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HRP
ASSOCIATES, INC.

REPORT OF AIR SPARGING/SOIL VAPOR PILOT EXTRACTION TESTS AND RELATED INVESTIGATIONS

OLD FUEL FARM
BRUNSWICK NAVAL AIR STATION
BRUNSWICK, MAINE

HRP #NAV-0030.FE

A/E CONTRACT #N 62472-93-D-1448

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1.0 INTRODUCTION

Previous investigations of the Brunswick Naval Air Station (BNAS) fuel farm were performed in 1990 and 1991 by O'Brien and Gere Engineers, Inc. (O&G) and included a soil gas survey, ground penetrating radar survey and the installation and sampling of 37 ground water monitoring wells. Current site conditions including the existing monitoring wells, site buildings and physical structures, and topography are shown in Sheet 1 (attached).

Results of the O&G investigations identified two (2) distinct petroleum contaminant plumes. Plume I is located in the east central portion of the fuel farm and appears to be sourced in the vicinity of an existing JP-5 tank (T-202), and extends downgradient towards the south southeast. Plume I consists principally of the BTEX compounds (benzene, toluene, ethyl benzene and xylenes) with the highest concentrations detected in monitoring well MW-12 (approximately twenty parts per million (ppm) total BTEX in 1990 and two ppm in 1991). Monitoring well MW-12 is located adjacent to tank T-202.

Plume II is located in the north central portion of the western half of the fuel farm and appears to be sourced in the vicinity of the former glycol tanks T-104 and T-105. Plume II also consists principally of BTEX compounds, although at significantly lower concentrations compared to Plume I. The highest total BTEX concentration detected by O&G within Plume I was approximately 120 parts per billion (ppb) in MW-23 (O&G 1991).

The old fuel farm at the BNAS originally consisted of nine underground storage tanks at the time of the O&G investigations as summarized below. All but two of these tanks have now been removed.

Tank #	Capacity (gallons)	Use	Current Status
T-101	100,000	sludge (former aviation gasoline)	Removed 1993
T-102	100,000	Gasoline	Removed 1993
T-103	100,000	Aviation Gasoline	Removed 1993
T-104	25,000	Ethylene Glycol	Removed 1993
T-105	25,000	Ethylene Glycol	Removed 1993
T-202	567,000	Jet Fuel JP-5	In Use
T-203	567,000	Jet Fuel JP-5	In Use
T-204	567,000	Jet Fuel JP-5	Removed 1993
T-205	567,000	Jet Fuel JP-5	Removed 1993

The fuel farm was constructed in two sections. The older, western portion (west of Seventh Street) included tanks T-101 through T-105. The newer, eastern portion (east of Seventh Street) included tanks T-202 through T-205. As indicated above, all of the tanks (and their associated utilities) were removed from the site in early 1993 with the exception of tanks T-202 and T-203, which are still in use.

The purpose of the investigation and testing performed by HRP, as described in this report, were: 1) to document the nature of the fill materials used in the tank excavations; 2) to confirm the degree and extent of the ground water contamination plumes (previously defined by O&G) utilizing the existing monitoring well network; and 3) to evaluate the feasibility of using air sparging/soil vapor extraction (AS/SVE) to remediate the ground water contamination.

2.0 DATA COLLECTION

As part of the hydrogeologic evaluation for the air sparging system pilot tests, HRP installed additional soil test borings and sampled and analyzed the existing ground water monitoring wells.

2.1 Test Boring Installations

Fifteen (15) soil test borings were installed at the locations shown on Sheet 1. Logs of each of the borings (B-1 through B-15) are included on Sheets 2 and 3.

The purpose of the test borings was to investigate the nature of the fill materials which have been utilized as backfill in the tank graves of the seven (7) underground tanks removed to date, and to provide general subsurface screening. The test boring location rationale and other pertinent data are summarized in Table 1. The depth (below grade) to the water table in these borings ranged from three to six feet below grade.

Soil samples were generally retrieved from the test borings over two foot intervals, every five feet, with a split spoon sampling device. Each soil sample was examined for soil descriptive purposes and for physical evidence of contamination (staining or odor), and was also screened with an HNu field photoionization detector (PID) for the presence of photoionizable volatile organic compounds in the parts per million range. The results of the HNu screening and physical inspection of samples are summarized in Table 2. Generally speaking, all of the borings encountered a fine to medium sand with occasional fines and organic (peat) lenses. This sand overlies a dense clay or bedrock surface at a depth ranging from 7.5 (B-15) to 16.0 (B-1) feet below grade. Refer to sheets 2 and 3 for test boring logs.

TABLE 1

TEST BORING LOCATION RATIONALE SUMMARY

Boring	Ground Elevation	Total Depth	Comments
B-1	72.09	24.5	Undisturbed area, blowing sand @ 9.0
B-2	71.83	16.5	T-103 grave
B-3	72.17	11.5	T-103 grave
B-4	72.63	14.5	T-101 grave
B-5	73.15	14.0	T-102 grave
B-6	72.72	9.0	T-104/T-105 grave, refusal @ 9.0
B-7	72.81	12.0	T-104/T-105 grave
B-8	72.58	12.0	T-104/T-105 grave
B-9	71.92	12.0	Undisturbed area
B-10	71.96	12.0	T-103 grave
B-11	69.61	15.0	T-205 grave
B-12	71.67	15.2	T-204 grave, refusal @ 15.2
B-13	72.70	13.0	T-204 grave, refusal @ 15.2
B-14	69.56	16.0	T-205 grave
B-15	68.80	11.0	Undisturbed Area

Elevations in feet above mean sea level
Depths in feet below grade

TABLE 2

TEST BORING SOIL SAMPLE PID SCREENING AND PHYSICAL INSPECTION RESULTS

Boring	Depth Interval	HNu Reading	Visible Staining?	Hydrocarbon Odor?
B-1	0-2	Ø	N	N
B-1	4.5 - 6.5	Ø	N	N
B-1	10 - 12	Ø	N	N
B-1	14.5 - 16.5	0.2	N	N
B-2	4.5 - 6.5	Ø	N	N
B-2	9.5 - 11.5	0.3	N	N
B-2	14.5 - 16.5	0.3	N	N
B-3	4.5 - 6.5	0.2	N	N
B-3	9.5 - 11.5	0.2	N	N
B-4	5 - 7	Ø	N	N
B-4	10 - 12	3.0	N	N
B-5	0 - 2	Ø	N	N
B-5	4.5 - 6.5	Ø	N	N
B-5	9 - 11	22.0	N	Y
B-6	0 - 2	Ø	N	N
B-6	5 - 7	19	Y	Y
B-7	5 - 7	70	Y	Y
B-7	10 - 12	30	Y	Y
B-8	0 - 2	Ø	N	N
B-8	5 - 7	24	N	Y
B-8	10 - 12	0.2	N	N
B-9	0 - 2	0.4	N	N
B-9	5 - 7	0.2	N	N
B-9	10 - 12	0.3	N	N
B-10	5 - 7	Ø	N	N
B-10	10 - 12	12	N	Y
B-11	0 - 2	Ø	N	N

TABLE 2
(continued)
TEST BORING SOIL SAMPLE PID
SCREENING AND PHYSICAL INSPECTION RESULTS

Boring	Depth Interval	HNu Reading	Visible Staining?	Hydrocarbon Odor?
B-11	5 - 7	2.8	N	N
B-11	10 - 12	5.5	N	Y
B-11	AF at 15	0.7	N	N
B-12	0 - 2	5.5	N	N
B-12	5 - 7	0.5	N	N
B-12	10 - 12	150	N	Y
B-13	5 - 7	3.0	N	N
B-13	10 - 12	∅	N	N
B-14	4 - 6	∅	N	N
B-14	9 - 11	2.2	N	N
B-14	14 - 16	0.1	N	N
B-15	4 - 6	∅	N	N
B-15	9 - 11	28	N	N

Depths in feet below grade
HNu readings in parts per million
Total headspace volatiles
N: No
Y: Yes
AF: Auger Flight

In all cases where a significant PID response or physical evidence of contamination was encountered, the samples in question had been collected at or below the local ground water table, which was encountered at three to six feet below grade. No significant evidence of soil contamination was observed in soil samples retrieved from above the water table in any of the fifteen test borings. Therefore, no physical evidence of residual petroleum contaminant source material was identified above the water table (vadose zone) in any of the borings.

2.2 Monitoring Well Sampling and Analysis

On October 14, 1993, HRP sampled 26 of the existing ground water monitoring wells that were previously installed by O&G (wells MW-7, MW-10 through MW-20A, MW-24 through MW-25A, and MW-27 through MW-31). Additionally, five other ground water samples were retrieved from monitoring wells MW-22, MW-26 and MW-2, piezometer PZ-23 (formerly MW-23) and the eastern area pilot sparging well (SWE) on November 10, 1993. These five samples were obtained from points which were installed or reconstructed by HRP at the time of the AS/SVE system installation. Several of the O&G monitoring wells which were crucial to plume definition in 1990 and 1991 had been seriously damaged or destroyed during site tank removal operations. Several of these wells were rehabilitated (MW-22, MW-1, MW-2) and two were converted into piezometers by pulling the two inch well materials from the ground and reinserting one inch materials back into the bore hole (PZ-5 and PZ-23).

Each of the samples were collected with a clean, single-use, disposable polyethylene bailer subsequent to the removal of approximately six (6) well

volumes of water for well development. PZ-23 and the eastern sparging well (SWE) were sampled with tygon tubing and a peristaltic pump as they are constructed of 1.0 inch inside diameter (I.D.) PVC. Samples were transferred directly into pre-labelled 40 milliliter VOA vials and packed on ice pending transport to Connecticut Testing Laboratories, Inc. (CTL) of Meriden, Connecticut. CTL is an independent Connecticut Department of Health Services certified analytical laboratory. The samples were analyzed for the presence of volatile organic compounds by U.S. EPA SW-846, Method 8260 (GC/MS) including quantifications of hydrocarbons as gasoline, kerosene, #2 fuel oil, diesel fuel, jet fuel (JP-5) and aviation gasoline. Each sample was also analyzed for the presence of pentane, hexane, heptane and octane by gas chromatography due to the presence of these compounds in several of the petroleum products currently or formerly stored at the fuel farm. The results of the ground water sampling are summarized in Table 3. Table 3 also includes current Federal and Maine drinking water standards for the detected contaminants. Complete laboratory analytical results are included as Appendix A.

Benzene was detected in seven (7) of the ground water samples at or in excess of current drinking water standards. Toluene and xylenes were also detected in the same seven ground water samples but were in excess of drinking water standards only in MW-10 (toluene) and MW-12 (toluene and xylenes). Hydrocarbons (as gasoline) were reported in the samples from MW-22, PZ-23 and the eastern sparge well (SWE) at levels above the Maine drinking water standard. Also the halogenated volatile organic compound 1,1-Dichloroethylene was detected in MW-24A in excess of the current drinking water

standard. This compound was not detected in any of the other sampled wells. MW-24A is screened in the deeper portion of the marine clay formation.

2.3 Definition of Ground Water Contaminant Plumes

The two ground water plumes defined by O&G in their 1990 and 1991 investigations are still present, based on the ground water sample analytical data. However, the distinction between the two plumes is no longer as evident. The approximate outlines of the contaminant plumes as total BTEX compounds are shown on Sheet 4. Two wells located on the western half of the facility which did not exhibit detectable levels of contamination in 1991, MW-22 and MW-25, exhibited contaminant levels in excess of current drinking water standards during the 1993 sampling.

The two plumes previously defined by the O&G investigations are currently represented by MW-10, MW-12, MW-18 and the eastern sparge well (Plume I), and by MW-22, PZ-23 (formerly MW-23) and MW-25 (Plume II). The interpreted source of Plume I is in the vicinity of Tank T-202 (west or north side) or the piping associated with it. It is noted that Plume I defined by O&G in 1990 was centered on wells MW-12 and MW-13, and also included wells MW-3, MW-4, MW-5, MW-8, MW-9, MW-10, MW-11, MW-14 and MW-16 to a much lesser extent. Many of these wells, including MW-13, were destroyed by tank removal operations or were dry at the time of the HRP sampling event. The source of Plume II appears to be located somewhere south of a line between MW-27 and MW-29, in the vicinity of tanks T-104 and T-105.

TABLE 3

VOLATILE ORGANIC COMPOUNDS IN GROUND WATER 10-14-93 AND 11-10-93

Well	STYR	CHA	11DCE	MEC	C12	TCA	BNZ	TOL	EBZ	XYL
MW-10							**68***	**2,880***		198
MW-12	2	3			2		**159***	**3,684***	146	**788***
MW-18				1			**35***	2		8
MW-22							**37***	191	18	64
PZ-23							**5***	8	1	6
MW-24A			**20***			19				
MW-25							**21***	148		16
Eastern Sparge Well (SWE)							**39***	7	21	31
Federal MCL	5	NS	7	5	70	200	5	1,000	700	10,000
Maine MEG	5	NS	7	48	70	200	5	NS	700	600

All results in parts per billion
STYR = Styrene
CHA = Chloroethane
11DCE = 1,1-Dichloroethylene
MEC = Methylene Chloride
C12 = Cis-1,2-Dichloroethylene

MCL = Maximum Contaminant Level (Federal)
MEG = Maximum Exposure Guideline (Maine)
NS = No Standard

Bold values* indicate standard equalled or exceeded
TCA = 1,1,1-Trichloroethane
BNZ = Benzene
TOL = Toluene
EBZ = Ethyl Benzene
XYL = Xylenes

No value indicates below detection level

TABLE 3 (Continued)

VOLATILE ORGANIC COMPOUNDS IN GROUND WATER 10-14-93 AND 11-10-93

Well	IBZ	NPBZ	135	TBBZ	124	ITOL	NAP	CHL	PENT	HC
MW-10										
MW-12										
MW-18										
MW-22	4	3	5	1	11	1	2		89	**640***
PZ-23			2		5	30	8		42	**150***
MW-24A										
MW-25										
Eastern Sparge Well (SWE)			2					3	132	**110***
Federal MCL	NS	NS	NS	NS	NS	NS	NS	100	NS	NS
Maine MEG	NS	NS	NS	NS	NS	NS	25	NS	NS	50

All results in parts per billion
IBZ = Isopropylbenzene
NPBZ = N-Propylbenzene
135 = 1,3,5-Trimethylbenzene
TBBZ = Tert-Butylbenzene
124 = 1,2,4 Trimethylbenzene

MCL = Maximum Contaminant Level (Federal)
MEG = Maximum Exposure Guideline (Maine)
NS = No Standard

Bold values* indicate standard equalled or exceeded
ITOL = P-Isopropyltoluene
NAP = Napthanlene
CHL = Chloroform
PENT = N-Pentane
HC = Hydrocarbons as Gasoline

No value indicates below detection level

For comparative purposes, the Federal MCL (maximum contaminant level) and Maine MEG (maximum exposure guidelines) are also presented in Table 3. It is noted that these drinking water standards apply to concentrations allowable in potable drinking water and not specifically to contaminants in ground water. However, they are typically utilized by environmental agencies as an initial basis of comparison in evaluating the need for remediation at contaminated sites. There is no current site use of the contaminated ground water identified at the BNAS old fuel farm.

As part of the treatability evaluation of site ground waters utilizing AS/SVE, six monitoring well ground water samples were also analyzed for iron, manganese, sodium and total dissolved solids (TDS) as summarized below.

Well	Iron	Manganese	Sodium	TDS
MW-7	5.33	0.28	23.2	205
MW-10	5.51	0.08	4.8	160
MW-12	5.01	0.23	4.5	119
MW-15	1.52	0.16	4.1	119
MW-20	0.60	0.58	10.6	278
MW-21	0.84	0.32	4.7	104
Standard	0.30*	0.20**	NS	NS

* Federal Secondary MCL
** Maine Maximum Exposure Guideline
NS No Federal or Maine Standard

Results in milligrams per liter.

Although the iron level is relatively high and would be a potential fouling concern in an above-ground air striping unit, none of the concentrations indicated above should pose a significant limitation on the use of air sparging for site remediation. Iron oxide precipitation in the aquifer material is not

expected to cause significant loss of permeability due to the typically short time spans that AS/SVE systems are operated (typically 6 months to one year).

2.4 Description of Subsurface Geologic and Hydrogeologic Conditions

Based on the previous drilling performed by O&G in 1990 and 1991, and the recent drilling by HRP as part of this investigation, the subsurface geology of the old fuel farm can be divided into three operational hydrostatigraphic units. Unit one, the deepest of the three units, is defined as the base of the unconsolidated, unconfined shallow aquifer system. Unit one is represented almost exclusively by the low permeability marine clay known as the Presumscott Formation. Unit one also includes the gneissic/ schistose bedrock. Unit one is separated from unit two by both a contrast in hydraulic conductivity and the absence of significant levels of BTEX ground water contamination.

Unit two, located immediately above Unit one, consists of a fine to medium sand which contains lenses of peat (up to one foot thick) and zones which contain finer grained materials (primarily silts). Unit two contains the unconfined, shallow aquifer system bounded on the bottom by unit one and on the top by the water table surface. The thickness of Unit two varies temporally with seasonal fluctuations in the water table elevation. Water level measurements performed by HRP (and previously by O&G) indicate that Unit two's average thickness in the investigated area is between two and ten feet.

Unit three lies above the local water table in the center of the western half of the site and consists of a silt and clay soil with abundant plant material (roots and stumps). Unit three lies stratigraphically above Unit two and appears to be approximately four feet thick. Unit three was identified during the installation of the western pilot test system. Unit three was not identified in

the test borings and appears localized in extent. This unit acted as a confining (or semi-confining) layer during the sparge test (when water elevations were artificially raised) and its relatively low permeability inhibited the performance of the venting portions of the western system pilot test.

Under natural ground water flow conditions, Unit three would not be expected to interact with the ground water system other than inhibiting the infiltration of areal recharge.

Ground water elevations were measured in all competent monitoring wells and piezometers on November 8, 1993. HRP included four monitoring wells located near the fuel farm's southwest corner (MW-9501 through MW-9504) in the ground water elevation mapping. Measured depths to ground water and calculated ground water elevations are presented in Table 4.

Ground water elevation contours were constructed using the shallow well data (Hydrostatographic Unit Two wells) only and are presented on Sheet 5. The contours define a primary flow direction towards the southeast with a distinct area of ground water mounding in the vicinity of tank T-203 and to a lesser extent, tank T-202. The mounding is presumed to be caused in part by a damming effect of the large underground tanks and in part as an echo of the topographic high caused by the tank cover materials. It is assumed that, subsequent to the removal of tanks T-202 and T-203 (scheduled for late spring/early summer 1994), ground water levels will equilibrate to a more uniform flow field.

TABLE 4 GROUND WATER LEVELS 11/8/93			
Well #	Reference Elevation	Depth to H_2O	Ground Water Elevation
MW-1	72.61	6.64	65.97
MW-2	70.83	5.90	64.93
PZ-5	75.22	12.27	62.95
MW-7	75.56	8.08	67.48
MW-9	81.49	Dry	---
MW-10	73.40	5.64	67.76
MW-11	74.36	7.14	67.22
MW-12	75.27	7.83	67.44
MW-13	81.39	Dry	---
MW-14	75.13	8.22	66.91
MW-15	73.59	6.64	66.95
MW-16	73.73	5.32	68.41
MW-17	73.04	4.51	68.53
MW-17A	73.67	11.25	62.42
MW-18	71.97	7.26	64.71
MW-18A	70.89	12.51	58.38
MW-19	69.68	6.75	62.93
MW-20	66.86	5.98	60.88
MW-20A	66.70	8.36	58.34
MW-21	72.99	7.01	65.98
MW-22	74.14	6.38	67.76
PZ-23	73.95	6.27	67.68
MW-24	75.33	8.17	67.16
MW-24A	75.24	8.14	67.10
MW-25	73.35	6.03	67.32
MW-25A	73.87	12.20	61.67
MW-26	69.59	5.39	64.20

TABLE 4 (continued) GROUND WATER LEVELS 11/8/93			
Well #	Reference Elevation	Depth to H_2O	Ground Water Elevation
MW-27	71.17	2.72	68.45
MW-28	72.84	3.70	69.14
MW-29	71.77	2.85	68.92
MW-30	80.66	10.75	69.91
MW-30A	81.41	17.78	63.63
MW-31	61.21	1.95	59.26
MW-9501	74.18	6.12	68.06
MW-9502	78.65	10.26	68.39
MW-9503	74.22	6.02	68.20
MW-9504	74.63	6.62	68.01

Elevations in feet above mean sea level.
Depths in feet below reference point.

MW-9501 through MW-9504 are located to the west of the southwest corner of the old fuel farm.

3.0 PILOT SYSTEM TESTING

To evaluate the feasibility of utilizing a combined air sparging/soil vapor extraction (AS/SVE) system as a remediation technology, two pilot AS/SVE systems were installed on the site. Each system consisted of a soil vapor extraction trench, an air sparging injection well and a series of soil vapor and ground water monitoring probes to monitor the tests. AS/SVE systems are a ground water remedial technique where pressurized air is injected into an aquifer beneath a zone of ground water contamination. Volatile organic compounds move from the dissolved phase to the vapor phase by diffusion into the injected air as it rises by simple buoyancy up through the contaminated aquifer. A soil vapor extraction system is then typically utilized to collect the sparged contaminated air for discharge to the atmosphere and/or off gas treatment.

3.1 System Location and Installation

The highest levels of ground water contamination detected on the site to date are located in the vicinity of Tank T-202. Both tanks T-202 and T-203 were operational at the time of the testing. Additionally, all of the piping, venting, and electrical services associated with Tanks T-202 and T-203 including the fueling and off-loading areas were intact and operational. Subsurface investigation and testing were therefore limited to the western and extreme eastern portions of the fuel farm where the levels of ground water contamination were comparatively lower, and where soil contamination (above the water table) was not in evidence.

The western pilot system was installed in the vicinity of monitoring well MW-23 (reconstructed by HRP with one inch diameter PVC as PZ-23), which exhibited the highest levels of ground water contaminants on the western half

of the site in the 1991 O&G sampling event. The eastern pilot system was installed in the vicinity of HRP test boring B-15 where it was considered that sufficient saturated and unsaturated thicknesses were present above the basal clay to allow meaningful testing. This location was also chosen as it is effectively down-gradient of the ground water contaminant plume (Plume I) centered around tank T-202 and would therefore likely intercept measurable ground water contamination.

The western system consisted of an SVE trench approximately forty-four feet in length, three feet deep and approximately three feet wide. Forty feet of two inch diameter, 0.01 inch slotted PVC well screen surrounded with filter fabric was placed into the trench bottom and surrounded with filter sand. A single layer of 6 mil poly sheeting was placed above the sand and the trench was backfilled with the excavated material. Two inch diameter PVC riser pipe was extended from the western end of the screen to a level above existing grade. A perpendicular line of probes and wells was extended from the midpoint of the trench towards the north as summarized in Table 5A. Construction details for the eastern system are summarized on Table 5B. Construction diagrams for both systems are shown on Sheet 6.

3.2 Test Overview

Both of the systems were tested utilizing a similar three step methodology: Step 1 consisted of an independent soil vapor extraction test; Step 2 consisted of an independent air sparging test; and Step 3 consisted of a combined air sparging/soil vapor extraction test as follows.

Step 1 - Soil Vapor Extraction Test -

- A Rotron DR-454 regenerative blower unit was piped to the soil vapor extraction trench riser (vent).

TABLE 5A

WESTERN PILOT SYSTEM CONSTRUCTION DETAILS

Point Designation	Type	Depth at Bottom	Screen Length	Diameter (I.D.)	Distance from Trench	Distance from SW
S 2.5	SM	10.0	2.0	1.5	2.5	12.5
V 5	VM	3.5	1.0	1.0	5.0	10.0
S 7.5	SM	10.0	2.0	1.5	7.5	7.5
V 10	VM	3.5	1.0	1.0	10.0	5.0
V 12.5	VM	3.5	1.0	1.0	12.5	2.5
SW(W) 15	SW	16.0	2.0	1.0	15	∅
V 17.5	VM	3.5	1.0	1.0	17.5	2.5
S 20	SM	10.0	2.0	1.5	20.0	5.0
V 25	VM	3.5	1.0	1.0	25.0	10.0

Types: SM = Sparging (water) Monitoring Probe
VM = Soil Vapor Monitoring Probe
SW = Sparging Injection Well

Depths in feet below grade
Distances and lengths in feet
Diameters in inches
All screens 0.01 inch slotted PVC

TABLE 5B

EASTERN PILOT SYSTEM CONSTRUCTION DETAILS

Point Designation	Type	Depth at Bottom	Screen Length	Diameter (I.D.)	Distance from Trench	Distance from SW
S 2.5	SM	7.5	1.0	1.5	2.5	10.0
V 5	VM	2.5	1.0	1.0	5.0	7.5
V 7.5	VM	2.5	1.0	1.0	7.5	5.0
S 10	SM	7.5	1.0	1.5	10.0	2.5
SW(E) 12.5	SW	8.0	1.0	1.0	12.5	∅
V 15	VM	2.5	1.0	1.0	15.0	2.5
S 17.5	SM	7.5	1.0	1.5	17.5	5.0
V 22.5	VM	2.5	1.0	1.0	22.5	10.0

Types: SM = Sparging (water) Monitoring Probe
VM = Soil Vapor Monitoring Probe
SW = Sparging Injection Well

Depths in feet below grade
Distances and lengths in feet
Diameters in inches
All screens 0.01 inch slotted PVC

- Pre-test soil vapor samples were retrieved from each of the soil vapor monitoring probes utilizing a glass sample bulb connected in line with a personal sampling pump. The sampling pump was operated at a rate of five liters per minute for a period of five minutes prior to taking the sample. Samples were injected into a Photovac 10S50 field portable gas chromatograph (GC) for identification and relative quantification of specific BTEX compounds present within the soil vapors.

- Operation of the blower unit was initiated to draw soil gas vapors from the subsurface via the extraction trench. Magnehelic vacuum pressure gauges were utilized to measure induced vacuum at each of the soil vapor monitoring probes at intervals of time until stabilization of the readings was apparent.

- Measurements of vacuum and flow rate, and periodic discharge samples were taken from ports located on the piping connecting the blower unit to the trench.

- Upon stabilization of pressure and contaminant concentration levels, step one of the test was terminated.

Step 2 - Air Sparging System Test -

- Pre-test water level and dissolved oxygen readings were taken at the sparge monitoring probes and nearby monitoring wells/piezometers.

- The sparging injection well was piped to an eight horsepower piston type air compressor.

- Operation of the compressor was initiated to inject air into the shallow aquifer.

- Periodic water levels and dissolved oxygen levels were measured in the sparge monitoring probes and nearby monitoring wells.

- The test was terminated after water level and D.O. readings stabilized or began to decrease.

Step 3 - Combined AS/SVE Test -

- Subsequent to the air sparging system test (step two), the soil vapor extraction system was then operated in conjunction with the air sparging injection.

- Samples (vapor) were retrieved from the sparge monitoring probes, soil vapor monitoring probes and from the vapor extraction trench piping (vent).

- The test was terminated when the soil vapor concentrations from the extraction trench vent had stabilized.

The western vapor extraction system induced a vacuum of approximately 15 inches of water with an air flow of approximately 100 to 110 cubic feet per minute (CFM) on the forty foot vapor extraction trench. The western air sparge injection well was operated at approximately four (4) CFM flow rate at five (5) pounds per square inch (PSI) of pressure.

The eastern vapor extraction system induced a vacuum of approximately 11.5 inches of water at 115 CFM. The eastern air sparge injection well was operated at approximately two (2) CFM flow rate at three (3) PSI. Graphical and numerical analysis of the AS/SVE system testing is included in Appendix B.

3.3 Western System Test Results

The western pilot system was tested on November 10, 1993. The venting only phase (Step 1) was performed for a period of two hours. Pre-test GC Measurements of BTEX compounds in the soil vapor monitoring probes and sparge monitoring probes identified Ethyl Benzene (at a relative concentration of 30.87 parts per billion (ppb)) in sparge monitoring point S-7.5 as the only detectable pre-test contaminant. Ethyl Benzene was also detected at 12.89 ppb in the vent discharge 90 minutes into the test, but was not detected in the samples retrieved at 0, 30, 60 or 120 minutes. No other BTEX constituents were detected before, after, or during the conduct of the venting portion of the western system testing.

No discernable pattern of pressure readings was generated during the two hour test. Significantly higher vacuum readings were occasionally measured in the venting points farther away from the venting trench than in those closer to it. Many of the readings were also very low, approaching the measurement accuracy of the magnehelic gauge (0.10 inches of water). This

reaction to the venting is believed to be due to the very low permeability of the uppermost three to four feet of soil (hydrostatographic Unit three) in the test area.

The sparging only portion (Step 2) of the western system testing was performed for a period of two hours. Dissolved oxygen and water level readings were made in the three sparge monitoring probes (S-2.5, S-7.5, and S-20), MW-22 and MW-24 both prior to and during the sparge only test. Water levels were also recorded in PZ-23, MW-24 and MW-24A. The results of the testing are presented in Tables 6 and 7:

TABLE 6
DISSOLVED OXYGEN READINGS, WESTERN SYSTEM TEST

Time	S-2.5	S-7.5	S-20	MW-22	MW-24
Pre-test (0900)	1.25	1.05	.65	.85	.70
0930	1.50	10.00	13.00	1.25	1.40
1020	1.30	6.75	12.00	1.10	1.10
1100	1.70	8.00	12.00	0.90	1.00
Net Change	0.45	6.95	11.35	0.05	0.30
Distance from sparge well	12.5	7.5	5.0	56.4	104.1

Distances in feet, D.O. levels in mg/l

TABLE 7
WATER LEVEL CHANGES, WESTERN SYSTEM TEST

Time	S-2.5	S-7.5	S-20	MW-22	PZ-23	MW-24	MW-24A
0930	2.1	3.35	4.42	0.06	1.45	NM	NM
1015	2.4	2.77	6.47	0.33	2.29	0.04	0.01
1045	1.94	2.62	5.87	0.50	1.95	0.05	0.00
Distance from sparge well	12.5	7.5	5.0	56.4	19.20	104.1	105.0

Values expressed as feet above pre-test conditions
Distances in feet
NM = Not Measured

The dissolved oxygen readings indicate a significant radius of influence of the sparging well of approximately 12.5 feet from the well as defined by the zero intercept of the line defined by the readings from S-7.5 and S-20. The readings from S-2.5, MW-22 and MW-24 are probably within a margin of error of the YSI dissolved oxygen meter utilized for the measurements. It is noted that bubbles were observed during the testing in both S-7.5 and S-20.

The water level data indicate that the pressure induced on the system by the sparge well was translated through the aquifer to a distance of at least 60 feet (beyond MW-22 at 56.4 feet). This is believed to be attributable to the low permeability soil in the upper three to four feet in the test area designated as hydrostratographic Unit three. The water level readings represent a piezometric surface in the vicinity of the sparging well and not the water table. It is noted that the water levels measured in probe S-20, located five feet from the sparge well were actually above ground level during a large portion of the test. A line plotted against the water level values from the sparge probes only, indicates a significant radius of influence between 9 and 16 feet from the sparge well.

The combined air sparging/soil vapor extraction test (Step 3) was performed for a period of one hour immediately following the sparging portion of the test. No detectable levels of BTEX compounds were identified in the soil vapor monitoring probes. However, GC screening of the sparge monitoring probes and vent discharge yielded the following results:

TABLE 8 COMBINED WESTERN AS/SVE TEST GC SCREENING RESULTS				
Sample Point	**Time**	**Ethyl Benzene**	**Total Xylenes**	**Distance from Sparge Well**
S-2.5	---	3,401.0	42.0	12.5
S-7.5	---	4,030.0	BDL	7.5
S-20	---	74.0	BDL	5.0
Vent	∅	23.0	BDL	15.0
Vent	15	14.0	BDL	15.0
Vent	30	11.7	BDL	15.0
Vent	45	13.0	BDL	15.0
Vent	60	11.0	BDL	15.0

Time in minutes
Concentrations in parts per billion
Distances in feet
BDL - Below Detection level
Sparge samples taken randomly during test

As Table 8 shows, significant quantities of volatile organic compounds were liberated by the air sparging as detected in the sparge monitoring probes. Contamination was being intercepted by the venting trench as indicated by the detectable levels of ethyl benzene in the discharge. The significantly lower values in the vent discharge are due to the dilution of the liberated VOCs by essentially clean soil vapors being drawn in along the length of the forty foot venting trench.

The relatively low level of ethyl benzene reported in monitoring probe S-20, which is nearest to the sparging well, is due to the large volume of "clean" atmospheric air being introduced via the sparging well at a rate far in excess of the rate of diffusion of ground water contaminants from the dissolved to the vapor phase.

3.4 Eastern System Test Results

The eastern pilot system was tested on November 11, 1993, in much the same manner as the western system test. GC screening of samples from the soil vapor and sparge monitoring probes and vacuum trench discharge did not reveal detectable levels of BTEX compounds either before, after or during any of the three phases of the eastern system test.

Vacuum pressure readings stabilized within five minutes of the initiation of the venting phase at the following vacuum readings:

Probe:	V-5	V-7.5	V-15	V-22.5
Vacuum: in inches of H_2O.	3.0	2.6	0.5	0.1

Vacuum readings remained constant throughout the two hour test duration. A simple vacuum vs distance plot indicates an effective radius of influence at the applied vacuum of approximately twenty two (22) feet. Utilizing the steady state solution developed by Johnson (1988) an estimate of the intrinsic soil permeability was performed. The resultant value of 8.7×10^{-4} cm^2 would be expected of clean gravels as opposed to clean fine to medium sands. This apparent overestimation may be due to some degree of short circuiting of air flow along the forty foot long horizontal venting trench.

The sparging portion of the test was performed for a one hour period with the following results:

TABLE 9 DISSOLVED OXYGEN READINGS, EASTERN SYSTEM TEST				
Time	S-2.5	S-10	S-17.5	MW-2
Pre-test (0900)	4.6	10.0	10.0	9.0
1005	5.0	10.0	10.0	NM
1020	5.0	10.0	10.8	NM
1045	5.5	10.0	10.5	9.0
Net Change	0.9	0.0	0.5	0.0
Distance from sparge well	10.0	2.5	5.0	62.5

Readings in mg/l
Distances in feet
NM = not measured

TABLE 10 WATER LEVEL CHANGES, EASTERN SYSTEM TEST				
Time	S-2.5	S-10	S-17.5	MW-1
1000	Ø	1.01	0.40	Ø
1015	Ø	1.34	0.73	Ø
1030	Ø	1.00	0.79	Ø
1045	Ø	1.00	0.76	Ø
1100	Ø	0.94	0.73	Ø
Distance from sparge well	10.0	2.5	5.0	62.5

Values expressed as feet above pre-test conditions
Distances in feet.

No radius of influence can be obtained from the dissolved oxygen data other than that it is likely greater than 10.0 feet from the sparge well. The water level changes indicate an approximate radius of influence of between 7.5 and 10.0+ feet.

The combined AS/SVE test was operated for a period of one hour during which the vent exhaust and monitoring probes were sampled periodically with the GC without detectable results.

3.5 Conclusions Concerning the Utility of Air Sparging to Site Remediation

Pilot AS/SVE ground water remediation systems were installed and tested in two areas of the site. The western system was installed in BTEX Plume II and the eastern system in Plume I.

Both pilot system tests were performed in areas where vadose zone soil contamination is minimal or non-existent and where ground water contamination levels are low to moderate. This was because the area of the most significant ground water contamination detected on the site is in close proximity to tank T-202, an active underground storage tank with a capacity of 567,000 gallons of jet fuel (JP-5), where subsurface testing cannot be performed at this time due to physical site constraints. The testing was therefore performed as a site baseline evaluation to a) evaluate the physical potential for the use of AS/SVE remedial techniques in the accessible areas of the site, and b) to extrapolate these results to other areas of the site as possible.

From a physical standpoint, both pilot systems performed well in the sparging phase, indicating sparge radii of between 10 and 12.5 feet. Physically, the venting phase of the tests performed well on the eastern system, indicating an effective vent radius of approximately 22 feet. Little measurable physical response was seen in the western system due to localized, near surface, low permeability soils.

From a contaminant removal standpoint, the western system test indicated that BTEX compounds can be stripped from site ground water by sparging and be removed by soil vapor extraction. No detectable levels of BTEX compounds were identified in the eastern system due to lower ground

water contaminant concentrations at the pilot test location. Due to the presence of tank T-102 and associated pipelines/structures, it was not possible to locate the pilot test in the center of the contamination plume previously identified by O&G. It is expected that an AS/SVE system installed in the eastern contaminant source area, where the highest on-site ground water contaminant levels have been detected, will be effective in contaminant removal.

HRP concludes that venting systems for the withdrawal of contaminated soil vapors and sparged contaminated vapors can be successfully operated at this site. The radius of influence from the venting trenches is expected to be on the order of 20 to 25 feet, depending on the vacuum and flow rates used. Effective sparging radii, however, appear to be limited to no more than fifteen feet due to the generally thin saturated thickness of the unconfined aquifer. HRP recommends that final design of the AS/SVE system proceed.

Many of the ground water monitoring wells which were installed by O'Brien and Gere have been destroyed, primarily on the eastern side of the fuel farm. HRP understands that many of these destroyed wells are to be replaced by the tank removal contractor subsequent to the completion of the removal of tanks T-202 and T-203. It is noted that ground water contaminant concentrations in Plume II have generally decreased since the O&G sampling events in 1990 and 1991. Although the number of wells in which petroleum compounds have been detected has increased from those reported by O&G, no petroleum compounds have as yet been detected in the outermost downgradient series of monitoring wells (MW-24, MW-26, MW-19, MW-20, and MW-31).

The bulk of the significant site ground water contamination is in the vicinity of tank T-202, which is slated for removal in the near future (late spring/early summer 1994). HRP understands that significant dewatering will be performed in the vicinity of this tank to accomplish its removal. This dewatering, in addition to source removal, should remediate a portion of the worst case site ground water contamination.

HRP recommends that the AS/SVE system design address the estimated or anticipated effects of the tank removals and associated dewatering on the aquifer thickness and ground water flow system dynamics. HRP recommends that separate systems for the western (Plume II) and eastern (Plume I) portions of the site be designed to allow construction and operation of the western system independent of any delays associated with tank removal and site restoration work on the eastern half of the site.

APPENDIX A

GROUND WATER SAMPLE LABORATORY ANALYTICAL REPORTS

November 1, 1993

RECEIVED
NOV - 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 : **October 15, 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.	: 103-477-6
PO/JOB No.	: NAV0030.FE
INVOICE No.	: 39814
ORDER No.	: 19716
CUSTOMER No.	: 350

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

Very truly yours,

Stephen J. Franco

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 : 10-15-93

Client Name... : **HRP Associates Inc.**	CTL Lab No. 103-477-6
Date of Report : 11-1-93	PO/Job No. NAV0030.FE

RESULTS OF ANALYSIS

Dissolved Metals

Matrix Type	**W**	**W**	**W**	**W**
CTL Sample No.	**12368**	**12369**	**12371**	**12374**
Field Id	**MW-7**	**MW-10**	**MW-12**	**MW-15**
Iron-mg/L	5.33	5.51	5.01	1.52
Manganese-mg/L	0.28	0.08	0.23	0.16
Sodium-mg/L	23.2	4.8	4.5	4.1
Tot. Dissolved Solids-mg/L	205	160	119	119

Dissolved Metals

Matrix Type	**W**	**W**		
CTL Sample No.	**12381**	**12383**		
Field Id	**MW-20**	**MW-21**		
Iron-mg/L	0.60	0.84		
Manganese-mg/L	0.58	0.32		
Sodium-mg/L	10.6	4.7		
Tot. Dissolved Solids-mg/L	278	104		

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

October 29, 1993

RECEIVED
NOV - 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 : **October 15, 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.	: 103-447-26
PO/JOB No.	: NAV0030.FE
INVOICE No.	: 39756
ORDER No.	: 19658
CUSTOMER No.	: 350

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

Very truly yours,

Stephen J. Franco

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.	: 103-447-26	Date Analyzed	:10/27-10/28/93
PO No.	: NAV0030.FE		
Rep. Date	: 10-29-93	Analyst	: YK

EPA METHOD 8260 GC/MS Date Samples Rec'd: 10-15-93

Matrix Type :		W	W	W	W
Field ID :	MDL	MW-7	MW-10	MW-11	MW-12
Dichlorodifluoromethane	1	BDL	BDL	BDL	BDL
Chloromethane	1	BDL	BDL	BDL	BDL
Vinyl chloride	1	BDL	BDL	BDL	BDL
Chloroethane	1	BDL	BDL	BDL	3.0
Bromomethane	1	BDL	BDL	BDL	BDL
Trichlorofluoromethane	1	BDL	BDL	BDL	BDL
1,1-Dichloroethylene	1	BDL	BDL	BDL	BDL
Methylene chloride	1	BDL	BDL	BDL	BDL
trans-1,2-Dichloroethylene	1	BDL	BDL	BDL	BDL
1,1-Dichloroethane	1	BDL	BDL	BDL	BDL
2,2-Dichloropropane	1	BDL	BDL	BDL	BDL
cis-1,2-Dichloroethylene	1	BDL	1.0	BDL	2.0
Chloroform	1	BDL	BDL	BDL	BDL
Bromochloromethane	1	BDL	BDL	BDL	BDL
1,1,1-Trichloroethane	1	BDL	BDL	BDL	BDL
1,1-Dichloropropylene	1	BDL	BDL	BDL	BDL
Carbon tetrachloride	1	BDL	BDL	BDL	BDL
Benzene	1	BDL	68.0	BDL	159.0
1,2-Dichloroethane	1	BDL	BDL	BDL	BDL
Trichloroethylene	1	BDL	BDL	BDL	BDL
1,2-Dichloropropane	1	BDL	BDL	BDL	BDL
Bromodichloromethane	1	BDL	BDL	BDL	BDL
Dibromomethane	1	BDL	BDL	BDL	BDL
cis-1,3-Dichloropropylene	1	BDL	BDL	BDL	BDL
Toluene	1	BDL	2,880.0	BDL	3,684.0
t-1,3-Dichloropropylene	1	BDL	BDL	BDL	BDL
1,1,2-Trichloroethane	1	BDL	BDL	BDL	BDL
Tetrachloroethylene	1	BDL	BDL	BDL	BDL
1,3-Dichloropropane	1	BDL	BDL	BDL	BDL
Dibromochloromethane	1	BDL	BDL	BDL	BDL
1,2-Dibromoethane (EDB)	1	BDL	BDL	BDL	BDL
Chlorobenzene	1	BDL	BDL	BDL	BDL
Ethylbenzene	1	BDL	BDL	BDL	146.0
1,1,1,2-Tetrachloroethane	1	BDL	BDL	BDL	BDL
p/m-Xylene	1	BDL	139.0	BDL	593.0
o-Xylene	1	BDL	59.0	BDL	195.0

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 06450
(203)-634-3731
Connecticut Certification No. PH-0547

Client	: HRP Associates Inc.		
Lab No.	: 103-447-26	Date Analyzed	:10/27-10/28/93
PO No.	: NAV0030.FE		
Rep. Date	: 10-29-93	Analyst	: YK

EPA METHOD 8260 GC/MS **Date Samples Rec'd:** 10-15-93

	MDL				
Matrix Type :		W	W	W	W
Field ID :		MW-7	MW-10	MW-11	MW-12
Styrene	1	BDL	BDL	BDL	2.0
Bromoform	1	BDL	BDL	BDL	BDL
Isopropylbenzene	1	BDL	BDL	BDL	BDL
1,1,2,2-Tetrachloroethane	1	BDL	BDL	BDL	BDL
Bromobenzene	1	BDL	BDL	BDL	BDL
1,2,3-Trichloropropane	1	BDL	BDL	BDL	BDL
n-Propylbenzene	1	BDL	BDL	BDL	BDL
2-Chlorotoluene	1	BDL	BDL	BDL	BDL
1,3,5-Trimethylbenzene	1	BDL	BDL	BDL	BDL
4-Chlorotoluene	1	BDL	BDL	BDL	BDL
tert-Butylbenzene	1	BDL	BDL	BDL	BDL
1,2,4-Trimethylbenzene	1	BDL	BDL	BDL	BDL
sec-Butylbenzene	1	BDL	BDL	BDL	BDL
p-Isopropyltoluene	1	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	1	BDL	BDL	BDL	BDL
1,2,3-Trimethylbenzene	1	BDL	BDL	BDL	BDL
1,4-Dichlorobenzene	1	BDL	BDL	BDL	BDL
n-Butylbenzene	1	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	1	BDL	BDL	BDL	BDL
1,2Dibromo-3-chloropropane	1	BDL	BDL	BDL	BDL
1,2,4-Trichlorobenzene	1	BDL	BDL	BDL	BDL
Hexachlorobutadiene	1	BDL	BDL	BDL	BDL
Naphthalene	1	BDL	BDL	BDL	BDL
1,2,3-Trichlorobenzene	1	BDL	BDL	BDL	BDL
HC as Gasoline-ppm	.05	BDL	BDL	BDL	BDL
HC as Kerosene-ppm	.05	BDL	BDL	BDL	BDL
HC as #2 Fuel Oil-ppm	.05	BDL	BDL	BDL	BDL
HC as Diesel Fuel-ppm	.05	BDL	BDL	BDL	BDL
HC as JP-5-ppm	.05	BDL	BDL	BDL	BDL
HC as Aviation Gas-ppm	.05	BDL	BDL	BDL	BDL

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

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

Client	: HRP Associates Inc.		
Lab No.	: 103-447-26	Date Analyzed	:10/27-10/28/93
PO No.	: NAV0030.FE		
Rep. Date	: 10-29-93	Analyst	: YK

EPA METHOD 8260 GC/MS **Date Samples Rec'd:** 10-15-93

	MDL				
Matrix Type :		W	W	W	W
Field ID :		MW-13	MW-14	MW-15	MW-16
Dichlorodifluoromethane	1	BDL	BDL	BDL	BDL
Chloromethane	1	BDL	BDL	BDL	BDL
Vinyl chloride	1	BDL	BDL	BDL	BDL
Chloroethane	1	BDL	BDL	BDL	BDL
Bromomethane	1	BDL	BDL	BDL	BDL
Trichlorofluoromethane	1	BDL	BDL	BDL	BDL
1,1-Dichloroethylene	1	BDL	BDL	BDL	BDL
Methylene chloride	1	BDL	BDL	BDL	BDL
trans-1,2-Dichloroethylene	1	BDL	BDL	BDL	BDL
1,1-Dichloroethane	1	BDL	BDL	BDL	BDL
2,2-Dichloropropane	1	BDL	BDL	BDL	BDL
cis-1,2-Dichloroethylene	1	BDL	BDL	BDL	BDL
Chloroform	1	BDL	BDL	BDL	BDL
Bromochloromethane	1	BDL	BDL	BDL	BDL
1,1,1-Trichloroethane	1	BDL	BDL	BDL	BDL
1,1-Dichloropropylene	1	BDL	BDL	BDL	BDL
Carbon tetrachloride	1	BDL	BDL	BDL	BDL
Benzene	1	BDL	BDL	BDL	BDL
1,2-Dichloroethane	1	BDL	BDL	BDL	BDL
Trichloroethylene	1	BDL	BDL	BDL	BDL
1,2-Dichloropropane	1	BDL	BDL	BDL	BDL
Bromodichloromethane	1	BDL	BDL	BDL	BDL
Dibromomethane	1	BDL	BDL	BDL	BDL
cis-1,3-Dichloropropylene	1	BDL	BDL	BDL	BDL
Toluene	1	BDL	BDL	BDL	BDL
t-1,3-Dichloropropylene	1	BDL	BDL	BDL	BDL
1,1,2-Trichloroethane	1	BDL	BDL	BDL	BDL
Tetrachloroethylene	1	BDL	BDL	BDL	BDL
1,3-Dichloropropane	1	BDL	BDL	BDL	BDL
Dibromochloromethane	1	BDL	BDL	BDL	BDL
1,2-Dibromoethane (EDB)	1	BDL	BDL	BDL	BDL
Chlorobenzene	1	BDL	BDL	BDL	BDL
Ethylbenzene	1	BDL	BDL	BDL	BDL
1,1,1,2-Tetrachloroethane	1	BDL	BDL	BDL	BDL
p/m-Xylene	1	BDL	BDL	BDL	BDL
o-Xylene	1	BDL	BDL	BDL	BDL

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 06450
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Connecticut Certification No. PH-0547

Client	: HRP Associates Inc.		
Lab No.	: 103-447-26	Date Analyzed	:10/27-10/28/93
PO No.	: NAV0030.FE		
Rep. Date	: 10-29-93	Analyst	: YK

EPA METHOD 8260 GC/MS **Date Samples Rec'd:** 10-15-93

Matrix Type :		**W**	**W**	**W**	**W**
Field ID :	**MDL**	**MW-13**	**MW-14**	**MW-15**	**MW-16**
Styrene	1	BDL	BDL	BDL	BDL
Bromoform	1	BDL	BDL	BDL	BDL
Isopropylbenzene	1	BDL	BDL	BDL	BDL
1,1,2,2-Tetrachloroethane	1	BDL	BDL	BDL	BDL
Bromobenzene	1	BDL	BDL	BDL	BDL
1,2,3-Trichloropropane	1	BDL	BDL	BDL	BDL
n-Propylbenzene	1	BDL	BDL	BDL	BDL
2-Chlorotoluene	1	BDL	BDL	BDL	BDL
1,3,5-Trimethylbenzene	1	BDL	BDL	BDL	BDL
4-Chlorotoluene	1	BDL	BDL	BDL	BDL
tert-Butylbenzene	1	BDL	BDL	BDL	BDL
1,2,4-Trimethylbenzene	1	BDL	BDL	BDL	BDL
sec-Butylbenzene	1	BDL	BDL	BDL	BDL
p-Isopropyltoluene	1	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	1	BDL	BDL	BDL	BDL
1,2,3-Trimethylbenzene	1	BDL	BDL	BDL	BDL
1,4-Dichlorobenzene	1	BDL	BDL	BDL	BDL
n-Butylbenzene	1	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	1	BDL	BDL	BDL	BDL
1,2Dibromo-3-chloropropane	1	BDL	BDL	BDL	BDL
1,2,4-Trichlorobenzene	1	BDL	BDL	BDL	BDL
Hexachlorobutadiene	1	BDL	BDL	BDL	BDL
Naphthalene	1	BDL	BDL	BDL	BDL
1,2,3-Trichlorobenzene	1	BDL	BDL	BDL	BDL
HC as Gasoline-ppm	.05	BDL	BDL	BDL	BDL
HC as Kerosene-ppm	.05	BDL	BDL	BDL	BDL
HC as #2 Fuel Oil-ppm	.05	BDL	BDL	BDL	BDL
HC as Diesel Fuel-ppm	.05	BDL	BDL	BDL	BDL
HC as JP-5-ppm	.05	BDL	BDL	BDL	BDL
HC as Aviation Gas-ppm	.05	BDL	BDL	BDL	BDL

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

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

Client	: HRP Associates Inc.		
Lab No.	: 103-447-26	Date Analyzed	:10/27-10/28/93
PO No.	: NAV0030.FE		
Rep. Date	: 10-29-93	Analyst	: YK

EPA METHOD 8260 GC/MS **Date Samples Rec'd:** 10-15-93

	MDL				
Matrix Type :		W	W	W	W
Field ID :		MW-17	MW-17A	MW-18	MW-18A
Dichlorodifluoromethane	1	BDL	BDL	BDL	BDL
Chloromethane	1	BDL	BDL	BDL	BDL
Vinyl chloride	1	BDL	BDL	BDL	BDL
Chloroethane	1	BDL	BDL	BDL	BDL
Bromomethane	1	BDL	BDL	BDL	BDL
Trichlorofluoromethane	1	BDL	BDL	BDL	BDL
1,1-Dichloroethylene	1	BDL	BDL	BDL	BDL
Methylene chloride	1	BDL	BDL	1.0	BDL
trans-1,2-Dichloroethylene	1	BDL	BDL	BDL	BDL
1,1-Dichloroethane	1	BDL	BDL	BDL	BDL
2,2-Dichloropropane	1	BDL	BDL	BDL	BDL
cis-1,2-Dichloroethylene	1	BDL	BDL	BDL	BDL
Chloroform	1	BDL	BDL	BDL	BDL
Bromochloromethane	1	BDL	BDL	BDL	BDL
1,1,1-Trichloroethane	1	BDL	BDL	BDL	BDL
1,1-Dichloropropylene	1	BDL	BDL	BDL	BDL
Carbon tetrachloride	1	BDL	BDL	BDL	BDL
Benzene	1	BDL	BDL	35.0	BDL
1,2-Dichloroethane	1	BDL	BDL	BDL	BDL
Trichloroethylene	1	BDL	BDL	BDL	BDL
1,2-Dichloropropane	1	BDL	BDL	BDL	BDL
Bromodichloromethane	1	BDL	BDL	BDL	BDL
Dibromomethane	1	BDL	BDL	BDL	BDL
cis-1,3-Dichloropropylene	1	BDL	BDL	BDL	BDL
Toluene	1	BDL	BDL	2.0	BDL
t-1,3-Dichloropropylene	1	BDL	BDL	BDL	BDL
1,1,2-Trichloroethane	1	BDL	BDL	BDL	BDL
Tetrachloroethylene	1	BDL	BDL	BDL	BDL
1,3-Dichloropropane	1	BDL	BDL	BDL	BDL
Dibromochloromethane	1	BDL	BDL	BDL	BDL
1,2-Dibromoethane (EDB)	1	BDL	BDL	BDL	BDL
Chlorobenzene	1	BDL	BDL	BDL	BDL
Ethylbenzene	1	BDL	BDL	BDL	BDL
1,1,1,2-Tetrachloroethane	1	BDL	BDL	BDL	BDL
p/m-Xylene	1	BDL	BDL	6.0	BDL
o-Xylene	1	BDL	BDL	2.0	BDL

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 06450
(203)-634-3731
Connecticut Certification No. PH-0547

Client	: HRP Associates Inc.		
Lab No.	: 103-447-26	Date Analyzed	:10/27-10/28/93
PO No.	: NAV0030.FE		
Rep. Date	: 10-29-93	Analyst	: YK

EPA METHOD 8260 GC/MS **Date Samples Rec'd:** 10-15-93

Matrix Type :		**W**	**W**	**W**	**W**
Field ID :	**MDL**	**MW-17**	**MW-17A**	**MW-18**	**MW-18A**
Styrene	1	BDL	BDL	BDL	BDL
Bromoform	1	BDL	BDL	BDL	BDL
Isopropylbenzene	1	BDL	BDL	BDL	BDL
1,1,2,2-Tetrachloroethane	1	BDL	BDL	BDL	BDL
Bromobenzene	1	BDL	BDL	BDL	BDL
1,2,3-Trichloropropane	1	BDL	BDL	BDL	BDL
n-Propylbenzene	1	BDL	BDL	BDL	BDL
2-Chlorotoluene	1	BDL	BDL	BDL	BDL
1,3,5-Trimethylbenzene	1	BDL	BDL	BDL	BDL
4-Chlorotoluene	1	BDL	BDL	BDL	BDL
tert-Butylbenzene	1	BDL	BDL	BDL	BDL
1,2,4-Trimethylbenzene	1	BDL	BDL	BDL	BDL
sec-Butylbenzene	1	BDL	BDL	BDL	BDL
p-Isopropyltoluene	1	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	1	BDL	BDL	BDL	BDL
1,2,3-Trimethylbenzene	1	BDL	BDL	BDL	BDL
1,4-Dichlorobenzene	1	BDL	BDL	BDL	BDL
n-Butylbenzene	1	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	1	BDL	BDL	BDL	BDL
1,2Dibromo-3-chloropropane	1	BDL	BDL	BDL	BDL
1,2,4-Trichlorobenzene	1	BDL	BDL	BDL	BDL
Hexachlorobutadiene	1	BDL	BDL	BDL	BDL
Naphthalene	1	BDL	BDL	BDL	BDL
1,2,3-Trichlorobenzene	1	BDL	BDL	BDL	BDL
HC as Gasoline-ppm	.05	BDL	BDL	BDL	BDL
HC as Kerosene-ppm	.05	BDL	BDL	BDL	BDL
HC as #2 Fuel Oil-ppm	.05	BDL	BDL	BDL	BDL
HC as Diesel Fuel-ppm	.05	BDL	BDL	BDL	BDL
HC as JP-5-ppm	.05	BDL	BDL	BDL	BDL
HC as Aviation Gas-ppm	.05	BDL	BDL	BDL	BDL

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.
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Client	: HRP Associates Inc.		
Lab No.	: 103-447-26	Date Analyzed	:10/27-10/28/93
PO No.	: NAV0030.FE		
Rep. Date	: 10-29-93	Analyst	: YK

EPA METHOD 8260 GC/MS Date Samples Rec'd: 10-15-93

Matrix Type :		W	W	W	W
Field ID :	MDL	MW-19	MW-20	MW-20A	MW-21
Dichlorodifluoromethane	1	BDL	BDL	BDL	BDL
Chloromethane	1	BDL	BDL	BDL	BDL
Vinyl chloride	1	BDL	BDL	BDL	BDL
Chloroethane	1	BDL	BDL	BDL	BDL
Bromomethane	1	BDL	BDL	BDL	BDL
Trichlorofluoromethane	1	BDL	BDL	BDL	BDL
1,1-Dichloroethylene	1	BDL	BDL	BDL	BDL
Methylene chloride	1	BDL	BDL	BDL	BDL
trans-1,2-Dichloroethylene	1	BDL	BDL	BDL	BDL
1,1-Dichloroethane	1	BDL	BDL	BDL	BDL
2,2-Dichloropropane	1	BDL	BDL	BDL	BDL
cis-1,2-Dichloroethylene	1	BDL	BDL	BDL	BDL
Chloroform	1	BDL	BDL	BDL	BDL
Bromochloromethane	1	BDL	BDL	BDL	BDL
1,1,1-Trichloroethane	1	BDL	BDL	BDL	BDL
1,1-Dichloropropylene	1	BDL	BDL	BDL	BDL
Carbon tetrachloride	1	BDL	BDL	BDL	BDL
Benzene	1	BDL	BDL	BDL	BDL
1,2-Dichloroethane	1	BDL	BDL	BDL	BDL
Trichloroethylene	1	BDL	BDL	BDL	BDL
1,2-Dichloropropane	1	BDL	BDL	BDL	BDL
Bromodichloromethane	1	BDL	BDL	BDL	BDL
Dibromomethane	1	BDL	BDL	BDL	BDL
cis-1,3-Dichloropropylene	1	BDL	BDL	BDL	BDL
Toluene	1	BDL	BDL	BDL	BDL
t-1,3-Dichloropropylene	1	BDL	BDL	BDL	BDL
1,1,2-Trichloroethane	1	BDL	BDL	BDL	BDL
Tetrachloroethylene	1	BDL	BDL	BDL	BDL
1,3-Dichloropropane	1	BDL	BDL	BDL	BDL
Dibromochloromethane	1	BDL	BDL	BDL	BDL
1,2-Dibromoethane (EDB)	1	BDL	BDL	BDL	BDL
Chlorobenzene	1	BDL	BDL	BDL	BDL
Ethylbenzene	1	BDL	BDL	BDL	BDL
1,1,1,2-Tetrachloroethane	1	BDL	BDL	BDL	BDL
p/m-Xylene	1	BDL	BDL	BDL	BDL
o-Xylene	1	BDL	BDL	BDL	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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165 Gracey Avenue / Meriden, CT 06450
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Client	: HRP Associates Inc.		
Lab No.	: 103-447-26	Date Analyzed	:10/27-10/28/93
PO No.	: NAV0030.FE		
Rep. Date	: 10-29-93	Analyst	: YK

EPA METHOD 8260 GC/MS **Date Samples Rec'd:** 10-15-93

	MDL				
Matrix Type :		W	W	W	W
Field ID :		MW-19	MW-20	MW-20A	MW-21
Styrene	1	BDL	BDL	BDL	BDL
Bromoform	1	BDL	BDL	BDL	BDL
Isopropylbenzene	1	BDL	BDL	BDL	BDL
1,1,2,2-Tetrachloroethane	1	BDL	BDL	BDL	BDL
Bromobenzene	1	BDL	BDL	BDL	BDL
1,2,3-Trichloropropane	1	BDL	BDL	BDL	BDL
n-Propylbenzene	1	BDL	BDL	BDL	BDL
2-Chlorotoluene	1	BDL	BDL	BDL	BDL
1,3,5-Trimethylbenzene	1	BDL	BDL	BDL	BDL
4-Chlorotoluene	1	BDL	BDL	BDL	BDL
tert-Butylbenzene	1	BDL	BDL	BDL	BDL
1,2,4-Trimethylbenzene	1	BDL	BDL	BDL	BDL
sec-Butylbenzene	1	BDL	BDL	BDL	BDL
p-Isopropyltoluene	1	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	1	BDL	BDL	BDL	BDL
1,2,3-Trimethylbenzene	1	BDL	BDL	BDL	BDL
1,4-Dichlorobenzene	1	BDL	BDL	BDL	BDL
n-Butylbenzene	1	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	1	BDL	BDL	BDL	BDL
1,2Dibromo-3-chloropropane	1	BDL	BDL	BDL	BDL
1,2,4-Trichlorobenzene	1	BDL	BDL	BDL	BDL
Hexachlorobutadiene	1	BDL	BDL	BDL	BDL
Naphthalene	1	BDL	BDL	BDL	BDL
1,2,3-Trichlorobenzene	1	BDL	BDL	BDL	BDL
HC as Gasoline-ppm	.05	BDL	BDL	BDL	BDL
HC as Kerosene-ppm	.05	BDL	BDL	BDL	BDL
HC as #2 Fuel Oil-ppm	.05	BDL	BDL	BDL	BDL
HC as Diesel Fuel-ppm	.05	BDL	BDL	BDL	BDL
HC as JP-5-ppm	.05	BDL	BDL	BDL	BDL
HC as Aviation Gas-ppm	.05	BDL	BDL	BDL	BDL

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

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

Client	: HRP Associates Inc.		
Lab No.	: 103-447-26	Date Analyzed	:10/27-10/28/93
PO No.	: NAV0030.FE		
Rep. Date	: 10-29-93	Analyst	: YK

EPA METHOD 8260 GC/MS **Date Samples Rec'd:** 10-15-93

Matrix Type :		W	W	W	W
Field ID :	**MDL**	**MW-24**	**MW-24A**	**MW-25**	**MW-25A**
Dichlorodifluoromethane	1	BDL	BDL	BDL	BDL
Chloromethane	1	BDL	BDL	BDL	BDL
Vinyl chloride	1	BDL	BDL	BDL	BDL
Chloroethane	1	BDL	BDL	BDL	BDL
Bromomethane	1	BDL	BDL	BDL	BDL
Trichlorofluoromethane	1	BDL	BDL	BDL	BDL
1,1-Dichloroethylene	1	BDL	20.0	BDL	BDL
Methylene chloride	1	BDL	BDL	BDL	BDL
trans-1,2-Dichloroethylene	1	BDL	BDL	BDL	BDL
1,1-Dichloroethane	1	BDL	BDL	BDL	BDL
2,2-Dichloropropane	1	BDL	BDL	BDL	BDL
cis-1,2-Dichloroethylene	1	BDL	BDL	BDL	BDL
Chloroform	1	BDL	BDL	BDL	BDL
Bromochloromethane	1	BDL	BDL	BDL	BDL
1,1,1-Trichloroethane	1	BDL	19.0	BDL	BDL
1,1-Dichloropropylene	1	BDL	BDL	BDL	BDL
Carbon tetrachloride	1	BDL	BDL	BDL	BDL
Benzene	1	BDL	BDL	21.0	BDL
1,2-Dichloroethane	1	BDL	BDL	BDL	BDL
Trichloroethylene	1	BDL	BDL	BDL	BDL
1,2-Dichloropropane	1	BDL	BDL	BDL	BDL
Bromodichloromethane	1	BDL	BDL	BDL	BDL
Dibromomethane	1	BDL	BDL	BDL	BDL
cis-1,3-Dichloropropylene	1	BDL	BDL	BDL	BDL
Toluene	1	BDL	BDL	148.0	BDL
t-1,3-Dichloropropylene	1	BDL	BDL	BDL	BDL
1,1,2-Trichloroethane	1	BDL	BDL	BDL	BDL
Tetrachloroethylene	1	BDL	BDL	BDL	BDL
1,3-Dichloropropane	1	BDL	BDL	BDL	BDL
Dibromochloromethane	1	BDL	BDL	BDL	BDL
1,2-Dibromoethane (EDB)	1	BDL	BDL	BDL	BDL
Chlorobenzene	1	BDL	BDL	BDL	BDL
Ethylbenzene	1	BDL	BDL	BDL	BDL
1,1,1,2-Tetrachloroethane	1	BDL	BDL	BDL	BDL
p/m-Xylene	1	BDL	BDL	5.0	BDL
o-Xylene	1	BDL	BDL	11.0	BDL

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 06450
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Client	: HRP Associates Inc.		
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PO No.	: NAV0030.FE		
Rep. Date	: 10-29-93	Analyst	: YK

EPA METHOD 8260 GC/MS **Date Samples Rec'd:** 10-15-93

Matrix Type :		W	W	W	W
Field ID :		MW-24	MW-24A	MW-25	MW-25A
	MDL				
Styrene	1	BDL	BDL	BDL	BDL
Bromoform	1	BDL	BDL	BDL	BDL
Isopropylbenzene	1	BDL	BDL	BDL	BDL
1,1,2,2-Tetrachloroethane	1	BDL	BDL	BDL	BDL
Bromobenzene	1	BDL	BDL	BDL	BDL
1,2,3-Trichloropropane	1	BDL	BDL	BDL	BDL
n-Propylbenzene	1	BDL	BDL	BDL	BDL
2-Chlorotoluene	1	BDL	BDL	BDL	BDL
1,3,5-Trimethylbenzene	1	BDL	BDL	BDL	BDL
4-Chlorotoluene	1	BDL	BDL	BDL	BDL
tert-Butylbenzene	1	BDL	BDL	BDL	BDL
1,2,4-Trimethylbenzene	1	BDL	BDL	BDL	BDL
sec-Butylbenzene	1	BDL	BDL	BDL	BDL
p-Isopropyltoluene	1	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	1	BDL	BDL	BDL	BDL
1,2,3-Trimethylbenzene	1	BDL	BDL	BDL	BDL
1,4-Dichlorobenzene	1	BDL	BDL	BDL	BDL
n-Butylbenzene	1	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	1	BDL	BDL	BDL	BDL
1,2Dibromo-3-chloropropane	1	BDL	BDL	BDL	BDL
1,2,4-Trichlorobenzene	1	BDL	BDL	BDL	BDL
Hexachlorobutadiene	1	BDL	BDL	BDL	BDL
Naphthalene	1	BDL	BDL	BDL	BDL
1,2,3-Trichlorobenzene	1	BDL	BDL	BDL	BDL
HC as Gasoline-ppm	.05	BDL	BDL	BDL	BDL
HC as Kerosene-ppm	.05	BDL	BDL	BDL	BDL
HC as #2 Fuel Oil-ppm	.05	BDL	BDL	BDL	BDL
HC as Diesel Fuel-ppm	.05	BDL	BDL	BDL	BDL
HC as JP-5-ppm	.05	BDL	BDL	BDL	BDL
HC as Aviation Gas-ppm	.05	BDL	BDL	BDL	BDL

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

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

Client	: HRP Associates Inc.		
Lab No.	: 103-447-26	Date Analyzed	:10/27-10/28/93
PO No.	: NAV0030.FE		
Rep. Date	: 10-29-93	Analyst	: YK

EPA METHOD 8260 GC/MS **Date Samples Rec'd:** 10-15-93

Matrix Type :		W	W	W	W
Field ID :		MW-27	MW-28	MW-29	MW-30
	MDL				
Dichlorodifluoromethane	1	BDL	BDL	BDL	BDL
Chloromethane	1	BDL	BDL	BDL	BDL
Vinyl chloride	1	BDL	BDL	BDL	BDL
Chloroethane	1	BDL	BDL	BDL	BDL
Bromomethane	1	BDL	BDL	BDL	BDL
Trichlorofluoromethane	1	BDL	BDL	BDL	BDL
1,1-Dichloroethylene	1	BDL	BDL	BDL	BDL
Methylene chloride	1	BDL	BDL	BDL	BDL
trans-1,2-Dichloroethylene	1	BDL	BDL	BDL	BDL
1,1-Dichloroethane	1	BDL	BDL	BDL	BDL
2,2-Dichloropropane	1	BDL	BDL	BDL	BDL
cis-1,2-Dichloroethylene	1	BDL	BDL	BDL	BDL
Chloroform	1	BDL	BDL	BDL	BDL
Bromochloromethane	1	BDL	BDL	BDL	BDL
1,1,1-Trichloroethane	1	BDL	BDL	BDL	BDL
1,1-Dichloropropylene	1	BDL	BDL	BDL	BDL
Carbon tetrachloride	1	BDL	BDL	BDL	BDL
Benzene	1	BDL	BDL	BDL	BDL
1,2-Dichloroethane	1	BDL	BDL	BDL	BDL
Trichloroethylene	1	BDL	BDL	BDL	BDL
1,2-Dichloropropane	1	BDL	BDL	BDL	BDL
Bromodichloromethane	1	BDL	BDL	BDL	BDL
Dibromomethane	1	BDL	BDL	BDL	BDL
cis-1,3-Dichloropropylene	1	BDL	BDL	BDL	BDL
Toluene	1	BDL	BDL	BDL	BDL
t-1,3-Dichloropropylene	1	BDL	BDL	BDL	BDL
1,1,2-Trichloroethane	1	BDL	BDL	BDL	BDL
Tetrachloroethylene	1	BDL	BDL	BDL	BDL
1,3-Dichloropropane	1	BDL	BDL	BDL	BDL
Dibromochloromethane	1	BDL	BDL	BDL	BDL
1,2-Dibromoethane (EDB)	1	BDL	BDL	BDL	BDL
Chlorobenzene	1	BDL	BDL	BDL	BDL
Ethylbenzene	1	BDL	BDL	BDL	BDL
1,1,1,2-Tetrachloroethane	1	BDL	BDL	BDL	BDL
p/m-Xylene	1	BDL	BDL	BDL	BDL
o-Xylene	1	BDL	BDL	BDL	BDL

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 06450
(203)-634-3731
Connecticut Certification No. PH-0547

Client	: HRP Associates Inc.		
Lab No.	: 103-447-26	Date Analyzed	:10/27-10/28/93
PO No.	: NAV0030.FE		
Rep. Date	: 10-29-93	Analyst	: YK

EPA METHOD 8260 GC/MS **Date Samples Rec'd:** 10-15-93

Matrix Type :		**W**	**W**	**W**	**W**
Field ID :	**MDL**	**MW-27**	**MW-28**	**MW-29**	**MW-30**
Styrene	1	BDL	BDL	BDL	BDL
Bromoform	1	BDL	BDL	BDL	BDL
Isopropylbenzene	1	BDL	BDL	BDL	BDL
1,1,2,2-Tetrachloroethane	1	BDL	BDL	BDL	BDL
Bromobenzene	1	BDL	BDL	BDL	BDL
1,2,3-Trichloropropane	1	BDL	BDL	BDL	BDL
n-Propylbenzene	1	BDL	BDL	BDL	BDL
2-Chlorotoluene	1	BDL	BDL	BDL	BDL
1,3,5-Trimethylbenzene	1	BDL	BDL	BDL	BDL
4-Chlorotoluene	1	BDL	BDL	BDL	BDL
tert-Butylbenzene	1	BDL	BDL	BDL	BDL
1,2,4-Trimethylbenzene	1	BDL	BDL	BDL	BDL
sec-Butylbenzene	1	BDL	BDL	BDL	BDL
p-Isopropyltoluene	1	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	1	BDL	BDL	BDL	BDL
1,2,3-Trimethylbenzene	1	BDL	BDL	BDL	BDL
1,4-Dichlorobenzene	1	BDL	BDL	BDL	BDL
n-Butylbenzene	1	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	1	BDL	BDL	BDL	BDL
1,2Dibromo-3-chloropropane	1	BDL	BDL	BDL	BDL
1,2,4-Trichlorobenzene	1	BDL	BDL	BDL	BDL
Hexachlorobutadiene	1	BDL	BDL	BDL	BDL
Naphthalene	1	BDL	BDL	BDL	BDL
1,2,3-Trichlorobenzene	1	BDL	BDL	BDL	BDL
HC as Gasoline-ppm	.05	BDL	BDL	BDL	BDL
HC as Kerosene-ppm	.05	BDL	BDL	BDL	BDL
HC as #2 Fuel Oil-ppm	.05	BDL	BDL	BDL	BDL
HC as Diesel Fuel-ppm	.05	BDL	BDL	BDL	BDL
HC as JP-5-ppm	.05	BDL	BDL	BDL	BDL
HC as Aviation Gas-ppm	.05	BDL	BDL	BDL	BDL

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

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

Client	: HRP Associates Inc.		
Lab No.	: 103-447-26	Date Analyzed	:10/27-10/28/93
PO No.	: NAV0030.FE		
Rep. Date	: 10-29-93	Analyst	: YK

EPA METHOD 8260 GC/MS **Date Samples Rec'd:** 10-15-93

	MDL				
Matrix Type :		W	W		
Field ID :		MW-30A	MW-31		
Dichlorodifluoromethane	1	BDL	BDL		
Chloromethane	1	BDL	BDL		
Vinyl chloride	1	BDL	BDL		
Chloroethane	1	BDL	BDL		
Bromomethane	1	BDL	BDL		
Trichlorofluoromethane	1	BDL	BDL		
1,1-Dichloroethylene	1	BDL	BDL		
Methylene chloride	1	BDL	BDL		
trans-1,2-Dichloroethylene	1	BDL	BDL		
1,1-Dichloroethane	1	BDL	BDL		
2,2-Dichloropropane	1	BDL	BDL		
cis-1,2-Dichloroethylene	1	BDL	BDL		
Chloroform	1	BDL	BDL		
Bromochloromethane	1	BDL	BDL		
1,1,1-Trichloroethane	1	BDL	BDL		
1,1-Dichloropropylene	1	BDL	BDL		
Carbon tetrachloride	1	BDL	BDL		
Benzene	1	BDL	BDL		
1,2-Dichloroethane	1	BDL	BDL		
Trichloroethylene	1	BDL	BDL		
1,2-Dichloropropane	1	BDL	BDL		
Bromodichloromethane	1	BDL	BDL		
Dibromomethane	1	BDL	BDL		
cis-1,3-Dichloropropylene	1	BDL	BDL		
Toluene	1	BDL	BDL		
t-1,3-Dichloropropylene	1	BDL	BDL		
1,1,2-Trichloroethane	1	BDL	BDL		
Tetrachloroethylene	1	BDL	BDL		
1,3-Dichloropropane	1	BDL	BDL		
Dibromochloromethane	1	BDL	BDL		
1,2-Dibromoethane (EDB)	1	BDL	BDL		
Chlorobenzene	1	BDL	BDL		
Ethylbenzene	1	BDL	BDL		
1,1,1,2-Tetrachloroethane	1	BDL	BDL		
p/m-Xylene	1	BDL	BDL		
o-Xylene	1	BDL	BDL		

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

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

Client	: HRP Associates Inc.		
Lab No.	: 103-447-26	Date Analyzed	:10/27-10/28/93
PO No.	: NAV0030.FE		
Rep. Date	: 10-29-93	Analyst	: YK

EPA METHOD 8260 GC/MS **Date Samples Rec'd:** 10-15-93

	MDL				
Matrix Type :		W	W		
Field ID :		MW-30A	MW-31		
Styrene	1	BDL	BDL		
Bromoform	1	BDL	BDL		
Isopropylbenzene	1	BDL	BDL		
1,1,2,2-Tetrachloroethane	1	BDL	BDL		
Bromobenzene	1	BDL	BDL		
1,2,3-Trichloropropane	1	BDL	BDL		
n-Propylbenzene	1	BDL	BDL		
2-Chlorotoluene	1	BDL	BDL		
1,3,5-Trimethylbenzene	1	BDL	BDL		
4-Chlorotoluene	1	BDL	BDL		
tert-Butylbenzene	1	BDL	BDL		
1,2,4-Trimethylbenzene	1	BDL	BDL		
sec-Butylbenzene	1	BDL	BDL		
p-Isopropyltoluene	1	BDL	BDL		
1,3-Dichlorobenzene	1	BDL	BDL		
1,2,3-Trimethylbenzene	1	BDL	BDL		
1,4-Dichlorobenzene	1	BDL	BDL		
n-Butylbenzene	1	BDL	BDL		
1,2-Dichlorobenzene	1	BDL	BDL		
1,2Dibromo-3-chloropropane	1	BDL	BDL		
1,2,4-Trichlorobenzene	1	BDL	BDL		
Hexachlorobutadiene	1	BDL	BDL		
Naphthalene	1	BDL	BDL		
1,2,3-Trichlorobenzene	1	BDL	BDL		
HC as Gasoline-ppm	.05	BDL	BDL		
HC as Kerosene-ppm	.05	BDL	BDL		
HC as #2 Fuel Oil-ppm	.05	BDL	BDL		
HC as Diesel Fuel-ppm	.05	BDL	BDL		
HC as JP-5-ppm	.05	BDL	BDL		
HC as Aviation Gas-ppm	.05	BDL	BDL		

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

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

Date Samples Received : 10-15-93

Client Name... : **HRP Associates Inc.**	CTL Lab No. 103-447-26
Date of Report : 10-29-93	PO/Job No. NAV0030.FE

RESULTS OF ANALYSIS

GC/FID

Matrix Type	**W**	**W**	**W**	**W**
Field Id	**MW-7**	**MW-10**	**MW-11**	**MW-12**
n-Pentane-ppb	ND<100	ND<100	ND<100	ND<100
n-Hexane-ppb	ND<10	ND<10	ND<10	ND<10
n-Heptane-ppb	ND<100	ND<100	ND<100	ND<100
n-Octane-ppb	ND<100	ND<100	ND<100	ND<100

GC/FID

Matrix Type	**W**	**W**	**W**	**W**
Field Id	**MW-13**	**MW-14**	**MW-15**	**MW-16**
n-Pentane-ppb	ND<100	ND<100	ND<100	ND<100
n-Hexane-ppb	ND<10	ND<10	ND<10	ND<10
n-Heptane-ppb	ND<100	ND<100	ND<100	ND<100
n-Octane-ppb	ND<100	ND<100	ND<100	ND<100

GC/FID

Matrix Type	**W**	**W**	**W**	**W**
Field Id	**MW-17**	**MW-17A**	**MW-18**	**MW-18A**
n-Pentane-ppb	ND<100	ND<100	ND<100	ND<100
n-Hexane-ppb	ND<10	ND<10	ND<10	ND<10
n-Heptane-ppb	ND<100	ND<100	ND<100	ND<100
n-Octane-ppb	ND<100	ND<100	ND<100	ND<100

GC/FID

Matrix Type	**W**	**W**	**W**	**W**
Field Id	**MW-19**	**MW-20**	**MW-20A**	**MW-21**
n-Pentane-ppb	ND<100	ND<100	ND<100	ND<100
n-Hexane-ppb	ND<10	ND<10	ND<10	ND<10
n-Heptane-ppb	ND<100	ND<100	ND<100	ND<100
n-Octane-ppb	ND<100	ND<100	ND<100	ND<100

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

Date Samples Received : 10-15-93

Client Name... : **HRP Associates Inc.**	CTL Lab No. 103-447-26
Date of Report : 10-29-93	PO/Job No. NAV0030.FE

RESULTS OF ANALYSIS

GC/FID

Matrix Type	**W**	**W**	**W**	**W**
Field Id	**MW-24**	**MW-24A**	**MW-25**	**MW-25A**
n-Pentane-ppb	ND<100	ND<100	ND<100	ND<100
n-Hexane-ppb	ND<10	ND<10	ND<10	ND<10
n-Heptane-ppb	ND<100	ND<100	ND<100	ND<100
n-Octane-ppb	ND<100	ND<100	ND<100	ND<100

GC/FID

Matrix Type	**W**	**W**	**W**	**W**
Field Id	**MW-27**	**MW-28**	**MW-29**	**MW-30**
n-Pentane-ppb	ND<100	ND<100	ND<100	ND<100
n-Hexane-ppb	ND<10	ND<10	ND<10	ND<10
n-Heptane-ppb	ND<100	ND<100	ND<100	ND<100
n-Octane-ppb	ND<100	ND<100	ND<100	ND<100

GC/FID

Matrix Type	**W**	**W**		
Field Id	**MW-30A**	**MW-31**		
n-Pentane-ppb	ND<100	ND<100		
n-Hexane-ppb	ND<10	ND<10		
n-Heptane-ppb	ND<100	ND<100		
n-Octane-ppb	ND<100	ND<100		

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

HRP Associates, Inc.
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HRP

CHAIN OF CUSTODY

Sheet 1 of 6
Job Number NAV0030.FE
Project Manager LAW

Place & Address of Collection: BNAS BRUNSWICK ME
Samplers Name (Signature):
Assistant (Witness)(Signature):

Sample Number	Sample Location	Container Type	Total Volume	Preservative	Date	Time	Sample Type: Water	Soil	Air	Waste	Remarks
MW-7		40A	40mL	Cool	10/14		X				
MW-10											
MW-11											
MW-12											
MW-13											

Relinquished By (Signature)	Received By (Signature)	Date 10/15/93	Time 2:50
Relinquished By (Signature)	Received By (Signature) M. McMahon	Date 10/15/93	Time 3:20
Name & Address of Laboratory: CTL Meriden			

LABORATORY SAMPLE PREPARATION REQUIRED

None ☐ Filter ☑ (Metals Samples) Adjust pH to _____ Priority ☐

Other

ANALYSES REQUIRED

Parameters	Sample Number 7	10	11	12	13
pH					
Ag					
Al					
As					
Ba					
Cd					
CN-A					
CN-T					
Cr^{+6}					
Cr-T					
Cu					
Fe-D					
Hg					
Na	X	X		X	
Ni					
Pb					
Se					
Sp. Cond.					
TDS	X	X		X	
Zn					

Parameters	Sample Number 7	10	11	12	13
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					
6Z4 8260	X	X	X	X	X
HC w/ JP-5	X	X	X	X	X
HC w/ Gas	X	X	X	X	X
Fe, Mn	X	X		X	

Remarks

MW 5/10 pollutants for TPH only on page 5

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№01303

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CHAIN OF CUSTODY

Sheet 2 of 6
Job Number NAV0030.FE
Project Manager LAW

Place & Address of Collection: BNAS Brunswick, ME
Samplers Name (Signature):
Assistant (Witness)(Signature):

Sample Number	Sample Location	Container Type	Total Volume	Preservative	Date	Time	Sample Type: Water	Soil	Air	Waste	Remarks
14	MW-14	VOA	40ml	Cool	10/13		X				
15	MW-15										
16	MW-16										
17	MW-17										
17A	MW-17A										

Relinquished By (Signature): Received By (Signature): Date 10/15/93 Time 2:50
Relinquished By (Signature): Received By (Signature) M. McMahon Date 10/15/93 Time 3:20
Name & Address of Laboratory: CTL Marlow

LABORATORY SAMPLE PREPARATION REQUIRED

None ☐ Filter ☑ (X 15 metals) Adjust pH to _____ Priority ☐

Other

ANALYSES REQUIRED

Parameters	Sample Number 14	15	16	17	17A
pH					
Ag					
Al					
As					
Ba					
Cd					
CN-A					
CN-T					
Cr^{+6}					
Cr-T					
Cu					
Fe-D					
Hg					
Na		X			
Ni					
Pb					
Se					
Sp. Cond.					
TDS		X			
Zn					

Parameters	Sample Number 14	15	16	17	17A
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					
624 8260	X	X	X	X	X
HC as JP-5	X	X	X	X	X
HC as Gas	X	X	X	X	X
Fe + Mn	~~X~~	~~X~~			
		X			

Remarks: Fe+Mn for # 15

MW 5 is not required for TPH analysis as

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CHAIN OF CUSTODY

Sheet 3 of 6
Job Number NAV0030.FE
Project Manager LAW

Place & Address of Collection: BNAS Brunswick ME
Samplers Name (Signature):
Assistant (Witness)(Signature):

Sample Number	Sample Location	Container Type	Total Volume	Preservative	Date	Time	Sample Type: Water	Soil	Air	Waste	Remarks
18	MW-18	VOA	40ml	Cool	10/13		Y				
18A	MW-18A										
19	MW-19										
20	MW-20										
20A	MW-20A										

Relinquished By (Signature): [signature] — Received By (Signature): [signature] — Date 10/15/93 — Time 2:50
Relinquished By (Signature): [signature] — Received By (Signature): M. McMahon — Date 10/15/93 — Time 3:20
Name & Address of Laboratory: CTL Meriden

LABORATORY SAMPLE PREPARATION REQUIRED

None ☐ — Filter ☑ #20 Metals — Adjust pH to _____ — Priority ☐
Other

ANALYSES REQUIRED

Parameters	Sample Number 18	18A	19	20	20A
pH					
Ag					
Al					
As					
Ba					
Cd					
CN-A					
CN-T					
Cr^{+6}					
Cr-T					
Cu					
Fe-D					
Hg					
Na				X	
Ni					
Pb					
Se					
Sp. Cond.					
TDS				X	
Zn					

Parameters	Sample Number 18	18A	19	20	20A
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					
624 8260	X	X	X	X	X
HC as JP-5	X	X	X	X	X
HC as Gas	X	X	X	X	X
Fe + Mn				X	

Remarks

no glass jars submitted for TPH 10/15 MEM

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№01305

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HRP

CHAIN OF CUSTODY

Sheet 4 of 6
Job Number NAV0030.FE
Project Manager LAW

Place & Address of Collection: BNAS BRUNSWICK ME
Samplers Name (Signature):
Assistant (Witness)(Signature):

Sample Number	Sample Location	Container Type	Total Volume	Preservative	Date	Time	Sample Type: Water	Soil	Air	Waste	Remarks
21	MW-21	VOA	40ml	Cool	10/13		X				
24	MW-24										
24A	MW-24A										
25	MW-25										
25A	MW-25A										

Relinquished By (Signature)		Received By (Signature)	Date 10/15/93	Time 2:50
Relinquished By (Signature)		Received By (Signature) M. McMahon	Date 10/15/93	Time 3:20
Name & Address of Laboratory	CTL Meriden			

LABORATORY SAMPLE PREPARATION REQUIRED

None ☐ | Filter ☐ ✓ X 21 metals | Adjust pH to _____ | Priority ☐

Other

ANALYSES REQUIRED

Parameters	Sample Number 21	24	24A	25	25A
pH					
Ag					
Al					
As					
Ba					
Cd					
CN-A					
CN-T					
Cr^{+6}					
Cr-T					
Cu					
Fe-D					
Hg					
Na				X	
Ni					
Pb					
Se					
Sp. Cond.					
TDS				X	
Zn					

Parameters	Sample Number 21	24	24A	25	25A
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					
624 8260	X	X	X	X	X
HCas JP-5	X	X	X	X	X
HCas Gas	X	X	X	X	X
Fe + Mn	X				

Remarks

No glass jars submitted for TPH 10/15 MEM

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№01306

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Plainville, CT 06062
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HRP

CHAIN OF CUSTODY

Sheet 5 of 6
Job Number NAV0030.FE
Project Manager LAW

Place & Address of Collection: BNAS BRUNSWICK ME
Samplers Name (Signature):
Assistant (Witness)(Signature):

Sample Number	Sample Location	Container Type	Total Volume	Preservative	Date	Time	Sample Type: Water	Soil	Air	Waste	Remarks
27	MW-27	VOA	40ml	Cool	10/13		Y				
28	MW-28										
29	MW-29										
30	MW-30										
30A	MW-30A										

Relinquished By (Signature)		Received By (Signature)	Date 10/15/93	Time 2:50
Relinquished By (Signature)		Received By (Signature) M. McMahon	Date 10/15/93	Time 3:20
Name & Address of Laboratory	CTL Meriden			

LABORATORY SAMPLE PREPARATION REQUIRED

None ☐ Filter ☐ Adjust pH to _____ Priority ☐

Other

ANALYSES REQUIRED

Parameters	Sample Number 27	28	29	30	30A
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 27	28	29	30	30A
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					
624 8240 -	X	X	X	X	X
HCAs JP-5	X	X	X	X	X
HCAs Gas	X	X	X	X	X

Remarks

No classicus submitted for TPH mem 10/15

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№0130

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CHAIN OF CUSTODY

Sheet 6 of 6
Job Number NAV0030.FE
Project Manager LAW

Place & Address of Collection: BNAS BRUNSWICK ME
Samplers Name (Signature):
Assistant (Witness)(Signature):

Sample Number	Sample Location	Container Type	Total Volume	Preservative	Date	Time	Sample Type: Water	Soil	Air	Waste	Remarks
31	MW-31	VOA	40ml	Cool	10/13		X				

Relinquished By (Signature): Received By (Signature): Date 10/15/93 Time 2:50
Relinquished By (Signature): Received By (Signature): M. McMahon Date 10/15/93 Time 3:20
Name & Address of Laboratory: CTL Mansfield

LABORATORY SAMPLE PREPARATION REQUIRED

None ☐ Filter ☐ Adjust pH to _____ Priority ☐
Other

ANALYSES REQUIRED

Parameters	Sample Number					Parameters	Sample Number: 31				
pH						TPH 418.1	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						624 8260	X				
Pb						HC as JP-5	X				
Se						HC as Gas	X				
Sp. Cond.											
TDS											
Zn											

Remarks

Also analysis submitted for TPH MEM 10/15

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№01308

November 24, 1993

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

Attn: Ms. Pat Terwilliger

RECEIVED
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HRP ASSOCIATES, INC.

Please find attached laboratory report(s) for the samples submitted on : **November 17, 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.	:	113-327-5
PO/JOB No.	:	NAV0030.FE
INVOICE No.	:	40430
ORDER No.	:	20332
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.	: 113-327-5	Date Analyzed	: 11/18--11/20
PO No.	: NAV0030.FE		
Rep. Date	: 11-24-93	Analyst	: YK

EPA METHOD 8260 GC/MS Date Samples Rec'd: 11-17-93

	MDL				
Matrix Type :		W	W	W	W
Field ID :		MW-22	PZ-23	MW-26	MW-2
Dichlorodifluoromethane	1	BDL	BDL	BDL	BDL
Chloromethane	1	BDL	BDL	BDL	BDL
Vinyl chloride	1	BDL	BDL	BDL	BDL
Chloroethane	1	BDL	BDL	BDL	BDL
Bromomethane	1	BDL	BDL	BDL	BDL
Trichlorofluoromethane	1	BDL	BDL	BDL	BDL
1,1-Dichloroethylene	1	BDL	BDL	BDL	BDL
Methylene chloride	1	BDL	BDL	BDL	BDL
trans-1,2-Dichloroethylene	1	BDL	BDL	BDL	BDL
1,1-Dichloroethane	1	BDL	BDL	BDL	BDL
2,2-Dichloropropane	1	BDL	BDL	BDL	BDL
cis-1,2-Dichloroethylene	1	BDL	BDL	BDL	BDL
Chloroform	1	BDL	BDL	BDL	BDL
Bromochloromethane	1	BDL	BDL	BDL	BDL
1,1,1-Trichloroethane	1	BDL	BDL	BDL	BDL
1,1-Dichloropropylene	1	BDL	BDL	BDL	BDL
Carbon tetrachloride	1	BDL	BDL	BDL	BDL
Benzene	1	37.0	5.0	BDL	BDL
1,2-Dichloroethane	1	BDL	BDL	BDL	BDL
Trichloroethylene	1	BDL	BDL	BDL	BDL
1,2-Dichloropropane	1	BDL	BDL	BDL	BDL
Bromodichloromethane	1	BDL	BDL	BDL	BDL
Dibromomethane	1	BDL	BDL	BDL	BDL
cis-1,3-Dichloropropylene	1	BDL	BDL	BDL	BDL
Toluene	1	191.0	8.0	BDL	BDL
t-1,3-Dichloropropylene	1	BDL	BDL	BDL	BDL
1,1,2-Trichloroethane	1	BDL	BDL	BDL	BDL
Tetrachloroethylene	1	BDL	BDL	BDL	BDL
1,3-Dichloropropane	1	BDL	BDL	BDL	BDL
Dibromochloromethane	1	BDL	BDL	BDL	BDL
1,2-Dibromoethane (EDB)	1	BDL	BDL	BDL	BDL
Chlorobenzene	1	BDL	BDL	BDL	BDL
Ethylbenzene	1	18.0	1.0	BDL	BDL
1,1,1,2-Tetrachloroethane	1	BDL	BDL	BDL	BDL
p/m-Xylene	1	42.0	3.0	BDL	BDL
o-Xylene	1	22.0	3.0	BDL	BDL

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

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

Client	: HRP Associates Inc.		
Lab No.	: 113-327-5	Date Analyzed	: 11/18--11/20
PO No.	: NAV0030.FE		
Rep. Date	: 11-24-93	Analyst	: YK

EPA METHOD 8260 GC/MS **Date Samples Rec'd:** 11-17-93

Matrix Type :		**W**	**W**	**W**	**W**
Field ID :	**MDL**	**MW-22**	**PZ-23**	**MW-26**	**MW-2**
Styrene	1	BDL	BDL	BDL	BDL
Bromoform	1	BDL	BDL	BDL	BDL
Isopropylbenzene	1	4.0	BDL	BDL	BDL
1,1,2,2-Tetrachloroethane	1	BDL	BDL	BDL	BDL
Bromobenzene	1	BDL	BDL	BDL	BDL
1,2,3-Trichloropropane	1	BDL	BDL	BDL	BDL
n-Propylbenzene	1	3.0	BDL	BDL	BDL
2-Chlorotoluene	1	BDL	BDL	BDL	BDL
1,3,5-Trimethylbenzene	1	5.0	2.0	BDL	BDL
4-Chlorotoluene	1	BDL	BDL	BDL	BDL
t rt-Butylbenzene	1	1.0	BDL	BDL	BDL
1,2,4-Trimethylbenzene	1	11.0	5.0	BDL	BDL
sec-Butylbenzene	1	BDL	BDL	BDL	BDL
p-Isopropyltoluene	1	1.0	30.0	BDL	BDL
1,3-Dichlorobenzene	1	BDL	BDL	BDL	BDL
1,2,3-Trimethylbenzene	1	BDL	BDL	BDL	BDL
1,4-Dichlorobenzene	1	BDL	BDL	BDL	BDL
n-Butylbenzene	1	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	1	BDL	BDL	BDL	BDL
1,2Dibromo-3-chloropropane	1	BDL	BDL	BDL	BDL
1,2,4-Trichlorobenzene	1	BDL	BDL	BDL	BDL
Hexachlorobutadiene	1	BDL	BDL	BDL	BDL
Naphthalene	1	2.0	8.0	BDL	BDL
1,2,3-Trichlorobenzene	1	BDL	BDL	BDL	BDL
MTBE	1	BDL	BDL	BDL	BDL
HC as Gasoline-ppm	.05	0.64	0.15	BDL	BDL
HC as Kerosene-ppm	.05	BDL	BDL	BDL	BDL
HC as #2 Fuel Oil-ppm	.05	BDL	BDL	BDL	BDL
HC as Diesel Fuel-ppm	.05	BDL	BDL	BDL	BDL
HC as JP-5-ppm	.05	BDL	BDL	BDL	BDL
HC as Aviation Gas-ppm	.05	BDL	BDL	BDL	BDL

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 06450
(203)-634-3731
Connecticut Certification No. PH-0547

Client	: HRP Associates Inc.		
Lab No.	: 113-327-5	Date Analyzed	: 11/18--11/20
PO No.	: NAV0030.FE		
Rep. Date	: 11-24-93	Analyst	: YK

EPA METHOD 8260 GC/MS Date Samples Rec'd: 11-17-93

Matrix Type :		W			
Field ID :	MDL	Sparge Well (E)			
Dichlorodifluoromethane	1	BDL			
Chloromethane	1	BDL			
Vinyl chloride	1	BDL			
Chloroethane	1	BDL			
Bromomethane	1	BDL			
Trichlorofluoromethane	1	BDL			
1,1-Dichloroethylene	1	BDL			
Methylene chloride	1	BDL			
trans-1,2-Dichloroethylene	1	BDL			
1,1-Dichloroethane	1	BDL			
2,2-Dichloropropane	1	BDL			
cis-1,2-Dichloroethylene	1	BDL			
Chloroform	1	3.0			
Bromochloromethane	1	BDL			
1,1,1-Trichloroethane	1	BDL			
1,1-Dichloropropylene	1	BDL			
Carbon tetrachloride	1	BDL			
Benzene	1	39.0			
1,2-Dichloroethane	1	BDL			
Trichloroethylene	1	BDL			
1,2-Dichloropropane	1	BDL			
Bromodichloromethane	1	BDL			
Dibromomethane	1	BDL			
cis-1,3-Dichloropropylene	1	BDL			
Toluene	1	7.0			
t-1,3-Dichloropropylene	1	BDL			
1,1,2-Trichloroethane	1	BDL			
Tetrachloroethylene	1	BDL			
1,3-Dichloropropane	1	BDL			
Dibromochloromethane	1	BDL			
1,2-Dibromoethane (EDB)	1	BDL			
Chlorobenzene	1	BDL			
Ethylbenzene	1	21.0			
1,1,1,2-Tetrachloroethane	1	BDL			
p/m-Xylene	1	29.0			
o-Xylene	1	2.0			

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

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

Client	: HRP Associates Inc.		
Lab No.	: 113-327-5	Date Analyzed	: 11/18--11/20
PO No.	: NAV0030.FE		
Rep. Date	: 11-24-93	Analyst	: YK

EPA METHOD 8260 GC/MS Date Samples Rec'd: 11-17-93

Matrix Type : W

Field ID :

	MDL	Sparge Well (E)			
Styrene	1	BDL			
Bromoform	1	BDL			
Isopropylbenzene	1	BDL			
1,1,2,2-Tetrachloroethane	1	BDL			
Bromobenzene	1	BDL			
1,2,3-Trichloropropane	1	BDL			
n-Propylbenzene	1	BDL			
2-Chlorotoluene	1	BDL			
1,3,5-Trimethylbenzene	1	2.0			
4-Chlorotoluene	1	BDL			
tert-Butylbenzene	1	BDL			
1,2,4-Trimethylbenzene	1	BDL			
sec-Butylbenzene	1	BDL			
p-Isopropyltoluene	1	BDL			
1,3-Dichlorobenzene	1	BDL			
1,2,3-Trimethylbenzene	1	BDL			
1,4-Dichlorobenzene	1	BDL			
n-Butylbenzene	1	BDL			
1,2-Dichlorobenzene	1	BDL			
1,2Dibromo-3-chloropropane	1	BDL			
1,2,4-Trichlorobenzene	1	BDL			
Hexachlorobutadiene	1	BDL			
Naphthalene	1	BDL			
1,2,3-Trichlorobenzene	1	BDL			
MTBE	1	BDL			
HC as Gasoline-ppm	.05	0.11			
HC as Kerosene-ppm	.05	BDL			
HC as #2 Fuel Oil-ppm	.05	BDL			
HC as Diesel Fuel-ppm	.05	BDL			
HC as JP-5-ppm	.05	BDL			
HC as Aviation Gas-ppm	.05	BDL			

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

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

Date Samples Received : 11-17-93

Client Name: **HRP Associates Inc.**	CTL Lab No. 113-327-5
Report Date: 11-24-93	PO/Job No. NAV0030.FE

RESULTS OF ANALYSIS

GC/FID

Matrix Type	**W**	**W**	**W**	**W**
Field Id	**MW-22**	**PZ-23**	**MW-26**	**MW-2**
n-Pentane-ppb	89.0	42.0	ND<10	ND<10
n-Hexane-ppb	ND<10	ND<10	ND<10	ND<10
n-Heptane-ppb	ND<10	ND<10	ND<10	ND<10
n-Octane-ppb	ND<10	ND<10	ND<10	ND<10

GC/FID

Matrix Type	**W**			
Field Id	**Sparge Well (E)**			
n-Pentane-ppb	132.0			
n-Hexane-ppb	ND<10			
n-Heptane-ppb	ND<10			
n-Octane-ppb	ND<10			

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

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 NAV0030.FE
Project Manager LAW

Place & Address of Collection BNAS BRUNSWICK, MAINE
Samplers Name (Signature) Simmons
Assistant (Witness)(Signature)

Sample Number	Sample Location	Container Type	Total Volume	Preservative	Date	Time	Sample Type: Water	Soil	Air	Waste	Remarks
MW-22	"	Glass VOA	80 ml	Cool	11/10/93		X				
PZ-23											
MW-26											
MW-2			40 ml	Vial							
SPARGE WELL (E)			80 ml								

Relinquished By (Signature)
Received By (Signature) M McMahon Date 11/17/93 Time 4:10
Relinquished By (Signature)
Received By (Signature) Date Time
Name & Address of Laboratory

LABORATORY SAMPLE PREPARATION REQUIRED

None ☐ Filter ☐ Adjust pH to _____ Priority ☐
Other

ANALYSES REQUIRED

Parameters	Sample Number					Parameters	Sample Number: MW-22	PZ-23	MW-26	MW-2	SPARGE WELL (E)
pH						TPH 418.1					
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						✓ 80260	X	X	X	X	X
Pb						✓ Pentane					
Se						✓ Hexane					
Sp. Cond.						✓ Heptane					
TDS						✓ Octane					
Zn						✓ HC as *					

Remarks Hydrocarbons as gasoline, kerosene, #2 fuel oil, diesel fuel, * JP-5 and Aviation Gasoline.

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

№ 01521

APPENDIX B

AS/SVE TEST CALCULATIONS

APPENDIX B

1.) Air/Soil Permeability Calculation from Eastern System Test Data

2.) Eastern System Plot of Vacuum Data for Vent Radius of Influence

3.) Eastern System Sparge Test Water Level Plot

4.) Western System Sparge Test Water Level Plot

5.) Western System Sparge Test Dissolved Oxygen Plot

6.) Estimation of Sparge Well Radius of Influence

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

PROJECT TITLE BNAS AS/SVE TESTS			
PROJECT NUMBER NAV0030.FE			
SUBJECT AIR PERMEABILITY CALCULATION			
DESIGNED RWS	DATE	CHECKED	DATE

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

where k = Soil Permeability in cm^2

Q = Volumetric withdrawal Rate in cm^3/s

μ = Viscosity of air in $g/cm \cdot s$

R_W = Vapor extraction well radius in cm

R_I = Radius of influence - steady state - of test from Vacuum vs Distance Plot in cm

H = Length of vapor extraction well screen in cm

P_W = Absolute pressure in the vapor extraction well in $g/cm \cdot s^2$

P_{atm} = Absolute atmospheric pressure in $g/cm \cdot s^2$

East System Steady State values:

$Q = 1.954 \times 10^8\ cm^3/s$

$\mu = 1.8 \times 10^{-4}\ g/cm \cdot s$

$R_W = 2.54\ cm$

$R_I = 670.6\ cm$

$H = 1219.2\ cm$

$P_W = 9.815 \times 10^5\ g/cm \cdot s^2$

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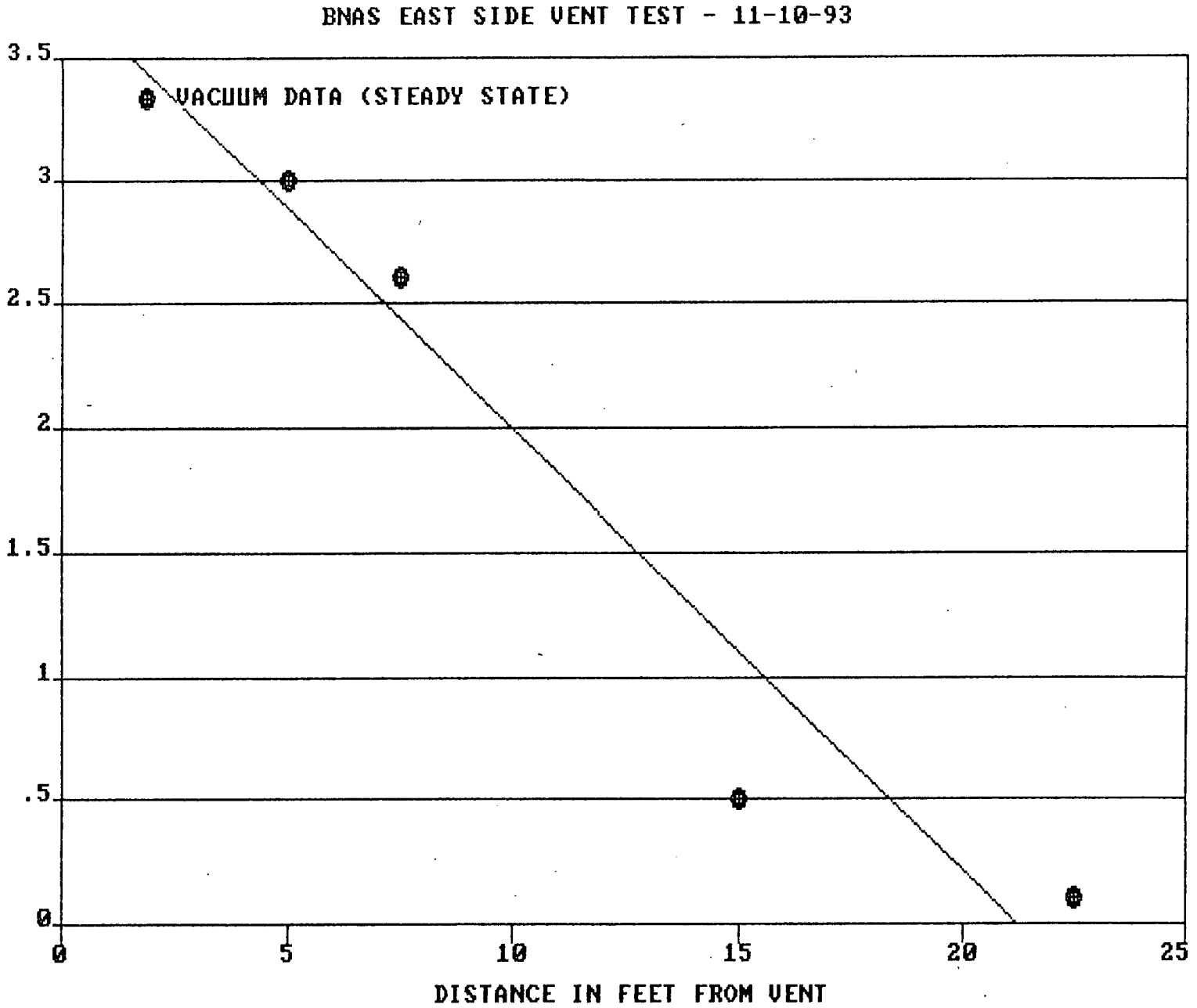
PROJECT TITLE BNAS AS/SVE TESTS			
PROJECT NUMBER NAV0030.FE			
SUBJECT AIR PERMEABILITY CALCULATION			
DESIGNED RWS	DATE	CHECKED	DATE

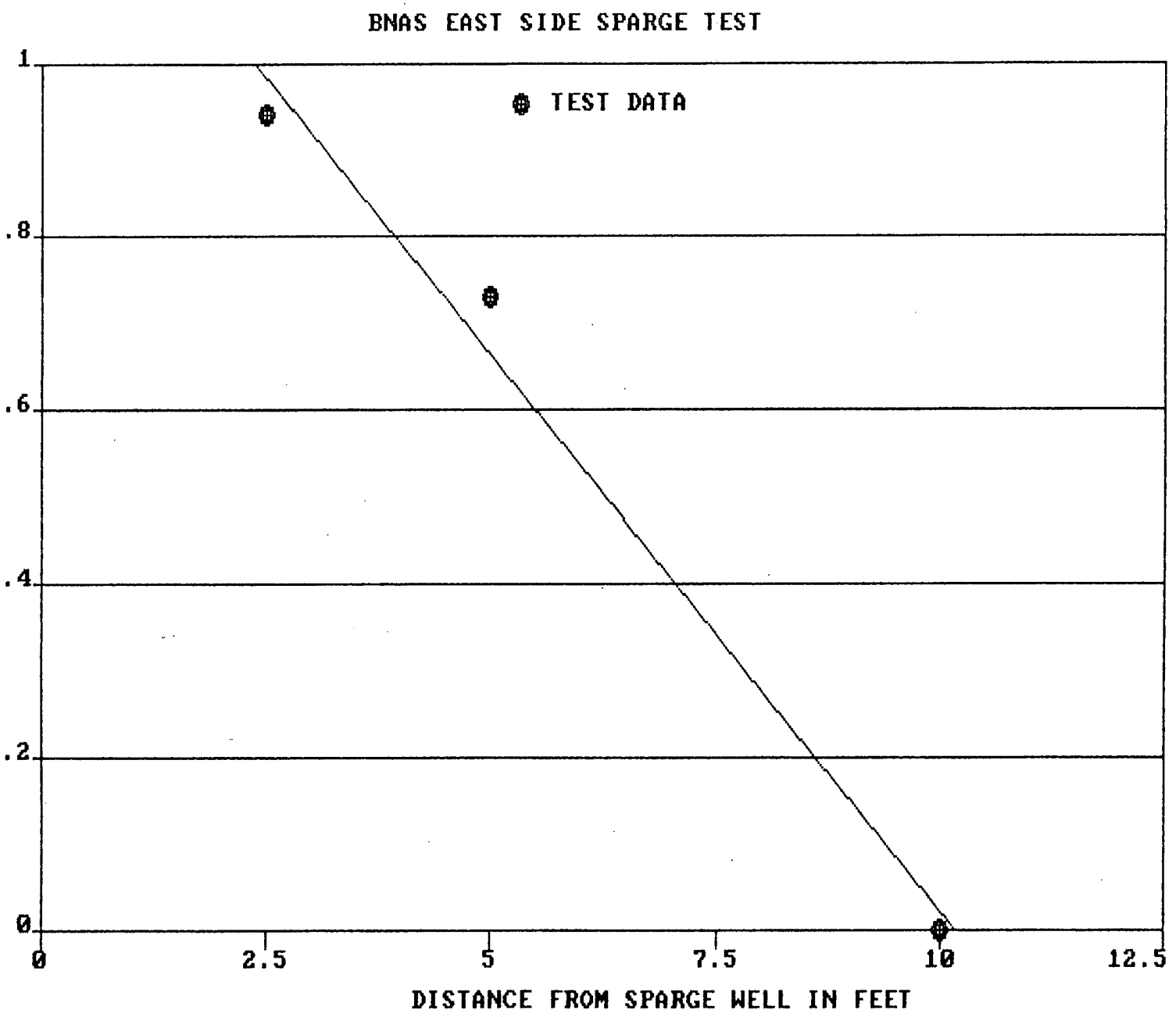
$P_{atm} = 1.01 \times 10^6 \ g/cm \cdot s^2$

$k = 8.7 \times 10^{-4} \ cm^2$



THE REGRESSION POLYNOMIAL OF LINE 1 -

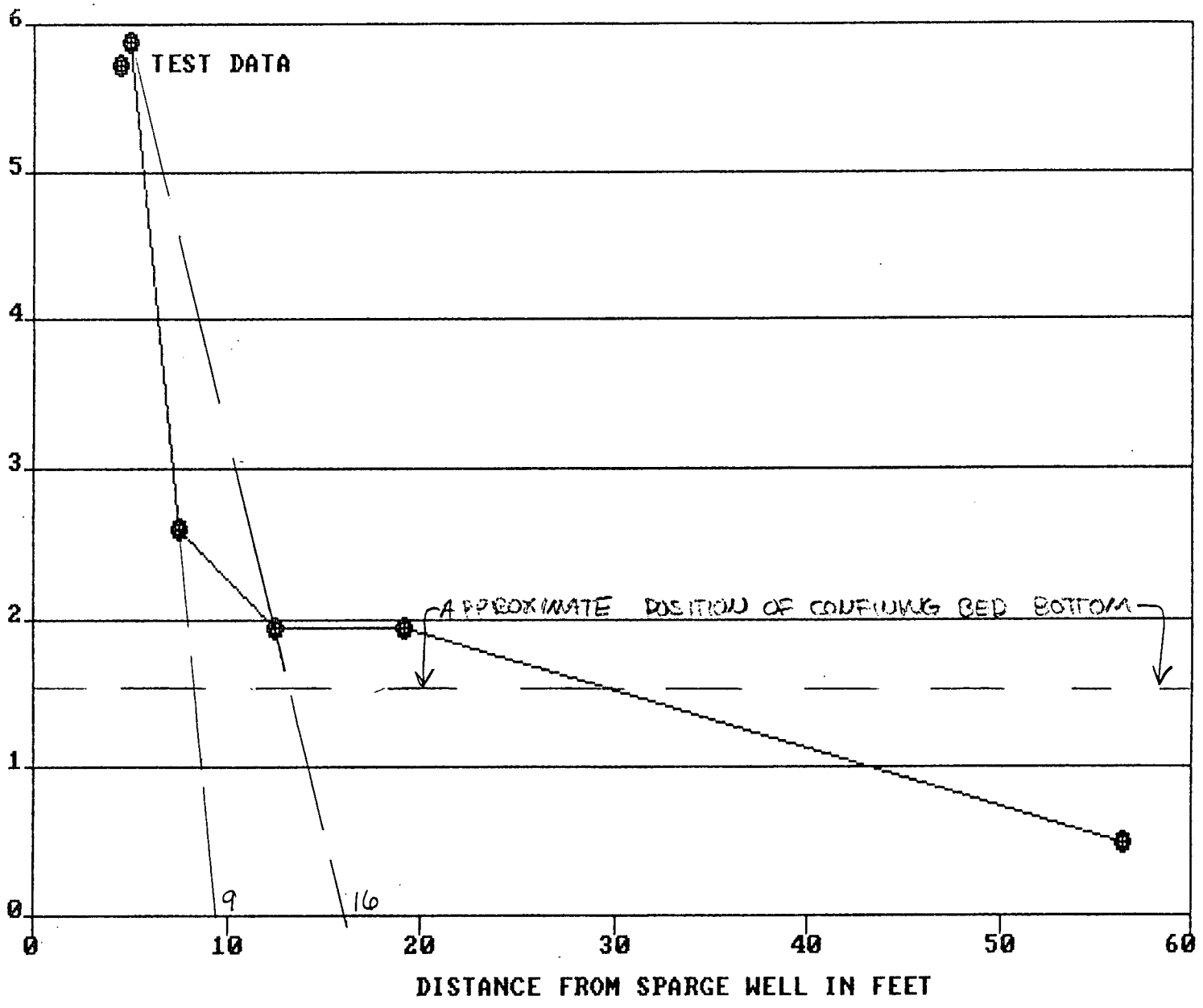
(3.767E+00) + (-1.773E-01)*X
THE VARIANCE - 1.284E-01



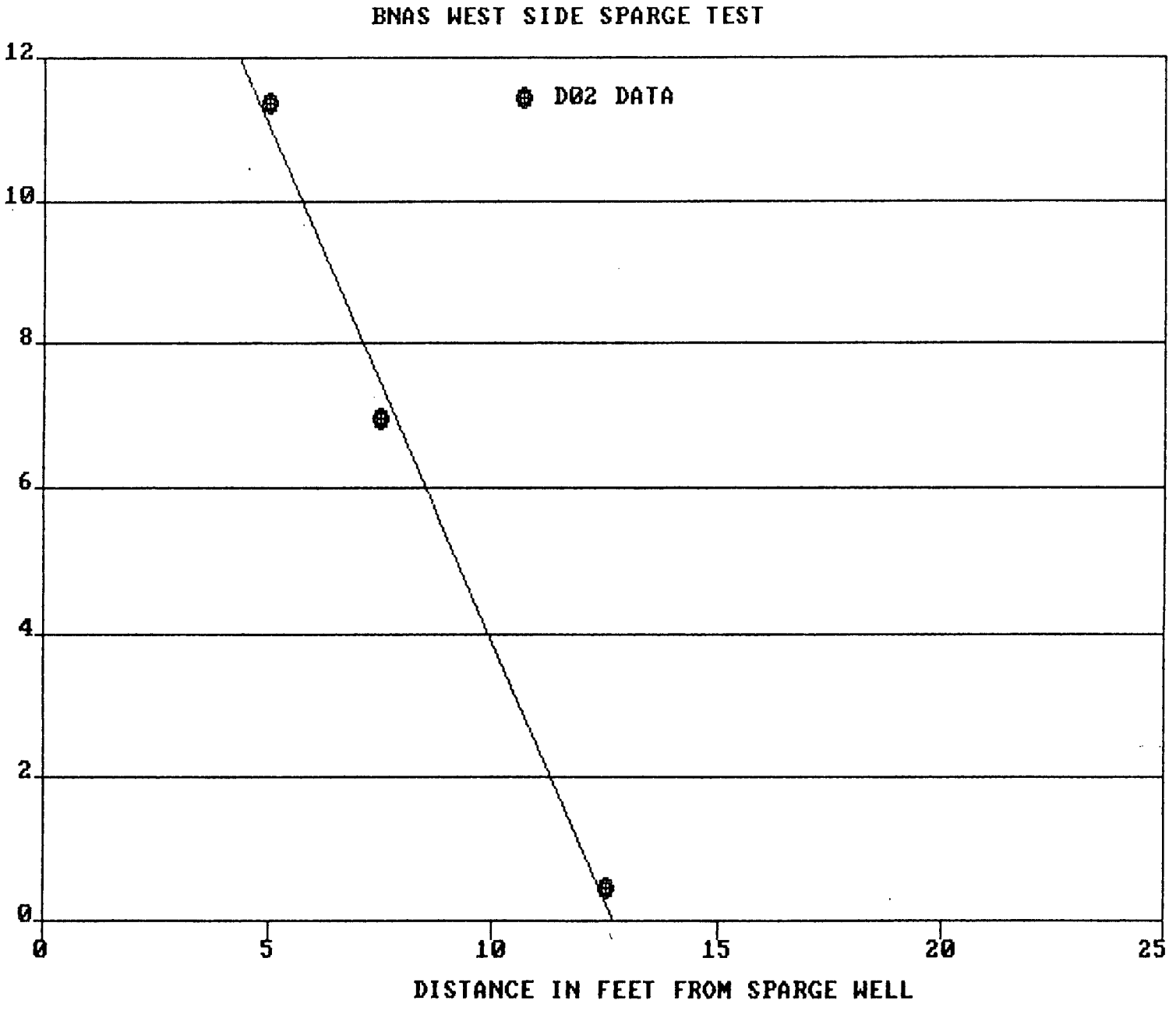
THE REGRESSION POLYNOMIAL OF LINE 1 -

(1.305E+00) + (-1.283E-01)*X
THE VARIANCE - 2.288E-03

WEST SYSTEM TEST DATA - WATER LEVEL CHANGE



9 + 16 = 25/2 = 12.5 ± RADIUS OF INFLUENCE



THE REGRESSION POLYNOMIAL OF LINE 1 -

(1.818E+01) + (-1.431E+00)*X
THE VARIANCE - 1.260E-01

HRP
ASSOCIATES, INC.
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PROJECT TITLE BNAS AS/SVE TEST			
PROJECT NUMBER NAV 0030.FE			
SUBJECT AIR SPARGE RADIUS			
DESIGNED RWS	DATE	CHECKED	DATE

AIR SPARGING RADIUS OF INFLUENCE (R_I)

FROM EAST H_2O LEVELS 10.1 FT

FROM WEST H_2O LEVELS 12.5 FT

FROM WEST $D.O_2$ LEVELS 12.5 FT

AVERAGE R_I 11.7 FT