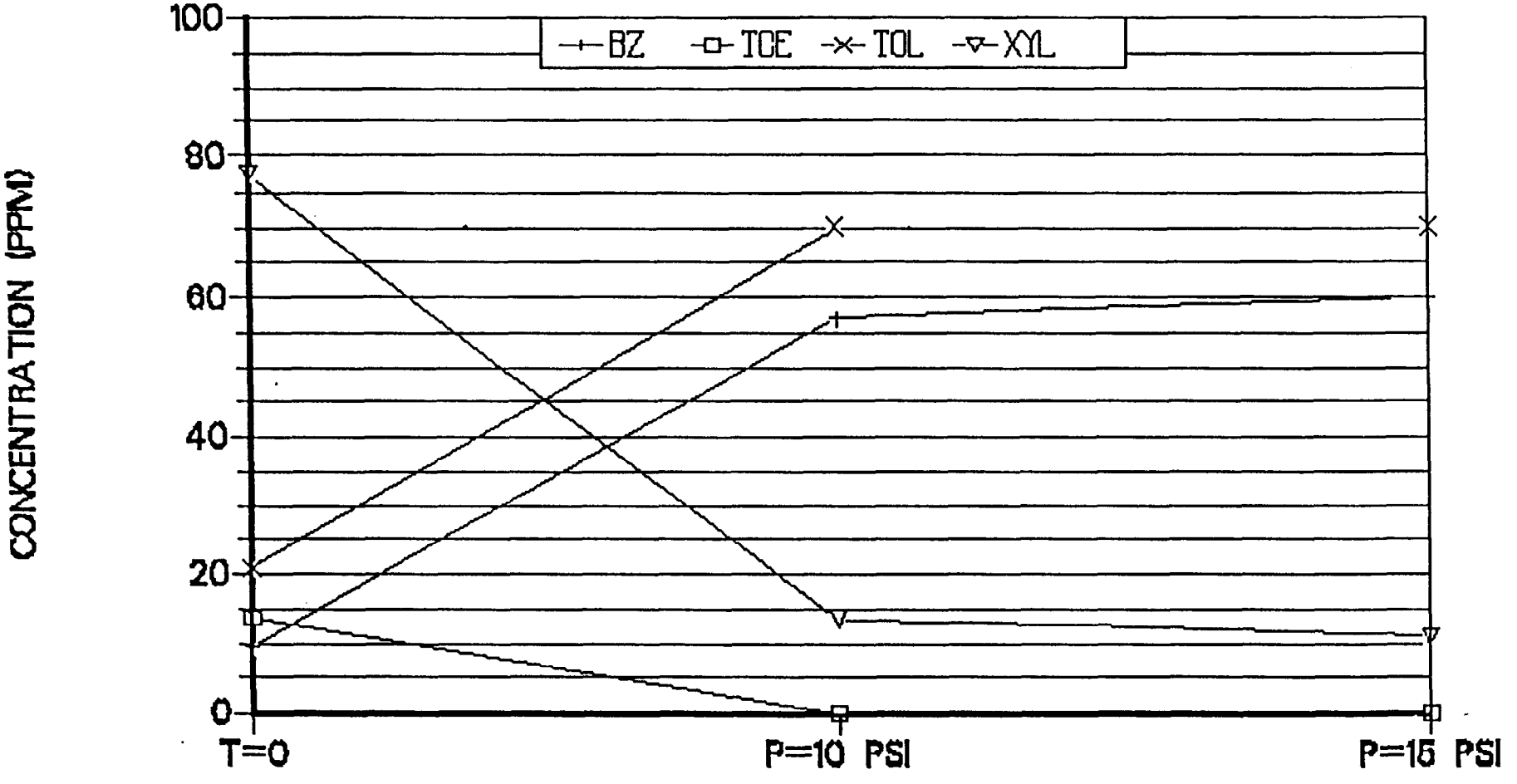
PROBE 2A CONCENTRATION CHANGES

NEX



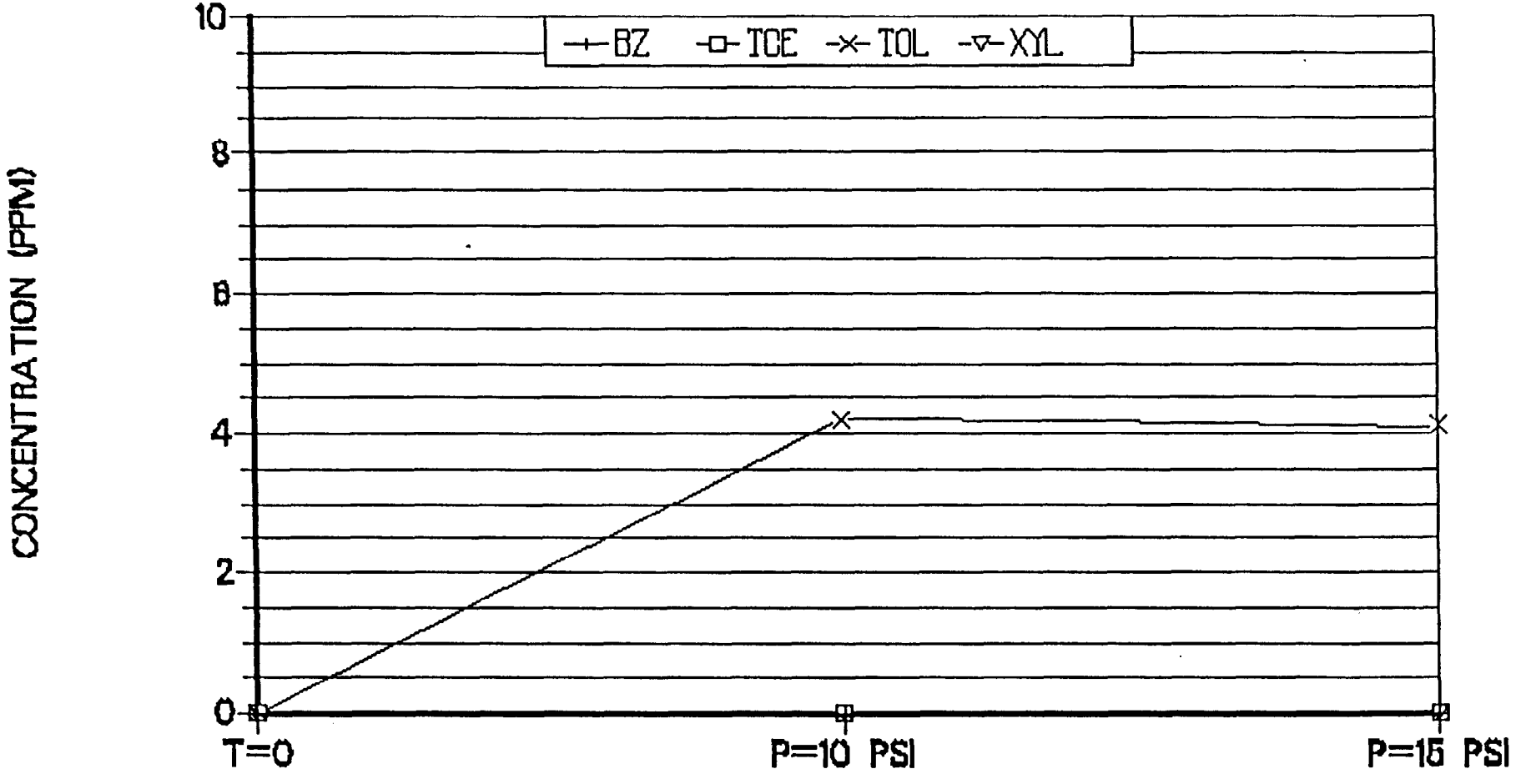
PROBE 1B CONCENTRATION CHANGES

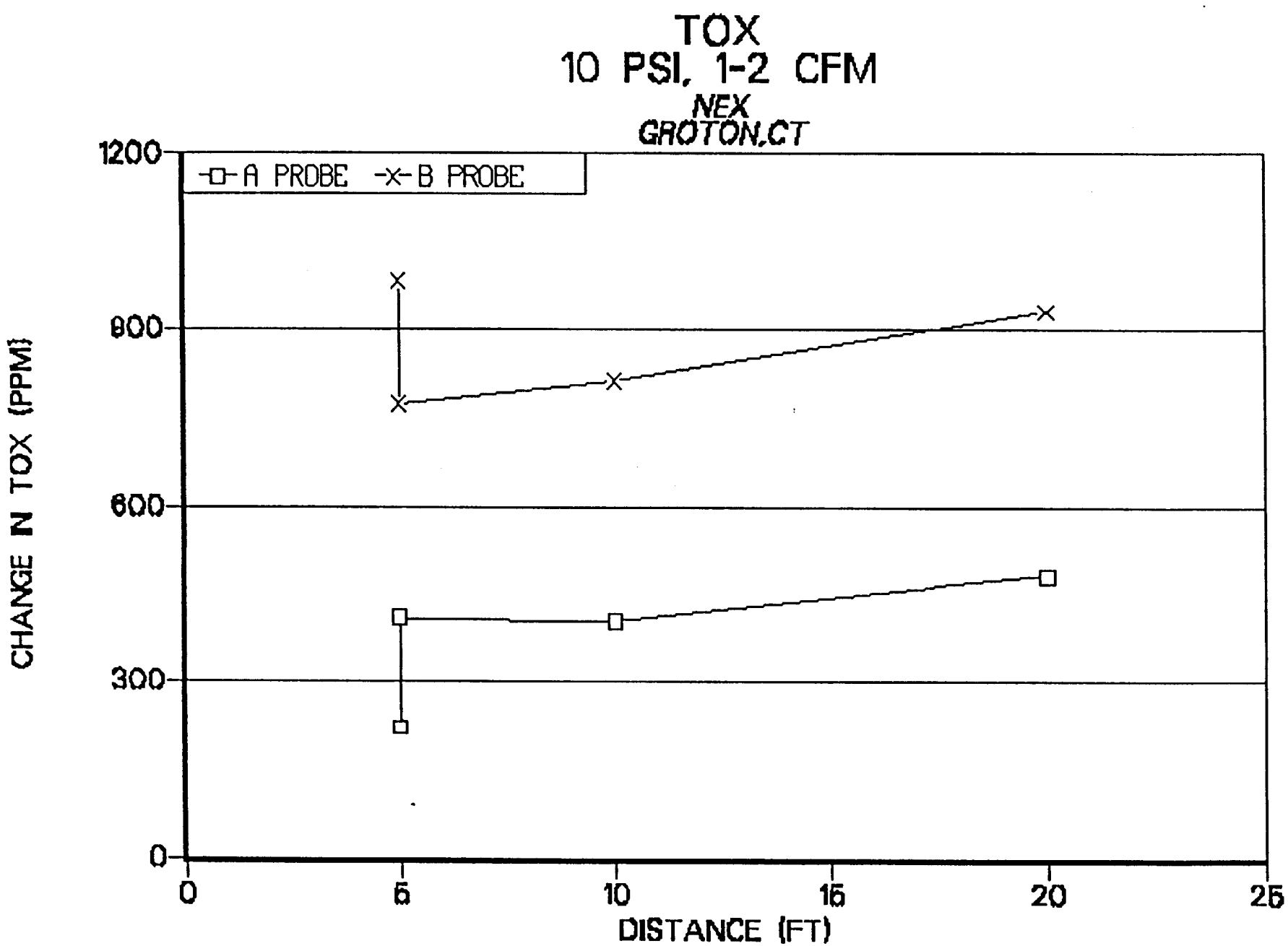
NEX

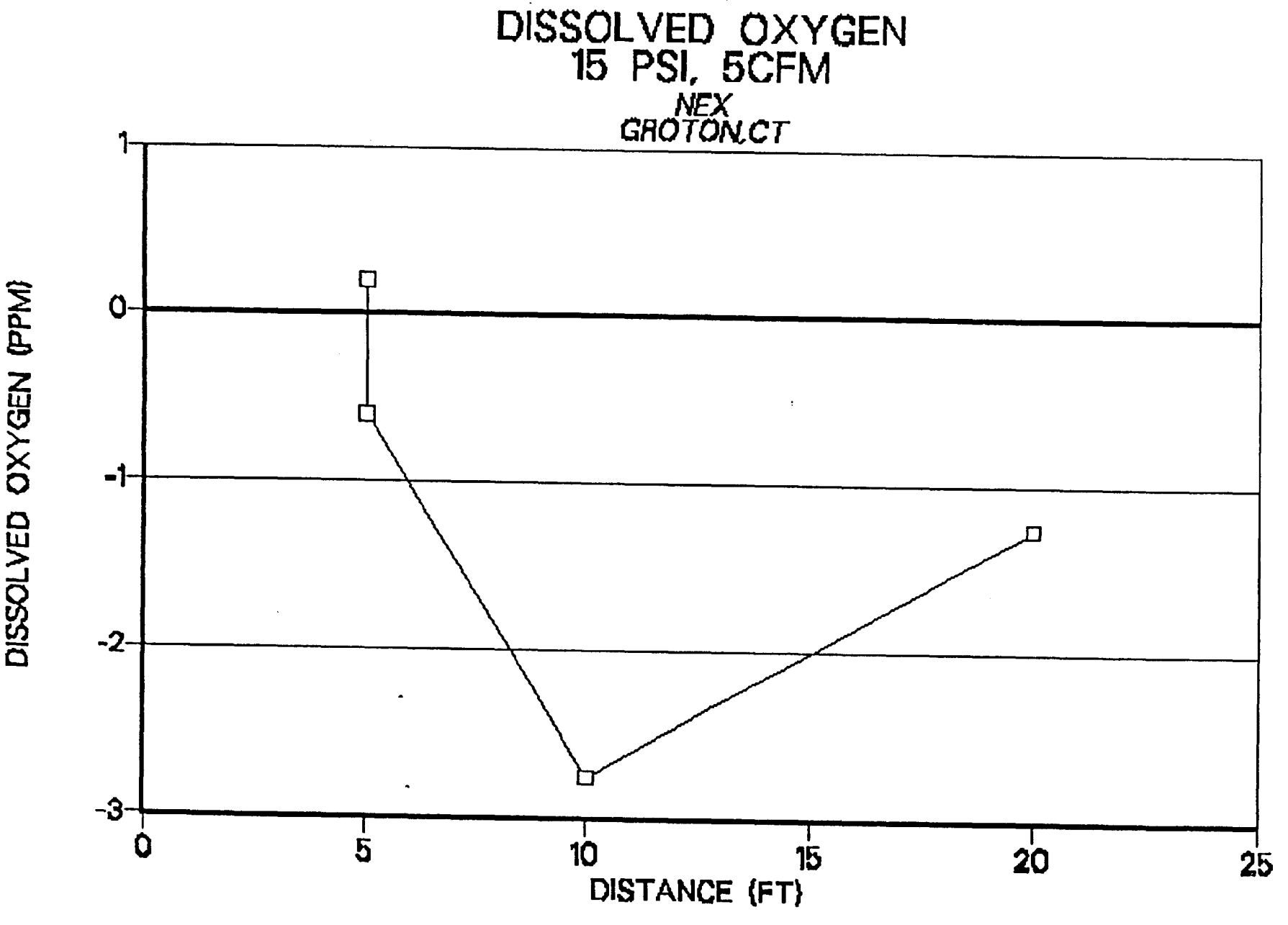


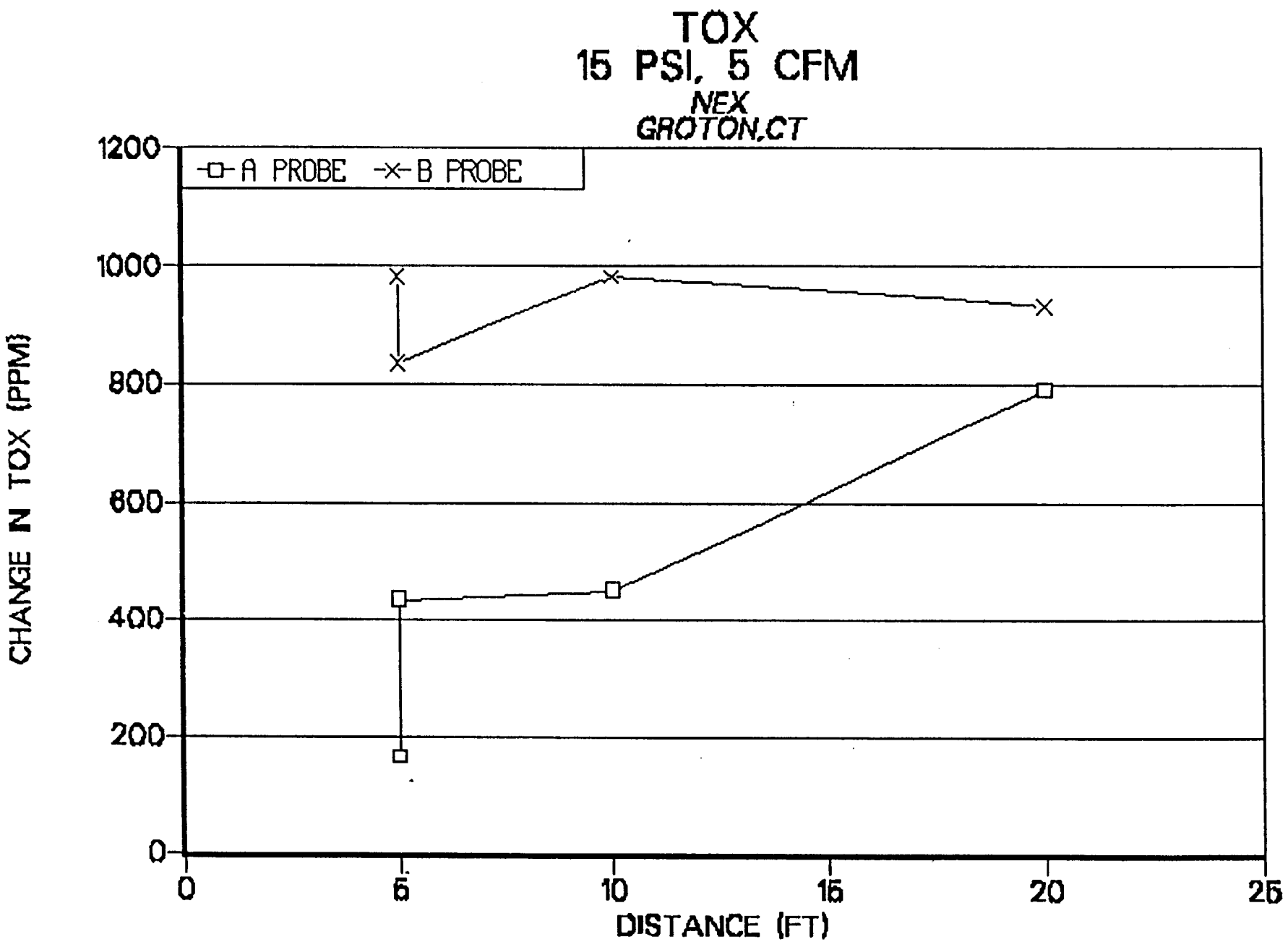
PROBE 1A CONCENTRATION CHANGES

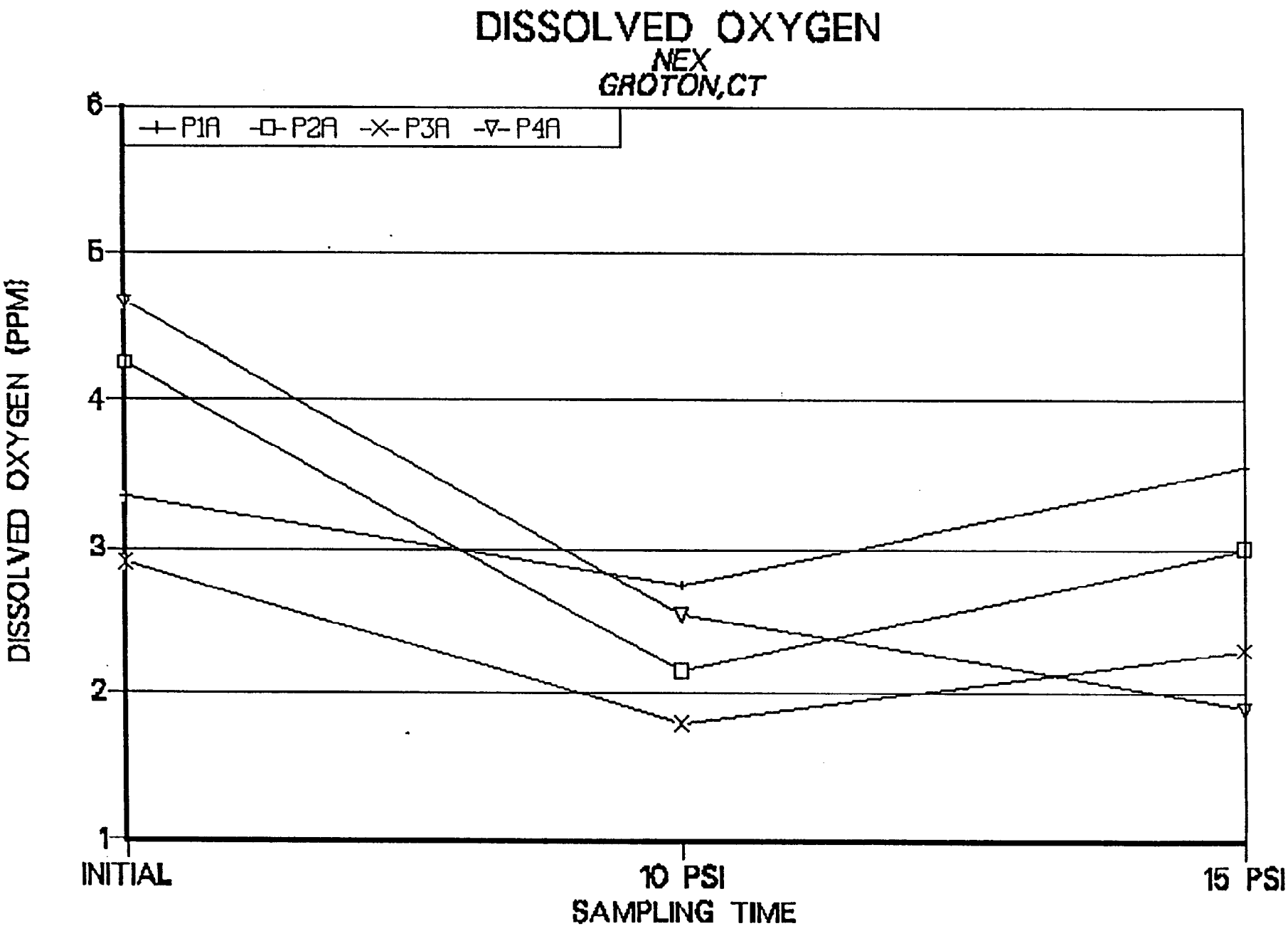
NEX

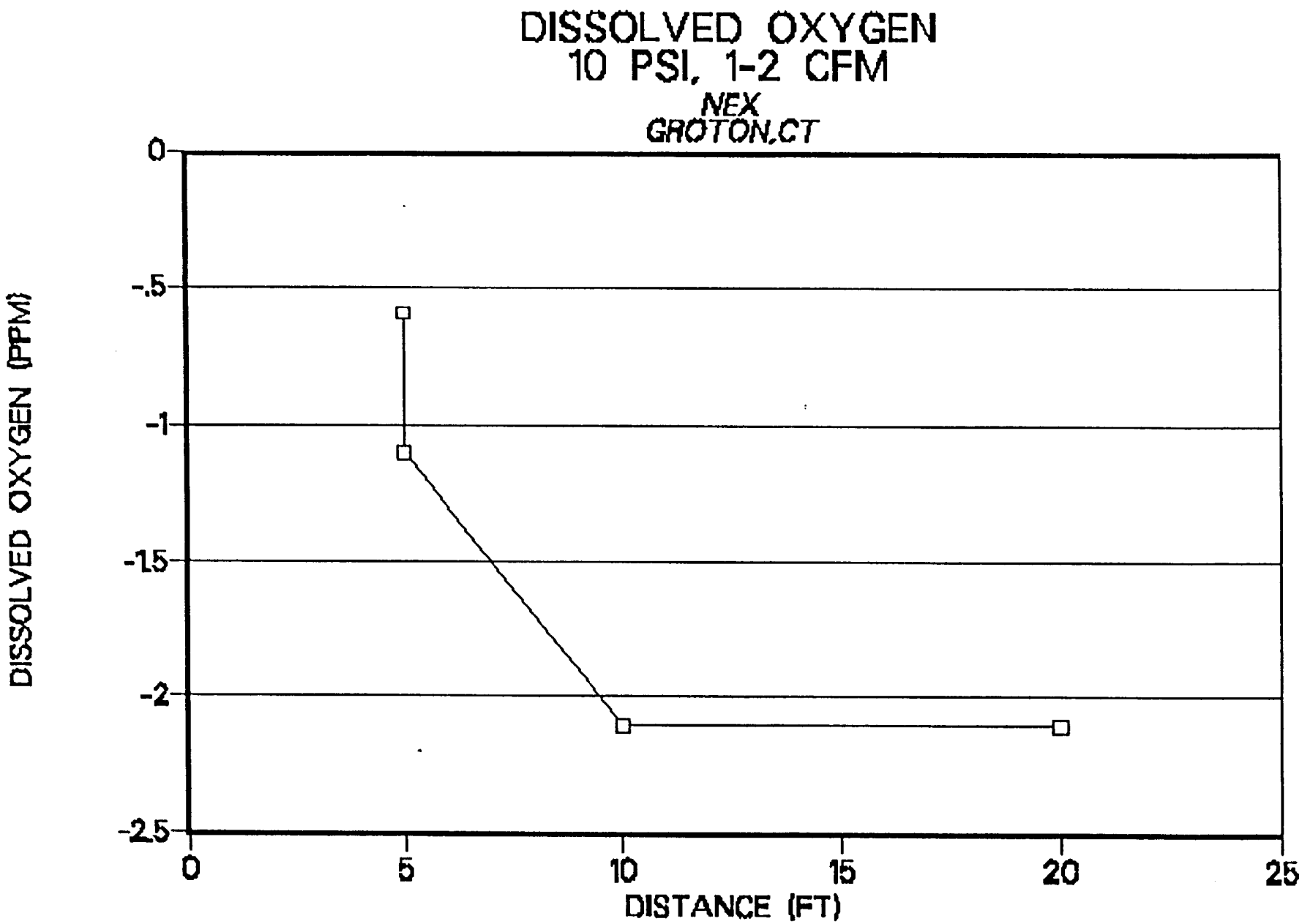


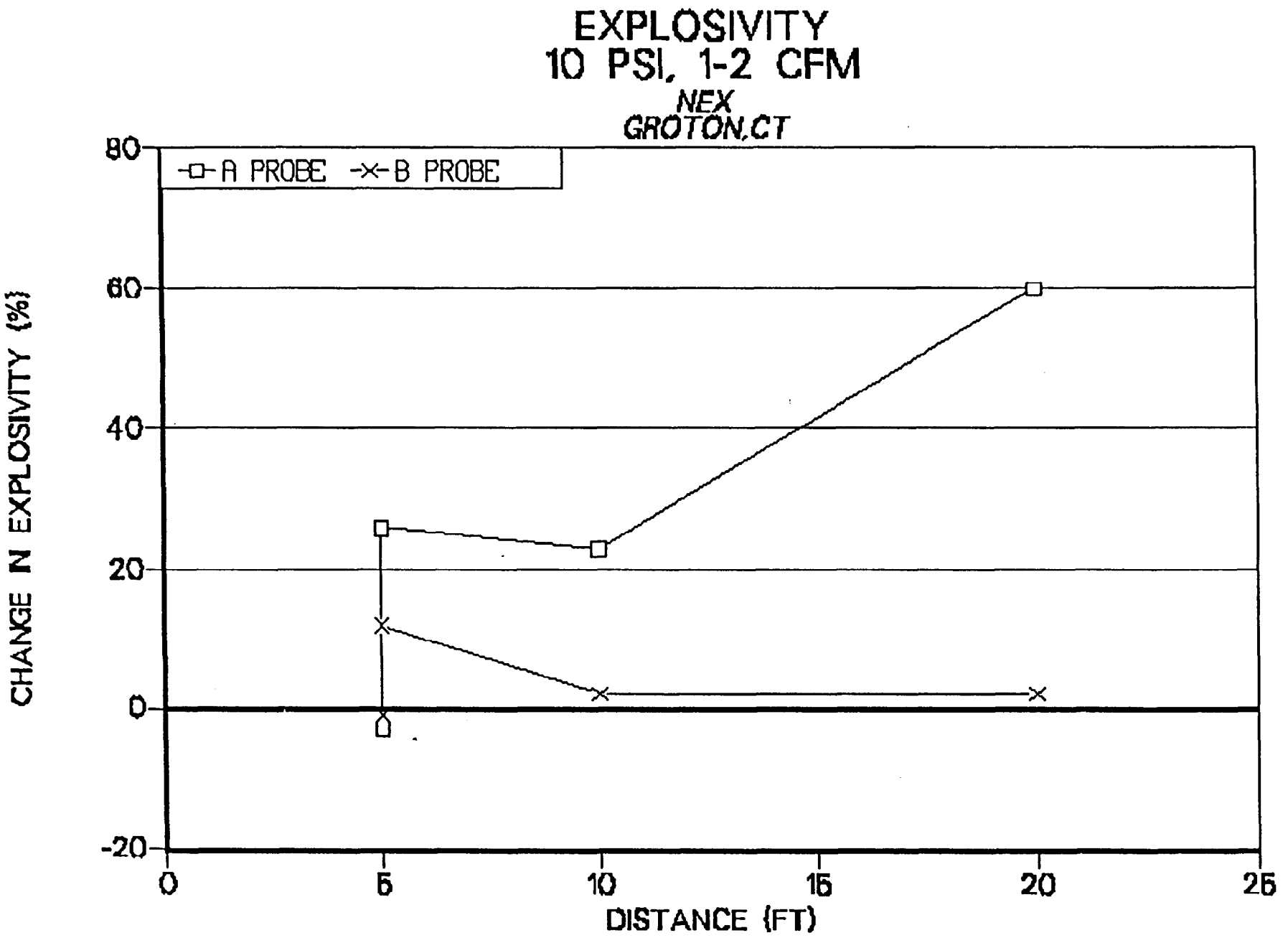

TOX
10 PSI, 1-2 CFM
NEX
GROTON,CT
A PROBE
B PROBE
CHANGE IN TOX (PPM)
1200
900
600
300
0
0
5
10
15
20
25
DISTANCE (FT)

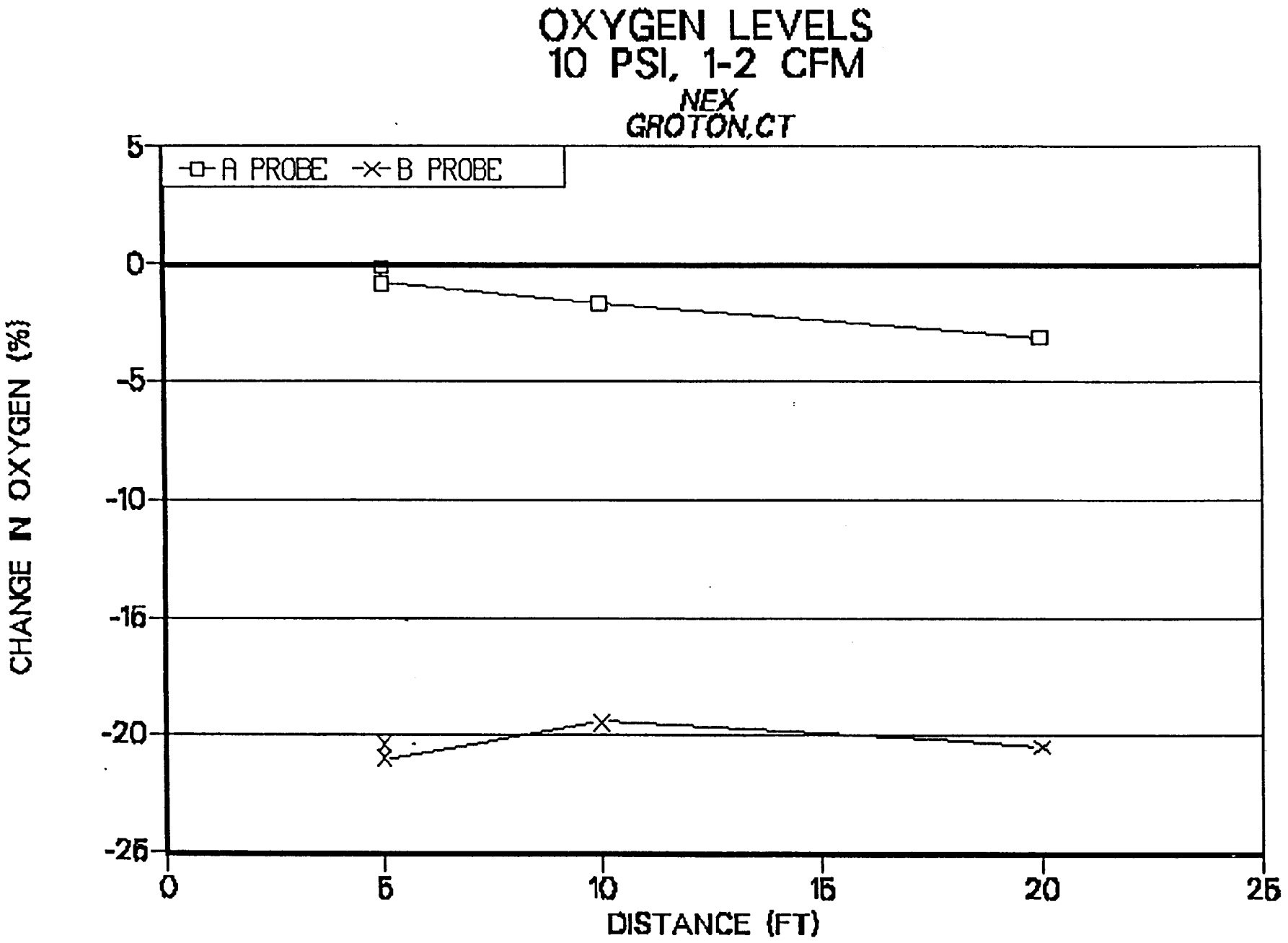

DISSOLVED OXYGEN
15 PSI, 5CFM
NEX
GROTON,CT
DISSOLVED OXYGEN (PPM)
1
0
-1
-2
-3
0
5
10
15
20
25
DISTANCE (FT)

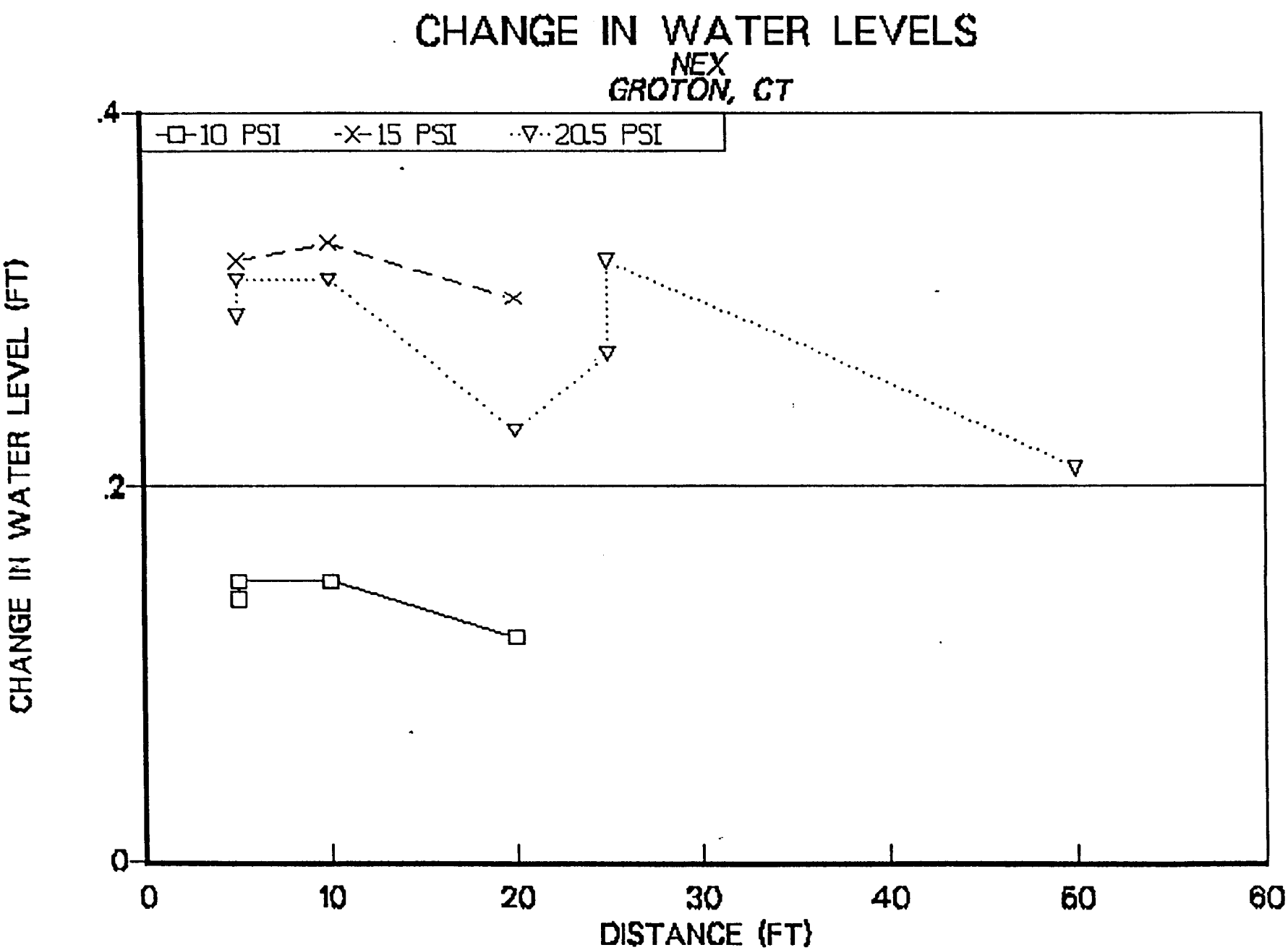

TOX
15 PSI, 5 CFM
NEX
GROTON,CT
A PROBE
B PROBE
CHANGE IN TOX (PPM)
1200
1000
800
600
400
200
0
0
5
10
15
20
25
DISTANCE (FT)

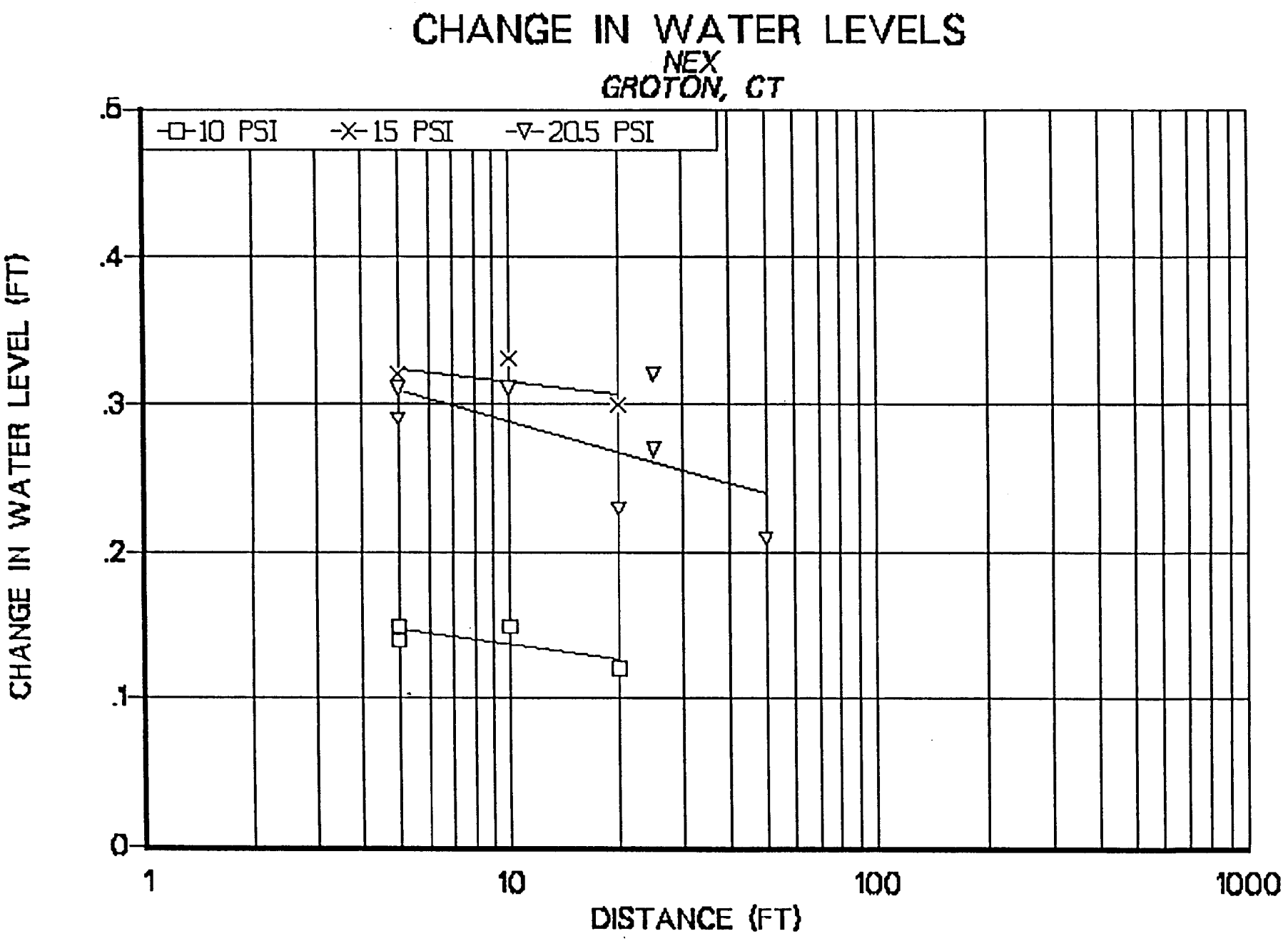

DISSOLVED OXYGEN
NEX
GROTON,CT
P1A
P2A
P3A
P4A
DISSOLVED OXYGEN (PPM)
6
5
4
3
2
1
INITIAL
10 PSI
15 PSI
SAMPLING TIME

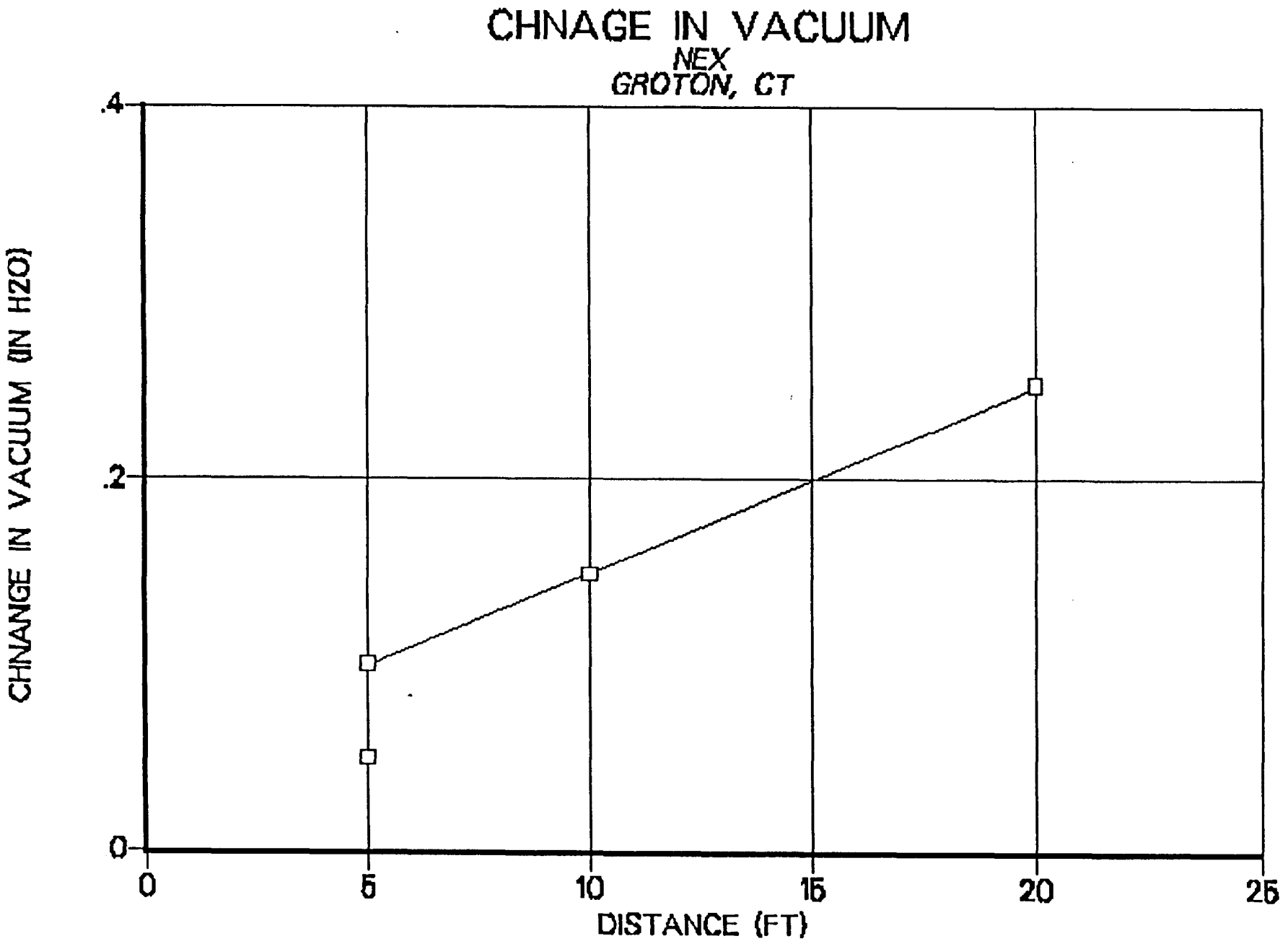

DISSOLVED OXYGEN
10 PSI, 1-2 CFM
NEX
GROTON,CT
DISSOLVED OXYGEN (PPM)
0
-.5
-1
-1.5
-2
-2.5
0
5
10
15
20
25
DISTANCE (FT)


EXPLOSIVITY
10 PSI, 1-2 CFM
NEX
GROTON,CT
A PROBE
B PROBE
CHANGE IN EXPLOSIVITY (%)
80
60
40
20
0
-20
0
5
10
15
20
25
DISTANCE (FT)


OXYGEN LEVELS
10 PSI, 1-2 CFM
NEX
GROTON,CT
A PROBE
B PROBE
CHANGE IN OXYGEN (%)
5
0
-5
-10
-15
-20
-25
0
5
10
15
20
25
DISTANCE (FT)

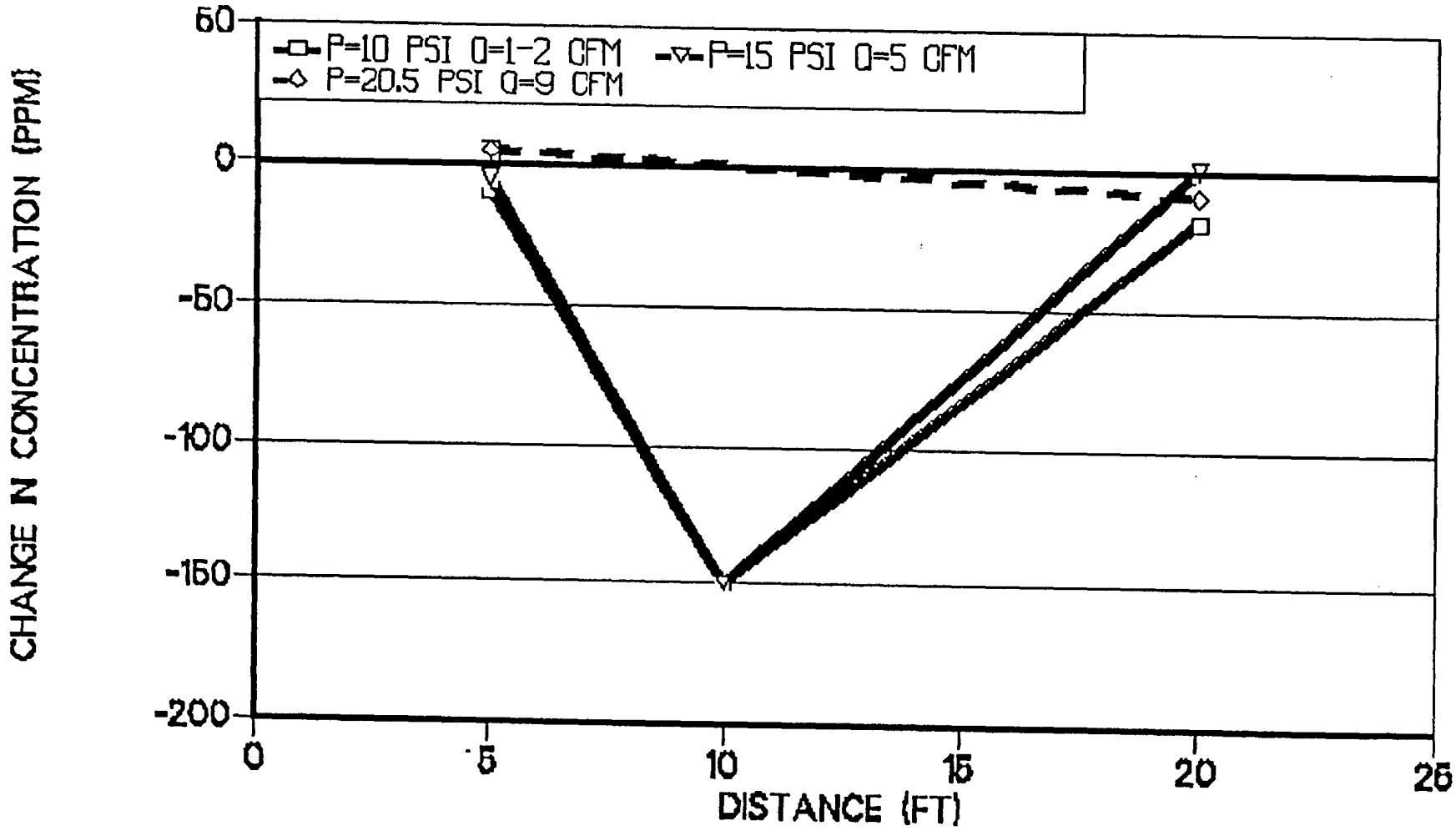

CHANGE IN WATER LEVELS
NEX
GROTON, CT
10 PSI
15 PSI
20.5 PSI
CHANGE IN WATER LEVEL (FT)
.4
.2
0
0
10
20
30
40
50
60
DISTANCE (FT)

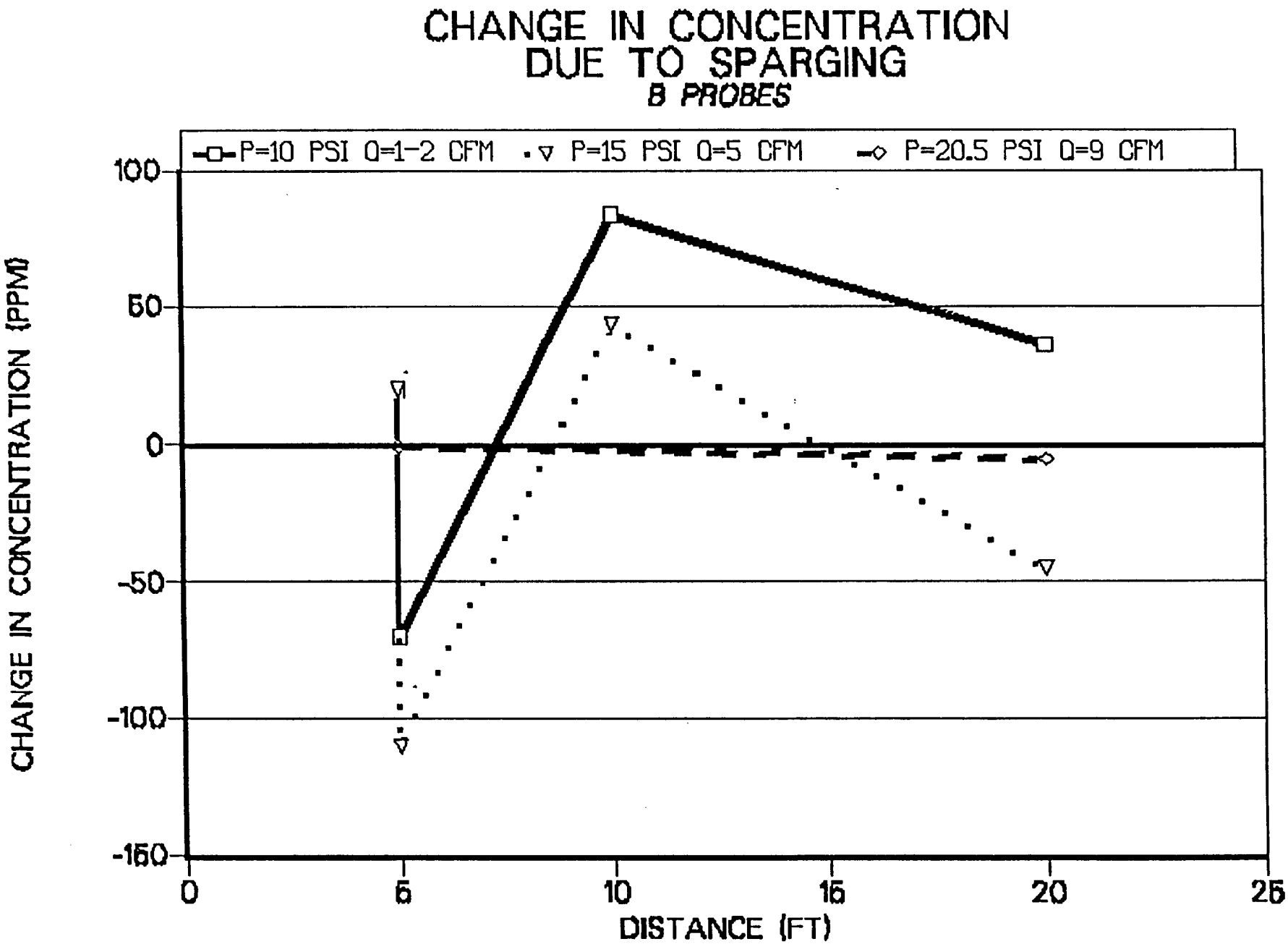

CHANGE IN WATER LEVELS
NEX
GROTON, CT
-□-10 PSI
-X-15 PSI
-▽-20.5 PSI
CHANGE IN WATER LEVEL (FT)
.5
.4
.3
.2
.1
0
1
10
100
1000
DISTANCE (FT)

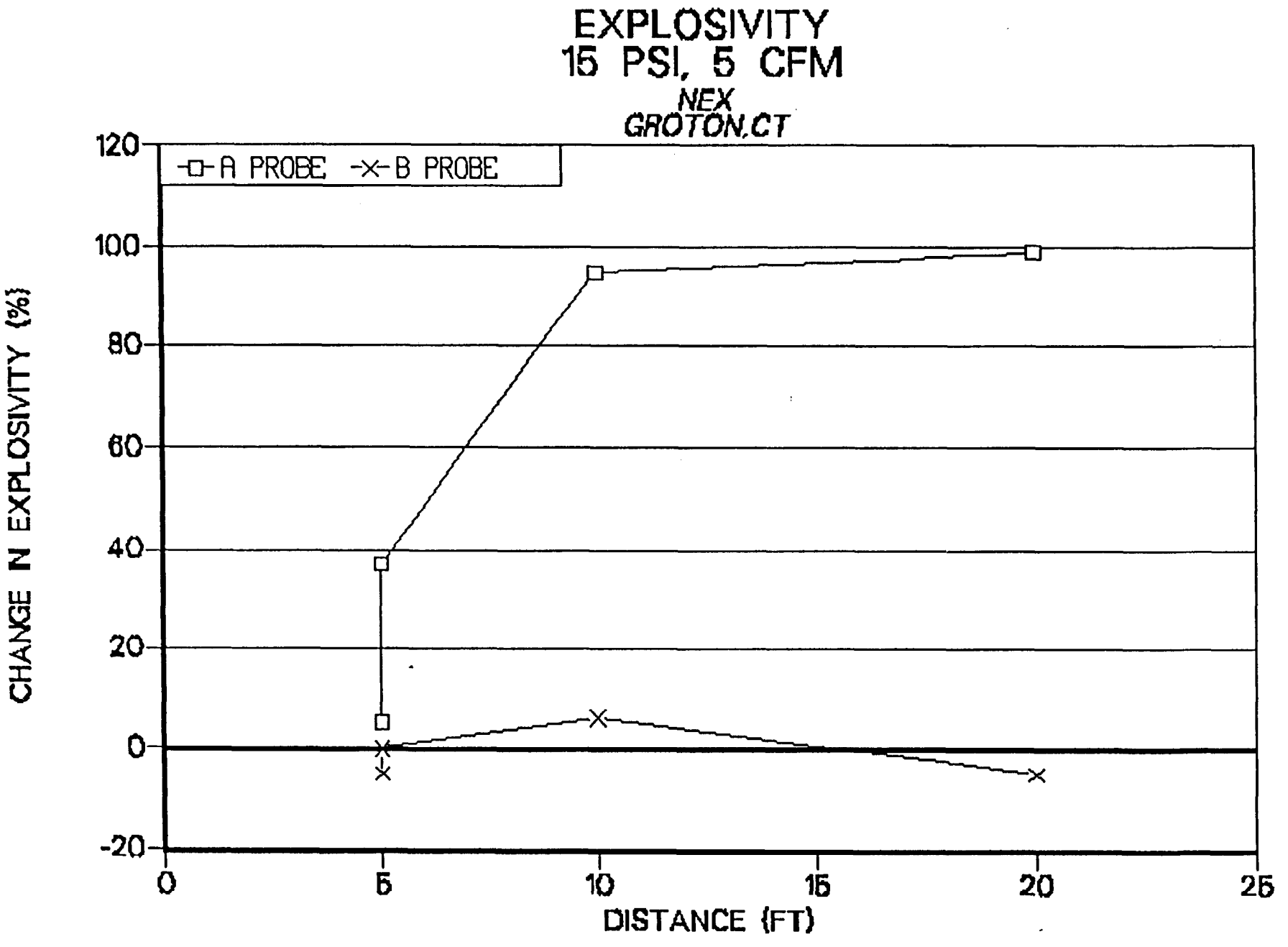

CHNAGE IN VACUUM
NEX
GROTON, CT
CHNANGE IN VACUUM (IN H2O)
.4
.2
0
0
5
10
15
20
25
DISTANCE (FT)

CHANGE IN CONCENTRATION DUE TO SPARGING

A PROBES (SATURATED)




CHANGE IN CONCENTRATION
DUE TO SPARGING
B PROBES
P=10 PSI Q=1-2 CFM
P=15 PSI Q=5 CFM
P=20.5 PSI Q=9 CFM
CHANGE IN CONCENTRATION (PPM)
100
50
0
-50
-100
-150
0
5
10
15
20
25
DISTANCE (FT)


EXPLOSIVITY
15 PSI, 5 CFM
NEX
GROTON,CT
A PROBE
B PROBE
CHANGE IN EXPLOSIVITY (%)
120
100
80
60
40
20
0
-20
0
5
10
15
20
25
DISTANCE (FT)

HRP
ASSOCIATES, INC.
167 New Britain Avenue
Plainville, CT 06062
(203) 793-6899
FAX: (203) 793-6871

PROJECT TITLE	NEX		
PROJECT NUMBER	NAV0028.FE TASK 12		
SUBJECT	SVE RADIAL INFLUENCE		
DESIGNED	DATE	CHECKED	DATE

REFERENCE: "A Practical Approach to the Design, Operation, and Monitoring of In-situ Soil Venting Systems", Johnson, et. al., Ground Water Monitoring Review, Spring 1990, p 159-178.

Estimation of k, intrinsic permeability

FIELD Data:

m = station Thickness = $8 ft \times 12 in/ft \times 2.54 \frac{cm}{in} = 243.8 cm$
μ = air viscosity, 1.8×10^{-4} g/cm·s
ϵ = air filled soil void fraction
$Q = 11{,}562.7 \ cm^3/s$
$P_{atm} = 1.013 \times 10^6 \ g/cm \cdot s^2$

Vacuum - time response

time (sec)	5	10	15	20	25	30	35	40	45	50	55	60	70
P1b	0.1	0.2	0.25	0.3	0.35	0.4	0.4	0.4	0.45	0.5	0.5	0.5	
P2b						0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.3
P3b	0.15	0.25	0.45	0.6	0.8	0.9	1.05	1.15	1.2	1.25	1.35	1.4	1.45
P4b		0.05	0.075	0.1	0.125	0.15	0.175	0.2	0.2	0.225	0.225	0.25	0.275

See Attached Graphs

$$k = \frac{Q\mu}{4\pi A m} \qquad \epsilon = \frac{4 k P_{atm}}{r^2 \mu} \exp\left[\frac{-4\pi m \, k/\mu \, B}{Q} - .5772\right]$$

A = slope of graph

B = y-intercept

$$R_I = R_W \Big/ e^{\left[\frac{\pi k P_W}{\frac{Q}{H}\mu}\left(1 - \left(\frac{P_{atm}}{P_W}\right)^2\right)\right]}$$

HRP
ASSOCIATES, INC.
167 New Britain Avenue
F nville, CT 06062
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PROJECT TITLE			
PROJECT NUMBER			
SUBJECT			
DESIGNED	DATE	CHECKED	DATE

P4b, r = 18 ft = 598.6 cm

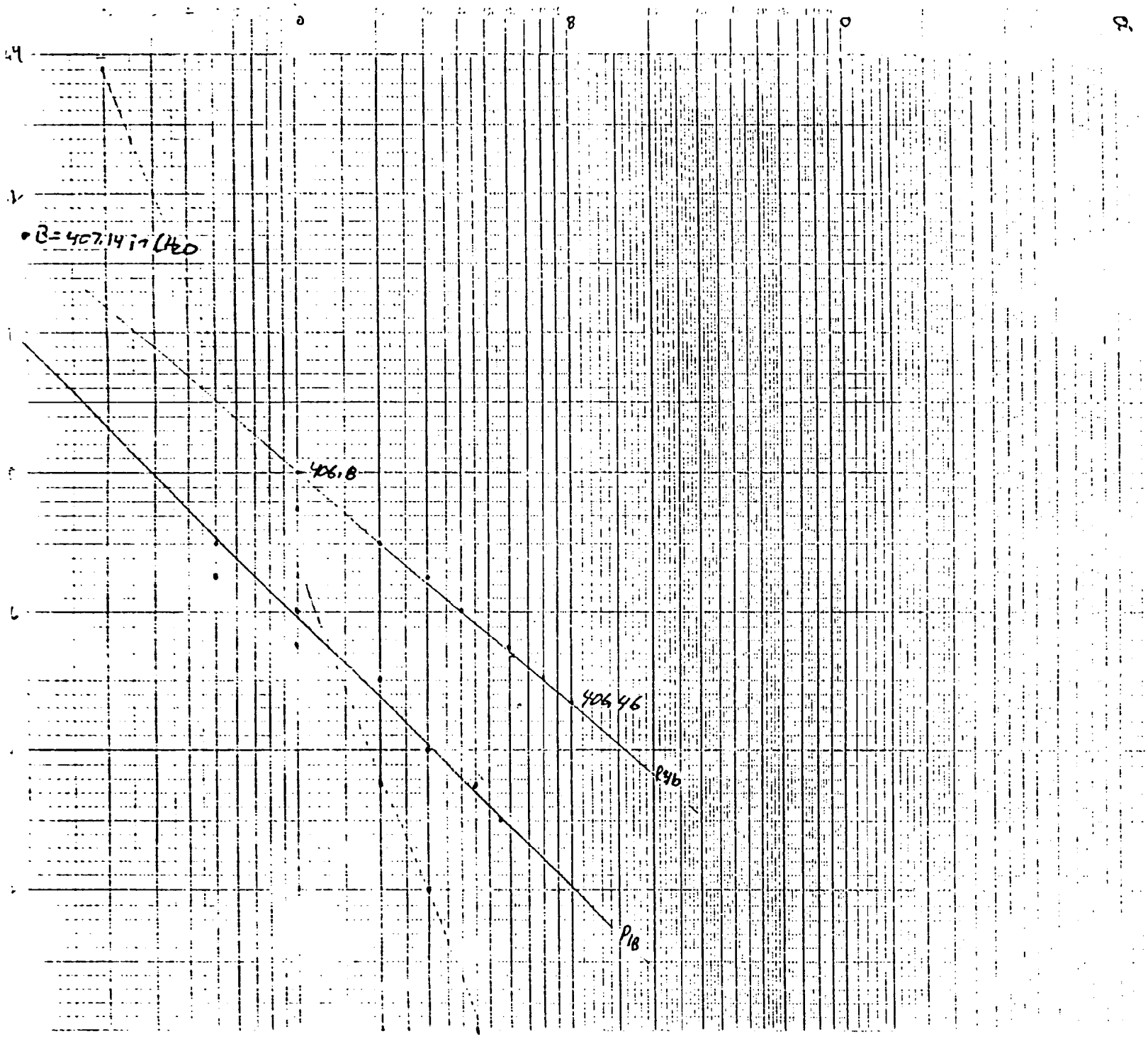
$$A = \text{ABS}\left(\frac{406.8 - 406.46}{\ln 10 - \ln 100}\right) = 0.148 \ \frac{\text{in } H_2O}{\ln t} * \frac{1.013\times10^6 \ g/cm\,s^2}{406.8 \text{ in } H_2O} = 367.7$$

$$B = \text{ABS}\left| 407.14 \times \frac{1.013\times10^6}{406.8} - 1.013\times10^6 \right| = 846.7$$

$$K = \frac{11562.7\ (1.8\times10^{-4})}{4\pi\,(367.7)\ \ 243.6} = 1.8\times10^{-6}\ cm^2$$

$$R_I = 457.2 \Big/ \exp\left[\frac{\pi(1.8\times10^{-6})\ 1.01219\times10^6}{\frac{11562.7}{1524}\ (1.8\times10^{-4})}\left(1 - \left(\frac{1.013\times10^6}{1.01219\times10^6}\right)^2\right)\right] = 894\ cm$$

$$= 30\ FT$$


B=407.14 in H2O
406.8
406.46
P46
P18

HRP
ASSOCIATES, INC.
167 New Britain Avenue
inville, CT 06062
(203) 793-6899
FAX: (203) 793-6871

PROJECT TITLE	NEX		
PROJECT NUMBER	NAV0026.FE TASK 12		
SUBJECT	EMISSION RATES		
DESIGNED BPW 11/23/93	DATE	CHECKED	DATE

$$C_{est} = \frac{1\times10^{-6}\ C_{ppm}\ MW}{RT}$$

C_{ppm} = 1.6 BZ 3.8 TCE 5.1 TOL

MW = 78100 131500 92100

R = .0821

T = 298

$$C_{est}\ bz = \frac{1\times10^{-6}\ (1.6)\ 78100}{.0821\ (298)} = .005\ \frac{mg}{L}$$

$$C_{est}\ TCE = \frac{1\times10^{-6}\ (3.8)\ 131500}{.0821\ (298)} = .02\ mg/L$$

$$C_{est}\ TOL = \frac{1\times10^{-6}\ (5.1)\ 92100}{.0821\ 298} = .02\ mg/L$$

Emission rate $\frac{C_{est}\ Q}{454000}$

$$Q = 24.5\ ft^3/m \times \frac{123\ in^3}{ft^3} \times \frac{2.54^3\ cm^3}{in^3} \times \frac{l}{1000\ cm^3} \times \frac{60\ m}{hr} = 41626\ l/hr$$

$$E_{BZ} = \frac{.005\ (41626)}{454000} = 4.6\times10^{-4}\ lb/hr$$

$$E_{TCE} = \frac{.02\ (41626)}{454000} = 1.8\times10^{-3}\ lb/hr$$

$$E_{TOL} = \frac{.02\ (41626)}{454000} = 1.8\times10^{-3}\ lb/hr$$

HRP
ASSOCIATES, INC.
167 New Britain Avenue
Farmington, CT 06062
(203) 793-6899
FAX: (203) 793-6871

PROJECT TITLE	NEX		
PROJECT NUMBER	NAVDOCB, FE TASK 12		
SUBJECT	AIR SPARGING EMISSION RATES		
DESIGNED CIW	DATE 11/23/93	CHECKED	DATE

Bz $C_{ppm} = 5.75$

$$C_{est} = \frac{1\times10^{-6}(5.75)\,78100}{.0821\,(298)} = 1.8\times10^{-2}$$

$$E = \frac{41626\,(1.8\times10^{-2})}{454000} = 1.7\times10^{-3}\ lb/hr$$

TCE $C_{ppm} = 6.86$

$$C_{est} = \frac{1\times10^{-6}(6.86)\,131500}{.0821\,(298)} = 3.7\times10^{-2}$$

$$E = \frac{41626\,(3.7\times10^{-2})}{454000} = 3.4\times10^{-3}\ lb/hr$$

TOL $C_{ppm} = 5.2$

$$C_{est} = \frac{1\times10^{-6}(5.2)\,92100}{.0821\,(298)} = 1.9\times10^{-2}$$

$$E = \frac{41626\,(1.9\times10^{-2})}{454000} = 1.8\times10^{-3}\ lb/hr$$

PCE $MW = 166000$ $C_{ppm} = 3$

$$C_{est} = \frac{1\times10^{-6}(3)\,166000}{.0821\,(298)} = 0.02$$

$$E = 41626\,(.02)\,/\,454000 = 1.8\times10^{-3}$$

Et Bz $C_{ppm} = .29$

$$C_{est} = 1\times10^{-6}(.29)(106200)/.0821\,(298) = 1.2\times10^{-3}$$

$$E = 41626\,(1.2\times10^{-3})/454000 = 1.1\times10^{-4}\ lb/hr$$

Xy $MW = 106200$ $C_{ppm} = 6.69$

$$C_{est} = 1\times10^{-6}(6.69)\,106200/.0821\,(298) = 2.9\times10^{-2}$$

$$E = 41626\,(2.9\times10^{-2})/454000 = 2.7\times10^{-3}\ lb/hr$$

APPENDIX D

Dolphin Mart Drill Logs

Soil Sampling Log
KENNEDY & SONS TEST BORING, INC.

Sub–Surface Exploration
P.O. Box 735
Naugatuck, Connecticut 06770
Bus. (203) 723-0686

TE START 10/14/93
FINISHED 10/14/93

IGHT OF HAMMER 140
ALL 30"

GROUND WATER OBSERVATIONS

DATE	TIME	DEPTH

APLER O.D. 2" I.D. 1 5/8"

OF RIG CME 55

ESPECIALLY COMPILED FOR
HRP Associates, Inc.
167 New Britain Ave.
Plainville, CT 06062

SHEET 1 OF 2
PROJ NO NAV 0028 FE

LOCATION Dolphin Mart
Groton, CT

OFFSET

GROUND ELEVATION
HOLE NO. HRP - 10

	CASING	SAMPLER	CORE	BARR
TYPE	HSA	SS		
SIZE I.D.	2 1/4"	1 5/8"		

AMPLE D. THS EV.FT.	BLOWS PER 6 IN. ON SAMPLER FROM – TO 0–6	6–12	12–18	18–24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	REC
'-2'	15	10	10	13			Black bituminous pavement.	1	2.0	12'
							Red brown fine to medium sand w/silt, very fine sand, gravel. SW			
-4'	18	50/4					Same as above. SW	2	10"	12'
							Moved hole because of condult torn up by auger 1st hole, back filled & sealed.			
'-6'	35	48	47	14			Same w/increasing fines, dark brown silt at tip. SM	3	2.0	18'
'-8'	10	23	23	10			5" of medium brown very fine to medium sand w/silt, then 5" gray silt, then wet gray-brown medium sand w/fine to coarse sand and pebbles, then 2" sand and silt. ML	4	2.0	20'
- 0'	8	8	15	24			2" of dark brown-gray silt, then fine to medium sand w/silt,increasing sand w/depth - patchy clayey silt, and sand, last 6" strong odor. SM	5	2.0	24'
0'-	15	19	17	11			Brown -gray fine to medium sand w/patchy silt, strong odor. SW	6	2.0	24'
2'-							Same as sample #6. SW			
							Sampling arrested due to bent spoon in last 2 samples, probable caused by boulders. Augered to 14'6"			

Proportions used: trace = 0.10%, little = 10.20%, some = 20.35%, and 35.50%

LER: Bill Kennedy
: Brian Kennedy
NGINEER Jennifer Convey

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON

COHESIONLESS DENSITY
0 - 10 LOOSE
10 - 30 MED COMP
30 - 50 DENSE

TOTAL FOOTAGE
Earth Boring ft
Rock Coring ft
HRP - 10

E START	10/14/93
FINISHED	10/14/93
GHT OF HAMMER	140
ALL	30"

GROUND WATER OBSERVATIONS

DATE	TIME	DEPTH

PLER O.D.	2"	I.D.	1 5/8"
OF RIG	CME 55		

Soil Sampling Log
KENNEDY & SONS TEST BORING, INC.

Sub–Surface Exploration
P.O. Box 735
Naugatuck, Connecticut 06770
Bus. (203) 723-0686

ESPECIALLY COMPILED FOR
HRP Associates, Inc.
167 New Britain Ave.
Plainville, CT 06062

SHEET 2 OF 2
PROJ. NO. NAV 0028 FE

LOCATION Dolphin Mart
Groton, CT

OFFSET

GROUND ELEVATION
HOLE NO. HRP - 10

	CASING	SAMPLER	CORE	BARR
TYPE	HSA	SS		
SIZE I.D.	2 1/4"	1 5/8"		

SAMPLE NO. DEPTHS ELEV.FT.	BLOWS PER 6 IN. ON SAMPLER FROM – TO 0–6	6–12	12–18	18–24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	REC
							Set 2" Well at 14'6" 10' screen 5' riser 250 lbs. sand 50 lbs. bentonite 1 bag cement 1 plug HRP -handway, camcap, lock			

Proportions used: trace = 0.10%, little = 10.20%, some = 20.35%, and 35.50%

ER: Bill Kennedy
Brian Kennedy
NGINEER: Jennifer Convey

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON

COHESIONLESS DENSITY
0 10 LOOSE
10 30 MED. COMP.
30 50 DENSE

TOTAL FOOTAGE
Earth Boring Ft
Rock Coring Ft
Hole No. HRP - 10

MONITOR WELL COMPLETION REPORT

GENERAL INFORMATION

Town: GROTON, CT

Site: DOLPHIN MART

Monitoring Point I.D. NO.: HRP-10

Date of Completion: OCTOBER 14, 1993

DEP/WPC ID No.:

Monitoring Point Location (relative to site features): SOUTH OF SITE BUILDING

Drilling Contractor: KENNEDY & SONS TEST BORING

Supervising Engineer/Geologist: JEN CONVEY

Well Construction Method: HOLLOW STEM AUGER 4¼ IN ID

WELL INFORMATION (ELEVATIONS TO NEAREST 0.01 FEET)

Ground survey elevation (MSL): 97.44 FT

Well depth below surface: 12.76 FT b.g.

Refusal: ___Yes ✓ No

Top of casing elevation (MSL): 97.14 FT

Screened interval: 2.76 FT to 12.76 FT b.g

Length of screen: 10 FT

Length of riser pipe: 2.46 FT

Screen type: PVC SCHED 40

Screen Slot size: 0.01 IN

Filter fabric: ___Yes ✓ No

Screen packing: ✓ Yes ___No

If yes, Thickness: 2.62 IN

Material: SILICA SAND

Grain size: COARSE

Well inside diameter: 2 IN

Aquifer material surrounding screen: f.s. & silt

Impermeable Backfill: Bentonite

Well casing material and schedule: PVC SCHED 40

Estimated K screened interval:

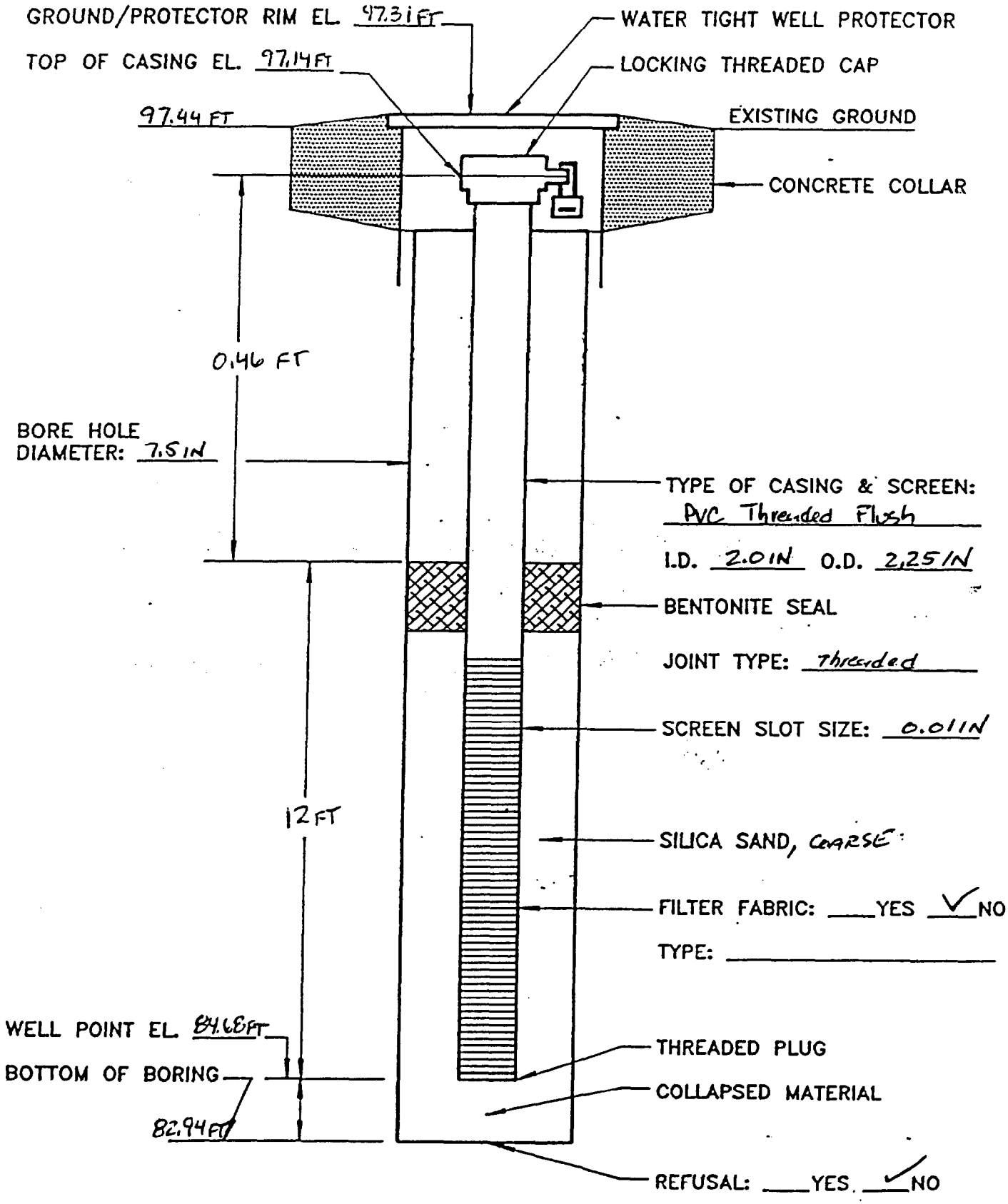
Method of development: BAIL & PURGE

Time spent developing: 0.5 HRS

Locking ✓ or threaded cap ___

Impermeable backfill: CONCRETE COLLAR

MONITOR WELL INSTALLATION DETAIL
FOR WELL IN UNCONSOLIDATED DEPOSIT



HRP-10

Soil Sampling Log
KENNEDY & SONS TEST BORING, INC.

Sub–Surface Exploration
P.O. Box 735
Naugatuck, Connecticut 06770
Bus. (203) 723-0686

E START 10/14/93
FINISHED 10/14/93

SHEET 1 OF 1
PROJ NO NAV 0028 FE

GHT OF HAMMER 140
ALL 30"

LOCATION Dolphin Mart
Groton, CT

OFFSET

GROUND WATER OBSERVATIONS

DATE	TIME	DEPTH

PLER O.D. 2" I.D. 1 5/8"

OF RIG CME 55

ESPECIALLY COMPILED FOR
HRP Associates, Inc.
167 New Britain Ave.
Plainville, CT 06062

GROUND ELEVATION
HOLE NO. HRP -11

	CASING	SAMPLER	CORE	BARR
TYPE	HSA	SS		
SIZE I.D.	2 1/4"	1 5/8"		

SAMPLE NO. DEPTHS ELEV.FT.	BLOWS PER 6 IN. ON SAMPLER FROM – TO 0–6	6–12	12–18	18–24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	REC
'-2'	1	2	2	5			Top soil (3"), then gray sandy silt w/roots. OL	1	2.0	10'
-4'	7	8	9	9			Same as sample #1. OL	2	2.0	14'
-6'	6	6	6	6			Same as sample #2. OL	3	2.0	14'
'-8'	7	5	5	6			Brown coarse sand w/fine to medium sand, then layered gray silt 2", sand 3", silt 4", sand 2". SM	4	2.0	16'
							Set 2" Well HRP supplied- screen, riser, stand pipe and lock, handway 250 lbs. sand 1 bag cement			

Proportions used: trace = 0.10%, little = 10.20%, some = 20.35%, and 35.50%

ER: Bill Kennedy
R: Brian Kennedy
ENGINEER
INSPECTOR Jennifer Convey

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON
TP = TEST PIT

COHESIONLESS DENSITY
0 - 10 LOOSE
10 - 30 MED. COMP.
30 - 50 DENSE
50 - VERY DENSE

TOTAL FOOTAGE
Earth Boring Ft
Rock Coring Ft
Hole No. HRP -11

Soil Sampling Log
KENNEDY & SONS TEST BORING, INC.

Sub–Surface Exploration
P.O. Box 735
Naugatuck, Connecticut 06770
Bus. (203) 723-0686

E START	10/14/93
FINISHED	10/14/93
OF HAMMER	140
FALL	30"
GROUND WATER OBSERVATIONS	DATE / TIME / DEPTH
PLER O.D.	2"
I.D.	1 5/8"
OF RIG	CME 55

ESPECIALLY COMPILED FOR
HRP Associates, Inc.
167 New Britain Ave.
Plainville, CT 06062

SHEET	1 OF 2
PROJ. NO.	NAV 0028 FE
LOCATION	Dolphin Mart, Groton, CT
OFFSET	
GROUND ELEVATION	
HOLE NO.	P-1
TYPE	CASING: HSA; SAMPLER: SS; CORE; BAR
SIZE I.D.	2 1/4"; 1 5/8"

SAMPLE NO. DEPTHS ELEV.FT.	BLOWS PER 6 IN. ON SAMPLER FROM – TO 0–6	6–12	12–18	18–24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV	FIELD IDENTIFICATION OF SOILS / REMARKS	SAMPLE NO.	PEN	REC
-2'	15	10	10	11			Black top.	1	2.0	20
							Medium brown fine to medium sand w/silt and gravel.			
2'-4'	10	13	8	9			Gray silt w/bit of wire, roots & sand.	2	2.0	24'
-6'	3	5	6	6	wet		Gray silt w/clay in sand, medium sand w/coarse to fine sand, last 5" - strong odor.	3	2.0	24'
-8'	8	27	50/3		wet		Brown fine to medium sand w/silt - strong odor.	4	2.0	1.
-	4	4	5	5	wet	9.0'	Brown medium sand w/fine to coarse sand.	5	2.0	24'
							Brown and gray sandy silt- strong odor.			
							Set deep point at 9' - screen to 8' 1 1/2' sand 1 1/2' bentonite activated thin layer sand			
							Set middle point 6' - screen to 5' 1 1/2' sand 1 1/2' bentonite activated thin layer sand			
							Set shallow point 3'- screen to 2' 1 1/2' sand 1 1/4' bentonite activated thin layer sand			

Proportions used: trace = 0.10%, little = 10.20%, some = 20.35%, and 35.50%

LER: Bill Kennedy
R: Brian Kennedy
ENGINEER

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON

COHESIONLESS DENSITY
0–10 LOOSE
10–30 MED. COMP.
30–50 DENSE

TOTAL FOOTAGE:
Earth Boring Ft.
Rock Coring Ft.
Hole No. P-1

MONITOR WELL COMPLETION REPORT

GENERAL INFORMATION

Town: GROTON, CT

Site: DOLPHIN MART

Monitoring Point I.D. NO.: HRP-11

Date of Completion: OCTOBER 14, 1993

DEP/WPC ID No.:

Monitoring Point Location (relative to site features): SOUTHWEST OF SITE BUILDING

Drilling Contractor: KENNEDY & SONS TEST BORING

Supervising Engineer/Geologist: JEN CONVEY

Well Construction Method: HOLLOW STEM AUGER 4 1/4 IN ID

WELL INFORMATION (ELEVATIONS TO NEAREST 0.01 FEET)

Ground survey elevation (MSL): 94.67 FT

Well depth below surface: 7.41 FT B.G.

Refusal: ___Yes ✓ No

Top of casing elevation (MSL): 96.62 FT

Screened interval: 1.41 FT TO 7.41 FT B.G.

Length of screen: 6 FT

Length of riser pipe: 3.36 FT

Screen type: PVC SCHED 40

Screen Slot size: 0.01 IN

Filter fabric: ___Yes ✓ No

Screen packing: ✓ Yes ___No

If yes, Thickness: 2.63 IN

Material: SILICA SAND

Grain size: COARSE

Well inside diameter: 2 IN

Aquifer material surrounding screen: f.s. and silt

Impermeable Backfill: BENTONITE

Well casing material and schedule: PVC SCHED 40

Estimated K screened interval:

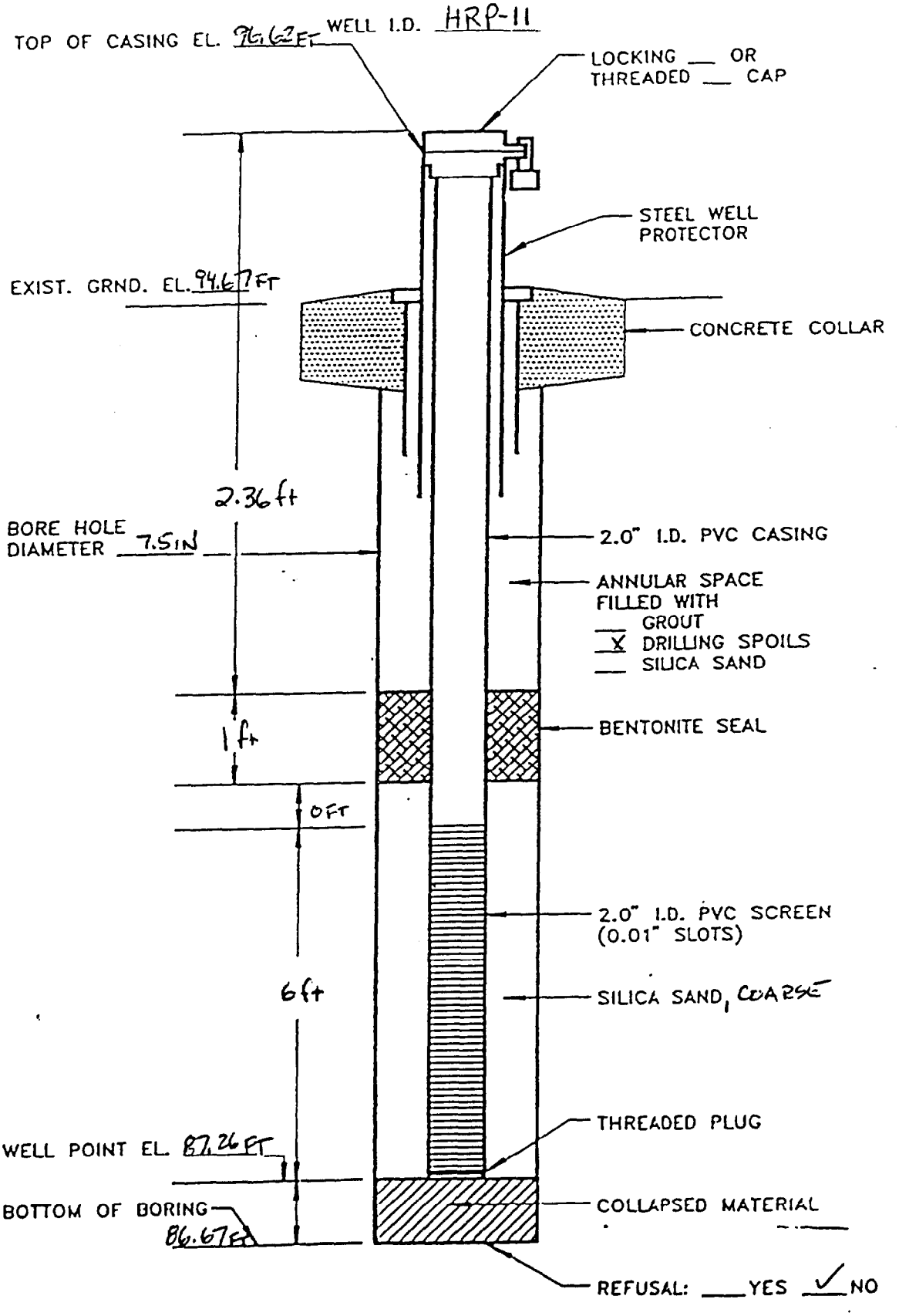
Method of development: BAIL & PURGE

Time spent developing: 0.5 HRS

Locking ✓ or threaded cap ___

Impermeable backfill: CONCRETE

MONITOR WELL INSTALLATION DETAIL
FOR WELL IN UNCONSOLIDATED DEPOSIT



Soil Sampling Log
KENNEDY & SONS TEST BORING, INC.

Sub–Surface Exploration
P.O. Box 735
Naugatuck, Connecticut 06770
Bus. (203) 723-0686

SHEET 1 OF 2
PROJ. NO. NAV 0028 FE

TE START 10/14/93
TE FINISHED 10/14/93

GHT OF HAMMER 140
FALL 30"

GROUND WATER OBSERVATIONS

DATE	TIME	DEPTH

MPLER O.D. 2" I.D. 1 5/8"

OF RIG CME 55

ESPECIALLY COMPILED FOR
HRP Associates, Inc.
167 New Britain Ave.
Plainville, CT 06062

LOCATION Dolphin Mart
Groton, CT

OFFSET

GROUND ELEVATION
HOLE NO. P-1

	CASING	SAMPLER	CORE	BAR
TYPE	HSA	SS		
SIZE I.D.	2 1/4"	1 5/8"		

SAMPLE NO. PTHS EV.FT.	BLOWS PER 6 IN. ON SAMPLER FROM – TO 0–6	6–12	12–18	18–24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	REC
0'-2'	15	10	10	11			Black top.	1	2.0	20
							Medium brown fine to medium sand w/silt and gravel. SM			
'-4'	10	13	8	9			Gray silt w/bit of wire, roots & sand. OL	2	2.0	24'
''-6'	3	5	6	6	wet		Gray silt w/clay in sand, medium sand w/coarse to fine sand, last 5" - strong odor. OL	3	2.0	24'
5'-8'	8	27	50/3		wet		Brown fine to medium sand w/silt - strong odor. SW	4	2.0	1.:
8'-9'	4	4	5	5	wet	9.0'	Brown medium sand w/fine to coarse sand. SW	5	2.0	24'
							Brown and gray sandy silt- strong odor. ML			
							Set deep point at 9' - screen to 8' 1 1/2' sand 1 1/2' bentonite activated thin layer sand			
							Set middle point 6' - screen to 5' 1 1/2' sand 1 1/2' bentonite activated thin layer sand			
							Set shallow point 3'- screen to 2' 1 1/2' sand 1 1/4' bentonite activated thin layer sand			

Proportions used: trace = 0.10%, little = 10.20%, some = 20.35%, and 35.50%

LLER: Bill Kennedy
PER: Brian Kennedy
ENGINEER
ING INSPECTOR Jennifer Convey

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON
TP = TEST PIT
UW = UNDISTURBED TUBEWALL

CORE SOIL DENSITY
0 - 10 VERY
10 - 30 MED COMP
30 - 50 DENSE
50 - VERY DENSE

TOTAL FOOTAGE
Earth Boring ft
Rock Coring ft
Hole No. P-1

Soil Sampling Log
KENNEDY & SONS TEST BORING, INC.

Sub–Surface Exploration
P.O. Box 735
Naugatuck, Connecticut 06770
Bus. (203) 723-0686

TE START	10/14/93
TE FINISHED	10/14/93
IGHT OF HAMMER	140
FALL	30"
GROUND WATER OBSERVATIONS	DATE / TIME / DEPTH
MPLER O.D.	2"
I.D.	1 5/8"
E OF RIG	CME 55

ESPECIALLY COMPILED FOR
HRP Associates, Inc.
167 New Britain Ave.
Plainville, CT 06062

SHEET 2 OF 2
PROJ. NO. NAV 0028 FE

LOCATION Dolphin Mart
Groton, CT

OFFSET

GROUND ELEVATION
HOLE NO. P-1

	CASING	SAMPLER	CORE	BAR
TYPE	HSA	SS		
SIZE I.D.	2 1/4"	1 5/8"		

SAMPLE NO. EPTHS EV.FT.	BLOWS PER 6 IN. ON SAMPLER FROM – TO 0–6	6–12	12–18	18–24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	RE
							Material used: HRP -screen, riser, handway 50 lbs. bentonite 250 lbs. sand			

Proportions used: trace = 0.10%, little = 10.20%, some = 20.35%, and 35.50%

ILLER Bill Kennedy
PER Brian Kennedy
G ENGINEER
ING INSPECTOR Jennifer Convey

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
D = UNDISTURBED PISTON
T = TUBE
U = UNDISTURBED THINWALL

CORE SOIL DENSITY
0 – 10 LOOSE
10 – 30 MED. COMP.
30 – 50 DENSE
50 – VERY DENSE

TOTAL FOOTAGE
Earth Boring ft
Rock Coring ft
Hole No. P-1

V022015

Soil Sampling Log
KENNEDY & SONS TEST BORING, INC.

Sub–Surface Exploration
P.O. Box 735
Naugatuck, Connecticut 06770
Bus. (203) 723-0686

SHEET 1 OF 2
PROJ NO. NAV 0028 FE

LOCATION Dolphin Mart
Groton, CT

OFFSET

GROUND ELEVATION
HOLE NO. P-2

ESPECIALLY COMPILED FOR
HRP Associates, Inc.
167 New Britain Ave.
Plainville, CT 06062

TE START 10/15/93
TE FINISHED 10/15/93

GHT OF HAMMER 140
FALL 30"

GROUND WATER OBSERVATIONS

DATE	TIME	DEPTH

MPLER O.D. 2" I.D. 1 5/8"

E OF RIG CME 55

	CASING	SAMPLER	CORE	BAR
TYPE	HSA	SS		
SIZE I.D.	2 1/4"	1 5/8"		

SAMPLE NO. DEPTHS ELEV.FT.	BLOWS PER 6 IN. ON SAMPLER FROM – TO 0–6	6–12	12–18	18–24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	RE
0'-2'	8	15	14	14			Dry gray sandy silt w/gravel. ML	1	2.0	12
2'-4'	10	9	9	9			4" of dark sandy organic silt w/clay and gravel, then wet gray clayey organic silt, then increasing brown and yellow silt - less clay -strong odor. OL	2	2.0	14
4'-6'	15	12	12	12			10" brown medium to coarse sand w/fine sand and gravel- then 2" same but gray, extremely strong odor. SW	3	2.0	12
6'-8'	10	8	12	50			8" of gray brown fine to medium sand w/coarse sand and gravel, then 2" of coarse brown sand w/gravel, trace fine to medium sand, then 8" of gray silty very fine to fine sand -strong odor. SW	4	1'6"	18
8'-10'							No 8'-10' sample due to boulder at 7.5'	5		
							Augered to 7'6" Set deep point A at 7'6" to 6'6" 1 1/2' sand bentonite 4' thin layer sand Set intermediate point B at 4'-3' 1 1/2' sand 6" bentonite Set shallow point C at 2' 1 1/2' sand 3" bentonite handway & concrete collar			

Proportions used: trace = 0.10%, little = 10.20%, some = 20.35%, and 35.50%

LER: Bill Kennedy
PER: Brian Kennedy
ENGINEER
ING INSPECTOR Jennifer Convey

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON
TP = TEST PIT
UW = UNDISTURBED THINWALL

COHESIONLESS DENSITY
0 10 LOOSE
10 30 MED COMP
30 50 DENSE
50 + VERY DENSE

TOTAL FOOTAGE
Earth Boring Ft
Rock Coring Ft
Hole No. P-2

Soil Sampling Log
KENNEDY & SONS TEST BORING, INC.

Sub–Surface Exploration
P.O. Box 735
Naugatuck, Connecticut 06770
Bus. (203) 723-0686

E START	10/15/93
TE FINISHED	10/15/93
GHT OF HAMMER	140
M / ALL	30"
GROUND WATER OBSERVATIONS	
DATE	
TIME	
DEPTH	
APLER O.D.	2"
I.D.	1 5/8"
OF RIG	CME 55

ESPECIALLY COMPILED FOR
HRP Associates, Inc.
167 New Britain Ave.
Plainville, CT 06062

SHEET	2 OF 2
PROJ. NO.	NAV 0028 FE
LOCATION	Dolphin Mart Groton, CT
OFFSET	
GROUND ELEVATION	
HOLE NO.	P-2
TYPE	CASING HSA / SAMPLER SS / CORE / BAR
SIZE I.D.	2 1/4" / 1 5/8"

SAMPLE NO. PTHS EV.FT.	BLOWS PER 6 IN. ON SAMPLER FROM – TO 0–6	6–12	12–18	18–24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	REC
							Materials used: 250 lbs. sand 30 lbs. bentonite HRP - screen, riser, handway			

Proportions used: trace = 0.10%, little = 10.20%, some = 20.35%, and 35.50%

LLER: Bill Kennedy
PER: Brian Kennedy
ENGINEER
ING INSPECTOR: Jennifer Convey

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON
TP = TEST PIT
UT = UNDISTURBED THINWALL

COHESIONLESS DENSITY
0–10 LOOSE
10–30 MED COMP
30–50 DENSE
50+ VERY DENSE

TOTAL FOOTAGE
Earth Boring FT.
Rock Coring FT.
Total P-2

V023018

TE START 10/15/93 TE FINISHED 10/15/93	**Soil Sampling Log** **KENNEDY & SONS TEST BORING, INC.** **Sub–Surface Exploration** P.O. Box 735 Naugatuck, Connecticut 06770 Bus. (203) 723-0686	SHEET 1 OF 1 PROJ. NO. NAV 0028 FE	
GHT OF HAMMER 140 LL 30"		LOCATION Dolphin Mart Groton, CT OFFSET	
GROUND WATER OBSERVATIONS DATE TIME DEPTH	ESPECIALLY COMPILED FOR HRP Associates, Inc. 167 New Britain Ave. Plainville, CT 06062	GROUND ELEVATION HOLE NO. P-3	
MPLER O.D. 2" I.D. 1 5/8"		TYPE CASING HSA SAMPLER SS CORE BAR	
OF RIG CME 55		SIZE I.D. 2 1/4" 1 5/8"	

SAMPLE NO. PTHS EV.FT.	BLOWS PER 6 IN. ON SAMPLER FROM – TO 0–6	6–12	12–18	18–24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	RE
0'-2'	4	11	11	11			Black top.	1	2.0	14
							Light brown fine to medium sand w/very fine to coarse sand, trace silt, then 6" of moist gray silty sand w/gravel. SW			
4'-6'	10	4	2	2			Gray-brown very fine to medium sand (dry) w/silt and gravel. SW	2	2.0	8'
4'-6'	2	1	1	1			Wet silty brown fine to coarse sand w/strong odor. SM	3	2.0	4'
	4	4	4	4			Same as sample #3. SM	4	2.0	6'
'-)'		8	9	28			6" of brown fine to coarse sand w/gravel, trace silt, then brown and gray (patchy) organic clayey silt - strong odor. OL	5	2.0	12'
							Set deep point A at 9' 1 1/2' sand 1 1/2' bentonite thin layer sand			
							Set medium point B at 6' 1 1/2' sand 1 1/2' bentonite thin layer sand			
							Set shallow point C at 3' 1 1/2' sand 1 1/2' bentonite			
							Materials used: 150 lbs. sand 25 lbs. bentonite			

Proportions used: trace = 0.10%, little = 10.20%, some = 20.35%, and 35.50%

ILLER: Bill Kennedy
PER: Brian Kennedy
ENGINEER
ING INSPECTOR Jennifer Convey

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON
TP = TEST PIT
GW = PERCHED GROUNDWATER

COHESIONLESS DENSITY
0 - 10 LOOSE
10 - 30 MED COMP
30 - 50 DENSE
50 + VERY DENSE

TOTAL FOOTAGE:
Earth Boring ft
Rock Coring ft
Hole No. P-3

Soil Sampling Log
KENNEDY & SONS TEST BORING, INC.

Sub–Surface Exploration
P.O. Box 735
Naugatuck, Connecticut 06770
Bus. (203) 723-0686

E START 10/15/93
TE FINISHED 10/15/93

GHT OF HAMMER 140
FALL 30"

GROUND WATER OBSERVATIONS

DATE	TIME	DEPTH

MPLER O.D. 2" I.D. 1 5/8"

OF RIG CME 55

ESPECIALLY COMPILED FOR
HRP Associates, Inc.
167 New Britain Ave.
Plainville, CT 06062

SHEET 1 OF 2
PROJ. NO NAV 0028 FE

LOCATION Dolphin Mart
Groton, CT

OFFSET

GROUND ELEVATION
HOLE NO. P-4

	CASING	SAMPLER	CORE	BAR
TYPE	HSA	SS		
SIZE I.D.	2 1/4"	1 5/8"		

SAMPLE NO. DEPTHS ELEV.FT.	BLOWS PER 6 IN. ON SAMPLER FROM – TO 0–6	6–12	12–18	18–24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV	FIELD IDENTIFICATION OF SOILS / REMARKS	SAMPLE NO.	PEN	RE
0'-2'	8	11	13	13			Black top.	1	2.0	12
							Brown and gray medium sand. SP			
'-4'	12	14	10	11	wet?		Very dark brown organic silt, then gray clayey silt. OL	2	2.0	16
4'-6'	3	3	6	10	wet?		Gray clayey silt w/sand. OL	3	2.0	12
'-8'	14	17	13	14			4" of gray clayey silt OL then 4" of gray fine to coarse sand w/silt, then 6" of brown medium to coarse sand w/fine sand, silt, and gravel - strong odor. SM	4	2.0	14
'- 0'	12	8	9	11			6" of brown medium to coarse sand w/fine sand, silt and gravel, then increasing gray and silty w/depth to gray sandy silt at last 2" -strong odor. SM	5	2.0	18
							Set deep point A at 9' - 1' screen 1 1/2' sand 1 1/2' bentonite thin layer sand			
							Set medium point B at 5'6" - 4'6" 1 1/2' sand to 4' 1/2' bentonite thin layer sand			

Proportions used: trace = 0.10%, little = 10.20%, some = 20.35%, and 35.50%

ER: Bill Kennedy
PER. Brian Kennedy
ENGINEER
ING INSPECTOR Jennifer Convey

SAMPLE TYPE
C - CORED W - WASHED
SS - SPLIT SPOON
UP - UNDISTURBED PISTON
TP - TEST PIT
UT - UNDISTURBED THINWALL

CORE SOIL DENSITY
0 - 10 LOOSE
10 - 30 MED. COMP.
30 - 50 DENSE
50 - 90 VERY DENSE

TOTAL FOOTAGE
Earth Boring FT
Rock Coring FT
HOLE NO. P-4

K023020

Soil Sampling Log
KENNEDY & SONS TEST BORING, INC.

Sub–Surface Exploration
P.O. Box 735
Naugatuck, Connecticut 06770
Bus. (203) 723-0686

SHEET 2 OF 2
PROJ. NO. NAV 0028 FE

E START 10/15/93
TE FINISHED 10/15/93

GHT OF HAMMER 140
FALL 30"

LOCATION Dolphin Mart
Groton, CT

OFFSET

GROUND WATER OBSERVATIONS

DATE	TIME	DEPTH

ESPECIALLY COMPILED FOR
HRP Associates, Inc.
167 New Britain Ave.
Plainville, CT 06062

GROUND ELEVATION
HOLE NO. P-4

IPLER O.D. 2" I.D. 1 5/8"

E OF RIG CME 55

	CASING	SAMPLER	CORE	BAR
TYPE	HSA	SS		
SIZE I.D.	2 1/4"	1 5/8"		

SAMPLE NO. EPTHS EV.FT.	BLOWS PER 6 IN. ON SAMPLER FROM – TO 0–6	6–12	12–18	18–24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	REC
							Set shallow point C at 2'3" deep 1 1/2' sand bentonite to 6" concrete collar			
							Materials used: 100 lbs. sand 25 lbs. bentonite HRP - screen and riser 3 bags cement total for P-1 thru 4			

Proportions used: trace = 0.10%, little = 10.20%, some = 20.35%, and 35.50%

LER Bill Kennedy
PER Brian Kennedy
S ENGINEER
ING INSPECTOR Jennifer Convey

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON
UT = UNDISTURBED THINWALL

COHESIONLESS DENSITY
0 - 10 LOOSE
10 - 30 MED. COMP.
30 - 50 DENSE
50 - 80 VERY DENSE

TOTAL FOOTAGE
Earth Boring FT.
Rock Coring FT.
Hole No. P-4

V023020

Soil Sampling Log
KENNEDY & SONS TEST BORING, INC.

Sub–Surface Exploration
P.O. Box 735
Naugatuck, Connecticut 06770
Bus. (203) 723-0686

E START	10/18/93
TE FINISHED	10/18/93
GHT OF HAMMER	140
ALL	30"
GROUND WATER OBSERVATIONS	
DATE	
TIME	
DEPTH	
MPLER O.D.	2"
I.D.	1 5/8"
OF RIG	CME 55

ESPECIALLY COMPILED FOR
HRP Associates, Inc.
167 New Britain Ave.
Plainville, CT 06062

SHEET 1 OF 1
PROJ. NO. NAV 0028 FE

LOCATION - DOLPHIN MART
Groton, CT

OFFSET

GROUND ELEVATION
HOLE NO. AS-1

	CASING	SAMPLER	CORE	BARR
TYPE	HSA	SS		
SIZE I.D.	2 1/4"	1 5/8"		

SAMPLE NO. PTHS EV.FT.	BLOWS PER 6 IN. ON SAMPLER FROM – TO 0–6	6–12	12–18	18–24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	REC
0'-2'	11	13	11	9			8" of light brown sandy silt, then gray clayey silt w/sand and gravel. SM	1	2.0	19'
5'-7'	6	4	6	9			Gray silt w/little wood - last 1" w/some coarse sand and gravel, moderate strong odor. OL	2	2.0	12'
10'-12'	8	14	22	23			Wet gray very fine to fine sand w/silt and medium sand then 2" gray silt, then 1/2" medium to coarse sand, then broken rock at tip. SM	3	2.0	20'
							Refusal in competent rock at 12.5'			
							Set point at 12'5"			
							1" PVC			
							2' sand			
							2' bentonite			
							grout to surface			
							Materials used:			
							HRP - handway			
							2 bags cement			
							100 lbs. sand			
							1 bag portland cement			
							2 bags black top - total job			
							25 bbs. bentonite			

Proportions used: trace = 0.10%, little = 10.20%, some = 20.35%, and 35.50%

LLER: Bill Kennedy
PER: Mike Kennedy
ENGINEER
ING INSPECTOR Jennifer Convey

SAMPLE TYPE
C - CORED W - WASHED
SS - SPLIT SPOON
UP - UNDISTURBED PISTON
TP - TEST PIT
UT - UNDISTURBED THINWALL

COHESIONLESS DENSITY
0 - 10 LOOSE
10 - 30 MEDIUM COMP
30 - 50 DENSE
50 - VERY DENSE

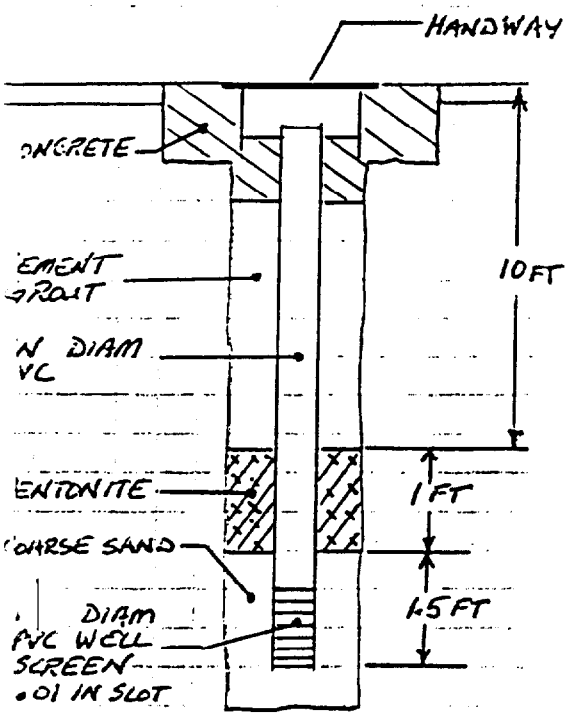
TOTAL FOOTAGE
Earth Bound Ft
Rock Cored Ft
Total Ft AS

V093027

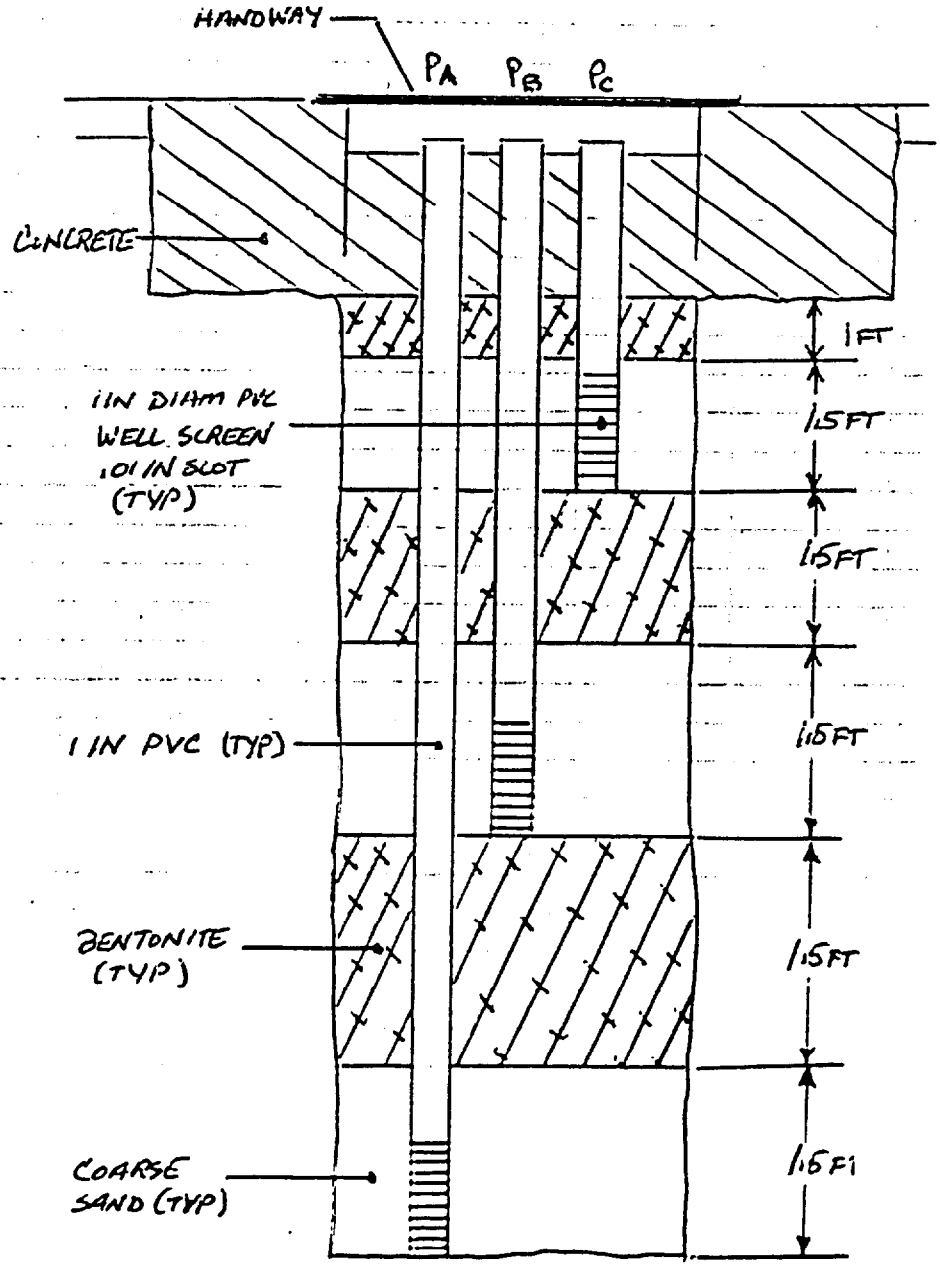
HRP
ASSOCIATES, INC.
67 New Britain Avenue
Plainville, CT 06062
(203) 793-6899
FAX: (203) 793-6871

PROJECT TITLE	DOLPHIN MART		
PROJECT NUMBER	NAV0028.FE		
SUBJECT	TYPICAL AS AND OBSERVATION PROBE COMPLETION		
DESIGNED BPW	DATE 12/10/93	CHECKED	DATE

AIR SPARGING POINT



OBSERVATION PROBE (TYP)



Watt.

APPENDIX E

Dolphin Mart Ground Water Analysis Results

November 8, 1993

RECEIVED
NOV 10 1993
HRP ASSOCIATES

HRP Associates Inc.
167 New Britain Ave
Plainville, CT 06062

Attn: Ms. Pat Terwilliger

Please find attached laboratory report(s) for the samples submitted on : **October 22, 1993:**

All pertinent information for this analysis is located on the report. Should it be necessary to contact us regarding billing and or the test results, please have the following information readily available :

LAB No.	:	103-632-13
PO/JOB No.	:	NAV0028.FE
INVOICE No.	:	39971
ORDER No.	:	19873
CUSTOMER No.	:	350

Please feel free to contact us if you have any questions.

Very truly yours,

Stephen J. Franco
Laboratory Director
PH-0547

connecticut testing laboratories inc.
WATER ■ SOIL ■ AIR

STEPHEN J. FRANCO
Laboratory Director
PHONE ■ 203/634-3731
165 GRACEY AVENUE ■ MERIDEN, CT ■ 06451

Date Samples Received : 10-22-93

Client Name... : HRP Associates Inc.	CTL Lab No. 103-632-13
Date of Report : 11-5-93	PO/Job No. NAV0028.FE Task 7

RESULTS OF ANALYSIS

EPA 418.1

Matrix Type: W

Field Id	CTL#	Oil & Grease (TPH)-mg/L			
WE-2D	12780	ND<5			
WE-2S	12781	ND<5			
WE-3	12782	ND<5			
WE-4	12783	ND<5			
WE-4B	12784	ND<5			
WE-5	12785	ND<5			
WE-6	12786	ND<5			
OBG-8A	12787	ND<5			
OBG-9A	12788	ND<5			
HRP-10	12789	5			
HRP-11	12790	ND<5			
EQ-1	12791	ND<5			
P-1B	12792	ND<5			

Dissolved Metals

Matrix Type		W			
CTL Sample No.		12786			
Field Id		WE-6			
Calcium-mg/L		16.5			
Manganese-mg/L		1.46			
Iron-mg/L		ND<0.05			

Matrix Types : W = Water/Aqueous
S = Soil/Solid
O = Oil/Hydrocarbons

CONNECTICUT TESTING LABORATORIES, INC.
165 Gracey Avenue / Meriden, CT 06451-2268
(203)-634-3731
Connecticut Certification No. PH-0547

November 8, 1993

RECEIVED
NOV 10 1993
HRP ASSOCIATES, INC.

HRP Associates Inc.
167 New Britain Ave
Plainville, CT 06062

Attn: Ms. Pat Terwilliger

Please find attached laboratory report(s) for the samples submitted on : **October 22, 1993:**

All pertinent information for this analysis is located on the report. Should it be necessary to contact us regarding billing and or the test results, please have the following information readily available :

LAB No.	: 103-645-13
PO/JOB No.	: NAAV0028FE
INVOICE No.	: 39968
ORDER No.	: 19870
CUSTOMER No.	: 350

Please feel free to contact us if you have any questions.

Very truly yours,

Stephen J. Franco
Laboratory Director
PH-0547

connecticut testing laboratories inc.
WATER ■ SOIL ■ AIR

STEPHEN J. FRANCO
Laboratory Director
PHONE ■ 203/634-3731
165 GRACEY AVENUE ■ MERIDEN, CT ■ 06451

Client	: HRP Associates Inc.		
Lab No.	: 103-645-13	Date Tested	: 11/2--11/5/93
PO No.	: NAV0028.FE Task 7		
Rep. Date	: 11-8-93	Analyst	: RS

EPA METHOD 602/8020 Date Samples Rec'd: 10-22-93

	MDL				
Matrix Type :		W	W	W	W
Field ID :		WE-2D	WE-2S	WE-3	WE-4
Benzene	1	3.0	BDL	6.0	431.0
Toluene	1	1.0	BDL	BDL	47.0
Chlorobenzene	1	BDL	BDL	BDL	BDL
Ethyl Benzene	1	1.0	BDL	BDL	398.0
P & M Xylene	1	BDL	BDL	2.0	564.0
O- Xylene	1	BDL	BDL	BDL	109.0
1,4-Dichlorobenzene	1	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	1	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	1	BDL	BDL	BDL	BDL
MTBE	1	BDL	2.0	83.0	BDL

MDL = Minimum Detectable Level/ **BDL** = Below Detection Level/ **UNITS= PPB**

Matrix Type: W= Water/Aqueous **S**= Soil/Solid **O**= Oil/Hydrocarbons

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HRP Associates, Inc.
167 New Britain Avenue
Plainville, CT 06062
Phone: 203-793-6899
Fax: 203-793-6871

HRP

CHAIN OF CUSTODY

Sheet 1 of 3
Job Number NAV-0028.FE task 7
Project Manager Robert Leach

Place & Address of Collection: Dolphin Mart, Groton, CT
Samplers Name (Signature): Christopher J. LaBbe
Assistant (Witness)(Signature):

Sample Number	Sample Location	Container Type	Total Volume	Preservative	Date	Time	Sample Type: Water	Soil	Air	Waste	Remarks
~~WE-1A~~	~~DRY~~	VOA, G	1120mL	ICE	10-22-93		~~X~~				
2	WE-2D	↓	↓	↓	↓		X				
3	WE-2S						X				
4	WE-3						X				
5	WE-4						X				

Relinquished By (Signature): Christopher J. LaBbe — Received By (Signature): M. McMahon — Date 10/22/93 — Time 3:30
Relinquished By (Signature): — Received By (Signature): — Date — Time
Name & Address of Laboratory: CTL - Meriden, CT

LABORATORY SAMPLE PREPARATION REQUIRED

None ☐ Filter ☐ Adjust pH to _____ Priority ☐
Other

ANALYSES REQUIRED

Parameters	Sample Number				
pH					
Ag					
Al					
As					
Ba					
Cd					
CN-A					
CN-T					
Cr^{+6}					
Cr-T					
Cu					
Fe-D					
Hg					
Na					
Ni					
Pb					
Se					
Sp. Cond.					
TDS					
Zn					

Parameters	Sample Number 1	2	3	4	5
TPH 418.1 ✓	X	X	X	X	X
TOC					
TOX					
STD Water					
Total Coliform					
Fluoride					
Chloride					
8010/601					
8015					
8020/602					
8020 + MTBE					
8080					
8100					
8 TCLP Metals					
602+MTBE	X	X	X	X	X

Remarks: TPH is adjusted with H_2SO_4

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№01356

HRP Associates, Inc.
167 New Britain Avenue
Plainville, CT 06062
Phone: 203-793-6899
Fax: 203-793-6871

HRP

CHAIN OF CUSTODY

Sheet 2 of 3
Job Number NAV-0028.FE task 7
Project Manager RHL

Place & Address of Collection: Dolphin Mart, Groton, CT
Samplers Name (Signature): Christopher J. Lattre
Assistant (Witness)(Signature):

Sample Number	Sample Location	Container Type	Total Volume	Preservative	Date	Time	Sample Type: Water	Soil	Air	Waste	Remarks
6	WE-4B	VOA, G	1120mL	ICE	10-22-93		X				
7	WE-5	VOA, G	1120mL				X				
8	WE-6	VOA G,P	2120mL				X				
9	OBG-8A	VOA, G	1120mL				X				
10	OBG-9A	VOA, G	1120mL				X				

Relinquished By (Signature): Christopher J. Lattre — Received By (Signature): M. McMahon — Date 10/22/93 — Time 3:00
Relinquished By (Signature): — Received By (Signature): — Date: — Time:
Name & Address of Laboratory: CTL - Meriden, CT

LABORATORY SAMPLE PREPARATION REQUIRED

None ☐ Filter ☐ Adjust pH to _____ Priority ☐
Other: prep. as necessary WE-6 for Ca, Mn, Fe by Dissolved

ANALYSES REQUIRED

Parameters	Sample Number				
			8		
pH					
Ag					
Al					
As					
Ba					
Cd					
CN-A					
CN-T					
Cr^{+6}					
Cr-T					
Cu					
Fe-D ✓			X		
Hg					
Na					
Ni					
Pb					
Se					
Sp. Cond.					
TDS					
Zn					

Parameters	Sample Number: 6	7	8	9	10
TPH 418.1 ✓	X	X	X	X	X
TOC					
TOX					
STD Water					
Total Coliform					
Fluoride					
Chloride					
8010/601					
8015					
8020/602					
8020 + MTBE					
8080					
8100					
8 TCLP Metals					
602 + MTBE	X	X	X	X	X

Remarks: Sample 8 - WE-6 - Ca, Mn, Fe - Dissolved
TPH is adjusted with H_2SO_4

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№ 01357

HRP Associates, Inc.
167 New Britain Avenue
Plainville, CT 06062
Phone: 203-793-6899
Fax: 203-793-6871

HRP

CHAIN OF CUSTODY

Sheet 3 of 3
Job Number NAV-0028.FE TASK 7
Project Manager RHL

Place & Address of Collection: Dolphin Mart, Groton, CT
Samplers Name (Signature): [signature]
Assistant (Witness)(Signature):

Sample Number	Sample Location	Container Type	Total Volume	Preservative	Date	Time	Sample Type: Water	Soil	Air	Waste	Remarks
11	HRP-10	VOA, G	1120ml	ICE	10-22-93		X				
12	HRP-11	↓	↓	↓	↓		X				
13	EQ-1	↓	↓	↓	↓		X				
14	P-1B	↓	↓	↓	↓		X				

Relinquished By (Signature): [signature] — Received By (Signature): M. McMahon — Date 10/22/93 — Time 3:30
Relinquished By (Signature): — Received By (Signature): — Date — Time
Name & Address of Laboratory: CTL - Meriden, CT

LABORATORY SAMPLE PREPARATION REQUIRED

None ☐ Filter ☐ Adjust pH to _____ Priority ☐
Other

ANALYSES REQUIRED

Parameters	Sample Number					Parameters	Sample Number 11	12	13	14	
pH						TPH 418.1	X	X	X	X	
Ag						TOC					
Al						TOX					
As						STD Water					
Ba						Total Coliform					
Cd						Fluoride					
CN-A						Chloride					
CN-T						8010/601					
Cr^{+6}						8015					
Cr-T						8020/602					
Cu						8020 + MTBE					
Fe-D						8080					
Hg						8100					
Na						8 TCLP Metals					
Ni						602 + MTBE	X	X	X	X	
Pb											
Se											
Sp. Cond.											
TDS											
Zn											

Remarks: TPH is adjusted with H_2SO_4

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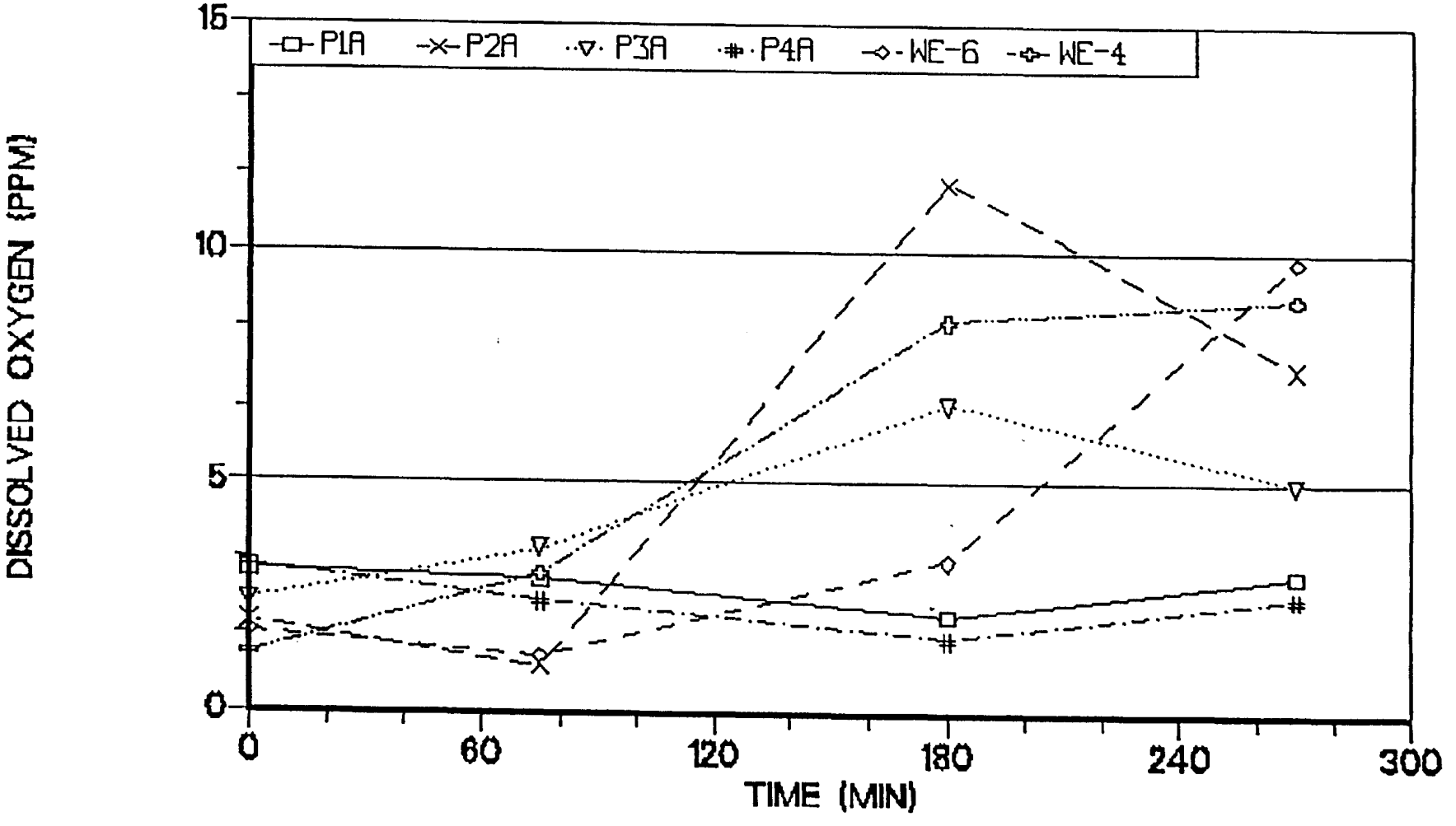
№ 01358

APPENDIX F

Dolphin Mart AS/SVE Data

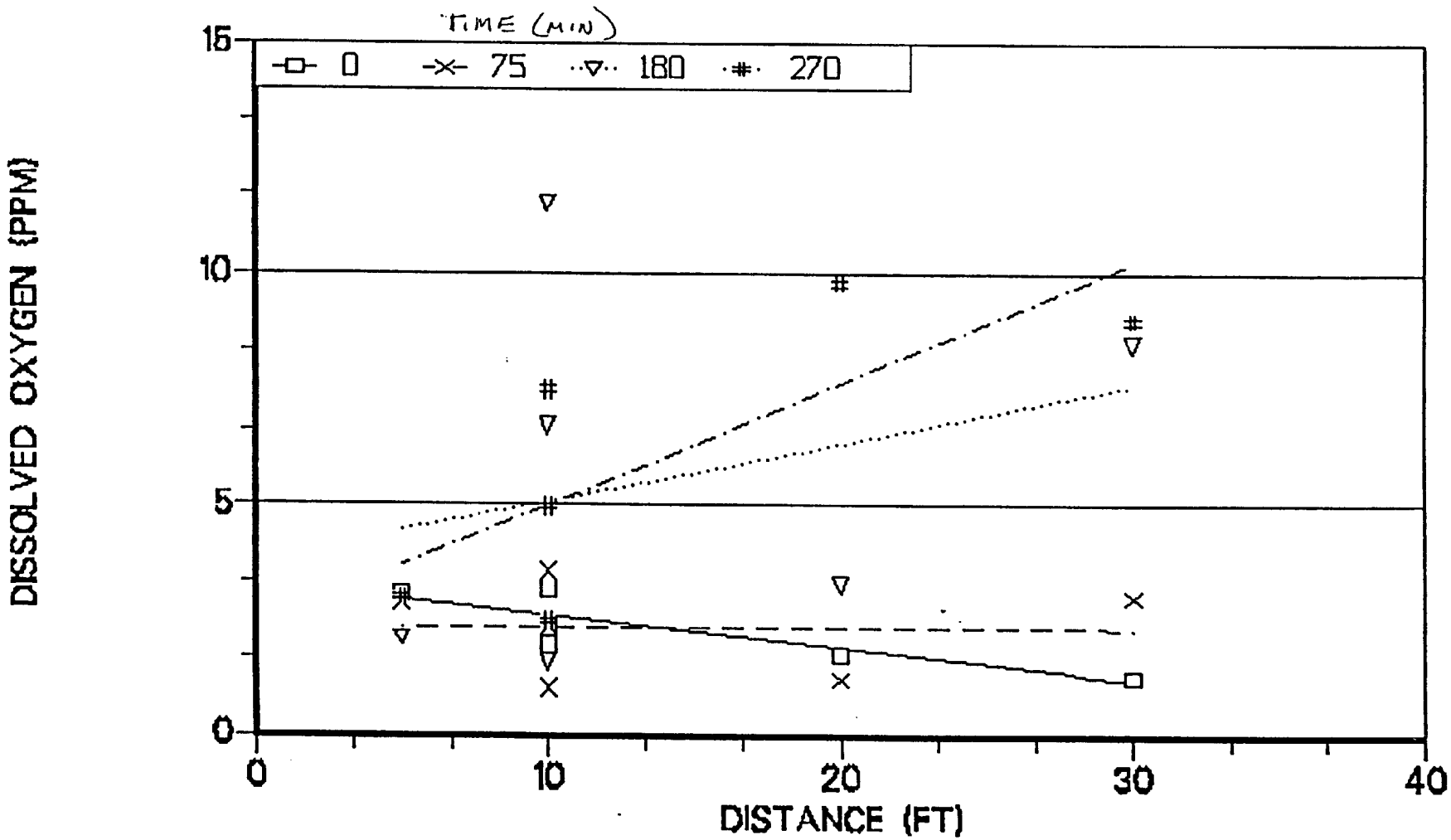
DISSOLVED OXYGEN
A PROBES

DOLPHIN MART



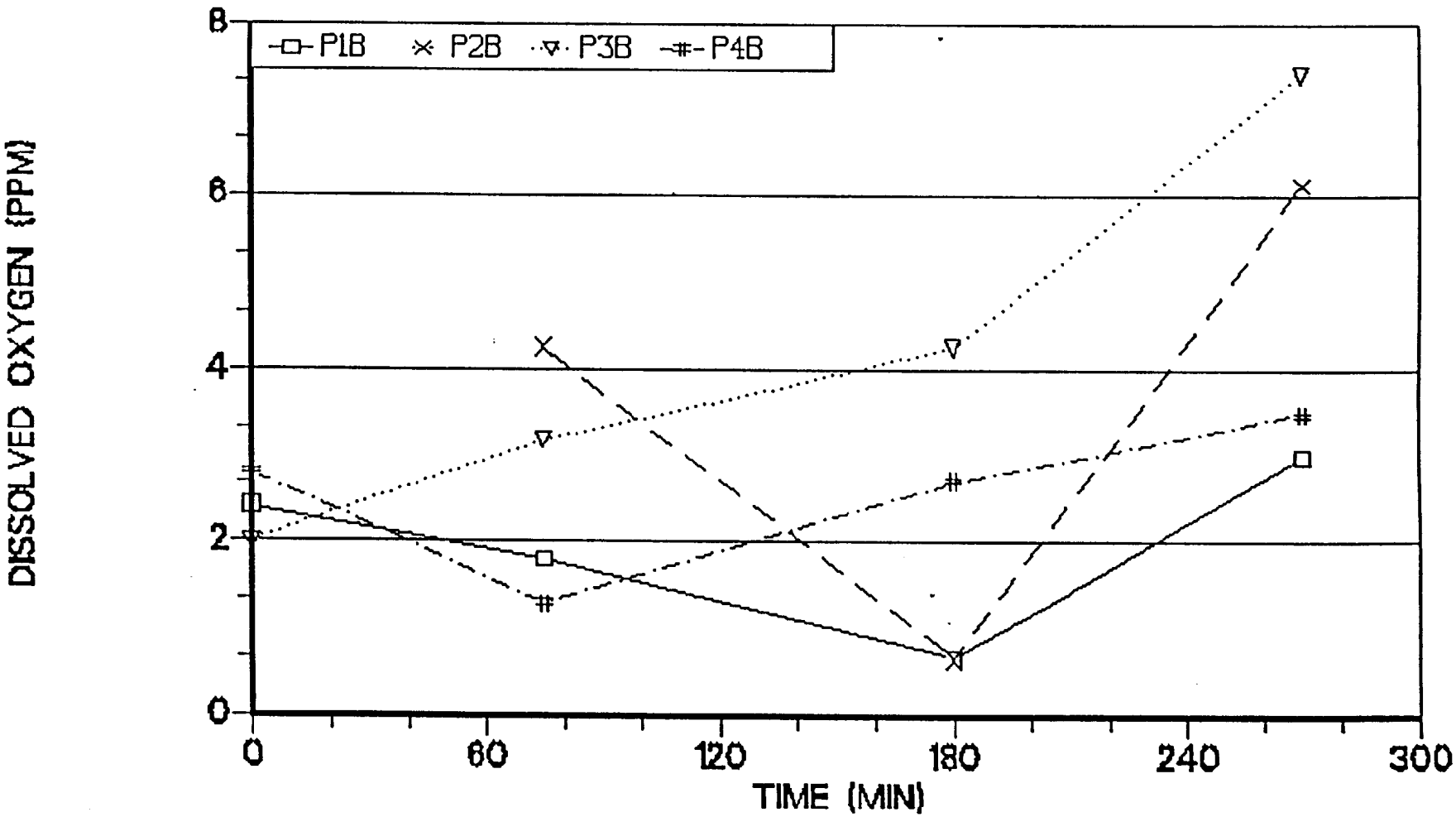
DISSOLVED OXYGEN
A PROBES

DOLPHIN MART



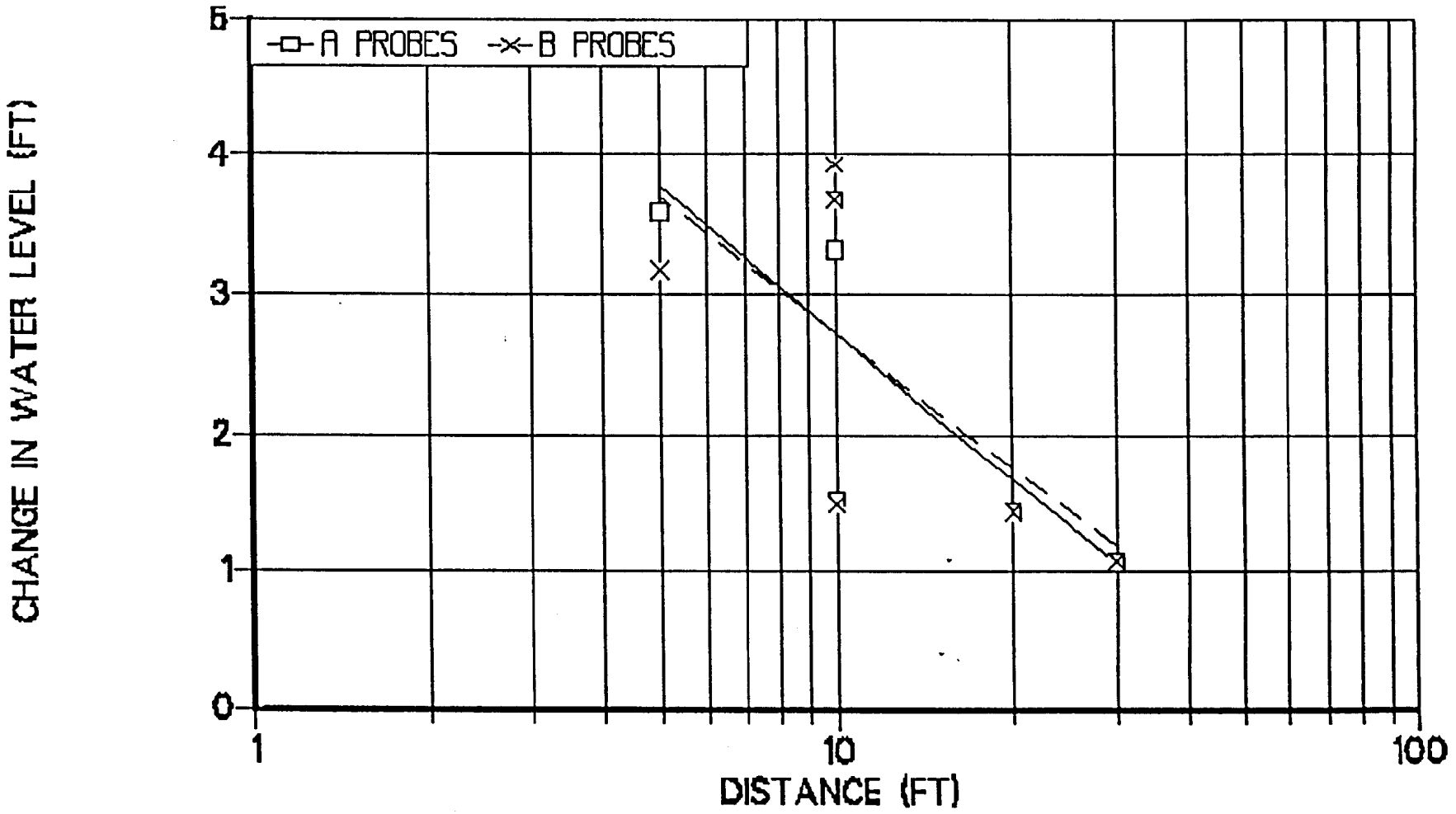
DISSOLVED OXYGEN
B PROBES

DOLPHIN MART



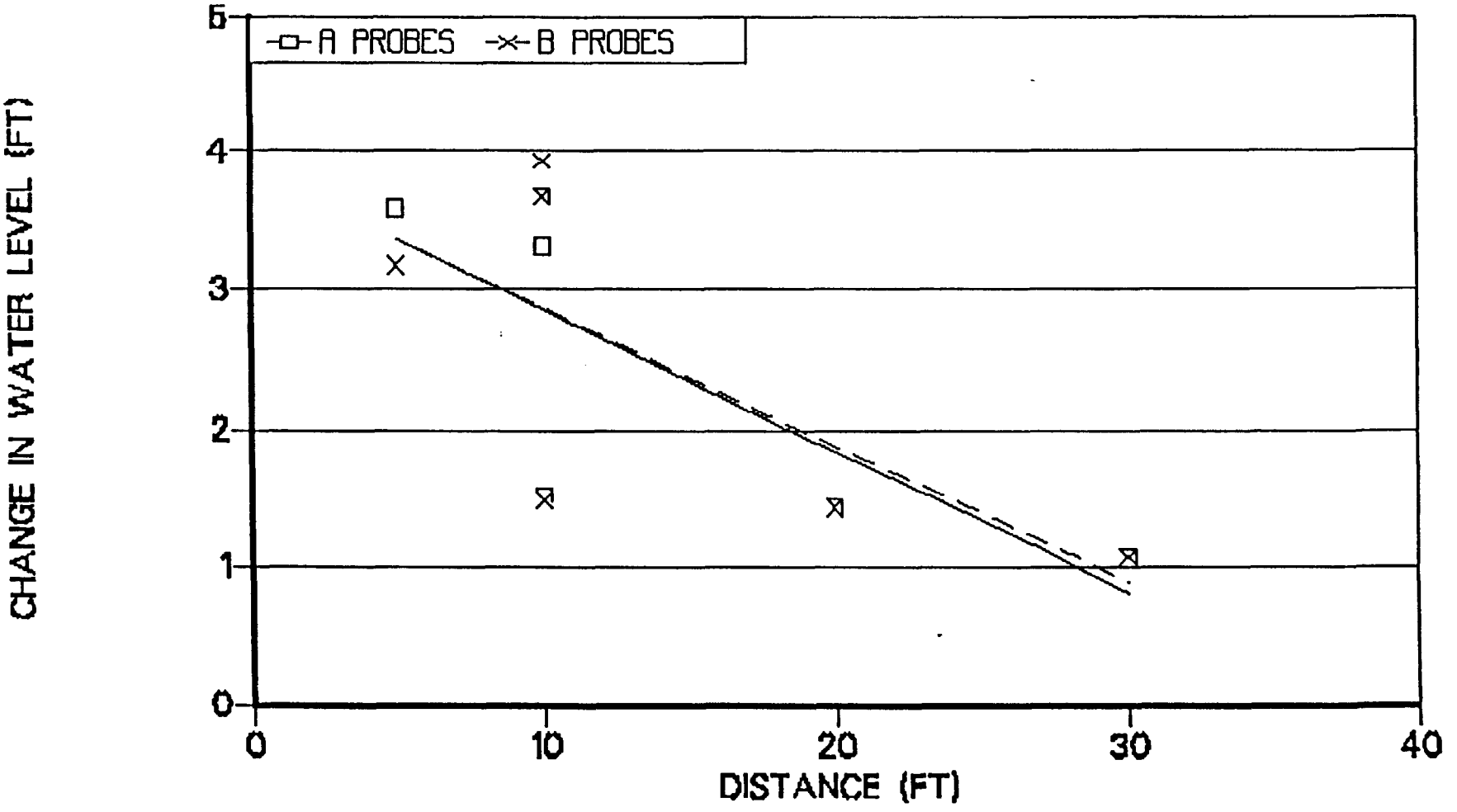
CHANGE IN WATER LEVELS

DOLPHIN MART



CHANGE IN WATER LEVELS

DOLPHIN MART



HRP
ASSOCIATES, INC.
167 New Britain Avenue
Plainville, CT 06062
(203) 793-6899
FAX: (203) 793-6871

PROJECT TITLE	DOLPHIN MART		
PROJECT NUMBER	NAVCOZE.T TASK 15		
SUBJECT	AS/SVE RESULTS		
DESIGNED BPW	DATE 11/29/93	CHECKED	DATE

SVE RADIUS OF INFLUENCE

K @ WE-4 from pump test $= 1.7\times10^{-4}\ ft/s \times \frac{12in}{ft} \times \frac{2.54cm}{in} = 5.2\times10^{-3}\ cm/s$

$$K = k_i\,\gamma/\mu \Rightarrow k_i = \frac{\mu k}{\gamma}$$

$\mu = 0.011404$ poise

$\gamma = \rho g = 0.999099\ gm/cm^3\ (980\ cm/s^2)$

$$k_i = \frac{.011404\ (5.2\times10^{-3})}{.999099\ (980)} = 6\times10^{-8}\ cm^2$$

$Q_{trench} = 25\ cfm \times \frac{12^3 in^3}{ft^3} \times \frac{2.54\ cm^3}{in^3} \times \frac{m}{60s} = 1.18\times10^4\ \frac{cm^3}{s}$

$H = 40ft \times \frac{12in}{ft} \times \frac{2.54cm}{in} = 1219cm$

$P_{pl} = 0.75$ in H_2O vacuum $= 1.01113\times10^6\ gm/cm\cdot s^2$

$$RI = R \Big/ e^{\left[\frac{\pi k_i P_w}{\frac{Q}{H}\mu}\left(1-\left(\frac{P_{atm}}{P_w}\right)^2\right)\right]}$$

$$RI = 152.4 \Big/ e^{\left[\frac{\pi(6\times10^{-8})\,1.0113\times10^6}{\frac{11800}{1219}(1.8\times10^{-4})}\left(1-\left(\frac{1.013\times10^6}{1.01113\times10^6}\right)^2\right)\right]}$$

$$= 228\ cm \times \frac{in}{2.54cm} \times \frac{ft}{12in} = 7.5\ ft$$

HRP
ASSOCIATES, INC.
167 New Britain Avenue
Plainville, CT 06062
(203) 793-6899
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PROJECT TITLE	DOLPHIN MART		
PROJECT NUMBER	NAV0028.FE TASK 15		
SUBJECT	DISCHARGE EMISSIONS		
DESIGNED BFW	DATE 12/6/93	CHECKED	DATE

SVE DISCHARGES & Emission Rate

$$C_{est} = \frac{1\times10^{-6}\ C_{ppm}\ MW}{R\ T} \qquad E = \frac{Q\,C_{est}}{454000}$$

$R = 0.0821\ \ell\ atm/mole\cdot°K$

$T = 298°K$

$$Q = 11800\ \frac{cm^3}{s} \times \frac{\ell}{1000\,cm^3} \times \frac{60\,s}{m} \times \frac{60\,m}{hr} = 42480$$

EMISSIONS AFTER 45 MINUTES

TCA $MW = 133400$ mg, $C_{ppm} = 0.515$

$$C_{est} = \frac{1\times10^{-6}\ (.515)\ 133400}{.0821\ (298)} = 2.8\times10^{-3}\ mg/L$$

$$E_{TCA} = \frac{42480\ (2.8\times10^{-3})}{454000} = 2.6\times10^{-4}\ lb/hr$$

TCE $MW = 131500$ mg $C_{ppm} = .165$

$$C_{est} = \frac{1\times10^{-6}\ (.165)\ 131500}{.0821\ (298)} = 8.8\times10^{-4}\ mg/L$$

$$E_{TCE} = \frac{42480\ (8.8\times10^{-4})}{454000} = 8.3\times10^{-5}\ lb/hr$$

EMISSIONS AFTER 105 MIN

TCA $C_{ppm} = 19.63$

$$C_{est} = \frac{1\times10^{-6}\ (19.63)\ (133400)}{.0821\ (298)} = 0.107$$

$$E_{TCA} = \frac{42480\ (.107)}{454000} = 0.01\ lb/hr$$

TCE $C_{ppm} = 1.55$

$$C_{est} = \frac{1\times10^{-6}\ (1.55)\ 131500}{.0821\ (298)} = 8.3\times10^{-3}\ mg/L$$

$$E = \frac{42480\ (8.3\times10^{-3})}{454000} = 7.8\times10^{-4}\ lb/hr$$

PCE $MW = 166000$ $C_{ppm} = .017$

$C_{est} = 1\times10^{-6}\ (.017)\ 166000 / .0821\ (298) = 1.1\times10^{-4}\ mg/L$

HRP
ASSOCIATES, INC.
167 New Britain Avenue
Plainville, CT 06062
(203) 793-6899
FAX: (203) 793-6871

PROJECT TITLE			
PROJECT NUMBER			
SUBJECT			
DESIGNED	DATE	CHECKED	DATE

EMISSIONS AFTER 120 MINUTES

TCA $C_{ppm} = 22.4$

$$C_{est} = \frac{1\times10^{-6}(22.4)\ 133400}{.0821\ (298)} = 0.122\ mg/L$$

$$E = \frac{42480\ (0.122)}{454000} = 1.1\times10^{-2}\ lb/hr$$

TCE $C_{ppm} = 1.524$

$$C_{est} = \frac{1\times10^{-6}(1.524)\ 131500}{.0821\ (298)} = 8.2\times10^{-3}$$

$$E = \frac{42480\ (8.2\times10^{-3})}{454000} = 7.7\times10^{-4}\ lb/hr$$

PCE $C_{ppm} = .013$

$$C_{est} = \frac{1\times10^{-6}(.013)(166000)}{.0821\ (298)} = 8.8\times10^{-5}$$

$$E = \frac{42480\ (8.8\times10^{-5})}{454000} = 8.3\times10^{-6}\ lb/hr$$

HRP
ASSOCIATES, INC.
167 New Britain Avenue
Plainville, CT 06062
(203) 793-6899
FAX: (203) 793-6871

PROJECT TITLE	DOLPHIN MART		
PROJECT NUMBER	NAV0028.FE TASK 15		
SUBJECT	EMISSION RATES DURING AS/SVE		
DESIGNED BPW	DATE 12/9/93	CHECKED	DATE

TCA $C_{ppm} = 107.9$

$$C_{est} = \frac{1\times10^{-6}(107.9)\,133400}{.0821\,(298)} = 0.588$$

$$E = \frac{42480\,(0.588)}{454000} = 5.5\times10^{-2}$$

TCE $C_{ppm} = 1.627$

$$C_{est} = \frac{1\times10^{-6}(1.627)\,131500}{.0821\,(298)} = 8.7\times10^{-3}$$

$$E = \frac{42480\,(8.7\times10^{-3})}{454000} = 8.1\times10^{-4}\ lb/hr$$

PCE $C_{ppm} = 0.1$

$$C_{est} = \frac{1\times10^{-6}(.1)\,166000}{.0821\,(298)} = 6.8\times10^{-4}$$

$$E = \frac{42480\,(6.8\times10^{-4})}{454000} = 6.4\times10^{-5}$$

Bz $MW = 78{,}100$ mg $C_{ppm} = 0.317$

$$C_{est} = \frac{1\times10^{-6}(.317)\,78100}{.0821\,(298)} = 1\times10^{-3}$$

$$E = 42480\,(1\times10^{-3})/454000 = 9.5\times10^{-5}\ lb/hr$$

TOL $MW = 92100$ $C_{ppm} = 3.198$

$$C_{est} = 1\times10^{-6}(3.198)\,92100/.0821\,(298) = 1.2\times10^{-2}$$

$$E = 42480\,(1.2\times10^{-2})/454000 = 1.1\times10^{-3}\ lb/hr$$

Eth Bz $MW = 106200$ $C_{ppm} = .154$

$$C_{est} = 1\times10^{-6}(.154)\,106200/.0821\,(298) = 6.7\times10^{-4}$$

$$E = 42480\,(6.7\times10^{-4})/454000 = 6.3\times10^{-5}\ lb/hr$$

Xy $MW = 106200$ $C_{ppm} = 1.775$

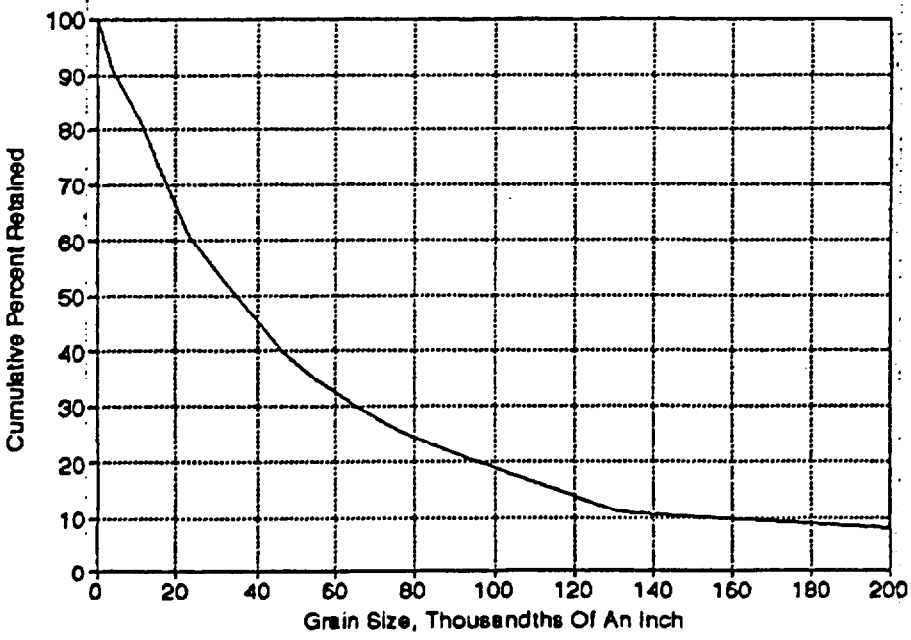
$$C_{est} = 1\times10^{-6}(1.775)\,106200/.0821\,(298) = 5.5\times10^{-3}$$

APPENDIX G

Dolphin Mart Recovery Well Design

Sieve Analysis for HRP Associates
October 22, 1993
Sample identified as P-4; 8' to 10'

Size In Inches	Wt.	% Ret.	% passing
0.525	0	0.0	100
0.263	16	5.5	94.5
0.131	32	10.9	89.1
0.093	61	20.8	79.2
0.078	73	24.9	75.1
0.065	88	30.0	70
0.055	102	34.8	65.2
0.046	117	39.9	60.1
0.0328	152	51.9	48.1
0.0232	178	60.8	39.2
0.0164	212	72.4	27.6
0.0116	237	80.9	19.1
0.0082	250	85.3	14.7
0.0041	265	90.4	9.6
Bottom Pan	293	100.0	0

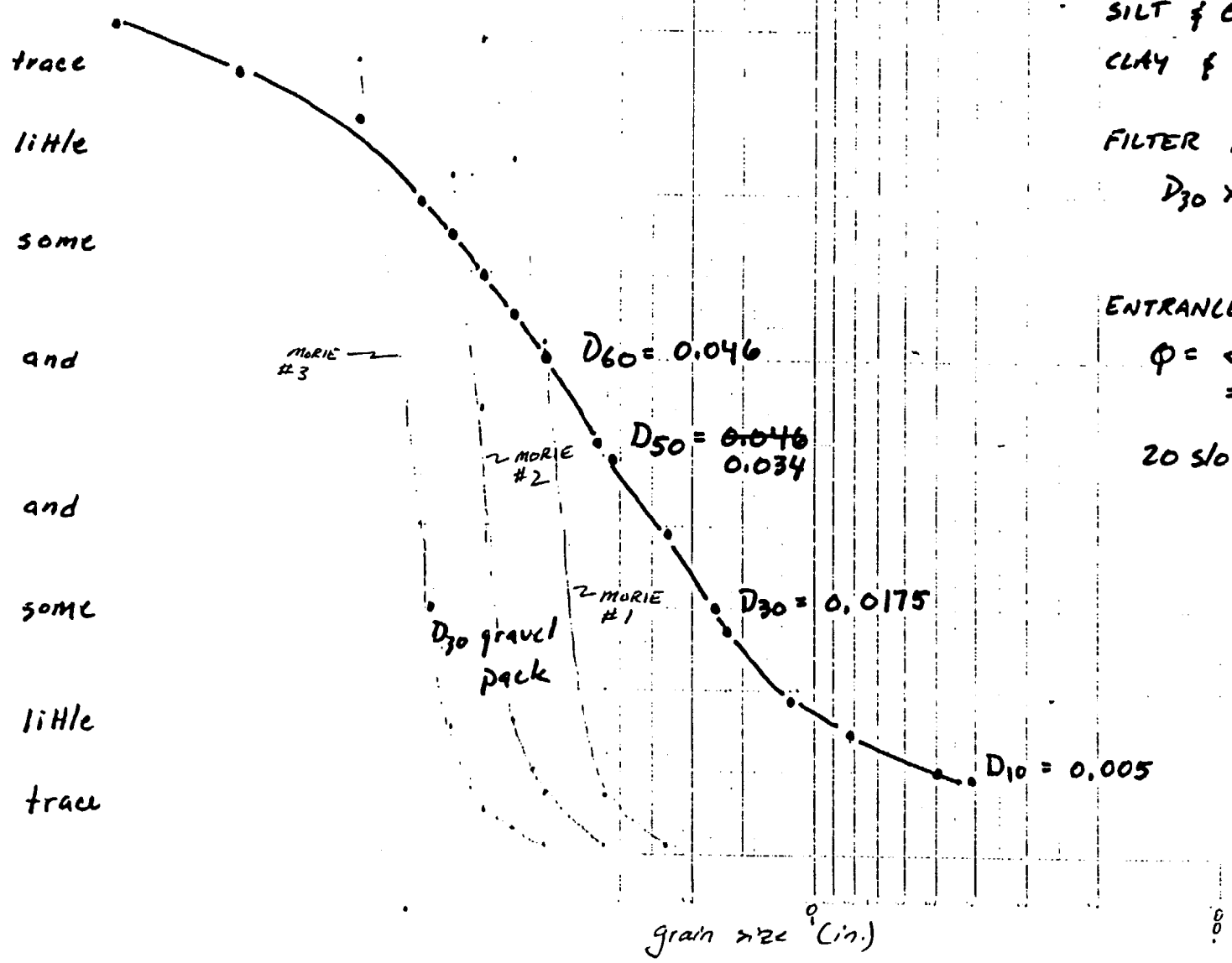


Sieve Analysis By S.B. Church Co.

EFFECTIVE GRAIN SIZE (D_{10}) = 0.005 IN

Avg. PARTICLE SIZE (D_{50}) = 0.034 IN

UNIFORMITY COEFFICIENT $\left(\frac{D_{60}}{D_{10}}\right) = \frac{.046}{.005} = 9.2$



DESCRIPTION: POORLY SORTED, WELL GRADED, VERY COARSE SAND ~~WITH~~ AND COARSE SAND WITH SOME MEDIUM SAND, SOME GRANULE, LITTLE FINE SAND, TRACE PEBBLE, TRACE SILT & CLAY. NOTE CLUMPS OF CLAY & SILT OBSERVED IN SAMPLE

FILTER PACK DESIGN:

$D_{30} \times 5 = .0175(5) = 0.0875$

ENTRANCE VELOCITY

$Q = <1$ to 5 gpm

$= .002$ to $.01 \frac{ft^3}{s}$

20 slot $A = 41 \frac{in^2}{ft} \times 5 ft \times \frac{ft^2}{144 in^2} = 1.42 ft^2$

$V = \frac{.002 \frac{ft^3}{s}}{1.42 ft^2}$ to $\frac{.01 \frac{ft^3}{s}}{1.42 ft^2}$

$= 0.001 \frac{ft}{s}$ to $0.007 \frac{ft}{s}$

20 slot well screen w/ MORIE #2 gravel

APPENDIX H

Dolphin Mart Pump Test Results

HRP
ASSOCIATES, INC.
167 New Britain Avenue
Plainville, CT 06062
(203) 793-6899
FAX: (203) 793-6871

PROJECT TITLE			
PROJECT NUMBER			
SUBJECT			
DESIGNED	DATE	CHECKED	DATE

RW-1:

$\beta = 0.03$
$W(u_A, \beta) = 1$
$u_A = 1$
$s = 1.75$
$t = 0.44$
$Q = .1915\ ft^3/m$
$D = 11$

$$kD = \frac{.1915}{4\pi(1.75)}(1) = 0.0087\ \frac{ft^2}{min}$$

$$k = 7.9\times10^{-4}\ ft/m = 1.3\times10^{-5}\ ft/s$$

WE-4:

$\beta = 0.2$
$W(u_A, \beta) = 1$
$u_A = 1$
$S = .17$
$t = 10.6$
$r = 57\ ft$
$D = 8.9$

$$kD = \frac{.1915}{4\pi(.17)} = 0.089\ ft^2/min$$

$$k = 7.\times10^{-2}\ ft/m = 1.7\times10^{-4}\ ft/s$$

$$S = \frac{4(.089)10.6}{57^2} = 1.2\times10^{-3}$$

WE-5:

$\beta = 0.2$
$W(u_A, \beta) = 1$
$u_A = 1$
$s = .24$
$t = 6\ min$
$r = 86\ ft$
$D = 7.06$

$$kD = \frac{.1915}{4\pi(.24)} = 0.063\ ft^2/min$$

$$k = 8.9\times10^{-3}\ ft/m = 1.5\times10^{-4}\ ft/s$$

$$S = \frac{4(.063)6}{86^2} = 2\times10^{-4}$$

WE-6:

$\beta = 0.1$
$W(u_A, \beta) = 1$
$u_A = 1$
$S = 0.8$
$t = 1.8$
$r = 5$
$D = 11.3$

$$kD = \frac{.1915}{4\pi(.8)} = 0.019\ ft^2/min$$

$$k = 1.7\times10^{-3}\ ft/min = 2.8\times10^{-5}\ ft/s$$

$$S = \frac{4(.019)1.8}{5^2} = 5.5\times10^{-3}$$

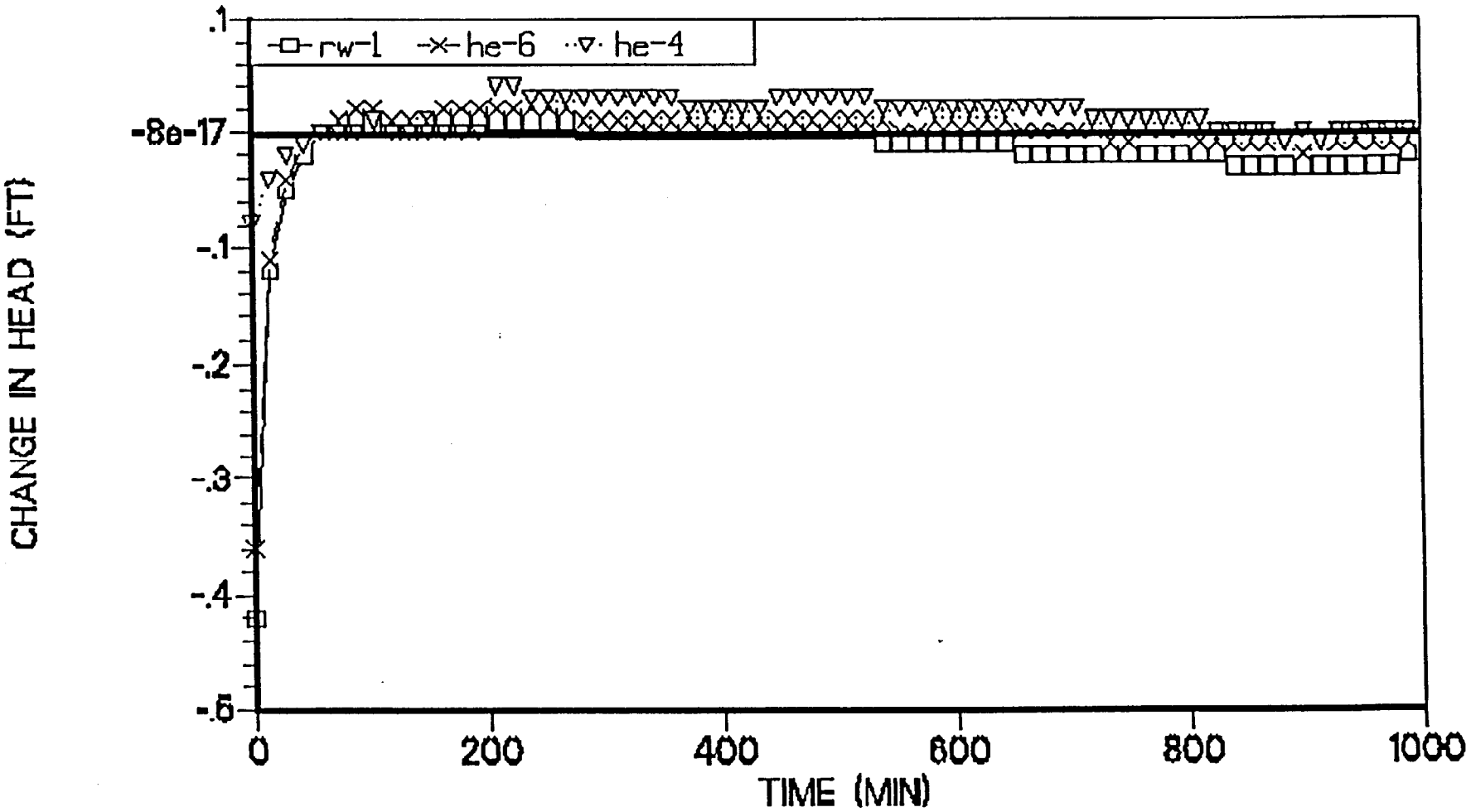
P3b:

$\beta = .06$
$W(u_A, \beta) = 1$
$u_A = 1$
$S = 0.28$

$$kD = \frac{.1915}{4\pi(.28)} = 0.0544\ ft^2/min$$

WATER LEVEL TRENDS

DOLPHIN MART
GROTON,CT



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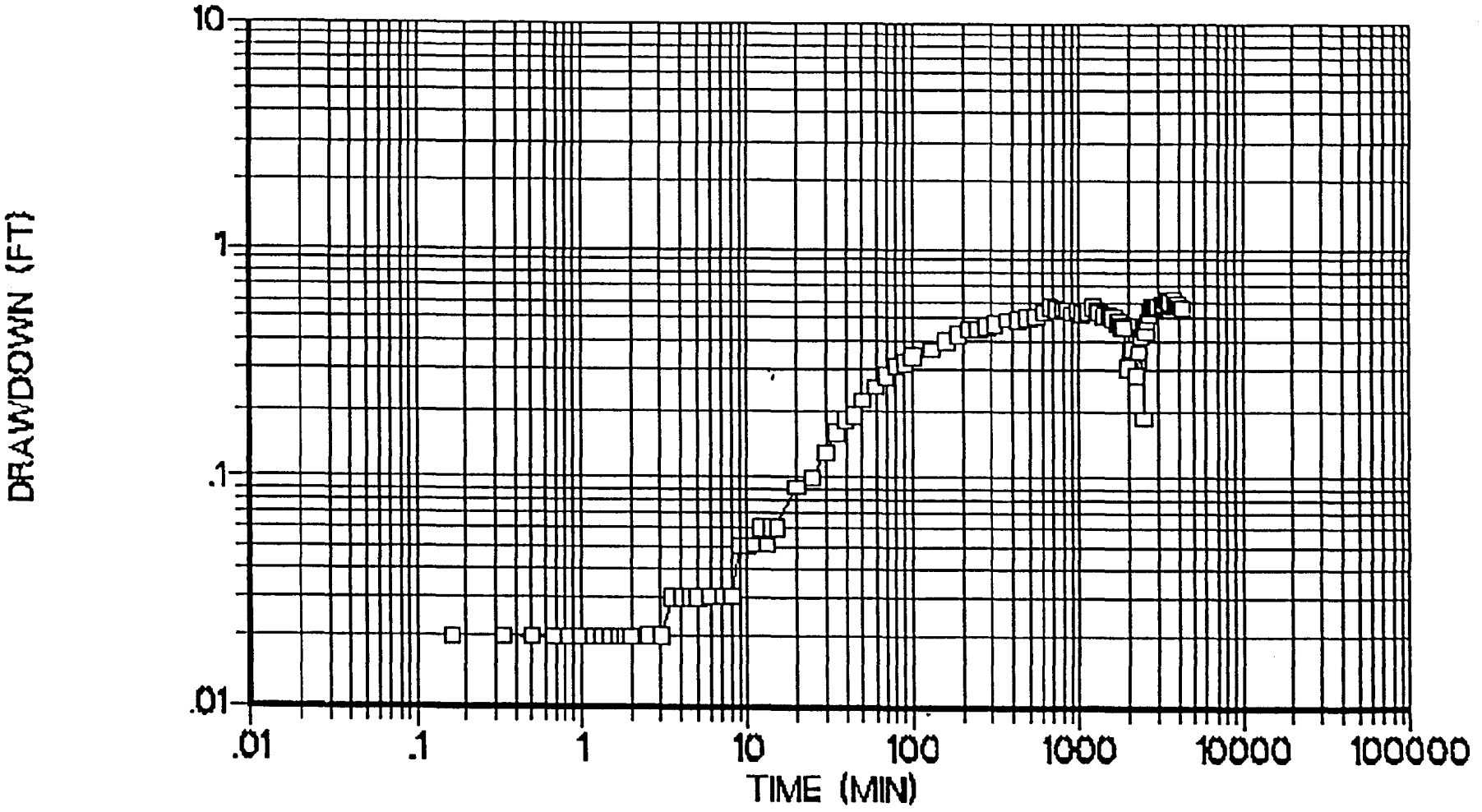

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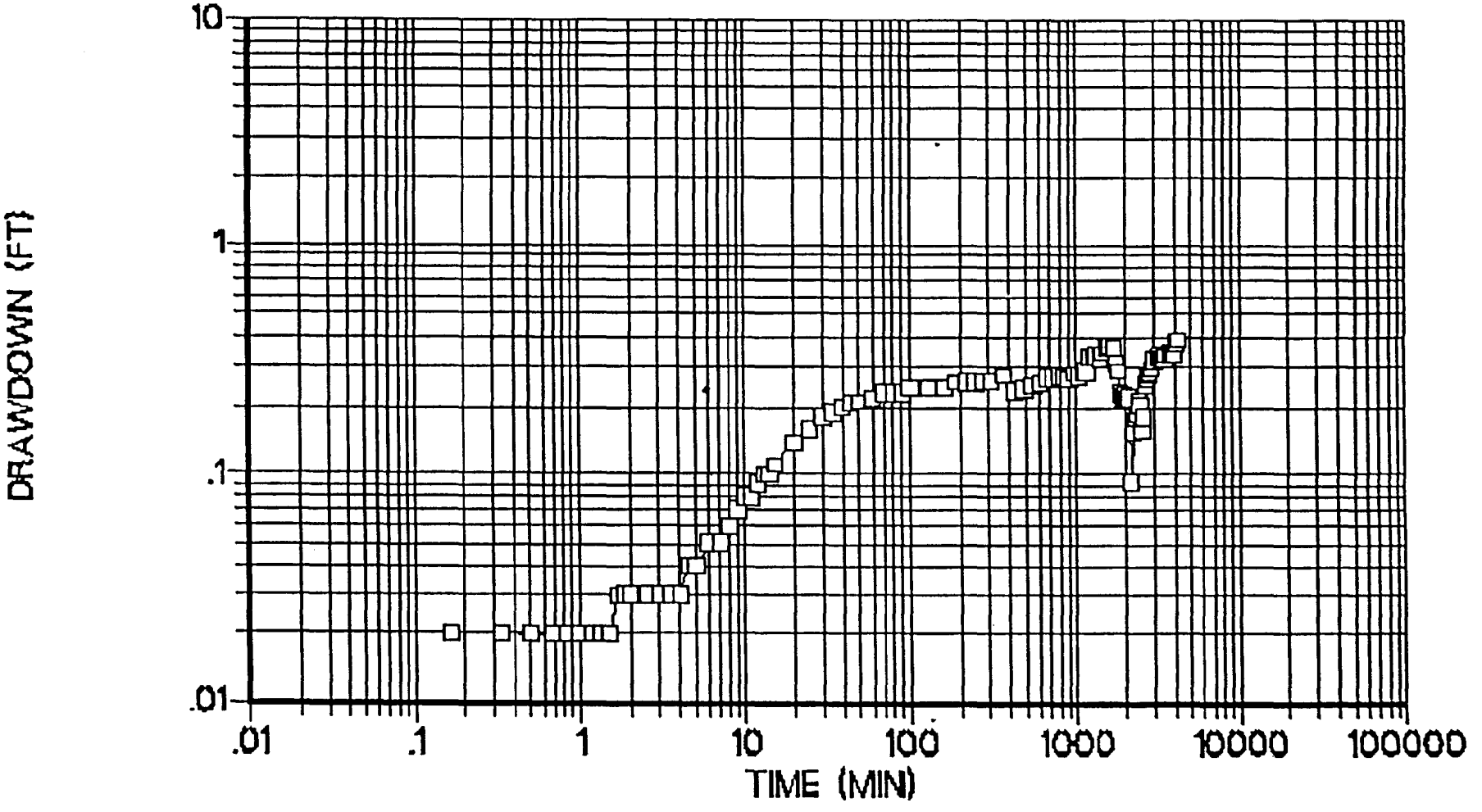

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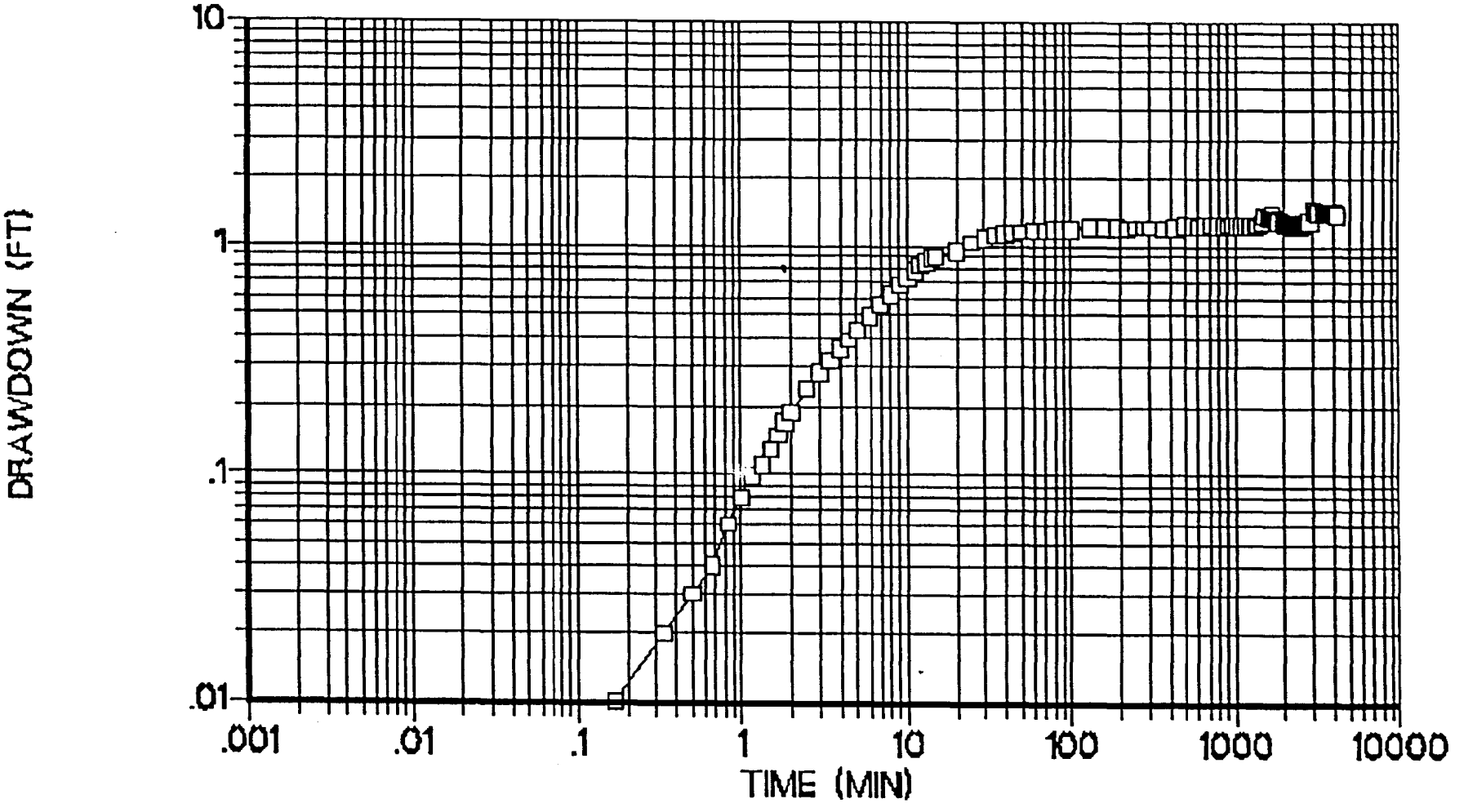

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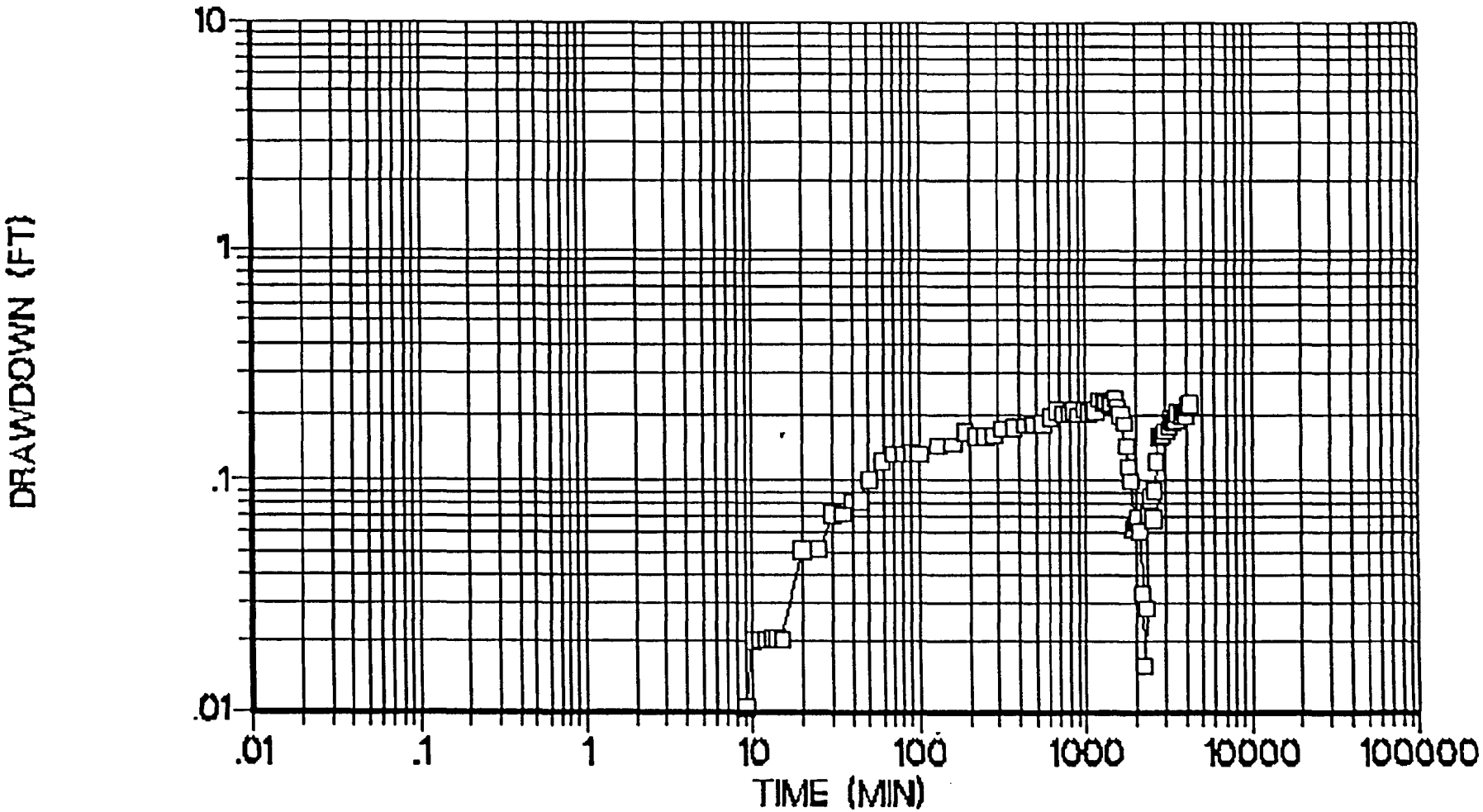
GROTON, CT



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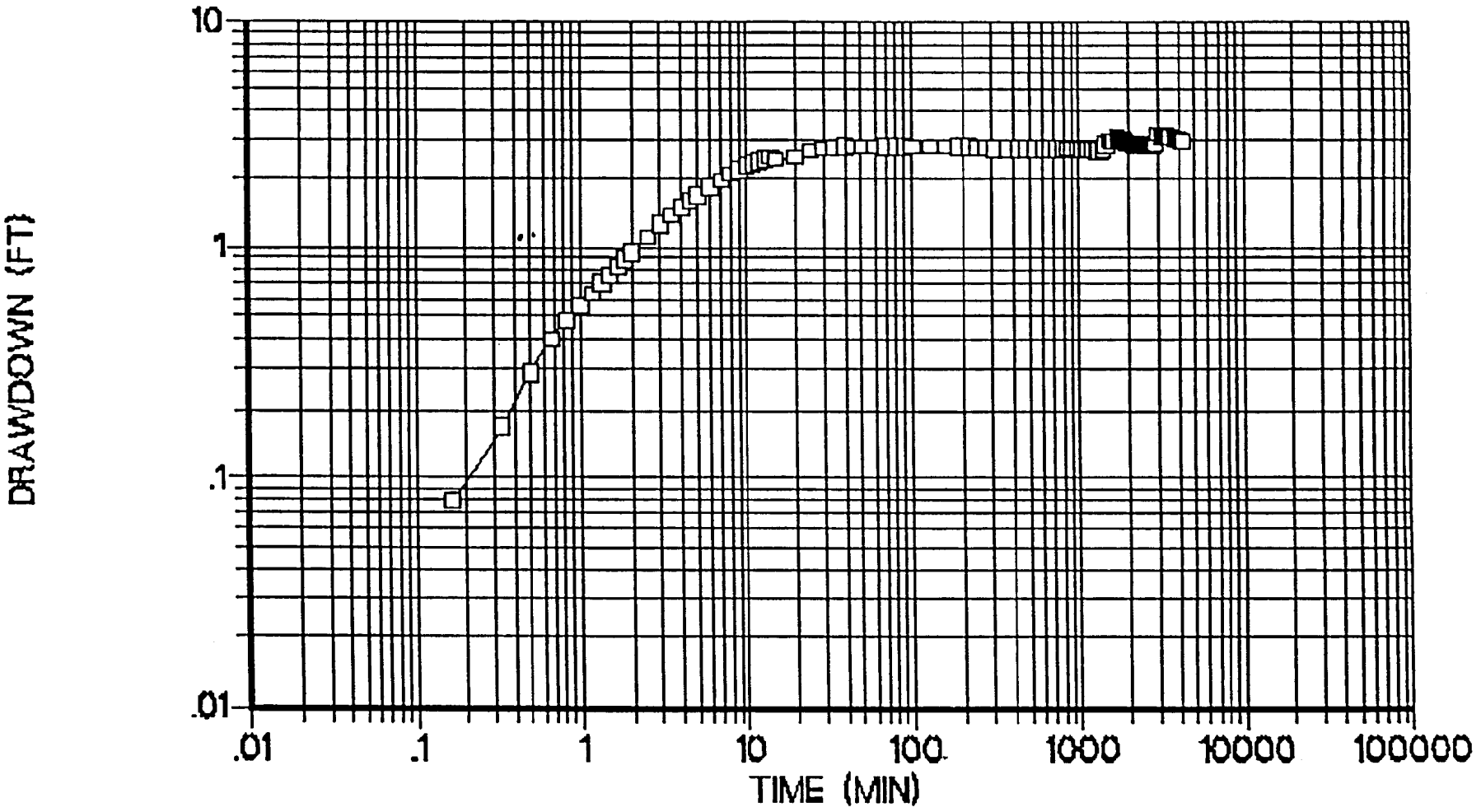
DOLPHIN MART
GROTON, CT



APPENDIX I

Dolphin Mart Discharge Permit and Discharge Analysis Results

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION

AUTHORIZATION
APPLICANT INSTRUCTIONS

APPLICATION REQUIREMENTS:

Any person who requests an Authorization must submit to the Commissioner adequate information to allow him to decide if the necessary criteria indicated in the corresponding fact sheets have been met.

If indicated by a check in the parentheses, the following information must be completed, signed, and submitted to the Department of Environmental Protection, Bureau of Water Management, Central Processing Unit, ("DEP/BWM/CPU") at this address:

Attention: Authorization Coordinator
Bureau of Water Management
CT Department of Environmental Protection,
PERD, Central Processing Unit
79 Elm Street, P.O. Box 5066,
Hartford, CT. 06102-5066

( ) (A) The attached site information form.
Attach additional sheets if necessary.

( ) (B) The attached certification of compliance form

( ) (C) A site plan showing all pertinent information associated with the specific discharge activity. (i.e., include the location of all recovery or interceptor wells for groundwater recovery systems and/or pump tests.)

( ) (D) The attached "Approval" form-only for sanitary sewer discharge.

( ) (E) Initial screening results on attached form.
INITIAL SCREENING: PRIOR to initiating a discharge in accordance with the Authorization, the water to be discharged must be tested, in its raw state, for parameters that are known or suspected to be present in the discharge, including, but not limited to, the following (indicated by a check in the parentheses):

	Parameter
( )	Total Volatile Organics, EPA Method 8010 & 8020
( )	Methyl tert-butyl ether (MTBE)
( )	Oil and Grease - HC fraction
( )	pH
( )	Total Suspended Solids (TSS)
( )	Biochemical Oxygen Demand (5 Day)
( )	Chemical Oxygen Demand
( )	Total Organic Carbon

( ) Ammonia(as Nitrogen)
( ) Phosphorus (Total)
( ) Maximum Temperature (Winter and Summer)
( ) Toxic Metals, Cyanides, Phenols
( ) GC/MS Fraction Acid Compounds
( ) Base Neutral Compounds
( ) Pesticides
( ) Other Substances

( ) (F) An outline of, or plans and specifications on the treatment system to be installed if required.

( ) (G) A P.E. Certification

( ) (H) A fee of _____, paid by certified check or money order, made payable to the Department of Environmental Protection, Bureau of Water Management, (note: Emergency Authorization).

Upon review of submittals a P.E. Certification and a fee may be required, if not already checked above.

Upon approval of submittals, a signed Authorization will be mailed to the discharger allowing the initiation of the discharge.

AUTHORIZATION

INITIAL SCREENING OR SUBSEQUENT MONITORING RESULTS
(Attach copy of laboratory results)

MAIL TO: Attention: Authorization Coordinator (CPU)
(for Initial Screening) or
DMR Processing (for subsequent monitoring)
Bureau of Water Management, PERD
CT Department of Environmental Protection
79 Elm Street, P.O. Box 5066,
Hartford, CT. 06102-5066

FACILITY ID._____ APPLICATION NO. _____ AUTHORIZATION NO. _____

NAME OF DISCHARGER: On-Site Treatment Technologies
SITE NAME & ADDRESS: Dolphin Mart Building No 1005 Sailfish Lane
Groton, CT 06

DISCHARGE LOCATION: Sanitary sewer
(Name of water body)

WATER QUALITY CLASSIFICATION: N/A

Sample Date: 10/22/93
Number of hours of discharge for each day of sample collection: N/A
Check one: INITIAL SCREENING OF RAW WATER ✓ SUBSEQUENT MONITORING_____

Reporting of the following parameters is required. Requirements for reporting a specific parameter are indicated on the Authorization form. For initial screening, report additional parameters that are known or suspected to be present.

POLLUTANT PARAMETER	RESULTS (w/units)	LIMITS
Maximum Daily Flow	---	N/A
Total Daily Flow	N/A	---
Instantaneous Flow (at time of grab sample collection)	N/A	N/A
Total Volatile Organics EPA Method 8010 & 8020	4320 ppb	10,000 ppb
Oil & Grease - HC Fraction	5 ppm	100 ppm
MTBE	83 ppb	1000 ppb

AUTHORIZATION-SITE INFORMATION FORM

FACILITY ID._____ APPLICATION NO._____ AUTHORIZATION NO._____

SITE OWNER U.S. Navy Subbase
OWNER ADDRESS New London, CT

DISCHARGER NAME On-site Treatment
DISCHARGER ADDRESS P.O Box 291, Plainville, CT 06062-0291
& PHONE (203) 793-6899

SITE NAME Dolphin Mart
SITE ADDRESS Building No. 1005, Sailfish Lane, US Naval Subbase
Groton, CT 06349

Indicate the point of discharge, either "sanitary sewer" or the name of a surface water body. If discharge is to a storm sewer, the water body to which the storm sewer discharges must be specified. For sanitary sewer discharges the attached "Approval" form must be signed by the Municipality and submitted with this Authorization.

DISCHARGE LOCATION Sanitary Sewer
ACTIVITY PRODUCING DISCHARGE aquifer pumptest
PROPOSED DISCHARGE RATE 1-5 GPM 1440-7200 GPD
TYPE OF CONTAMINATION aromatic volatile organics, MTBE
VOLUME OF PRODUCT LOST (groundwater contamination or spills only) unknown
DATE DISCHARGE WILL BEGIN 11/15/93 DATE DISCHARGE WILL END 11/18/93
WATER QUALITY CLASSIFICATION (receiving groundwater or surface water body) NA

Are there any public or private drinking water supply wells located within a 1/4 mile radius of the contaminated area? (Groundwater contamination only)

_____

I certify under penalty of law that I have read and understand all conditions of the authorization issued for the discharge described in this site information form. I have personally examined and am familiar with the information submitted in this document and all attachments and certify that based on reasonable investigation, including my inquiry of those individuals responsible for obtaining the information, the submitted information is true, accurate and complete to the best of my knowledge and belief, and I understand that any false statement made in this document or its attachments may be punishable as a criminal offense.

11-8-93
Date

RH Leach
Name: R.H. LEACH
Title: PRES. ON SITE TREATMENT TECHNOLOGIE

Mail original to:
Bureau of Water Management, PERD, Central Processing Unit
CT Department of Environmental Protection,
79 Elm Street, P.O. Box 5066, Hartford, CT. 06102-5066

AUTHORIZATION

CERTIFICATION OF COMPLIANCE

Site Name & Address: Dolphin Mart
Building No. 1005 Sailfish Lane
Groton, CT 06349

"I certify that in my professional judgement proper operation and maintenance of any systems installed to treat the discharges(s) which are described in the site information form dated 11/8/93 and submitted to the Commissioner for discharges by [INSERT NAME OF DISCHARGER HERE On-Site Treatment Technologies] at [INSERT ADDRESS/LOCATION OF DISCHARGE HERE Dolphin Mart, Building No. 1005 Sailfish Lane Groton Connecticut] will insure that all effluent limitations and other conditions in this authorization for the discharge are met, or if there is no treatment system for such discharges(s), that the discharge(s) will meet all effluent limitations and conditions of this authorization without treatment. This certification is based on my review of engineering reports and plans and specifications describing (1) the proposed activities and (2) any proposed treatment system for the wastewaters to be discharged. I am aware that there are significant penalties for false statements in this certification, including the possibility of fine and imprisonment for knowingly making false statements."

R H Leach
Signature of Discharger

11-8-93
Date

ON SITE TREATMENT TECHNOLOGIES
R.H. LEACH
Print Name of Discharger

Mail original to:
Attention: Authorization Coordinator
Bureau of Water Management
CT Department of Environmental Protection,
PERD, Central Processing Unit
79 Elm Street, P.O. Box 5066,
Hartford, CT. 06102-5066

AUTHORIZATION

PROFESSIONAL ENGINEER CERTIFICATION

Site Name & Address: Dolphin Mart
Building No. 1005 Sailfish Lane
Groton, CT 06349

"I certify that in my professional judgement proper operation and maintenance of any systems installed to treat the discharges(s) which are described in the site information form dated 11/8/93 and submitted to the Commissioner for discharges by [INSERT NAME OF DISCHARGER HERE On-site Treatment Technologies] at [INSERT ADDRESS/LOCATION OF DISCHARGE HERE Dolphin Mart, Building No. 1005, Groton Connecticut] will insure that all effluent limitations and other conditions in this authorization for the discharge are met, or if there is no treatment system for such discharges(s), that the discharge(s) will meet all effluent limitations and conditions of this authorization without treatment. This certification is based on my review of engineering reports and plans and specifications describing (1) the proposed activities and (2) any proposed treatment system for the wastewaters to be discharged. I am aware that there are significant penalties for false statements in this certification, including the possibility of fine and imprisonment for knowingly making false statements."

Signature of Professional Engineer

Date 11/8/93

MARK C. POSSIDENTO
Print Name of Professional Engineer

10368
P.E. Number

STATE OF CONNECTICUT
MARK C. POSSIDENTO
NO. 10368
REGISTERED PROFESSIONAL ENGINEER

Affix P.E. Stamp Above

Mail original to:
Attention: Authorization Coordinator
Bureau of Water Management
CT Department of Environmental Protection,
PERD, Central Processing Unit
79 Elm Street, P.O. Box 5066,
Hartford, CT. 06102-5066

AUTHORIZATION

INITIAL SCREENING OR SUBSEQUENT MONITORING RESULTS
(Attach copy of laboratory results)

I certify that I have personally examined and am familiar with the information submitted in this document and all attachments and certify that based on reasonable investigation, including my inquiry of those individuals responsible for obtaining the information, the submitted information is true, accurate and complete to the best of my knowledge and belief, and I understand that any false statement made in this document or its attachments may be punishable as a criminal offense. I certify that all discharge limitations of this Authorization have been met, otherwise if a violation of any of the discharge limits occurs, the discharge will be stopped immediately and written notification will be sent to the DEP/BWM/CPU within twenty-four hours. In this situation, the discharge shall not be re-started without prior approval of the Commissioner.

11/8/93
Date

R.H. Leach
Name: R.H. LEACH
Title: PRESIDENT
ON SITE TREATMENT TECH.

cc: Groundwater Section, 79 Elm St., P.O.Box 5066, Hartford, CT 06102-5066 (groundwater contamination only)
cc: Town Water Pollution Control Authority (sewer discharges only)
cc: Town Engineer (surface water discharges)

Date Samples Received : 10-22-93

Client Name... : ERP Associates Inc.	CTL Lab No. 103-632-13
Date of Report : 11-5-93	PO/Job No. NAV0028.FE Task 7

RESULTS OF ANALYSIS

EPA 418.1

Matrix Type: W

Field Id	CTL#	Oil & Grease (TPH)-mg/L			
WE-2D	12780	ND<5			
WE-2S	12781	ND<5			
WE-3	12782	ND<5			
WE-4	12783	ND<5			
WE-4B	12784	ND<5			
WE-5	12785	ND<5			
WE-6	12786	ND<5			
OBG-8A	12787	ND<5			
OBG-9A	12788	ND<5			
HRP-10	12789	5			
HRP-11	12790	ND<5			
EQ-1	12791	ND<5			
P-1B	12792	ND<5			

Dissolved Metals

Matrix Type		W			
CTL Sample No.		12786			
Field Id		WE-6			
Calcium-mg/L		16.5			
Manganese-mg/L		1.46			
Iron-mg/L		ND<0.05			

Matrix Types : W = Water/Aqueous
S = Soil/Solid
O = Oil/Hydrocarbons

Post-it™ brand fax transmittal memo 7671 | # of pages ▸ 1

To Brian Washburn	From Helen
Co. Imp	Co. CTL
Dept. NAV0028.fe	Phone #

13 MTBE

Due Da

Post-it™ brand fax transmittal memo 7671 | # of pages ▸ 7

To Brian Washburn	From Marlene
Co. HRP	Co. OTL
Dept.	Phone #
Fax # NAV0028.FE TASK 7	Fax # 11/5/93

Client : HRP

Lab No.: 103- -13

PO No. : NAV 0028. FE Task 7

Date Rec'd: 10/22/93

MATRIX TYPE: W

USE FORM 602W

Date Extracted

Date Tested 11-2-93 11-3-93 11-4-93

Analyst BS

EPA METHOD 602/8020 (PPB)

	MDL	WE-2D	WE-2S	WE-3	WE-4
Benzene		3.0	BDL	6.0	(431.0)
Toluene		1.0		BDL	47.0
Chlorobenzene		BDL			BDL
Ethyl Benzene		1.0			(398.0)
P & M Xylene		BDL		2.0	(564.0)
O- Xylene				BDL	109.0
1,4-Dichlorobenzene					BDL
1,3-Dichlorobenzene					
1,2-Dichlorobenzene					
MTBE	1		2.0	53.0	BDL

MDL = Minimum Detectable Level

BDL = Below Detection Level

Due Date_____

USE FORM 602 W

Client :_____

Lab No.:_____

PO No. :_____

Date Rec'd:_____

MATRIX TYPE:_____

Date Extracted_____

Date Tested_____

Analyst_____

EPA METHOD 602/8020(PPB)

	MDL	WE-4B	WE-5	WE-6	OBG-8A
Benzene		(406.0)	(478.0)	BDL	56.0
Toluene		41.0	26.0		8.0
Chlorobenzene		BDL	BDL		BDL
Ethyl Benzene		4.0	3.0		53.0
P & M Xylene		(507.0)	(1626.0)	10.0	101.0
O- Xylene		142.0	(606.0)	2.0	35.0
1,4-Dichlorobenzene		BDL	BDL	BDL	BDL
1,3-Dichlorobenzene					
1,2-Dichlorobenzene					
MTBE	1	77.0	57.0	2.0	BDL

MDL = Minimum Detectable Level

BDL = Below Detection Level

Due Date_____

USE FORM 602 (b)

Client :_____

Lab No.:_____

PO No. :_____

Date Rec'd:_____

MATRIX TYPE:_____

Date Extracted_____

Date Tested_____

Analyst_____

EPA METHOD 602/8020(PPB)

	MDL	OBG-9A	HRP-10 *	HRP-11	EQ-1
Benzene		BDL	815.0	BDL	BDL
Toluene			79.0		
Chlorobenzene			BDL		
Ethyl Benzene			826.0		
P & M Xylene			(1400.0)	4.0	
O- Xylene			574.0	BDL	
1,4-Dichlorobenzene			BDL		
1,3-Dichlorobenzene					
1,2-Dichlorobenzene					
MTBE	1	2.0	BDL		

MDL = Minimum Detectable Level

BDL = Below Detection Level

AMOUNT DUE $_____

* MDL = 10 ppb for all compounds.

Due Date_____

USE FORM 602 W

Client :_____

Lab No.:_____

PO No. :_____

Date Rec'd:_____

MATRIX TYPE:_____

Date Extracted_____

Date Tested_____

Analyst_____

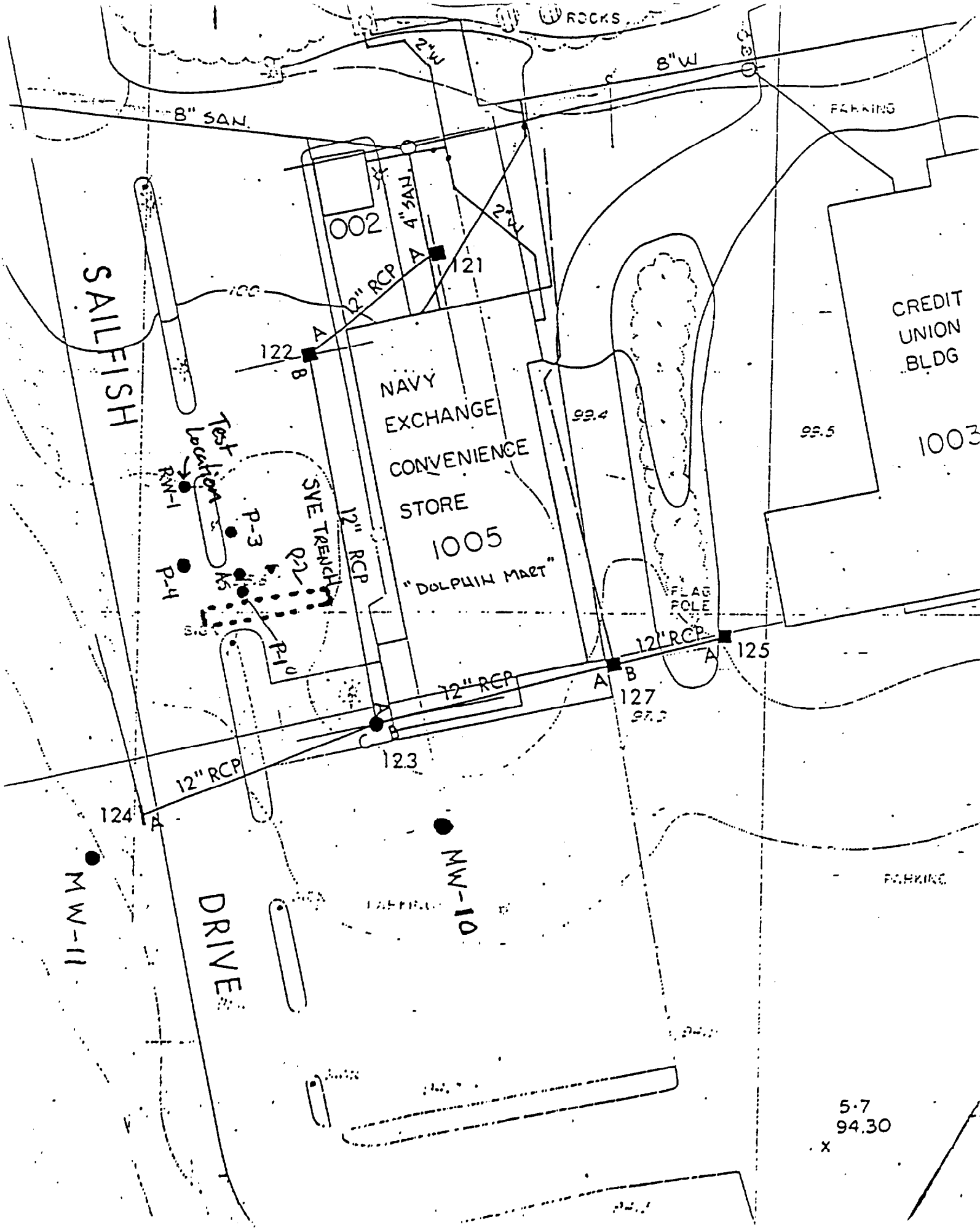
EPA METHOD 602/8020(PPB)

	MDL	P-1B	QC TV	QC Results	
Benzene		203.0	20.0	22.0	
Toluene		12.0	20.0	21.0	
Chlorobenzene		BDL	20.0	21.0	
Ethyl Benzene		134.0	20.0	21.0	
P & M Xylene		(520.0)	BDL	BDL	
O- Xylene		9.0			
1,4-Dichlorobenzene		BDL			
1,3-Dichlorobenzene					
1,2-Dichlorobenzene					
MTBE	1				

MDL = Minimum Detectable Level

BDL = Below Detection Level

AMOUNT DUE $_____


ROCKS
8" W
8" SAN.
PARKING
2" W
4" SAN.
002
121
12" RCP
122
NAVY
EXCHANGE
CONVENIENCE
STORE
1005
"DOLPHIN MART"
SAILFISH
DRIVE
CREDIT
UNION
BLDG
1003
99.4
99.5
Test location
RW-1
P-3
P-4
P-1
P-2
SVE TRENCH
12" RCP
FLAG POLE
125
127
123
124
MW-10
MW-11
5.7
94.30

TREATMENT PROCESS

- 3,000-GALLON OIL/WATER SEPARATION TANK
- 2-STAGE, 5-MICRON FILTRATION SYSTEM
- HIGH-CAPACITY AERATION
- 1,000-POUND GRANULAR ACTIVATED CARBON UNIT
- FLOW MONITORING

APPLICATIONS

- TEST AND TREATMENT OF VOC-CONTAMINATED WATER
- CONTAMINANT RECOVERY WELL PUMP TESTS
- EXCAVATION DEWATERING
- TANK REMOVAL PROJECTS

240V 30A SERVICE

- WATER TREATMENT CAPACITY: 0 TO 100 gpm
- SIGNIFICANT COST SAVINGS
- 24-HOUR CONTINUOUS SERVICE
- SELF-CONTAINED AND HEATED
- STATE-OF-THE-ART TECHNOLOGY
- RAPID RESPONSE

Emergency discharge permits for operation of the system can be obtained quickly and easily. Permits are effective immediately on filing and are valid for nine months with an option for renewal.

For more information, call HRP Associates at: **(203) 793-[illegible] 9**

HRP
ASSOCIATES, INC.

November 12, 1993

Mr. Carl Almquist
Water Pollution Control Facility
45 Fort Hill Road
Groton, Connecticut 06340

RE: REQUEST FOR APPROVAL OF TEMPORARY DISCHARGE TO SANITARY SEWER, DOLPHIN MART, SAILFISH LANE, GROTON, CONNECTICUT
(HRP #NAV0028.FE - TASK 13)

Dear Mr. Almquist:

I am writing to provide the additional information regarding the approval for a temporary discharge to the sanitary we discussed by telephone on November 12, 1993. The temporary discharge will be generated by a pump test which will be conducted at the Dolphin Mart. The test will begin on November 15, 1993 and end November 19, 1993. Ground water contaminated with gasoline constituents will be removed from the ground and treated using gravity settling, filtration, and aeration before being discharged to the sanitary sewer. The discharge rate is anticipated to be about 0.5 gpm and will be metered during the test.

It is my understanding, that data recording the total volume of treated water which was discharged to the sanitary sewer will be submitted to you following the test and a sewer fee of $0.0185/cu. ft. will be assessed.

The data collected during the test will be used to assist the design of a permanent treatment system at the Dolphin Mart. Any necessary application forms regarding a permanent discharge to the sanitary sewer will be submitted to you when the final design plans are completed.

Thank you for timely assistance.

Sincerely,

HRP ASSOCIATES, INC.

Brian P. Washburn

Brian P. Washburn
Chief Hydrogeologist

BPW/db
n\nav-28fe.bpw

167 New Britain Ave. ■ Plainville, CT 06062 ■ (203) 793-6899 ■ FAX (203) 793-6871

EMERGENCY AUTHORIZATION FOR CONTAMINATED GROUNDWATER

APPROVAL FOR CONNECTION TO MUNICIPAL SANITARY SEWER

1) Discharger completes this section (Type or Print Clearly)

Discharger: Bob Leach

Address: On-Site Treatment

P.O. Box 291 Plainville CT 06062-0291

Facility Dolphin Mart, U.S. Subbase

Address: Building No. 1005 Sailfish Lane

Groton, CT 06349

2) Municipality completes this section

~~City~~/Town/~~District~~: Groton

Department: Public Works

Address: 45 Fort Hill Road

Groton, CT 06340

THE DISCHARGER IS HEREBY APPROVED FOR CONNECTION TO THE MUNICIPAL SEWERAGE SYSTEM, FOR THE TEMPORARY DISCHARGE OF PRE-TREATED CONTAMINATED GROUNDWATER, AS SPECIFIED ABOVE.

Signature of Duly Authorized Municipal Official

Gary Schneider

Name of Duly Authorized Municipal Official

Director of Public Works

Title of Duly Authorized Municipal Official

11/15/93

Date

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION

EMERGENCY AUTHORIZATION

I. Pursuant to Public Act No. 93-428 an Emergency Authorization to initiate, create, originate or maintain a discharge into the waters of the state is hereby granted to:

On-Site Treatment Company
P.O. Box 291
Plainville, CT 06062-0291

to initiate, create, originate or maintain a discharge to the waters of the state at:

The Sanitary Sewer in Groton, CT. at The Dolphin Mart on Sailfish Lane.

II. This Emergency Authorization specifically allows the discharger to discharge the initial Pump Test and subsequent Groundwater Remediation wastewater of groundwater contaminated with gasoline constituents.

III. This Emergency Authorization shall become effective on the date it is issued, and shall expire 1) one year after the date it is issued; 2) when the requirements for coverage under a general permit issued pursuant to section 22a-430b of the General Statutes have been satisfied; 3) upon issuance of an individual permit in accordance with Section 22a-430 of the Connecticut General Statutes as amended; or 4) immediately upon notification of a tentative determination to deny a permit; 5) when the discharge ceases; whichever is sooner.

IV. A fee of $250.00 shall be paid by certified check or money order, made payable to the Department of Environmental Protection, Bureau of Water Management, (note: Emergency Authorization), submitted no later than ten days after the date of issuance of this Authorization, OTHERWISE THIS AUTHORIZATION SHALL BE CONSIDERED NULL AND VOID. The fee shall be sent to the following address:

Attention: Authorization Coordinator
Bureau of Water Management, PERD, Central Processing Unit
CT Department of Environmental Protection
79 Elm Street
Hartford, CT. 06106-5127

V. This Emergency Authorization is based upon the following documents:

A) Authorization application package submitted November 8, 1993.

B) Town of Groton Public Works Approval dated November 15, 1993.

VI. A. DEFINITIONS

The definitions of terms used in this Emergency Authorization shall be the same as the definitions contained in Section 22a-423 of the Connecticut General Statutes and Section 22a-430-3(a) of the Regulations of Connecticut State Agencies. In addition, the following definition(s) shall apply:

Any person who or municipality which initiates, creates, originates or maintains a discharge for which an emergency authorization is issued must comply with that authorization. If the source or activity generating the discharge for which an authorization is issued, is owned by one person or municipality but is leased or in some other way the legal responsibility of another person or municipality (the discharger) the discharger is responsible for compliance with any authorization issued by the Commissioner.

B. SPECIAL CONDITIONS

1) Within 30 days of issuance of this Authorization, a Registration for coverage under the General Permit for Groundwater Contamination Recovery Systems will be submitted to the DEP/ Bureau of Water Management.

2) DISCHARGE LIMITS: The following limits shall not be exceeded at any time:

(a)

Pollutant Parameter	LIMITS Sanitary Sewer
Maximum Daily Flow	5000 gallons per day
Total Volatile Organics - EPA Methods 8010 & 8020	10 mg/l
Methyl tert-butyl ether (MTBE)	1000 ug/l
Oil and Grease - HC fraction	100 mg/l

(b) For discharges through an outfall authorized by the Commissioner under a currently valid State or NPDES permit, the permit limits specified for that outfall shall not be violated at any time.

(c) Flow

For discharges to a sanitary sewer. The discharge shall not exceed one per cent of the design flow of the POTW or the maximum daily flow limit specified in this Authorization, whichever is lower.

(d) Temperature

For discharge to a sanitary sewer. The temperature of the discharge shall not exceed 150°F at the first manhole after leaving the site and shall not cause the temperature of the influent at the headworks of the sewage treatment plant to exceed 104°F.

(e) pH

For discharges to a sanitary sewer. The pH of discharges of water shall not be less than 6.0 nor greater than 9.0 Standard units at any time.

3) DISCHARGE CONDITIONS: The following conditions shall be met:

(a) Any water shall be discharged to a surface water body, either directly or via a storm sewer, or to the sanitary sewer. If discharge is to a storm sewer, the surface water body to which the storm sewer discharges must be identified. If discharge is to a surface water body, directly or via a storm sewer, the Water Quality Classification of the water body must be identified. Discharge to the ground surface, or to groundwater, either directly or via a storm sewer, is NOT allowed without prior written approval from the Commissioner.

(b) The discharge shall not contain pollutants in excess of the levels indicated in part 1). The treatment systems, if required, shall be maintained as necessary to ensure that the listed limitations are met.

(c) Any person or municipality covered by this Authorization shall ensure that all discharges covered by this Authorization are in conformance with the sewer ordinance of the municipality receiving the discharge, or that a variance from the sewer ordinance has been granted by the municipality, and that all required local permits and approvals have been obtained for the discharges covered by this Authorization.

(d) For discharges to POTWs
The applicant shall submit sufficient design and operating data regarding the discharge of wastewater to the authority of the receiving POTW for the purposes of ensuring that such discharge will not adversely impact the performance of the POTW and cause any violation of their discharge permit, or render the sludge generated at the POTW unsuitable for landfilling, land application or incineration.

(e) Best Management Practices shall be implemented to ensure that no litter, debris, building materials, or similar materials are discharged to the waters of the state.

(f) For consistency with the Federal Resource Conservation and Recovery Act:
Solid waste, including but not limited to contaminated soils or sludges, may be generated as a result of the remediation activity allowed by this Authorization. All waste generated must be disposed of in accordance with applicable federal, state and local law. Some or all of these wastes may be hazardous waste identified in accordance with Section 3001

of the Federal Resource Conservation and Recovery Act of 1976 (42 USC 6901 et seq.) or other wastes of special concern requiring Department approval prior to disposal. It is the responsibility of the authorized person or municipality to ensure that all wastes generated are properly identified and that all necessary Department approvals are secured prior to disposal of the wastes. For further information regarding solid waste management, please contact Patricia Gray of the Waste Engineering and Enforcement Division of the Department of Environmental Protection at (203) 566-4867.

(g) For consistency with the Federal Clean Air Act:
Air pollution, including but not limited to hazardous air pollutants, may be emitted as a result of the remediation activity allowed by this authorization. All air pollution emitted must be analyzed to ensure compliance with all applicable federal, state and local laws including but not limited to sections 22a-174-1 (Definitions), 22a-174-3 (New Sources), and 22a-174-29 (Hazardous air pollutants) of the Regulations of Connecticut State Agencies and the National Emission Standards for Hazardous Air Pollutants (NESHAPs) in the Code of Federal Regulations (40 CFR Part 61). It is the responsibility of the authorized person or municipality to ensure that all air pollution emitted is properly identified and quantified, and that all necessary Department approvals are secured prior to emitting such pollutants. For further information, please contact the New Source Review Group, Bureau of Air Management, Department of Environmental Protection at (203) 566-8230.

4) MONITORING AND TREATMENT SCHEDULE: Monitoring and treatment shall be as indicated below.

(a) Monitoring and reporting of the discharge for the following parameters is required of all discharges. If the initial screening or subsequent monitoring indicates that a pollutant parameter is present above the maximum level listed in part 1) of this Authorization, the minimum treatment shall be as indicated below.

Pollutant Parameter	Sample Type	Minimum Treatment
Volatile Organics	Grab	Dual Activated Carbon Filters or Air Stripping
Oil & Grease	Grab	See note (b) below

(b) If the initial screening or subsequent monitoring indicates that Oil & Grease-hydrocarbon fraction (O&G/HC) is present above the maximum level listed in part 1), or if oil, or an oily sheen, is visible in the water, monitoring of the

effluent for O&G/HC and treatment of the water for removal of O&G/HC is required. The minimum treatment required shall consist of gravity separation and skimming of floatable materials in a holding tank with a retention time of at least two hours at maximum instantaneous flow.

(c) Flow Monitoring
For sites with a maximum daily flow of wastewater greater than 5,000 gallons per day, a flow meter capable of measuring, indicating and recording instantaneous and total daily flow shall be used continuously, during all periods of discharge, to determine flow rate.

(d) Monitoring Location
All wastewater samples shall be composed solely of the discharge authorized by this Authorization, prior to combination with wastewaters of any other type or with the receiving waters. All samples shall be representative of the discharge during standard operating conditions.

(e) Sampling Frequency: It should be noted that for each initiation or restart of a discharge, samples shall be collected on the first day of discharge. Then monitor discharge every other day for the first two weeks following each initiation or restart of the discharge, weekly for the next month, and then monthly for the duration of this Authorization.

(f) All sample analyses which are required by this Authorization, and all reporting of such analyses, shall be done by a laboratory certified by the Connecticut Department of Health Services. Chemical analysis shall be performed using methods approved in accordance with 40 CFR 136 which are capable of achieving limits of detection below the level established as an effluent limitation in part 1) of this Authorization.

5) REPORTING REQUIREMENTS:

(a) Within one week of sampling, monitoring results, shall be entered on the attached form (or a copy of it) and submitted to the following address:

*Attention: DMR Processing
Bureau of Water Management, PERD
CT Department of Environmental Protection
79 Elm Street
Hartford, CT. 06106-5127

* Initial Screening results shall be directed to the attention of "Authorization Coordinator" in the Central Processing Unit (CPU). Subsequent monitoring results shall

be directed to the attention of "DMR Processing" as indicated above.

(b) The permittee shall submit to the Commissioner quarterly reports of the results of the monitoring performed in accordance with this Authorization.

(c) If a violation of any of the discharge limits included in this Authorization occurs <u>THE DISCHARGE MUST BE STOPPED IMMEDIATELY</u>, and written notification must be sent to the DEP/BWM/CPU within twenty-four hours. In this situation the discharge shall not be re-started without prior approval of the Commissioner. The monitoring results shall be reported on the attached monitoring form and "FAIL" shall be placed in the space provided. Failure to report as indicated above, may result in penalties.

(d) The discharger shall notify the DEP/BWM/CPU in writing of the date of final discontinuance of the discharge.

5) This Emergency Authorization shall be non-transferrable.

6) The discharger shall comply with the following Regulations of Connecticut State Agencies which are hereby incorporated into this Authorization, as if fully set forth herein:

1. <u>Section 22a-430-3:</u>

Subsection (b) General - subparagraph (1)(D) and subdivisions (2), (3), (4) and (5)
Subsection (c) Inspection and Entry
Subsection (d) Effect of a Permit - subdivisions (1) and (4)
Subsection (e) Duty to Comply
Subsection (f) Proper Operation and Maintenance
Subsection (g) Sludge Disposal
Subsection (h) Duty to Mitigate
Subsection (i) Facility Modifications, Notification - subdivisions (1) and (4)
Subsection (j) Monitoring, Records and Reporting Requirements -
subdivisions (1), (6), (7), (8), (9) and (11) (except subparagraphs (9)(A)(2), and (9)(C))
Subsection (k) Bypass
Subsection (m) Effluent Limitation Violations
Subsection (n) Enforcement
Subsection (o) Resource Conservation
Subsection (p) Spill Prevention and Control
Subsection (q) Instrumentation, Alarms, Flow Recorders
Subsection (r) Equalization

2. <u>Section 22a-430-4:</u>

Subsection (t) - Prohibitions
Subsection (p) - Revocation, Denial, Modification
Appendices

7) The following additional terms and conditions shall be complied with:

1. This Authorization is for the discharge of (A) pollutants in quantities and concentrations as specified in this Authorization; and (B) any substances resulting from the processes or activities described in this Authorization in concentrations and quantities which the Commissioner determines cannot reasonably be expected to cause pollution and will not adversely affect the operation of a POTW. However, the Commissioner may seek an injunction or issue an order to prevent or abate pollution, and may seek criminal penalties against a person who willfully or with criminal negligence causes or threatens pollution.

2. Discharge of any substance which is not from the processes or activities described in this Authorization shall be considered a violation of this Authorization unless it is authorized by an individual permit issued under Section 22a-430 of the General Statutes or a general permit issued under section 22a-430b of the General Statutes.

8) Within fifteen days after the date the discharger becomes aware of a change in any information submitted to the Commissioner under any registration or this Authorization, or that any such information was inaccurate or misleading or that any relevant information was omitted, the discharger shall submit the correct or omitted information in writing to the Commissioner.

9) Nothing in this Authorization shall relieve the discharger of other obligations under applicable federal, state and local law.

10) Any document, including but not limited to any notice, which is required to be submitted to the Commissioner under this Authorization by the discharger shall be signed by the discharger and by the individual or individuals responsible for actually preparing such document, each of whom shall certify in writing as follows: "I have personally examined and am familiar with the information submitted in this document and all attachments and certify that based on reasonable investigation, including my inquiry of those individuals responsible for obtaining the information, the submitted information is true, accurate and complete to the best of my knowledge and belief, and I understand that any false statement made in this document or its attachments may be punishable as a criminal offense."

11) Any false statement in any information submitted pursuant to this Authorization may be punishable as a criminal offense under Section 22a-438 of the General Statutes or, in accordance with Section 22a-6, under Section 53a-157 of the General Statutes.

12) The Commissioner reserves the right to make appropriate revisions to this Emergency Authorization in order to establish any appropriate effluent limitations, schedules of compliance, or

other provisions which may be necessary to adequately protect human health and the environment.

13) The Commissioner may order summary suspension of this Authorization in accordance with Section 4-182 of the Connecticut General Statutes.

Entered as an Emergency Authorization of the Commissioner of Environmental Protection.

4/17/93
Date

Robert E. Moore
Deputy Commissioner

FACILITY ID. 059-103
APPLICATION NO. 93-11ED
AUTHORIZATION NO. EA0000008

AUTHORIZATION

INITIAL SCREENING OR SUBSEQUENT MONITORING RESULTS
(Attach copy of laboratory results)

MAIL TO: Attention: Authorization Coordinator (CPU)
(for Initial Screening) or
DMR Processing (for subsequent monitoring)
Bureau of Water Management, PERD
CT Department of Environmental Protection
79 Elm Street
Hartford, CT. 06106-5127

FACILITY ID. 059-103 APPLICATION NO. 93-11ED AUTHORIZATION NO. EA0000008

NAME OF DISCHARGER: On-Site Treatment Company
SITE NAME & ADDRESS: Dolphin Mart Building No. 1005
Sailfish Lane in Groton, CT

DISCHARGE LOCATION: Groton Sanitary Sewer
(Name of waterbody)

WATER QUALITY CLASSIFICATION: n/a

Sample Date: _____
Number of hours of discharge for each day of sample collection: _____
Check one: INITIAL SCREENING OF RAW WATER _____ SUBSEQUENT MONITORING _____

Reporting of the following parameters is required. Requirements for reporting a specific parameter are indicated on the Authorization form. For initial screening, report additional parameters that are known or suspected to be present. For subsequent monitoring, if any parameters exceed limits specified in this Authorization, report the results and place "FAIL" in the space provided, otherwise place "PASS" in the space provided.

POLLUTANT PARAMETER	RESULTS (w/units)	LIMITS
Maximum Daily Flow	----	5000 gpd
Total Daily Flow	_____	----
Instantaneous Flow (at time of grab sample collection)	_____	_____
Total Volatile Organics EPA Method 8010 & 8020	_____	10 mg/l
Oil & Grease - HC Fraction	_____	100 mg/l
MTBE	_____	1000 ug/l
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

ALL PARAMETERS SPECIFIED ABOVE ("PASS" or "FAIL") _____

AUTHORIZATION

INITIAL SCREENING OR SUBSEQUENT MONITORING RESULTS

(Attach copy of laboratory results)

I certify that I have personally examined and am familiar with the information submitted in this document and all attachments and certify that based on reasonable investigation, including my inquiry of those individuals responsible for obtaining the information, the submitted information is true, accurate and complete to the best of my knowledge and belief, and I understand that any false statement made in this document or its attachments may be punishable as a criminal offense. I certify that all discharge limitations of this Authorization have been met, otherwise if a violation of any of the discharge limits occurs, the discharge will be stopped immediately and written notification must be sent to the DEP/BWM/CPU within twenty-four hours. In this situation, the discharge shall not be re-started without prior approval of the Commissioner. I also certify that I have correctly completed the "PASS/FAIL" space provided, otherwise a penalty may be imposed.

_____ _____

Date

Name:
Title:

cc: Town Water Pollution Control Authority (sewer discharges only)
cc: Town Engineer (surface water discharges)

AUTHORIZATION-SITE INFORMATION FORM

FACILITY ID. 059-103 APPLICATION NO. 93-11ED AUTHORIZATION NO. EA0000008

SITE OWNER Dolphin Mart
OWNER ADDRESS Sailfish Lane in Groton, CT 06349

DISCHARGER NAME On-Site Treatment Company
DISCHARGER ADDRESS P.O. Box 291 Plainville, CT 06062-0291
& PHONE 793-6899 Bob Leach

SITE NAME Dolphin Mart
SITE ADDRESS Sailfish Lane in Groton, CT

Indicate the point of discharge, either "sanitary sewer" or the name of a surface water body. If discharge is to a storm sewer, the water body to which the storm sewer discharges must be specified. For sanitary sewer discharges the attached "Approval" form must be signed by the Municipality and submitted with this Authorization.

DISCHARGE LOCATION Sanitary Sewer - Groton
ACTIVITY PRODUCING DISCHARGE Pump test and remediation
PROPOSED DISCHARGE RATE_____GPM__ 5000 GPD
TYPE OF CONTAMINATION gasoline
VOLUME OF PRODUCT LOST (groundwater contamination or spills only) unknown
DATE DISCHARGE WILL BEGIN ASAP DATE DISCHARGE WILL END unknown
WATER QUALITY CLASSIFICATION (receiving groundwater or surface water body) n/a

Are there any public or private drinking water supply wells located within a 1/4 mile radius of the contaminated area? (Groundwater contamination only)
YES (If "yes" mail a copy of this form to the groundwater section to the same address as indicated below, Attention: Groundwater Section.)

I certify under penalty of law that I have read and understand all conditions of the authorization issued for the discharge described in this site information form. I have personally examined and am familiar with the information submitted in this document and all attachments and certify that based on reasonable investigation, including my inquiry of those individuals responsible for obtaining the information, the submitted information is true, accurate and complete to the best of my knowledge and belief, and I understand that any false statement made in this document or its attachments may be punishable as a criminal offense.

Date

Name:
Title:

Mail original to: Attention: Authorization Coordinator
Bureau of Water Management, PERD, Central Processing Unit
CT Department of Environmental Protection,
79 Elm Street, Hartford, CT. 06106-5127

EMERGENCY AUTHORIZATION WORKSHEET

Name of Applicant or Facility: On-Site Treatment

Location: Dolphin Mart - Sailfish Lane - Groton, CT

Description of Activity: Performing a pump test prior to full start up of a remediation system. One condition of this Authorization is that a General Permit will be applied for as soon as data from pump test is available.

Program:

_____	22a-32	Tidal wetlands
_____	22a-66	Pesticide application
_____	22a-174	Air pollution control
_____	22a-208a	Solid waste management
_____	22a-342	Stream channel encroachment lines
_____	22a-368	Diversion
_____	22a-403	Dam safety
XXXXX	22a-430	Water discharge
_____	22a-449	Hazardous waste, petroleum and chemical liquid terminals
_____	22a-454	Connecticut regulated waste

(1) Is the emergency authorization necessary to prevent, abate or mitigate an imminent threat to human health or the environment?

_XX__ Yes _____ No

Explain: Contamination is in a GAA area. This Authorization is needed to initiate a pump test to develope data for submittal of the General Permit.

(2) Is the emergency authorization consistent with the federal Water Pollution Control Act, and the federal Rivers and Harbors Act?

_XX__ Yes _____ No

Explain: The discharge falls into Connecticut's authority to issue general permits for this type of discharge.

(3) What special conditions does the authorization need to include in order to adequately protect human health and the environment?

Explain: Normal Treatment. Facility is required to apply for the General Permit as soon as possible.

HRP
ASSOCIATES, INC.

November 12, 1993

Mr. Carl Almquist
Water Pollution Control Facility
45 Fort Hill Road
Groton, Connecticut 06340

RE: REQUEST FOR APPROVAL OF TEMPORARY DISCHARGE TO SANITARY SEWER, DOLPHIN MART, SAILFISH LANE, GROTON, CONNECTICUT (HRP #NAV0028.FE - TASK 13)

Dear Mr. Almquist:

I am writing to provide the additional information regarding the approval for a temporary discharge to the sanitary we discussed by telephone on November 12, 1993. The temporary discharge will be generated by a pump test which will be conducted at the Dolphin Mart. The test will begin on November 15, 1993 and end November 19, 1993. Ground water contaminated with gasoline constituents will be removed from the ground and treated using gravity settling, filtration, and aeration before being discharged to the sanitary sewer. The discharge rate is anticipated to be about 0.5 gpm and will be metered during the test.

It is my understanding, that data recording the total volume of treated water which was discharged to the sanitary sewer will be submitted to you following the test and a sewer fee of $0.0185/cu. ft. will be assessed.

The data collected during the test will be used to assist the design of a permanent treatment system at the Dolphin Mart. Any necessary application forms regarding a permanent discharge to the sanitary sewer will be submitted to you when the final design plans are completed.

Thank you for timely assistance.

Sincerely,

HRP ASSOCIATES, INC.

Brian P. Washburn

Brian P. Washburn
Chief Hydrogeologist

BPW/db
n\nav-28fe.bpw

167 New Britain Ave. ■ Plainville, CT 06062 ■ (203) 793-6899 ■ FAX (203) 793-6871

AUTHORIZATION

INITIAL SCREENING OR SUBSEQUENT MONITORING RESULTS

(Attach copy of laboratory results)

I certify that I have personally examined and am familiar with the information submitted in this document and all attachments and certify that based on reasonable investigation, including my inquiry of those individuals responsible for obtaining the information, the submitted information is true, accurate and complete to the best of my knowledge and belief, and I understand that any false statement made in this document or its attachments may be punishable as a criminal offense. I certify that all discharge limitations of this Authorization have been met, otherwise if a violation of any of the discharge limits occurs, the discharge will be stopped immediately and written notification must be sent to the DEP/BWM/CPU within twenty-four hours. In this situation, the discharge shall not be re-started without prior approval of the Commissioner. I also certify that I have correctly completed the "PASS/FAIL" space provided, otherwise a penalty may be imposed.

12-13-93

Date

R H Leach

Name: R.H. LEACH
Title: PRESIDENT
ON SITE TREATMENT TECHNOLOGIES

cc: Town Water Pollution Control Authority (sewer discharges only)
cc: Town Engineer (surface water discharges)

AUTHORIZATION

INITIAL SCREENING OR SUBSEQUENT MONITORING RESULTS
(Attach copy of laboratory results)

MAIL TO: Attention: Authorization Coordinator (CPU)
(for Initial Screening) or
DMR Processing (for subsequent monitoring)
Bureau of Water Management, PERD
CT Department of Environmental Protection
79 Elm Street
Hartford, CT. 06106-5127

FACILITY ID. 059-103 APPLICATION NO. 93-11ED AUTHORIZATION NO. EA0000008

NAME OF DISCHARGER: On-Site Treatment Company
SITE NAME & ADDRESS: Dolphin Mart Building No. 1005
Sailfish Lane in Groton, CT

DISCHARGE LOCATION: Groton Sanitary Sewer
(Name of waterbody)

WATER QUALITY CLASSIFICATION: n/a

Sample Date: 11/17/93
Number of hours of discharge for each day of sample collection: 24
Check one: INITIAL SCREENING OF RAW WATER _____ SUBSEQUENT MONITORING X

Reporting of the following parameters is required. Requirements for reporting a specific parameter are indicated on the Authorization form. For initial screening, report additional parameters that are known or suspected to be present. For subsequent monitoring, if any parameters exceed limits specified in this Authorization, report the results and place "FAIL" in the space provided, otherwise place "PASS" in the space provided.

POLLUTANT PARAMETER	RESULTS (w/units)	LIMITS
Maximum Daily Flow	----	5000 gpd
Total Daily Flow	2,060 gpd	----
Instantaneous Flow (at time of grab sample collection)	1.43 gpm	
Total Volatile Organics EPA Method 8010 & 8020	0.656 mg/L	10 mg/l
Oil & Grease - HC Fraction	ND < 5 mg/L	100 mg/l
MTBE	ND (< 1 µg/L)	1000 ug/l

ALL PARAMETERS SPECIFIED ABOVE ("PASS" or "FAIL") P

December 2, 1993

RECEIVED
DEC - 3 1993
HRP ASSOCIATES, INC.

HRP Associates Inc.
167 New Britain Ave
Plainville, CT 06062

Attn: Ms. Pat Terwilliger

Please find attached laboratory report(s) for the samples submitted on : November 18, 1993:

All pertinent information for this analysis is located on the report. Should it be necessary to contact us regarding billing and or the test results, please have the following information readily available :

```
LAB No.      : 113-461-1
PO/JOB No.   : NAV0028.FE
INVOICE No.  : 40606
ORDER No.    : 20509
CUSTOMER No.: 350
```

Please feel free to contact us if you have any questions.

Very truly yours,

Stephen J. Franco
Laboratory Director
PH-0547

connecticut testing laboratories inc.
WATER ■ SOIL ■ AIR

STEPHEN J. FRANCO
Laboratory Director
PHONE ■ 203/634-3731
165 GRACEY AVENUE ■ MERIDEN, CT ■ 06451

Date Samples Received : 11-18-93

Client Name: HRP Associates Inc.	CTL Lab No. 113-461-1
Report Date: 12-1-93	PO/Job No. NAV0028.FE

RESULTS OF ANALYSIS

EPA 418.1

Matrix Type	W				
CTL Sample No.	14159				
Field Id	Discharge				
Oil & Grease (TPH)-mg/L	ND<5				

Matrix Types : W = Water/Aqueous
S = Soil/Solid
O = Oil/Hydrocarbons

CONNECTICUT TESTING LABORATORIES, INC.
165 Gracey Avenue / Meriden, CT 06451-2268
(203)-634-3731
Connecticut Certification No. PH-0547

December 1, 1993

RECEIVED
DEC - 3 1993
HRP ASSOCIATES, INC.

HRP Associates Inc.
167 New Britain Ave
Plainville, CT 06062

Attn: Ms. Pat Terwilliger

Please find attached laboratory report(s) for the samples submitted on : **November 18, 1993:**

All pertinent information for this analysis is located on the report. Should it be necessary to contact us regarding billing and or the test results, please have the following information readily available :

LAB No.	:	113-444-1
PO/JOB No.	:	NAV0028.FE
INVOICE No.	:	40565
ORDER No.	:	20467
CUSTOMER No.	:	350

Please feel free to contact us if you have any questions.

Very truly yours,

Stephen J. Franco
Laboratory Director
PH-0547

connecticut testing laboratories inc.
WATER ■ SOIL ■ AIR

STEPHEN J. FRANCO
Laboratory Director
PHONE ■ 203/634-3731
165 GRACEY AVENUE ■ MERIDEN, CT ■ 06451

Client	: HRP Associates Inc.	Date Tested	: 11/24-11/30/93
Lab No.	: 113-444-1	Analyst	: RS
PO No.	: NAV0028.FE		
Rep. Date	: 12-1-93		

EPA METHOD 601/8010 Date Samples Rec'd: 11-18-93

Matrix Type :		W			
Field ID :		* Discharge			
	MDL				
Chloromethane	2	BDL			
Bromomethane	2	BDL			
Vinylchloride	2	BDL			
Chloroethane	2	BDL			
Methylenechloride	1	BDL			
Trichlorofluoromethane	1	BDL			
11-Dichloroethylene	1	BDL			
11-Dichloroethane	1	BDL			
T12-Dichloroethylene	1	BDL			
Chloroform	1	BDL			
12-Dichloroethane	1	BDL			
111-Trichloroethane	1	BDL			
Carbontetrachloride	1	BDL			
Bromodichloromethane	1	BDL			
12-Dichloropropane	1	BDL			
T13-Dichloropropylene	1	BDL			
Trichloroethylene	1	BDL			
Dibromochloromethane	1	BDL			
112-Trichloroethane	1	BDL			
Cis13-Dichloropropylene	1	BDL			
2-Chlorethylvinylether	1	BDL			
Bromoform	1	BDL			
1122-Tetrachloroethane	1	BDL			
Tetrachloroethylene	1	BDL			
Chlorobenzene	1	BDL			
Benzyl Chloride	10	BDL			
Bis(2-chlorethoxy)methane	10	BDL			
Bis(2-chloroisopropyl)eth	10	BDL			
Bromobenzene	1	BDL			
Chloracetaldehyde	10	BDL			
1-Chlorohexane	1	BDL			
Chloromethyl methyl ether	10	BDL			
Chlorotoluene	1	BDL			
Dibromomethane	1	BDL			
12-Dichlorobenzene	1	BDL			
13-Dichlorobenzene	1	BDL			
14-Dichlorobenzene	1	BDL			
Trichloropropane	1	BDL			

* MDL = 10 ppb for all compounds.

MDL= Minimum Detectable Level/BDL= Below Detection Level/UNITS= PPB

Matrix Type : W= Water/Aqueous S= Soil/Solid O= Oil/Hydrocarbons

CONNECTICUT TESTING LABORATORIES, INC.
165 Gracey Avenue / Meriden, CT 06451-2208
(203)-634-3731
Connecticut Certification No. PH-0547

Client	: HRP Associates Inc.	Date Tested	: 11/24-11/30/93
Lab No.	: 113-444-1	Analyst	: RS
PO No.	: NAV0028.FE		
Rep. Date	: 12-1-93		

EPA METHOD 602/8020 Date Samples Rec'd: 11-18-93

Matrix Type :		W			
Field ID :		* Discharge			
	MDL				
Benzene	1	61.0			
Toluene	1	154.0			
Chlorobenzene	1	BDL			
Ethyl Benzene	1	33.0			
P & M Xylene	1	283.0			
O- Xylene	1	125.0			
,4-Dichlorobenzene	1	BDL			
1,3-Dichlorobenzene	1	BDL			
1,2-Dichlorobenzene	1	BDL			
MTBE	1	BDL			

* MDL = 10 ppb for all compounds.

MDL = Minimum Detectable Level/ BDL = Below Detection Level/ UNITS= PPB

Matrix Type: W= Water/Aqueous S= Soil/Solid O= Oil/Hydrocarbons

CONNECTICUT TESTING LABORATORIES, INC.
165 Gracey Avenue / Meriden, CT 06451-2208
(203)-634-3731
Connecticut Certification No. PH-0547

HRP Associates, Inc.
167 New Britain Avenue
Plainville, CT 06062
Phone: 203-793-6899
Fax: 203-793-6871

HRP

CHAIN OF CUSTODY

Sheet 1 of 1
Job Number NAV-0028 FE
Project Manager

Place & Address of Collection: Navy Dolphin Mart, Groton, CT
Samplers Name (Signature): [signature]
Assistant (Witness)(Signature):

Sample Number	Sample Location	Container Type	Total Volume	Preservative	Date	Time	Sample Type: Water	Soil	Air	Waste	Remarks
1	Discharge	Glass	1080ml	cool + H_2SO_4	11/17/93		X				

Relinquished By (Signature): [signature]
Received By (Signature): [signature] Date: 11/18/93 Time: 1:30
Relinquished By (Signature):
Received By (Signature): Date: Time:
Name & Address of Laboratory: CTL Lab, Meriden, CT

LABORATORY SAMPLE PREPARATION REQUIRED

None ☐ Filter ☐ Adjust pH to _____ Priority ☐
Other

ANALYSES REQUIRED

Parameters	Sample Number					Parameters	Sample Number: Discharge				
pH						TPH 418.1	X				
Ag						TOC					
Al						TOX					
As						STD Water					
Ba						Total Coliform					
Cd						Fluoride					
CN-A						Chloride					
CN-T						8010/601	X				
Cr^{+6}						8015					
Cr-T						8020/602					
Cu						8020 + MTBE	X				
Fe-D						8080					
Hg						8100					
Ni						8 TCLP Metals					
Pb											
Se											
Sp. Cond											
TDS											
Zn											

Remarks: TPH adjusted in Field to <2 H_2SO_4

White Copy - Accounting Yellow Copy - Lab Pink Copy - Field Services Gold Copy - Job File

№ 01535

AUTHORIZATION

INITIAL SCREENING OR SUBSEQUENT MONITORING RESULTS
(Attach copy of laboratory results)

MAIL TO: Attention: Authorization Coordinator (CPU)
(for Initial Screening) or
DMR Processing (for subsequent monitoring)
Bureau of Water Management, PERD
CT Department of Environmental Protection
79 Elm Street
Hartford, CT. 06106-5127

FACILITY ID. 059-103 APPLICATION NO. 93-11ED AUTHORIZATION NO. EA0000008

NAME OF DISCHARGER: On-Site Treatment Company
SITE NAME & ADDRESS: Dolphin Mart Building No. 1005
Sailfish Lane in Groton, CT

DISCHARGE LOCATION: Groton Sanitary Sewer
(Name of waterbody)

WATER QUALITY CLASSIFICATION: n/a

Sample Date: 11/19/93
Number of hours of discharge for each day of sample collection: 36 hrs
Check one: INITIAL SCREENING OF RAW WATER _____ SUBSEQUENT MONITORING X

Reporting of the following parameters is required. Requirements for reporting a specific parameter are indicated on the Authorization form. For initial screening, report additional parameters that are known or suspected to be present. For subsequent monitoring, if any parameters exceed limits specified in this Authorization, report the results and place "FAIL" in the space provided, otherwise place "PASS" in the space provided.

POLLUTANT PARAMETER	RESULTS (w/units)	LIMITS
Maximum Daily Flow	----	5000 gpd
Total Daily Flow	2060 gpd	----
Instantaneous Flow (at time of grab sample collection)	1.43 gpm	
Total Volatile Organics EPA Method 8010 & 8020	1.478 mg/L	10 mg/l
Oil & Grease - HC Fraction	ND < 5 mg/L	100 mg/l
MTBE	BDL < 1 µg/L	1000 ug/l

ALL PARAMETERS SPECIFIED ABOVE ("PASS" or "FAIL") P

December 2, 1993

RECEIVED
DEC - 3 1993
HRP ASSOCIATES, INC.

HRP Associates Inc.
167 New Britain Ave
Plainville, CT 06062

Attn: Ms. Pat Terwilliger

Please find attached laboratory report(s) for the samples submitted on : **November 19, 1993:**

All pertinent information for this analysis is located on the report. Should it be necessary to contact us regarding billing and or the test results, please have the following information readily available :

LAB No.	: 113-493-2
PO/JOB No.	: NAV0028.FE
INVOICE No.	: 40639
ORDER No.	: 20542
CUSTOMER No.	: 350

Please feel free to contact us if you have any questions.

Very truly yours,

Stephen J. Franco
Laboratory Director
PH-0547

connecticut testing laboratories inc.
WATER ■ SOIL ■ AIR

STEPHEN J. FRANCO
Laboratory Director
PHONE ■ 203/634-3731
165 GRACEY AVENUE ■ MERIDEN, CT ■ 06451

Date Samples Received : 11-19-93

Client Name: HRP Associates Inc.	CTL Lab No. 113-493-2
Report Date: 12-2-93	PO/Job No. NAV0028.FE

RESULTS OF ANALYSIS

EPA 418.1

Matrix Type	W	W		
CTL Sample No.	14230	14231		
Field Id	Discharge	RW-1		
Oil & Grease (TPH)-mg/L	ND<5	ND<5		

Matrix Types : W = Water/Aqueous
S = Soil/Solid
O = Oil/Hydrocarbons

CONNECTICUT TESTING LABORATORIES, INC.
165 Gracey Avenue / Meriden, CT 06451-2268
(203)-634-3731
Connecticut Certification No. PH-0547

December 1, 1993

RECEIVED
DEC - 3 1993
HRP ASSOCIATES, INC.

HRP Associates Inc.
167 New Britain Ave
Plainville, CT 06062

Attn: Ms. Pat Terwilliger

Please find attached laboratory report(s) for the samples submitted on : **November 19, 1993:**

All pertinent information for this analysis is located on the report. Should it be necessary to contact us regarding billing and or the test results, please have the following information readily available :

LAB No.	: 113-447-2
PO/JOB No.	: NAV0028.FE
INVOICE No.	: 40568
ORDER No.	: 20470
CUSTOMER No.	: 350

Please feel free to contact us if you have any questions.

Very truly yours,

Stephen J. Franco
Laboratory Director
PH-0547

connecticut testing laboratories inc.
WATER ■ SOIL ■ AIR

STEPHEN J. FRANCO
Laboratory Director
PHONE ■ 203/634-3731
165 GRACEY AVENUE ■ MERIDEN, CT ■ 06451

Client	: HRP Associates Inc.	Date Tested	: 11-30-93
Lab No.	: 113-447-2	Analyst	: RS
PO No.	: NAV0028.FE		
Rep. Date	: 12-1-93		

EPA METHOD 601/8010 Date Samples Rec'd: 11-19-93

Matrix Type :		W *	W **		
Field ID :	MDL	Discharge	RW-1		
Chloromethane	2	BDL	BDL		
Bromomethane	2	BDL	BDL		
Vinylchloride	2	BDL	BDL		
Chloroethane	2	BDL	BDL		
Methylenechloride	1	BDL	BDL		
Trichlorofluoromethane	1	BDL	BDL		
11-Dichloroethylene	1	BDL	BDL		
11-Dichloroethane	1	BDL	BDL		
T12-Dichloroethylene	1	BDL	BDL		
Chloroform	1	BDL	BDL		
12-Dichloroethane	1	BDL	BDL		
111-Trichloroethane	1	BDL	BDL		
Carbontetrachloride	1	BDL	BDL		
Bromodichloromethane	1	BDL	BDL		
12-Dichloropropane	1	BDL	BDL		
T13-Dichloropropylene	1	BDL	BDL		
Trichloroethylene	1	BDL	BDL		
Dibromochloromethane	1	BDL	BDL		
112-Trichloroethane	1	BDL	BDL		
Cis13-Dichloropropylene	1	BDL	BDL		
2-Chlorethylvinylether	1	BDL	BDL		
Bromoform	1	BDL	BDL		
1122-Tetrachloroethane	1	BDL	BDL		
Tetrachloroethylene	1	BDL	BDL		
Chlorobenzene	1	BDL	BDL		
Benzyl Chloride	10	BDL	BDL		
Bis(2-chlorethoxy)methane	10	BDL	BDL		
Bis(2-chloroisopropyl)eth	10	BDL	BDL		
Bromobenzene	1	BDL	BDL		
Chloracetaldehyde	10	BDL	BDL		
1-Chlorohexane	1	BDL	BDL		
Chloromethyl methyl ether	10	BDL	BDL		
Chlorotoluene	1	BDL	BDL		
Dibromomethane	1	BDL	BDL		
12-Dichlorobenzene	1	BDL	BDL		
13-Dichlorobenzene	1	BDL	BDL		
14-Dichlorobenzene	1	BDL	BDL		
Trichloropropane	1	BDL	BDL		

* MDL = 10 ppb for all compounds.
** MDL = 100 ppb for all compounds.
MDL= Minimum Detectable Level/BDL= Below Detection Level/UNITS= PPB

Matrix Type : W= Water/Aqueous S= Soil/Solid O= Oil/Hydrocarbons

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Client	: HRP Associates Inc.	Date Tested	: 11-30-93
Lab No.	: 113-447-2	Analyst	: RS
PO No.	: NAV0028.FE		
Rep. Date	: 12-1-93		

EPA METHOD 602/8020 Date Samples Rec'd: 11-19-93

Matrix Type :		W *	W **		
Field ID :	MDL	Discharge	RW-1		
Benzene	1	133.0	200.0		
Toluene	1	418.0	866.0		
Chlorobenzene	1	BDL	BDL		
Ethyl Benzene	1	71.0	BDL		
P & M Xylene	1	615.0	1,245.0		
O- Xylene	1	241.0	466.0		
1,4-Dichlorobenzene	1	BDL	BDL		
1,3-Dichlorobenzene	1	BDL	BDL		
1,2-Dichlorobenzene	1	BDL	BDL		
MTBE	1	BDL	BDL		

* MDL = 10 ppb for all compounds.
** MDL = 100 ppb for all compounds.

MDL = Minimum Detectable Level/ BDL = Below Detection Level/ UNITS= PPB

Matrix Type: W= Water/Aqueous S= Soil/Solid O= Oil/Hydrocarbons

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HRP Associates, Inc.
167 New Britain Avenue
Plainville, CT 06062
Phone: 203-793-6899
Fax: 203-793-6871

HRP

CHAIN OF CUSTODY

Sheet 1 of 1
Job Number NAV-0038-FE
Project Manager

Place & Address of Collection: Navy Dolphin Mart, Groton, CT
Samplers Name (Signature): Terrence P. Clayson
Assistant (Witness)(Signature):

Sample Number	Sample Location	Container Type	Total Volume	Preservative	Date	Time	Sample Type: Water	Soil	Air	Waste	Remarks
1	Discharge	Glass	1050ml	Cool + H_2SO_4	11/19/93		X				
2	RW-1	↓	↓	↓	↓		X				

Relinquished By (Signature): Terrence P. Clayson	Received By (Signature): M. McMahon	Date 11/19/93	Time 3:50
Relinquished By (Signature):	Received By (Signature):	Date	Time

Name & Address of Laboratory: CTL Lab, Meriden, CT

LABORATORY SAMPLE PREPARATION REQUIRED

None ☐ | Filter ☐ | Adjust pH to _____ | Priority ☐

Other

ANALYSES REQUIRED

Parameters	Sample Number					Parameters	Sample Number: Discharge	RW-1			
pH						TPH 418.1 ✓	X	X			
Ag						TOC					
Al						TOX					
As						STD Water					
Ba						Total Coliform					
Cd						Fluoride					
CN-A						Chloride					
CN-T						8010/601 ✓	X	X			
Cr^{+6}						8015					
Cr-T						8020/602					
Cu						8020 + MTBE ✓	X	X			
Fe-D						8080					
Hg						8100					
Ni						8 TCLP Metals					
Pb											
Se											
Sp. Cond.											
TDS											
Zn											

Remarks: TPH adjusted in field < 2 H_2SO_4

White Copy - Accounting Yellow Copy - Lab Pink Copy - Field Services Gold Copy - Job File

№ 01538

APPENDIX J

Health and Safety Plan

HRP ASSOCIATES

HAZARD COMMUNICATION AND SITE CONTINGENCY PLAN FOR

(PROJECT) Naval Sub Base/Dolphin Mart, Groton, Connecticut

(COMPANY) Naval Facilities Engineering Command

HRP #NAV0028.FC- Task 1 - 21

1.0 PURPOSE AND SCOPE

HRP has developed this plan to address the safety of site workers during on-site (field) work not covered under OSHA's Hazardous Waste Operations and Emergency Response regulation (29 CFR 1910.120). It is assumed that all site workers (HRP employees, contractor and subcontractor employees, etc.) have been trained under OSHA's Hazard Communication Standard (29 CFR 1910.1200) and are familiar with basic toxicology and hazards of chemicals. HRP recognizes that although the site is not covered under 29 CFR 1910.120, a plan which outlines procedures to handle emergencies and contingencies is useful. This plan is to be used only in conjunction with HRP projects as HRP can not accept liability for this plan's use unless under direct HRP supervision.

2.0 SITE INFORMATION

Facility Name Groton Naval Sub Base/Dolphin Mart Phone No. 449-4497

Address Naval Submarine Base - (NEX) Building 428, Groton, CT 06349

Dolphin Mart, Sailfish Road, Groton, CT 06349

Site Contact(s) Government - Ms. Christi Davis/Naval - Bob Brown

Site Description Dolphin Mart is a former gasoline station within Naval boundaries now a convenience store. Naval Submarine Base NEX Building 428 is an on-site gasoline and JP-5 dispensing station for Groton Naval site.

Scope of Work: Listing is included with tasks and projected work dates for both facilities.

3.0 EMERGENCY PHONE NUMBERS

Site personnel should familiarize themselves with the location of the nearest telephones (i.e. in a site building) and how to obtain an outside line.

Note: When contacting the local authorities be sure to give: your name, facility name, full address, telephone number and the nature of the emergency.

Fire Department, Ambulance, Police Department:	911
Poison Control Center:	1-(800)-343-2722
CT-DEP Oil and Chemical Spills:	566-3338
State Police Barracks Troop E-Montville	848-1201
Local Hospital: Life Threatening - Naval Hospital, Bldg. 449	
Lawrence Memorial Hospital - New London, CT	442-0711

Address: 365 Montauk Avenue, New London, CT 06320

Travel time to the local Hospital is 20 minutes.

Map showing routes (primary and alternate) to Hospital attached [ ]

Description of route: Attached

Emergency Evacuation Signal Loud Hail - Siren

HRP Associates, Inc., 167 New Britain Ave., Plainville, CT. 06062 (203) 793-6899

4.0 PERSONNEL

The Emergency Coordinator will be responsible for administering the procedures set forth in this plan in the case of a fire, spill or other emergency/contingency. The Emergency Coordinator or his alternate shall be on-site at all times. The Emergency Coordinator should determine the number of workers to be working on-site at the start of each day so that all personnel can be accounted for in an emergency.

Emergency Coordinator Brian Washburn, alternate Jennifer Convey

Alternate Bob Brown

HRP Project Manager Robert Leach

Companies present on-site:

COMPANY	FOREMAN	NUMBER OF PERSONS
Kennedy & Sons	Bob/Bill Kennedy	4
B&M Excavating	Jeff Merk	
Maher Environmental		

5.0 CONTINGENCY

During any of the work involving the site (drilling, excavating, grading, etc.) if any unknown substance is detected (sludge, unlabelled (full) containers, liquid, etc.), work will be suspended immediately. The Emergency Coordinator will assess the situation (in conjunction with site personnel and the HRP Project Manager) and decide on a course of action. This could include, but is not limited to, are listed below. It should be noted that any uncontrolled release of oil or chemicals must be reported immediately by the site owner/operator to the CT-DEP Oil and Chemical Spills division at 566-3338.

A. If a containerized waste is discovered, the Emergency Coordinator may:

1. Leave the drum in place if corroded and/or leaking and call a commercial disposal firm to sample the contents of the drum (work in this area would be indefinitely suspended and the area cordon off);

2. Leave the drum in place if corroded and/or leaking and subsequently sample using appropriate personal protection to characterize its contents (work in this area would be suspended and the area cordoned off pending laboratory analysis); or

3. Remove the drum from the excavation and place aside for subsequent sampling and disposal.

B. If an unknown sludge or liquid is discovered, the Emergency Coordinator may:

1. Determine the nature or type of sludge by physical characteristics, odor or other methods and determine whether it is hazardous; and/or

2. Suspend work in the area indefinitely and cordon off the area pending sampling and laboratory analysis.

C. If the situation warrants emergency response, one of the following companies can be contacted:

United Oil Recovery Meriden, Connecticut	235-3753
Sealand Environmental Derby, Connecticut	735-1817

D. If any other contingency is encountered, the Emergency Coordinator will take the appropriate action based on his knowledge and experience.

6.0 STANDARD OPERATING PROCEDURES

Listed below are the Standard Operating Procedures (SOP's) which are effective or expected to be used on-site. The actual written procedures are contained in Section 7.0 of HRP's Corporate Safety and Health Program, and site personnel should familiarize themselves with all SOP's prior to the commencement of site work.

Completed by: _____ Date: 10/6/93

Checked by: _____ Date: 10/13/93

HOSPITAL DIRECTIONS

RED PRIMARY ROUTE
GREEN ALTERNATE ROUTE

Primary Route - Non-Life Threatening Route

From NEX (Building 428) facing south take left onto Tang Avenue (east bound) to Crystal Lake Road take a left and go to security entrance (on Route 12) take a right onto Route 12 - follow Route 12 south for 3 miles and go onto I-95 south. Stay in right lanes proceeding over Thames River take first exit immediately after bridge crossing bear left off of exit and take left onto Eugene O'Neil Avenue. At end take a left onto Tolley Street and bear right onto Bank Street. Take a left onto Montauk Avenue, Lawrence Memorial Hospital is on right - #365 Montauk Avenue.

Primary Route - Life Threatening Route

Contact Naval Personnel immediately. Follow Tank Avenue as before but bear left to hook into Tautog Avenue, take second right onto Thresher Avenue. Naval Hospital is at intersection of Thresher and Corsair Avenues. These may be one way streets so it is essential to contact on-site Naval Military Police or personnel to guide to the hospital. Access is denied to civilian personnel with the exclusion of life threatening circumstances.

Alternate Route - Non-Life Threatening Route

Route as before from NEX take Colman Street (Route 1 exit) exit, take left onto Route 1 (Colman Street). Follow 3 miles at Bank Street and take a right and a quick left onto Lee Avenue. Take a right onto Route 213, Lawrence Memorial is on the left at Farre Harbor Street.

For work at Dolphin Mart, take Sailfish Road, left to Gungywump Road, take left and go to Route 12. Take another left and follow above directions for non-life threatening from Route 12 directions on.

SUB BASE GROTON SCHEDULE
NEX DOLPHIN MART

This schedule does <u>not</u> follow schedule used in arriving at the cost breakdown

Task		Date
1.	Review Existing Data	Ongoing
2.	HASP (outline form per Navy) Short Form	Week of 10/4/93
3.	Prepare Base Maps	Week of 10/4/93
4.	• Conduct Site Inspection • Evaluate Wells • Mark SVE/AS Test Pits • Call for Mark Out • Coordinate with Navy Engineer for Site Owned Utilities	Week of 10/4/93
5.	Install New Wells - 2 at Dolphin	Week of 10/11/93
	Install SVE/AS Pits Dolphin and NEX	Pending wetland permits
6.	Sample New and Existing Wells Dolphin (PRIORITY)	Week of 10/18/93
7.	Review Water Data Prepare Isopleth Maps and Geological Cross Sections	Week of 10/25/93
8.	Install Rec. Well and SVE Trench Dolphin	Week of 10/18/93 (10/25/92)
9.	Conduct SVE/AS Tests NEX and Dolphin	Week of 10/25/93 (11/1/93)
10.	Conduct Pump Test Dolphin Mart	Week of 10/25/93 (11/1/93) or 11/7/93

o/w/n/navy.gbh

11. Analyze SVE/AS and Pump Test Data — Week of 11/7/93 or 11/14/93

12. Model GW at Dolphin — Week of 11/14/93 or 11/21/93

13. Conceptual Design — Week of _____

14. Final Design

    A. Building Design
    B. Process Design
    C. Well Decision (in 13 above)
    D. Piping Design
    E. Treatment Plant Design
    F. Details
    G. Specs
    H. Design Report
    I. Cost Estimate

Life threatening situations

Contact Naval Personnel Immediately

Insurance information

Golf

Gun

NEX

BLDG. ACTIVITY

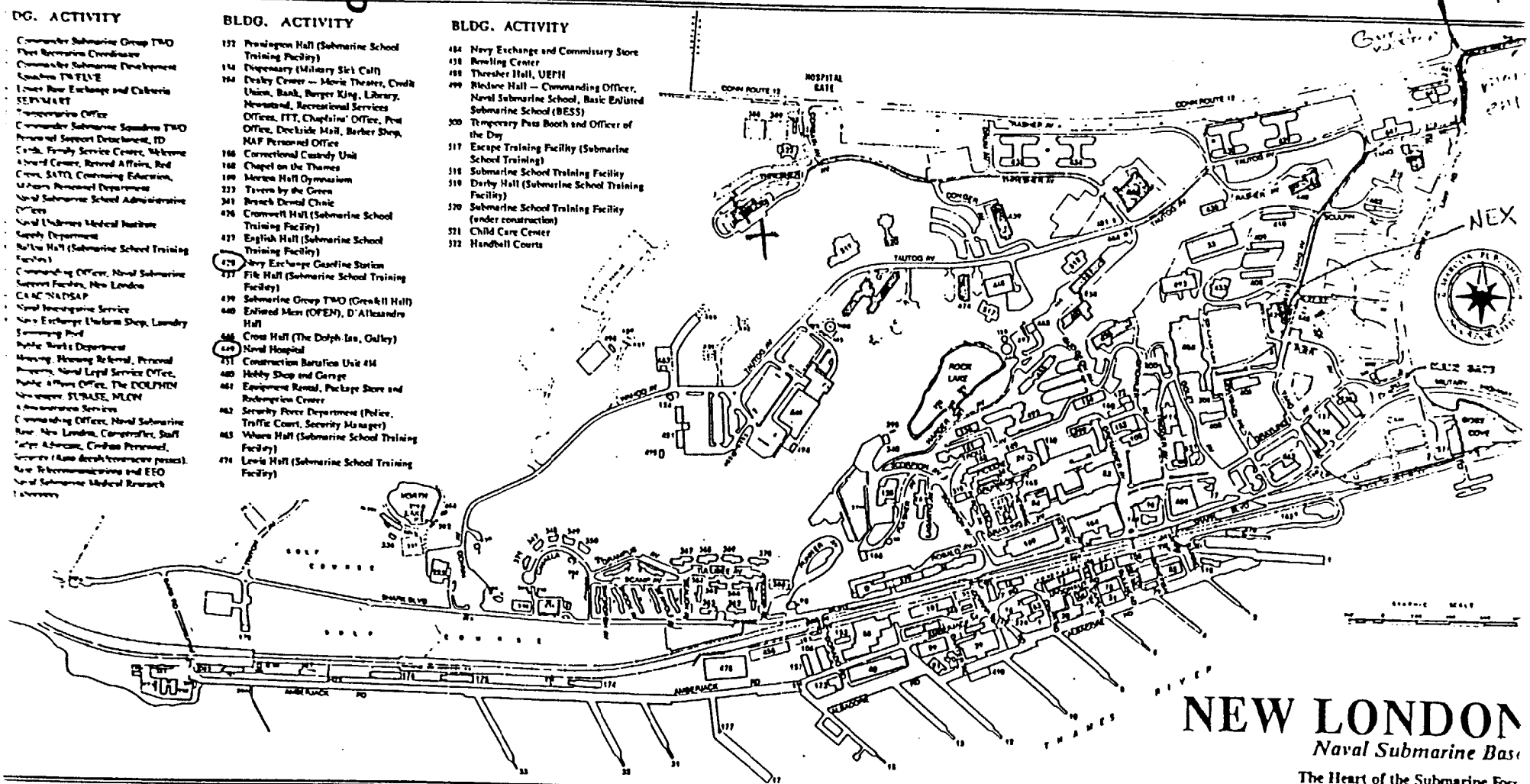
- Commander Submarine Group TWO
- Fleet Recreation Coordinator
- Commander Submarine Development Squadron TWELVE
- Exchange and Cafeteria
- SERVIMART
- Commissaries Office
- Commander Submarine Squadron TWO
- Personnel Support Detachment, ID
- Family Service Center, Welcome Aboard Center, Retired Affairs, Red Cross, SATTC, Continuing Education, Military Personnel Department
- Naval Submarine School Administrative Offices
- Naval Undersea Medical Institute
- Supply Department
- Hallen Hall (Submarine School Training Facility)
- Commanding Officer, Naval Submarine Support Facility, New London
- CINCLANTSUBAP
- Naval Investigative Service
- Navy Exchange Uniform Shop, Laundry
- Swimming Pool
- Public Works Department
- Housing, Housing Referral, Personal Property, Naval Legal Service Office, Public Affairs Office, The DOLPHIN Newspaper, SUBASE, NLON
- Administrative Services
- Commanding Officer, Naval Submarine Base New London, Comptroller, Staff Judge Advocate, Civilian Personnel, Security (Base decals/overseas passes), Base Telecommunications and EEO
- Naval Submarine Medical Research Laboratory

BLDG. ACTIVITY

- 132 Pennington Hall (Submarine School Training Facility)
- 134 Dispensary (Military Sick Call)
- 164 Dealey Center — Movie Theater, Credit Union, Bank, Burger King, Library, Newsstand, Recreational Services Offices, ITT, Chaplains' Office, Post Office, Deckside Mall, Barber Shop, NAF Personnel Office
- 166 Correctional Custody Unit
- 168 Chapel on the Thames
- 189 Morton Hall Gymnasium
- 223 Tavern by the Green
- 341 Branch Dental Clinic
- 426 Cromwell Hall (Submarine School Training Facility)
- 427 English Hall (Submarine School Training Facility)
- 429 Navy Exchange Gasoline Station
- 437 Fife Hall (Submarine School Training Facility)
- 439 Submarine Group TWO (Grenkell Hall)
- 440 Enlisted Mess (OPEN), D'Alessandro Hall
- 446 Crow Hall (The Dolphin Inn, Galley)
- 449 Naval Hospital
- 451 Construction Battalion Unit 414
- 460 Hobby Shop and Garage
- 461 Equipment Rental, Package Store and Redemption Center
- 462 Security Force Department (Police, Traffic Court, Security Manager)
- 463 Where Hall (Submarine School Training Facility)
- 474 Lewis Hall (Submarine School Training Facility)

BLDG. ACTIVITY

- 484 Navy Exchange and Commissary Store
- 498 Bowling Center
- 498 Thresher Hall, UEPH
- 499 Bledsoe Hall — Commanding Officer, Naval Submarine School, Basic Enlisted Submarine School (BESS)
- 500 Temporary Pass Booth and Officer of the Day
- 517 Escape Training Facility (Submarine School Training)
- 518 Submarine School Training Facility
- 519 Darby Hall (Submarine School Training Facility)
- 520 Submarine School Training Facility (under construction)
- 521 Child Care Center
- 522 Handball Courts



CONTINUED ON: MAP 50

CONTINUED ON: MAP 51

CONTINUED ON: MAP 60

CONTINUED ON: MAP 63

P Q R S T U

21 22 23 24

NEW LONDON
WATERFORD
AIRPORT

NEW LONDON

THAMES RIVER

Morningside Park

Groton

GROTON
NEW LONDON
AIRPORT

Reservoir

Brook

Great

Crystal Lake

U.S. COAST GUARD ACADEMY

CONNECTICUT COLLEGE ARBORETUM

COLLEGE CT.

GALLOWS

TOTOKET RD.

MILTON DR.

BLOOMINGDALE

GREEN DR.

DUNBAR RD.

BRIAR HILL RD.

CHAPMAN AV.

PILGRIM RD.

MEADOW

KENTON RD.

DAYTON RD.

VAUXHALL ST.

HICKORY LN.

FAIRLEAST DR.

BEACON HILL

DOUGLAS LN.

BALLENTREE DR.

TNPK.

CROSS RD.

FOSTER RD.

PROPOSED

PARKWAY N.

PARKWAY S.

AUSTIN

JEFFERSON

CROSS

POST RD.

WARILYN RD.

BEVERLY RD.

ROCK RIDGE RD.

SUNNYCREST DR.

COCKSHIRE RD.

TOWNSHIP

LAKE ST.

CLARK LN.

MULLEN HILL RD.

PARA LN.

GALLUP LN.

OVERLOOK DR.

LONGVIEW AV.

NORTH RD.

TOWNHALL

WIEMES CT.

NAPLE TER RD.

SUNSET DR.

DANIELS LN.

SOUTHWEST ELEM. SCH.

ROPE FERRY

COLONIAL CT.

LAUREL CREST DR.

GREAT

DEERFIELD RD.

WHALING

WATERFORD

HOLL RD.

MINER LN.

WINROE ST.

NORMAN ST.

CLEVELAND ST.

BRIDGE ST.

BANKS ST.

BANKS AV.

BANKS PL.

BANKS CT.

BANKS TER.

BANKS CIR.

BANKS PARK

RIVERSIDE PARK

WINTHROP SCH.

TOWN HALL

CITY HOSPITAL

BUILDING

BAKER

GRANITE ST.

LATHAM

FOREST ST.

CHESTNUT ST.

BURGE ST.

CHAPMAN

NICHOLS

TRITON

WARNER

GODFREY

MOYAND

LEE SCH.

BLUEBERRY HL. RD.

VILLAGE RD.

HOLLY

HALE

PLANT ST.

BIRCH LN.

CHESTNUT

SOUTH RD.

BUDDINGTON RD.

LAURELWOOD RD.

GREENEN

STAR

MEMORIAL

BRIDGE ST.

ROBERT RD.

THORBURN RD.

BOTTOM

TOWER RD.

NEW ROCK RD.

THOMAS

HALE

BONNIE CIR.

LINDA CT.

CAROL CT.

ELLA VISTA ST.

JAMES ST.

BALTOWSTALL

FAIRWOOTH ST.

DEBNON ST.

ROSELEAN DR.

ROLLER

ANN RD.

CRYSTAL LAKE

CRYSTAL LAKE RD.

CLAYTON RD.

BONANZIE ELEM. SCH.

DOUGLAS

WATERWOOD

OAKVILLE

COMPLEX

CAMP RD.

Brook

Great

21 22 23 24

P Q R S T U