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REPORT ON SOIL VAPOR EXTRACTION AND AQUIFER AIR SPARGING PILOT TESTING CONDUCTED AT NAVY EXCHANGE SERVICE STATION NAVAL AIR STATION, BRUNSWICK, MAINE

Contract No. N62472-91-D-1449
Amendment No. 12 to Appendix A,
Project No. 18, Delivery Order No. 0011

Volume 1 of 2
(Text Through Appendix D)

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12 September 1994
FINAL
EA Project No. 12197.14

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FINAL
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1. PROJECT DESCRIPTION

1.1 INTRODUCTION

Under Contract No. N62472-91-D-1449, Amendment No. 12 to Appendix "A," Project No. 18, Northern Division, Naval Facilities Engineering Command issued Delivery Order No. 0011 to EA Engineering, Science, and Technology to conduct remediation pilot testing of soil vapor extraction (SVE) and aquifer air sparging (AAS) technologies at the Navy Exchange (NEX) service station (Building 538), Naval Air Station, Brunswick, Maine. This Final Report has been prepared to provide an assessment of the performance of these innovative remedial technologies in removing volatile organic compounds (VOCs) from the subsurface and subsequently restoring soil and ground-water quality at the site. Pilot testing of SVE/AAS was performed based on the potential applicability in remediating the petroleum-impacted ground water and soil at the NEX service station.

Based on the remedial investigation performed at the site in 1992 (ERM 1992), four remedial alternatives for site soil were presented for future consideration: (1) excavation and offsite disposal, (2) SVE, (3) bioremediation, and (4) asphalt batching (a form of excavation and offsite disposal resulting in a beneficial use of the soil). In the same report, two remedial alternatives were presented for the removal of dissolved-phase hydrocarbons from site ground water, including AAS and ground-water pump and treat. Preferred remedial methods were not selected by ERM (1992) as the extent of sorbed-phase and dissolved-phase hydrocarbons in soil and ground water was not completely delineated during the field investigation.

From the proposed alternatives, and based upon available site data, pilot treatability studies were conducted utilizing the *in situ* technologies SVE and AAS. SVE was pilot tested to evaluate the effectiveness of this process in removing VOCs from the unsaturated zone soil with subsequent treatment of the off-gas above surface grade. A second *in situ* remedial technology, AAS, was pilot tested based on its potential to partition dissolved- and sorbed-phase hydrocarbons present within the saturated zone into the vapor phase. The buoyant nature of the hydrocarbon-laden sparged air causes the vapors to migrate into the unsaturated zone, where they are extracted by a concurrently operating SVE system.

1.2 PILOT TEST OBJECTIVES

The primary objective of pilot testing is to evaluate the effectiveness of SVE/AAS in reducing VOC concentrations in soil and ground water within the vicinity of the NEX service station. To accomplish the stated objective, a total of 10 air sparging wells and 5 lateral vapor extraction trenches were installed at the site, with associated air delivery and vapor extraction return pipe directed to a single pilot plant building housing skid-mounted SVE and AAS systems.

The pilot study was performed over an extended period of time to assess whether these technologies can achieve the "stringent cleanup goals" established by the State of Maine Department of Environmental Protection (MEDEP) (1992), to provide the criterion for design alterations, if appropriate, and to determine if other remedial technologies should be revisited. Included within the pilot study was the characterization of site conditions (both chemically and hydrogeologically) immediately prior to, during, and following remedial pilot plant operations.

Once constructed and activated, the SVE/AAS system was routinely monitored and sampled to assess the impact of the remedial system operations on site soil and ground water. In addition to system monitoring and sampling, the following monitoring and sampling activities were required:

- Soil vapor sampling during SVE start-up to assess the influence of the SVE system on hydrocarbons present within the unsaturated zone.
- Soil and ground-water sampling to evaluate the impact over time of SVE/AAS system operations in reducing the concentrations of residual and dissolved-phase hydrocarbons in site soil and ground water.
- Preparation of ground-water elevation contour maps from well gauging data prior to, during, and following pilot plant operations.

The results of the pre-treatment, operational period, and post-treatment analyses are presented in this technology evaluation report. The results of the pre-treatment analyses, in comparison with post-treatment analyses, define the overall effectiveness of employing the remedial technologies at the NEX service station.

1.3 SITE DESCRIPTION

The NEX service station is located north of the intersection of Second Street and Burbank Avenue at Naval Air Station, Brunswick, Maine. Figure 1-1 provides the location of the subject site, as taken from the Brunswick, Maine, U.S. Geological Survey 7.5-minute series topographic quadrangle map. Figure 1-2 provides the general site layout. The NEX service station (Building 538) and adjoining property to the southeast, occupied by the Family Services Center (Building 27), constitute the area undergoing remedial pilot testing during this study.

The NEX service station is bordered on all sides by Naval Air Station grounds. West of the subject site, across Second Street, the Public Works Department maintains a vehicle compound. The NEX shopping complex (Building 11) is located approximately 100 ft northeast of the underground storage tanks (USTs). Abutting NEX service station property

to the immediate north is a water pump house with mounded water tank (Building 295); approximately 100 ft to the southeast, on the opposite side of Burbank Avenue, is the Family Services Center (Building 27). Several other facilities exist within 1,000 ft of the site.

The NEX service station building is approximately 5,300 ft^2 in area and consists of a service garage with two bays, a beverage container redemption center, and an office. Remaining service station grounds include an active pump island with canopy and three 10,000-gal gasoline USTs, which were installed in 1993. Alongside the western side of the service station building are two aboveground storage tanks (one 275-gal waste oil tank and one 550-gal fuel oil tank). The original building was constructed in 1957 and has since been expanded. The site has been operated as a petroleum distributor for approximately 36 years. Product historically stored at the NEX service station includes several grades of gasoline, fuel oil, and waste oil.

The topography of the site area is characterized as flat and gently sloping to the south-southwest in the direction of the intersection of Burbank Avenue and Second Street. A small, steeply graded hill (approximately 8 ft total height) is located directly north of the service station and is the setting for the pump house and water tank (Building 295).

On and directly adjacent to the NEX service station grounds are several buried utilities, including water, storm sewer, sanitary sewer, and steam. Several storm sewer and sanitary sewer lines traverse the southern portion of NEX service station grounds, as shown in Figure 1-2. A water main extends across Second Street to a fire hydrant located at the southwestern corner of service station grounds. A 1-in. water line runs from the Burbank Avenue water main due east of the former pump dispensers into the center of the NEX service station. Electric services are located both overhead and below grade within the vicinity of the subject site. The locations of known utility lines are shown in Figure 1-2.

1.3.1 History of Fuel Storage

As detailed in the remedial investigation report prepared by ERM (1992) in September 1992, there were four USTs at the NEX service station. Three of these USTs were single-walled steel gasoline storage tanks installed in 1974 and formerly located in the grassy area east of the service station; these tanks passed integrity tests conducted by Tankpro of Scarboro, Maine in July 1989. The fourth UST was a 1,000-gal single-walled steel fuel oil tank installed in 1975 and formerly located along the northern edge of the service station. All of the tanks were registered with the State of Maine. During 1993, ATEC Associates, Inc. of Norwell, Massachusetts completed the installation of three fiberglass gasoline USTs within the same excavation that the steel USTs were removed. The locations of the former steel USTs, and the replacement fiberglass USTs, are shown in Figure 1-2.

Prior to replacement in 1974, two 5,000-gal gasoline USTs were located onsite in an area now occupied by an extension to the original service station, as shown in Figure 1-2. A 550-gal waste oil tank, installed in 1975 along the western wall of the service station, was removed in 1989. No records of these removals were immediately available for review.

1.3.2 Petroleum Spill/Release History

The petroleum spill/release history of the site has been taken directly from the remedial investigation report prepared by ERM (1992). According to Naval Air Station personnel, gasoline odors were detected in the vicinity of the service station in 1981. To determine the sources of the vapors, surface soils in a 60-70 ft^2 area around the UST system were removed, and a faulty connection in one of the pipes was found and repaired. The excavated soils were analyzed by MEDEP personnel, and the contaminated soils were disposed of offsite. No other information was available regarding the removal and disposal of contaminated soil.

According to Mr. Neil Campbell, a Naval Air Station maintenance worker, a ground-water recovery system was installed at the site in 1984 to correct for gasoline odors in Buildings 25 and 27. The system, which was removed in 1993 during tank replacement activities, consisted of 3 shallow ground-water recovery wells connected to a central manifold and pump system located in the grassy island at the corner of Second Street and Burbank Avenue. Using this recovery system, ground water was pumped into a temporary aboveground holding tank for approximately one week and analyzed by MEDEP. Subsequently, for a period of approximately one year, MEDEP authorized discharge of the pumped ground water to the nearby storm sewer. Ground-water pumping was terminated when water no longer appeared to be contaminated. The date of the termination of pumping was not identified nor was any other information regarding the operation and maintenance of the ground-water recovery system.

There are no records, remedial system specifications, or sampling data in MEDEP's files to document any of the above activities or to characterize soil and ground-water quality onsite. The only documentation in Naval Air Station files concerning these activities is a work authorization for installation of the wells dated 22 July 1981.

ERM reviewed MEDEP files to identify reported spill incidents associated with the site; complete files were only available for the period since 1984 (ERM 1992). One incident of a gasoline spill at the site had been reported to MEDEP in 1989. According to Mr. Bradford Hahn of MEDEP's Portland office who prepared a report for the incident, a minor amount of petroleum-impacted soil was discovered while performing a tank tightness test. Approximately 1 yd^3 of soil was removed and disposed offsite. According to the contractor who performed the tightness test (Tankpro of Scarboro, Maine), the spill did not appear to be related to the tightness test. Based on the contractor's description of the incident, Mr. Hahn

indicated that due to the minor nature of the release and immediate containment of the impacted soil, no follow-up investigation was necessary. No other information was identified in MEDEP files regarding this spill incident.

During a 30 March 1993 site visit, EA personnel inspected a 6-in. diameter exhaust stack originating from below grade along the north side of the Family Services Center (Building 27), located hydraulically downgradient of the NEX service station. From discussions with Naval Air Station Public Works personnel, EA learned the stack is connected to the footing drains installed beneath the building due to the high water table. The stack was installed in 1989 as a means of diverting and exhausting organic vapors from the foundation of Building 27. The underdrain system discharges to the storm sewer system located east and west of the building.

1.3.3 General Site Characteristics

Based upon the geologic logs of pre-existing and recently installed ground-water monitoring wells and air sparging wells, and SVE trenches, the site-specific shallow stratigraphy is comprised of a surficial layer of brown, sandy loam overlaying a tan-brown-gray, medium- to fine-grained sand with trace silt. These unconsolidated materials overlie an extensive sequence of soft gray marine clay. The sand horizon ranges in thickness from less than 4 ft (Well MW-5) to approximately 21.5 ft (Well MW-1R).

The gray marine clay underlying the surficial loam and sand layers is considered to be a natural aquiclude for purposes of site remediation. Depth of the marine clay has been reported to extend to 93.5 ft, based on a geotechnical boring installed adjacent to the NEX service station in 1974. Underlying the marine clay is 2 ft of coarse sand and gravel, followed by bedrock at approximately 95.5 ft below grade.

The depth to ground water at the site ranges from approximately 2 ft (Well MW-5) to 8 ft (Sparge Well AAS-1) below grade, with seasonal fluctuations up to several feet. Based upon several rounds of well gauging, ground-water flow in the shallow water table aquifer at the NEX service station is to the south at a shallow gradient, with a slight increase in hydraulic gradient south of Burbank Avenue. The average hydraulic gradient, as calculated from data presented in the remedial investigation report (ERM 1992), is 0.011 but varies with seasonal recharge.

The saturated thickness of the water table in the sand sub-unit ranges from approximately 1 ft (Wells MW-2 and MW-5, both located south of Burbank Avenue) to greater than 8.5 ft (Well MW-1) in the portion of the site to undergo remediation. Hydraulic conductivities derived from slug test data at Wells MW-4 and MW-5 (ERM 1992) were estimated at 8.6×10^{-6} cm/sec; these estimates appear low for the sandy loam and sand with trace amounts of silt. Seepage velocity, as calculated by ERM (1992), is estimated at 0.39 ft/year. Other investigations performed at Naval Air Station calculated seepage velocities ranging from 9 to 104 ft/year.

1.3.4 Nature and Extent of Petroleum Hydrocarbons

The petroleum hydrocarbons detected in soil and ground water at the NEX service station prior to pilot testing are summarized in Table 1-1. In general, the results indicate the presence of gasoline-related constituents in site soil and ground water, including benzene, toluene, ethylbenzene, and xylenes (BTEX) and the oxygenate methyl tertiary-butyl ether (MTBE). Fuel oil range hydrocarbons were also reported in several soil and ground-water samples. Total lead was reported in several soil samples at low concentrations.

Prior to pilot plant operations, personnel in the adjacent Family Services Center (Building 27) observed odors in the building thought to be associated with the NEX service station. The odors observed in the building had not been adequately defined, but were speculated to be related to the migration of dissolved-phase and/or vaporous hydrocarbons originating from the soil and ground water at the adjacent NEX service station. A footing drain installed along the north end of the Family Services Center consistently showed elevated concentrations of hydrocarbon vapors.

1.4 OVERVIEW OF REPORT

The remaining chapters of this report address the following topics: field construction activities, pilot test methodologies, physical characteristics of the study area, pilot test results, and summary and conclusions.

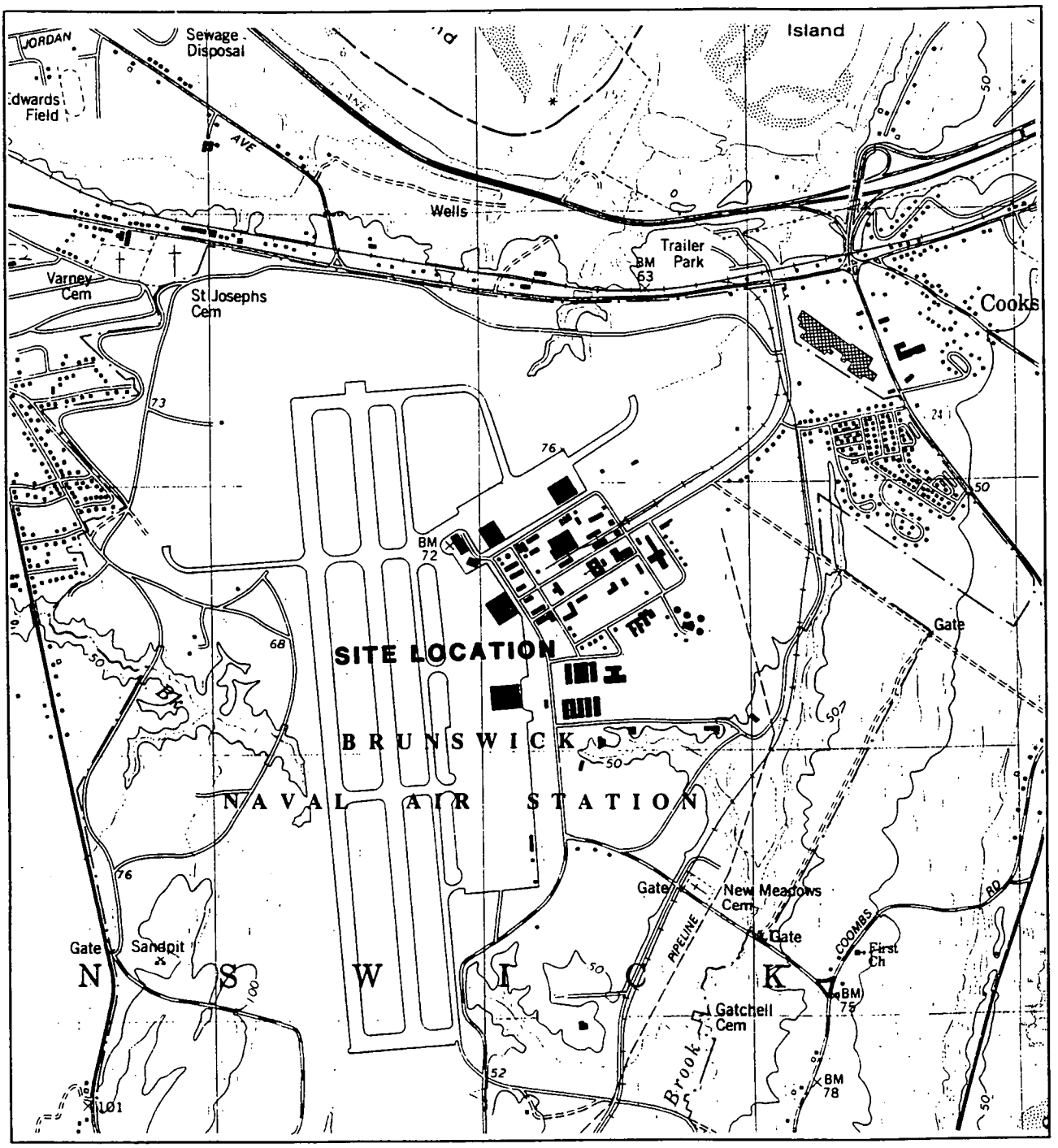
Chapter 2, Pilot Plant Installation, provides detail on the installation of AAS wells, SVE trenches, skid-mounted SVE and AAS systems and associated piping, construction of the concrete pad and treatment building, electrical work, and management of construction waste.

Chapter 3, Pilot Test Methodology, provides a summary of the activities associated with the performance of the SVE/AAS pilot tests. Also discussed in this chapter are the changes in the scope of field programs that occurred following the development of the Final Work Plan.

Chapter 4, Pilot Test Results, discusses in detail the findings of the SVE and SVE/AAS pilot tests and results of ground-water, soil vapor, and soil sampling.

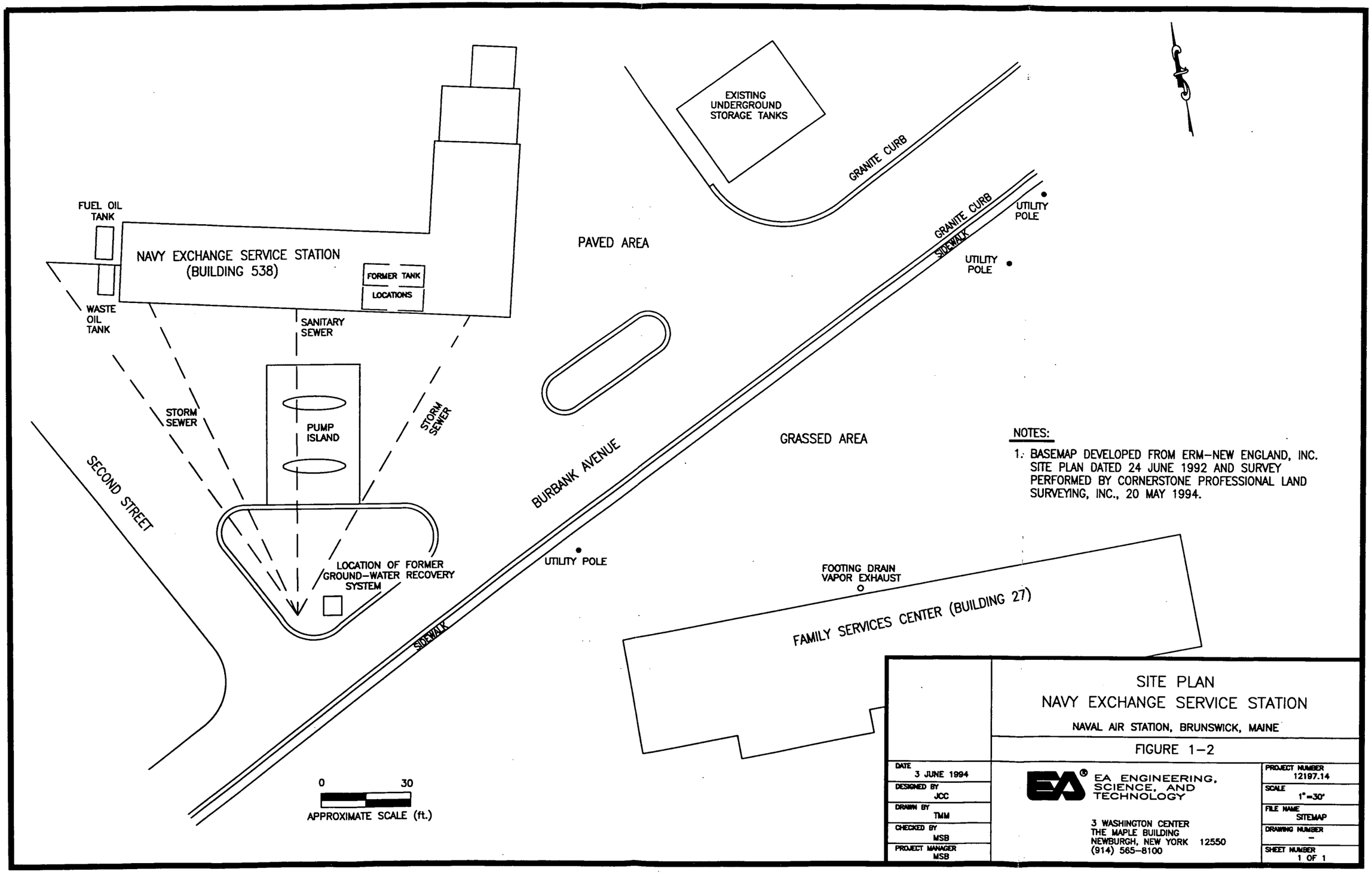
Summary and conclusions, based on the findings of this pilot test, are presented in Chapter 5.

NAVY EXCHANGE SERVICE STATION
NAVAL AIR STATION, BRUNSWICK, MAINE



Source: U.S. Geological Survey 7.5 Minute Series
Topographic Quadrangle Map
Brunswick, Maine Quadrangle, 1980

Figure 1-1. Site location map, Navy Exchange Service Station, Naval Air Station, Brunswick, Maine, U.S. Geological Survey 7.5-minute series topographic quadrangle map.



NOTES:

1. BASEMAP DEVELOPED FROM ERM-NEW ENGLAND, INC. SITE PLAN DATED 24 JUNE 1992 AND SURVEY PERFORMED BY CORNERSTONE PROFESSIONAL LAND SURVEYING, INC., 20 MAY 1994.

SITE PLAN
NAVY EXCHANGE SERVICE STATION
NAVAL AIR STATION, BRUNSWICK, MAINE

FIGURE 1-2

DATE	3 JUNE 1994
DESIGNED BY	JCC
DRAWN BY	TMM
CHECKED BY	MSB
PROJECT MANAGER	MSB

EA ENGINEERING, SCIENCE, AND TECHNOLOGY

3 WASHINGTON CENTER
THE MAPLE BUILDING
NEWBURGH, NEW YORK 12550
(914) 565-8100

PROJECT NUMBER	12197.14
SCALE	1"=30'
FILE NAME	SITEMAP
DRAWING NUMBER	-
SHEET NUMBER	1 OF 1

TABLE 1-1 SUMMARY OF ANALYTICAL DATA FOR SOIL AND GROUND-WATER SAMPLING CONDUCTED AT THE NAVY EXCHANGE SERVICE STATION, NAVAL AIR STATION, BRUNSWICK, MAINE

Analysis	MW-1		MW-2		MW-3		MW-4		MW-5	
	Soil	Water	Soil	Water	Soil	Water	Soil	Water	Soil	Water
Volatile Organics (μg/kg or μg/L)										
Toluene	1.3U	1.0U	1.2U	1.1	1.2U	18	640,000	12,000	1.2U	1.0U
Benzene	1.3U	1.0U	1.2U	1.0U	1.2U	14	5,300	1,000	1.2U	1.0U
Ethylbenzene	1.3U	1.0U	1.2U	1.0U	1.2U	4.8	340,000	3,900	1.2U	1.0U
Total Xylenes	2.6U	2.0U	2.8U	4.2	2.4U	23	1,800,000	22,000	2.4U	2.0U
MTBE	2.6U	2.0U	2.4U	2.0U	3.6	2.5	7,300	2,000U	2.4U	5.9
Hydrocarbon Analyses (mg/kg or mg/L)										
Total Petroleum Hydrocarbons	10U	1.0U	10U	1.0U	30	1.0U	1,000	22	13	1.0U
Gasoline in Soil/Water	6U	0.020U	6U	0.035	6U	0.020U	31,000	210	6U	0.056
Fuel Oil in Soil/Water	10U	0.010	10U	0.460	10U	0.061	4,800	84	10U	0.300
Inorganics (mg/kg or mg/L)										
Total Lead	10U	0.005U	13	0.005U	10U	0.005U	10U	0.005U	20	0.005U

NOTE: Soil samples taken 16 May 1992; ground-water samples taken 21 May 1992.
MTBE = Methyl tertiary-butyl ether; U = Analyzed for but not detected.
The numerical value reported represents the detection limit of the analyte.

2. PILOT PLANT INSTALLATION

The SVE/AAS pilot plant was constructed in two phases. The first phase involved the installation and development of the 10 AAS wells. The second phase involved the installation of SVE trenches and construction of the pilot plant treatment building. The pilot plant installation was completed in phases due to delays in start-up caused by the prolonged construction period associated with the UST replacement activities at the NEX service station.

A site plan showing pertinent site features is provided as Figure 1-2. Utility clearances were secured from the Resident Officer in Charge of Construction office at Naval Air Station and by calling the "Dig Safe" utility clearance service. The locations of all known utilities were cleared prior to each phase of construction.

2.1 AIR SPARGING WELL INSTALLATIONS AND DEVELOPMENT

A&W Environmental Drilling, Ltd. of North Smithfield, Rhode Island, was subcontracted by EA to perform the installation of 10 AAS wells. This task was completed under the direct supervision of an EA geologist during 20-22 July 1993. The locations of the AAS wells are shown on Figure 2-1. The sparge wells were installed within the portion of the site suspected to contain elevated concentrations of dissolved-phase hydrocarbons within the overburden ground water. Air sparging wells AAS-1 through AAS-5 were installed to the north of Burbank Avenue, adjacent to the existing tank field at the NEX service station. Air sparging wells AAS-6 through AAS-10 were installed to the south of Burbank Avenue, within the landscaped area adjacent to Building 27. All sparge wells were screened nominally above the top of the marine clay encountered at depths ranging from approximately 7 to 19 ft.

During drilling, split-spoon sampling was conducted at 5-ft intervals at each AAS well to permit air monitoring and classification of site soils. Air monitoring and headspace analyses were conducted using an HNu Systems Inc. Model PI 101 photoionization detector; the results are recorded on the boring logs presented as Appendix A. All soils retrieved via split-spoon were examined by the onsite EA geologist and classified according to the methods and nomenclature of the Unified Soils Classification System. Surficial overburden soil, consisting of fine to medium sands with trace amounts of silt, is classified as SP, an indication of the homogeneity of the content of sand in the soil samples. The marine clay underlying the sand is classified as CL.

The borings for the sparge wells were completed to depths reaching 1-2 ft into the top of the silty clay. Total depth of the sparge well borings ranged from 7 ft below grade (AAS-9) to 19 ft below grade (AAS-1). The screened intervals of the sparge wells were placed at or

within 0.5 ft of the top of the marine clay and from 1 to 8 ft beneath the water table to permit adequate air displacement into the surrounding impacted water table aquifer. Sparge wells AAS-9 and AAS-10 are seasonally dry.

The screened interval for each sparge well is constructed of 0.010-in. continuous slot, high-flow, 2-in. inner diamter (ID) Schedule 40 PVC, which contains a higher than normal ratio of slot openings per inch than standard PVC screen. This screen type reduces the potential for channeling of air through the sand pack and surrounding sediment, which increases the efficiency of the sparging process. The sand pack surrounding each screened interval consists of No. 1 silica well gravel. To prevent short-circuiting of air up the sand pack, a minimum 1-ft thick hydrated coarse-grade bentonite seal was installed approximately 0.5 ft above the screened interval. The remainder of the borehole was backfilled with a cement grout. Appendix B provides complete well construction diagrams for each of the sparge wells.

The 10 AAS wells were developed by A&W Environmental Drilling, Ltd. under the supervision of an EA geologist immediately following the installation of the last well. Development was completed by pumping and surging to remove "fines" and reduce turbidity. Each sparge well was developed a minimum of 10 times the volume of standing water in each well using a 2-in. submersible pump. All down-hole equipment was decontaminated with a rinse of Alconox, potable tap water, and methanol to prevent cross-contamination between wells.

2.2 REPLACEMENT AIR SPARGING AND GROUND-WATER MONITORING WELL INSTALLATION AND DEVELOPMENT

During construction activities associated with UST replacements in August and September 1993, 2 AAS wells (AAS-3 and AAS-4) and ground-water monitoring wells (MW-1 and MW-4) were destroyed by heavy machinery and excavating. Following the completion of these invasive activities, EA re-mobilized to the site to replace the wells.

Northeast Diamond Drilling, Inc. of Brunswick, Maine, was subcontracted by EA to perform the installation of the replacement wells. This task was completed under the direct supervision of an EA geologist during 23-24 March 1994. The locations of the replacement AAS wells (AAS-3R and AAS-4R) and ground-water monitoring wells (MW-1R and MW-4R) are shown on Figure 2-1. The replacement wells were installed within 3 ft of their original locations.

During drilling, continuous split-spoon sampling was conducted at each well to permit air monitoring and classification of site soils. Air monitoring and headspace analyses were conducted using an HNu Systems Inc. Model PI 101 photoionization detector; the results are recorded on the boring logs presented as Appendix A. Representative soil samples from the 2 replacement ground-water monitoring wells were retrieved for laboratory analysis to compare to the results of the original soil samples collected and assess treatment via SVE.

Soil samples were also collected from the 2 replacement sparge wells to document soil quality at these locations. All soils retrieved via split-spoon were examined by the onsite EA geologist and classified according to the methods and nomenclature of the Unified Soils Classification System.

The borings for the replacement sparge wells were completed to depths reaching 1-2 ft into the top of the silty clay. Total depth of the replacement sparge well borings approximated the depths of the originally installed sparge wells. The screened intervals of the sparge wells were placed at or within 0.5 ft of the top of the marine clay. The screened interval for both replacement sparge wells are constructed of 0.010-in. slot, high-flow, 2-in. ID Schedule 80 PVC. The sand pack surrounding each screened interval consists of No. 1 silica well gravel. To prevent short-circuiting of air up the sand pack, a minimum 1-ft thick hydrated coarse-grade bentonite seal was installed approximately 0.5 ft above the screened interval. The remainder of the borehole was backfilled with a cement grout. Appendix B provides complete well construction diagrams for the replacement sparge wells.

The borings for replacement monitoring wells MW-1R and MW-4R were completed to depths of 24 ft and 18 ft below grade, respectively. The wells were each constructed of 2-in. Schedule 40, 0.01-in. slotted PVC well screen with threaded joints, extending a minimum of 2 ft above the standing water table to allow for seasonal fluctuations, and 2-in. Schedule 40 PVC riser pipe. The annular space between the screened interval and borehole was filled with No. 1 silica sand to a depth of approximately 1 ft above the top of the well screen. A minimum of 1-ft hydrated bentonite was placed above the sand pack. Clean sand was used to backfill the remainder of each borehole to land surface. Each well was then completed in a 6-in. diameter well vault set in a 1-ft cement collar flush to grade. Well construction detail is provided in Appendix B.

On 25 March 1994, Northeast Diamond Drilling, under the supervision of an EA geologist, developed the replacement sparge and monitoring wells. Development was completed by pumping and surging to remove "fines" and reduce turbidity. Each sparge well was developed using a 2-in. submersible pump. All down-hole equipment was decontaminated with a rinse of Alconox, potable tap water, and methanol to prevent cross-contamination between wells. Temperature, conductivity, pH, and dissolved oxygen were measured and recorded using a Hydrolab® Model H20G water quality meter during the development process. Development continued at each well until a minimum of 10 times the volume of standing water in each well was removed and/or upon reaching stabilized conductivity and pH measurements. The results of the development process are summarized in the Field Record of Well Development forms provided in Appendix C.

2.3 SOIL VAPOR EXTRACTION TRENCH AND AIR INJECTION LINE INSTALLATIONS

SVE trenches were installed by EA in two phases due to ongoing tank replacement activities and limited space for construction-related machinery at the site. The first phase of SVE

trench installations took place during 18-24 July 1993. EA remobilized to the site on 21-30 September 1993 to complete the installation of trenches SVE-1, SVE-2, and SVE-3. A plan view of the as-built layout of AAS wells and SVE trenches is provided on Figure 2-1. Screened intervals for SVE were designed as lateral trenches to maximize the retrieval of VOCs within the unsaturated zone and minimize the potential for up-welling of the shallow water table into the screened interval of the vents.

SVE trenches were installed in five intervals, ranging in length from 30 ft (Trenches SVE-2 and SVE-3) to 60 ft (Trenches SVE-4 and SVE-5). Based upon available site information, the projected effective radial influence of the vent trenches was approximated at 30 ft. The SVE trenches are located no greater than 60 ft apart, and are aligned in such a manner as to fully intercept potential migration of vapors due to active sparging. Vapor extraction trench SVE-1 was installed at the interpreted northernmost extent of the dissolved-phase hydrocarbon plume. Trenches SVE-2 and SVE-3 are located centrally within the area found to contain the highest concentrations of VOCs in soil and ground water. Trenches SVE-4 and SVE-5 are located downgradient of air sparging wells AAS-6 through AAS-10 to prevent migration of hydrocarbon-laden soil vapor toward Building 27.

Each SVE trench consists of an interval of 4-in. ID 0.010-in. slotted PVC screen installed in lateral trenches extending to approximately 4 ft below grade, or approximately 2 ft above the anticipated high seasonal water table level. A nylon filter mesh was slipped over the length of screened interval. Native sand was deemed suitable for placement as a sand pack and was backfilled atop the horizontal screen in 1-ft lifts.

A 4-in. Schedule 80 PVC "tee" was installed in the center of SVE trenches SVE-1, SVE-4, and SVE-5, with an equal length of screen on either side. The "tee" connections at trenches SVE-2 and SVE-3 were installed with 20-ft and 10-ft screened intervals on either side. Each "tee" then connects to a central riser pipe, extending approximately 2 ft upward to another 4-in. ID PVC "tee." This PVC "tee" is manifolded to a 3-in. ID Schedule 40 PVC extension pipe installed to the top of a sand pack and used to access the vapor trench, and a 3-in. ID Schedule 40 solid PVC vapor collection line returning to the treatment shed. Prior to backfilling the vapor collection trenches to surface grade, the open excavation was used to house sparge air delivery and vapor collection pipe runs to the main trench running back to the treatment shed located behind the NEX service station (Figure 2-1). The main trench excavation was completed to a depth of approximately 3 ft below land surface to complete AAS air delivery and SVE vapor collection pipe runs to the equipment pads. Air delivery and vapor collection lines to sparge wells and vapor extraction trenches south of Burbank Avenue are run through a single 30-ft length of 12-in. ID Schedule 80 pipe installed beneath Burbank Avenue.

Four air delivery lines are completed to the 10 AAS wells. North of Burbank Avenue, sparge wells AAS-1 and AAS-2 are supplied air from a common air delivery line, as are

sparge wells AAS-3, AAS-4, and AAS-5. South of Burbank Avenue, sparge wells AAS-6 and AAS-7 are supplied air from a common air delivery line, as are sparge wells AAS-8, AAS-9, and AAS-10.

The top portion of each AAS well casing was cut at approximately 2 ft below grade and a 2-in. ID Schedule 80 PVC "tee" fitting attached to the casing with its horizontal outlet positioned to lie in the excavated spur trench. A 2-in. diameter Schedule 80 PVC casing was fitted in the horizontal outlet of the tee section and connected to a 2-in. ID Schedule 80 ball valve to permit flow regulation into the sparge well. The vertical "tee" spur was fitted with a 1-ft section of PVC casing extending upward and sealed with an expandable o-ring plug. Each sparge well was completed in a flush-mounted, 2-ft × 2-ft steel, H20-rated utility vault. For sparge wells AAS-1 and AAS-2, which were installed within paved areas, 6-ft × 6-ft fiberglass-reinforced concrete collars were installed around the steel vaults to prevent settling.

2.4 PILOT PLANT EQUIPMENT INSTALLATION

During the SVE trench installation phase, EA set a 12-ft × 18-ft concrete pad behind the northernmost extension of the NEX service station and fenced area. Once cured, the skid-mounted AAS and SVE systems were secured on the concrete pad and a 12-ft × 10-ft Texture I-II treatment building installed. Adjacent to the treatment building, the 1,800-lb granular activated carbon vessel was seated on the concrete pad. Pipe manifolding within the building was completed by EA.

Electrical servicing was completed by Gerrard Robbins Electrical Contractor, Inc. of Brunswick, Maine, who ran power from the two transformers located behind the NEX service station underground to the treatment building. Electrical service at the pilot plant consists of 100-amp, 480-volt, 3-phase power run through a weatherproof NEMA 3R panel on the outside of the treatment building. All electrical components and wiring within the treatment building are National Electric Code Class I, Division II, Group D (explosion proof). In addition to the skid-mounted systems and control panel, an explosion proof, ceiling-mounted light fixture is installed within the building.

To accomplish SVE at the site, a Rotron Model EN12 15-hp regenerative blower, capable of evacuating 500 standard cubic feet per minute (scfm) at a vacuum of 30 in. H_2O, was installed. The blower system is equipped with an inline 10 micron particulate filter/silencer, a vacuum relief valve, a moisture separator and 30-gal knock-out tank equipped with a high liquid level shut-off, a filter silencer, associated ball valves, in-line air sample ports, temperature gauges, and vacuum gauges. Each SVE run connected to the SVE system is equipped with a flow sensor which connects to a centralized flow meter capable of measuring flows to 150 cfm. Electronically, the SVE system will shut down in the event of a high liquid level within the knock-out tank or high temperature within the blower system.

To accomplish AAS at the site, an M-D Pneumatics Competitor Model 40005A positive displacement rotary air blower, capable of producing 165 scfm at a pressure of 4 lb per square inch (psi), was selected. The AAS blower system is equipped with an inlet 10-micron particulate filter/silencer, a pressure relief valve, a discharge silencer, and associated temperature and pressure gauges. Each AAS run connected to the AAS system is equipped with a flow sensor which connects to a centralized flow meter capable of measuring flows to 50 cfm. Electronically, the AAS system will shut down in the event of a high temperature within the blower system, or if the SVE system is shut down.

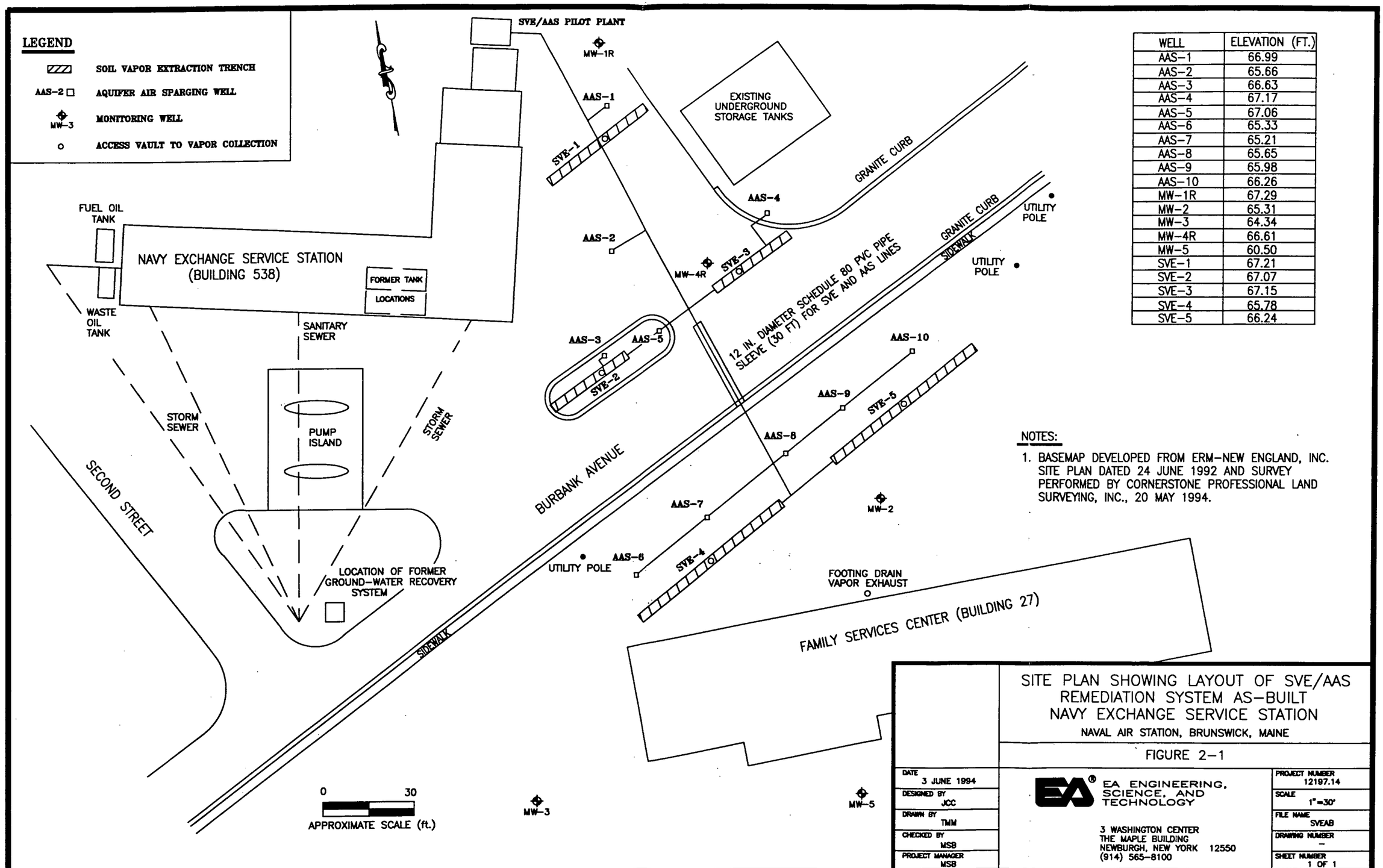
2.5 MANAGEMENT OF CONSTRUCTION DERIVED WASTE

Construction derived waste generated during the pilot plant installation included drill cuttings, equipment decontamination fluids, and well development fluids. Management of these wastes is discussed below.

Excess soil generated during the trenching of AAS air delivery lines, SVE trenches, and SVE return lines was field screened with a photoionization detector. Based on the low soil screening concentrations observed (<5 ppm), and the composition of the soil (sand), the soil was utilized as backfill within the trenches. Minimal excess soil was used locally as fill prior to resurfacing at the NEX service station during tank replacement activities.

Drill cuttings generated during the installation of AAS wells and replacement AAS wells and monitoring wells were containerized in 55-gal drums. The soil was then transferred to a landfarming staging area within Naval Air Station grounds under the direction of Naval Air Station Public Works. In total, 11 drums of soil were transferred to the landfarming area.

Wastewater was generated during the initial drilling and development program and subsequent purging (for ground-water sampling) of the AAS and ground-water monitoring wells. Decontamination water and rinsate was generated during the decontamination procedures utilized in the well installation and development process. Wastewaters, with the exception of development fluids, were collected in 55-gal drums, treated via granular activated carbon, and discharged to the storm sewer located along Burbank Avenue. Ground water extracted during the well development process was discharged adjacent to the developed wells and permitted to infiltrate due to the high silt content within the fluids.



WELL	ELEVATION (FT.)
AAS-1	66.99
AAS-2	65.66
AAS-3	66.63
AAS-4	67.17
AAS-5	67.06
AAS-6	65.33
AAS-7	65.21
AAS-8	65.65
AAS-9	65.98
AAS-10	66.26
MW-1R	67.29
MW-2	65.31
MW-3	64.34
MW-4R	66.61
MW-5	60.50
SVE-1	67.21
SVE-2	67.07
SVE-3	67.15
SVE-4	65.78
SVE-5	66.24

NOTES:

1. BASEMAP DEVELOPED FROM ERM-NEW ENGLAND, INC. SITE PLAN DATED 24 JUNE 1992 AND SURVEY PERFORMED BY CORNERSTONE PROFESSIONAL LAND SURVEYING, INC., 20 MAY 1994.

SITE PLAN SHOWING LAYOUT OF SVE/AAS REMEDIATION SYSTEM AS-BUILT
NAVY EXCHANGE SERVICE STATION
NAVAL AIR STATION, BRUNSWICK, MAINE

FIGURE 2-1

DATE	3 JUNE 1994
DESIGNED BY	JCC
DRAWN BY	TMM
CHECKED BY	MSB
PROJECT MANAGER	MSB

EA ENGINEERING, SCIENCE, AND TECHNOLOGY

3 WASHINGTON CENTER
THE MAPLE BUILDING
NEWBURGH, NEW YORK 12550
(914) 565-8100

PROJECT NUMBER	12197.14
SCALE	1"=30'
FILE NAME	SVEAB
DRAWING NUMBER	–
SHEET NUMBER	1 OF 1

3. PILOT TEST METHODOLOGY

This chapter describes the pilot test procedures employed at the NEX service station. The pilot study program for this project included the following operational activities: short-term SVE pilot testing to assess radius of influence and hydrocarbon removal; long-term SVE operations, including several weeks of SVE/AAS operations; soil sampling during SVE operations; ground-water sampling; well location and elevation surveying; and management of investigation-derived waste.

3.1 SHORT-TERM PILOT TEST METHODOLOGY

Prior to full-scale operations, short-term SVE pilot testing was conducted from 25 to 29 October 1993 to permit the assessment of SVE radial influence and optimal removal rates. AAS pilot testing was accomplished on 3-4 May 1994 after allowing the SVE system to operate for approximately 5.5 months and achieve asymptotic hydrocarbon removal rates. SVE pilot testing was conducted both as step tests and constant rate tests at trenches SVE-1 and SVE-4. Step tests were conducted to assess the optimal removal rate of SVE trenches. Constant rate tests were conducted to evaluate the effective radial influence of the system.

As discussed above, short-term pilot tests were conducted in two phases: step tests and constant rate tests. The first test, the step test, was conducted to assess vacuum response at varying flow rates and determine optimal flow rates from the subsurface to maximize hydrocarbon removal. The step test involved the application of varying head pressures to the extraction trench and observing flow rate and hydrocarbon recovery response.

Constant rate testing at involved the application of a constant vacuum to the subsurface for a period sufficient to recover a minimum of 1 pore volume from the projected radial influence of the vent. For this site, using an assumed radial influence of 35 ft required a minimum period of approximately 20 minutes of constant rate testing. During the test, the effect of the applied vacuum was measured at the adjacent vapor monitoring points via a series of Dwyer Magnehelic® differential pressure gauges capable of detecting vacuums from 0.05 to 15.0 in. H_2O. At SVE-1, the constant rate test was conducted at a flow rate of 110 cfm and a vacuum of 13 in. H_2O. At SVE-4, the constant rate test was conducted at a flow rate of 185 cfm and a vacuum of 10 in. H_2O.

During the tests, measurements of the operating parameters of the system were recorded. Flow rate through the SVE system was measured using a TSI Velocicalc Model 8355 air velocity/flow rate meter and in-line flow sensors connected to a Dwyer Magnehelic® Series 2000 differential pressure gauge calibrated for flow.

3.1.1 Monitoring Point Network Design

Monitoring/sampling accomplished during SVE and SVE/AAS pilot testing included soil vapor analysis, vadose zone vacuum and pressure monitoring, saturated zone pressure monitoring, gauging of depth to water, and measurements of water quality parameters. The network of monitoring/sampling locations is described below.

Prior to the start of full SVE and SVE/AAS operations, temporary monitoring probes were installed using portable drilling techniques and standard soil gas probes. The vapor probes, labeled VP-1 through VP-16, were installed to permit instantaneous monitoring of the vacuum or pressure exerted in the subsurface via venting and sparging, and to monitor hydrocarbon concentrations in the vadose zone during SVE. For AAS system start-up, vapor probes were set to two distinct depths to permit pressure monitoring in both the saturated and the unsaturated zones. Shallow vapor probe depths ranged from 3 to 5 ft below grade. The deeper vapor probes were set below the water table, typically to 10 ft below grade.

Constant rate testing was performed to evaluate the effective radius of influence of SVE-1 (representative of SVE within a paved area) using four vapor probes aligned symmetrically at distances of 15, 20, 25, and 35 ft, and additional points set at 40 and 70 ft. Initial constant rate pilot testing at SVE-4 (representative of SVE within a grassy area) was performed using nine vapor probes aligned at approximate distances of 5, 10, 15, 20, 25, 30, and 80 ft. Constant rate testing was performed to evaluate the effective radius of influence at AAS-1 using the four unsaturated zone vapor probes aligned symmetrically at distances of 15, 20, 25, and 35 ft; two additional vadose zone vapor probes at 20 and 45 ft; and two saturated zone vapor monitoring points set at 10 and 20 ft. Several ground-water monitoring wells were used as additional probes during pilot testing.

The tops of the vapor probes were fitted with hose barbs and connected to either Dwyer Magnehelic gauges for pressure monitoring or a Gast air pump to conduct vapor sampling. During AAS pilot testing, onsite monitoring wells MW-1 and MW-4 were outfitted with specially designed pressure-tight slip caps containing hose barb fittings to permit vacuum/pressure monitoring and vapor sampling.

3.1.2 Vapor Sampling and Analysis

During SVE pilot testing during the week of 25-29 October 1993, a mobile laboratory was placed onsite for analysis of soil vapor samples. The objective of soil vapor sampling was to assess the presence of total volatile hydrocarbons (TVH) in unsaturated soil in areas potentially influenced by the SVE system and to determine TVH removal rates during active SVE. Results of the soil vapor survey served to provide guidance in the selection of optimum SVE flow rates.

Prior to SVE pilot testing, syringe blanks, standards, and background vapor point samples were analyzed for quality control purposes. Soil vapor samples were collected in rapid succession prior to, during, and after each step of pilot testing. At a minimum, at least one soil vapor sample was collected during each SVE test step. In total, 28 soil vapor samples were analyzed during testing conducted at vent SVE-4 and 14 during testing conducted at vent SVE-1.

Soil vapor samples collected from the SVE system piping manifold were withdrawn from pre-installed septum ports by drawing vapor into gas-tight syringes. Soil vapor samples collected from the subsurface were obtained by driving a sampling probe to the desired depth using an electric rotary hammer. The probe consisted of 30-in. (length) × 0.625-in. outer diameter heavy-gauge stainless steel piping. The leading section of the probe was fitted with a threaded point followed by a 6-in. interval of vertically slotted tubing (slot size, 0.010 in.). Successive 30-in. probe sections were added using hollow-threaded adapters until the probe had been driven to the desired sampling depth. Upon seating of the final section of probe for a given location, care was taken to assure that an adequate gas seal existed at the ground surface to prevent "short-circuiting" of the sampling probe by ambient (surface) air.

Following installation, the probe assembly was fitted with a vacuum pump/vacuum gauge manifold. Vacuum was then applied to the probe assembly for 2-4 minutes while observations of the vacuum gauge performance were made to assure that a near steady-state condition had been attained. During vapor purging, soil resistance to gas flow, read as inches of Hg vacuum, was observed and recorded. During the purging process, field judgements as to the representativeness of a particular installation were made based on vacuum gauge observations. Significant variability in vacuum gauge readings (e.g., rapid vacuum loss or no significant gauge response) during purging attempts resulted in extended purging intervals (3-5 minutes).

Upon completion of the purging process, samples were collected by drawing soil vapor into gas-tight syringes. Samples were then transferred to EA's mobile laboratory for immediate field analysis. An HNu Model 421 programmable gas chromatograph, interfaced with a Shimadzu integrator, was used to analyze the soil vapor samples. The HNu is a programmable gas chromatograph equipped with a flame ionization detector. The flame ionization detector responds specifically to compounds that will yield a carbon skeleton, which can be oxidized when introduced into an air/hydrogen flame. Therefore, it is sensitive to all organic compounds except formaldehyde and formic acid.

Soil vapor samples tend to contain many compounds. When a sample is injected into the gas chromatograph, compounds are first separated by an appropriate analytical column. As the separated compounds elute from the gas chromatograph column, they enter the air/hydrogen flame where they become ionized. The resulting ions attach to an electrode, which increases the signal current. The signal is then amplified, integrated, and reported as a chromatographic peak. The flame ionization detector provided direct quantification of BTEX compounds. Unknown hydrocarbons eluting prior to benzene were semi-quantitatively

reported as "benzene equivalents" and unknown hydrocarbons eluting prior to xylenes were semi-quantitatively reported as "xylene equivalents." TVHs were reported as the sum of the BTEX results and the unknowns. Supporting data and chromatograms are presented in Appendix D.

The HNu system was calibrated by injecting known amounts of vapor standards onto each column in the gas chromatograph. The set of standards contained benzene, toluene, ethylbenzene, m- and p-xylenes, o-xylene, n-pentane, and iso-octane which was used to calibrate the flame ionization detector. Compound retention time and response data were stored in the integrator and subsequently used to make identification and to quantify unknowns in samples. Probe and sampler blanks were analyzed periodically to ensure that the system was free of contamination. Samples were also periodically analyzed in duplicate. These data, along with multiple standard runs, ensured that the analytical system was producing reliable values.

Soil vapor concentrations were calculated using the external standard method. The instrument was calibrated at the start of the day and after every fifth sample run. This method ensured control of potential detector sensitivity changes during the operational day. The following equation was used to calculate the soil gas concentrations:

$$C_i = CF_i * A_i * V_s / V_{std}$$

where

C_i = Vapor concentration of analyte of concern (ppm_v)
CF_i = Calibration factor for analyte of concern
A_i = Observed area of targeted analyte
V_s = Vapor volume of sample (ml)
V_{std} = Vapor volume of standard (ml).

CF_i is calculated by dividing the concentration of the target analyte in the calibration standard (ppm_v) by its observed peak area on the gas chromatogram.

3.1.2.1 Quality Assurance and Quality Control

In order to ensure the integrity and validity of all aspects of the field screening analysis and the data generated, a comprehensive quality control program was implemented during the soil vapor survey. Records for all calibration, operations, and maintenance operations on field instrumentation were documented on the soil gas survey data sheets. Detection limits for targeted compounds were also provided (typically less than 1 ppm_v). Prior to analysis, the soil gas survey instrumentation was calibrated via an external standard run. Replicate analysis was performed following every 20 successive samples to ensure result integrity.

Blanks were analyzed every eight operational hours to confirm system cleanliness. Sample tracking and custody protocols were observed at sample preparation areas where entry into the sample tracking logbook was accomplished per the system standard operating procedures.

3.1.2.2 Decontamination

Upon completion of soil vapor sampling at each soil vapor sampling point, the probe assemblies were decontaminated in the pre-designated area. Soil vapor sampling probes were dismantled and physically brushed to remove residual soil. The probes and sampling manifolds were then thoroughly decontaminated with Alconox® scrub and water rinse. The gas-tight syringe was purged with "zero air" (reagent grade air known to contain no organic compounds), then heated to drive off residual compounds following each injection into the gas chromatograph.

3.2 LONG-TERM PILOT TEST METHODOLOGY

Long-term SVE pilot system operations were conducted from 15 November 1993 to 22 June 1994. The objectives of long-term SVE pilot testing were to assess to overall effectiveness of the technology in reducing the concentrations of VOC within the unsaturated zone and the potential to achieve site clean-up goals for soil as established by MEDEP. To achieve the stated objectives, the SVE pilot plant was operated continuously from 15 November 1993 to 22 June 1994. The pilot study conducted at the NEX service station continued for a period of seven months. Initially, the SVE system was operated for a period of 5.5 months prior to simultaneous operation with the AAS system. SVE-only operations served to reduce TVH concentrations in soil vapor and allow for the potential development of a concentration gradient during active AAS. Several periods of down-time were observed. During 26-29 November 1993, the SVE pilot plant was deactivated to permit tank tightness testing at the newly installed USTs. The SVE/AAS pilot plant was shut down on 3 June 1994 due to a base-wide power failure. Section 3.2.2 provides a discussion of the routine monitoring, maintenance, and sampling tasks conducted during pilot plant operations.

3.2.1 Soil Vapor Extraction/Aquifer Air Sparging Pilot Testing Methodology

Combined SVE/AAS pilot system operations commenced 3 May 1994, and continued until 8 June 1994. The objectives of combined SVE/AAS pilot plant testing were to assess to overall effectiveness of the air sparging in removing dissolved-phase hydrocarbons from the shallow saturated zone and the potential to achieve site clean-up goals for ground water as established by MEDEP. Pilot test methodology is discussed below. Section 3.2.2 provides a discussion of the routine monitoring, maintenance, and sampling tasks conducted during pilot plant operations.

Prior to the start of AAS pilot testing, depth to ground water and water quality parameter measurements were taken across the site to establish baseline conditions and ensure that light, non-aqueous phase liquid (LNAPL) was not present. Based on depth to ground-water data

obtained during well gauging, and because vent trench SVE-5 was not operational due to the high water table in that area, only the sparge wells located north of Burbank Avenue could be activated, excluding well AAS-4, which requires concurrent operation of vent trench SVE-5.

Calculations were made in the field to determine the pressure, in pounds psi, required to overcome the static water head pressure at sparge wells AAS-1, AAS-2, AAS-3, and AAS-5, and provide an adequate rate of air delivery to the surrounding water table aquifer. Based on the presence of 9.4 ft, 5.45 ft, 6.5 ft, and 0.32 ft of standing water in sparge wells AAS-1, AAS-2, and AAS-3, and AAS-5, respectively, minimum sparge pressures of 4.1 psi, 2.4 psi, 2.8 psi, and 0.14 psi, respectively, were required to overcome hydrostatic pressure.

Prior to activation of the 4 sparge wells, a short duration pilot test was performed at well AAS-1 as a check on system performance. A positive pressure was applied by the AAS system to sparge well AAS-1 and maintained for a period of 2 hours prior to activation of AAS-2 and subsequently AAS-3 and AAS-5. The 2-hour time period of AAS-1 operations was employed in an effort to obtain consistent pressure readings and vapor concentrations. The effect of the applied sparge pressure was measured at adjacent monitoring wells and vapor points via standard magnehelic gauges capable of detecting pressure differentials ranging from 0.005 to 100.0 in. of water (in. H_2O). Measurements of flow (in scfm) were recorded directly from the in-line Dwyer flow meters.

During the tests, measurements of the operating parameters of the system were recorded at frequent intervals. The results of the AAS pilot tests are presented in the next section of this report. Depth to water, pH, and dissolved oxygen measurements were recorded at the rate of at least two rounds of data during the first two days of the test. To accomplish water level gauging and determine the absence/presence of LNAPL, an Oil Recovery Systems, Inc. oil/water interface probe was used. To obtain dissolved oxygen measurements, a Hydrolab Model H2OG water quality data meter was used. Each instrument was calibrated and decontaminated according to the manufacturer's specifications.

The SVE system was concurrently operated during the AAS tests to ensure the retrieval of hydrocarbon-laden air released into the vadose zone by the sparging process. The SVE system removal rate was maintained at a flow rate at least twice the rate (in cfm) of ambient air sparged into the saturated zone. On occasion, an SVE influent sample was taken as a gauge of combined SVE/AAS hydrocarbon removal rates.

3.3 MONITORING AND SAMPLING ACTIVITIES

Monitoring and sampling activities were performed routinely throughout the performance of the pilot study to assess the influence of the pilot remediation system on subsurface soil and ground water. Pilot plant operations were also routinely monitored to provide information

related to the impact of changes in flows, pressures, etc. on system performance. The methodologies used to conduct the monitoring and sampling activities are described below. The field monitoring logs completed during the pilot test are provided in Appendix E.

3.3.1 Ground-Water Sampling and Analysis

Ground-water sampling at the site monitoring wells was conducted on three separate occasions. The first round, conducted 13 July 1993, was accomplished prior to pilot testing to obtain background ground-water quality. The second round, conducted 12-13 April 1994, was completed after approximately 5 months of SVE. The third round, conducted 7-8 July 1994, was performed to assess ground-water quality at the site following the SVE/AAS pilot test.

Prior to sampling, wells were gauged using an Oil Recovery Systems, Inc. oil/water interface probe to determine depth to LNAPL (if present), depth to water, and depth to well bottom. The Oil Recovery Systems, Inc. interface probe contains a graduated tape and probe capable of distinguishing between LNAPL and water to an accuracy of 0.01 ft. Based on well gauging results for all rounds, site wells were not observed to contain LNAPL and, therefore, ground-water sampling was conducted at all site wells. Sampling was conducted by a qualified geologist familiar with accepted methods for the extraction of ground-water samples. In accordance with the Work Plan (EA 1993), purging and sampling of each well was performed a minimum of 14 days after completion of well development.

Each well sampled was purged using a new, dedicated 1.5-in. × 3-ft (length) polypropylene disposable bailer and nylon sample cord. Either a minimum of 5 well volumes was removed during the purging process or the well was purged dry a minimum of twice prior to obtaining samples. Static water levels were recorded both prior to and after purging to ensure that sufficient recharge had occurred prior to sampling. Ground-water samples were collected and stored in sample containers, with collection sequence governed by order of volatility. Samples were appropriately preserved, labeled, and retained in temperature controlled coolers. Appendix F provides the Field Record of Well Gauging, Purging, and Sampling forms completed for each of the sampling events.

Ground-water samples collected on 13 July 1993 were shipped to IEA, Inc. of North Billerica, Massachusetts. Ground-water samples collected on 12-13 April 1994 and 7-8 July 1994 were shipped to EA Laboratories of Sparks, Maryland. All samples were analyzed for BTEX and MTBE by EPA Methods 602/8020, total petroleum hydrocarbons (TPH) as gasoline by MEDEP laboratory operating procedure 4.2.1, and TPH as fuel oil by MEDEP laboratory operating procedure 4.1.1. Ground-water samples from the 13 July 1993 sampling event were further analyzed for total iron and total manganese by inductively coupled plasma Method 200.7. A quality assurance duplicate ground-water sample was collected from well MW-04 during the 12-13 April 1994 sampling event and analyzed for the same parameters as the original sample. To document the cleanliness of the disposable bailers, rinsate blank samples were collected during all sample rounds by running de-ionized

water through a new, dedicated disposable bailer and into the appropriate sample containers and analyzing for the full volatile analysis list. As a check of the sample shipment process, a trip blank was sent with each sample cooler and analyzed for BTEX and MTBE by EPA Method 602. The results these analyses are discussed in Chapter 4.

3.3.2 Water Level Measurements

Depth to ground water and LNAPL (if present) data were collected from each of the site monitoring wells and AAS wells at least monthly throughout the duration of the pilot test. The purpose of obtaining water level readings is to monitor water table fluctuations (i.e., seasonal) over time and to track the influence of the SVE/AAS remediation system on the shallow water table. Water level readings, in addition to LNAPL (if any), were obtained at monitoring wells and sparge wells using an Oil Recovery Systems, Inc. oil/water interface probe graduated at 0.01-ft intervals. The probe and graduated tape were decontaminated between measurements according to the protocol described in Section 3.4.

3.3.3 Dissolved Oxygen Measurements

Dissolved oxygen measurements were obtained on a routine basis during SVE/AAS operations to assess the lateral influence of the air sparging wells. Dissolved oxygen measurements were obtained at ground-water monitoring wells and air sparging wells. A Hydrolab® H20G multiparameter water quality data transmitter, or a YSI® Model 57 Dissolved Oxygen Meter, were used to obtain the readings. When employing the Hydrolab Model H20G, the dissolved oxygen probe was lowered into the well, permitted to stabilize, and the measurement recorded. When using the YSI Model 57, the dissolved oxygen probe was lowered into the well and manual stirring performed by raising and lowering the probe about 1 ft per second. After allowing sufficient time for the probe to stabilize (approximately 1 minute), the dissolved oxygen reading was taken. All equipment was calibrated and operated in accordance with manufacturer's instructions. The probe and graduated tape were decontaminated between measurements according to the manufacturer's protocol.

3.3.4 Temperature, Conductivity, and pH Measurements

Ground-water quality parameters, including temperature, conductivity, and pH, were recorded on a routine basis during SVE/AAS pilot plant operations to assess the effects of AAS on the shallow water table aquifer. These parameters were also monitored during ground-water sampling events. During AAS, the carbon dioxide and oxygen content of air may affect the ground-water chemistry. Temperature, pH, and conductivity were recorded with the Hydrolab® H20G multi-parameter water quality data transmitter. The instrument probe was inserted into the water bearing zone of the well and readings taken either directly or stored in a datalogger. The instrument was calibrated on a daily basis and operated in accordance with manufacturer's specifications. The probe and lead wire were decontaminated between measurements according to the protocol outlined in Section 3.4.

3.3.5 Soil Vapor Velocity, Flow Rate, and Temperature Measurements

Soil vapor flow velocity and temperature readings were collected and utilized to calculate the flow rate, in actual cubic feet per minute, at the SVE trenches and SVE extraction composite. During initial SVE and SVE/AAS start-up activities, these measurements were taken at frequent intervals to permit fine-tuning of the SVE/AAS pilot plant. At a minimum, these measurements were obtained bi-weekly to ensure that desired flow rates were achieved. The flow rate was then used to calculate the quantity of TVH removed.

Air velocity was measured by inserting the probe of the TSI Velocicalc Model 8355 air velocity/flow rate meter to the midpoint of the piping at the monitoring point. The air velocity is then recorded in feet per minute. The soil vapor temperature will then be obtained by switching the meter function to the temperature mode and recording that value, in degrees Fahrenheit. Flow rate was then calculated by multiplying the square footage of the pipe opening by the air velocity (ft/min) to obtain ft^3/min. SVE flow rate and AAS injection rates were also recorded using Dwyer Magnehelic or Capsuhelic differential pressure gauges calibrated for flow through 4-in. (SVE) and 2-in. (AAS) pipe.

3.3.6 Ambient Air Temperature Measurements

Ambient air temperature, which may influence SVE/AAS performance, was recorded at the start of field activities and throughout the duration of the pilot test. Ambient temperature was recorded from a weatherproof mercury thermometer.

3.3.7 Vacuum/Pressure Measurements

Vacuum/pressure response was recorded to determine the lateral influence of vapor extraction trenches and AAS wells. During system start-up activities, vacuum/pressure readings were obtained at frequent intervals on a daily basis until desired flow rates and lateral influences were achieved. During the remainder of the field demonstration, vacuum and pressure readings were recorded from the SVE trench and AAS well heads a minimum of twice per month. Standard Magnehelic gauges were used to collect vacuum/pressure influence data, in inches of H_2O. The gauges in service provided the following ranges (inches of H_2O): 0-0.25, 0-1.0, 1-5, 1-10, and 1-100.

3.3.8 Volatile Organic Compound Measurements

Total VOC concentrations were measured in soil vapor samples collected from the individual SVE trenches, SVE composite, and after carbon vessel treatment at frequent intervals during initial SVE and SVE/AAS pilot plant operations and at least twice per month thereafter (except January 1994) to provide raw data on system performance. VOC measurements were also collected at monitoring wells and soil vapor monitoring points during AAS start-up operations to assess the approximate radial influence of the AAS system. VOC measurements were taken by inserting the tip of the HNu Systems, Inc.™ Model PI101 or Microtip

Model HS-2000 PhotoVac photoionization detector into the port of the 1-liter Tedlar sample bag after purging soil vapor from the monitoring point directly into the Tedlar bag with a Gast® hi-volume vacuum pump. The photoionization detector reading was allowed to stabilize, then the highest reading recorded. Prior to use, and at a minimum frequency of daily, the photoionization detector was calibrated with a 100 parts per million isobutylene-in-air commercial gas standard, and used in accordance with the manufacturer's instructions.

Vapor samples were collected at the SVE system manifold and SVE process stream influent and effluent ports. All samples were collected according to the following procedures:

- Install a vapor sampling train consisting of a T-fitting equipped with a ball valve and a fill valve, an air sample pump, and an in-line vacuum vapor trap for connecting the gas sampler.
- Close the ball valve on the sampling train.
- Attach an unused piece of Tygon tubing to the hose bard and to the fill valve on a new, dedicated 1-liter Tedlar air sample bag.
- Close the fill valve on the air sample bag.
- Purge clean air from the sample train and the vapor sampling point by opening the ball valve on the train and allowing air to pass through the sample tube and out the bypass valve.
- After the purge is complete, open the fill valve on the air sample bag, and allow the sample bag to fill. Once the bag has been inflated to approximately two-thirds of its full capacity (e.g., fully inflated), close the fill valve and the ball valve, and remove the tubing from the fill valve.
- While keeping the sample bag under pressure, open the fill valve and deflate the sample bag.
- Reconnect the fill valve to the teflon tubing.
- Allow the bag to fill twice, deflating the bag after each fill to purge the sample bag.
- After repeating the sample purge procedure, fill the bag once again to collect the sample, making sure the fill valve is securely closed once the bag is filled.

- After removing the tubing from the fill valve, tighten the locking nut on the fill valve so the valve cannot be inadvertently opened.

- Store the bag samples in a cool area and out of direct sunlight until ready to obtain the photoionization detector measurement.

3.4 EQUIPMENT DECONTAMINATION

Field personnel decontaminated monitoring/sampling equipment in between stations, after each measurement/sample was taken, and at the conclusion of daily activities to ensure cross-contamination between stations did not occur, and to eliminate the possibility of contaminants being carried offsite. Equipment cleaning was undertaken in a manner that minimized contamination of monitoring/sampling sites, boreholes, and monitoring wells. All VOC-based washwaters and waste products generated during cleaning operations were cycled through granular activated carbon prior to discharge into the storm sewer.

All soil vapor and ground-water monitoring/sampling equipment was brushed with a wire brush to remove soil particles. Samplers which were in contact with LNAPL were wiped with absorbent cloth and then with reagent-grade methanol. Equipment that did not come in contact with LNAPL was wiped with a dry cloth. All equipment was then washed in accordance with the rinse sequence described in detail below.

3.4.1 Decontamination of Sample Collection Equipment

The procedure for cleaning non-disposable sample collection equipment was as follows:

- Washed with warm potable water and laboratory-grade detergent (e.g., Alconox®)

- Rinsed with de-ionized water

- Rinsed with methanol

- Rinsed with de-ionized water

- Allowed to air dry

- Wrapped sampling equipment in aluminum foil or plastic, as appropriate

- Placed in sealed plastic bag.

3.4.2 Decontamination of Field Measuring Equipment

The procedure for cleaning field measuring equipment was as follows:

- Washed with potable water (from an approved source) and laboratory-grade detergent (e.g., Alconox®)
- Rinsed with de-ionized water
- Rinsed with methanol
- Rinsed with de-ionized water
- Allowed to air dry.

Modifications to the above were required for some field instruments, such as the Hydrolab, which contains sensitive probes. In such instances, the procedures outlined in the vendors' equipment operations manuals were followed.

3.5 LOCATION SURVEY

On 10 May 1994, representatives of the surveying firm Cornerstone Professional Land Surveying, Inc. of Bowdoinham, Maine, under contract with EA, conducted elevation and location surveying of the wells and site features at the NEX service station site. The services for the survey included the establishment of horizontal and vertical control at pertinent site features. Horizontal control was tied to the Maine State Plane Grid Coordinate System according to North American Data of 1927, while vertical control was referenced to National Geodetic Vertical Datum. Monitoring wells, soil boring locations, buildings, underground tanks and equipment, fuel dispensing islands, roads, curbing, paved areas, and other pertinent site features were located utilizing conventional surveying techniques. At monitoring well locations, ground and PVC riser pipe elevations were surveyed. A site survey map plotting locations of structures and improvements, soil borings, monitoring wells, and soil vapor points was developed using AutoCAD Version 12.0.

3.6 MANAGEMENT OF PILOT TEST DERIVED WASTE

Wastes generated during the performance of the pilot study include well purging fluids, SVE condensate fluids, and spent vapor-phase activated carbon vessels. Management of these wastes is discussed below.

Purge water was generated during ground-water sampling at the ground-water monitoring wells. Moisture condensed from soil vapor extracted during SVE operations was also collected (less than 20 gal). No decontamination fluids were generated during ground-water

sampling as dedicated, disposable bailers were used. Wastewaters were collected in a 55-gal drum, treated via granular activated carbon, and discharged to the storm sewer located along Burbank Avenue.

As the SVE system was expected to remove soil vapor containing elevated concentrations of TVH, MEDEP required an air pollution abatement system be used due to the potential for SVE emissions to exceed 10 lb/hour TVH and 100 lb/day TVH. Though the SVE/AAS pilot test did not require an air discharge permit, appropriate measures were expected to be taken to ensure meeting the above emissions requirements. The soil vapor retrieved by the SVE system was, therefore, directed through an 1,800-lb vapor-phase granular activated carbon vessel prior to atmospheric discharge, ensuring the removal of TVH to below MEDEP discharge limits.

During the pilot test, two 1,800-lb granular activated carbon vessels were used to remove TVH from the SVE air stream prior to atmospheric discharge. When the effectiveness of the carbon vessels were determined to be limited due to hydrocarbon loading, the vessels were returned to the vendor and the carbon regenerated for re-use. The first carbon vessel was installed in October 1993, prior to the start of pilot test activities. Carbon vessel replacement occurred on 22 March 1994. The second carbon vessel was removed from the site on 15 July 1994.

4. PILOT TEST RESULTS

4.1 SITE HYDROGEOLOGY

4.1.1 Surficial Soil

Shallow site stratigraphy was evaluated based on data obtained during the drilling and trenching programs conducted as part of the pilot test, as well as geologic data from previous studies. The data was used to develop geologic cross-sections oriented north-south and west-east across the site. The locations of the transect lines for the cross-sections is shown on Figure 4-1. Figures 4-2 and 4-3 present the interpreted geologic cross-sections for transect lines A-A' and B-B'.

The site-specific shallow overburden consists of a fine to medium sand with varying amounts of silt. Beneath the NEX service station, the fine to medium sand contains a only trace amount of silt. However, to the southeast toward the Family Services Center (the grassed area), the silt content increases such that the unconsolidated soil may be referred to as a sandy loam. The surficial layer of sandy loam ranges in thickness from 0 to 7 ft. Underlying the sandy loam and the fine to medium sand at depths ranging from less than 4 ft (MW-5) to greater than 21 ft (MW-1R) is a soft, gray silty marine clay. A sandy clay with silt sub-unit was also encountered at several locations overlying the marine clay.

The soft, gray marine clay underlying the fine to medium sands and sandy loam is reported to extend to a depth of 93.5 ft, based on a geotechnical boring installed behind the NEX service station in 1974 (ERM 1992). Reportedly underlying the marine clay is 2 ft of coarse sand and gravel, followed by bedrock at approximately 95.5 ft below grade. A geotechnical report prepared for a site located less than 1,500 ft northwest of the NEX service station reports the marine clay sequence to range in thickness from 32.5 ft to 53.5 ft (Haley & Aldrich, Inc. 1992). Based on the extensive thickness of the clay sub-unit, it is likely that the deposit acts as an aquitard, inhibiting the vertical movement of ground water (hydraulic communication) between the surficial water table aquifer and potential deep aquifers.

The interpreted soils profile as viewed from north to south across the NEX service station, Burbank Avenue, and the grassed area in the vicinity of the Family Services Center, shows the fine to medium sands to decrease in thickness. An apparent rise in the marine clay may provide seasonal hydraulic separation of the surficial water table aquifer, as shown in Figure 4-2.

Review of the west to east soil profile south of Burbank Avenue shows the depth to marine clay to occur at much shallower depths (approximately 7-14 ft below land surface). Similar to the north-south soil profile, during seasonally low water table periods, the presence of the

marine clay at shallow depths may serve as an apparent hydraulic barrier, thus diverting the direction of ground-water flow (Figure 4-3). Incomplete hydrogeologic data currently exists to fully assess ground-water movement southeast of the existing tank field.

4.1.2 Ground-Water Occurrence

Well gauging was accomplished during each site visit to assess depth to ground water and confirm the absence or presence of LNAPL. Results of the gauging conducted from 13 July 1993 to 8 July 1994 are provided in Appendix G. In total, well gauging was accomplished 34 times throughout the approximate 1-year period.

Depth to ground water at the site ranges from 1.10 (Well MW-5) to 8.15 ft (sparge well AAS-1) below top of well casing. Depth to ground water was observed to fluctuate an average of 1.5 ft due to seasonal influences, with variations of up to 2.4 ft observed at well MW-5.

Movement of the shallow water table across the subject site is to the south-southwest at a shallow gradient, with a slight increase in hydraulic gradient observed south of Burbank Avenue. Figures 4-4 through 4-6 provide interpreted water table elevations prior to SVE, prior to SVE/AAS, and following pilot testing, respectively (corresponding to the three rounds of ground-water sampling conducted). As shown on the figures, the relative elevation and ground-water flow direction has remained consistent throughout the study period.

During the extended well gauging period, LNAPL was not consistently observed at any of the 15 monitoring locations. Measurable LNAPL thicknesses were recorded at one well location during the performance of the pilot study, at thicknesses ranging from 0.01 to 0.20 ft (sparge well AAS-7). Sparge well AAS-7 was found to contain approximately 0.20 ft of product on 26 October 1993. After bailing, the LNAPL thickness was reported at 0.01 ft on 28 October 1993. LNAPL was not detected in the well again until 0.01 ft was reported on 7 June 1994. The screened interval of sparge well AAS-7 is located below the top of the water table, which may inhibit the influx of LNAPL into the well. On one occasion, a film of LNAPL (<0.01 ft) was reported at sparge well AAS-5 (7 June 1994). A spotty hydrocarbon sheen of LNAPL was observed during several gauging events at monitoring well MW-4R and sparge wells AAS-3 and AAS-4.

4.2 SHORT-TERM PILOT TEST RESULTS

4.2.1 Introduction

On 27-28 October 1993, SVE pilot tests were conducted on vent trenches SVE-4 (60-ft length) and SVE-1 (40-ft length). The objective of the tests was to assess SVE radius of influence and optimal flow rates within asphalt-covered and grassed areas. The vent tests involved applying a vacuum to the vent pipe, causing a lower piezometric head within the voids in the soil near the piping. This resulted in air movement through the interstices of the

affected vadose zone. The test results were used to calculate soil permeability to air, interpreted effective radius of influence, and TVH removal rates in soil vapor. Using these results, long-term SVE operational parameters were established.

Short-term SVE tests were conducted in two steps. The first step, a step test, was performed to determine well head vacuum at different blower flow rates and provides information necessary for the design and operation of the SVE system. The second test, the constant rate test, was used to evaluate the radius of SVE influence from the test point. Soil permeability to air was also assessed using the constant rate test data.

The step test performed at SVE-4 was conducted at flow rates of 185, 275, and 319 cfm. Seven vacuum monitoring points (VP-1, VP-2, and VP-5 through VP-9) were used during tests at SVE-4. The step test at SVE-1 was conducted at flow rates of 88, 110, and 138 cfm. Nine vacuum monitoring points (VP-9 through VP-16, and SVE-3) were used during the test. Figure 4-7 shows the locations of the vacuum monitoring points in relation to the vent trenches.

Soil vapor removal rates are a function of blower capacity, tightness of soil (soil permeability to air), and size of zone being vented, and are required to determine mass loading of TVH to the atmosphere. Field data sheets completed during testing are provided in Appendix E.

4.2.2 Radius of Influence

Table 4-1 summarizes the results of the differential pressure monitoring conducted during testing at SVE-4. Differential pressure measurements recorded during Test Step 4 (same settings as Test Step 1) were used to assess radial influence based on TVH concentrations and flow response. During the test step, differential pressures ranged from 0.0 in. H_2O at distances of approximately 37 and 46 ft to 0.46 in. H_2O at a distance of approximately 10 ft from SVE-4. A differential pressure of 0.33 in. H_2O was measured at a distance of approximately 21 ft from SVE-4.

Table 4-2 summarizes the results of the differential pressure monitoring conducted during testing at SVE-1. Nine vacuum monitoring points (VP-9 through VP-16, and SVE-3) were used during the test. Differential pressure measurements recorded during Test Step 1 were used to assess radial influence based on TVH concentrations and flow response. During the test step, differential pressures ranged from 0.0 in. H_2O at a distance of approximately 25 ft to 3.80 in. H_2O at a distance of approximately 15 ft from SVE-1. A differential pressure of 0.73 in. H_2O was measured at greater than 40 ft from SVE-1.

Differential pressure gauge readings for the constant rates tests were linearly regressed against horizontal distance from the vent trench using a relationship of the form:

$$\log dP = a + bX$$

where

dP = Pressure differential (vacuum), inches water
a = y intercept at X = 0
b = Slope of the regression line
X = Distance of monitoring point from well, feet.

Vacuum readings at the vent trench manifold were used in the regression analysis because they were determined to be representative of conditions in the surrounding soil. The zone of effective SVE influence was operationally defined to be that area within a pressure differential of 0.25 in. H_2O. Data from up to three monitoring points were excluded from each regression analysis due to the inability to monitor the location or slow/delayed gauge response. Regression analysis data and graphs are provided in Appendix H.

The 0.25 in. H_2O differential pressure guideline and the previously described linear model were used to calculate SVE radius of influence at SVE-1, located within the paved lot at the NEX service station. Radius of influence from vent trench SVE-1 was calculated at 49 ft for Test Step 1 (110 cfm at 13 in. H_2O). As the remaining step tests approximated durations of 60 minutes, radial of influence was likewise calculated for these steps. At a blower setting of 138 cfm and 15 in. H_2O vacuum (Test Step 2), the interpreted SVE radial influence was calculated at 54 ft. For Test Steps 3 and 4, flow rates of 88 cfm at 10 in. H_2O, and 80 cfm at 8 in. and H_2O, the interpreted SVE radial influence was calculated at 42 ft. The results demonstrate an increasing radial influence with applied vacuum. Figure 4-7 shows the interpreted radius of influence for vent trench SVE-1.

For tests conducted at trench SVE-4, the effective SVE radial influence was much lower than that of SVE-1, primarily due to its location within a grassy area. The interpreted radius of influence during Test Steps 1 and 4 (185 cfm at 10 in. H_2O) was calculated at 16 ft. As the remaining step test time frames exceeded 30 minutes, radial influence was likewise calculated for these test steps. For Test Step 2, (319 cfm at 16 in. H_2O), the interpreted SVE radius of influence was calculated at 17 ft. The interpreted SVE radius of influence for Test Step 3 (275 cfm at 14 in. H_2O) was calculated at 18 ft. The results show a negligible increase in radial influence with increased vacuum or flow, presumably related to short-circuiting of ambient air through the grassed surface. Figure 4-7 shows the interpreted radius of influence for vent trench SVE-4.

4.2.3 Soil Permeability

Soil permeability was calculated using the following equation (Johnson et al. 1988):

$$K = (Qu/H\pi P_w) \ln(R_W/R_I) \; / \; [1 - (P_{atm}/P_W)^2]$$

where

K_a = Soil permeability to air (cm^2)
Q = Flow in cm^3/sec
u = Viscosity of air = 0.018 cp
R_W = Radius of vent well (cm)
R_I = Distance R from vent well (cm)
H = Effective well screen (cm)
P_W = Vent well head pressure (absolute, atm)
P_M = Pressure at monitoring point R_I (absolute, atm).

Using the data obtained during the SVE pilot tests, soil permeability at the project site during short-term SVE pilot testing at SVE-1 was calculated at 15.20 darcy, or 1.5×10^{-7} cm^2. Soil permeability to air in the vicinity of SVE-4 was calculated at 12.32 darcy, or 1.2×10^{-7} cm^2 based on short-term testing (Appendix H). These results are consistent with reported permeability values for silty to clean sands (Freeze and Cherry 1979) and sandy soils (Johnson et al. 1988).

4.2.4 Hydrocarbon Removal Rates

Soil vapor samples were collected before and after the exhaust gas treatment during the short-term pilot tests. Samples of pre-treatment (influent) vapor were obtained at the positive pressure side of the system, and the post-treatment (effluent) samples were taken in the exhaust stack of the system. All samples were collected while the system was operating by inserting a gas-tight syringe through a septum port in the equipment piping. Soil vapor samples were analyzed onsite employing the methodology described in Section 3.1.2 for analyzing soil vapor samples.

Analyte concentrations for soil vapor extracted during the vent test are presented in Tables 4-3 through 4-5. Prior to the start of the tests, soil vapor samples were collected from monitoring points adjacent to SVE-4 and SVE-1, and from each SVE line, to assess the concentrations of TVH which may potentially be removed by SVE (see vapor point data in Tables 4-3 through 4-5). TVH concentrations in the SVE lines ranged from 0.9 ppm_v (SVE-5) to 570 ppm_v (SVE-3). TVH concentrations in soil vapor samples ranged from <0.1 ppm_v (multiple locations) to 83,000 ppm_v (VP-7). The two concentrations observed greater than 100 ppm_v were reported in samples taken hydraulically downgradient of the tank field.

During pilot testing at SVE-4, TVH concentrations in the soil vapor removed increased significantly as a result of SVE (Table 4-4). Concentrations of TVH varied significantly during the performance of the step tests. During Step Test 1, the average TVH concentrations was approximately 551 ppm_v. As vacuum and flow rate were increased at SVE-4, the average TVH concentrations decreased to 335 ppm_v and then 33 ppm_v, during Test Steps 2 and 3, respectively. The analysis of vapor samples confirmed that an increase in vacuum and flow rate would reduce SVE efficiency within the grassed area (e.g., SVE-4 and SVE-5).

Analysis of soil vapor samples collected during pilot testing at SVE-1 confirmed significant increases in TVH concentrations as a result of active SVE. Varying vacuum and flow rate during the pilot test suggested moderate variability in TVH removal (Table 4-5). TVH concentrations in the vapor samples were reported to range between 1,300 ppm_v (Test Step 2) and 3,500 ppm_v (Test Step 3), with the lower concentrations reported during periods of higher flow rate and vacuum. The results show no loss in removal efficiency due to short-circuiting at surface grade (paved surface). These results were utilized to establish operating parameters at SVE-2 and SVE-3, both located primarily within paved areas.

To ensure adequate removal of TVH from the extracted soil vapor, samples taken following treatment by granular activated carbon were also analyzed. The results show TVH concentrations ranging from 0.2 ppm_v (0.02 lb/day) to 4.3 ppm_v (0.21 lb/day), indicating compliance with MEDEP discharge criteria for TVH.

4.3 LONG-TERM PILOT TEST RESULTS

Following the completion of the short-term pilot tests, minor system adjustments were made to obtained the desired flow rates and vacuums in both the paved and grassed areas. Long-term pilot test activities commenced 15 November 1993 with the operation of the SVE pilot plant. SVE pilot plant operations were performed according to the following site visit schedule: twice per week from 15 November through December 17 1993, weekly from 18 to 31 December 1993, monthly during 1 January through 15 March 1994, and twice per month from 16 March through 2 May 1994. Site visits during SVE/AAS pilot plant operations were made weekly from 3 May to 8 June 1994, at which time SVE-only operations were again continued until 22 June 1994. A summary of the daily TVH removal rates for individual SVE trenches, and the SVE composite, calculated for each site visit is provided in Table 4-6. Table 4-7 provides a summary of the field monitoring conducted at site monitoring and sparge wells throughout the duration of the pilot tests. Field monitoring logs are provided in Appendix E.

4.3.1 Cumulative Hydrocarbon Removal

Long-term SVE and SVE/AAS pilot plant operations were monitored to assess the cumulative total of TVH removed from the subsurface. Analysis of soil vapor samples were completed with field-calibrated photoionization detectors. Daily TVH removal rates calculated for individual SVE trenches and the SVE composite are provided in Table 4-6. Appendix I provides the cumulative hydrocarbon removal calculations for both the SVE and SVE/AAS phases of the pilot study. Based on the monitoring data and formula assumptions discussed in Appendix I, in total, 888.5 lb of hydrocarbons were removed from the subsurface during the long-term pilot test, including over 65 lb of hydrocarbons removed from the saturated zone during AAS (Figure 4-8).

SVE composite removal rates were calculated based on the summation of the flow rates from individual trenches and the composite TVH concentration from the SVE manifold. The initial TVH removal rate upon system activation (15 November 1993) was calculated at 78.3 lb/day. TVH removal rates on 16 November 1993 from the SVE trenches ranged from 0.24 lb/day at SVE-5 to 6.48 lb/day at SVE-2 (Table 4-6). Hydrocarbon removal rates decreased to 18.3 lb/day by 19 November 1993 and to 9.5 lb/day by 7 December 1993. From the period of 10 December 1993 through 16 February 1994, TVH removal rates decreased from 7.5 lb/day to 1.9 lb/day.

Based on the questionable flow rates and elevated vacuum measurements obtained during system monitoring during the SVE pilot plant operational period from 17 February to 19 April 1994, TVH removal was considered to be negligible. Primary factors in the SVE system down time included increased water table elevation, which introduced water into the screened intervals of several SVE trenches, and extensive frost. Continued efforts to remove water from the piping systems during this period were successfully conducted when the frost had dissipated, snow had melted, and water table elevations had decreased.

SVE pilot plant operations were effectively restarted on 20 April 1994. SVE-5 had to remain deactivated as water was still in the return line due to the shallow depth to water in that vicinity. Upon reactivation, the TVH removal rate was calculated at 0.9 lb/day, approximately the same rate observed prior to experiencing weather-related down time. SVE pilot plant operations continued until 2 May 1994, at which time it was determined that the AAS system could be operated.

Combined SVE/AAS pilot plant operations were run from 3 May to 7 June 1994. During this period, 4 of 10 AAS wells were actively sparged. Concurrent operation of the SVE and AAS pilot plant systems resulted in an immediate increase in the TVH removal rate from 1.9 lb/day (3 May 1994) to 16.3 lb/day (4 May 1994), of which 14.4 lb/day was attributed to AAS. Net TVH daily removal rates via AAS were calculated by subtracting the asymptotic SVE baseline removal rate from the SVE/AAS removal rate.

As was the case during extended SVE operations, hydrocarbon removal rates decreased through time. Following one week of SVE/AAS, TVH removal rates were calculated at 3.9 lb/day, of which 2.9 lb/day was attributed to AAS. Following 2 weeks of SVE/AAS, TVH removal rates were calculated at 1.6 lb/day, of which 0.7 lb/day was attributed to AAS. Just prior to deactivation of the AAS system, TVH removal rates attributed to AAS were calculated at 1.1 lb/day. In total, 65.4 lb of TVH was calculated as being removed from the shallow water table as a result of AAS pilot plant operations (Appendix I).

To ensure adequate removal of TVH from the extracted soil vapor, samples taken following treatment by granular activated carbon were also analyzed. The reported maximum TVH concentration was 86 ppm_v (14 lb/day), which occurred during the initial SVE pilot plant start-up in November 1993. At no time during the pilot test were MEDEP air discharge criteria for TVH exceeded.

4.3.2 Air Sparging Operational Results

Air sparging operations commenced on 3 May 1994. Operational results are provided in Appendix E. TVH removal rates calculated for individual SVE trenches and the SVE composite for each site visit during SVE/AAS are provided in Table 4-6. Table 4-7 provides a summary of the water quality monitoring conducted at site monitoring and sparge wells. Table 4-8 provides a summary of air injection rates during the SVE/AAS pilot plant operational period.

Prior to activation of the 4 AAS wells, well AAS-1 was briefly operated to assess injection rates and radial influences which may be achieved. In response to the relatively high soil permeability, the initial air injection rate into well AAS-1 (32-36 cfm) was considerably higher than anticipated (10-15 cfm). Following the brief test period, wells AAS-2, AAS-3, and AAS-5 were activated at injection (sparge) rates of 35 cfm, 32 cfm, and 24 cfm, respectively, for a combined injection rate of 127 cfm (Table 4-8).

Flow rates were recorded at the well head assembly of the AAS wells using a flow sensor and a Dwyer Capsuhelic® differential pressure gauge calibrated for flows from 0 to 50 cfm. Flow measurements within the treatment building could not be utilized as the flow rates into manifolds exceeded 50 cfm. As a result of the need to utilize the flow sensor and gauge, which is of limited reliability in shorter pipe lengths, flow measurements are considered approximations.

System re-adjustments were made on several occasions to modify flow rates and pressures. Air sparge rates at individual wells ranged from 17 to 54 cfm during the test period. Combined sparge rates during the test period ranged from 127 to 183 cfm. Corresponding SVE removal rates during this same period ranged from 346 to 406 cfm. Thus, the minimum vapor extraction to air injection ratio maintained was 2.2:1. Air sparging rates

decreased slightly from 11 to 25 May 1994, from 183 to 152 cfm. This decrease was a result of a decrease in the shallow water table elevation, which enabled lower well head pressures to be maintained (and thus lower sparge rates).

Attempts at assessing AAS radial influence were made by monitoring differential pressure within the vadose zone and dissolved oxygen in ground water. Measurements of differential pressure did not show a discernable trend of decreasing pressure versus distance; this was primarily due to the concurrent operations of the SVE system, which was necessitated by the continued observance of elevated TVH concentrations in the exhaust stack of the footing drain at the Family Services Center. In general, vacuum within the vadose zone was observed to decrease immediately following start-up of AAS operations. At locations experiencing limited SVE, such as by the tank field, active sparging appeared to create a pressure within the vadose zone.

Dissolved oxygen levels in ground water, typically used to assess radial influence of sparge wells, did not demonstrate a discernable trend with respect to decreased concentration versus distance from sparge wells. Dissolved oxygen concentrations monitored throughout the duration of the long-term pilot study are provided in Table 4-7. As shown, many dissolved oxygen measurements were recorded at levels approaching oxygen saturation in ground water. Such readings can be rationalized in the vicinity of the active AAS system, as ambient air containing approximately 20 percent oxygen is sparged into the shallow water table. At outlying wells, such as well MW-5, elevated dissolved oxygen concentrations may be related to the shallow depth to water and the zone within the well where the measurements were taken (top of water table).

Other water quality parameters, including pH, temperature, and conductivity, were measured to assess potential indications of AAS radial influence. None of these parameters proved useful in assessing radial influence. Depth to water also could not be used to gauge AAS influence, particularly due to the seasonal fluctuations occurring during the spring months.

The AAS pilot plant was de-activated on Tuesday, 7 June 1994, due to the presence of a film of LNAPL within active sparge well AAS-5. The presence of LNAPL on this date marked the first time LNAPL had been observed at this location. LNAPL was also observed as a film in inactive sparge well AAS-7; however, free-product had been observed at this location in the past. Other factors contributing to the deactivation of the AAS pilot plant were that elevated concentrations of TVH were observed adjacent to the existing tank field, where insufficient SVE coverage appeared to exist; dissolved oxygen levels in ground water could not be used to asses AAS radius of influence; and to evaluate the concentrations of petroleum hydrocarbons in site ground water following AAS at high injection rates.

The presence of a LNAPL sheen at sparge well AAS-5 appeared to be the result of the mobilization of LNAPL trapped from below the top of the water table in that vicinity. Sparge well AAS-5 is adjacent to ground-water monitoring well MW-4, which historically has contained the highest concentrations of dissolved-phase and sorbed hydrocarbons at the

site. The presence of a LNAPL sheen in site wells is not an indication of uncontrolled LNAPL transport. The presence of LNAPL at this location may be in response to the forced mobilization of LNAPL which had been trapped within the soil beneath the water table, or within the zone of water table fluctuation. This result may be an indication that air sparging is physically removing petroleum hydrocarbons from the shallow water table.

4.3.3 Results of Soil Sampling

Soil samples were collected during the March 1994 installation of replacement monitoring wells MW-1R and MW-4R and replacement sparge wells AAS-3R and AAS-4R. The soil sample collected from monitoring well MW-4R was retained from the same approximate location and depth as the soil sample collected during the March 1992 well installation program. Soil samples were analyzed for the same parameters as the March 1992 soil samples to assess the impact of active SVE at the site. Soil samples collected during the installation of replacement wells represent subsurface conditions following approximately 4 months of SVE operations. Table 4-9 provides a summary of the analytical results for the soil samples collected at replacement wells in March 1994. The results of the analyses performed on soil samples collected from monitoring wells MW-1R and MW-4R in March 1994, along with the results of the analyses performed on soil samples collected at these well locations in 1992, are summarized in Table 4-10. The analytical report for the soil samples collected during the installation of replacement monitoring and sparge wells is provided in Appendix J.

Table 4-9 shows that soil samples collected at wells MW-4R and AAS-3R contain elevated concentrations of petroleum-related hydrocarbons. Both of these wells are located in the vicinity of the former dispenser lines. Total BTEX concentrations in soil samples collected at these locations were reported at 835,000 μg/kg and 95,600 μg/kg, respectively. TPH as gasoline was reported at concentrations of 2,500 mg/kg and 263 mg/kg, respectively, at wells MW-4R and AAS-3R. TPH as fuel oil was reported at low concentrations at wells MW-1R and MW-4R only; however, the analytical report states that these results are a dissimilar GC fingerprint than a fuel oil and were reported based on the elution range of fuel oil.

As shown in Table 4-10, from prior to pilot testing to active SVE, concentrations of total BTEX and MTBE in the soil sample collected at upgradient well MW-1R deceased from 6.5 μg/kg to non-detect, and 2.6 μg/kg to non-detect, respectively. TPH as fuel oil also decreased from 6 mg/kg to non-detect during that period. TPH as fuel oil reportedly increased during the period from 10 mg/kg to 120 mg/kg at well MW-1R. The latter result, however, was reported by the laboratory as a dissimilar GC fingerprint than fuel oil and was reported based on the elution range of fuel oil.

Significant decreases in petroleum hydrocarbons concentrations were observed in the soil samples collected at well MW-4R as a result of active SVE (Table 4-10). TPH as gasoline concentrations reportedly decreased from 31,000 to 2,500 mg/kg. Concentrations of TPH as fuel oil, reported at 4,800 mg/kg prior to pilot testing, was reported as non-detected

following approximately 4 months of SVE. Total BTEX concentrations were reported to decrease from 2,785,300 to 835,000 μg/kg as a result of SVE. MTBE concentrations were reported to decrease from 7,300 μg/kg to non-detected.

4.3.4 Results of Ground-Water Sampling

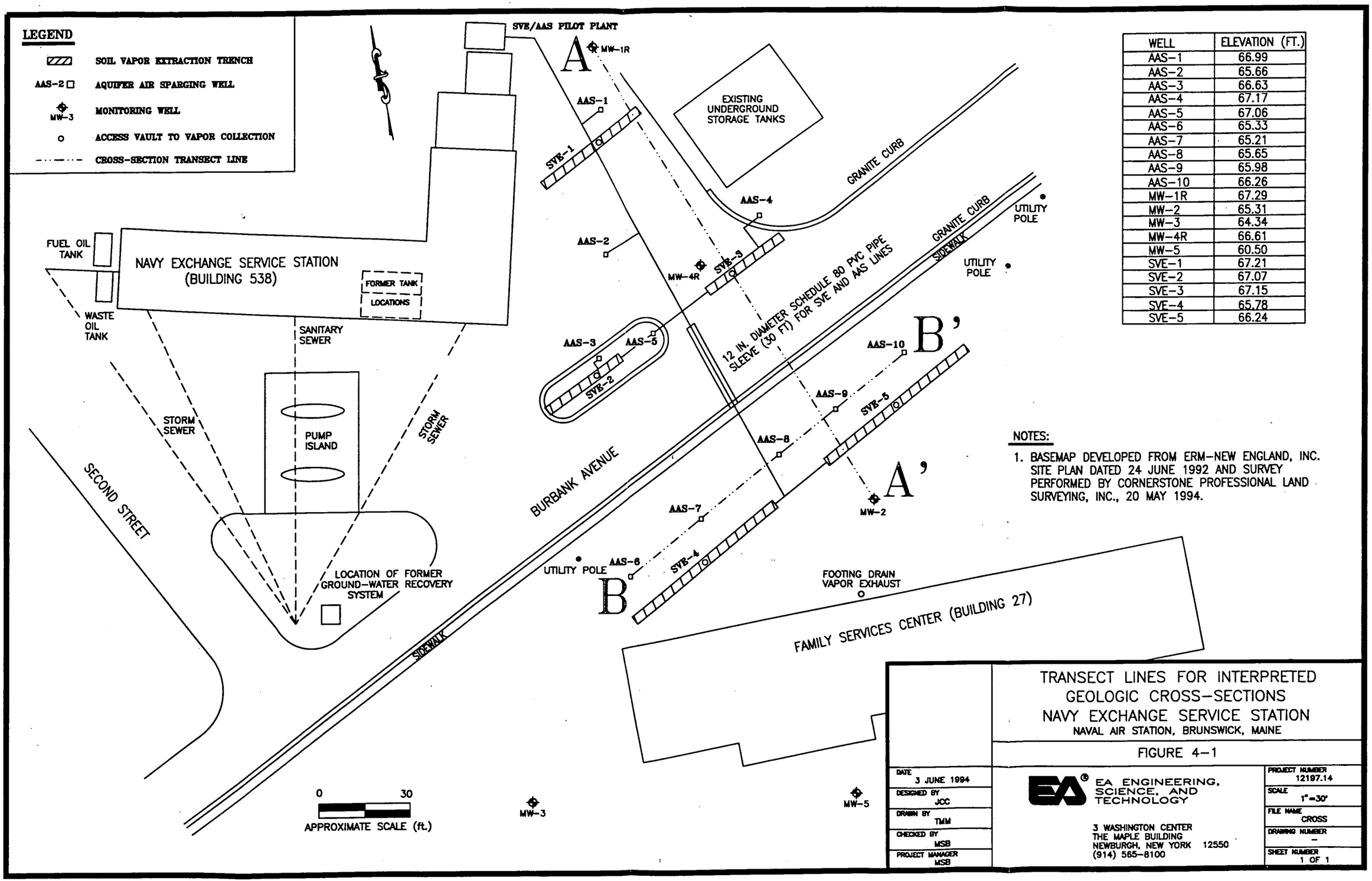
Ground-water sampling was conducted on three occasions at the subject site. The first round, conducted 13 July 1993, was completed prior to pilot testing to obtain background data on ground-water quality. The second round, conducted 12-13 April 1994, was completed following approximately 5 months of SVE and just prior to activation of the AAS pilot plant. The final round of sampling was conducted 7-8 July 1994 following the completion of pilot plant testing. Table 4-11 summarizes the analytical results for ground-water samples collected at the 5 site monitoring wells. Also included in the table are the analytical results from the round of sampling conducted on 20 May 1992 by others. The analytical reports for the 13 July 1993, 12-13 April 1994, and 7-8 July 1994 sampling rounds are provided in Appendix K.

At upgradient (background) monitoring well MW-1, non-detect concentrations of BTEX, MTBE, TPH as gasoline, and TPH as fuel oil have been reported for the four sampling rounds conducted at the subject site. Therefore, operation of sparge well AAS-1 has not resulted in the forced migration of dissolved-phase hydrocarbons to this area.

Within the suspected release area, concentrations of dissolved phase hydrocarbons at well MW-4 (which was redrilled as well MW-4R) have varied widely over time, but have remained at concentrations indicative of the presence of LNAPL within the subsurface. Prior to pilot testing, concentrations of total BTEX in ground water were reported at 38,900 μg/L and 7,510 μg/L, respectively, on 20 May 1992 and 13 July 1993. Following several months of SVE, total BTEX was reported at 22,947 μg/L (April 1994). At the conclusion of the SVE/AAS pilot study, the reported total BTEX concentrations was 38,031 μg/L. Similar results were reported for TPH as gasoline and TPH as fuel oil, except in these instances the post-test results were reported at lower concentrations. MTBE concentrations of up to 210 μg/L were reported for during the latter two sampling rounds. The MEDEP remedial action goal for MTBE is 50 μg/L.

At the 3 wells located hydraulically downgradient of the tank field, concentrations of dissolved-phase hydrocarbons have remained low. Total BTEX concentrations at wells MW-2 and MW-3 have decreased through time, and historically has not been detected at well MW-5 (Table 4-11). At no point during the performance of the pilot test were the MEDEP remedial action goals of 5 μg/L of benzene and 50 μg/L TPH as gasoline exceeded at these locations, with the exception of a reported TPH gasoline concentration of 51 μg/L during the 7-8 July 1994 sampling at well MW-3.

The MEDEP remedial action goal of 50 μg/L for TPH as fuel oil was exceeded at all three downgradient wells, with concentrations ranging from 110 μg/L (well MW-3) to 280 μg/L (well MW-2). The laboratory, however, has reported that these samples did not have chromatographic fingerprints indicative of petroleum product. According to the laboratory, the fingerprints were indicative of higher average molecular weight interferences, but since the compounds eluted within the boiling point range of fuel oil, they were quantified against fuel oil. Based on this assessment, the remedial action goal for TPH as fuel oil was not exceeded at any of the downgradient well locations.



WELL	ELEVATION (FT.)
AAS-1	66.99
AAS-2	65.66
AAS-3	66.63
AAS-4	67.17
AAS-5	67.06
AAS-6	65.33
AAS-7	65.21
AAS-8	65.65
AAS-9	65.98
AAS-10	66.26
MW-1R	67.29
MW-2	65.31
MW-3	64.34
MW-4R	66.61
MW-5	60.50
SVE-1	67.21
SVE-2	67.07
SVE-3	67.15
SVE-4	65.78
SVE-5	66.24

NOTES:

1. BASEMAP DEVELOPED FROM ERM-NEW ENGLAND, INC. SITE PLAN DATED 24 JUNE 1992 AND SURVEY PERFORMED BY CORNERSTONE PROFESSIONAL LAND SURVEYING, INC., 20 MAY 1994.

TRANSECT LINES FOR INTERPRETED GEOLOGIC CROSS-SECTIONS
NAVY EXCHANGE SERVICE STATION
NAVAL AIR STATION, BRUNSWICK, MAINE

FIGURE 4-1

DATE	3 JUNE 1994
DESIGNED BY	JCC
DRAWN BY	TMM
CHECKED BY	MSB
PROJECT MANAGER	MSB

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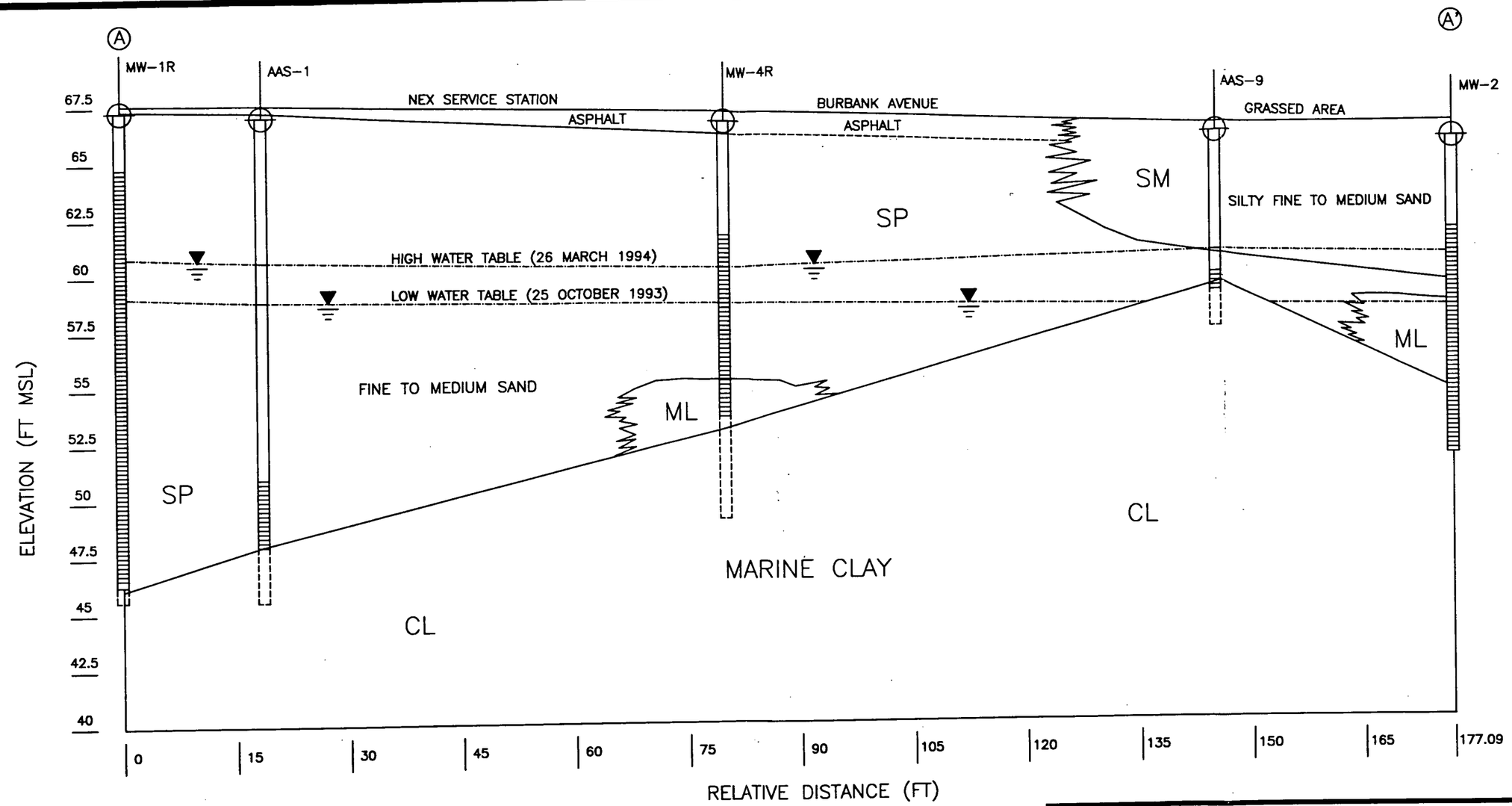
PROJECT NUMBER	12197.14
SCALE	1"=30'
FILE NAME	CROSS
DRAWING NUMBER	-
SHEET NUMBER	1 OF 1



LEGEND

SP	MEDIUM TO FINE SAND
SM	SILTY FINE TO MEDIUM SAND (SANDY LOAM)
ML	SANDY CLAY WITH SILT
CL	SILTY CLAY
————	INTERPRETED BOUNDARY BETWEEN UNCONSOLIDATED SOIL TYPES (JAGGED WHERE INFERRED)
-·-·-·-·-	INTERPRETED WATER TABLE ELEVATION

NOTE: WATER TABLE ELEVATIONS FOR 25 OCTOBER 1993 INFERRED FOR WELLS MW-1R, MW-4R, AND AAS-9.

INTERPRETED GEOLOGIC CROSS SECTION
FOR TRANSECT LINE A-A'
NAVY EXCHANGE SERVICE STATION
NAVAL AIR STATION, BRUNSWICK, MAINE

FIGURE 4-2

DATE	01 SEPTEMBER 94
DESIGNED BY	CJV
DRAWN BY	CJV
CHECKED BY	MSB
PROJECT MANAGER	MSB

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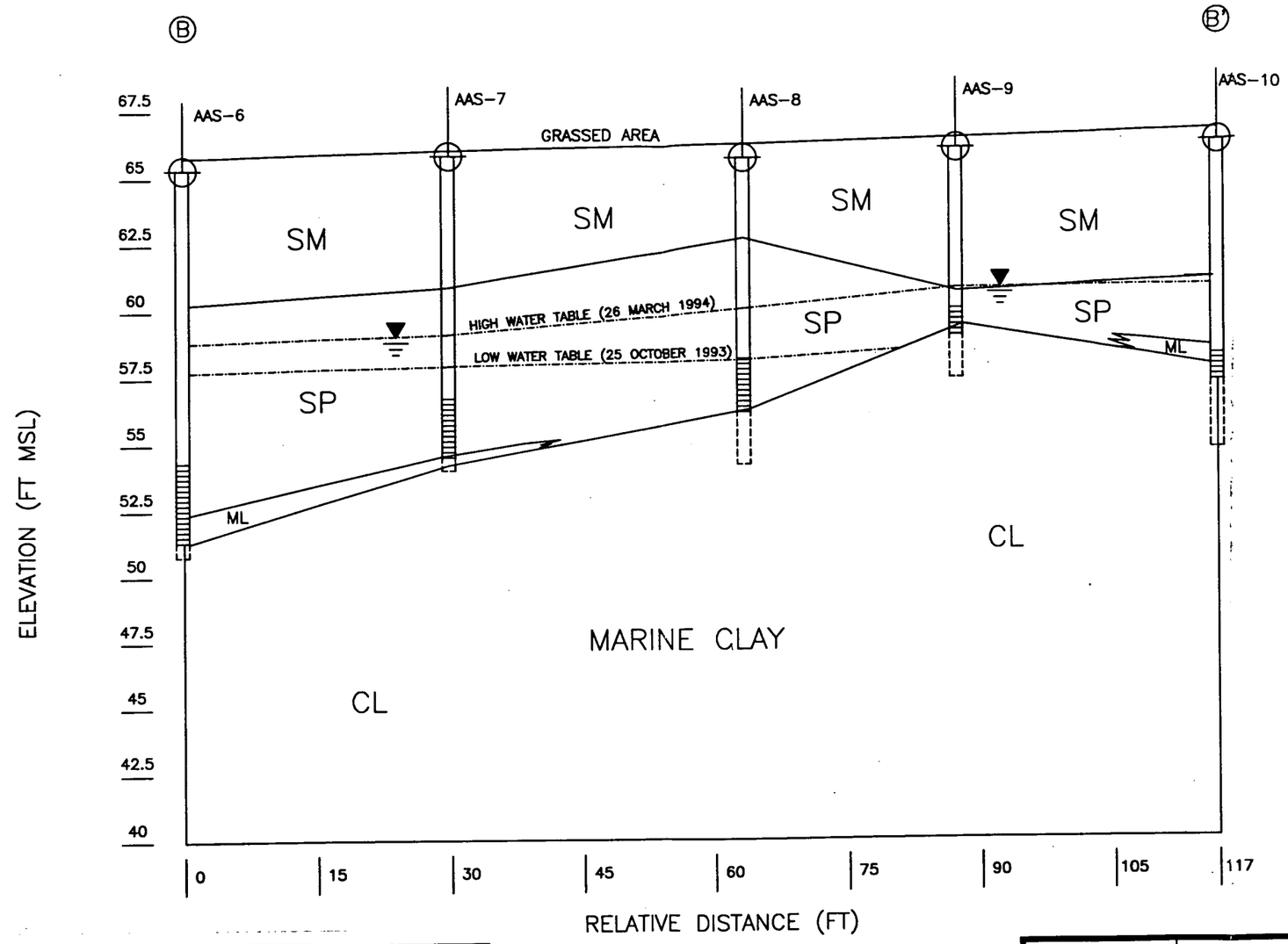
PROJECT NUMBER	12197.14.0186
SCALE	-
FILE NAME	XSECTAA
DRAWING NUMBER	-
SHEET NUMBER	1 OF 1



LEGEND

SP	MEDIUM TO FINE SAND
SM	SILTY FINE TO MEDIUM SAND (SANDY LOAM)
ML	SANDY CLAY WITH SILT
CL	SILTY CLAY

——— INTERPRETED BOUNDARY BETWEEN UNCONSOLIDATED SOIL TYPES (JAGGED WHERE INFERRED)

-·-·-·- INTERPRETED WATER TABLE ELEVATION

INTERPRETED GEOLOGIC CROSS SECTION
FOR TRANSECT LINE B–B'
NAVY EXCHANGE SERVICE STATION
NAVAL AIR STATION, BRUNSWICK, MAINE

FIGURE 4–3

DATE	01 SEPTEMBER 94
DESIGNED BY	CJV
DRAWN BY	CJV
CHECKED BY	MSB
PROJECT MANAGER	MSB

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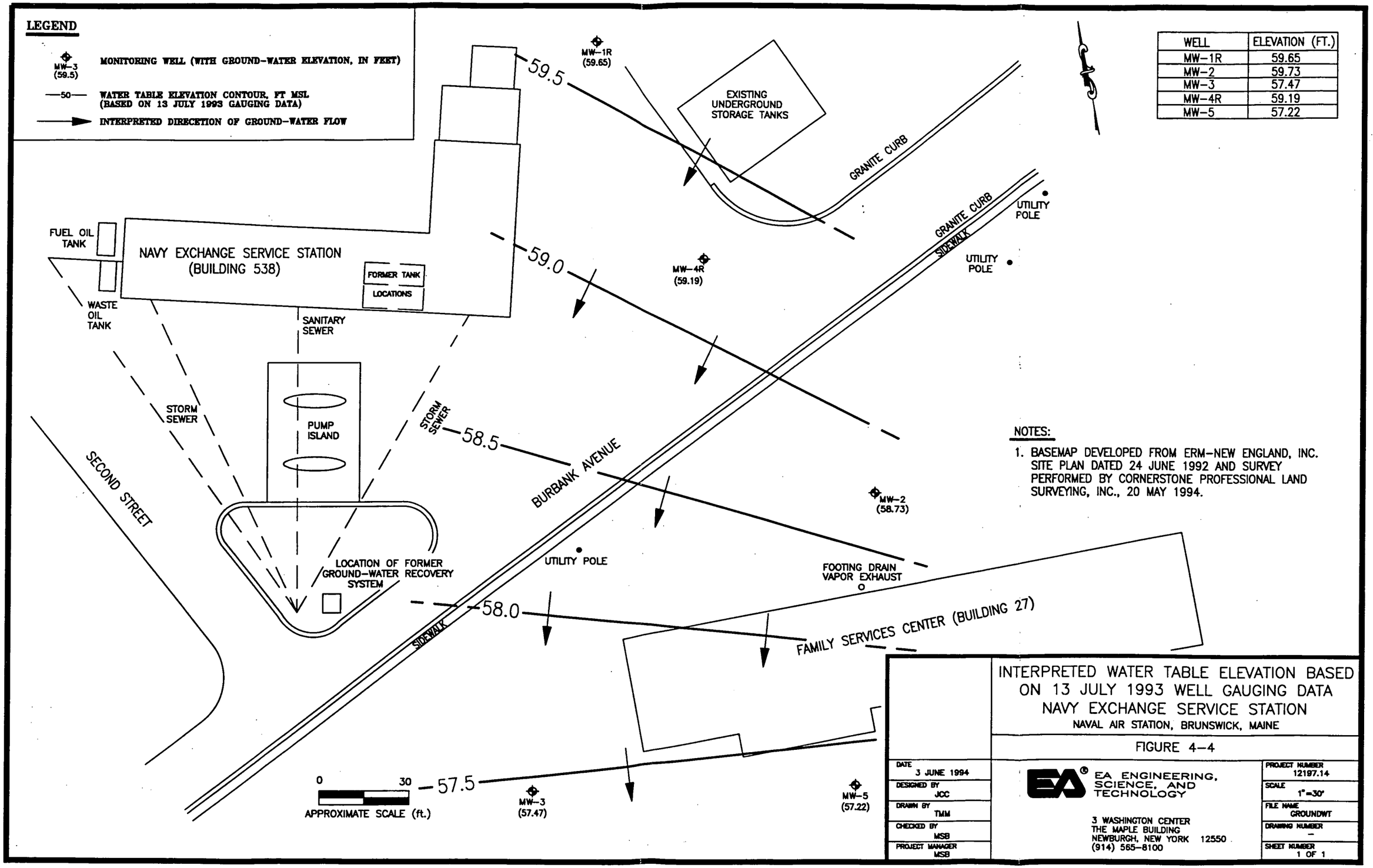
PROJECT NUMBER	12197.14.0188
SCALE	–
FILE NAME	XSECTBB
DRAWING NUMBER	–
SHEET NUMBER	1 OF 1



WELL	ELEVATION (FT.)
MW-1R	59.65
MW-2	59.73
MW-3	57.47
MW-4R	59.19
MW-5	57.22

NOTES:

1. BASEMAP DEVELOPED FROM ERM-NEW ENGLAND, INC. SITE PLAN DATED 24 JUNE 1992 AND SURVEY PERFORMED BY CORNERSTONE PROFESSIONAL LAND SURVEYING, INC., 20 MAY 1994.

INTERPRETED WATER TABLE ELEVATION BASED ON 13 JULY 1993 WELL GAUGING DATA
NAVY EXCHANGE SERVICE STATION
NAVAL AIR STATION, BRUNSWICK, MAINE

FIGURE 4-4

DATE	3 JUNE 1994
DESIGNED BY	JCC
DRAWN BY	TMM
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PROJECT MANAGER	MSB

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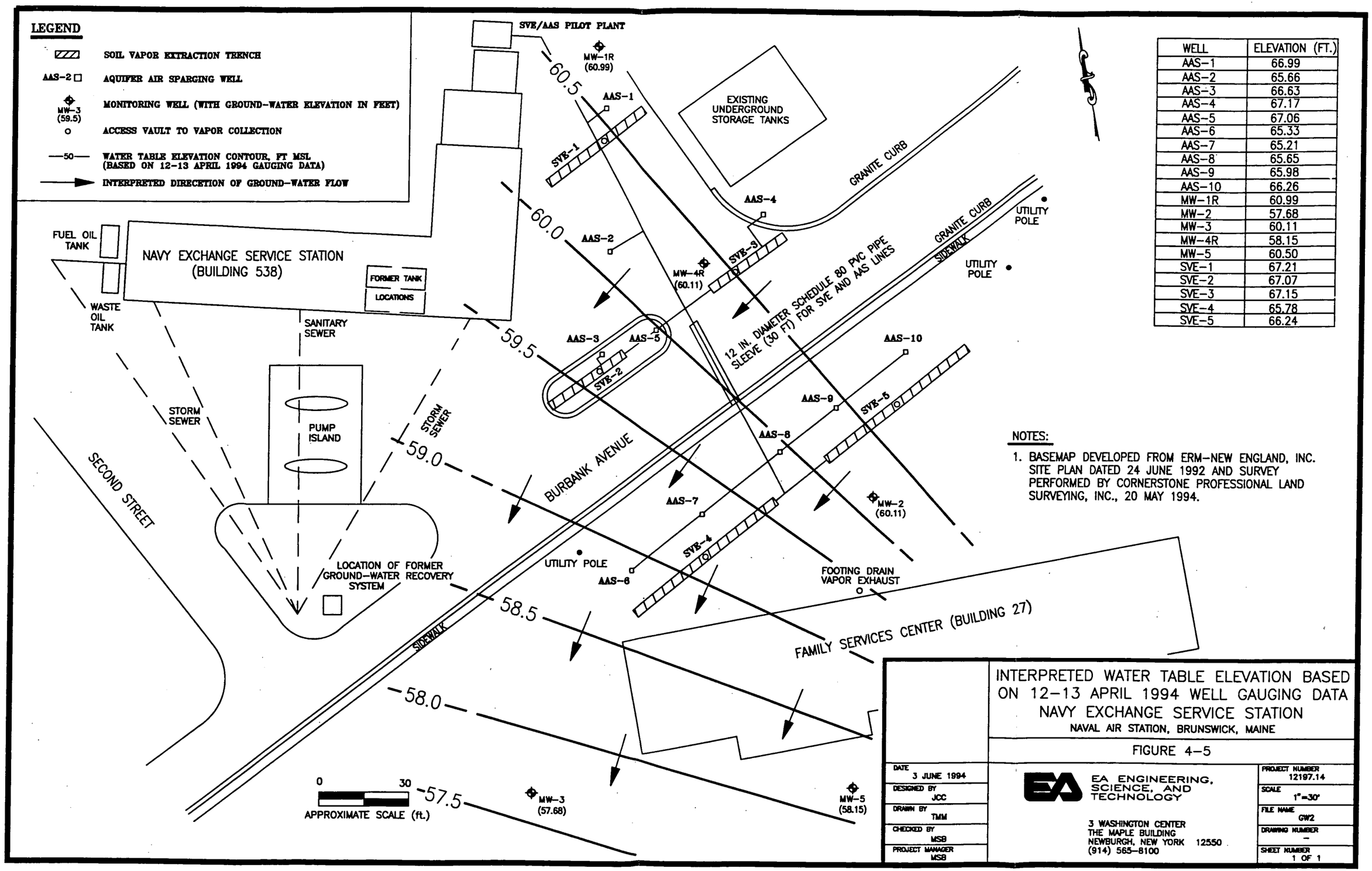
PROJECT NUMBER	12197.14
SCALE	1"=30'
FILE NAME	GROUNDWT
DRAWING NUMBER	–
SHEET NUMBER	1 OF 1



WELL	ELEVATION (FT.)
AAS-1	66.99
AAS-2	65.66
AAS-3	66.63
AAS-4	67.17
AAS-5	67.06
AAS-6	65.33
AAS-7	65.21
AAS-8	65.65
AAS-9	65.98
AAS-10	66.26
MW-1R	60.99
MW-2	57.68
MW-3	60.11
MW-4R	58.15
MW-5	60.50
SVE-1	67.21
SVE-2	67.07
SVE-3	67.15
SVE-4	65.78
SVE-5	66.24

NOTES:

1. BASEMAP DEVELOPED FROM ERM-NEW ENGLAND, INC. SITE PLAN DATED 24 JUNE 1992 AND SURVEY PERFORMED BY CORNERSTONE PROFESSIONAL LAND SURVEYING, INC., 20 MAY 1994.

INTERPRETED WATER TABLE ELEVATION BASED ON 12-13 APRIL 1994 WELL GAUGING DATA
NAVY EXCHANGE SERVICE STATION
NAVAL AIR STATION, BRUNSWICK, MAINE

FIGURE 4-5

DATE	3 JUNE 1994
DESIGNED BY	JCC
DRAWN BY	TMM
CHECKED BY	MSB
PROJECT MANAGER	MSB

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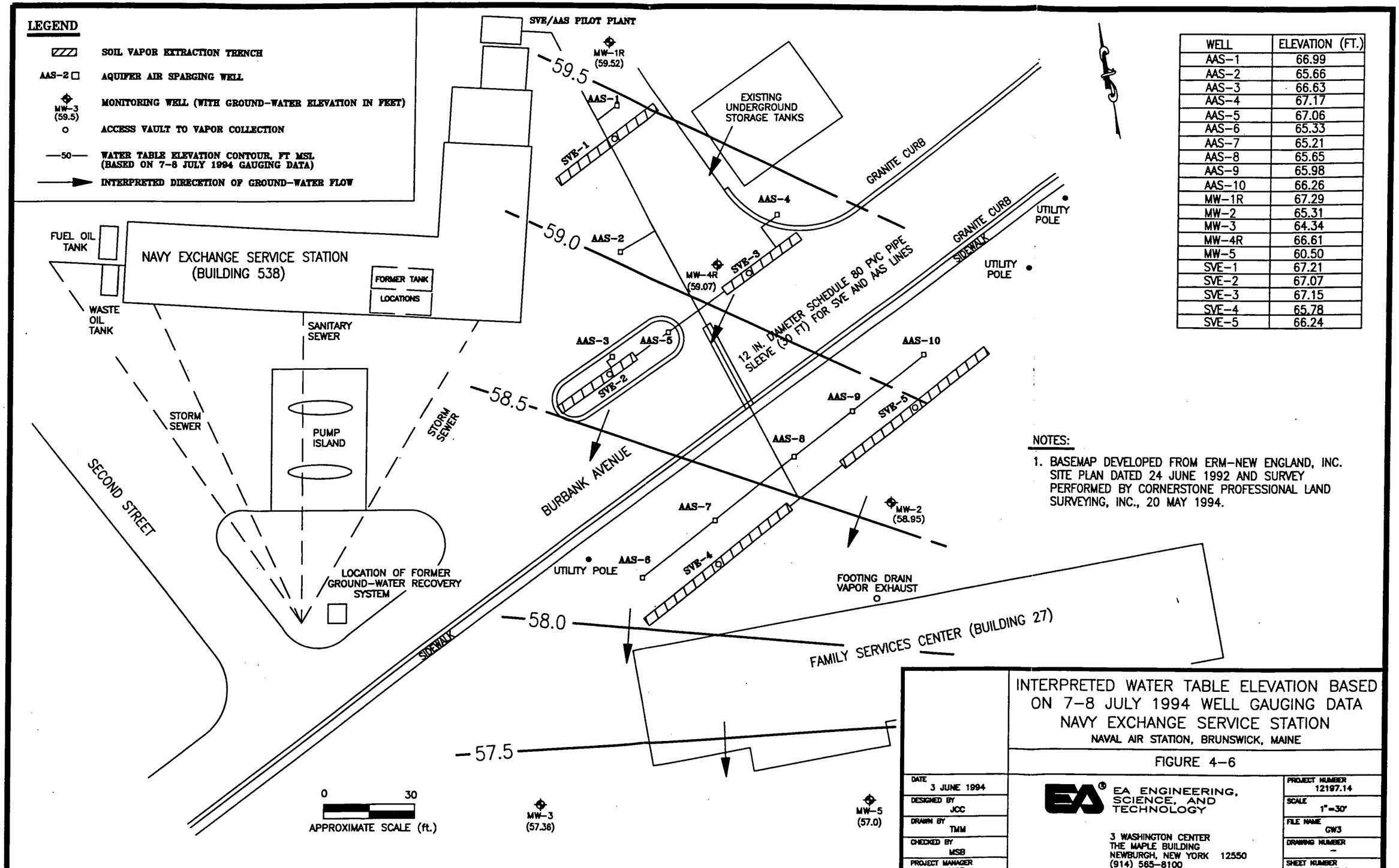
PROJECT NUMBER	12197.14
SCALE	1"=30'
FILE NAME	GW2
DRAWING NUMBER	-
SHEET NUMBER	1 OF 1



WELL	ELEVATION (FT.)
AAS-1	66.99
AAS-2	65.66
AAS-3	66.63
AAS-4	67.17
AAS-5	67.06
AAS-6	65.33
AAS-7	65.21
AAS-8	65.65
AAS-9	65.98
AAS-10	66.26
MW-1R	67.29
MW-2	65.31
MW-3	64.34
MW-4R	66.61
MW-5	60.50
SVE-1	67.21
SVE-2	67.07
SVE-3	67.15
SVE-4	65.78
SVE-5	66.24

NOTES:

1. BASEMAP DEVELOPED FROM ERM-NEW ENGLAND, INC. SITE PLAN DATED 24 JUNE 1992 AND SURVEY PERFORMED BY CORNERSTONE PROFESSIONAL LAND SURVEYING, INC., 20 MAY 1994.

INTERPRETED WATER TABLE ELEVATION BASED ON 7-8 JULY 1994 WELL GAUGING DATA
NAVY EXCHANGE SERVICE STATION
NAVAL AIR STATION, BRUNSWICK, MAINE

FIGURE 4-6

DATE	3 JUNE 1994
DESIGNED BY	JCC
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CHECKED BY	MSB
PROJECT MANAGER	MSB

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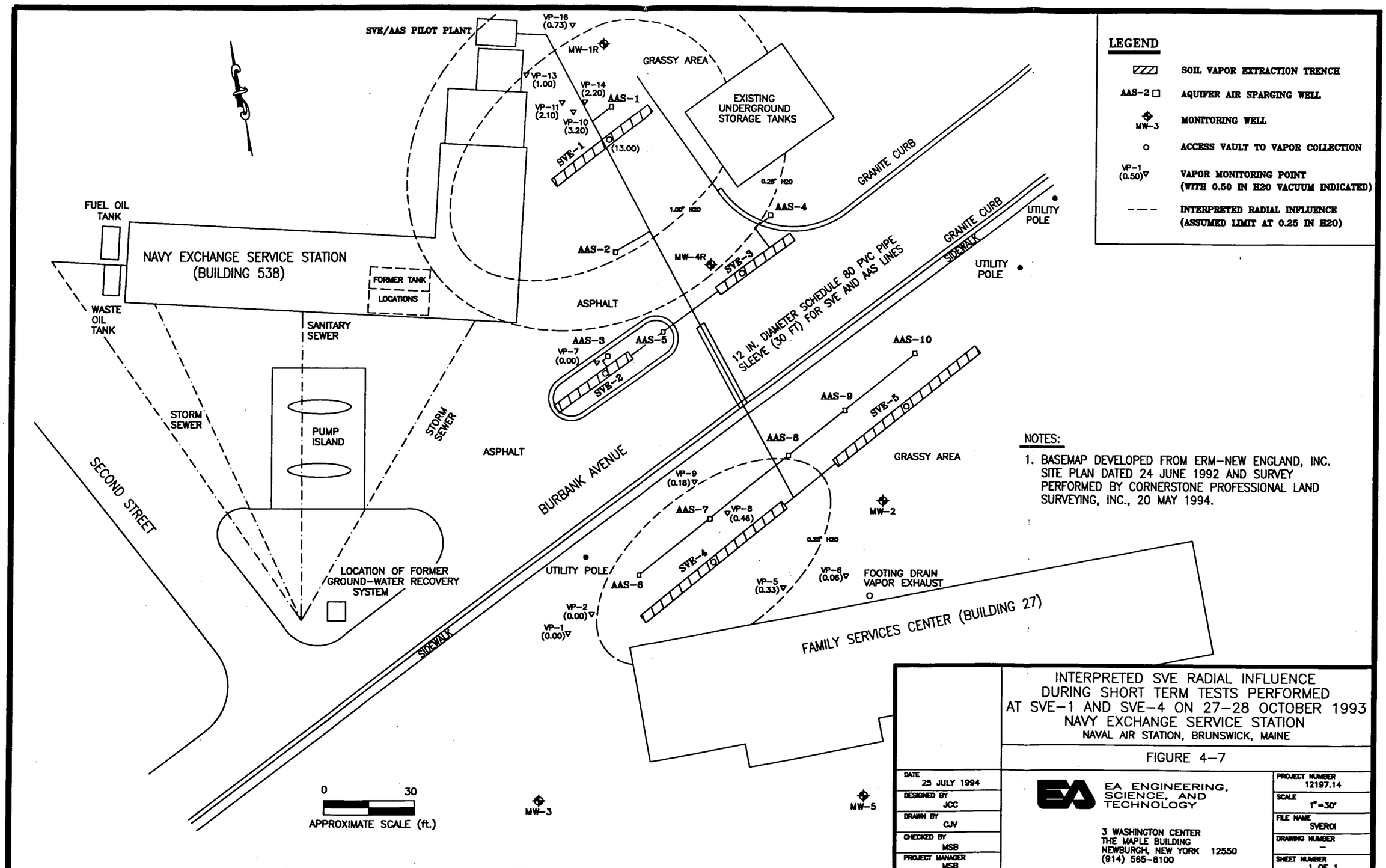
PROJECT NUMBER	12197.14
SCALE	1"=30'
FILE NAME	GW3
DRAWING NUMBER	-
SHEET NUMBER	1 OF 1



NOTES:

1. BASEMAP DEVELOPED FROM ERM-NEW ENGLAND, INC. SITE PLAN DATED 24 JUNE 1992 AND SURVEY PERFORMED BY CORNERSTONE PROFESSIONAL LAND SURVEYING, INC., 20 MAY 1994.

INTERPRETED SVE RADIAL INFLUENCE
DURING SHORT TERM TESTS PERFORMED
AT SVE-1 AND SVE-4 ON 27-28 OCTOBER 1993
NAVY EXCHANGE SERVICE STATION
NAVAL AIR STATION, BRUNSWICK, MAINE

FIGURE 4-7

DATE	25 JULY 1994
DESIGNED BY	JCC
DRAWN BY	CJV
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PROJECT MANAGER	MSB

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PROJECT NUMBER	12197.14
SCALE	1"=30'
FILE NAME	SVEROI
DRAWING NUMBER	–
SHEET NUMBER	1 OF 1

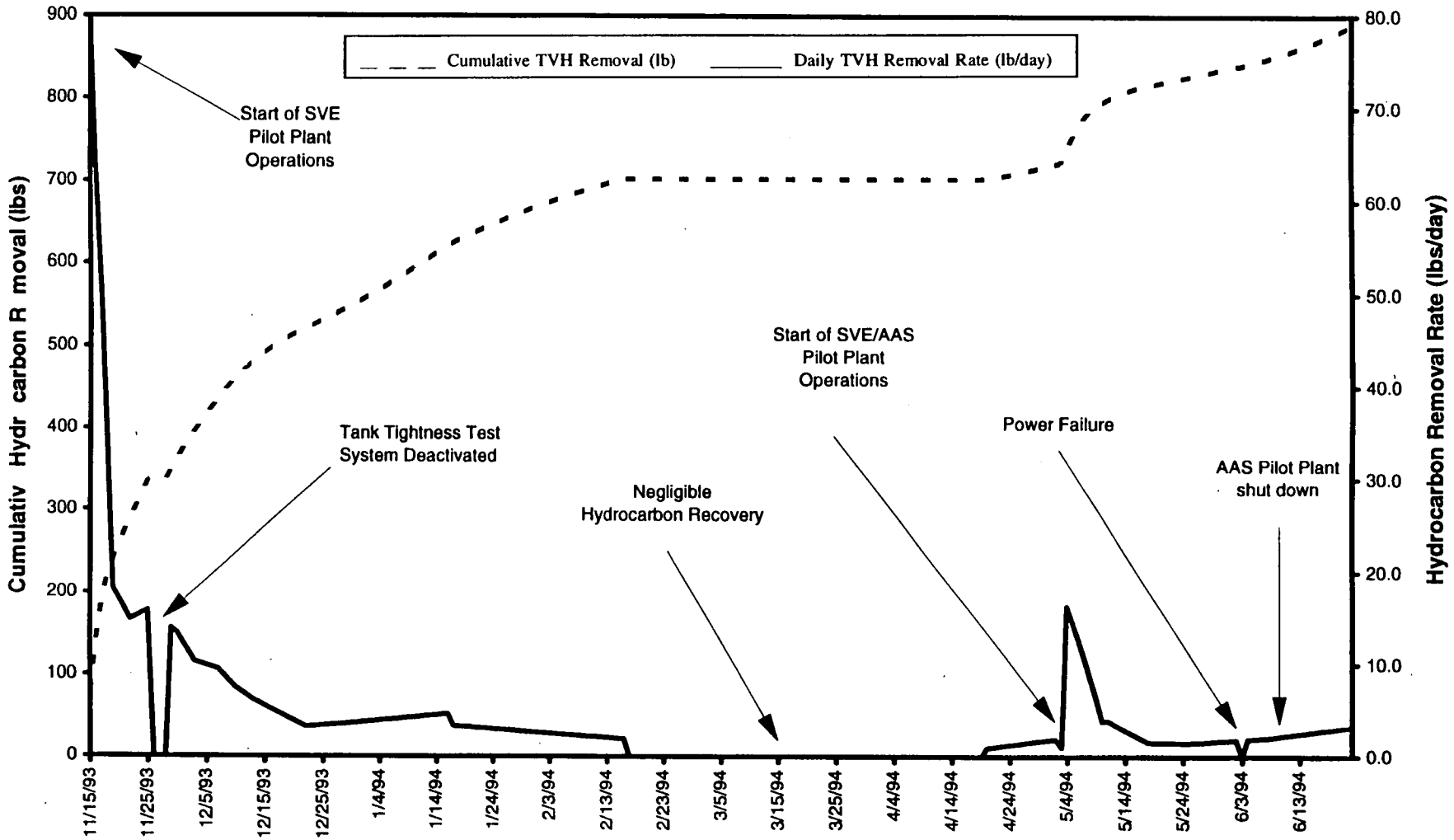


Figure 4-8 Cumulative TVH removal and daily TVH removal rate during SVE/AAS pilot study.

TABLE 4-1 DIFFERENTIAL PRESSURE MEASURED AT MONITORING POINTS DURING PERFORMANCE OF SOIL VAPOR EXTRACTION PILOT TEST AT TRENCH SVE-4, 27 OCTOBER 1993 NAVY EXCHANGE SERVICE STATION NAVAL AIR STATION, BRUNSWICK, MAINE

Test Time	Monitoring Points (Distance from SVE-4)						
	VP-1 (46.5 ft)	VP-2 (37.5 ft)	VP-5 (21 ft)	VP-6 (31 ft)	VP-7 (60 ft)	VP-8 (10 ft)	VP-9 (25 ft)
Test Step 1: 10 in. H_2O Vacuum (185 cfm)							
0MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9MIN	0.00	0.00	0.30	0.05	0.00	0.44	0.02
16MIN	0.00	0.00	0.29	0.05	0.00	0.44	0.08
26MIN	0.00	0.00	0.29	0.05	0.00	0.44	0.01
31MIN	0.00	0.00	0.30	0.05	0.00	0.44	0.01
36MIN	0.00	0.00	0.30	0.05	0.00	0.44	0.02
41MIN	0.00	0.00	0.30	0.05	0.00	0.44	0.02
46MIN	0.00	0.00	0.30	0.05	0.00	0.44	0.02
52MIN	0.00	0.00	0.30	0.05	0.00	0.46	0.02
58MIN	0.00	0.00	0.30	0.05	0.00	0.46	0.02
Test Step 2: 14 in. H_2O Vacuum (275 cfm)							
68MIN	0.00	0.00	≥0.50	0.11	0.00	≥0.50	0.03
70MIN	0.00	0.00	≥0.50	0.11	0.00	≥0.50	0.03
91MIN	0.00	0.00	≥0.50	0.11	0.00	≥0.50	0.05
102MIN	0.00	0.00	≥0.50	0.11	0.00	≥0.50	0.08
111MIN	0.00	0.00	≥0.50	0.11	0.00	≥0.50	0.10
116MIN	0.00	0.00	≥0.50	0.11	0.00	≥0.50	0.11
125MIN	0.00	0.00	≥0.50	0.11	0.00	≥0.50	0.11
Test Step 3: 16 in. H_2O Vacuum (319 cfm)							
148MIN	0.00	0.00	≥0.50	0.14	0.00	≥0.50	0.18
163MIN	0.00	0.00	≥0.50	0.14	0.00	≥0.50	0.20
Test Step 4: 10 in. H_2O Vacuum (185 cfm)							
181MIN	0.00	0.00	0.32	0.07	0.00	0.45	0.00
195MIN	0.00	0.00	0.33	0.07	0.00	0.46	0.02
215MIN	0.00	0.00	0.33	0.07	0.00	0.46	0.06
300MIN	0.00	0.00	0.33	0.06	0.00	0.46	0.18

NOTE: Results expressed in inches H_2O. Pilot test for trench SVE-4 ran continuously for 300 minutes. Test Step 1 ran for 58 minutes. Test Step 2 ran for 67 minutes, Test Step 3 ran for 38 minutes, and Test Step 4 ran for 137 minutes.

TABLE 4-2 DIFFERENTIAL PRESSURE MEASURED AT MONITORING POINTS DURING PERFORMANCE OF SOIL VAPOR EXTRACTION PILOT TEST AT TRENCH SVE-1, 28 OCTOBER 1993 NAVY EXCHANGE SERVICE STATION NAVAL AIR STATION, BRUNSWICK, MAINE

Test Time	Monitoring Points (Distance from SVE-1)								
	VP-10 (15 ft)	VP-11 (20 ft)	VP-12 (25 ft)	VP-13 (35 ft)	VP-14 (15 ft)	VP-15 (25 ft)	VP-9 (25 ft)	VP-16 (40 ft)	SVE-3 (65 ft)
Test Step 1: 13 in. H_2O Vacuum (110 cfm)									
0MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(a)
9MIN	≥0.50	≥0.50	0.0	≥0.50	≥0.50	0.32	0.00	0.00	(a)
14MIN	≥0.50	≥0.50	0.0	≥0.50	≥0.50	0.34	0.00	0.00	(a)
19MIN	≥0.50	≥0.50	0.02	≥0.50	≥0.50	0.35	0.00	0.00	(a)
24MIN	≥0.50	≥0.50	0.02	≥0.50	≥0.50	0.35	0.00	0.00	(a)
29MIN	≥0.50	≥0.50	0.05	≥0.50	≥0.50	0.36	0.00	0.00	(a)
34MIN	≥0.50	≥0.50	0.06	≥0.50	≥0.50	0.37	0.00	0.00	(a)
39MIN	3.80	3.05	0.10	1.35	2.05	0.40	0.00	0.00	(a)
49MIN	3.85	3.05	0.12	1.35	2.05	0.41	0.00	0.00	(a)
62MIN	3.80	2.80	(b)	1.35	2.20	(b)	0.00	0.00	(a)
113MIN	3.20	2.10	(b)	1.00	(b)	(b)	0.00	0.73	(a)
Test Step 2: 15 in. H_2O Vacuum (138 cfm)									
144MIN	4.00	2.90	(b)	0.80	2.20	(a)	0.01	0.89	1.20
158MIN	4.05	2.90	(b)	0.80	2.20	(a)	0.00	0.89	1.20
170MIN	4.05	2.90	(b)	0.80	2.20	(a)	0.00	0.88	1.20
Test Step 3: 10 in. H_2O Vacuum (88 cfm)									
185MIN	2.20	1.40	(b)	0.40	1.20	(a)	0.0	0.50	0.80
190MIN	2.20	1.40	(b)	0.40	1.20	(a)	0.0	0.50	0.80
195MIN	2.20	1.40	(b)	0.30	1.20	(a)	0.0	0.50	0.80
200MIN	2.20	1.40	(b)	0.30	1.20	(a)	0.0	0.50	0.80
Test Step 4: 8 in. H_2O Vacuum (80 cfm)									
255MIN	1.95	1.40	0.01	0.58	1.00	(a)	0.00	0.46	(a)

(a) Location not monitored.
(b) Monitoring data not available due to slow gauge response (caused by usage of gauge at multiple monitoring points).

NOTE: Results expressed in inches H_2O. Pilot test for trench SVE-1 ran continuously for 255 minutes. Test Step 1 ran for 113 minutes, Test Step 2 ran for 57 minutes, Test Step 3 ran for 30 minutes, and Test Step 4 ran for 55 minutes.

TABLE 4-3 ANALYTICAL RESULTS FOR SOIL VAPOR SAMPLES COLLECTED PRIOR TO SOIL VAPOR EXTRACTION PILOT TESTING AT TRENCH SVE-4, 25-26 OCTOBER 1993
NAVY EXCHANGE SERVICE STATION
NAVAL AIR STATION, BRUNSWICK, MAINE

Location (Distance from SVE-4)	Benzene	Toluene	Ethylbenzene	Total Xylenes	Total BTEX	Total Volatile Hydrocarbons
Blank	<0.1	<0.1	<0.1	<0.1	ND	<0.1
VP-1 (46.5 ft)	<0.1	<0.1	<0.1	<0.1	ND	<0.1
VP-2 (37.5 ft)	<0.1	<0.1	<0.1	<0.1	ND	<0.1
VP-3 (31.5 ft)	<0.1	<0.1	<0.1	<0.1	ND	<0.1
VP-4 (25 ft)	<0.1	<0.1	<0.1	<0.1	ND	<0.1
VP-5 (21 ft)	<0.1	<0.1	<0.1	<0.1	ND	<0.1
VP-6 (31 ft)	<0.1	<0.1	<0.1	<0.1	ND	<0.1
VP-7 (60 ft)	46.8	17.6	<0.1	19.0	83.4	83,000
Blank	<0.1	<0.1	<0.1	<0.1	ND	0.2
SVE-1	<0.1	<0.1	<0.1	<0.1	ND	3.1
SVE-2	0.4	0.2	<0.1	<0.1	0.6	14
SVE-3	14.2	10.4	<0.1	<0.1	24.6	570
SVE-4	<0.1	<0.1	<0.1	<0.1	ND	14
SVE-5	<0.1	<0.1	<0.1	<0.1	ND	0.9
Blank	<0.1	<0.1	<0.1	<0.1	ND	0.3

NOTE: ND = Not detected.
Results in parts per million by volume (ppm$_v$).
BTEX summation excludes unquantified compounds.
Total volatile hydrocarbons are the sum of the BTEX compound concentrations and unquantified compounds ("benzene equivalents" and "xylene equivalent") (Section 3.1.2).

TABLE 4-4 ANALYTICAL RESULTS FOR SOIL VAPOR SAMPLES COLLECTED DURING SOIL VAPOR EXTRACTION PILOT TESTING AT TRENCH SVE-4, 27 OCTOBER 1993 NAVY EXCHANGE SERVICE STATION NAVAL AIR STATION, BRUNSWICK, MAINE

Location (Distance from SVE-4)	Benzene	Toluene	Ethylbenzene	Total Xylenes	Total BTEX	Total Volatile Hydrocarbons
Blank	<0.1	<0.1	<0.1	<0.1	ND	<0.1
Influent (Background)	8.4	4.5	<0.1	3.5	16.4	323
VP-8 (10 ft)	<0.1	<0.1	<0.1	<0.1	ND	8.9
VP-9 (25 ft)	(a)	279	55.2	395	729.2	2,300
Influent (Step 1)	15	13	3	30.8	61.8	471
Effluent (Step 1)	<0.1	<0.1	<0.1	<0.1	ND	2.1
Influent (Step 1)	16	14	1.5	19.1	50.6	504
Influent (Step 2)	7.9	11.4	<0.1	10.4	29.7	346
Influent (Step 2)	8.9	7.9	<0.1	15	31.8	284
Influent (Step 3)	0.9	<0.1	<0.1	9.4	10.3	33
Influent (Step 1)	17	17	<0.1	30.5	64.5	524
Influent (Step 1)	20	16	<0.1	37.8	73.8	623
Influent (Step 1)	20	14	<0.1	37	71	611
Influent (Step 1)	18	18	<0.1	31.3	67.3	577
SVE-4	18	19	<0.1	36.2	73.2	551
Composite Influent	28	20	<0.1	42.1	90.1	564
Composite Effluent	<0.1	<0.1	<0.1	<0.1	ND	0.2
Blank	<0.1	<0.1	<0.1	<0.1	ND	<0.1

(a) Compound unable to be quantified due to peak interference.

NOTE: ND = Not detected.
Results in parts per million by volume (ppm_v).
BTEX summation excludes unquantified compounds.
Total volatile hydrocarbons are the sum of the BTEX compound concentrations and unquantified compounds ("benzene equivalents" and "xylene equivalent") (Section 3.1.2).

TABLE 4-5 ANALYTICAL RESULTS FOR SOIL VAPOR SAMPLES COLLECTED DURING SOIL VAPOR EXTRACTION PILOT TESTING AT TRENCH SVE-1, 28 OCTOBER 1993
NAVY EXCHANGE SERVICE STATION
NAVAL AIR STATION, BRUNSWICK, MAINE

Location	Benzene	Toluene	Ethylbenzene	Total Xylenes	Total BTEX	Total Volatile Hydrocarbons
Blank	<0.1	<0.1	<0.1	<0.1	ND	33.0
VP-9	18.4	34.7	5.5	55.2	113.8	1,900
VP-AAS-1-30	<0.1	<0.1	<0.1	<0.1	ND	43
VP-AAS-1-30DUP	<0.1	<0.1	<0.1	<0.1	ND	16
VP-AAS-1-20	<0.1	<0.1	<0.1	<0.1	ND	4.5
VP-AAS-1-15	<0.1	<0.1	<0.1	<0.1	ND	14
VP-AAS-1-10	<0.1	<0.1	<0.1	<0.1	ND	6
Influent (Step 1)	12.4	56.8	<0.1	32.7	101.9	1,800
Influent (Step 1)	23.1	58.8	<0.1	57.7	139.6	2,500
Effluent (Step 1)	<0.1	<0.1	<0.1	<0.1	ND	4.3
Influent (Step 1)	29.7	69.5	<0.1	97.9	197.1	2,700
Influent (Step 2)	15.8	16.5	<0.1	49.9	82.2	1,300
Influent (Step 2)	23.1	67.9	<0.1	84.6	175.6	1,800
Influent (Step 3)	30.3	67.7	<0.1	108	206	2,200
Influent (Step 3)	57	128	<0.1	116	301	3,500
Blank	<0.1	<0.1	<0.1	<0.1	ND	1.0

NOTE: ND = Not detected.
Results in parts per million by volume (ppm_v).
BTEX summation excludes unquantified compounds.
Total volatile hydrocarbons are the sum of the BTEX compound concentrations and unquantified compounds ("benzene equivalents" and "xylene equivalent") (Section 3.1.2).

TABLE 4-6 SUMMARY OF PILOT TEST DATA RECORDED DURING PERFORMANCE OF SVE/AAS OPERATIONS AT THE NAVY EXCHANGE SERVICE STATION, NAVAL AIR STATION, BRUNSWICK, MAINE 15 NOVEMBER 1993 - 22 JUNE 1994

Sample Date	Total Hydrocarbons (ppm_v)[a]	Vacuum at Pilot Plant (in. H_2O)[b]	Vacuum at Trench (in. H_2O)	Daily Total Volatile Hydrocarbon Removal Rate (lb/day)[c][d]
SVE-1				
16 NOV 93	70.0	9.8	7.0	1.86
19 NOV 93	20.0	12.0	9.5	0.53
22 NOV 93	13.2	13.5	10.0	0.35
24 NOV 93	19.0	13.0	9.0	0.50
30 NOV 93	8.6	14.0	9.5	0.23
03 DEC 93	11.1	14.5	9.0	0.30
07 DEC 93	10.6	15.0	11.0	0.28
10 DEC 93	2.4	---	10.0	0.06
13 DEC 93	1.8	15.5	10.0	0.05
16 DEC 93	2.70	15.0	10.0	0.07
22 DEC 93	0.35	21.0	10.0	0.01
29 DEC 93	1.22	16.0	7.0	0.03
17 JAN 94	2.80	14.0	8.5	0.07
16 FEB 94	4.60	33.5	---	0.10
16 MAR 94	---	---	---	---
26 MAR 94	---	---	---	---

(a) Based on measurements taken with photoionization detector (PID). PID measurement considered a conservative approximation of total hydrocarbon concentrations at sample location due to instrument response limitations.

(b) Composite influent vacuum measurement considered equal to system effluent pressure measurement. Data for system effluent is in. H_2O pressure.

(c) Loading rate calculated using formula provided by EPA (1989):

$$ER = Q * C * MW * 1.58x10^{-7} * 24$$

where

ER = Emissions rate (lb/day)
Q = Flow rate (cfm)
C = Total hydrocarbon concentration in influent (ppm_v)
MW = Molecular weight (average) of vapor phase weathered gasoline (92.14 lb/lb-mole).

(d) Total hydrocarbon emissions rate (lb/day) for SVE composite effluent.

NOTE: Dashes (---) = No data; NA = Not applicable.

Sample Date	Total Hydrocarbons (ppm_v)[a]	Vacuum at Pilot Plant (in. H_2O)[b]	Vacuum at Trench (in. H_2O)	Daily Total Volatile Hydrocarbon Removal Rate (lb/day)[c][d]
SVE-1 (Continued)				
12 APR 94	---	---	---	---
20 APR 94	3.5	13.0	10.0	0.11
02 MAY 94	2.2	14.0	12	0.05
03 MAY 94	0.4	14.0	13.0	0.01
04 MAY 94	322.0	15.0	15.0	9.56
10 MAY 94	19.3	18.0	---	0.59
11 MAY 94	14.4	17.0	---	0.45
18 MAY 94	0.8	17.0	---	0.02
25 MAY 94	2.9	18.0	---	0.08
07 JUN 94	0.8	17.0	---	0.02
08 JUN 94	4.2	15.0	---	0.10
22 JUN 94	2.6	13.0	---	0.06
SVE-2[e]				
16 NOV 93	180.0	10.0	9.0	6.48
19 NOV 93	173.0	12.0	10.3	6.23
22 NOV 93	170.0	15.0	10.5	6.12
24 NOV 93	171.0	12.5	10.0	6.16
30 NOV 93	162.0	14.0	9.5	5.83
03 DEC 93	143.0	14.0	10.5	5.15
07 DEC 93	122.0	15.0	11.0	4.39
10 DEC 93	111.0	---	11.0	4.00
13 DEC 93	89.0	17.0	12.0	3.20
16 DEC 93	83.0	17.0	15.0	2.97
22 DEC 93	64.0	21.0	20.0	2.30
29 DEC 93	51.0	15.0	15.0	1.84
17 JAN 94	60.0	14.0	14.0	2.16
16 FEB 94	---	---	---	---
16 MAR 94	---	---	---	---
26 MAR 94	---	---	---	---
12 APR 94	---	---	---	---
20 APR 94	36.0	14.0	10.5	1.13
02 MAY 94	26.0	14.0	13.0	0.79
03 MAY 94	14.0	15.0	13.0	0.45
04 MAY 94	298.0	14.0	14.0	10.10
10 MAY 94	56.8	18.0	---	2.30

(e) A total of 3 in. H_2O vacuum subtracted from vacuum gauge data taken at trench due to high gauge response.

Sample Date	Total Hydrocarbons (ppm_v)[a]	Vacuum at Pilot Plant (in. H_2O)[b]	Vacuum at Trench (in. H_2O)	Daily Total Volatile Hydrocarbon Removal Rate (lb/day)[c][d]
SVE-2[e] (Continued)				
11 MAY 94	46.1	17.5	---	1.82
18 MAY 94	10.9	17.0	---	0.42
25 MAY 94	3.1	18.0	---	0.12
07 JUN 94	39.2	17.0	---	1.70
08 JUN 94	33.7	14.0	---	1.12
22 JUN 94	48.0	12.0	---	1.43
SVE-3				
16 NOV 93	82.0	10.0	8.5	2.29
19 NOV 93	161.0	11.5	10.0	4.50
22 NOV 93	128.0	13.5	11.0	3.58
24 NOV 93	134.0	13.5	10.5	3.75
30 NOV 93	112.0	14.0	13.5	3.13
03 DEC 93	102.0	15.0	11.0	2.85
07 DEC 93	100.0	15.0	12.0	2.80
10 DEC 93	70.0	---	10.5	1.96
13 DEC 93	62.0	16.0	12.0	1.73
16 DEC 93	52.0	16.0	13.0	1.45
22 DEC 93	51.0	21.5	17.0	1.42
29 DEC 93	25.0	17.0	13.0	0.70
17 JAN 94	27.0	15.0	12.0	0.75
16 FEB 94	20.0	34.0	---	0.27
16 MAR 94	---	---	---	---
26 MAR 94	---	---	---	---
12 APR 94	---	---	---	---
20 APR 94	5.80	13.0	10.0	0.14
02 MAY 94	6.7	14.0	13.0	0.17
03 MAY 94	3.9	14.0	14.0	0.10
04 MAY 94	309.0	14.0	15.0	7.88
10 MAY 94	40.2	18.0	---	1.05
11 MAY 94	32.7	17.0	---	0.87
18 MAY 94	16.6	17.0	---	0.40
25 MAY 94	5.6	17.0	---	0.12
07 JUN 94	1.9	16.5	---	0.04
08 JUN 94	5.1	15.0	---	0.09
22 JUN 94	10.0	13.0	---	0.21

Sample Date	Total Hydrocarbons (ppm_v)[a]	Vacuum at Pilot Plant (in. H_2O)[b]	Vacuum at Trench (in. H_2O)	Daily Total Volatile Hydrocarbon Removal Rate (lb/day)[c][d]
SVE-4				
16 NOV 93	70.0	11.8	6.0	2.69
19 NOV 93	68.0	13.5	6.5	2.61
22 NOV 93	53.0	15.0	7.0	2.04
24 NOV 93	59.0	15.0	6.0	2.27
30 NOV 93	65.0	16.0	6.0	2.50
03 DEC 93	49.0	15.0	5.0	1.88
07 DEC 93	37.0	17.0	7.0	1.42
10 DEC 93	38.0	---	7.0	1.46
13 DEC 93	27.0	16.0	8.0	1.04
16 DEC 93	27.0	16.0	8.0	1.04
22 DEC 93	20.0	21.0	11.0	0.77
29 DEC 93	28.0	18.0	11.0	1.08
17 JAN 94	30.0	16.0	11.0	1.15
16 FEB 94	---	---	---	---
16 MAR 94	---	---	---	---
26 MAR 94	---	---	---	---
12 APR 94	4.2	32.0	---	---
20 APR 94	7.2	15.0	7.0	0.25
02 MAY 94	16.5	16.0	8.0	0.61
03 MAY 94	8.7	17.0	9.0	0.32
04 MAY 94	17.0	17.0	10.0	0.62
10 MAY 94	17.7	21.0	---	0.74
11 MAY 94	10.9	20.0	---	0.48
18 MAY 94	3.7	20.0	---	0.16
25 MAY 94	11.3	20.0	---	0.49
07 JUN 94	14.7	17.0	---	0.55
08 JUN 94	22.3	14.5	---	0.63
22 JUN 94	23.0	15.0	---	0.74
SVE-5				
16 NOV 93	7.0	12.5	5.0	0.24
19 NOV 93	13.4	15.0	7.0	0.46
22 NOV 93	12.1	16.0	7.0	0.41
24 NOV 93	7.8	16.0	6.0	0.27
30 NOV 93	17.4	17.0	6.0	0.60
03 DEC 93	7.6	17.5	5.5	0.26
07 DEC 93	4.0	18.0	7.5	0.14

Sample Date	Total Hydrocarbons (ppm_v)[a]	Vacuum at Pilot Plant (in. H_2O)[b]	Vacuum at Trench (in. H_2O)	Daily Total Volatile Hydrocarbon Removal Rate (lb/day)[c][d]
SVE-5 (Continued)				
10 DEC 93	6.5	---	6.0	0.22
13 DEC 93	2.2	18.0	8.5	0.07
16 DEC 93	1.2	18.0	8.0	0.04
22 DEC 93	1.4	23.0	12.0	0.05
29 DEC 93	0.0	19.0	7.0	0.00
17 JAN 94	0.7	17.0	7.0	0.02
16 FEB 94	---	---	---	---
16 MAR 94	---	---	---	---
26 MAR 94	---	---	---	---
12 APR 94	---	---	---	---
20 APR 94	---	---	---	---
02 MAY 94	---	---	---	---
03 MAY 94	---	---	---	---
04 MAY 94	---	---	---	---
10 MAY 94	---	---	---	---
11 MAY 94	---	---	---	---
18 MAY 94	---	---	---	---
25 MAY 94	---	---	---	---
07 JUN 94	2.4	16.0	---	0.06
08 JUN 94	3.3	14.5	---	0.11
22 JUN 94	2.1	13.0	---	0.06
SVE COMPOSITE EFFLUENT				
15 NOV 93	12.0	60.0	NA	2.0
16 NOV 93	---	63.0	NA	---
19 NOV 93	86.0	66.0	NA	14.0
22 NOV 93	80.0	66.5	NA	13.1
24 NOV 93	69.0	64.0	NA	11.3
30 NOV 93	72.0	66.0	NA	11.7
03 DEC 93	53.0	64.0	NA	8.7
07 DEC 93	53.0	67.5	NA	8.7
10 DEC 93	42.0	67.0	NA	6.9
13 DEC 93	46.0	68.0	NA	7.5
16 DEC 93	34.0	68.0	NA	5.58
22 DEC 93	48.0	70.0	NA	7.88
29 DEC 93	33.0	72.0	NA	5.42
17 JAN 94	26.0	60.0	NA	3.86

Sample Date	Total Hydrocarbons (ppm_v)[a]	Vacuum at Pilot Plant (in. H_2O)[b]	Vacuum at Trench (in. H_2O)	Daily Total Volatile Hydrocarbon Removal Rate (lb/day)[c][d]
SVE COMPOSITE EFFLUENT (Continued)				
16 FEB 94	---	---	---	---
16 MAR 94	---	---	---	---
26 MAR 94	---	---	---	---
12 APR 94	0.04	40.0	NA	---
20 APR 94	1.0	50.0	NA	0.16
02 MAY 94	1.5	53.0	NA	0.24
03 MAY 94	1.4	57.0	NA	0.23
04 MAY 94	59.9	68.0	NA	9.31
10 MAY 94	25.3	66.0	NA	4.16
11 MAY 94	15.9	69.0	NA	2.57
18 MAY 94	5.3	70.0	NA	0.86
25 MAY 94	5.2	68.0	NA	0.84
07 JUN 94	1.4	70.0	NA	0.23
08 JUN 94	7.1	---	NA	1.15
22 JUN 94	17.4	65.0	NA	2.81

TABLE 4-7 SUMMARY OF AQUIFER AIR SPARGING WELL AND MONITORING WELL GAUGING AND WATER QUALITY MONITORING NAVY EXCHANGE SERVICE STATION NAVAL AIR STATION, BRUNSWICK, MAINE

Date	Top of PVC Elevation (ft)	Depth to Water (ft)	Water Table Elevation (ft)	pH	Temperature (°F)	Dissolved Oxygen (mg/L)	Conductivity (μmhos/cm)	LNAPL Thickness (ft)
AAS-1								
26 SEP 1993	66.99	8.15	58.84	5.66	59.86	9.36	184	ND
28 SEP 1993	66.99	8.10	58.89	5.95	57.52	2.93	182	ND
02 MAY 1994	66.99	7.11	59.88	6.80	50.00	5.20	—	ND
03 MAY 1994	66.99	—	—	—	—	5.20	—	ND
11 MAY 1994	66.99	6.93	60.06	5.41	50.40	(a)	263	ND
18 MAY 1993	66.99	6.90	60.09	5.47	51.30	8.08	408	ND
25 MAY 1993	66.99	6.99	60.00	5.49	52.20	(a)	608	ND
07 JUN 1994	66.99	7.28	59.71	5.43	58.20	(a)	483	ND
22 JUN 1994	66.99	7.44	59.55	5.38	56.30	(a)	471	ND
AAS-2								
26 SEP 1993	65.66	7.28	58.38	5.91	59.77	9.62	642	0.01
28 SEP 1993	65.66	7.14	58.52	6.17	59.65	3.13	641	0.03
02 MAY 1994	65.66	6.25	59.41	6.90	44.78	1.30	—	≤0.01
03 MAY 1994	65.66	—	—	—	48.38	1.40	—	—
11 MAY 1994	65.66	6.23	59.43	5.99	49.10	(a)	891	ND
18 MAY 1994	65.66	6.09	59.57	6.12	48.9	1.30	928	ND
25 MAY 1994	65.66	6.18	59.48	6.10	49.0	3.70	1,012	ND
07 JUN 1994	65.66	6.37	59.29	6.09	53.0	6.03	758	ND
22 JUN 1994	65.66	6.53	59.13	6.01	52.1	6.00	763	ND

(a) Indicates dissolved oxygen measurement near or at saturation. Measurements may not be valid.

NOTE: ND = Non-detect; Dashes (—) = No data due to insufficient water volume in well equipment failure, or presence of LNAPL in well. SVE pilot plant activated on 15 November 1993, AAS activated on 3 May 1994 (AAS-1, AAS-2, AAS-3, and AAS-5 only). AAS pilot plant shut off on 7 June 1994.

Date	Top of PVC Elevation (ft)	Depth to Water (ft)	Water Table Elevation (ft)	pH	Temperature (°F)	Dissolved Oxygen (mg/L)	Conductivity (μmhos/cm)	LNAPL Thickness (ft)
AAS-3R								
02 MAY 1994	66.63	7.51	59.12	6.60	42.08	0.80	—	ND
03 MAY 1994	66.63	—	—	—	47.30	1.20	—	ND
11 MAY 1994	66.63	7.36	59.27	5.97	48.40	(a)	1,119	ND
18 MAY 1994	66.63	7.35	59.28	6.08	47.80	3.86	1,112	ND
25 MAY 1994	66.63	7.41	59.22	6.09	47.70	4.82	1,120	ND
07 JUN 1994	66.63	7.63	59.00	—	—	—	—	≤0.01
22 JUN 1994	66.63	7.79	58.84	—	—	—	—	≤0.01
AAS-4R								
02 MAY 1994	67.17	7.11	60.06	6.90	41.72	7.80	—	ND
03 MAY 1994	67.17	—	—	—	46.22	7.40	—	ND
04 MAY 1994	67.17	7.30	59.87	6.60	46.40	6.20	—	ND
11 MAY 1994	67.17	6.85	60.32	5.85	45.20	(a)	—	ND
18 MAY 1994	67.17	6.98	60.19	6.01	46.80	(a)	1,028	ND
25 MAY 1994	67.17	6.84	60.33	6.12	47.10	(a)	1,032	ND
07 JUN 1994	67.17	7.39	59.78	5.89	52.0	(a)	1,085	ND
22 JUN 1994	67.17	7.55	59.62	5.73	51.6	(a)	1,103	ND
AAS-5								
26 SEP 1993	67.06	7.38	59.68	6.18	57.76	6.85	935	ND
28 SEP 1993	67.06	7.33	59.73	6.44	57.25	1.57	936	ND
02 MAY 1994	67.06	7.78	59.28	6.50	41.90	2.60	—	ND
03 MAY 1994	67.06	—	—	—	46.40	1.40	—	ND
11 MAY 1994	67.06	7.69	59.37	5.87	49.10	(a)	1,080	ND
18 MAY 1994	67.06	7.61	59.45	5.93	48.40	3.04	886	ND
25 MAY 1994	67.06	7.67	59.39	5.93	48.80	3.80	892	ND
07 JUN 1994	67.06	7.92	59.14	—	—	—	—	0.01
22 JUN 1994	67.06	8.08	58.98	—	—	—	—	0.01

Date	Top of PVC Elevation (ft)	Depth to Water (ft)	Water Table Elevation (ft)	pH	Temperature (°F)	Dissolved Oxygen (mg/L)	Conductivity (μmhos/cm)	LNAPL Thickness (ft)
AAS-6								
26 SEP 1993	65.33	7.60	57.73	6.55	56.95	2.65	411	ND
28 SEP 1993	65.33	7.53	57.80	6.59	57.45	1.72	661	ND
02 MAY 1994	65.33	6.91	58.42	6.90	42.08	1.20	—	ND
04 MAY 1994	65.33	6.93	58.40	6.60	48.38	5.70	—	ND
11 MAY 1994	65.33	6.74	58.59	5.98	46.00	(a)	538	ND
18 MAY 1994	65.33	6.83	58.50	6.12	47.0	9.38	563	ND
25 MAY 1994	65.33	6.90	58.43	6.18	47.1	9.42	568	ND
07 JUN 1994	65.33	6.99	58.34	6.30	49.6	8.75	1,120	ND
22 JUN 1994	65.33	7.08	58.25	6.21	49.3	8.21	1,192	ND
AAS-7								
26 SEP 1993	65.21	7.26	57.95	5.60	55.85	9.26	1,050	0.02
28 SEP 1993	65.21	7.30	57.91	5.71	56.34	1.55	1,148	0.01
02 MAY 1994	65.21	6.53	58.68	6.80	41.90	1.20	—	ND
04 MAY 1994	65.21	6.55	58.66	6.60	47.84	1.20	—	ND
11 MAY 1994	65.21	6.29	58.92	5.44	45.50	5.73	292	ND
18 MAY 1994	65.21	6.53	58.68	5.68	46.20	1.84	327	ND
25 MAY 1994	65.21	6.59	58.62	5.62	46.80	1.92	362	ND
07 JUN 1994	65.21	6.65	58.56	—	—	—	—	≤0.01
22 JUN 1994	65.21	6.75	58.46	—	—	—	—	≤0.01
AAS-8								
26 SEP 1993	65.65	7.56	58.09	6.51	51.30	1.51	100	ND
28 SEP 1993	65.65	7.50	58.15	—	—	—	—	ND
02 MAY 1994	65.65	6.36	59.29	7.0	41.54	8.30	—	ND
04 MAY 1994	65.65	6.33	59.32	6.70	46.04	6.60	—	ND
11 MAY 1994	65.65	5.95	59.70	5.78	45.40	(a)	175	ND
18 MAY 1994	65.65	6.23	59.42	5.68	45.8	(a)	169	ND
25 MAY 1994	65.65	6.29	59.36	5.72	46.10	(a)	165	ND
07 JUN 1994	65.65	6.62	59.03	5.54	50.0	(a)	274	ND
22 JUN 1994	65.65	6.77	58.88	5.30	49.6	(a)	263	ND

Date	Top of PVC Elevation (ft)	Depth to Water (ft)	Water Table Elevation (ft)	pH	Temperature (°F)	Dissolved Oxygen (mg/L)	Conductivity (μmhos/cm)	LNAPL Thickness (ft)
AAS-9								
26 SEP 1993	65.98	DRY	—	—	—	—	—	—
28 SEP 1993	65.98	DRY	—	—	—	—	—	—
02 MAY 1994	65.98	6.00	59.98	—	41.36	3.80	—	ND
04 MAY 1994	65.98	6.01	59.97	—	46.04	5.80	—	ND
11 MAY 1994	65.98	5.44	60.54	6.02	45.20	7.18	434	ND
18 MAY 1994	65.98	5.85	60.13	—	—	—	—	ND
25 MAY 1994	65.98	5.91	60.07	—	—	—	—	ND
07 JUN 1994	65.98	DRY	—	—	—	—	—	—
22 JUN 1994	65.98	DRY	—	—	—	—	—	—
AAS-10								
26 SEP 1993	66.26	DRY	—	—	—	—	—	—
28 SEP 1993	66.26	DRY	—	—	—	—	—	—
02 MAY 1994	66.26	5.75	60.51	—	41.54	6.60	—	ND
04 MAY 1994	66.26	5.83	60.43	6.60	46.40	6.10	—	ND
11 MAY 1994	66.26	5.28	60.98	6.09	45.90	(a)	376	ND
18 MAY 1994	66.26	5.62	60.64	5.99	47.0	(a)	341	ND
25 MAY 1994	66.26	5.68	60.58	5.87	47.2	(a)	353	ND
07 JUN 1994	66.26	6.19	60.07	6.06	50.9	7.45	378	ND
22 JUN 1994	66.26	6.46	59.80	6.01	49.3	7.02	350	ND
MW-1R								
13 JUL 1993	67.29	7.64	59.65	6.29	64.4	—	160	ND
12 APR 1994	67.29	6.30	60.99	5.23	50.68	—	223	ND
02 MAY 1994	67.29	7.15	60.14	7.00	50.00	7.80	—	ND
03 MAY 1994	67.29	—	—	—	53.78	4.90	—	ND
04 MAY 1994	67.29	7.20	60.09	6.70	53.60	3.40	—	ND
05 MAY 1994	67.29	6.90	60.39	5.23	50.54	(a)	210	ND
11 MAY 1994	67.29	6.93	60.36	5.45	54.30	(a)	233	ND
18 MAY 1994	67.29	7.04	60.25	5.76	52.80	(a)	239	ND
25 MAY 1994	67.29	7.11	60.18	5.72	51.0	(a)	245	ND
07 JUN 1994	67.29	7.35	59.94	5.23	54.4	(a)	471	ND
22 JUN 1994	67.29	7.54	59.75	5.16	52.3	(a)	403	ND
08 JUL 1994	67.29	7.77	59.52	6.49	62.6	—	280	ND

Date	Top of PVC Elevation (ft)	Depth to Water (ft)	Water Table Elevation (ft)	pH	Temperature (°F)	Dissolved Oxygen (mg/L)	Conductivity (μmhos/cm)	LNAPL Thickness (ft)
MW-2								
13 JUL 1993	65.31	6.58	58.73	7.60	62.60	—	190	ND
26 SEP 1993	65.31	7.04	58.27	6.97	54.23	(a)	305	ND
28 SEP 1993	65.31	6.97	58.34	7.05	53.60	1.40	299	ND
12 APR 1994	65.31	5.20	60.11	5.81	46.72	—	118	ND
02 MAY 1994	65.31	5.60	59.71	6.60	41.72	1.60	—	ND
04 MAY 1994	65.31	5.60	59.71	6.80	46.76	0.70	—	ND
05 MAY 1994	65.31	4.85	60.46	5.78	45.32	2.14	154	ND
11 MAY 1994	65.31	4.75	60.56	5.85	45.20	(a)	377	ND
18 MAY 1994	65.31	5.36	59.95	5.73	45.40	3.38	156	ND
25 MAY 1994	65.31	5.42	59.89	5.71	47.6	4.02	158.0	ND
07 JUN 1994	65.31	5.98	59.33	5.51	47.6	3.90	146.6	ND
22 JUN 1994	65.31	6.24	59.07	5.63	48.3	4.36	141.2	ND
08 JUL 1994	65.31	6.36	58.95	7.34	54.5	—	320	ND
MW-3								
13 JUL 1993	64.34	6.87	57.47	7.12	69.80	—	390	ND
26 SEP 1993	64.34	7.15	57.19	6.22	55.62	0.62	503	ND
28 SEP 1993	64.34	—	—	6.31	55.44	1.45	497	ND
12 APR 1994	64.34	6.66	57.68	6.01	45.01	—	166	ND
02 MAY 1994	64.34	6.70	57.64	—	42.08	4.20	—	ND
04 MAY 1994	64.34	6.70	57.64	6.70	46.76	5.20	—	ND
05 MAY 1994	64.34	6.41	57.93	5.82	47.44	5.64	311	ND
11 MAY 1994	64.34	6.47	57.87	5.90	46.70	(a)	307	ND
18 MAY 1994	64.34	6.63	57.71	5.97	47.10	4.75	295	ND
25 MAY 1994	64.34	6.69	57.65	5.92	48.4	5.01	291	ND
07 JUN 1994	64.34	6.78	57.56	6.03	49.30	0.88	320	ND
22 JUN 1994	64.34	6.89	57.45	5.98	49.9	0.93	363	ND
08 JUL 1994	64.34	6.98	57.36	7.04	57.20	—	280	ND

Date	Top of PVC Elevation (ft)	Depth to Water (ft)	Water Table Elevation (ft)	pH	Temperature (°F)	Dissolved Oxygen (mg/L)	Conductivity (μmhos/cm)	LNAPL Thickness (ft)
MW-4R								
13 JUL 1993	66.61	7.42	59.19	6.75	68	—	1,800	ND
12 APR 1994	66.61	6.50	60.11	6.19	44.35	—	503	ND
02 MAY 1994	66.61	6.76	59.85	6.70	42.08	0.80	—	ND
03 MAY 1994	66.61	—	—	—	48.20	1.10	—	ND
04 MAY 1994	66.61	6.82	59.79	6.60	48.02	0.80	—	ND
05 MAY 1994	66.61	6.50	60.11	6.07	50.00	1.26	370	ND
11 MAY 1994	66.61	6.54	60.07	5.99	48.60	3.92	271	ND
18 MAY 1994	66.61	6.60	60.01	6.05	48.20	3.95	633	ND
25 MAY 1994	66.61	6.65	59.96	6.01	48.10	4.01	612	ND
07 JUN 1994	66.61	6.94	59.67	6.01	50.30	3.00	903	ND
22 JUN 1994	66.61	7.51	59.10	6.00	51.6	3.32	873	≤0.01
08 JUL 1994	66.61	7.54	59.07	6.98	62.6	—	600	ND
MW-5								
13 JUL 1993	60.50	3.28	57.22	7.90	64.4	—	210	—
26 SEP 1993	60.50	3.46	57.04	6.90	56.25	4.74	204	—
28 SEP 1993	60.50	—	—	7.11	54.75	0.93	282	ND
12 APR 1994	60.50	2.35	58.15	5.98	43.95	—	89	ND
02 MAY 1994	60.50	2.44	58.06	—	41.90	8.0	—	ND
04 MAY 1994	60.50	2.60	57.90	6.60	46.76	4.5	—	ND
05 MAY 1994	60.50	1.81	58.69	5.51	48.78	(a)	604	ND
11 MAY 1994	60.50	2.00	58.50	5.60	47.00	(a)	600	ND
18 MAY 1994	60.50	2.24	58.26	5.66	49.20	(a)	78.0	ND
25 MAY 1994	60.50	3.01	57.49	5.62	49.1	(a)	89.0	ND
07 JUN 1994	60.50	3.03	57.47	5.75	53.6	(a)	65.8	ND
22 JUN 1994	60.50	3.17	57.33	5.73	51.2	(a)	63.10	—
08 JUL 1994	60.50	3.50	57.00	7.76	54.5	—	150	—

TABLE 4-8 SUMMARY OF AIR INJECTION AND SOIL VAPOR EXTRACTION RATES DURING SVE/AAS PILOT PLANT OPERATIONS
NAVY EXCHANGE SERVICE STATION
NAVAL AIR STATION, BRUNSWICK, MAINE

Monitoring Date	AAS-1	AAS-2	AAS-3	AAS-5	AAS Combined	SVE Removal Rate	SVE:AAS Ratio
4 MAY 1994	36	35	32	24	127	346	2.7:1
11 MAY 1994	39	54	38	52	183	406	2.2:1
18 MAY 1994	39	48	54	17	158	385	2.4:1
25 MAY 1994	38	48	49	17	152	371	2.4:1

NOTE: Measurements in cfm.
No measurements taken prior to AAS pilot plant deactivation on 7 June 1994.

TABLE 4-9 SUMMARY OF ANALYTICAL RESULTS FOR SOIL SAMPLES COLLECTED 21-24 MARCH 1994 AT THE NAVY EXCHANGE SERVICE STATION, NAVAL AIR STATION, BRUNSWICK, MAINE

Parameter	Sample Location					
	MW-1R	MW-4R	AAS-3R	AAS-4R	Field Blank	Trip Blank
TPH AS GASOLINE BY MEDEP METHOD 4.2.3 (mg/kg dry soil)						
Gasoline	(U < 0.5)	2,500	263	(U < 0.5)	(U < 0.5)	---
TPH AS FUEL OIL BY MEDEP METHOD 4.1.2 (mg/kg dry soil)						
Kerosene	(U < 20.0)	(U < 20.0)	(U < 20.0)	(U < 20.0)	---[a]	---
Fuel Oil No. 2	120[b]	(U < 20.0)	(U < 20.0)	89[c][b]	---[a]	---
VOLATILE AROMATICS BY EPA METHOD 8020 (μg/kg dry soil)						
Benzene	(U < 1.0)	26,000	(U < 1.0)	(U < 1.0)	(U < 1.0)	(U < 1.0)
Chlorobenzene	(U < 1.0)	(U < 1.0)	(U < 1.0)	(U < 1.0)	(U < 1.0)	(U < 1.0)
1,2-Dichlorobenzene	(U < 1.0)	(U < 1.0)	(U < 1.0)	(U < 1.0)	(U < 1.0)	(U < 1.0)
1,3-Dichlorobenzene	(U < 1.0)	(U < 1.0)	(U < 1.0)	(U < 1.0)	(U < 1.0)	(U < 1.0)
1,4-Dichlorobenzene	(U < 1.0)	(U < 1.0)	(U < 1.0)	(U < 1.0)	(U < 1.0)	(U < 1.0)
Ethylbenzene	(U < 1.0)	76,000	7,900	(U < 1.0)	(U < 1.0)	(U < 1.0)
Toluene	(U < 1.0)	53,000	3,700	(U < 1.0)	(U < 1.0)	(U < 1.0)
Total Xylenes	(U < 1.0)	680,000	84,000	(U < 1.0)	(U < 1.0)	(U < 1.0)
Total BTEX	ND	835,000	95,600	ND	ND	ND
MTBE	(U < 1.0)	(U < 1.0)	(U < 1.0)	(U < 1.0)	(U < 1.0)	(U < 1.0)

(a) Sample broken during transport; no analyses performed.
(b) Dissimilar GC fingerprint than fuel oil. Result designation based on elution range.
(c) Sample duplicate analysis = 91 mg/kg.

NOTE: (U < ___) = Compound not detected above method detection limit shown.
ND = Not detected.
MEDEP = State of Maine Department of Environmental Protection.
Dashes (---) = Parameter not analyzed.

TABLE 4-10 SUMMARY OF ANALYTICAL RESULTS FOR SOIL SAMPLES COLLECTED PRIOR TO AND DURING SOIL VAPOR EXTRACTION PILOT TESTING NAVY EXCHANGE SERVICE STATION NAVAL AIR STATION, BRUNSWICK, MAINE

	Sample Locations			
	MW-1(R)		MW-4(R)	
	9-10.5 ft	2-4 ft	7-8.5 ft	8-10 ft
Parameter	Pre-SVE	Active SVE	Pre-SVE	Active SVE
TPH as Gasoline by MEDEP Method 4.2.3 (mg/Kg dry soil)				
Gasoline	6	(U<0.5)	31,000	2,500
TPH as Fuel Oil by MEDEP Method 4.1.2 (mg/Kg dry soil)				
Fuel Oil No. 2	10	120[a]	4,800	(U<20.0)
Volatile Aromatics by EPA Method 8020 (µg/Kg dry soil)				
Benzene	1.3	(U<1.0)	5,300	26,000
Ethylbenzene	1.3	(U<1.0)	340,000	76,000
Toluene	1.3	(U<1.0)	640,000	53,000
Total xylenes	2.6	(U<1.0)	1,800,000	680,000
Total BTEX	6.5	ND	2,785,300	835,000
Methyl tertiary-butyl ether	2.6	(U<1.0)	7,300	(U<1.0)

(a) Dissimilar GC fingerprint than fuel oil. Result designation based on elution range.

NOTE: Pre-SVE soil samples collected 14 May 1992; active SVE soil samples collected 21-24 March 1994.
(U<__) = Compound not detected above method detection limit shown.
MEDEP = State of Maine Department of Environmental Protection.
ND = Not detected.

TABLE 4-11 SUMMARY OF ANALYTICAL RESULTS FOR GROUND-WATER SAMPLES COLLECTED FROM 20 MAY 1992 TO 7-8 JULY 1994 AT THE NAVY EXCHANGE SERVICE STATION, NAVAL AIR STATION, BRUNSWICK, MAINE

Date	Parameters							
	Benzene	Toluene	Ethylbenzene	Total Xylenes	Total BTEX	MTBE	TPH as Gasoline	TPH as Fuel Oil
MW-1R								
20 MAY 1992	(U<1.0)	(U<1.0)	(U<1.0)	(U<2.0)	ND	(U<2.0)	(U<20.0)	(U<10.0))
13 JUL 1993	(U<1.0)	(U<1.0)	(U<1.0)	(U<1.0)	ND	(U<1.0)	(U<100.0)	(U<500.0)
12-13 APR 1994	(U<1.0)	(U<1.0)	(U<1.0)	(U<1.0)	ND	(U<1.0)	(U<100.0)	(U<50.0)
7-8 JUL 1994	(U<1.0)	(U<1.0)	(U<1.0)	(U<1.0)	ND	(U<1.0)	(U<50.0)	(U<50.0)
MW-2								
20 MAY 1992	(U<1.0)	1.1	(U<1.0)	4.2	5.3	(U<2.0)	35.0	460.0
13 JUL 1993	(U<1.0)	(U<1.0)	(U<1.0)	(U<1.0)	ND	(U<1.0)	(U<100.0)	(U<500.0)
12-13 APR 1994	(U<1.0)	(U<1.0)	(U<1.0)	(U<1.0)	ND	(U<1.0)	(U<100.0)	99.0
7-8 JUL 1994	(U<1.0)	(U<1.0)	(U<1.0)	(U<1.0)	ND	(U<1.0)	(U<50.0)	280[a]
MW-3								
20 MAY 1992	14.0	18.0	4.8	23.0	59.8	2.5	(U<20.0)	61.0
13 JUL 1993	2.0	(U<1.0)	(U<1.0)	(U<1.0)	2.0	2.0	(U<100.0)	(U<500.0)
12-13 APR 1994	(U<1.0)	(U<1.0)	(U<1.0)	(U<1.0)	ND	(U<1.0)	(U<100.0)	100.0
7-8 JUL 1994	2.1	3.0	(U<1.0)	2.3	7.4	3.2	51.0	110.0[a]
MW-4(R)								
20 MAY 1992	1,000	12,000	3,900	22,000	38,900	(U<2,000)	210,000	84,000
13 JUL 1993	810.0	5,900	110.0	690.0	7,510	(U<100.0)	24,000	15,000
12-13 APR 1994	47.0	4,200	2,000	16,700	22,947	210.0	3,500	85,000
7-8 JUL 1994	21	4,300D	2,900D	24,800D	38,031	81	80,000	13,000
MW-5								
20 MAY 1992	(U<1.0)	(U<1.0)	(U<1.0)	(U<2.0)	ND	5.9	56.0	300
13 JUL 1993	(U<1.0)	(U<1.0)	(U<1.0)	(U<1.0)	ND	(U<1.0)	(U<100.0)	(U<500.0)
12-13 APR 1994	(U<1.0)	(U<1.0)	(U<1.0)	(U<1.0)	ND	(U<1.0)	(U<100.0)	53
7-8 JUL 1994	(U<1.0)	(U<1.0)	(U<1.0)	(U<1.0)	ND	(U<1.0)	(U<50)	150[a]

(a) Sample did not have chromatagraphic fingerprint indicative of petroleum product. The fingerprint was indicative of high average molecular weight interferences. However, since the interference was in the elution range (boiling point)of fuel oil, it was quantified against fuel oil (per the method).

NOTE: (U<__) = Compound not detected above method detection limit shown.
ND = Not detected.
D = Analysis run at secondary dilution factor.
Trip blanks for all four rounds "non-detect" for all EPA Method 602 Analytes (BTEX and MTBE).

5. SUMMARY AND CONCLUSIONS

This technical report provides an evaluation of the data generated as a result of the long-term operation of an SVE/AAS pilot plant at the NEX service station. The primary objective of the test was to provide an assessment of the capability of these *in situ* remedial technologies in removing sorbed, trapped, and dissolved-phase hydrocarbons from the subsurface. A corollary objective of the tests was to obtain system performance data which may be used to enhance system design, if necessary.

5.1 SITE HYDROGEOLOGY

Shallow site stratigraphy consists of approximately 4-16 ft of fine to medium sands with varying amounts of silt overlying a silty marine clay. Through SVE pilot tests, the average soil permeability to air for the fine to medium sands was calculated at 1.35×10^{-7} cm^2, which is greater than minimum permeability criteria of 1.0×10^{-10} cm^2 defined for SVE (U.S. EPA 1991). Though no geotechnical analyses were performed during this study, the marine clay underlying the sand has been identified as an extensive sequence of low permeability (>30 ft) material based on geotechnical borings completed by others. Thus, restoration of soil and ground-water quality within the surficial sand is an appropriate remedial response at the subject site.

Depth to ground water within the sand sub-unit ranges from less than 2 ft to approximately 8 ft below grade. During seasonally high water table periods, this shallow depth to water serves to impede the development of a pressure gradient within the unsaturated zone due to the draw-in of soil moisture and/or ground water into the slotted intervals of the vent trenches. During the winter months, pilot plant operations were also limited by the depth frost extended into the subsurface, which reduced porosity within the vadose zone. Periods of inefficient operations, or system down-time, should be anticipated during the winter and early spring months.

Seasonal water table fluctuations, in conjunction with site geology, may alter the movement of ground water locally at the site. The presence of an apparent mound in the marine clay at shallow depths south of Burbank Avenue may, during periods of lower water table elevation, serve to divert or alter ground-water flow toward both the southwest and southeast. The continued observance of elevated TVH concentrations in vapor samples taken from the exhaust stack located on the footing drain adjacent to the Family Services Center may be attributed to any of the following: flow of impacted ground water toward the eastern end of the Family Services Center, ground-water flow through a more permeable trench excavation made during the setting of utility lines to the Family Services Center, or the interception and diversion of ground water through the footing drain to either side of the Family Services Center. Neither of the above flow scenarios were substantiated during the pilot study.

The direction of ground-water flow remained fairly constant during the course of the pilot test, with only slight deviation in the hydraulic gradient observed. The presence of LNAPL, ranging from a hydrocarbon sheen to thicknesses up to 0.20 ft, was confirmed sporadically at several well locations; LNAPL recharge did not persist at any of these locations. Wells showing the presence of LNAPL were all located approximately downgradient of the former USTs and product lines extending from the former tank field to the pump dispensers.

5.2 PILOT TEST RESULTS

5.2.1 Soil Vapor Extraction

Radius of influence for SVE was assessed during the initial short-term pilot tests prior to full-scale operations. For the subject site, a pressure differential of 0.25 in. H_2O was used to define the effective SVE radial influence. By plotting the results of vapor monitoring performed during the tests on the horizontal axis versus distance on the vertical axis, regression analyses were used to calculate SVE radius of influence. Test results for SVE-1, located within the paved lot at the NEX service station, yielded an effective SVE radius of influence of 49 ft. Similar response was projected for vent trenches SVE-2 and SVE-3.

SVE pilot testing at vent trench SVE-4, located within the grassed area adjacent to the Family Services Center, confirmed a much lower effective radial influence (16 ft). Test results showed a negligible increase in radial influence with increased vacuum or flow, presumably related to short-circuiting of ambient air through the grassed surface. Test results also showed that increasing the extraction rate did not result in the increase of the TVH removal rate. Similar response was projected for vent trench SVE-5, also located within the landscaped area.

The interpreted composite SVE pilot plant effective radius of influence is provided on Figure 5-1. As indicated, several portions of the site are subject to extensive SVE, particularly within the paved lot to the east of the NEX service station. Conversely, limited remedial effect is observed under current operating conditions south of Burbank Avenue and in the vicinity of the existing tank field. The limited influence within these areas may be attributed to short circuiting through lower pressure gradients, such as landscaped surfaces and UST pits containing coarse, rounded stone.

5.2.2 Air Sparging

Attempts at assessing AAS radial influence were made by monitoring differential pressure and TVH concentrations within the vadose zone, and dissolved oxygen, temperature, pH, and conductivity in ground water. Measurements of differential pressure in the vadose zone did not reveal any discernable trend of decreasing pressure versus distance; this was primarily due to the concurrent operations of the SVE system. In general, vacuum within the vadose zone was observed to decrease immediately following start-up of AAS operations. At locations experiencing limited SVE, such as by the tank field, active sparging appeared to

create a slight positive pressure within the vadose zone. Dissolved oxygen levels in ground water, typically used to assess radial influence of sparge wells, did not demonstrate a discernable trend with respect to decreased concentration versus distance from sparge wells. Other water quality parameters, including pH, temperature, and conductivity, were also not useful in defining AAS radial influence.

Despite the lack of definition, AAS radius of influence within the saturated zone was assessed by monitoring trends in TVH concentrations at individual SVE trenches, by gauging wells for the presence of LNAPL and petroleum sheens, and through the sampling and analysis of ground water. The daily TVH removal rates summarized in Table 4-7 show that activation of the 4 sparge wells at the NEX service station resulted in increased TVH removal at trenches SVE-1 through SVE-3 only, indicating remedial influence within these areas only. TVH removal rates instantaneously increased approximately 9.5 lb/day at trenches SVE-1 and SVE-2, and greater than 7.5 lb/day at SVE-3.

The AAS pilot plant was deactivated due to the presence of a film of LNAPL within active sparge well AAS-5, marking the first time LNAPL had been observed at this location. LNAPL was also observed as a film in inactive sparge well AAS-7 for the first time since October 1993. The presence of a LNAPL sheen at sparge wells AAS-5 and AAS-7 may be indicative of the mobilization of LNAPL trapped below the water table. The presence of LNAPL at these locations may have been in response to the forced mobilization of LNAPL which had been trapped within the soil below the top of the water table, or within the zone of water table fluctuation. This result may be an indication that air sparging is physically removing petroleum hydrocarbons from the shallow water table.

The results of the final round of ground-water sampling, in comparison to prior analytical results, were also used to assess AAS radial influence. Increases in dissolved-phase hydrocarbon concentrations at distance may be an indication of active AAS. Within the suspected release area, concentrations of dissolved-phase hydrocarbons at well MW-4R have varied widely over time. Prior to pilot testing, concentrations of total BTEX in ground water were reported at 38,900 μg/L and 7,510 μg/L, respectively, on 20 May 1992 and 13 July 1993. Following several months of SVE, total BTEX was reported at 22,947 μg/L (April 1994). At the conclusion of the SVE/AAS pilot study, the reported total BTEX concentration was 38,031 μg/L. Similar results were reported for TPH as gasoline and TPH as fuel oil, except in these instances the post-test results were reported at lower concentrations. The results suggest that additional site remediation is required in the suspected impacted area.

At the 3 wells located hydraulically downgradient of the tank field, concentrations of dissolved-phase hydrocarbons have remained low. Total BTEX concentrations at wells MW-2 and MW-3 have decreased through time, and historically have not been detected at well MW-5.

At no point during the performance of the pilot test were MEDEP remedial action goals of 5 μg/L of benzene and 50 μg/L TPH as gasoline exceeded, with the exception of 51 μg/L of TPH as gasoline during the 7-8 July 1994 sampling at well MW-3. The consistently low concentrations observed at these downgradient locations confirm that concurrent operation of the SVE and AAS pilot plant systems has not adversely impacted ground-water quality during active treatment of the suspected impacted area.

5.2.3 Hydrocarbon Removal

The SVE and AAS pilot tests demonstrated the capability of the pilot plant to sustain the removal of elevated concentrations of petroleum-related hydrocarbons from both soil and ground water at the subject site. SVE pilot plant operations resulted in the removal of greater than 823 lb of TVH during approximately 6 months of effective operations. The AAS pilot plant achieved significant TVH removal from the saturated and phreatic zone (greater than 65 lb) in just over one month of combined SVE/AAS.

SVE composite removal rates were calculated based on the summation of the flow rates from individual trenches and the composite TVH concentration from the SVE manifold. The initial TVH removal rate upon system activation was calculated at 78.3 lb/day. TVH removal rates decreased to 18.3 lb/day TVH by 19 November 1993 and to 9.5 lb/day by 7 December 1993. From the period of 10 December 1993 through 16 February 1994, TVH removal rates decreased from 7.5 lb/day to asymptotic levels (less than 2 lb/day).

Combined SVE/AAS pilot plant operations were run at 4 of 10 AAS wells from 3 May to 7 June 1994. Concurrent operation of the SVE and AAS pilot plant systems resulted in an immediate increase in the TVH removal rate from 1.9 lb/day (3 May 1994) to 16.3 lb/day (4 May 1994), of which 14.4 lb/day was attributed to AAS. As was the case during extended SVE operations, hydrocarbon removal rates decreased through time. Just prior to deactivation of the AAS system, TVH removal rates attributed to AAS were calculated at 1.1 lb/day.

As a means of assessing hydrocarbon removal from the subsurface, soil samples were taken from the samples yielding the highest photoionization detector headspace concentration during the installation of replacement wells MW-1R (background) and MW-4R (impacted area). The results from prior to pilot testing to active SVE show reported concentrations of total BTEX, MTBE, and TPH as gasoline to have decreased to non-detected. TPH as fuel oil reportedly increased during the period from 10 mg/kg to 120 mg/kg at well MW-1R; however, the result was reported by the laboratory as a dissimilar GC fingerprint than fuel oil and was reported based on the elution range of fuel oil.

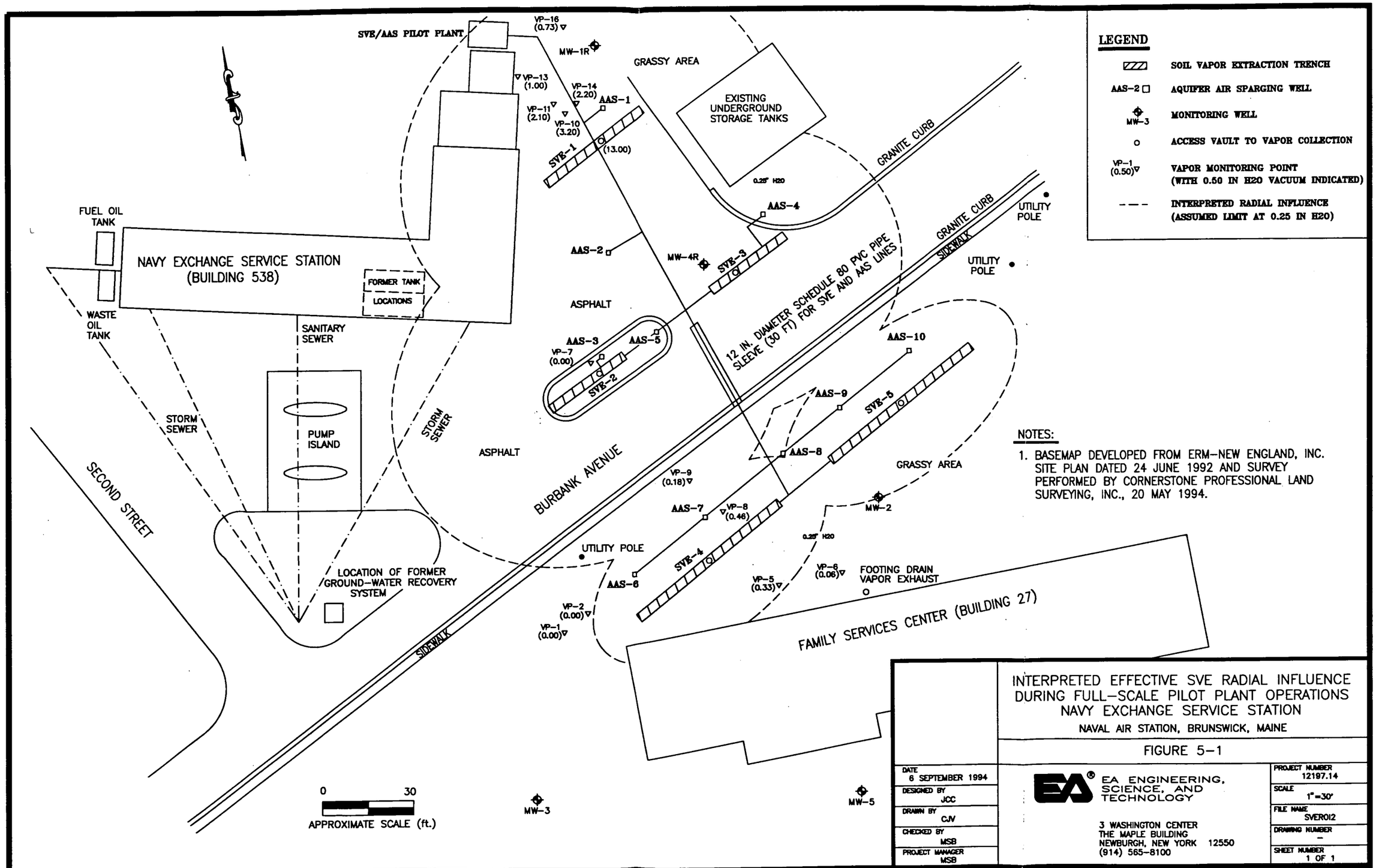
Significant decreases in petroleum hydrocarbons concentrations were observed in the soil sample collected 8-10 ft at well MW-4R as a result of SVE pilot testing. TPH as gasoline concentrations reportedly decreased from 31,000 mg/kg (prior to SVE) to 2,500 mg/kg (during SVE). TPH as fuel oil, reported at 4,800 mg/kg prior to pilot testing, was reported

as non-detected following less than 4 months of effective SVE. Total BTEX concentrations were reported to decrease from 2,785,300 μg/kg to 835,000 μg/kg as a result of SVE. MTBE concentrations were reported to decrease from 7,300 μg/kg to non-detected.

5.3 RECOMMENDATIONS

Extended SVE pilot plant operations have demonstrated the ability to achieve removal of sorbed and vapor-phase hydrocarbons within the vadose zone. Asymptotic hydrocarbon removal rates have been observed at several locations across the site, allowing for the potential adjustment of the pilot plant equipment for more aggressive recovery within the source area, particularly during active AAS. The asymptotic removal rates may be an indication that TVH removal is a diffusion-limited process within the subsurface. Confirmatory soil sampling within the vadose zone is required to demonstrate cleanup to MEDEP remedial action goals. Such sampling should not be accomplished until extended SVE/AAS has resulted in significant reductions in the concentration of dissolved-phase hydrocarbons at all site wells.

Limited operation of the AAS pilot plant has demonstrated the ability to achieve removal of dissolved-phase and trapped hydrocarbons within the saturated zone. Based on the results of the pilot test, it is evident that LNAPL is trapped within the zone of water table fluctuation, and potentially below the water table within the area immediately downgradient of the former USTs and product lines. Active AAS has demonstrated the potential to mobilize this trapped LNAPL from the subsurface, as evidenced by increased TVH removal rates and the presence of LNAPL sheens at several locations. Continuation of the remedial effort is, therefore, recommended, with focus on obtaining better control of sparge injection rates and pressures. Active remediation in the form of SVE/AAS should continue until the trapped LNAPL has been mobilized and removed, and asymptotic concentrations of dissolved-phase hydrocarbons within site ground water are observed.



LEGEND

- SOIL VAPOR EXTRACTION TRENCH
- AAS-2 — AQUIFER AIR SPARGING WELL
- MW-3 — MONITORING WELL
- ACCESS VAULT TO VAPOR COLLECTION
- VP-1 (0.50) — VAPOR MONITORING POINT (WITH 0.50 IN H2O VACUUM INDICATED)
- INTERPRETED RADIAL INFLUENCE (ASSUMED LIMIT AT 0.25 IN H2O)

NOTES:

1. BASEMAP DEVELOPED FROM ERM-NEW ENGLAND, INC. SITE PLAN DATED 24 JUNE 1992 AND SURVEY PERFORMED BY CORNERSTONE PROFESSIONAL LAND SURVEYING, INC., 20 MAY 1994.

INTERPRETED EFFECTIVE SVE RADIAL INFLUENCE DURING FULL-SCALE PILOT PLANT OPERATIONS
NAVY EXCHANGE SERVICE STATION
NAVAL AIR STATION, BRUNSWICK, MAINE

FIGURE 5-1

DATE	6 SEPTEMBER 1994
DESIGNED BY	JCC
DRAWN BY	CJV
CHECKED BY	MSB
PROJECT MANAGER	MSB

EA ENGINEERING, SCIENCE, AND TECHNOLOGY
3 WASHINGTON CENTER
THE MAPLE BUILDING
NEWBURGH, NEW YORK 12550
(914) 565-8100

PROJECT NUMBER	12197.14
SCALE	1"=30'
FILE NAME	SVER012
DRAWING NUMBER	–
SHEET NUMBER	1 OF 1

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Appendix A

Boring Logs

LOG OF BORING MW-1R

EA Engineering, Science & Technology

Coordinates: Northing: 387197.4, Easting: 562674.3
Top of Well Casing Elevation: 67.29 ft.
Surface Elevation: 67.59 ft.
Well Casing Below Surface: 0.30 ft.
Reference Elevation: 70.40 ft.
Reference Description: Basis for elevation is Navy disk recessed in concrete platform on Orion Street just south of Fitch Street. Coordinates based on pre-existing wells.
Start Date: 3/23/94
Completion Date: 3/23/94

Location: Southwest corner of Transportation Division's parking lot, Brunswick Naval Air Station, Brunswick, Maine.
Job No.: 29600.21.3605
Client: N. Division, Naval Facilities Engineering Command.
Drilling Method: Truck-mounted CME drill-rig using 4.25" ID hollow-stem augers.
Sampling Method: 2' and 1.5' split-spoons (SS) driven 24" and 18" by 140 lb. hammer falling 30 inches.
Soil sreening method: PID headspace readings for VOC.
Surface Conditions: Asphalt; level.

Sample Type	In. Driven	In. Rcvd.	Casing Depth (ft)	Sample No.	Sample Depth (ft)	Blows\ 6-in.	Depth Feet	Graph Log	Description
							0		
SS	18	18	0	1	0-2	12		FILL	Asphalt and fill for top 2".
						28			Bottom 16": dark brown silty fine to medium sand.
						31			Sample 1 PID headspace reading: 2.0 ppm.
						37			
SS	24	24	0	2	2-4	11		SP	Brown medium to fine sand consisting of subangular, fairly well-sorted clasts of quartz
						6			with some mica flakes and traces of feldspars; trace of silt; dry to slightly moist; medium density.
						7			Sample 2 PID headspace reading: 20.0 ppm.
						7			Sample collected for laboratory analysis- sample MW-1R
SS	18	18	4	3	4-6	5			Same as above.
						6	5		Sample 3 PID headspace reading: 2.0 ppm.
						7			
						6			
SS	24	24	6	4	6-8	1			Same as above; wet at 7'.
						1			Sample 4 PID headspace reading: 1.0 ppm.
						1			
						2			
SS	24	12	8	5	8-10	1			Same as above.
						1			Sample 5 PID headspace reading: 0.0 ppm.
						2			
						1	10		
SS	18	18	10	6	10-12	2			Same as above.
						2			Sample 6 PID headspace reading: 0.0 ppm.
						3			
						2		SP	
SS	24	24	12	7	12-14	3			Same as above.
						4			Sample 7 PID headspace reading: 0.0 ppm.
						2			
						3			
SS	24	24	14	8	14-16	11			Same as above.
						6	15		Sample 8 PID headspace reading: 0.0 ppm.
						12			Samples 8, 9 and 10 are of running sand and are not true representatives of the formation.
						8			
SS	18	0	16	9	16-18	7			Same as above.
						6			Sample 9 PID headspace reading: 0.0 ppm.
						8			
						9			
SS	24	24	18	10	18-20	7			Same as above.
						9			Sample 10 PID headspace reading: 0.0 ppm.
						54			
						91	20		
SS	24	24	20	11	20-22	4			Top 16": Same as above- grades to a grey silty clay with fine sand for bottom 8".
						7			Sample 11 PID headspace reading: 0.0 ppm.
						11			
						49		CL	
SS	24	0	22	12	22-24	8			No recovery.
						2			
						3			
						8			

Well Installation:

5-0 ft.: Schedule 40, 2-in. I.D. PVC riser.
21-5 ft.: Schedule 40, 2-in. I.D. PVC 0.01-in. screen.
21-4 ft.: #1 Morie filter sand.
4-2 ft.: Coarse-grade Bentonite seal.
2-0 ft.: Concrete and steel, bolt-down curb box.

LOG OF BORING MW-4R

EA Engineering, Science & Technology

Coordinates: Northing: 387122.1, Easting: 562702.5
Top of Well Casing Elevation: 66.61 ft.
Surface Elevation: 67.05 ft.
Well Casing Below Surface: 0.44 ft.
Reference Elevation: 70.40 ft.
Reference Description: Basis for elevation is Navy disk recessed in concrete platform on Orion Street just south of Fitch Street. Coordinates based on pre-existing wells.
Start Date: 3/23/94
Completion Date: 3/23/94

Location: Navy Exchange Service Station, Brunswick Naval Air Station, Brunswick, Maine.
Job No.: 29600.21.3605
Client: N. Division, Naval Facilities Engineering Command.
Drilling Method: Truck-mounted CME drill-rig using 4.25" ID hollow-stem augers.
Sampling Method: 2' and 1.5' split-spoons (SS) driven 24" and 18" by 140 lb. hammer falling 30 inches.
Soil screening method: PID headspace readings for VOC.
Surface Conditions: Asphalt; level.

	Sample Type	In. Driven	In. Rcvd.	Casing Depth (ft)	Sample No.	Sample Depth (ft)	Blows\ 6-in.	Depth Feet	Graph Log	Description
								0		Top 3" of asphalt broken off- first split-spoon taken from -3".
	SS	18	18	0	1	0-2	8		Fill	Top 12": fill material: medium to fine sand with gravel and pebbles.
							9			Bottom 6": brown medium to fine sand consisting of subangular, fairly well sorted clasts of quartz
							10		SP	w/ some mica flakes and traces of feldspars: trace of silt; dry to slightly moist; medium density.
							9			Sample 1 PID headspace reading: 1.0 ppm.
	SS	24	24	0	2	2-4	4			Brown medium to fine sand consisting of subangular, fairly well sorted clasts of quartz
							7			w/ some mica flakes and traces of feldspars: trace of silt; dry to slightly moist; medium density.
							7			Sample 2 PID headspace reading: 3.0 ppm.
							6			
	SS	18	18	4	3	4-6	8			Same as above.
							9	5		Sample 3 PID headspace reading: 7.0 ppm.
							9			
							9			
	SS	24	24	6	4	6-8	5		SP	Same as above.
							7			Sample 4 PID headspace reading: 140.0 ppm.
							6			
							7			
	SS	24	12	8	5	8-10	3			Same as above but wet: water table at 8'.
							3			Sample 5 PID headspace reading: 300.0 ppm.
							3			Sample collected for laboratory analysis-sample MW-4R.
							4	10		
	SS	18	18	10	6	10-12	5			Same as above but with iron staining and wet with oily sheen.
							5			Brown sandy clay at 11.5.
							6			Sample 6 PID headspace reading: 200.0 ppm.
							5		ML	
	SS	24	24	12	7	12-14	3			Top 8": Brown medium to fine sand; running sand, not representative of formation.
							3			Middle 14": Brown sandy clay w/ silt.
							3			Bottom 2": Grey silty clay.
							3			Entire spoon wet with oily sheen. Sample 7 PID headspace reading: 200.0 ppm.
	SS	18	18	14	8	14-16	1 for 12"		CL	Top 9": running sand: not representative.
							---	15		Bottom 9"; grey silty clay.
							1 for 12"			Wet with oily sheen.
							---			Sample 8 PID headspace reading: 300.0 ppm.
	SS	24	24	16	9	16-18	1 for 12"			Silty grey clay; wet with oily sheen.
							---			Sample 9 PID headspace reading: 50.0 ppm.
							1 for 12"			

								20		

Well Installation:

5-0 ft.: Schedule 40, 2-in. I.D. PVC riser.
13-5 ft.: Schedule 40, 2-in. I.D. PVC 0.01-in. screen.
13.5-4 ft.: #1 Morie filter sand.
4-2 ft.: Coarse-grade bentonite seal.
2-1: #1 Morie filter sand.
1-0 ft.: Concrete and steel, bolt-down curb-box.

LOG OF BORING AAS-1

EA Engineering, Science & Technology

Coordinates: Northing: 387176.0, Easting: 562671.1
Top of Well Casing Elevation: 66.99 ft.
Surface Elevation: 67.53 ft.
Well Casing Below Surface: 0.54 ft.
Reference Elevation: 70.40 ft.
Reference Description: Basis for elevation is Navy disk recessed in concrete platform on Orion Street just south of Fitch Street. Coordinates based on pre-existing wells.
Start Date: 7/21/93
Completion Date: 7/21/93

Location: Navy Exchange Service Station, Brunswick Naval Air Station, Brunswick, Maine.
Job No.: 12197.14
Client: N. Division, Naval Facilities Engineering Command.
Drilling Method: Truck-mounted, Mobile, Inc., B-61 drill-rig using 4.25" ID hollow-stem augers.
Sampling Method: 2' split-spoon (SS) driven 24" by dropping 140 lb. hammer 30".
Soil analyses method: Hnu PID headspace readings for VOC.
Surface Conditions: Asphalt; level.

Sample Type	In. Driven	In. Rcvd.	Casing Depth	Sample No.	Sample Depth	Blows\ 6-in.	Depth Feet	Graph Log	Description
							0		Augered 0 to 5 ft.
									Top 4 inches is asphalt and layered gravel.
									Drill cuttings: light brown, fine to med. sand, trace of silt.
							5		
SS	24	24	5'	1	5'-7'	4			Light brown fine to med. sand consisting of subangular, fairly well sorted clasts of quartz with some
						10		SP	mica flakes and traces of feldspars; trace of silt; dry to slightly moist.
						9			Medium density.
						9			Sample 1 Hnu reading: 0.3 ppm.
									Augered to 10 ft.
									Drill cuttings: Same as above (SAA)
									Water table encountered at approximately 8 ft.
							10		
SS	24	18	10'	2	10'-12'	2			SAA but with higher percentage of med. sand, wet and loose.
						3		SP	
						5			Sample 2 Hnu reading: 0 ppm.
						6			
									NOTE:
									Augered to 15 ft. At 13 to 20 ft. running sands began to rise up into auger due to depth beneath water-table and the subsequent pressure difference when the auger plug was removed; as a result, samples 3 and 4 and their blow counts may not be reflective of actual site conditions.
									Auger cuttings: SAA.
							15		
SS	24	18	15'	3	15'-17'	3			SAA.
						3		SP	
						3			Sample 3 Hnu reading: 0 ppm.
						4			
									Augered to 20 ft.
									Drill cuttings: SAA.
							20		
SS	24	4	20'	4	20'-22'	5			Blue-grey clay with trace of silt. High plasticity, soft.
						5		CL	Clay interface with overlaying sand occurs at 19.5 ft.
						4			Sample 4 Hnu reading: 0.3 ppm.
						5			Drilling completed to 22 ft.

Air Sparging Well Construction:

22-19.5 ft.	Backfill.
19-16 ft.	Schedule 40, 2-in. ID. 0.01 slotted PVC screen.
16-1 ft.	Schedule 40, 2-in ID PVC riser.
19.5-15.5 ft.	#1 Silica sand.
15.5-13.5 ft.	Coarse-grade bentonite seal.
13.5-2 ft.	Portland grout.

LOG OF BORING AAS-2

EA Engineering, Science & Technology

Coordinates: Northing: 387130.6, Easting: 562667.9
Top of Well Casing Elevation: 65.66 ft.
Surface Elevation: 66.94 ft.
Well Casing Below Surface: 1.28 ft.
Reference Elevation: 70.40 ft.
Reference Description: Basis for elevation is Navy disk recessed in concrete platform on Orion Street just south of Fitch Street. Coordinates based on pre-existing wells.
Start Date: 7/22/93
Completion Date: 7/22/93

Location: Navy Exchange Service Station, Brunswick Naval Air Station, Brunswick, Maine.
Job No.: 12197.14
Client: N. Division, Naval Facilities Engineering Command.
Drilling Method: Truck-mounted, Mobile, Inc., B-61 drill-rig using 4.25" ID hollow-stem augers.
Sampling Method: 2' split-spoon (SS) driven 24" by dropping 140 lb. hammer 30".
Soil analyses method: Hnu PID headspace readings for VOC.
Surface Conditions: Asphalt; level.

Sample Type	In. Driven	In. Rcvd.	Casing Depth	Sample No.	Sample Depth	Blows\ 6-in.	Depth Feet	Graph Log	Description
							0		
									Augered 0 to 5 ft.
									Top 4 inches is asphalt and layered gravel.
									Drill cuttings: light brown, silty, fine to med. sand, trace of clay; organic; loamy.
								SM	
							5		
SS	24	18	5'	1	5'-7'	3			light brown med. sand w/ some fine sand; consisting of subangular, fairly well sorted clasts of quartz
						6		SP	w/ some mica flakes and traces of feldspars; trace of silt; dry to slightly moist; loose.
						4			
						4			Sample 1 Hnu reading: 120.0 ppm.
									Augered to 10 ft.
									Drill cuttings: Same as above (SAA)
									Water table encountered at approximately 8 ft.
							10		
SS	24	15	10'	2	10'-12'	1			SAA but Wet.
						2		SP	
						3			Sample 2 Hnu reading: 5.0 ppm.
						6			
									NOTE:
									Augered to 15 ft. At 13 to 20 ft. running sands began to rise up into auger due to depth beneath
									water-table and the subsequent pressure difference when the auger plug was removed; as a result,
									samples 3 and 4 and their blow counts may not accurately reflect site conditions.
									Auger cuttings: SAA.
							15		
SS	24	12	15'	3	15'-17'	2			SAA except fine sand w/ some med. sand.
						2		SP	
						4			Sample 3 Hnu reading: 10.0 ppm.
						8			
									Augered to 20 ft.
									Drill cuttings: SAA.
							20		
SS	24	24	20'	4	20'-22'	3			light brown fine sand; wet.
						6		SP	
						8			Sample 4 Hnu reading: not taken.
						20			Drilling completed to 22 ft.

Air Sparging Well Construction:

22-15.5 ft.	Backfill.
15-12 ft.	Schedule 40, 2-in. ID, 0.01 slotted PVC screen.
12-1 ft.	Schedule 40, 2-in ID PVC riser.
15.5-11.5 ft.	#1 Silica sand.
11.5-9.5 ft.	Coarse-grade bentonite seal.
9.5-2 ft.	Portland grout.

LOG OF BORING AAS-3R

EA Engineering, Science & Technology

Coordinates: Northing: 387095.6, Easting: 562663.5
Top of Well Casing Elevation: 66.63 ft.
Surface Elevation: 67.94 ft.
Well Casing Below Surface: 1.31 ft.
Reference Elevation: 70.40 ft.
Reference Description: Basis for elevation is Navy disk recessed in concrete platform on Orion Street just south of Fitch Street. Coordinates based on pre-existing wells.
Start Date: 3/24/94
Completion Date: 3/24/94

Location: Navy Exchange Service Station, Brunswick Naval Air Station, Brunswick, Maine.
Job No.: 29600.21.3605
Client: N. Division, Naval Facilities Engineering Command.
Drilling Method: Truck-mounted CME drill-rig using 4.25" ID hollow-stem augers.
Sampling Method: 2' and 1.5' split-spoons (SS) driven 24" and 18" by 140 lb. hammer falling 30 inches.
Soil screening method: PID headspace readings for VOC.
Surface Conditions: Grassy, level topsoil.

Sample Type	In. Driven	In. Rcvd.	Casing Depth (ft)	Sample No.	Sample Depth (ft)	Blows\ 6-in.	Depth Feet	Graph Log	Description
							0		
AUGER								TOPSOIL	Augered to 6' (5' from ground surface plus 1' of topsoil of road island).

									Auger cuttings: dark brown silty fine to medium sand (topsoil).
							5		
SS	18	18	6	1	6-8	6		SP	Top 3": dark brown silty fine to medium sand.
						7			Bottom 15": brown medium to fine sand consisting of subangular, fairly well-sorted clasts of quartz
						7			with some mica flakes and traces of feldspars; trace of silt; dry to slightly moist; medium density.
						11			Sample 1 PID headspace reading: 1.0 ppm.
SS	24	24	8	2	8-10	3			Same as above but wet: water table at 9'; petroleum odor.
						2			Sample 2 PID headspace reading: 400.0 ppm.
						4			Sample collected for laboratory analysis-sample AAS-3R.
						2	10		
SS	18	18	10	3	10-12	6			Same as above but stained dark brown at 11 ft. and wet with oily sheen; strong petroleum odor.
						6			Sample 3 PID headspace reading: 380.0 ppm.
						7			
						8			
SS	24	24	12	4	12-14	6			Same as above; stained dark brown, wet with oily sheen.
						5			Sample 4 PID headspace reading: 340.0 ppm.
						11			
						16			
SS	24	24	14	5	14-16	10			Same as above but with no staining or oily sheen.
						11	15		Sample 5 PID headspace reading: 360.0 ppm.
						18			
						27			
SS	24	24	14	6	16-18	10			Top 20": Same as above.
						13			Bottom 4": brown sandy clay with silt.
						16			Sample 6 PID headspace reading: 120.0 ppm.
						12		ML	
SS	24	24	18	7	18-20	6			Top 20": brown medium to fine sand: running sand, not representative of formation.
						2			Bottom 4": grey-blue silty clay.
						3			Sample 7 PID headspace reading: 45.0 ppm.; reading taken from bottom 4".
						2	20	CL	

Air Sparging Well Installation:

14-0 ft.:	Schedule 80, 2-in. I.D. PVC riser.
17-14 ft.:	Schedule 80, 2-in. I.D. PVC 0.01-in. screen.
17.5-13.5 ft.:	#1 Morie filter sand.
13.5-11.5 ft.:	Coarse-grade Bentonite seal.
11.5-4:	Portland cement grout.
4-0 ft.:	Backfill and temporary steel, bolt-down curb-box.

LOG OF BORING AAS-4R

EA Engineering, Science & Technology

Coordinates: Northing: 387132.5, Easting: 562720.5
Top of Well Casing Elevation: 67.17 ft.
Surface Elevation: 67.89 ft.
Well Casing Below Surface: 0.72 ft.
Reference Elevation: 70.40 ft.
Reference Description: Basis for elevation is Navy disk recessed in concrete platform on Orion Street just south of Fitch Street. Coordinates based on pre-existing wells.
Start Date: 3/24/94
Completion Date: 3/24/94

Location: Navy Exchange Service Station, Brunswick Naval Air Station, Brunswick, Maine.
Job No.: 29600.21.3605
Client: N. Division, Naval Facilities Engineering Command.
Drilling Method: Truck-mounted CME drill-rig using 4.25" ID hollow-stem augers.
Sampling Method: 2' and 1.5' split-spoons (SS) driven 24" and 18" by 140 lb. hammer falling 30 inches.
Soil screening method: PID headspace readings for VOC.
Surface Conditions: Grassy, level topsoil.

	Sample Type	In. Driven	In. Rcvd.	Casing Depth (ft)	Sample No.	Sample Depth (ft)	Blows\ 6-in.	Depth Feet	Graph Log	Description
								0		
	AUGER									Augered to 5'. Encountered PVC piping fragments at 1'-2' (pipe extension from AAS system).
										Auger cuttings: brown coarse to medium sand, trace of fine sand (pre-existing sandpack).
								5		
	SS	24	24	6	1	5-7	5			Top 4": Same as above.
							4			Bottom 14": brown medium to fine sand consisting of subangular, fairly well sorted clasts of quartz
							3		SP	w/ some mica flakes and traces of feldspars: trace of silt; dry to slightly moist; medium density.
							4			Some iron staining. Sample 1 PID headspace reading: 0.6 ppm.
	SS	24	12	8	2	7-9	1			Top 2": lense of brown silty fine sand.
							2			Bottom 22": brown medium to fine sand consisting of subangular, fairly well sorted clasts of quartz
							2			w/ some mica flakes and traces of feldspars: trace of silt; dry to slightly moist; medium density.
							2			Some iron staining; wet; water table 7'-8.' Sample 2 PID headspace reading: 0.2 ppm.
	SS	18	18	10	3	9-11	3			Same as above.
							5	10		Bottom 2": brown silty clay w/ fine to medium sand.
							5			Sample 3 PID headspace reading: 1.2 ppm.
							5			
	SS	24	24	12	4	11-13	2		ML	Top 12": brown medium to fine sand.
							1			Middle 6": brown silty clay with fine to medium sand.
							2			Bottom 6": grey silty clay.
							3		CL	Sample 4 PID headspace reading: 1.6 ppm.
										Sample collected for laboratory analysis-sample AAS-4R.
								15		
								20		

Air Sparging Well Installation:

9-0 ft.: Schedule 80, 2-in. I.D. PVC riser.
12-9 ft.: Schedule 80, 2-in. I.D. PVC, 0.01-in. screen.
12.5-8.5 ft.: #1 Morie filter sand.
8.5-6.5 ft.: Coarse-grade bentonite seal.
6.5-3.5 ft.: Portland cement grout.
3.5-0 ft.: Backfill and temporary bolt-down curb-box.

LOG OF BORING AAS-5

EA Engineering, Science & Technology

Coordinates: Northing: 387099.1, Easting: 562683.2
Top of Well Casing Elevation: 67.06 ft.
Surface Elevation: 67.52 ft.
Well Casing Below Surface: 0.46 ft.
Reference Elevation: 70.40 ft.
Reference Description: Basis for elevation is Navy disk recessed in concrete platform on Orion Street just south of Fitch Street. Coordinates based on pre-existing wells.
Start Date: 7/21/93
Completion Date: 7/21/93

Location: Navy Exchange Service Station, Brunswick Naval Air Station, Brunswick, Maine.
Job No.: 12197.14
Client: N. Division, Naval Facilities Engineering Command.
Drilling Method: Truck-mounted, Mobile, Inc., B-61 drill-rig using 4.25" ID hollow-stem augers.
Sampling Method: 2' split-spoon (SS) driven 24" by dropping 140 lb. hammer 30".
Soil analyses method: Hnu PID headspace readings for VOC.
Surface Conditions: Asphalt; level.

Sample Type	In. Driven	In. Rcvd.	Casing Depth	Sample No.	Sample Depth	Blows\ 6-in.	Depth Feet	Graph Log	Description
							0		Augered 0 to 5 ft.
									Top 4 inches is asphalt and layered gravel.
									Drill cuttings: dark brown, silty, fine to med. sand; loamy, organic; to lt. brown med. sand w/ fine sand; fairly well sorted, subangular clasts-predominantly quartz; petroleum odor.
								SM	
							5		
SS	24	18	5'	1	5'-7'	4			light brown med. sand w/ some to trace of fine sand; consisting of subangular, fairly well sorted clasts of w/quartz w/ traces of feldspars and mica flakes; trace of silt; dry to slightly moist; loose.
						4		SP	
						5			Petroleum odor.
						4			Sample 1 Hnu reading: 120.0 ppm.
									Augered to 10 ft.
									Drill cuttings: Same as above (SAA)
									Water table encountered at approximately 8 ft.
							10		
SS	24	24	10'	2	10'-12'	2			Top 15 inches: SAA; wet; loose.
						3			Bottom 9 inches: brown silty fine sand w/ some med. sand and traces of clay; laminated; wet; loose.
						3			Sample 2 Hnu reading: 180 ppm.
						2		SM	
SS	24	24	12'	3	12'-14'	2			Top 12 inches: Same as bottom 9 inches of SS sample 2 (above).
						1			Middle 10 inches: brown-grey silty clay w/ some fine sand; wet; low density; high plasticity.
						2		ML	Bottom 2 inches: blue-grey clay w/ trace of silt; soft; high plasticity.
						1			Sample 3 Hnu reading: 300 ppm.
								CL	
							15		
									Drilling completed to 14 ft.
							20		

Air Sparging Well Construction:

14-13.5 ft.	Backfill.
13-10 ft.	Schedule 40, 2-in. ID, 0.01 slotted PVC screen.
10-1 ft.	Schedule 40, 2-in ID PVC riser.
13.5-9.5 ft.	#1 Silica sand.
9.5-7.5 ft.	Coarse-grade bentonite seal.
7.5-2 ft.	Portland grout.

LOG OF BORING AAS-6

EA Engineering, Science & Technology

Coordinates: Northing: 387021.0, Easting: 562663.0
Top of Well Casing Elevation: 65.33 ft.
Surface Elevation: 65.78 ft.
Well Casing Below Surface: 0.45 ft.
Reference Elevation: 70.40 ft.
Reference Description: Basis for elevation is Navy disk recessed in concrete platform on Orion Street just south of Fitch Street. Coordinates based on pre-existing wells.
Start Date: 7/20/93
Completion Date: 7/20/93

Location: Navy Exchange Service Station, Brunswick Naval Air Station, Brunswick, Maine.
Job No.: 12197.14
Client: N. Division, Naval Facilities Engineering Command.
Drilling Method: Truck-mounted, Mobile, Inc., B-61 drill-rig using 4.25" ID hollow-stem augers.
Sampling Method: 2' split-spoon (SS) driven 24" by dropping 140 lb. hammer 30".
Soil analyses method: Hnu PID headspace readings for VOC.
Surface Conditions: Grassy; level.

Sample Type	In. Driven	In. Rcvd.	Casing Depth	Sample No.	Sample Depth	Blows\ 6-in.	Depth Feet	Graph Log	Description
							0		
									Augered 0 to 5 ft.
									Drill cuttings: dark brown to brown, silty, fine to med. sand, traces of coarse sand and clay; loamy, organic rich; slight petroleum odor. Medium plasticity.
							5		
SS	24	24	5'	1	5'-7'	8		SM	Top 5 inches: dark reddish brown, silty medium to fine sand; medium density.
						9		SP	Grades to med to light brown med. sand w/ some to trace of fine sand; consisting of subangular, fairly well sorted clasts of quartz w/ traces of feldspars and mica flakes; trace of silt; dry to slightly moist.
						12			Medium density. Petroleum odor.
						9			Sample 1 Hnu reading: 140.0 ppm.
									Augered to 10 ft.
									Drill cuttings: Same as above (SAA)
									Water table encountered at approximately 7-8 ft.
							10		
SS	24	24	10'	2	10'-12'	1			SAA but wet and loose; water has oily sheen.
						3		SP	
						5			Sample 2 Hnu reading: 120 ppm.
						4			
									Augered to 13 ft.
SS	24	20	13'	3	13'-15'	2		SP	Top 6 inches: same as SS sample 2.
						4		ML	Middle 9 inches: brown-grey silty clay w/ some fine sand; low density, high plasticity; wet.
						2		----------	Bottom 5 inches: blue-grey clay w/ trace of silt; high plasticity, soft. Wet.
						2	15	CL	Strong petroleum odor.
									Sample 3 Hnu reading: 160 ppm.
									Drilling completed to 15 ft.
							20		

Air Sparging Well Construction:

15-14.5 ft.	Backfill.
14-11 ft.	Schedule 40, 2-in. ID, 0.01 slotted PVC screen.
11-1 ft.	Schedule 40, 2-in ID PVC riser.
14.5-10.5 ft.	#1 Silica sand.
10.5-8.5 ft.	Coarse-grade bentonite seal.
8.5-2 ft.	Portland grout.

LOG OF BORING AAS-7

EA Engineering, Science & Technology

Coordinates: Northing: 387036.4, Easting: 562690.2
Top of Well Casing Elevation: 65.21 ft.
Surface Elevation: 66.01 ft.
Well Casing Below Surface: 0.80 ft.
Reference Elevation: 70.40 ft.
Reference Description: Basis for elevation is Navy disk recessed in concrete platform on Orion Street just south of Fitch Street. Coordinates based on pre-existing wells.
Start Date: 7/20/93
Completion Date: 7/20/93

Location: Navy Exchange Service Station, Brunswick Naval Air Station, Brunswick, Maine.
Job No.: 12197.14
Client: N. Division, Naval Facilities Engineering Command.
Drilling Method: Truck-mounted, Mobile, Inc., B-61 drill-rig using 4.25" ID hollow-stem augers.
Sampling Method: 2' split-spoon (SS) driven 24" by dropping 140 lb. hammer 30".
Soil analyses method: Hnu PID headspace readings for VOC.
Surface Conditions: Grassy; level.

Sample Type	In. Driven	In. Rcvd.	Casing Depth	Sample No.	Sample Depth	Blows\ 6-in.	Depth Feet	Graph Log	Description
							0		
									Augered 0 to 5 ft.
									Drill cuttings: dark brown to brown, silty, fine to med. sand, some to trace of clay and traces of coarse sand and fine gravel; loamy, organic rich; slight petroleum odor. Medium plasticity.
								SM	
							5		
SS	24	18	5'	1	5'-7'	5			Light brown med. sand w/ some to trace of fine sand; consisting of subangular, fairly
						8		SP	well sorted clasts of quartz w/ traces of feldspars and mica flakes; trace of silt; slightly moist to wet.
						9			Medium density. Petroleum odor.
						10			Sample 1 Hnu reading: 60.0 ppm.
									Augered to 10 ft.
									Drill cuttings: Same as above (SAA)
									Water table encountered at approximately 7-8 ft.
									Strong petroleum odor.
							10		
SS	24	19	10'	2	10'-12'	2		SP	Top 10 inches: same as SS sample 1 but loose.
						1		----------	Middle 6 inches: brown-grey to blue silty clay w/ some fine sand; low density, med. plasticity; wet.
						3		ML	Bottom 3 inches: blue-grey clay w/ trace of silt; high plasticity; soft. Wet.
						3		CL	Strong petroleum odor.
									Sample 2 Hnu reading: 160 ppm.
									Drilling completed to 12 ft.
							15		
							20		

Air Sparging Well Construction:

11.5-8.5 ft.	Schedule 40, 2-in. ID, 0.01 slotted PVC screen.
8.5-1 ft.	Schedule 40, 2-in ID PVC riser.
12-8 ft.	#1 Silica sand.
8-6 ft.	Coarse-grade bentonite seal.
6-2 ft.	Portland grout.

LOG OF BORING AAS-8

EA Engineering, Science & Technology

Coordinates: Northing: 387052.2, Easting: 562715.5
Top of Well Casing Elevation: 65.65 ft.
Surface Elevation: 66.17 ft.
Well Casing Below Surface: 0.52 ft.
Reference Elevation: 70.40 ft.
Reference Description: Basis for elevation is Navy disk recessed in concrete platform on Orion Street just south of Fitch Street. Coordinates based on pre-existing wells.
Start Date: 7/20/93
Completion Date: 7/20/93

Location: Navy Exchange Service Station, Brunswick Naval Air Station, Brunswick, Maine.
Job No.: 12197.14
Client: N. Division, Naval Facilities Engineering Command.
Drilling Method: Truck-mounted, Mobile, Inc., B-61 drill-rig using 4.25" ID hollow-stem augers.
Sampling Method: 2' split-spoon (SS) driven 24" by dropping 140 lb. hammer 30".
Soil analyses method: Hnu PID headspace readings for VOC.
Surface Conditions: Grassy; level.

Sample Type	In. Driven	In. Rcvd.	Casing Depth	Sample No.	Sample Depth	Blows\ 6-in.	Depth Feet	Graph Log	Description
							0		Augered 0 to 5 ft.
								SM	Drill cuttings: dark brown to brown, silty, fine to med. sand, some to trace of clay and traces of coarse sand and fine gravel; loamy, organic rich; slight petroleum odor. Medium plasticity.
									Grades to: light brown med. sand w/ some to trace of fine sand; consisting of subangular, fairly well sorted clasts of quartz w/ traces of feldspars and mica flakes; trace of silt; slightly moist to wet.
							5		
SS	24	19	5'	1	5'-7'	5 8 9 10		SP	light brown med. sand w/ some to trace of fine sand; consisting of subangular, fairly well sorted clasts of quartz w/ traces of feldspars and mica flakes; trace of silt; slightly moist to wet. Medium density. Petroleum odor. Sample 1 Hnu reading: 50.0 ppm.
									Augered to 10 ft. Drill cuttings: Same as above (SAA) Water table encountered at approximately 7-8 ft. Strong petroleum odor.
							10		
SS	24	24	10'	2	10'-12'	1 1 1/12" ---		CL	Blue-grey clay w/ trace of silt; high plasticity; soft. Wet.
									Sample 2 Hnu reading: 4.0 ppm.
									Clay-sand interface suspected to be at approximately 9.5 ft. based on surrounding geology.
									Drilling completed to 12 ft.
							15		
							20		

Air Sparging Well Construction:

12-10	Backfill.
9.5-7.5 ft.	Schedule 40, 2-in. ID, 0.01 slotted PVC screen.
7-1 ft.	Schedule 40, 2-in ID PVC riser.
10-7 ft.	#1 Silica sand.
7-5 ft.	Coarse-grade bentonite seal.
5-2 ft.	Portland grout.

LOG OF BORING AAS-9

EA Engineering, Science & Technology

Coordinates: Northing: 387067.0, Easting: 562741.1
Top of Well Casing Elevation: 65.98 ft.
Surface Elevation: 66.37 ft.
Well Casing Below Surface: 0.39 ft.
Reference Elevation: 70.40 ft.
Reference Description: Basis for elevation is Navy disk recessed in concrete platform on Orion Street just south of Fitch Street. Coordinates based on pre-existing wells.
Start Date: 7/20/93
Completion Date: 7/21/93

Location: Navy Exchange Service Station, Brunswick Naval Air Station, Brunswick, Maine.
Job No.: 12197.14
Client: N. Division, Naval Facilities Engineering Command.
Drilling Method: Truck-mounted, Mobile, Inc., B-61 drill-rig using 4.25" ID hollow-stem augers.
Sampling Method: 2' split-spoon (SS) driven 24" by dropping 140 lb. hammer 30".
Soil analyses method: Hnu PID headspace readings for VOC.
Surface Conditions: Grassy; level.

	Sample Type	In. Driven	In. Rcvd.	Casing Depth	Sample No.	Sample Depth	Blows\ 6-in.	Depth Feet	Graph Log	Description
								0		Augered 0 to 5 ft.
										Drill cuttings: brown, silty, fine to med. sand, some to trace of clay and traces of coarse sand and fine gravel; loamy, organic rich. Medium plasticity.
								5		
	SS	24	24	5'	1	5'-7'	2		SM	Top 8 inches: SAA. Dry to slightly moist, low density and medium plasticity.
							7			Middle 14 inches: light brown to reddish brown med. sand w/ trace of fine sand and silt; consisting of
							10		SP	subangular, fairly well sorted clasts of quartz w/ traces of feldspars and mica flakes; dry
							8			to slightly moist; med. density. Bottom 3 inches: blue-grey clay w/ trace of silt.
	SS	24	24	7'	2	7'-9'	2		CL	Sample 1 Hnu reading: 4.0 ppm.
							2			Blue-grey clay w/ trace of silt; high plasticity; soft. Wet.
							3			Sample 2 Hnu reading: 5.0 ppm.
							1			
										Drilling completed at 9 ft.
								10		
								15		
								20		

Air Sparging Well Construction:

9-7.5	Backfill.
7-6 ft.	Schedule 40, 2-in. ID, 0.01 slotted PVC screen.
6-1 ft.	Schedule 40, 2-in ID PVC riser.
7.5-5.5 ft.	#1 Silica sand.
5.5-3.5 ft.	Coarse-grade bentonite seal.
4.5-2 ft.	Portland grout.

LOG OF BORING AAS-10

EA Engineering, Science & Technology

Coordinates: Northing: 387082.9, Easting: 562766.1
Top of Well Casing Elevation: 66.26 ft.
Surface Elevation: 66.71 ft.
Well Casing Below Surface: 0.45 ft.
Reference Elevation: 70.40 ft.
Reference Description: Basis for elevation is Navy disk recessed in concrete platform on Orion Street just south of Fitch Street. Coordinates based on pre-existing wells.
Start Date: 7/21/93
Completion Date: 7/21/93

Location: Navy Exchange Service Station, Brunswick Naval Air Station, Brunswick, Maine.
Job No.: 12197.14
Client: N. Division, Naval Facilities Engineering Command.
Drilling Method: Truck-mounted, Mobile, Inc., B-61 drill-rig using 4.25" ID hollow-stem augers.
Sampling Method: 2' split-spoon (SS) driven 24" by dropping 140 lb. hammer 30".
Soil analyses method: Hnu PID headspace readings for VOC.
Surface Conditions: Grassy; level.

	Sample Type	In. Driven	In. Rcvd.	Casing Depth	Sample No.	Sample Depth	Blows\ 6-in.	Depth Feet	Graph Log	Description
								0		
										Augered 0 to 5 ft.
										Drill cuttings: brown, silty, fine to med. sand, some to trace of clay and traces of coarse sand and fine gravel; loamy, organic rich. Medium plasticity.
									SM	
								5		
	SS	24	18	5'	1	5'-7'	6			light brown med. sand w/ trace of fine sand and silt; consisting of subangular, fairly well sorted clasts of
							15		SP	quartz w/ traces of feldspars and mica flakes; trace of silt; dry to slightly moist; slight petroleum odor.
							16			Medium density.
							17			Sample 1 Hnu: 0 ppm.
	SS	24	24	7'	2	7'-9'	8		ML-CL	Top 12 inches: SAA with some silt and trace of clay.
							7			Middle 11 inches: grey-brown silty clay; medium density and plasticity.
							7		CL	Bottom 1 inch: Blue-grey clay w/ trace of silt; high plasticity. Wet.
							8			Sample 2 Hnu reading: 1.0 ppm.
								10		Drilling completed to 9 ft.
								15		
								20		

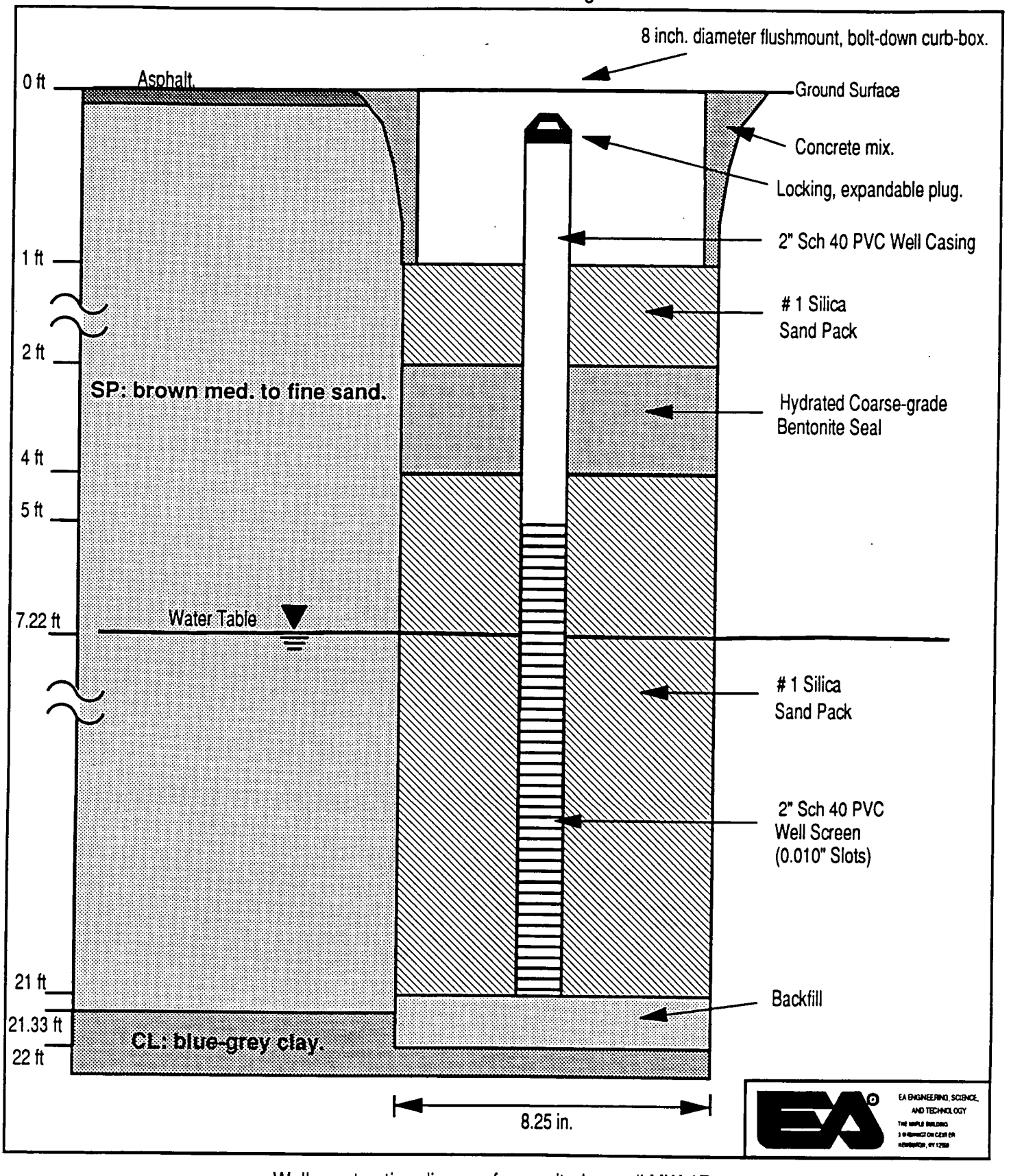
Air Sparging Well Construction:

9-8.5	Backfill.
8-7 ft.	Schedule 40, 2-in. ID, 0.01 slotted PVC screen.
7-1 ft.	Schedule 40, 2-in ID PVC riser.
8.5-6.5 ft.	#1 Silica sand.
6.5-4.5 ft.	Coarse-grade bentonite seal.
4.5-2 ft.	Portland grout.

Appendix B

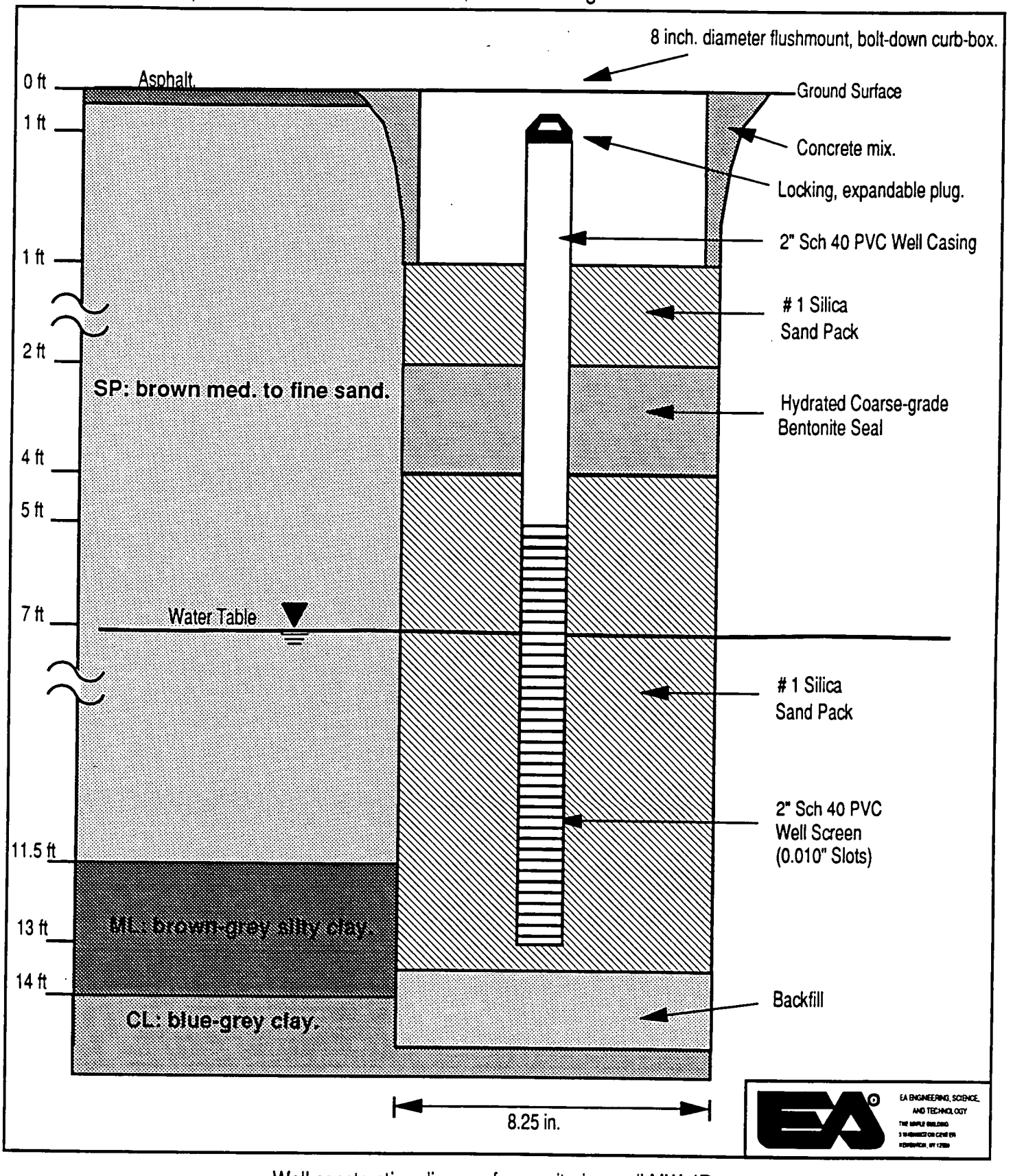
Well Construction Diagrams

Well Construction Diagram



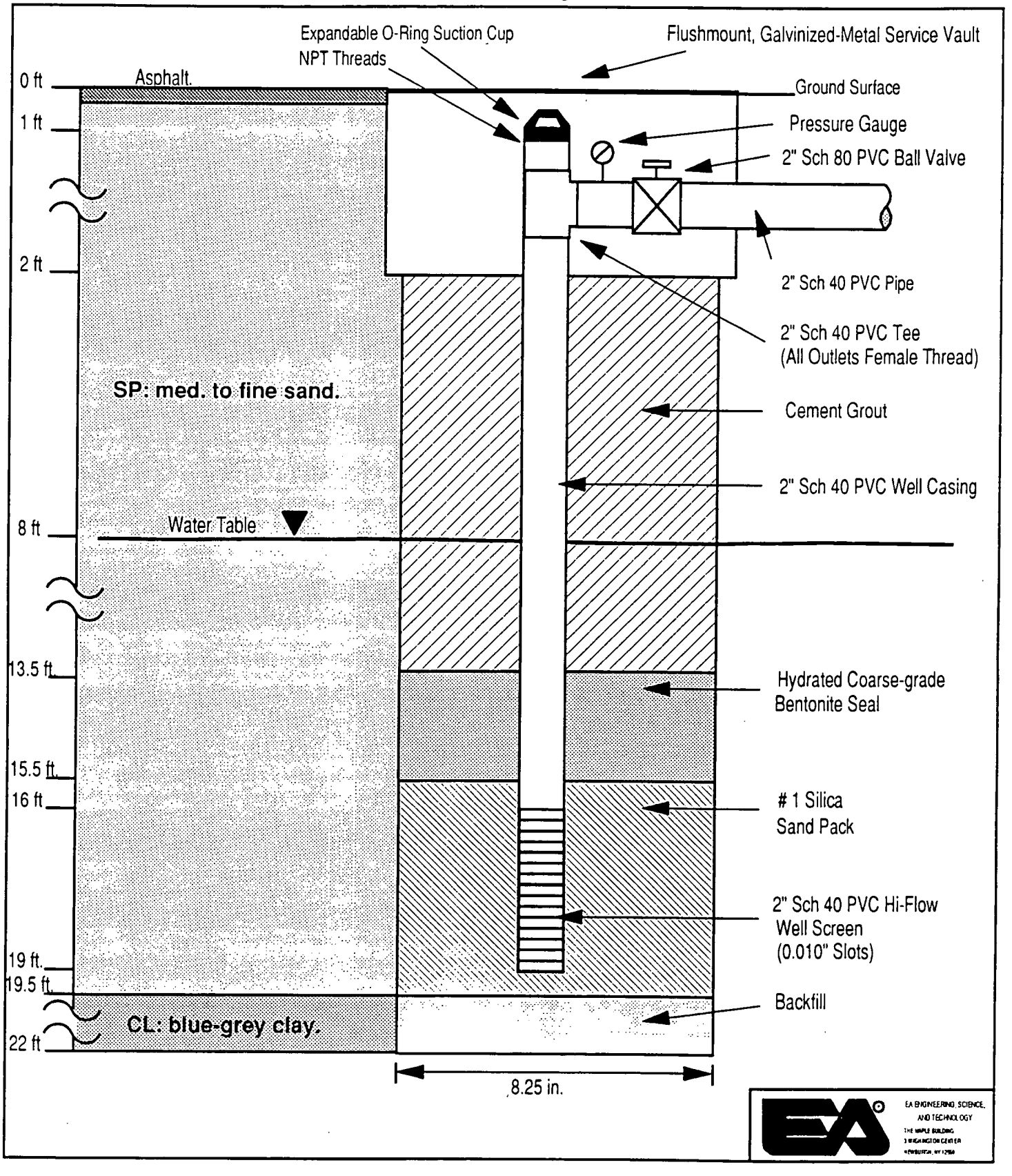
Well construction diagram for monitoring well MW-1R.

Well Construction Diagram

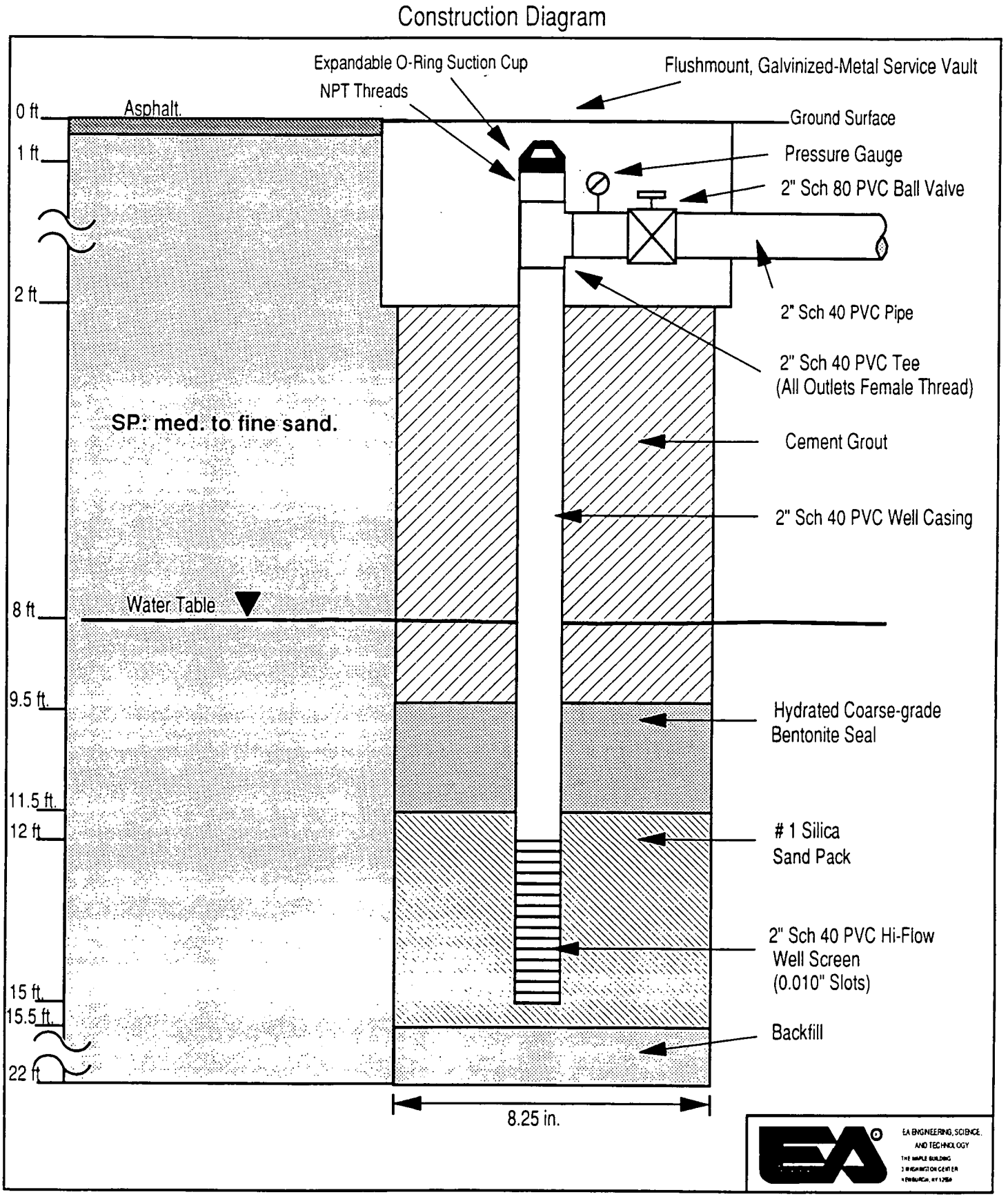


Well construction diagram for monitoring well MW-4R.

Construction Diagram

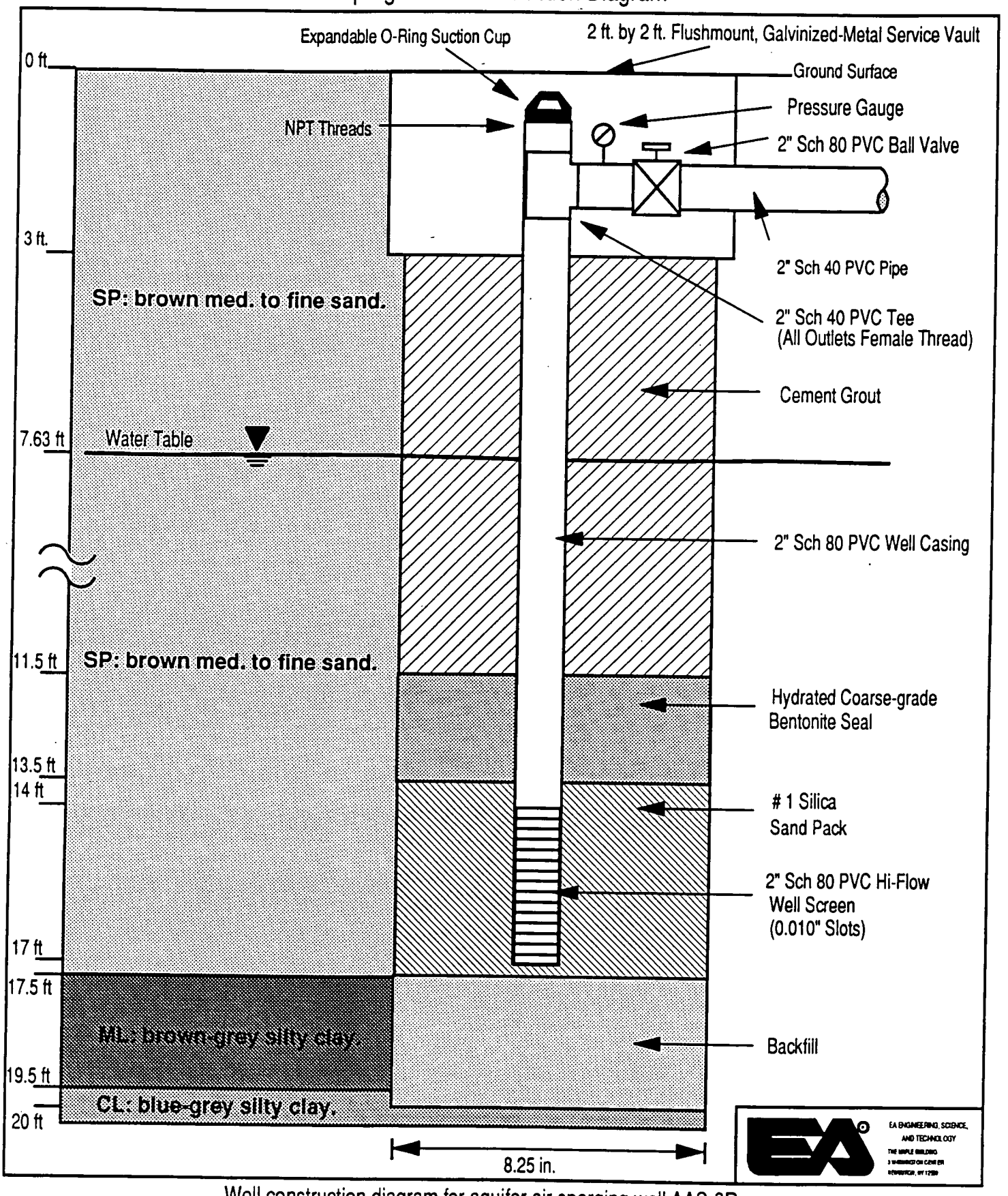


Well construction diagram of aquifer air sparging well AAS-1.

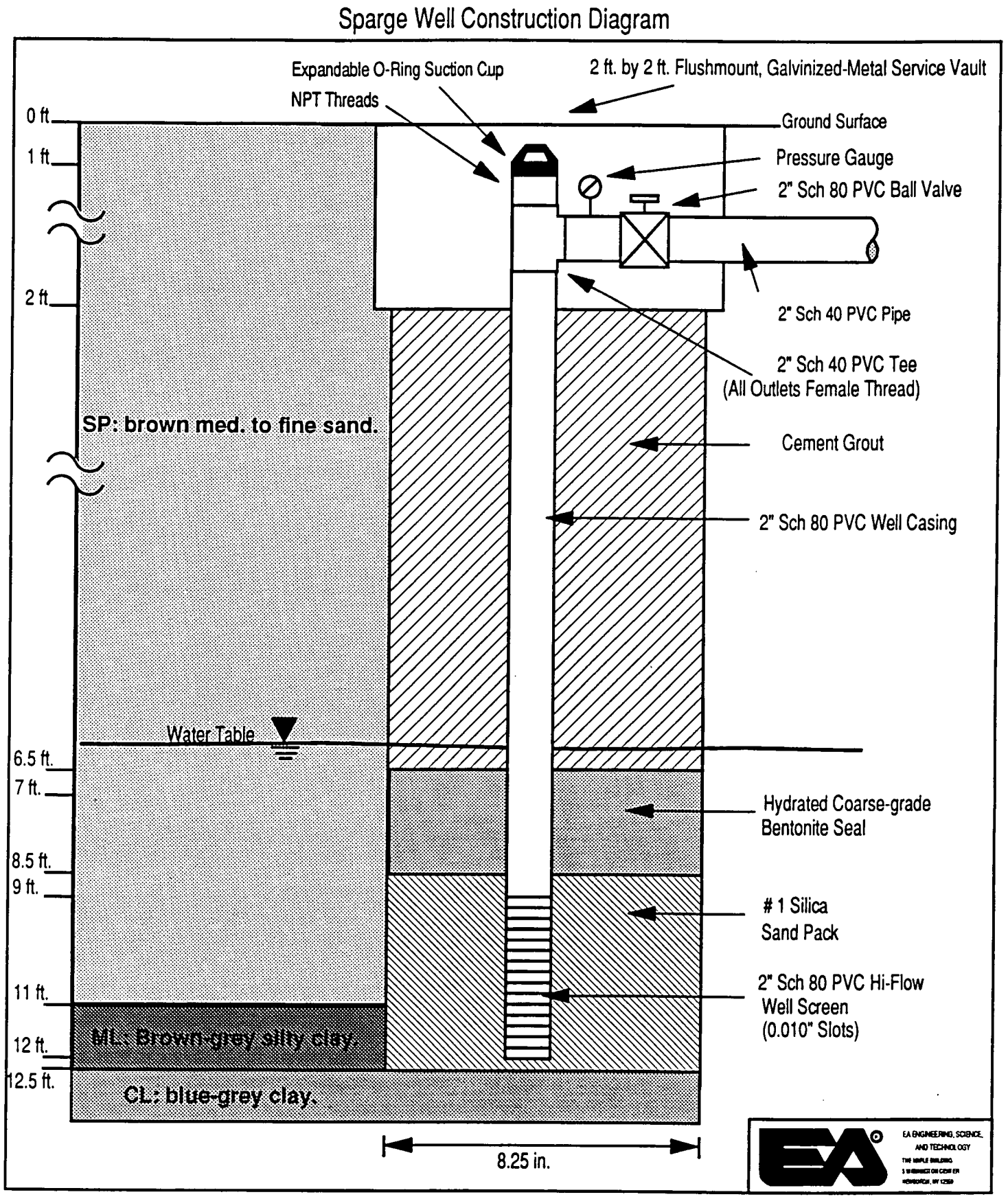


Well construction diagram of aquifer air sparging well AAS-2.

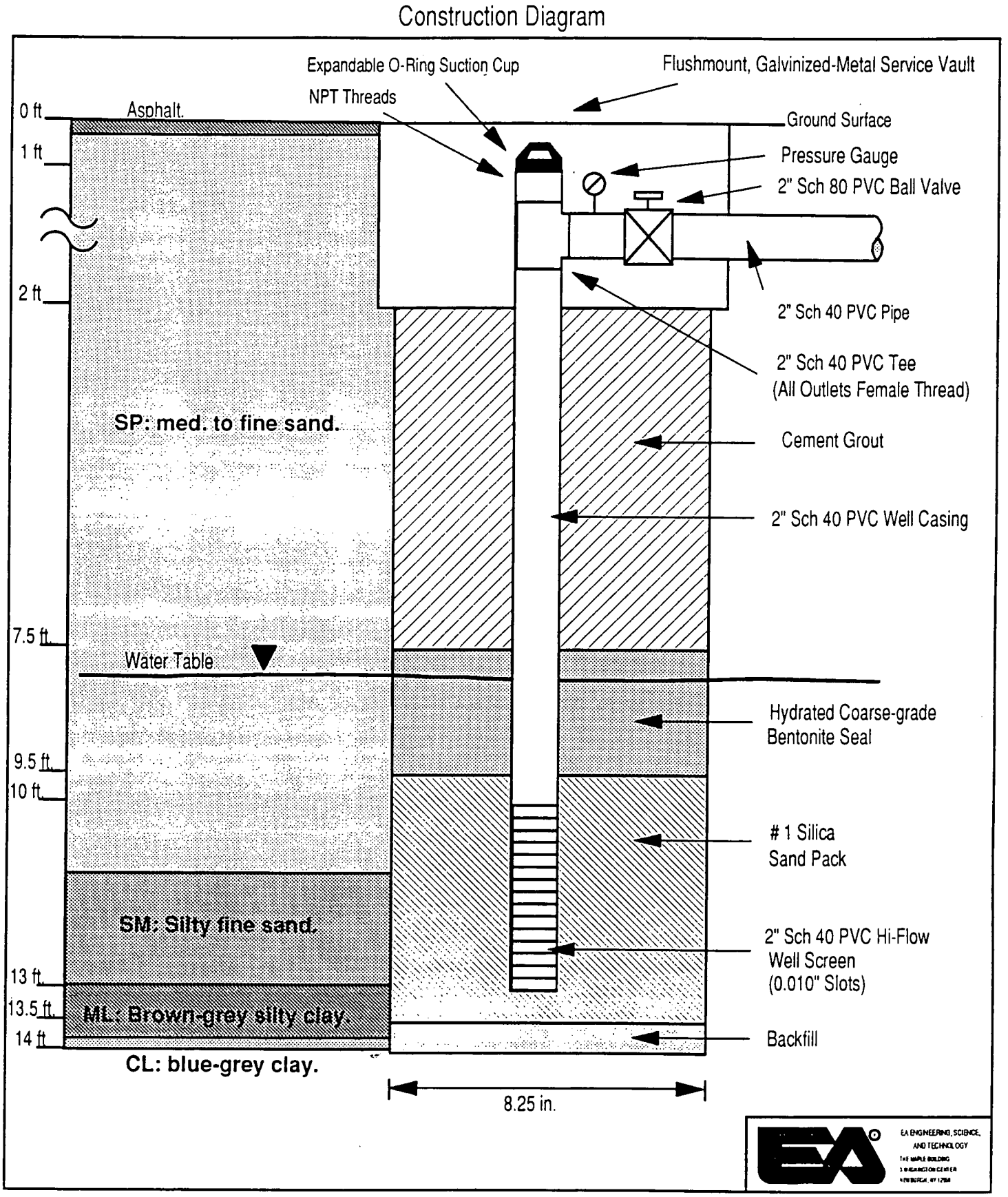
Sparge Well Construction Diagram



Well construction diagram for aquifer air sparging well AAS-3R.

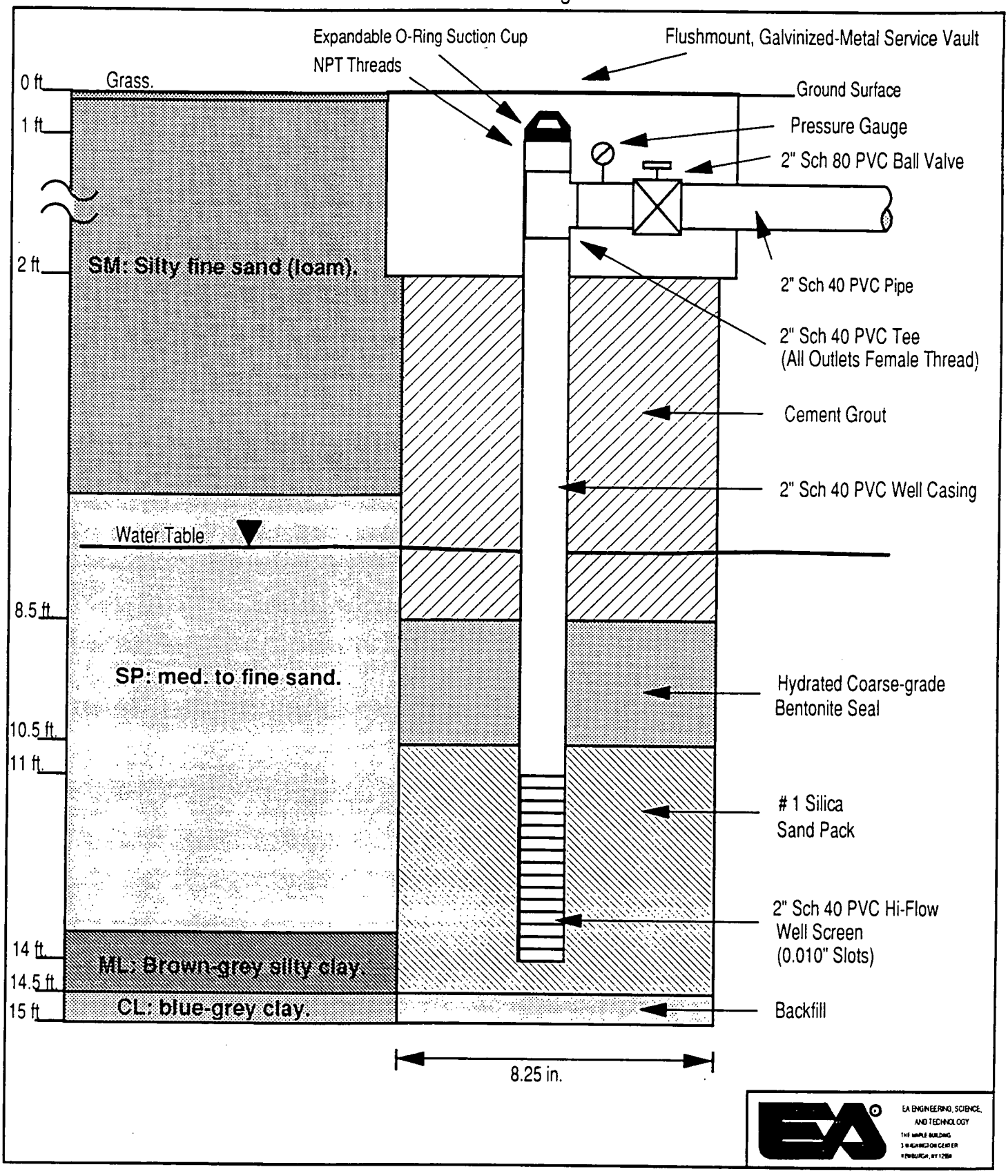


Well construction diagram for aquifer air sparging well AAS-4R.

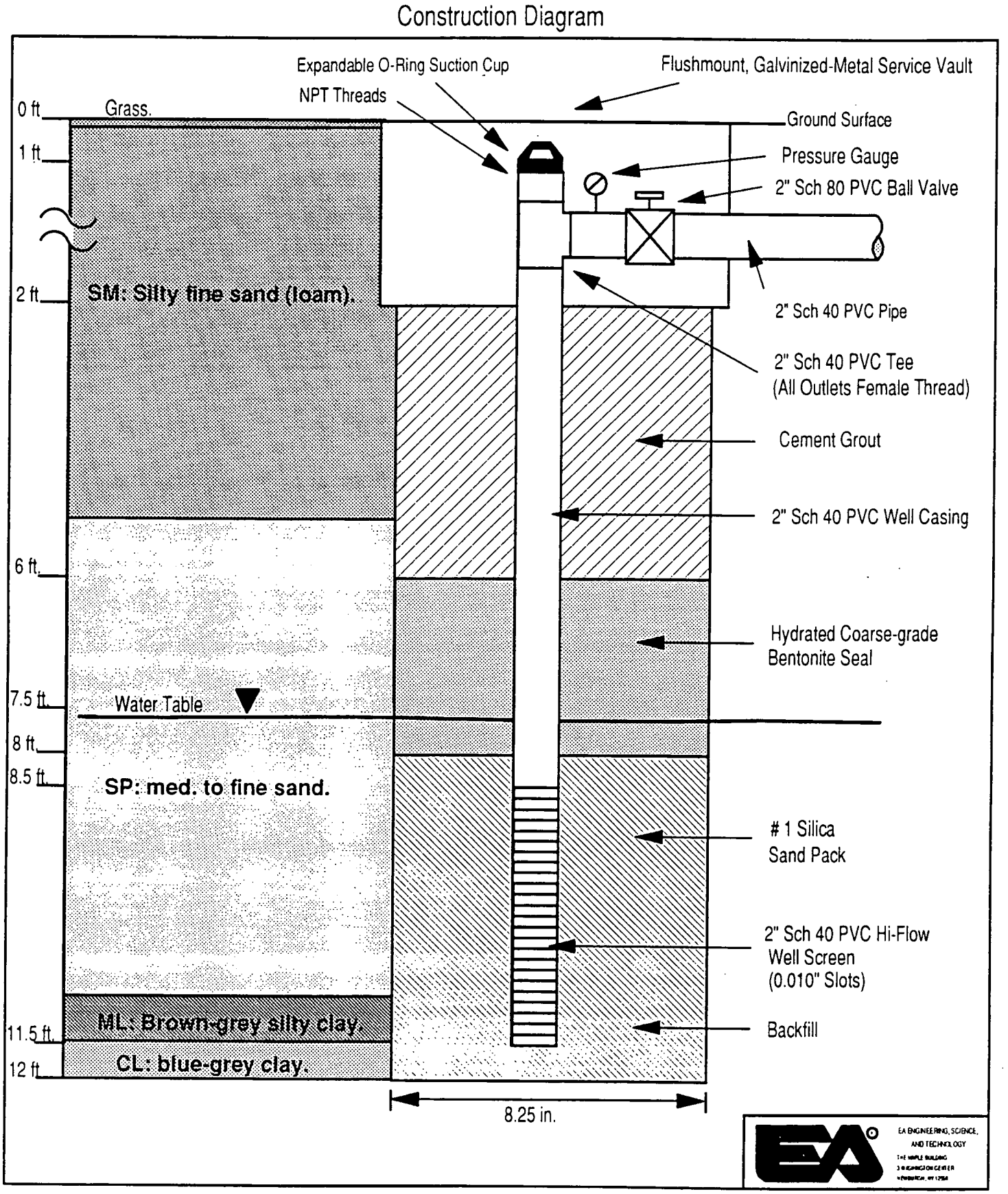


Well construction diagram of aquifer air sparging well AAS-5.

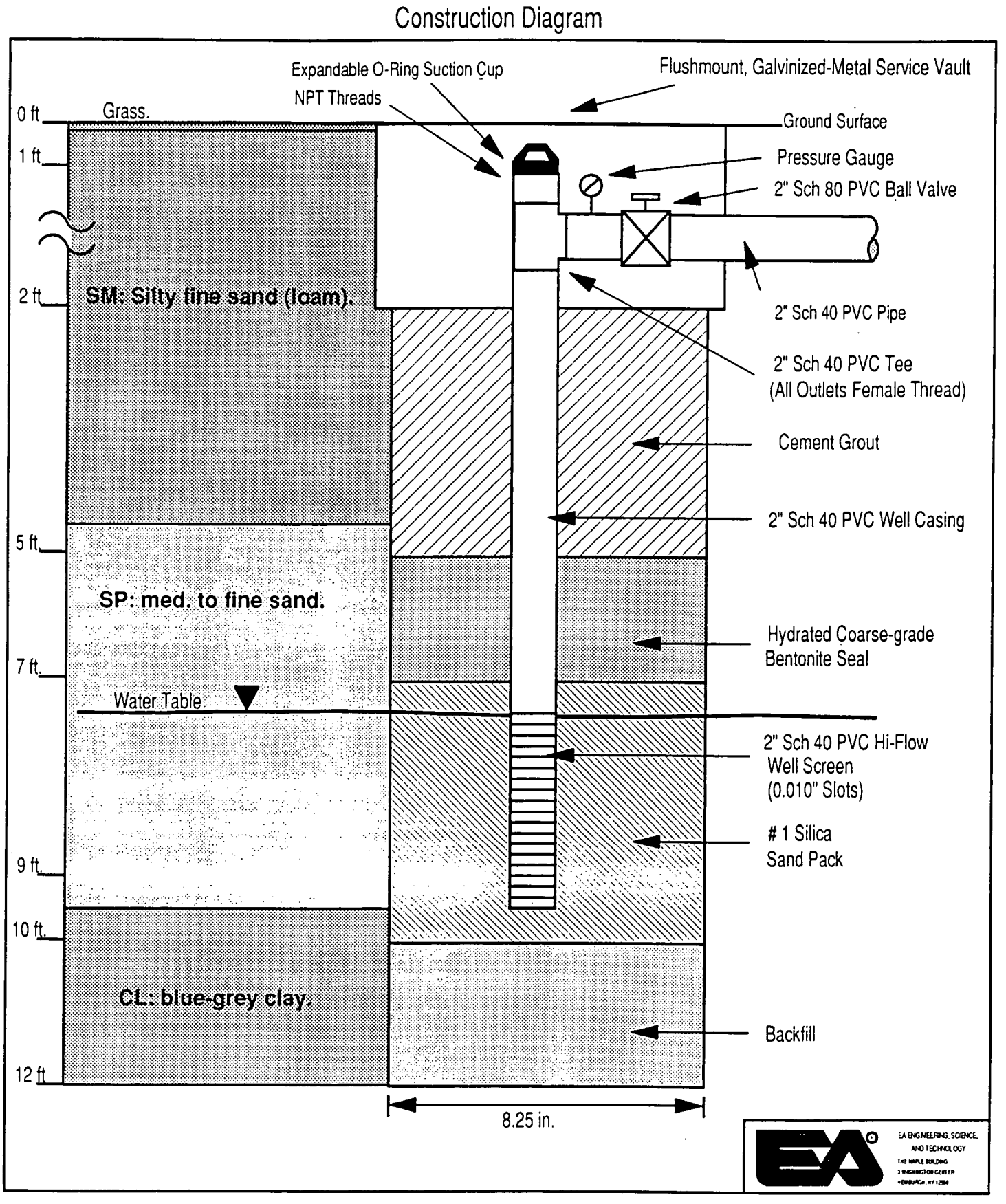
Construction Diagram



Well construction diagram of aquifer air sparging well AAS-6.

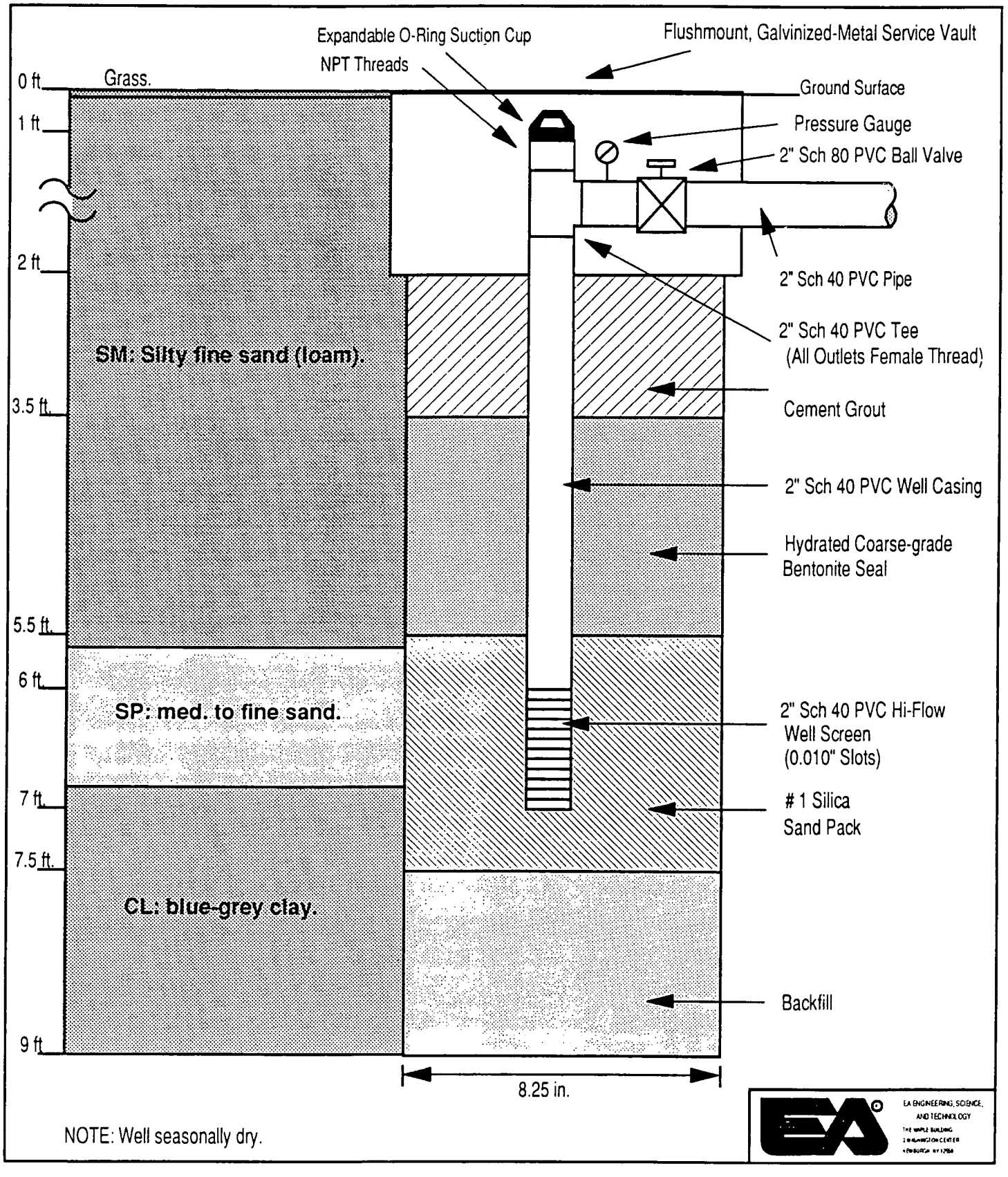


Well construction diagram of aquifer air sparging well AAS-7.



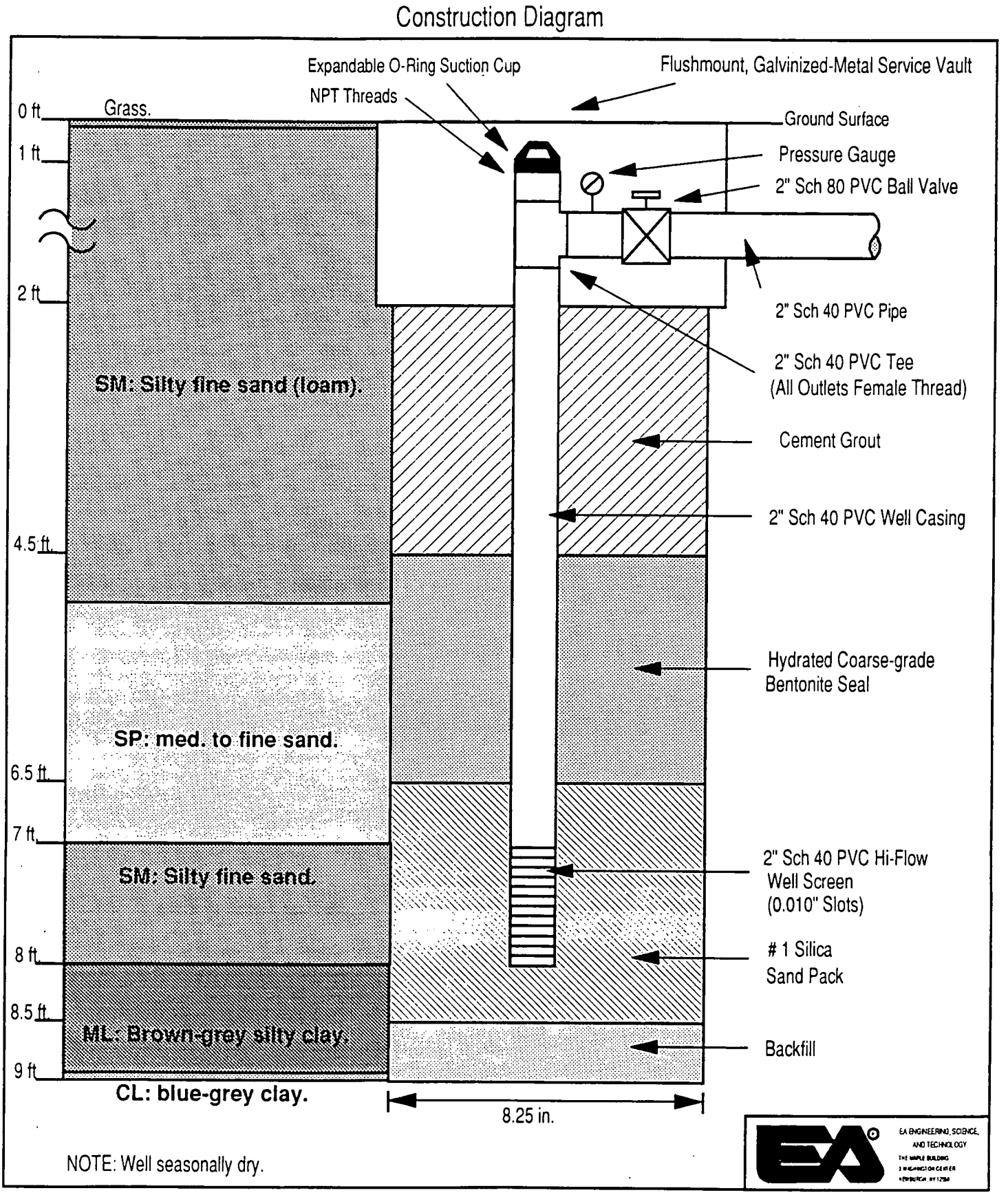
Well construction diagram of aquifer air sparging well AAS-8.

Construction Diagram



NOTE: Well seasonally dry.

Well construction diagram of aquifer air sparging well AAS-9.



Well construction diagram of aquifer air sparging well AAS-10.

Appendix C

Field Record of Well Development Forms

EA

FIELD RECORD OF WELL DEVELOPMENT

WELL I.D.: AAS-3R
WELL CONDITION: NEW

SITE NAME: NAS BRUNSWICK
WEATHER: 38° F + CLOUDY

GAUGE DATE: 3/25/94
SOUNDING METHOD: ORS PROBE
STICK UP/DOWN (ft): —

GAUGE TIME: 0935
MEASUREMENT REF: T.O.C.
WELL DIAMETER (in.): 2"

DEVELOPMENT DATE: 3/25/94
DEVELOPMENT METHOD: submersible RV pump

DEVELOPMENT TIME: 0937
FIELD TECHNICIAN: AT

WELL VOLUME

A. WELL DEPTH (ft): 17
B. DEPTH TO WATER (ft): 7.36
C. LIQUID DEPTH (ft) (A-B): 9.64

D. WELL VOLUME/FT: 0.16
E. WELL VOLUME (gal) (C*D): 1.54
F. FIVE WELL VOLUMES (gal) (E*5): 7.71
10x = 15.4

	BEGINNING	1	2	3	4	5
TIME (min)	0938	0939	0941	0944		0955
DEPTH TO WATER (ft)	7.36	—	—	—	SURGED WELL AGAIN 4 MINUTES	—
RATE (GPM)	0	POST SURGE	~2	~2		~2
VOLUME PURGED (gal)	0	0	2	5		7
pH	6.18	6.18	6.15	6.12		6.19
TEMPERATURE (C)	8.67	9.03	9.02	9.88		9.70
CONDUCTIVITY (μmhos/cm)	1324	1590	1580	1660		1760
DISSOLVED OXYGEN (mg/L)	0.67	0.54	0.54	0.55		0.65

	6	7	8	9	10	END
TIME (min)	0958	1000	1002			
DEPTH TO WATER (ft)	—	—	—			
RATE (GPM)	~2	~2	~2			
VOLUME PURGED (gal)	11	13	15			
pH	6.07	6.06	6.06			
TEMPERATURE (C)	9.92	10.2	10.2			
CONDUCTIVITY (μmhos/cm)	1690	1650	1670			
DISSOLVED OXYGEN (mg/L)	0.52	0.42	0.45			

TOTAL QUANTITY OF WATER REMOVED (gal): 15

COMMENTS AND OBSERVATIONS: Instant Recharge. SURGED WELL A THIRD TIME AT 0959
WATER BECAME xtal CLEAR AFTER 11 GALLONS.

FIELD RECORD OF WELL DEVELOPMENT

WELL I.D.: AAS-4R
WELL CONDITION: NEW

SITE NAME: NAS BRUNSWICK
WEATHER: 38° F + CLEAR

GAUGE DATE: 3/25/94
SOUNDING METHOD: ORS PROBE
STICK UP/DOWN (ft): submersible RV pump

GAUGE TIME: 0846
MEASUREMENT REF: T.O.C.
WELL DIAMETER (in.): 2"

DEVELOPMENT DATE: 3/25/94
DEVELOPMENT METHOD: submersible RV pump

DEVELOPMENT TIME: 0848
FIELD TECHNICIAN: AT

WELL VOLUME

A. WELL DEPTH (ft): 12
B. DEPTH TO WATER (ft): 6.6
C. LIQUID DEPTH (ft) (A-B): 5.4

D. WELL VOLUME/FT: 0.16
E. WELL VOLUME (gal) (C*D): 0.86
F. FIVE WELL VOLUMES (gal) (E*5): 4.32
10x = 8.64

	BEGINNING	1	2	3	4	5
TIME (min)	0848	0849	0850	0922	SURGED WELL ~5 minutes	1009
DEPTH TO WATER (ft)	6.6	—	—	—		—
RATE (GPM)	0	POST SURGE	~1-2	~2		~2
VOLUME PURGED (gal)	0	0	1	2		3
pH	5.85	5.95	WENT DRY	6.04		6.44
TEMPERATURE (C)	7.46	7.46		10.41		13.60
CONDUCTIVITY (μmhos/cm)	880	892		765		634
DISSOLVED OXYGEN (mg/L)	0.62	0.48		0.42		0.67

	6	7	8	9	10	END
TIME (min)	1011	1013	1016	1018		
DEPTH TO WATER (ft)	—	—	—	—		
RATE (GPM)	~2	~2	~2	~2		
VOLUME PURGED (gal)	5	7	10	12		
pH	6.37	6.14	6.08	6.04		
TEMPERATURE (C)	8.60	7.69	7.52	7.52		
CONDUCTIVITY (μmhos/cm)	866	786	897	886		
DISSOLVED OXYGEN (mg/L)	0.64	0.59	0.61	0.56		

TOTAL QUANTITY OF WATER REMOVED (gal): 12

COMMENTS AND OBSERVATIONS: Color of WATER WENT x-tal clear After 10 gallons

FIELD RECORD OF WELL DEVELOPMENT

WELL I.D.: MW-1R
WELL CONDITION: NEW

SITE NAME: NAS BRUNSWICK
WEATHER: 38° F + cloudy

GAUGE DATE: 3/25/94
SOUNDING METHOD: ORS PROBE
STICK UP/DOWN (ft): —

GAUGE TIME: 0730
MEASUREMENT REF: T.O.C
WELL DIAMETER (in.): 2"

DEVELOPMENT DATE: 3/25/94
DEVELOPMENT METHOD: submersible RU PUMP

DEVELOPMENT TIME: 0730
FIELD TECHNICIAN: AT

WELL VOLUME

A. WELL DEPTH (ft): 21.0
B. DEPTH TO WATER (ft): 6.4
C. LIQUID DEPTH (ft) (A-B): 14.6

D. WELL VOLUME/FT: 0.16
E. WELL VOLUME (gal) (C*D): 2.34
F. FIVE WELL VOLUMES (gal) (E*5): 11.68
10 X = 116.8

	BEGINNING	1	2	3	4	5
TIME (min)	0730	0745	0813	0816	0821	0823
DEPTH TO WATER (ft)	6.4	6.4	—	—	—	—
RATE (GPM)	0	POST SURGE	~2	~2	~2	~2
VOLUME PURGED (gal)	0	0	4	13	18	23
pH	7.03	6.51	6.02	5.77	5.83	5.82
TEMPERATURE (C)	8.38	7.33	9.26	9.74	9.99	10.36
CONDUCTIVITY (μmhos/cm)	242	240	221	230	230	226
DISSOLVED OXYGEN (mg/L)	0.59	0.60	0.52	0.51	0.48	0.48

	6	7	8	9	10	END
TIME (min)	0825	0828				
DEPTH TO WATER (ft)	—	—				
RATE (GPM)	~2	—				
VOLUME PURGED (gal)	33	35				
pH	5.70	5.45				
TEMPERATURE (C)	10.23	10.15				
CONDUCTIVITY (μmhos/cm)	233	231				
DISSOLVED OXYGEN (mg/L)	0.47	0.45				

TOTAL QUANTITY OF WATER REMOVED (gal): 35

COMMENTS AND OBSERVATIONS: Instant Recharge
DARK BROWN TO LIGHT TAN AND
TRANSLUCENT AT 35 gallons.

EA

FIELD RECORD OF WELL DEVELOPMENT

WELL I.D.: MW-4R
WELL CONDITION: NEW

SITE NAME: NAS BRUNSWICK
WEATHER: 38° F + CLOUDY

GAUGE DATE: 3/25/94
SOUNDING METHOD: ORS interface
STICK UP/DOWN (ft): —

GAUGE TIME: 0858
MEASUREMENT REF: T.O.C
WELL DIAMETER (in.): 2"

DEVELOPMENT DATE: 3/25/94
DEVELOPMENT METHOD: submersible RU PUMP

DEVELOPMENT TIME: 0900
FIELD TECHNICIAN: AT

WELL VOLUME

A. WELL DEPTH (ft): 13
B. DEPTH TO WATER (ft): 6.51
C. LIQUID DEPTH (ft) (A-B): 6.49

D. WELL VOLUME/FT: 0.16
E. WELL VOLUME (gal) (C*D): 1.04
F. FIVE WELL VOLUMES (gal) (E*5): 5.2
10X = 10.4

	BEGINNING	1	2	3	4	5
TIME (min)	0903	0904	0908	0910	0913	0916
DEPTH TO WATER (ft)	6.51	—	—	—	—	—
RATE (GPM)	0	POST SURGE	~2	~2	~2	~2
VOLUME PURGED (gal)	0	0	1	5	10	15
pH	6.40	5.96	6.07	5.97	5.92	5.88
TEMPERATURE (C)	6.87	6.78	6.09	5.81	5.96	6.03
CONDUCTIVITY (μmhos/cm)	801	820	788	787	774	784
DISSOLVED OXYGEN (mg/L)	0.61	0.54	0.55	0.48	0.42	0.43

	6	7	8	9	10	END
TIME (min)	0917					
DEPTH TO WATER (ft)	—					
RATE (GPM)	~2					
VOLUME PURGED (gal)	20					
pH	5.82					
TEMPERATURE (C)	6.09					
CONDUCTIVITY (μmhos/cm)	790					
DISSOLVED OXYGEN (mg/L)	0.41					

TOTAL QUANTITY OF WATER REMOVED (gal): 20

COMMENTS AND OBSERVATIONS: BROWN WATER WITH OILY SHEEN
- CHANGED TO A TRANSLUCENT TAN COLOR
w/ OILY SHEEN AFTER 5 GALLONS -
- CHANGED TO A X-TAL CLEAR COLOR
w/ OILY SHEEN AT ~15 GALLONS

Appendix D

Supporting Data and Chromatograms

SVCA FIELD DATA SHEET

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Project Number: 12197.01

Gas Chromatograph: Hnu 321

Project Manager: [illegible]

Station Number:

Anaylsts: S. Olson

Date: 25 OCT 93

Sit L cation: NAS BRUNSWICK ME

SAMPLE LOCATION	TIME	DEPTH (ft.)	PURGE TIME (min.)	VACUUM (IN Hg)	VACUUM RELEASE (min.)	VOLUME INJECTION (ul) FID	ECD	SAMPLER NUMBER	COMMENTS
STD	1630	NA	NA	NA	NA	500			
[illegible]	1647	NA	2 min	0	6 sec	1000		5	
vp-1	1712	3.5	2	5	2 sec	1000		5	
vp-2	1741	3.5	2	10	2 sec	1000		5	
vp-3	1803	3.5	2	5	1 sec	1000		5	
vp-4	1821	3.5	2	6	1 sec	1000		5	
vp-5	1842	3.5	2	4	1 sec	1000		5	
vp-6	1859	3.5	2	5	1 sec	1000		5	
vp-7	1915	3.5	2	5	1 sec	1000		5	
STD	1936	NA	NA	NA	NA	500		NA	

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

SVCA SAMPLE CALCULATIONS

Site: Brunswick NAS
Project No.: ~~[illegible]~~ 12197.01 Analysis Date: 25 OCT 93
Calculated by: S. Dobson Checked by: [illegible]

Sample ID	Depth	Benzene ppm	Toluene ppm	Ethyl Benzene ppm	o Xylene ppm	Total Xylene	Total Hydrocarbons ppm					Inject Volume (uL)	Time
Blank	NA	<0.1 ~~<0.02~~	<0.1	<0.1	<0.1 ~~0.00~~		<0.1					1000	1647
VP-1	3.5	<0.1	<0.1	<0.1	<0.1		<0.1					1000	1712
VP-2	3.5											1000	1741
VP-3	3.5											1000	1754
VP-4	3.5												1821
VP-5	3.5												1842
VP-6	3.5												1854
VP-7	3.5	46.8	3.6 11.0		3.0	19.0	83000						1933

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

SVCA INSTRUMENT CALIBRATION RECORD

Site: Brunswick NAS
Project No.: ~~11432.01~~ 12197.01
Analysis Date: 25 OCT 93

Benzene 16.7		Toluene 20.0		Ethyl Benzene 15.3		Ortho-Xylene 11.0								Inject volume (uL)	Time ~~Temp~~ (c)
RT	RF	RT	RF	RT	RF	RT	RF	RT	RF	RT	RF	RT	RF		
3.687	0.040	6.437	5.4×10^{-3}	8.938	0.065	9.737	7.2×10^{-3}								16.30 ~~3.687~~
3.033	0.040	5.652	6.1×10^{-3}	8.4	0.080	9.26	0.010								
	0.040		5.8×10^{-3}		0.073		0.017								

RF = (std conc.) (std inj vol)

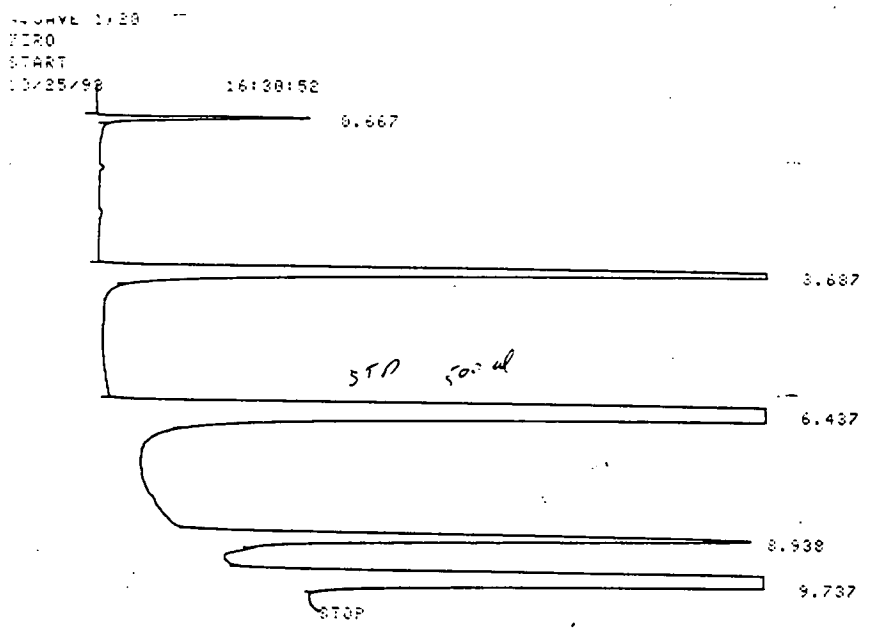
sample conc. = (peak area) (RF)

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 25 OCTOBER 1993 Project Manager: Battle Chemist: Tobson Site: NAS Brunswick, ME

Geologist: Sample: STD Volume Injected: 500 µl Std. Vol. Inj.:



CHROMATOGRAM 1 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 161
REPORT NO 4

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.667	17549			0.592	
2	3.687	209747			7.0759	
3	6.437	1851555			62.4628	
4	8.938	116986			3.9463	
5	9.737	760424			25.923	
TOTAL		2954261			100	

Comments:

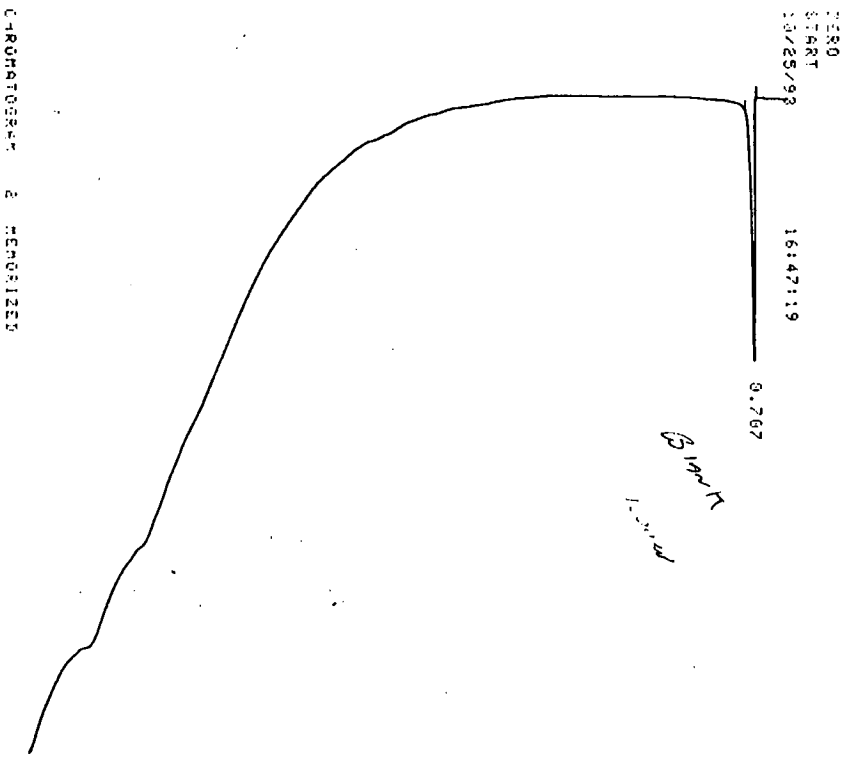
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 25 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: Blank Volume Injected: 1000 µl Std. Vol. Inj.:

Comments:



CHROMATOGRAM 2 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 161
REPORT NO 5

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.767	25678			100	
TOTAL		25678			100	

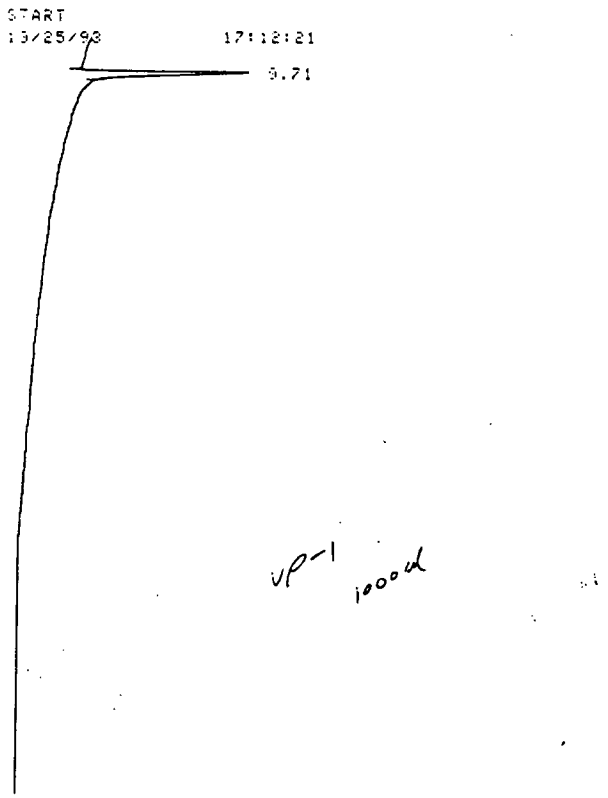
ZERO

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 25 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: VP-1 Volume Injected: 1000 ul Std. Vol. Inj.:



CHROMATOGRAM 3 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 161
REPORT NO 6

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.71	18564			100	
	TOTAL	18564			100	

ZERO

Comments:

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 25 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS BRUNSWICK, ME

Geologist: Sample: VP-2 Volume Injected: 1000 ml Std. Vol. Inj.:

Comments:

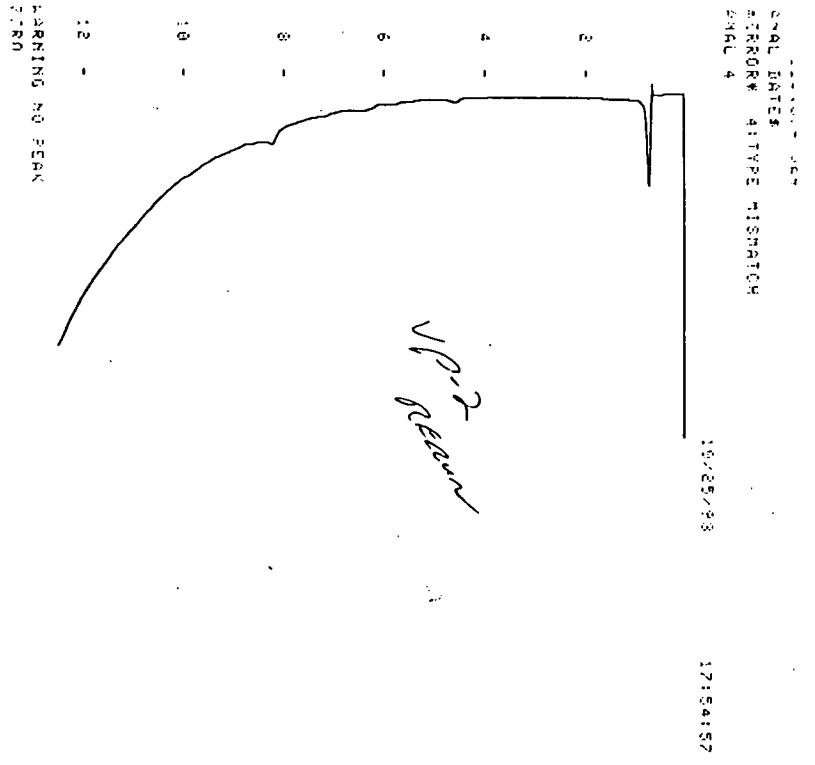
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 25 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS BRUNSWICK, ME

Geologist: Sample: VP-2 Volume Injected: Std. Vol. Inj.:

Comments:



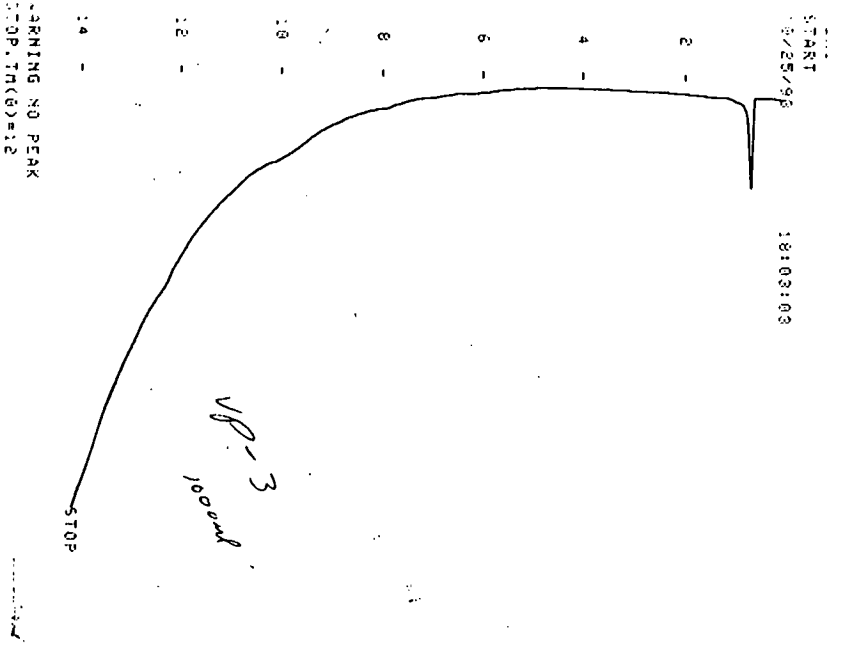
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 25 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: VP-3 Volume Injected: 1000 µl Std. Vol. Inj.:

Comments:



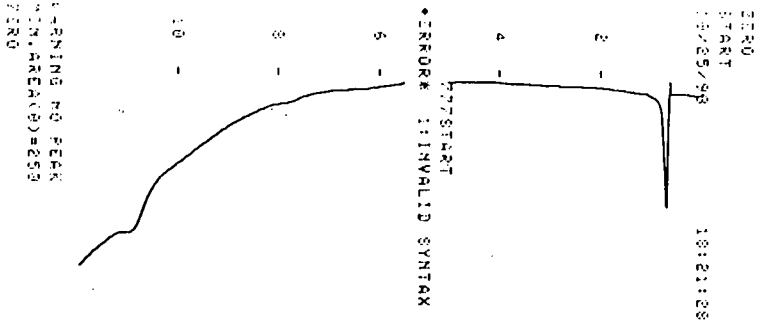
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 25 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS BRUNSWICK, ME

Geologist: _____ Sample: VP-4 Volume Injected: 1000 ml Std. Vol. Inj.: _____

Comments:



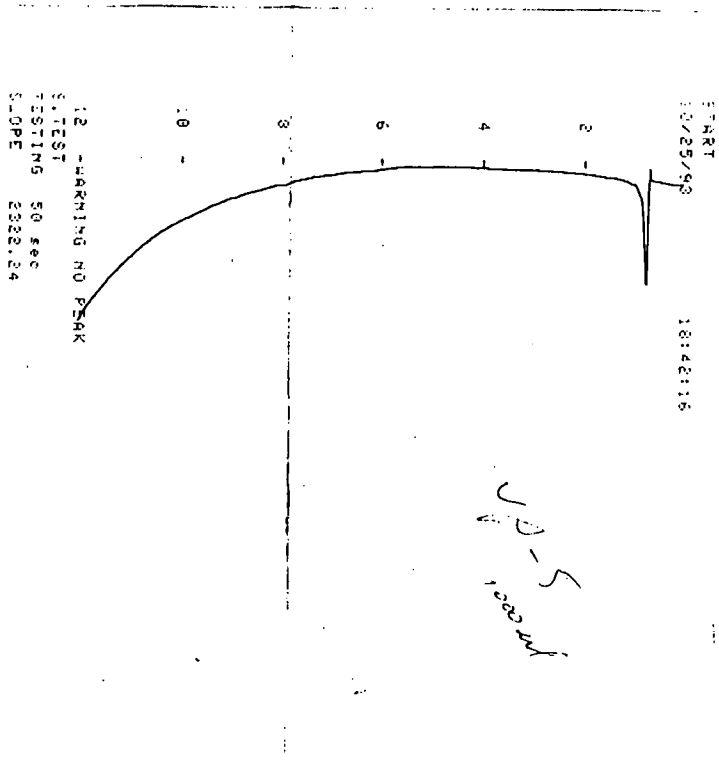
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 25 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: VP-5 Volume Injected: 1000 µl Std. Vol. Inj.: —

Comments:



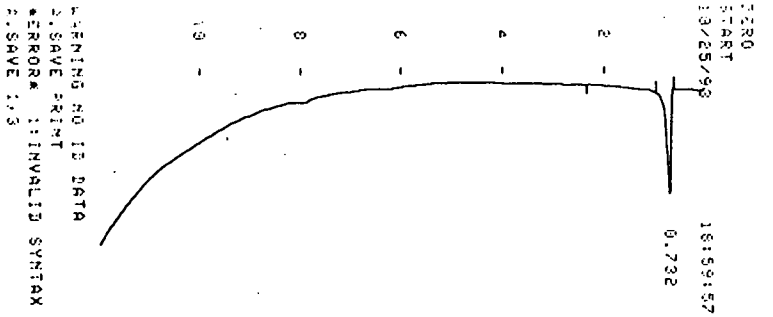
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 25 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: VP-6 Volume Injected: 1000 µl Std. Vol. Inj.:

Comments:



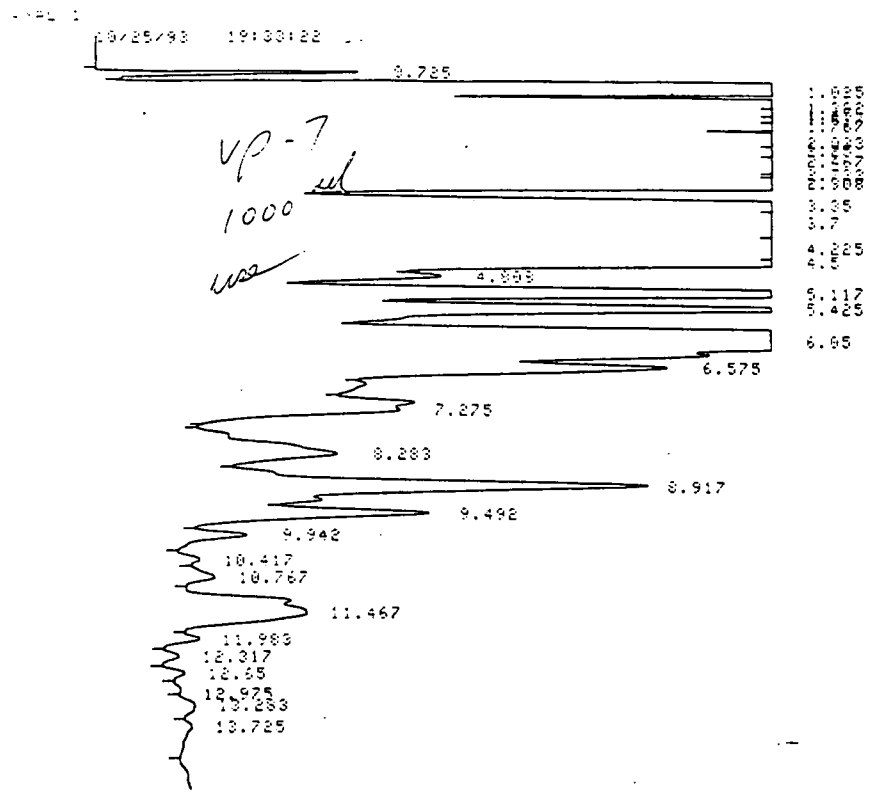
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 25 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: VP-7 Volume Injected: 1000µl Std. Vol. Inj.:

Comments:



CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 161
REPORT NO 7

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.725	111538			0.1343	
2	1.025	9606388	VE		11.5687	
3	1.392	9998866	VE		12.0317	
4	1.45	8989808	VE		10.8262	
5	1.617	3864613	V		4.6541	
6	1.767	3822018	V		4.6028	
7	2.633	10065375	VE		12.1215	
8	2.25	6015156	V		7.2439	
9	2.467	4513794	V		5.4358	
10	2.733	405852	V		0.4888	
11	2.908	4542257	V		5.4702	
12	3.35	1170686	VB		1.4098	
13	3.7	5389224	V		6.4901	
14	4.225	6273545	V		7.5551	
15	4.5	843801	V		1.0162	
16	4.808	153819	V		0.1852	
17	5.117	835173	V		1.0058	
18	5.425	621763	VT		0.7488	
19	6.05	3033174	VT		3.6528	
20	6.575	388436	V		0.4678	
21	7.275	223387			0.269	
22	8.283	313857			0.378	
23	8.917	826637	V MTP		0.9955	
24	9.492	291466	VOX		0.351	
25	9.942	49951			0.0602	
26	10.417	24683			0.0297	
27	10.767	61936	V		0.0746	
28	11.467	420659	V		0.5066	
29	11.983	36127	V		0.0435	
30	12.317	14542			0.0175	
31	12.65	22934			0.0276	
32	12.975	18963	V		0.0228	
33	13.283	54574	V		0.0657	
34	13.725	40613	V		0.0489	
	TOTAL	83037609			100	

ZERO

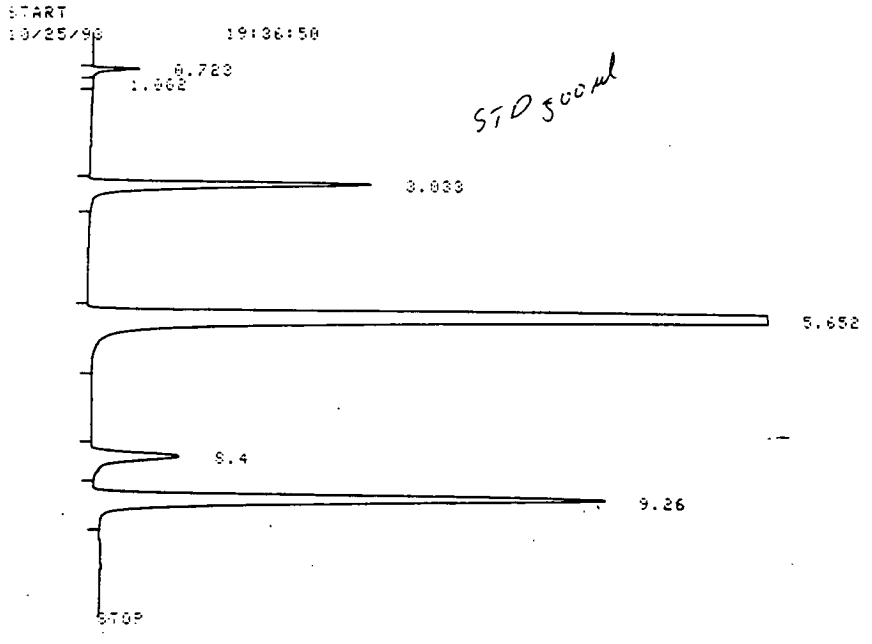
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 25 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: STD Volume Injected: 500 ml Std. Vol. Inj.:

Comments:



CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 161
REPORT NO 8

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.723	18167			0.7298	
2	1.002	1736	V		0.0697	
3	3.033	210624			8.461	
4	5.652	1638530			65.8213	
5	9.4	95077			3.8193	
6	9.26	525228			21.0989	
	TOTAL	2489362			100	

SVCA FIELD DATA SHEET

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Project Number: 12197.01

Gas Chromatograph: [illegible]

Project Manager: [illegible]

Station Number:

Anaylsts: J. [illegible]

Date: [illegible]

Site Location: Brunswick ME NAS

SAMPLE LOCATION	TIME	DEPTH (ft.)	PURGE TIME (min.)	VACUUM (IN Hg)	VACUUM RELEASE (min.)	VOLUME INJECTION (ul) FID	ECD	SAMPLER NUMBER	COMMENTS
STA	0747					500			Will [illegible]
STA	0805					500			
BLANK	0820					1000			
STA	1038					500			
SVE ~~AAS~~-1	1255		BACKGROUND			1000			
SVE-2	1309		BACKGROUND			1000			
SVE-3	1323		BACKGROUND			1000			
SVE-4	1340		BACKGROUND			1000			
SVE-5	1352		BACKGROUND			1000			

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

SVCA SAMPLE CALCULATIONS

Site: BRUNSWICK NAS
Project No.: ~~[illegible]~~ 12197.01 Analysis Date: 26 OCT 93
Calculated by: S. Dobson Checked by:

Sample ID	Depth	Benzene ppm	Toluene ppm	Ethyl-Benzene ppm	Ortho-Xylene ppm	Total Xylenes	Total Hydrocarbons					Inject Volume (uL)	Time
BLANK		<0.1	<0.1	<0.1	<0.1		0.2					1000	0820
SVE-1		<0.1	<0.1	↓	↓		3.1					1000	1255
SVE-2		0.4	0.2	↓	↓		14					1000	1309
SVE-3		14.2	10.4	↓	↓		570					1000	1323
SVE-4		<0.1	<0.1	<0.1	<0.1		14					1000	1340
SVE-5		<0.1	<0.1	<0.1	<0.1		0.9					1000	1352
Building wall		96	102	DID NOT [illegible]	60	204	1300					500	1503
BLANK		<0.1	<0.1	<0.1	<0.1		0.3					1000	1549

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

SVCA INSTRUMENT CALIBRATION RECORD

Site: Brunswick NAS
Project No.: ~~4732.11~~ 12197.01
Analysis Date: S. Robson

Benzene 16.7 ppm		Toluene 20.0		Ethyl Benzene 15.3		Ortho-Xylene 11.0								Inject volume (uL)	~~Temp~~ Time ~~(c)~~
RT	RF	RT	RF	RT	RF	RT	RF	RT	RF	RT	RF	RT	RF		
3.3	0.073	6.002	0.021	8.577	0.33	9.387	0.073							500	747
3.181	0.062	5.922	0.017	8.537	0.45	9.349	0.066							500	805
3.245	0.087	5.928	0.028	8.512	0.72	9.318	0.103							500	1527
3.752	0.075	6.412	0.023	8.85	0.68	9.632	0.086							500	1038
	0.074		0.022		0.55		0.082								

RF = (std conc.) (std inj vol)

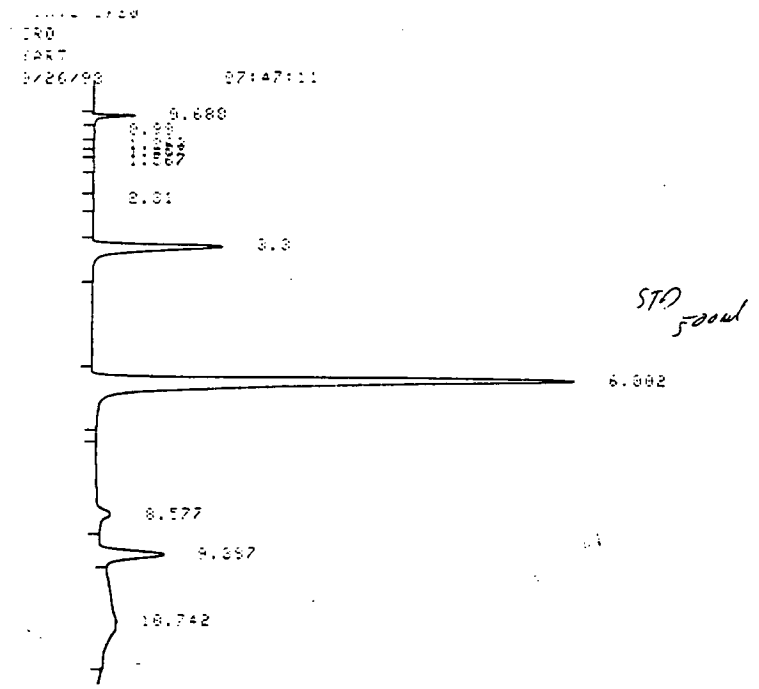
sample conc. = (peak area) (RF)

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 26 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: STD Volume Injected: 500 ml Std. Vol. Inj.: 500



CHROMATOGRAM 1 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 161
REPORT NO 1

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.680	12484			1.5168	
2	0.98	1669	V		0.2028	
3	1.261	692	V		0.0841	
4	1.487	583	V		0.0708	
5	1.567	786	V		0.0955	
6	2.31	639			0.0777	
7	3.3	114882			13.9954	
8	6.002	479889			58.1766	
9	8.577	16140			2.0124	
10	9.187	75187	V		9.1266	
11	10.742	1.4760	V		10.9413	
	Total	821194			100	

.RO

Comments:

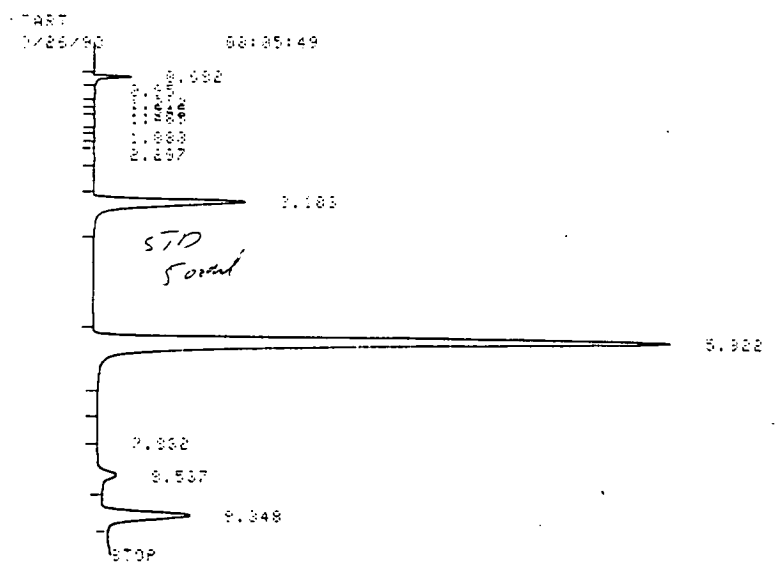
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 26 OCTOBER 1993 Project Manager: Battle Chemist: Tobson Site: NAS Brunswick, ME

Geologist: Sample: STD Volume Injected: 500ml Std. Vol. Inj.:

Comments:



CHROMATOGRAM 2 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 161
REPORT NO 2

NO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.661	[illegible]			1.3762	
2	0.95	1627	V		0.1935	
3	1.411	681	V		0.0751	
4	1.345	583	V		0.0694	
5	1.400	[illegible]	V		0.1082	
6	2.207	669			0.0785	
7	3.183	[illegible]			15.9304	
8	5.922	590128			70.197	
9	8.537	[illegible]			2.0146	
10	9.348	83707			9.9572	
TOTAL		840673			100	

METHOD#(6)="121"
TOTAL DATE#

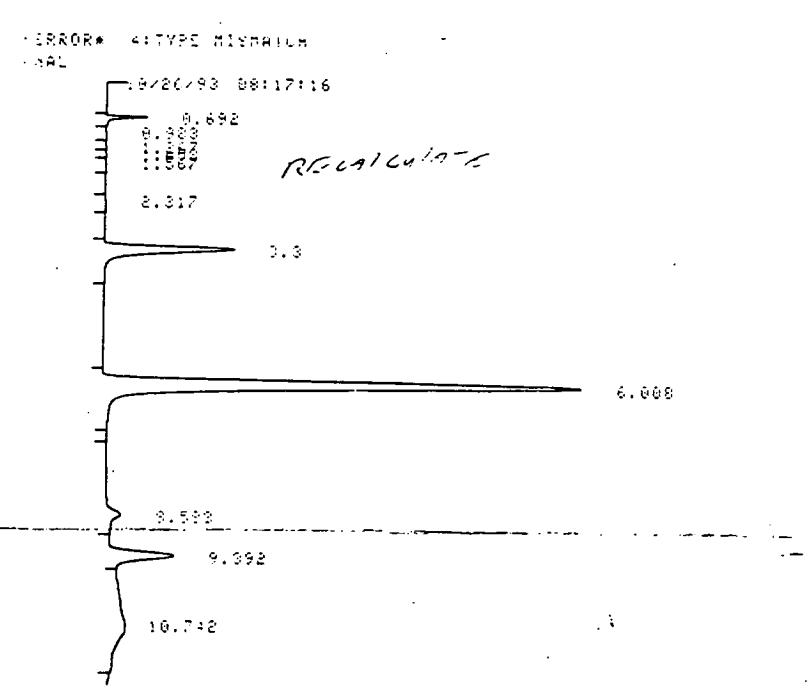
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 26 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: STD Volume Injected: Std. Vol. Inj.:

Comments:



CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 121
REPORT NO 3

IND	TIME	AREA	MK	IDNO	CONC	NAME
1	[illegible]	[illegible]			1.5168	
2	0.983	1669	V		0.2020	
3	1.367	694	V		0.0841	
4	1.408	582	V		0.0708	
5	1.567	798	V		0.0955	
6	2.317	639			0.0777	
7	3.3	[illegible]			12.8954	
8	6.008	478089			58.1766	
9	8.500	23155			2.8124	
10	9.592	75127	V		9.1266	
11	10.742	114786	V		13.9413	
	TOTAL	820164			100	

METHOD$(0)="502"

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

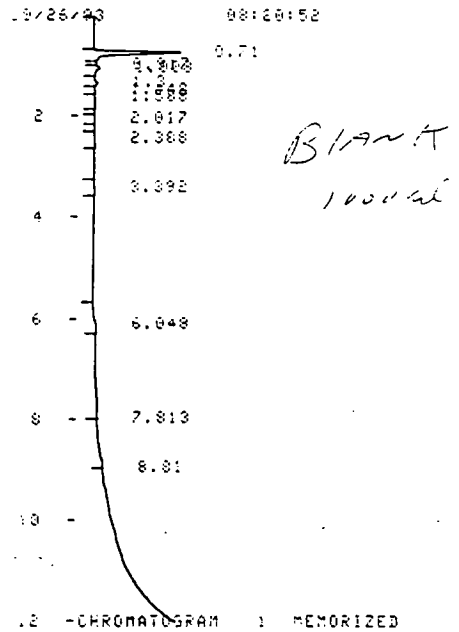
Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 26 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: Blank Volume Injected: 1000 µl Std. Vol. Inj.:

Comments:

```
.SAVE PRINT STOP
*ERROR*  1:INVALID SYNTAX
.SAVE 1,29
METHOD$(0)="560STOP
*ERROR*  1:INVALID SYNTAX
METHOD$(0)="561"
ZERO
START
10/26/93          08:20:52
```



Blank
1000 µl

```
12  -CHROMATOGRAM   1  MEMORIZED

CHROMATOPAC   C-R3A                    FILE        0
SAMPLE NO   0                          METHOD      561
REPORT NO   4
```

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.71	32296			74.3407	
2	0.917	955	V		2.1984	
3	1.008	3234	V		7.4902	
4	1.3	2143	V		4.9349	
5	1.445	1322	V		3.0466	
6	1.588	717	V		1.652	
7	1.392	501			1.2231	
8	6.048	2220			5.111	
TOTAL		43429			100	

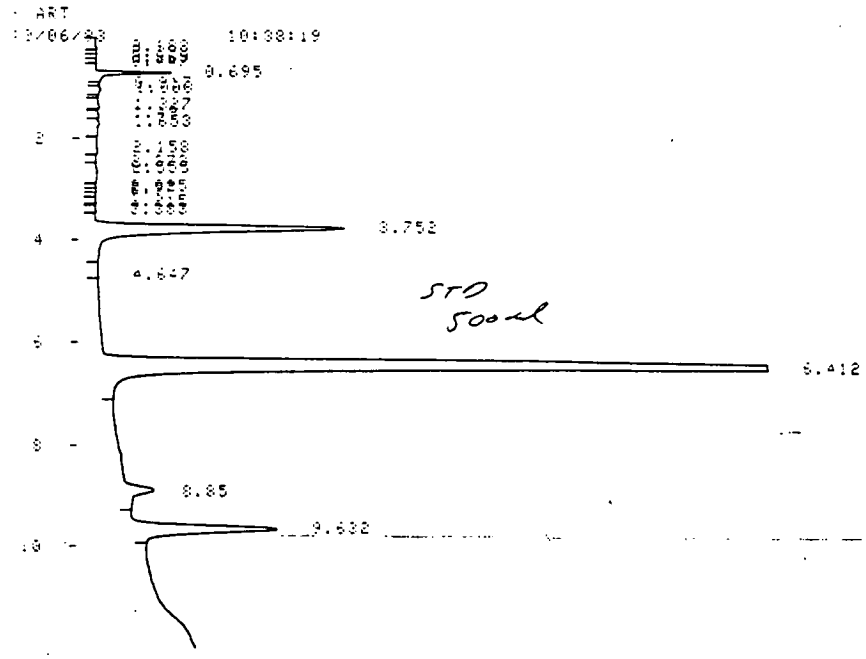
```
.TEST
*WARNING* LEVEL OUT OF RANGE
WAITING  50 sec
```

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.61 Date: 26 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: STD Volume Injected: 500 ul Std. Vol. Inj.:



CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 1

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.183	1033			0.159	
2	0.695	20931	SV		3.2263	
3	1.653	807	TV		0.1242	
4	2.555	883	TV		0.1358	
5	3.752	111018			17.0788	
6	6.412	440398			67.7548	
7	8.85	11235			1.7285	
8	9.632	63690			9.7987	
	TOTAL	649988			100	

PTRO

Comments:

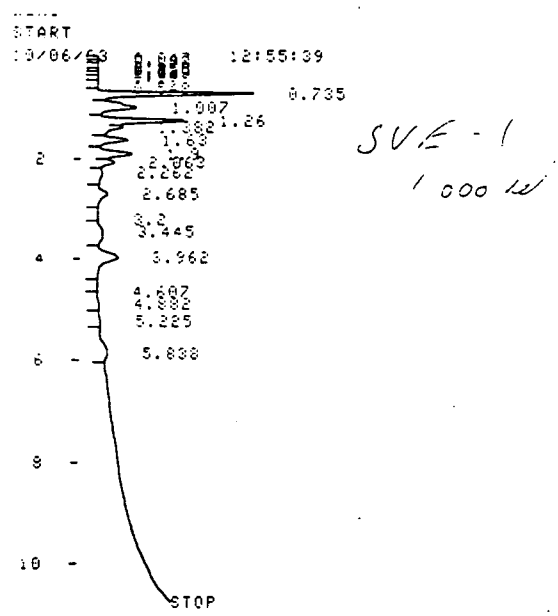
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 26 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: SVE-1 Volume Injected: 1000 µl Std. Vol. Inj.:

Comments:



CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 2

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.548	563	V		0.3924	
2	0.735	34397	V		23.9631	
3	1.007	16265	V		11.3314	
4	1.26	23508	V		16.3772	
5	1.382	8460	V		5.8939	
6	1.63	9611	V		6.6956	
7	1.9	12135	V		8.4542	
8	2.063	5853	V		4.0778	
9	2.282	3346	V		2.3312	
10	2.685	5624	V		3.9183	
11	3.2	776	V		0.5403	
12	3.445	5594	V		3.8968	
13	3.962	13182	V		9.1836	
14	4.882	609			0.4245	
15	5.838	3617			2.5195	
	TOTAL	143541			100	

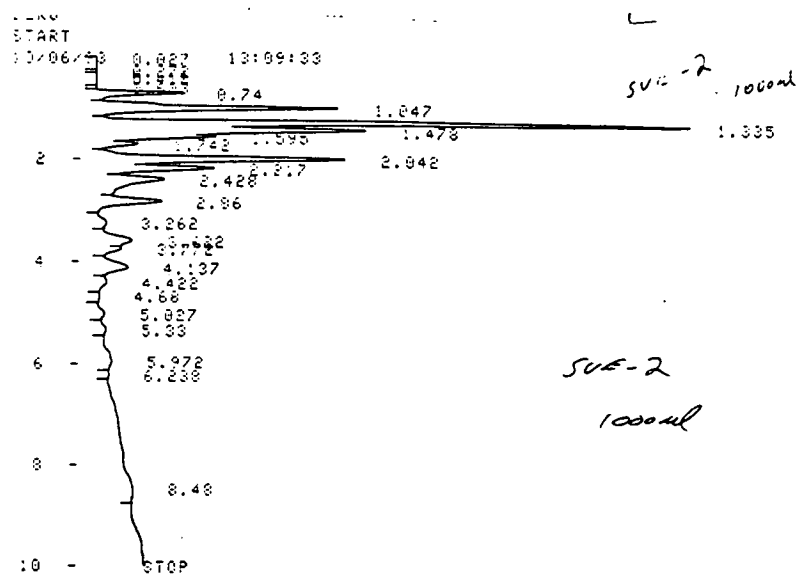
STOP

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 26 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: SVE-2 Volume Injected: 1000 µl Std. Vol. Inj.:



CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD .561
REPORT NO 3

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.027	622			0.6953	
2	0.74	20564			3.1523	
3	1.047	77723	V		11.9149	
4	1.335	159923	V		23.135	
5	1.478	83078	V		12.735	
6	1.595	29392	V		4.5855	
7	1.742	11742	V		1.7999	
8	2.042	81723	V		12.5272	
9	2.217	39864	V		6.1015	
10	2.428	40132	V		6.1518	
11	2.86	26371	V		4.0424	
12	3.262	5463	V0		0.8375	
13	3.622	21517	V		3.2983	
14	3.772	8848	V		1.3563	
15	4.137	19978	V		3.0624	
16	4.422	5431	V		0.8326	
17	5.027	2814			0.4314	
18	5.33	2630	V		0.4031	
19	5.972	7474	VT		1.1456	
20	6.238	707	V		0.1084	
21	8.48	15419			2.3636	
TOTAL		652360			100	

P.SAVE 1,20

Comments:

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

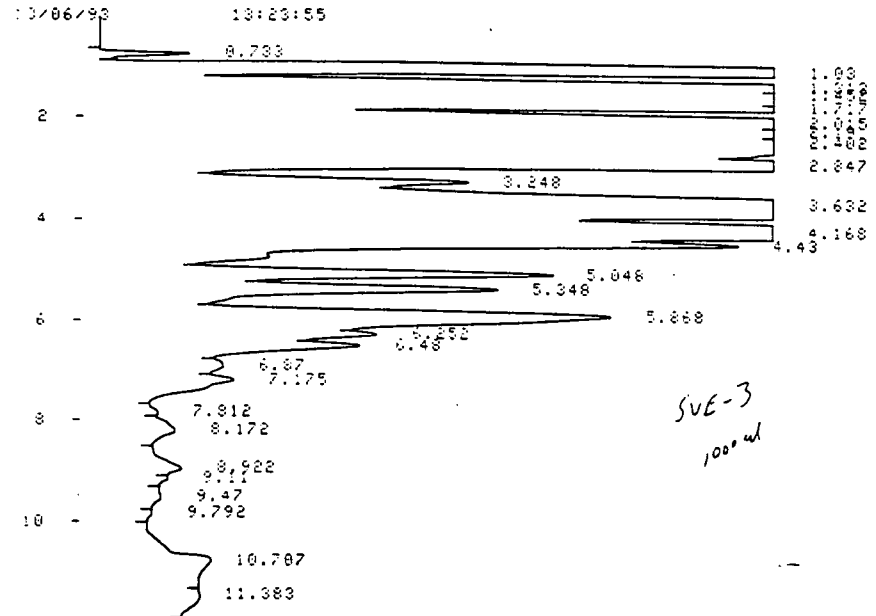
Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.61 Date: 26 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: SVE-3 Volume Injected: 1000 ul Std. Vol. Inj.:

Comments:

```
TESTING  50 sec
SLOPE    697.44
ZERO
START
10/06/93          13:23:55
```




```
-CHROMATOGRAM   1  MEMORIZED

CHROMATOPAC   C-R3A                    FILE        0
SAMPLE NO   0                          METHOD      561
REPORT NO   4
```

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.733	21038			0.0805	
2	1.03	1640458	V		6.2786	
3	1.313	5939479	VE		22.7326	
4	1.452	3516851	V		13.4603	
5	1.717	636758	V		2.4371	
6	2.015	3883880	V		14.9651	
7	2.19	1931701	V		7.3933	
8	2.462	1680316	V		6.4312	
9	2.847	1322641	V		5.0622	
10	3.248	192306	V	B	0.736	
11	3.632	1844399	V		7.0611	
12	4.168	1416234	V		5.4205	
13	4.43	416314	V		1.5934	
14	5.048	241835	V		0.9256	
15	5.348	256302	V		0.981	
16	5.868	470807	V	T	1.802	
17	6.252	134972	V		0.5166	
18	6.48	159246	V		0.6095	
19	6.87	78758	V		0.3014	
20	7.175	100057	V		0.383	
21	7.812	13795	V		0.0528	
22	8.172	44968	V		0.1721	
23	8.922	42013	V		0.1608	
24	9.11	13291	V		0.0509	
25	9.47	17421	V		0.0667	
26	9.792	2806	V		0.0107	
27	10.707	81053			0.3102	
28	11.383	27412	V		0.1049	
	TOTAL	26127596			100	

```
STOP.TM(0)=15
```

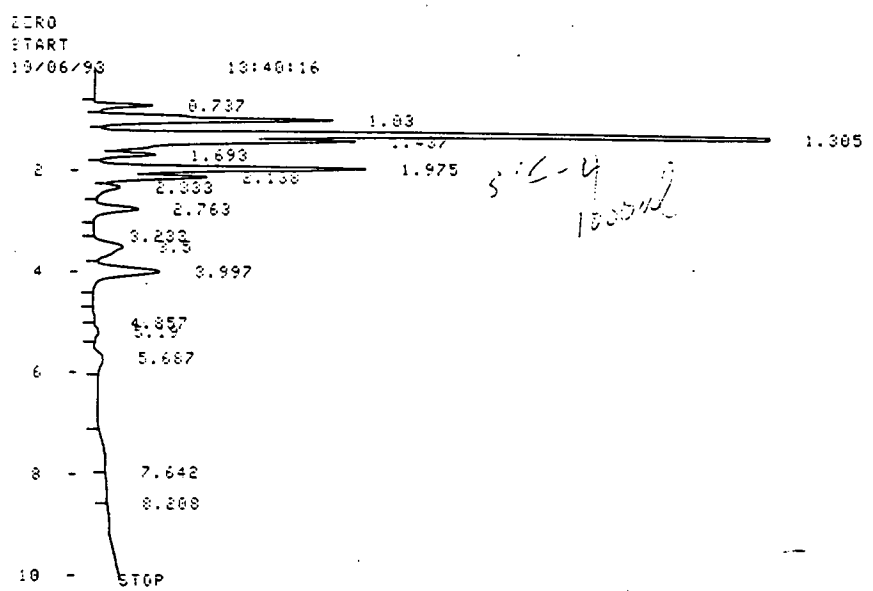
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 18197.01 Date: 26 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: SVE-4 Volume Injected: 1000 ml Std. Vol. Inj.:

Comments:



CHROMATOGRAM 2 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 5

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.737	14142			2.1312	
2	1.03	78245	V		11.7919	
3	1.305	240993	V		36.7712	
4	1.437	80295	V		12.1009	
5	1.693	17898	V		2.6961	
6	1.975	85213	V		12.8421	
7	2.138	35284	V		5.3174	
8	2.333	11991	V		1.8072	
9	2.763	18862	V		2.8427	
10	3.233	1279	V		0.1928	
11	3.5	23009	V		3.4676	
12	3.997	37438	V		5.6421	
13	4.857	1118			0.1685	
14	5.19	2703	V		0.4074	
15	5.687	5495			0.8282	
16	7.642	4734			0.7134	
17	8.208	1854	V		0.2793	
TOTAL		663544			100	

ZERO

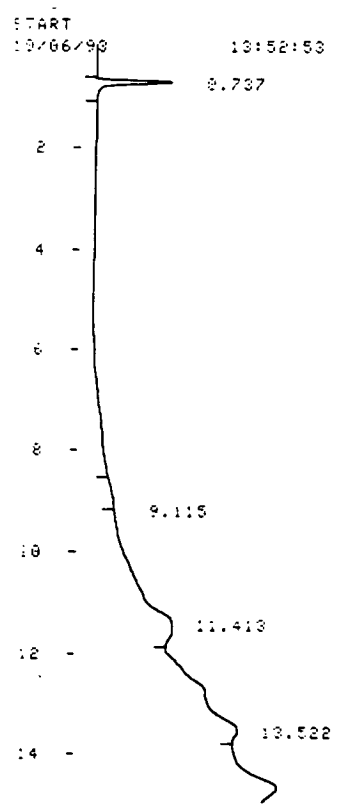
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 26 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: SVE-5 Volume Injected: 1000 ml Std. Vol. Inj.:

Comments:



SVE-5
1000ml

CHROMATOGRAM 2 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 6

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.737	18731			32.0634	
2	9.115	1425			2.4387	
3	11.413	3164			5.4162	
4	13.522	35099			60.0816	
	TOTAL	58418			100	

END

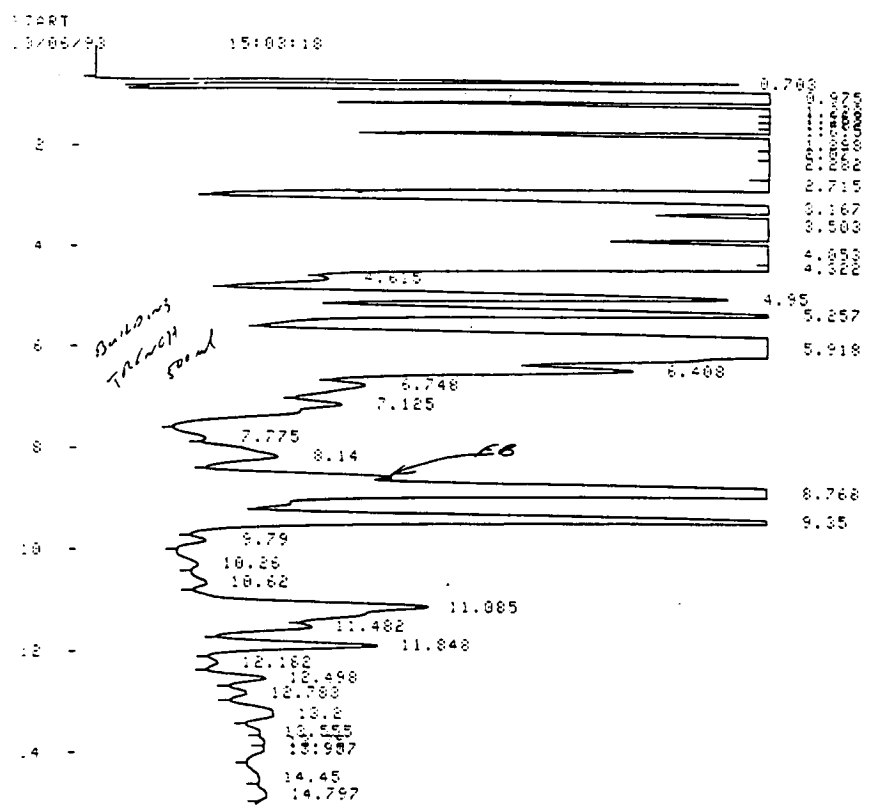
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 26 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: Building Trench Volume Injected: 500 ml Std. Vol. Inj.:

Comments:



CHROMATOGRAM 4 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 7

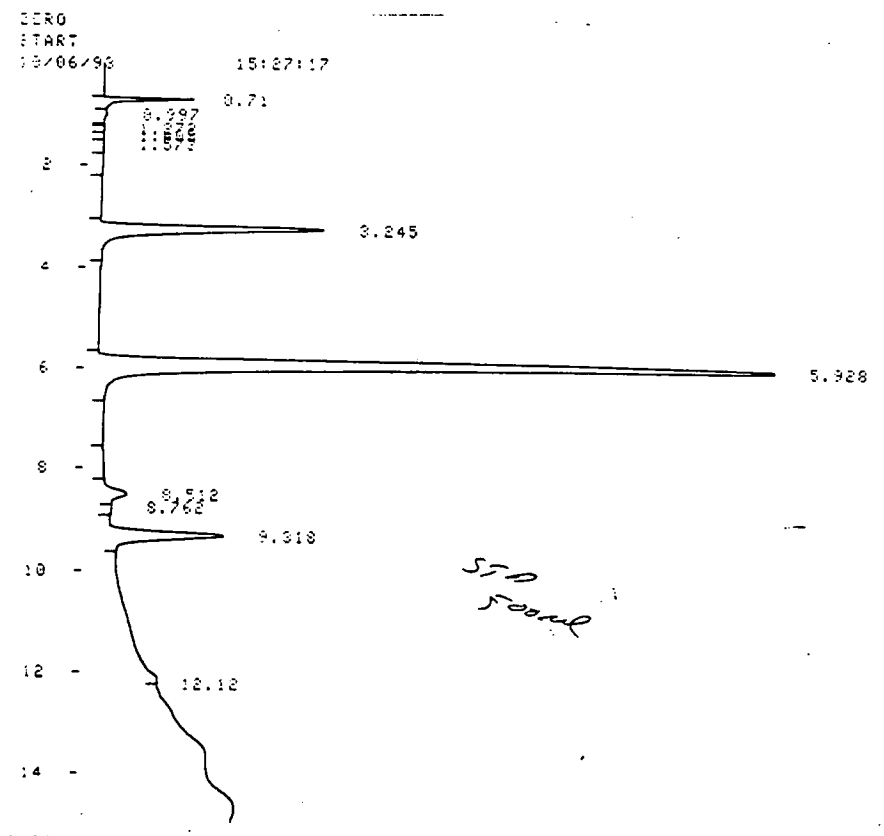
PKNO	TIME	AREA	PK	IDNO	CONC	NAME
1	0.713	100816			0.3305	
2	0.975	2447443	V		8.0237	
3	1.228	5413752	VE		17.7484	
4	1.363	2427089	V		7.957	
5	1.482	1188179	V		3.8953	
6	1.615	475036	V		1.5574	
7	1.898	3177437	V		10.4169	
8	2.87	1527177	V		5.009	
9	2.882	1438795	V		4.7169	
10	3.715	1326217	V		4.3479	
11	3.167	646941	V	B	2.1209	
12	3.593	2030305	V		6.6561	
13	4.053	2044211	V		6.7017	
14	4.322	406528	V		1.3328	
15	4.615	100915	V		0.3279	
16	4.95	331453	V		1.0866	
17	5.257	442939	V		1.4521	
18	5.918	2309445	V	T	7.5713	
19	6.408	329098	V		1.0789	
20	6.748	184335	V		0.6043	
21	7.125	185117	V		0.6071	
22	7.775	28572	V		0.092	
23	8.14	116716	V		0.3826	
24	8.768	895334	V		2.9353	
25	9.35	367154	V	X	1.2037	
26	9.79	13839	V		0.0454	
27	10.26	10618			0.0348	
28	10.62	15458	V		0.0507	
29	11.085	219222	V		0.7187	
30	11.482	60371	V		0.1979	
31	11.848	85639	V		0.2807	
32	12.182	5781	V		0.019	
33	12.498	26768			0.0878	
34	12.783	17599	V		0.0577	
35	13.2	45183	V		0.1481	
36	13.555	16229	V		0.0532	
37	13.75	15666	V		0.0514	
38	13.907	14654	V		0.048	
39	14.45	8043	V		0.0264	
40	14.797	7322	V		0.024	
	TOTAL	30502706			100	

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 26 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: STANDARD Volume Injected: Special Std. Vol. Inj.:



CHROMATOGRAM 5 MEMORIZED

CHROMATOPAC C-R3A FILE 9
SAMPLE NO 0 METHOD 561
REPORT NO 3

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.71	14951			2.675	
2	0.997	1324	V		0.2467	
3	1.573	582	V		0.1085	
4	3.245	95527			17.8065	
5	5.928	360070			67.1184	
6	8.512	10674			1.9897	
7	8.762	751	V		0.14	
8	9.318	53191			9.9151	
	TOTAL	536470			100	

ZERO

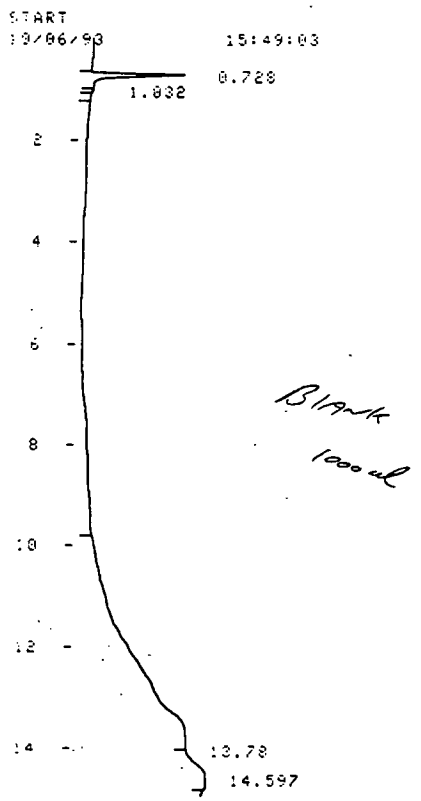
Comments:

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 20 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: Blank Volume Injected: 1000 ml Std. Vol. Inj.:



CHROMATOGRAM 6 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 9 METHOD 561
REPORT NO 9

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.728	19658			61.6828	
2	14.597	12531	V		38.9172	
	TOTAL	32198			100	

Comments:

SVCA FIELD DATA SHEET

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Project Number: 12197 ~~[illegible]~~ 01

Gas Chromatograph: 4nu 421

Project Manager: M. GATTLE

Station Number:

Anaylsts: S. Dobson

Date: 27 OCT 93

Site Location: BRUNSWICK NAS

SAMPLE LOCATION	TIME	DEPTH (ft.)	PURGE TIME (min.)	VACUUM (IN Hg)	VACUUM RELEASE (min.)	VOLUME INJECTION (ul) FID	ECD	SAMPLER NUMBER	COMMENTS
STD	0751					500			
BLANK	0818					1000			
SYSTEM INFLUENT	1006					500			BACKGROUND, PUMPING AMBIENT AIR
VP-8	1049	3.5		7	1 SEC	1000		5	
VP-9	1109 ~~1049~~	3		25	8 SEC	1000		5	
INFLUENT	1127					500			START VENT @ 1106 20 PSI SVE-4
EFFLUENT	1146					1000			POST CARBON
INFLUENT	1203					500			LATE START ON GC
STD	1221					500			STEP TEST @ 1206 TO 40 PSI
INFLUENT	1235					500			COLLECTED SAMPLE @ 1226
INFLUENT	1305					500			
INFLUENT	1330					500			55 PSI @ 1325
INFLUENT	1403					500			1358 BACK TO 20 PSI
INFLUENT	1453					500			
INFLUENT	1516					500			
BUILDING TRENCH	1550					500			
INFLUENT	1616					500			TURN ON ALL SVE WELL 1-5 @ 1620
INFLUENT	1637					200			BAD SYRINGE
SVE-4	1643					500			
TOTAL INFLUENT	1706					100			ALL SVE WELLS 1-5
EFFLUENT	1729					1000			
BLANK	1245 ~~1000~~					1000			
STD	180					500			

SVCA SAMPLE CALCULATIONS

Site: Brunswick NAS **Analyst:** Scott Dobson
Project No.: 12197.01 **Analysis Date:** 27 Oct 93
QC [illegible]

Sample ID	Inj. Vol.	Time	Benzene ppm	Toluene ppm	Ethyl Benzene ppm	O Xylene ppm	Total Xylenes	Total Hydrocarbons ppm							
BLANK	1000	0818	<0.1	<0.1	<0.1	<0.1		<0.1							
INFLUENT	500	1006	8.4	4.5	~~1.2~~	0.5	3.5	323							
VP-8	1000	1049	<0.1	<0.1	<0.1	<0.1		8.9							
VP-9	1000	1109	A	279	552	~~64~~ 68.8	395	2300							
INFLUENT	500	1137	15	13	30	6.9	30.8	471							
EFFLUENT	1000	1146	<0.1	<0.1	<0.1	<0.1		2.1							
INFLUENT	500	1203	16	14	~~<0.1~~ 1.5	~~13~~ 3.8	19.1	504							
INFLUENT	500	1235	7.9	11.4	<0.1	1.5	10.4	346							
INFLUENT	500	1305	8.9	7.9	<0.1	~~12~~ 2.7	15.0	284							
INFLUENT	500	1330	0.9	<0.1	<0.1	~~27~~ 2.2	4.4	33							
INFLUENT	500	1403	17	17	<0.1	~~25~~ 5.8	30.5	524							
INFLUENT	500	1453	20	16	<0.1	~~30~~ 7.3	37.8	623							
INFLUENT	500	1516	20	14	<0.1	~~36~~ 7.2	37.0	611							
Building stack	500	1550	<0.1	7.1	<0.1	12	26.9	~~72~~ 3.1							
INFLUENT	500	1616	18	18	<0.1	~~25~~ 6.3	31.3	~~3.1~~ 577							
~~EFFLUENT~~		~~1637~~													
SLE-4	500	1643	18	19	<0.1	~~28~~ 7.8	36.2	551							
TOTAL INFLUENT	100	1706	~~5.6~~ 28	20	<0.1	~~37.7~~ 8.7	~~8.4~~ 42.1	564							
EFFLUENT	100	1729	<0.1	<0.1	<0.1	<0.1		0.2							
BLANK		1745	<0.1	<0.1	<0.1	<0.1		<0.1							

A. UNABLE TO QUANTIFY

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

SVCA INSTRUMENT CALIBRATION RECORD

Site: Brunswick NAS
Project No.: 12197.01 Analysis Date: 22 oct 93
Calculated by: SKO Checked by:

Benzene 16.7 ppm		Toluene 20.0 ppm		Ethylbenzene 15.3 ppm		O-xylene 11.0 ppm								Inject volume (uL)	~~Temp~~ (c)
RT	RF	RT	RF	RT	RF	RT	RF	RT	RF	RT	RF	RT	RF		
3.7	0.037	6.38	0.010	8.843	0.044	9.642	0.047								0751
3.242	0.045	5.92	0.014	8.549	0.078	9.392	0.089								1221
3.192	0.054	5.86	0.020	8.473	0.128	9.31	0.176								1800
	0.045		0.015		0.083		0.104								

RF = (std conc.) (std inj vol)

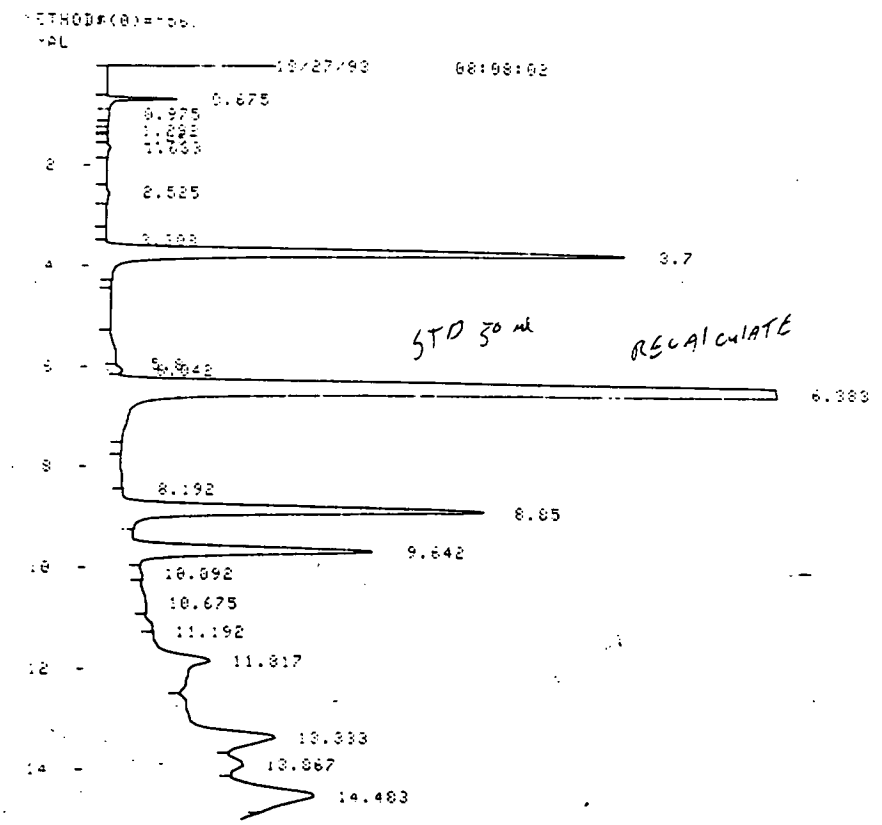
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 27 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: STD Volume Injected: 50ml Std. Vol. Inj.:

Comments:



CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 1

RNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.675	[illegible]			0.6017	
2	1.633	1129	V		0.0668	
3	2.525	1.07			0.0655	
4	3.7	228436			13.5101	
5	[illegible]	4124			0.2439	
6	6.042	3115	V		0.1842	
7	6.383	[illegible]	V		57.138	
8	8.192	578			0.0342	
9	8.85	[illegible]			10.2611	
10	9.642	116063	V		6.8642	
11	10.092	[illegible]	V		9.1652	
12	10.675	4036	V		0.2387	
13	11.192	[illegible]			0.0701	
14	11.817	43549	V		2.5755	
15	12.333	[illegible]			3.2407	
16	13.867	17196	V		1.017	
17	14.483	[illegible]			0.723	
	TOTAL	[illegible]			100	

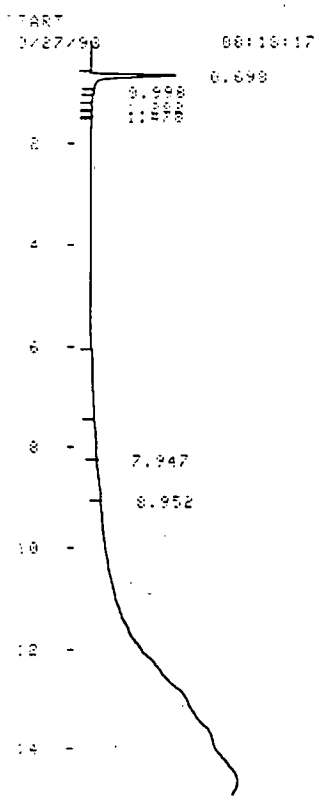
ZERO

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 27 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: Blank Volume Injected: 1000 ul Std. Vol. Inj.:



Blank
1000 ul

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 2

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.698	18147	b		95.8834	
2	7.947	779			4.1166	
TOTAL		18926			100	

Comments:

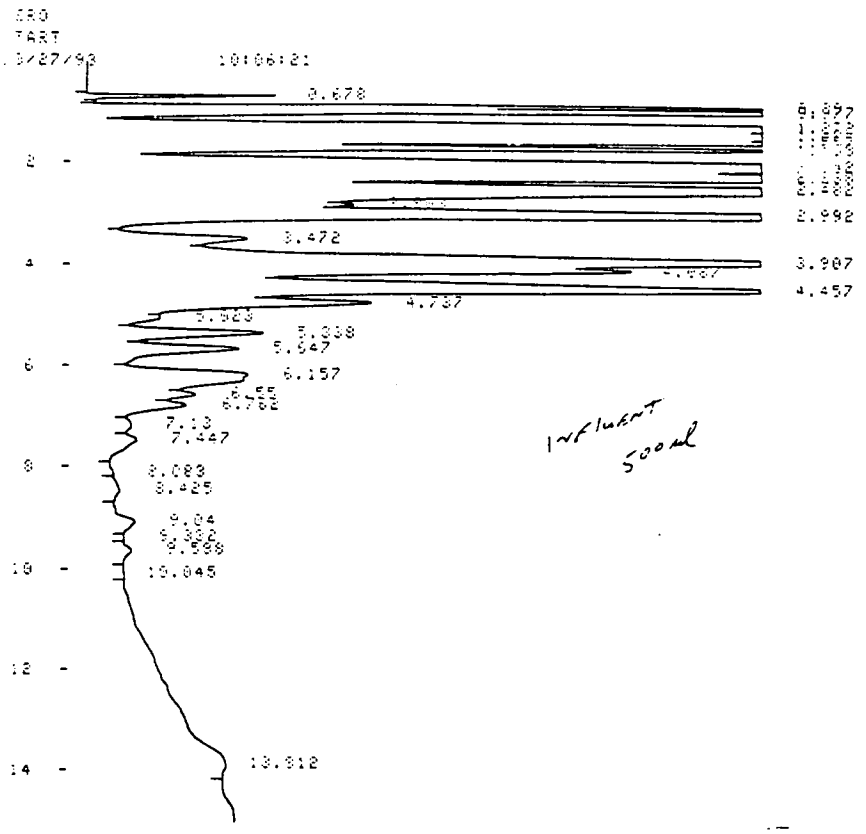
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 27 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: INFLUENT Volume Injected: 500 ml Std. Vol. Inj.:

Comments:



CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 3

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.678	36151			0.2425	
2	0.783	1064	V		0.0099	
3	0.85	128259	V		1.1894	
4	0.977	615169	V		5.7946	
5	1.272	2441484	V		22.6405	
6	1.42	1281701	V		11.8856	
7	1.557	363133	V		3.3674	
8	1.708	216122	V		2.0042	
9	2.042	1611897	V		14.9475	
10	2.238	788173	V		7.3089	
11	2.488	729591	V		6.7995	
12	2.883	71521	V		0.6632	
13	2.991	527281	V		4.8894	
14	3.472	93339	V	6	0.8656	
15	3.957	503366	V		4.6673	
16	4.087	235114	V		2.1803	
17	4.457	463366	V		4.3015	
18	4.737	160618	V		1.4894	
19	5.023	30152	V		0.2805	
20	5.338	85316	V		0.7912	
21	5.647	87142	V		0.8081	
22	6.157	151427	V	T	1.4042	
23	6.55	45408	V		0.4211	
24	6.762	50728	V		0.4704	
25	7.13	21028	V		0.195	
26	7.447	25895	V		0.2401	
27	8.083	1872			0.0174	
28	8.425	6935	V		0.0643	
29	9.04	1346		MTT	0.1335	
30	9.332	2440	V	0	0.0226	
31	9.588	8053	V		0.0747	
32	10.045	1038	V		0.0096	
TOTAL		10783685			100	

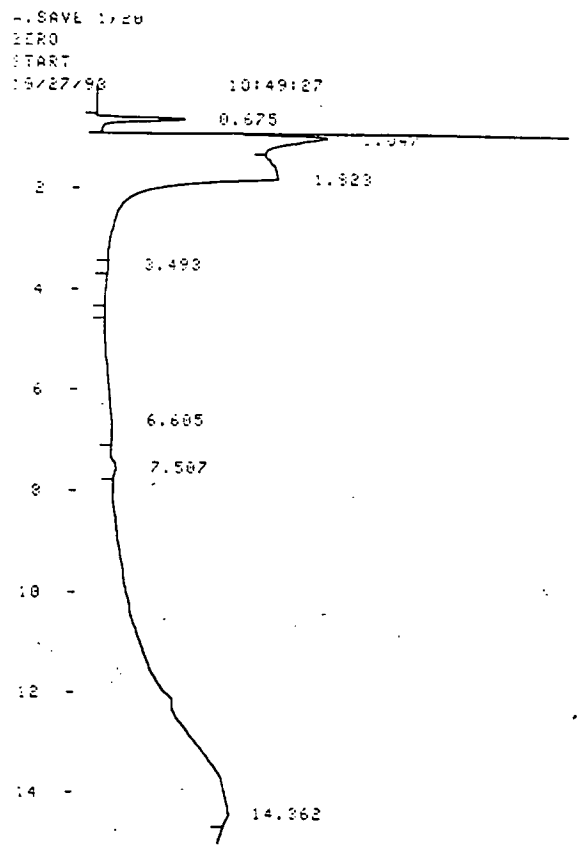
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 27 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: VP-8 Volume Injected: 1000µl Std. Vol. Inj.:

Comments:



VP-8 1000µl

CHROMATOGRAM : MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 4

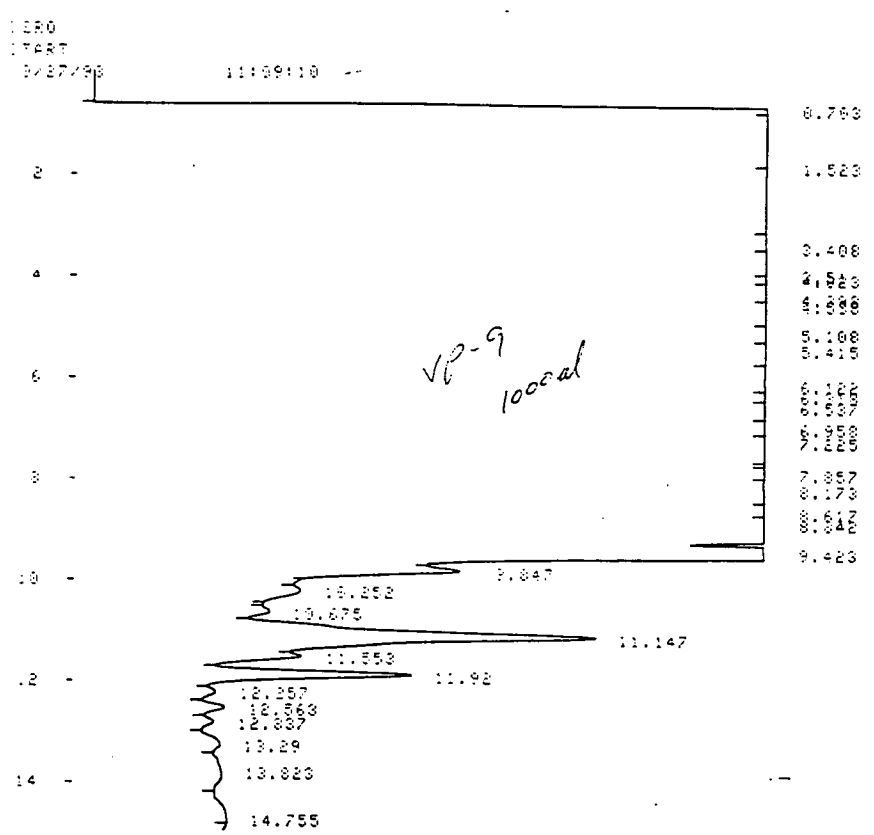
PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.675	38240			3.6256	
2	1.047	221652	V		36.134	
3	1.823	357997	SV		58.3595	
4	3.605	9164			1.4939	
5	7.507	2374			0.387	
TOTAL		613417			100	

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 27 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: VP-9 Volume Injected: 1000 µl Std. Vol. Inj.:



CHROMATOGRAM 2 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 5

RKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.763	1867823			1.2074	
2	1.523	29484178	E		19.0589	
3	3.408	12753839	E		8.2442	
4	3.51	24556086	VE	D	15.8733	
5	4.823	8649783	VE		5.5913	
6	4.398	18269424	VE		11.8096	
7	4.538	12414088	VE		8.0246	
8	5.108	7183451			4.6435	
9	5.415	5962329	V		3.8541	
10	6.122	18587752	E	T	12.0153	
11	6.318	3673050	V		2.3743	
12	6.537	3272413	V		2.1153	
13	6.958	703479			0.4547	
14	7.225	1745241	V		1.1281	
15	7.857	116996			0.0756	
16	8.173	489833	V		0.3166	
17	8.617	665465	V	E	0.4302	
18	8.842	3182827	V	mod	2.0574	
19	9.423	613663		K	0.3967	
20	9.847	29160			0.0188	
21	10.252	9194			0.0059	
22	10.675	5714			0.0037	
23	11.147	283995			0.1836	
24	11.553	35872	V		0.0232	
25	11.92	90417			0.0584	
26	12.257	3931			0.0025	
27	12.563	9938			0.0064	
28	12.837	5075	V		0.0033	
29	13.29	12901			0.0083	
30	13.823	18625	V		0.012	
31	14.755	3814			0.0025	
	TOTAL	154780.76			100	

Comments:

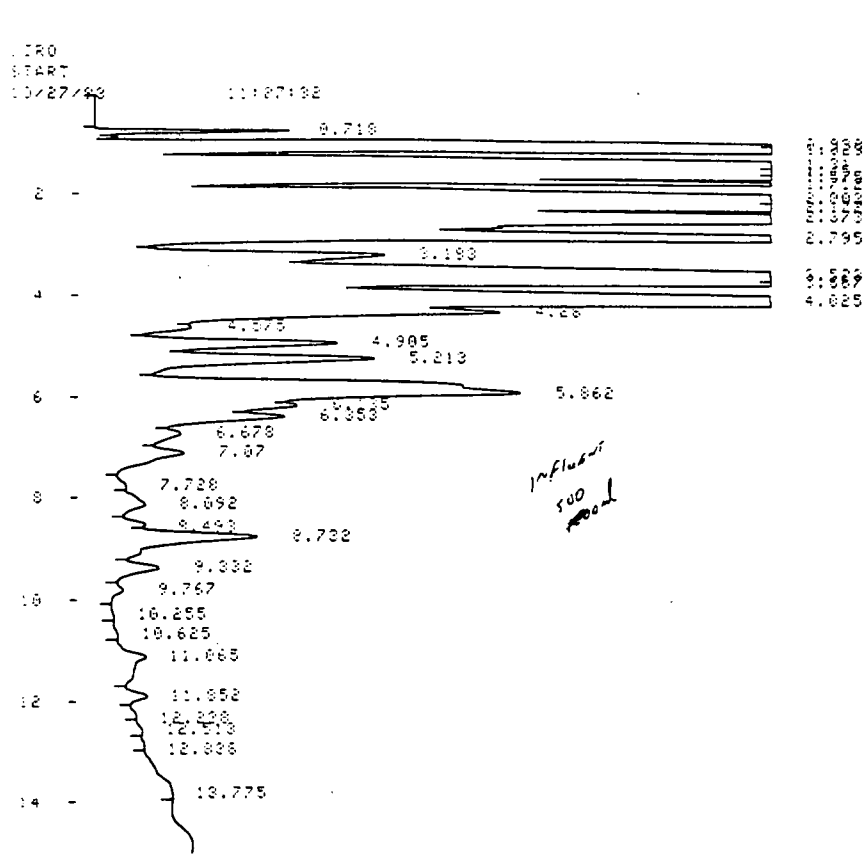
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 27 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: INFLUENT Volume Injected: 500 ml Std. Vol. Inj.:

Comments:



CHROMATOGRAM 3 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 6

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.719	34039			0.2165	
2	0.827	3721	V		0.0236	
3	0.938	200943	V		1.2761	
4	1.023	1111616	V		7.0595	
5	1.31	3527786	V		22.3908	
6	1.45	1759230	V		11.1723	
7	1.575	582871	V		3.7016	
8	1.712	256083	V		1.6263	
9	2.083	1968518	V		12.5014	
10	2.172	952619	V		6.0498	
11	2.373	963467	V		6.1187	
12	2.795	673423	V		4.2767	
13	3.183	164486	V B		1.0446	
14	3.523	693492	V		4.4042	
15	3.667	315632	V		2.0045	
16	4.025	914368	V		5.8069	
17	4.28	220073	V		1.3976	
18	4.575	44941	V		0.2854	
19	4.905	128539	V		0.9163	
20	5.213	182194	V		1.1571	
21	5.862	432398	V T		2.746	
22	6.125	90503	V		0.5748	
23	6.353	114428	V		0.7267	
24	6.678	63635	V		0.4041	
25	7.07	72610	V		0.4611	
26	7.728	13364	V		0.0849	
27	8.092	40219	V		0.2554	
28	8.493	17836	V E		0.1133	
29	8.732	114717	V MTP		0.7285	
30	9.332	33180	V X		0.2107	
31	9.767	6988	V		0.0444	
32	10.255	792			0.005	
33	10.625	1149	V		0.0073	
34	11.065	27782			0.1764	
35	11.852	9166			0.0582	
36	12.238	1856			0.0118	
37	12.513	2591	V		0.0165	
38	12.838	977	V		0.0062	
39	13.775	6110			0.0388	
	TOTAL	15746315			100	

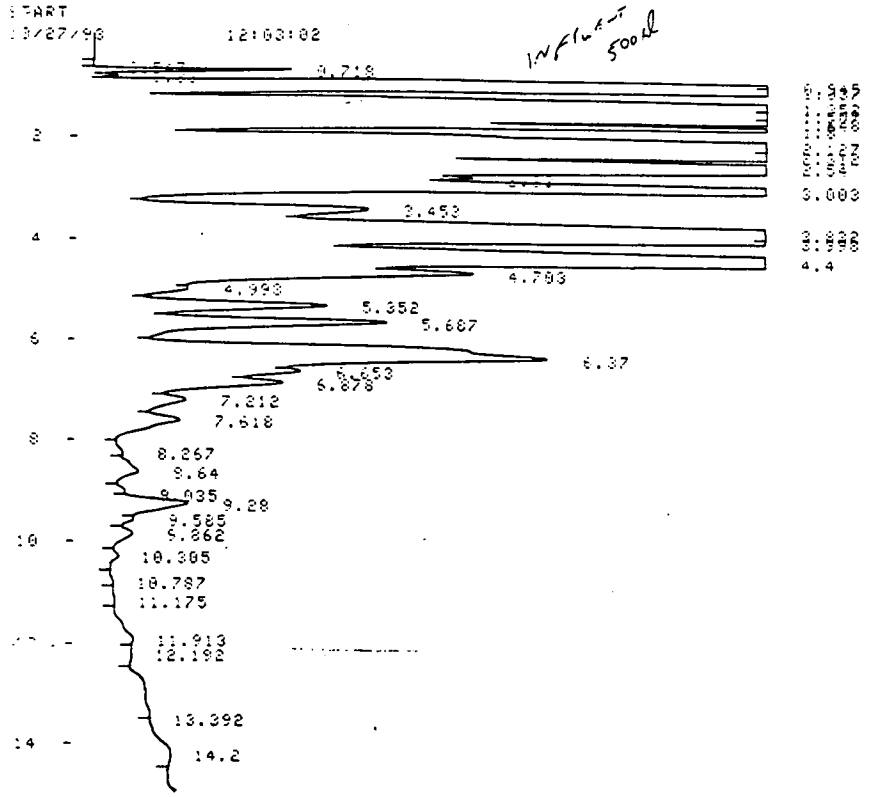
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 27 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: INFLUENT Volume Injected: 500ml Std. Vol. Inj.:

Comments:



CHROMATOGRAM 5 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 8

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.718	30915	V		0.1835	
2	0.83	4095	V		0.0243	
3	0.945	244549	V		1.4516	
4	1.637	1229091	V		7.2954	
5	1.352	3879615	V		23.028	
6	1.587	1917331	V		11.3806	
7	1.642	631764	V		3.7499	
8	1.8	272611	V		1.6191	
9	2.127	2102132	V		12.4775	
10	2.312	1014945	V		6.0244	
11	2.54	912350	V		5.4154	
12	2.83	94777	V		0.5626	
13	3.003	707354	V	6	4.1986	
14	3.453	182122	V		1.081	
15	3.832	720375	V		4.2759	
16	3.998	327128	V		1.9417	
17	4.4	958815	V		5.6912	
18	4.703	232316	V		1.3789	
19	4.993	44634	V		0.2649	
20	5.352	133417	V		0.7919	
21	5.687	191950	V		1.1393	
22	6.37	470536	V	T	2.7929	
23	6.653	92087	V		0.5466	
24	6.878	119125	V		0.7071	
25	7.212	67522	V		0.4008	
26	7.618	68875	V		0.4088	
27	8.267	12679	V		0.0753	
28	8.64	34005	V		0.2018	
29	9.035	9043	V	C	0.0537	
30	9.28	61875	V	XMT	0.3673	
31	9.585	11669	V		0.0693	TOOL
32	9.862	18147	VOK		0.1077	
33	10.305	4993	V		0.0296	
34	10.787	1051			0.0062	
35	11.175	1429	V		0.0085	
36	11.913	11325			0.0672	
37	12.192	5358	V		0.0318	
38	13.392	15903			0.0944	
39	14.2	9472	V		0.0562	
	TOTAL	16847364			100	

ZERO

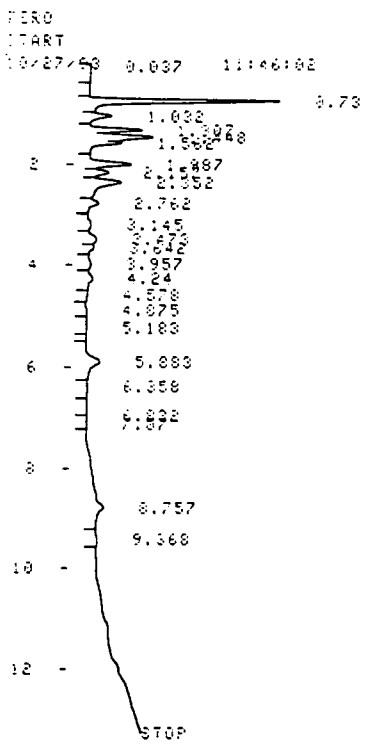
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12193.01 Date: 27 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: EFFLUENT Volume Injected: 1000 ml Std. Vol. Inj.:

Comments:



EFFLUENT 1000 ml

CHROMATOGRAM 4 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 7

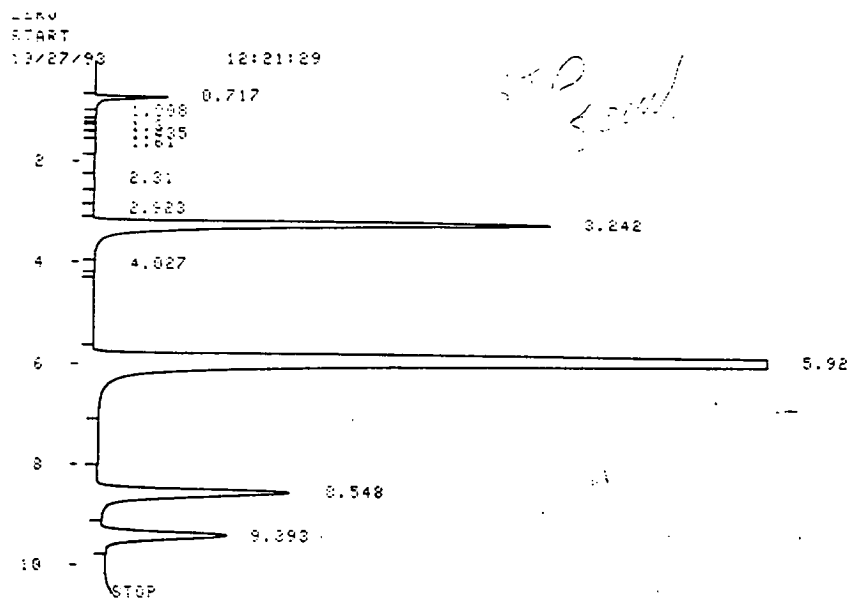
PKNO	TIME	AREA	PK	IDNO	CONC	NAME
1	0.037	590			0.3265	
2	0.73	41535			22.9693	
3	1.032	6262	V		3.5183	
4	1.307	12393	V		6.8533	
5	1.446	19844	V		10.9741	
6	1.562	7693	V		4.2542	
7	1.987	12913			7.1402	
8	2.157	7022	V		3.8831	
9	2.358	16908	V		9.3502	
10	2.762	4587	V		2.5366	
11	3.145	2192			1.7651	
12	3.473	5707	V		3.1558	
13	3.642	3238	V		1.7863	
14	3.957	3834	V		2.12	
15	4.24	4539	V		2.5101	
16	4.875	559			0.3093	
17	5.183	729	V		0.4033	
18	5.883	10339			5.7174	
19	6.358	941	V		0.5204	
20	8.757	16669			9.218	
21	9.368	1245	V		0.6884	
TOTAL		188830			100	

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 27 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: STD Volume Injected: 500 ml Std. Vol. Inj.:



CHROMATOGRAM 6 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 9

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.717	13335	E		1.2394	
2	1.61	832	V		0.0773	
3	2.31	893			0.083	
4	3.242	186205	S		17.306	
5	5.92	714530			66.4089	
6	8.548	98078			9.1155	
7	9.393	62082			5.7699	
TOTAL		1075955			100	

E.TEST

Comments:

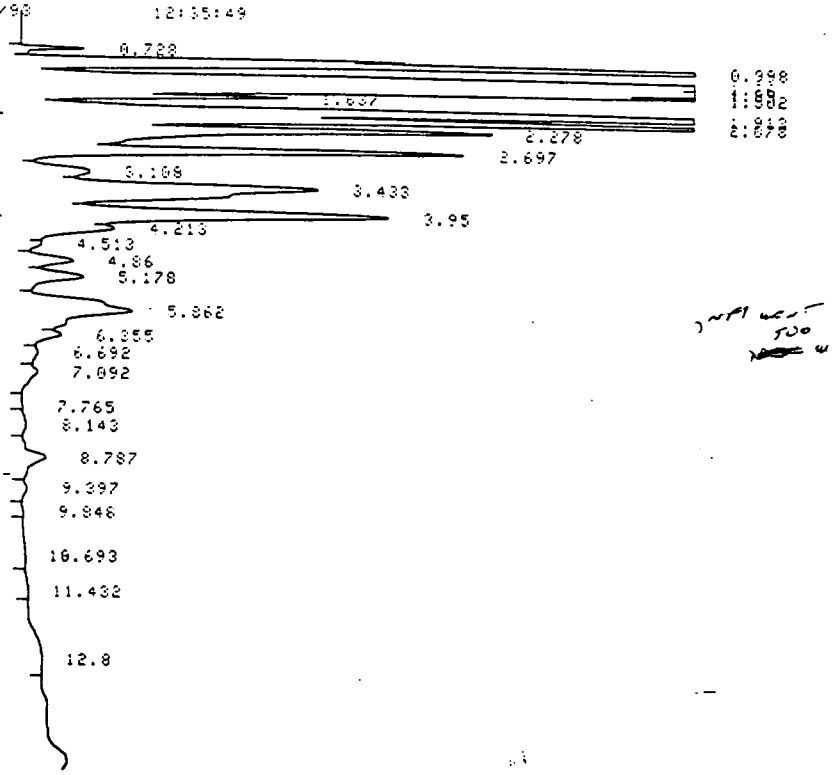
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 27 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: INFLUENT Volume Injected: STD Std. Vol. Inj.:

TESTING 50 sec
SLOPE 1343.04
S.TEST
TESTING 50 sec
SLOPE 434.88
ATTEN(0)=6
ZERO
START
10/27/93 12:35:49



CHROMATOGRAM 7 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 10

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.728	24656			0.2972	
2	0.998	745863	V		8.9918	
3	1.26	1941456	V		23.4052	
4	1.39	1003972	V		12.1034	
5	1.582	285180	V		3.438	
6	1.637	135937	V		1.6388	
7	1.913	1028425	V		12.3982	
8	2.078	499458	V		6.0212	
9	2.278	494445	V		5.9608	
10	2.697	341255	V		4.114	
11	3.108	87710	V	B	1.0574	
12	3.433	504358	V		6.0803	
13	3.95	460496	V		5.5515	
14	4.213	109265	V		1.3172	
15	4.513	18466	V		0.2226	
16	4.96	60173	V		0.7254	
17	5.178	85270	V		1.028	
18	5.862	271813	V	T	3.2768	
19	6.355	50089	V		0.6039	
20	6.692	29141	V		0.3513	
21	7.092	28298	V		0.3411	
22	7.765	1794			0.0216	
23	8.143	9821	V		0.1184	
24	8.787	42551	V	MT	0.513	
25	9.397	7415	V	X	0.0894	
26	9.846	1302			0.0157	
27	10.693	5881	V		0.0709	
28	11.432	3578			0.0431	
29	12.8	16899			0.2037	
	TOTAL	8294957			100	

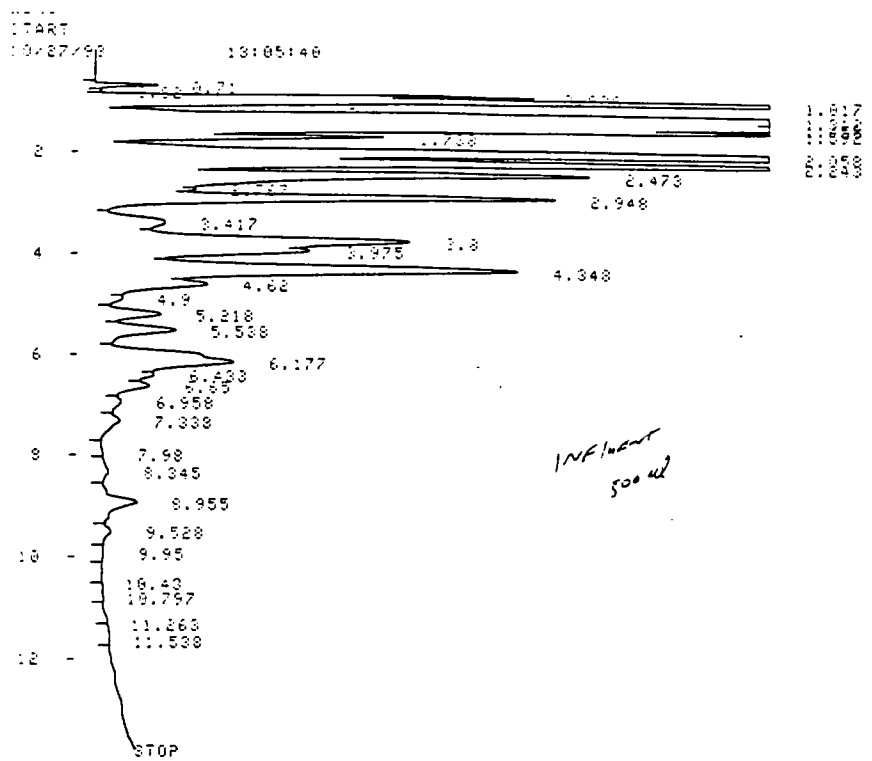
Comments:

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.61 Date: 27 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: INFLUENT Volume Injected: 500 ml Std. Vol. Inj.:



CHROMATOGRAM 8 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 11

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.71	21198			0.2236	
2	0.82	2383	V		0.0251	
3	0.968	145262	V		1.5332	
4	1.917	714128	V		7.5324	
5	1.312	2250625	V		23.7411	
6	1.458	1110538	V		11.7126	
7	1.592	356198	V		3.7571	
8	1.738	150280	V		1.5851	
9	2.058	1173665	V		12.3795	
10	2.243	562461	V		5.9327	
11	2.473	515412	V		5.4364	
12	2.767	46050	V		0.4857	
13	2.948	390173	V		4.1154	
14	3.417	99640	V	B	1.0446	
15	3.3	387154	V		4.0836	
16	3.975	182654	V		1.9266	
17	4.348	510342	V		5.3829	
18	4.62	126657	V		1.3359	
19	4.9	22971	V		0.2423	
20	5.218	69636	V		0.7345	
21	5.538	99823	V		1.0529	
22	6.177	263381	V	T	2.7781	
23	6.433	51441	V		0.5426	
24	6.65	60092	V		0.6337	
25	6.950	33618	V		0.3546	
26	7.338	33726	V		0.3557	
27	7.98	4349	V		0.0459	
28	8.345	15840	V		0.1671	
29	8.955	59571	V	Xmp	0.6281	
30	9.528	12824	V	o	0.1353	
31	9.95	2835	V		0.0299	
32	10.797	1005	V		0.0106	
33	11.263	1778			0.0188	
34	11.538	3831	V		0.0404	
TOTAL		9480720			100	

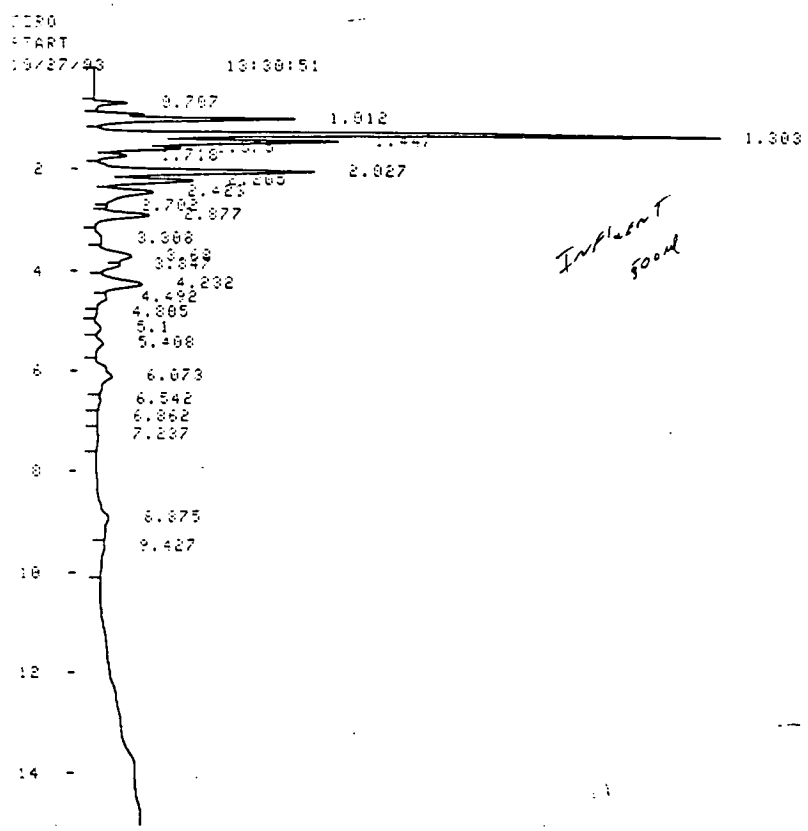
Comments:

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 27 OCTOBER 1993 Project Manager: Bottle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: INFLUENT Volume Injected: 500 µl Std. Vol. Inj.:



CHROMATOGRAM 9 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 12

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.707	12552			1.1142	
2	1.912	100108	V		8.8871	
3	1.303	255027	V		22.6399	
4	1.447	131188	V		11.6462	
5	1.575	42406	V		3.7646	
6	1.718	16665	V		1.4794	
7	2.027	135629	V		12.0404	
8	2.205	64376	V		5.715	
9	2.423	60066	V		5.3318	
10	2.702	5407	V		0.48	
11	2.877	43822	V		3.8903	
12	3.308	10209	V		0.9063	
13	3.68	45411	V		4.0313	
14	3.847	19498	V		1.7309	
15	4.232	58036	V		5.1522	
16	4.492	13788	V		1.224	
17	4.805	1248	V		0.1108	
18	5.1	6389			0.5672	
19	5.408	9310	V		0.8265	
20	6.073	36878	V	T	~~3.2730~~	
21	6.542	6761	V		0.6002	
22	6.862	3015	V		0.2676	
23	7.237	3310	V		0.2939	
24	8.875	34840			3.0929	
25	9.427	10513			0.9333	
TOTAL		1126446			100	

Comments:

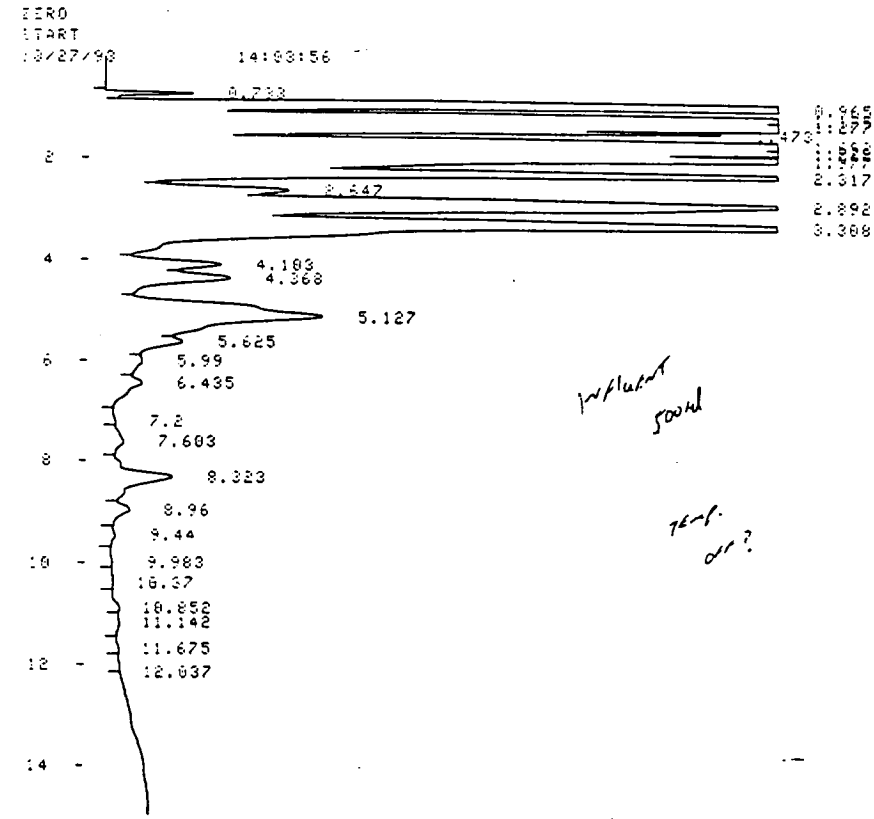
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.61 Date: 27 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: INFLUENT Volume Injected: 500ml Std. Vol. Inj.:

Comments:



Influent sound

Temp. off?

CHROMATOGRAM 10 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 13

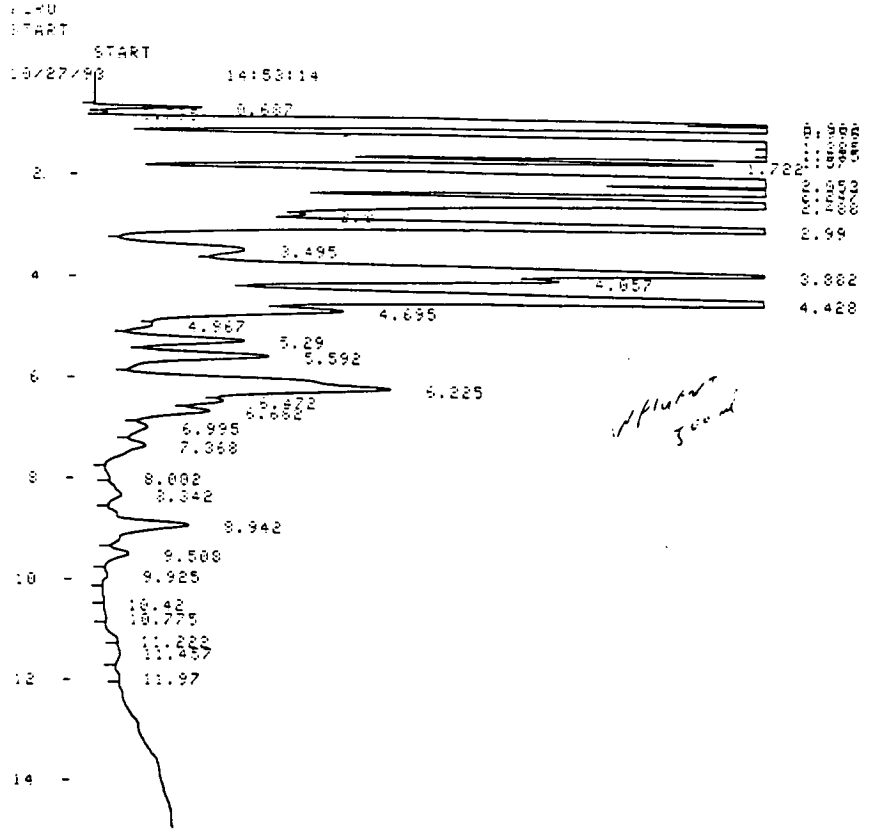
PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.733	34250			0.1958	
2	0.965	1583926	V		9.0548	
3	1.175	4151380	V		23.7322	
4	1.277	2672514	V		15.278	
5	1.473	267352	V		1.5284	
6	1.692	2188960	V		12.5136	
7	1.822	1005746	V		5.7496	
8	1.977	1071668	V		6.1264	
9	2.317	721768	V		4.1261	
10	2.647	184498	V	b	1.0547	
11	2.892	1057367	V		6.0447	
12	3.308	1201563	V		6.869	
13	4.103	134058	V		0.7664	
14	4.368	187898	V		1.0742	
15	5.127	563037	V	T	3.2187	
16	5.625	114414	V		0.6541	
17	5.99	67554	V		0.3862	
18	6.435	68858	V		0.3936	
19	7.2	10732	V		0.0614	
20	7.603	32668	V		0.1868	
21	8.323	118701	V	MM	0.6786	
22	8.96	27818	V	9X	0.159	
23	9.44	5593	V		0.032	
24	9.983	1392			0.008	
25	10.37	2268	V		0.013	
26	10.852	6585			0.0376	
27	11.142	7481	V		0.0428	
28	11.675	1651			0.0094	
29	12.037	915			0.0052	
TOTAL		17492598			100	

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 27 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: INFLUENT Volume Injected: Std. Vol. Inj.:



CHROMATOGRAM 11 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 14

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.887	32131			0.1545	
2	0.995	4163	V		0.02	
3	0.982	290526	V		1.3968	
4	0.988	1609929	V		7.7402	
5	1.235	4914959	VE		23.6302	
6	1.435	2517251	V		12.1025	
7	1.57	763196	V		3.6693	
8	1.722	327459	V		1.5744	
9	2.053	2582960	V		12.4184	
10	2.247	1236243	V		5.9436	
11	2.489	1151372	V		5.5356	
12	2.8	106332	V		0.5112	
13	2.99	845750	V		4.0662	
14	3.495	217706	V6		1.0467	
15	3.882	847682	V		4.0755	
16	4.057	382325	V		1.8381	
17	4.428	1062449	V		5.1081	
18	4.695	279004	V		1.3414	
19	4.967	52374	V		0.2518	
20	5.29	156465	V		0.7523	
21	5.592	214714	V		1.0323	
22	6.225	544150	V 1		2.6162	
23	6.472	105697	V		0.5082	
24	6.682	134137	V		0.6449	
25	6.995	75439	V		0.3627	
26	7.368	80537	V		0.3872	
27	8.002	13018	V		0.0626	
28	8.342	40044	V		0.1925	
29	8.942	141839	V x mm		0.6819	
30	9.508	34884	V ox		0.1677	
31	9.925	6203	V		0.0327	
32	10.42	940			0.0045	
33	10.775	1819	V		0.0087	
34	11.222	9509			0.0457	
35	11.457	13543	V		0.0653	
36	11.97	2094			0.0101	
TOTAL		20799468			100	

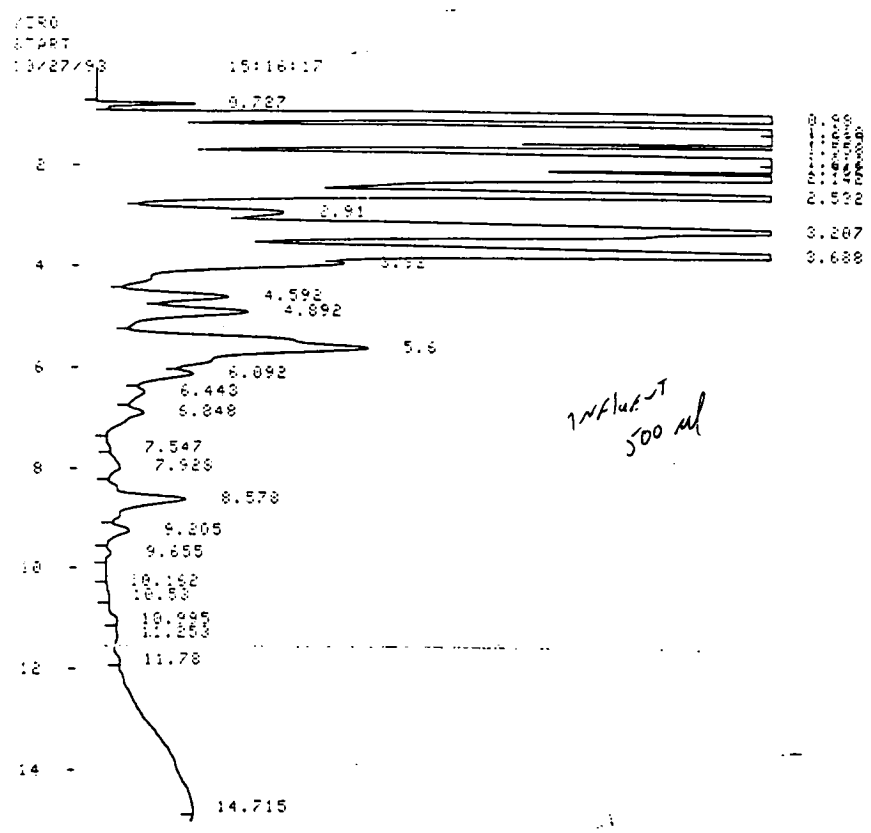
Comments:

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.61 Date: 27 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: INFLUENT Volume Injected: 500 ml Std. Vol. Inj.:



CHROMATOGRAM 12 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 15

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.787	37874			0.1818	
2	0.98	1848420	V		9.0634	
3	1.218	4884290	VE		23.6551	
4	1.335	3147919	V		15.4353	
5	1.558	319741	V		1.5678	
6	1.812	2513748	V		12.3257	
7	1.962	1220543	V		5.9847	
8	2.142	1232580	V		6.0438	
9	2.532	827191	V		4.0559	
10	2.91	218590	V	B	1.0718	
11	3.207	1206222	V		5.9145	
12	3.688	1070550	V		5.2493	
13	3.91	305168	V		1.4963	
14	4.592	152588	V		0.7482	
15	4.892	214266	V		1.0506	
16	5.6	645951	V	T	3.1673	
17	6.092	127589	V		0.6256	
18	6.443	76104	V		0.3732	
19	6.848	79975	V		0.3921	
20	7.547	11869	V		0.0582	
21	7.928	38193	V		0.1873	
22	8.578	143004	V	MTBE	0.7012	
23	9.205	34673	V	QX	0.17	
24	9.655	6496	V		0.0318	
25	10.162	1324			0.0065	
26	10.53	2848	V		0.014	
27	10.995	8049			0.0395	
28	11.253	7827	V		0.0384	
29	11.78	2532			0.0124	
30	14.715	69012			0.3384	
	TOTAL	20394292			100	

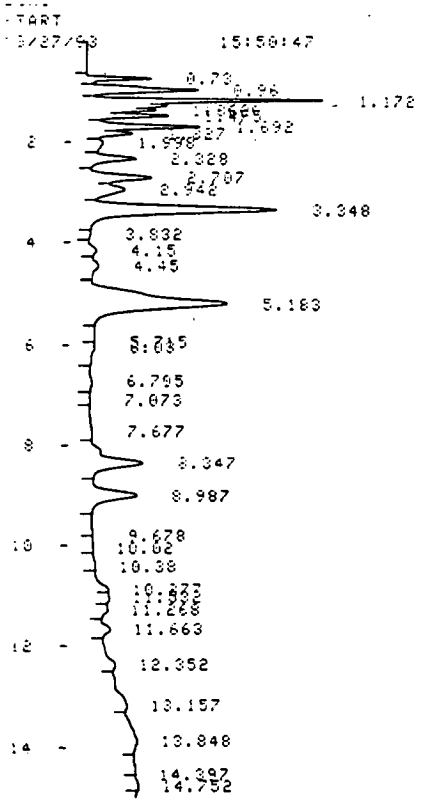
Comments:

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 27 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: Building Wall Volume Injected: 500 µl Std. Vol. Inj.:



Building wall sound

CHROMATOGRAM 13 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 16

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.73	24829			1.9194	
2	0.96	71647	V		5.5387	
3	1.172	100312	V		7.7547	
4	1.272	34353	V		2.6557	
5	1.362	31453	V		2.4315	
6	1.475	38552	V		2.9803	
7	1.692	65140	V		5.0357	
8	1.827	26088	V		2.0168	
9	1.998	19736	V		1.5257	
10	2.328	37309	V		2.8841	
11	2.707	54054	V		4.1787	
12	2.942	44667	V-		3.453	
13	3.348	191977	SV		14.8409	
14	4.15	8053	T		0.6225	
15	4.45	11014	TV		0.8514	
16	5.183	235683	V T		18.2196	
17	5.715	10264	V		0.7935	
18	6.02	8296	V		0.6308	
19	6.705	5231	V		0.4044	
20	7.677	6771			0.5234	
21	8.347	73186	V MTB		5.6577	
22	8.987	56270	V XOX		4.35	
23	9.678	1391			0.1075	
24	10.02	971	V		0.0751	
25	10.38	1090			0.0842	
26	10.877	11492			0.8884	
27	11.032	13676	V		1.0572	
28	11.265	9317	V		0.7203	
29	11.663	8809	V		0.681	
30	12.352	9089			0.7026	
31	13.157	25700	V		1.9868	
32	13.848	42312	V		3.2709	
33	14.397	9776	V		0.7557	
34	14.752	4551	V		0.3518	
	TOTAL	1293567			100	

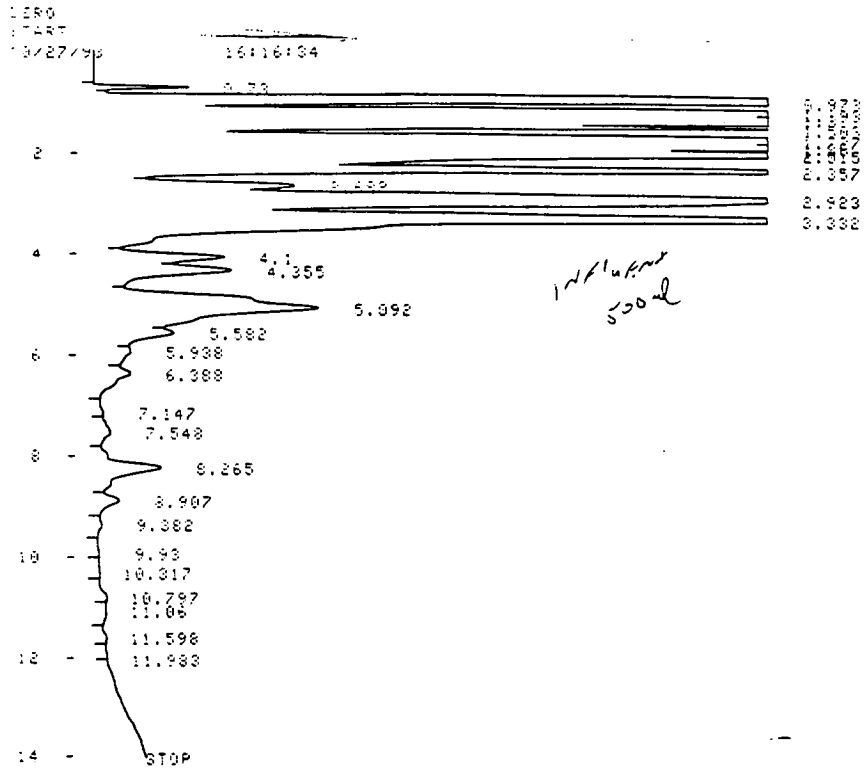
Comments:

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 27 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: INFLUENT Volume Injected: 500 ml Std. Vol. Inj.:



CHROMATOGRAM 14 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 17

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.73	34628			0.1796	
2	0.973	1768752	V		9.1732	
3	1.193	4575009	VE		23.7271	
4	1.3	3061917	V		15.8799	
5	1.503	305868	V		1.5863	
6	1.727	2405923	V		12.4777	
7	1.86	1141601	V		5.9206	
8	2.015	1170485	V		6.0704	
9	2.357	766795	V		4.0605	
10	2.682	199319	V	D	1.0337	
11	2.923	1135113	V		5.9046	
12	3.332	1285157	V		6.6651	
13	4.1	147250	V		0.7637	
14	4.355	196306	V		1.0181	
15	5.092	584967	V		3.0338	
16	5.582	119217	V		0.6183	
17	5.938	66554	V		0.3452	
18	6.388	71850	V		0.3726	
19	7.147	10852	V		0.0563	
20	7.548	32211	V		0.1671	
21	8.265	120603	V	MTP	0.6255	
22	8.907	30073	V	OK	0.156	
23	9.382	5624	V		0.0292	
24	9.93	1283			0.0067	
25	10.317	1889	V		0.0098	
26	10.797	7548			0.0391	
27	11.06	8503	V		0.0441	
28	11.598	2460			0.0128	
29	11.983	641			0.0033	
	TOTAL	19281770			100	

Comments:

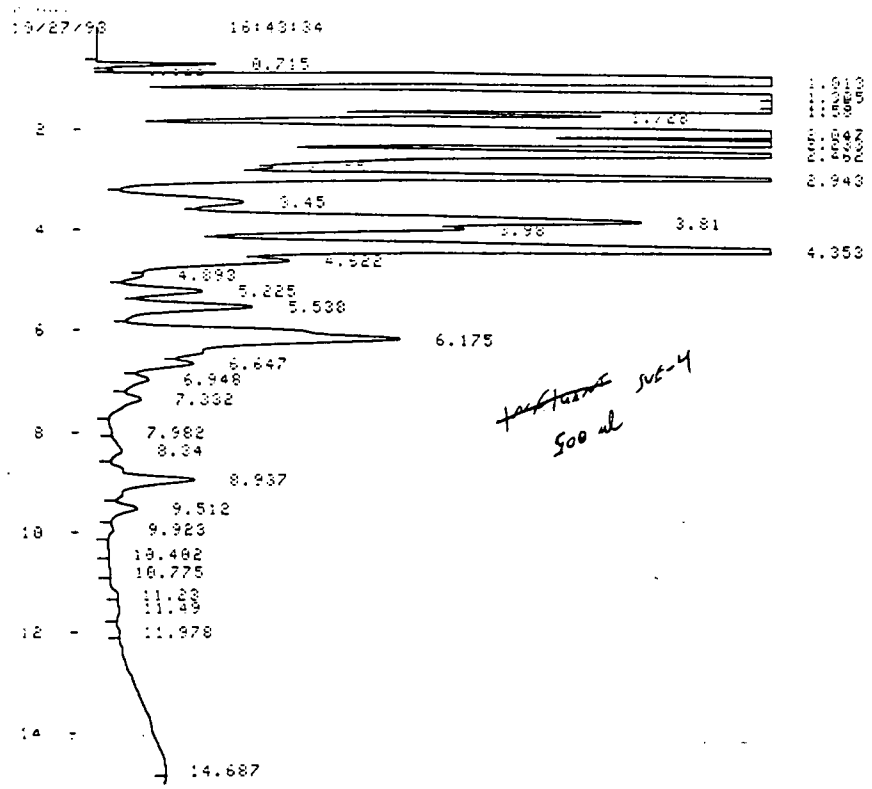
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 27 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: SVE-4 Volume Injected: Std. Vol. Inj.:

Comments:



CHROMATOGRAM 16 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 19

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.715	38266			0.2879	
2	0.822	5187	V		0.0282	
3	1.013	1909251	V		10.3745	
4	1.305	4528337	VE		24.6061	
5	1.45	2362931	V		12.8397	
6	1.58	743561	V		4.0404	
7	1.708	265390	V		1.4421	
8	2.047	2115699	V		11.4963	
9	2.233	975806	V		5.3023	
10	2.462	900963	V		4.8956	
11	2.755	86874	V		0.4721	
12	2.943	662223	V		3.5984	
13	3.45	202941	V	B	1.1027	
14	3.81	657144	V		3.5708	
15	3.98	304334	V		1.6537	
16	4.353	974253	V		5.2939	
17	4.622	211457	V		1.149	
18	4.893	35548	V		0.1932	
19	5.225	112204	V		0.6097	
20	5.538	185382	V		1.0073	
21	6.175	623258	V	T	3.3899	
22	6.647	103970	V		0.565	
23	6.948	65906	V		0.3581	
24	7.332	59314	V		0.3223	
25	7.982	11270	V		0.0612	
26	8.34	31252	V		0.1698	
27	8.937	136625	V	m/p	0.7424	
28	9.512	37528	V	o/X	0.2039	
29	9.923	6795	V		0.0369	
30	10.402	1438			0.0078	
31	10.775	1844	V		0.01	
32	11.23	6939			0.0377	
33	11.49	8376	V		0.0455	
34	11.978	2493			0.0135	
35	14.687	28004			0.1522	
	TOTAL	18403326			100	

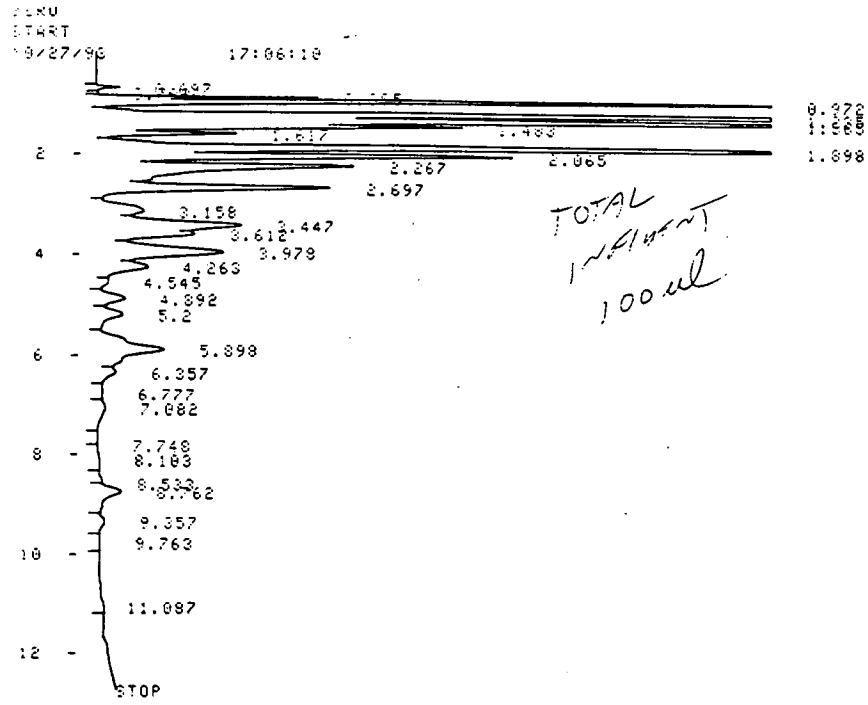
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 27 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: TOTAL INFLUENT Volume Injected: 100 ul Std. Vol. Inj.:

Comments:



CHROMATOGRAM 17 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 20

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.697	5998			0.1589	
2	0.798	613	V		0.0163	
3	0.895	53952	V		1.4313	
4	0.972	248724	V		6.5986	
5	1.235	783245	V		20.7794	
6	1.365	429158	V		11.3855	
7	1.483	155123	V		4.1154	
8	1.617	61513	V		1.6319	
9	1.898	490126	V		13.0029	
10	2.065	245026	V		6.5005	
11	2.267	264678	V		7.006	
12	2.697	171760	V		4.5568	
13	3.156	62278	V		1.6522	
14	3.447	167223	V		4.4364	
15	3.612	79847	V		2.1183	
16	3.979	168471	V		4.4695	
17	4.263	63136	V		1.675	
18	4.545	11336	V		0.3007	
19	4.892	31732	V		0.8419	
20	5.2	34775	V		0.9226	
21	5.898	135029	V		3.5823	
22	6.357	25044	V		0.6644	
23	6.777	11602	V		0.3078	
24	7.082	16582	V		0.4399	
25	7.745	959			0.0254	
26	8.103	5390	V		0.143	
27	8.533	4618	V		0.1225	
28	8.762	32161	V		0.8532	
29	9.357	8351	V		0.2216	
30	9.763	1503	V		0.9399	
	TOTAL	3769342			100	

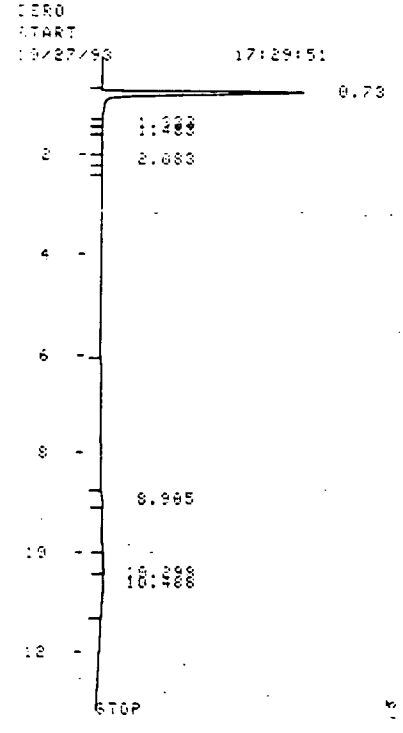
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 27 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: EFFLUENT Volume Injected: 1000 ml Std. Vol. Inj.:

Comments:



EFFLUENT
1000 ml

CHROMATOGRAM 18 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 21

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.73	88465	S		93.9593	
2	8.985	852			0.9047	
3	10.298	3037			3.2255	
4	10.488	1799			1.9105	
	TOTAL	94153			100	

ZERO

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

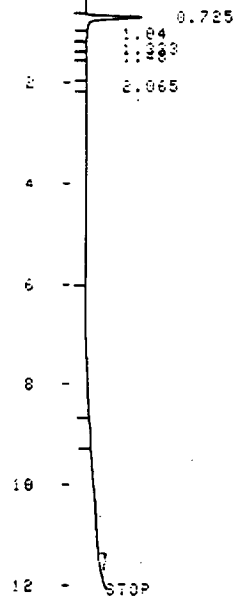
Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 27 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: Blank Volume Injected: 100 ml Std. Vol. Inj.:

Comments:

START
10/27/93 17:45:15



1745
BLANK
100ml

CHROMATOGRAM 19 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 22

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.725	24482	S		100	
	TOTAL	24482			100	

ZERO
START

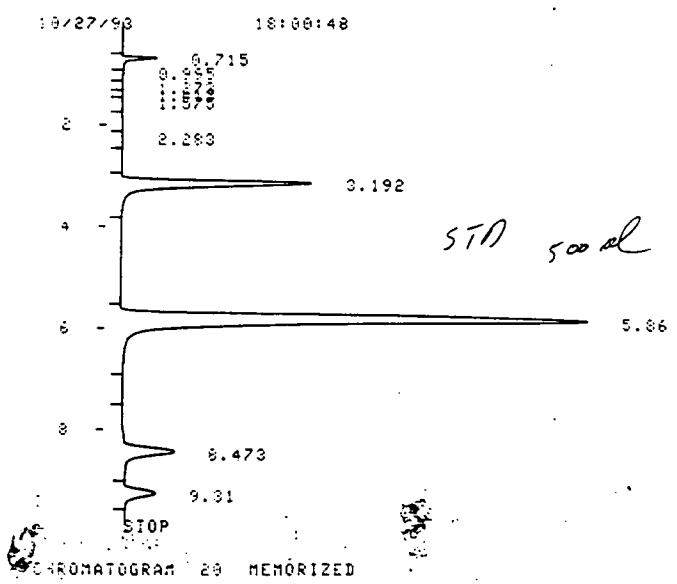
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 18197.61 Date: 27 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: STD Volume Injected: STOP Std. Vol. Inj.:

Comments:



CHROMATOGRAM 20 MEMORIZED

CHROMATOPAC - C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 23

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.715	12916			1.5755	
2	0.995	783	V		0.1027	
3	1.575	650	V		0.1115	
4	2.283	815			0.1069	
5	3.192	154785			20.2954	
6	5.86	502196			65.8479	
7	8.473	59986			7.8653	
8	9.31	31230			4.0948	
	TOTAL	762661			100	

SVCA FIELD DATA SHEET

EA ENGINEERING SCIENCE, AND TECHNOLOGY, INC.

Project Number: 12197.01
Gas Chromatograph: Hnu 421
Project Manager: M. Battle
Station Number:
Anaylsts: S. Dobson
Date: 10-28-93
Sit Location: Brunswick NAS

SAMPLE LOCATION	TIME	DEPTH (ft.)	PURGE TIME (min.)	VACUUM (IN Hg)	VACUUM RELEASE (min.)	VOLUME INJECTION (ul) FID	ECD	SAMPLER NUMBER	COMMENTS
[illegible]	0750	NA	NA	NA	NA	500		NA	SVE-1 30 in H_2O
BLANK	0749	NA	2	0	<1	1000		4	
VP-9	0807	3.5	2	25	8	1000		4	
VP AAS-1-30	0826	5.5	2	4	1	1000		4	
VP AAS-1-30	0842	5.5	2	4	1	1000		4	
VP AAS-1-20	0901	5.5	2	7	1	1000		4	
VP AAS-1-15	0917	5.5	2	5	1	1000		4	
VP AAS-1-10	0932	5.5	2	7	1	1000		4	
STD	0954	NA	NA	NA	NA	500		NA	
INFLUENT	1007					500			
INFLUENT	1047					500			
EFFLUENT	1120					1000			
INFLUENT	1139					500			
STD	1203					500			
INFLUENT	1214					500			STEP TEST TO 30 in H_2O
INFLUENT	1241					500			
BAG BLANK	1259					1000			1245 STEP TEST BACK TO 10 in H_2O
DIRECTOR OFFICE	1314					1000			
INFLUENT	1330					500			COLLECTED @ 1315
3-06. VENT STACK	1349					1000			
INFLUENT	1407					500			
INFLUENT SPIKE	1430					600	200 BTEX ST 400 SAMPLE		
STD	1707					500			WEAK STD, SHOOT NEW ONE

SVCA SAMPLE CALCULATIONS

Site: BRUNSWICK NAS **Analyst:** SCOTT [illegible]

Project No.: 12197.01 **Analysis Date:** 28 OCT 93

Sample ID	Inj. Vol.	Time	Benzene ppm	Toluene ppm	Ethyl-Benzene	O Xylene	[illegible] Xylenes	Total Hydrocarbons ppm							
BLANK	1000	745	<0.1	<0.1	<0.1	<0.1		33							
VP-9	1000	0907	18.4	35 [illegible]	5.5	41 [illegible]	55.2	1900							
[illegible]-AAS-1-30	1000	826	<0.1	<0.1	<0.1	<0.1		43							
[illegible]-AAS-1-30 [illegible]	1000	842						16							
[illegible]-AAS-1-20	1000	0901						4.5							
[illegible]-AAS-1-15	1000	0917						14							
[illegible]-AAS-1-10	1000	0932						6.0							
INFLUENT	500	1007	12.4	57 [illegible]	<0.1	25 [illegible]	52.4	1800							
INFLUENT	500	1047	23.1	59 [illegible]	<0.1	46 [illegible]	57.4	2500							
EFFLUENT	1000	1120	<0.1	<0.1	<0.1	<0.1		[illegible]							
INFLUENT	500	1139	30 [illegible]	70 [illegible]		78 [illegible]	47.9	2700							
INFLUENT	500	1214	16 [illegible]	17 [illegible]		41 [illegible]	44.6	1300							
INFLUENT	500	1241	24 [illegible]	68 [illegible]		69 [illegible]	84.6	1800							
DAC BLANK	1000	1259	<0.1	<0.1	<0.1	<0.1		[illegible]							
DIRECTORS OFFICE	1000	1314	<0.1	<0.1	<0.1	<0.1		0.1							
INFLUENT	500	1330	30.3	68 [illegible]	<0.1	88 [illegible]	108	2200							
BLDG. STACK	1000	1341	15.0	145 [illegible]	22 [illegible]	248 [illegible]	187	540							
INFLUENT	500	1407	32 [illegible]	128	<0.1	92 [illegible]	116	3500							
BLANK	1000	1746	<0.1	<0.1	<0.1	<0.1		1.0							

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

SVCA INSTRUMENT CALIBRATION RECORD

Site: Brunswick NAS
Project No.: 12197.01 Analysis Date: 28 OCT 93
Calculated by: SMS Checked by: [illegible]

Benzene 16.7 ppm		Toluene 20.0 ppm		Ethylbenzene 15.3 ppm		O-xylene 11.0 ppm								Inject volume (uL)	~~Temp~~ (c)
RT	RF	RT	RF	RT	RF	RT	RF	RT	RF	RT	RF	RT	RF		
3.692	0.115	6.37	0.067	8.835	0.485	9.633	0.770							500	0010
2.625	0.039	5.038	0.056	7.985	2.59x10⁻³	8.917	0.022							500	0954
2.648	0.018	5.062	0.073	7.997	0.033	8.912	0.024							500	1203
3.513 ~~2.679~~	0.048	6.203 ~~5.070~~	0.038	8.7	0.017	9.492	0.049							500	1727
	0.053		0.059		0.134		0.216								

RF = (std conc.) (std inj vol)

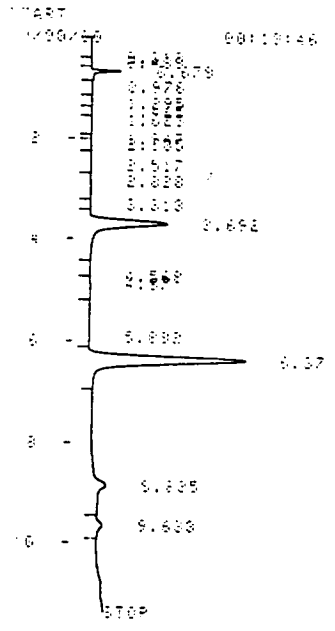
sample conc. = (peak area) (RF)

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 28 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: STANDARD Volume Injected: 500 ml Std. Vol. Inj.:



STD 500 ml

CHROMATOGRAM 1 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 1

CHNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.013	[illegible]			0.1718	
2	0.483	952	V		0.3612	
3	0.678	8001	V		3.2671	
4	0.972	1182	V		0.4487	
5	1.295	511	V		0.1942	
6	1.623	1272	V		0.4829	
7	2.517	1127	V		0.4277	
8	2.828	1382	V		0.5246	
9	3.833	72711			27.5958	
10	4.568	613	V		0.2326	
11	4.87	606	V		0.2301	
12	5.882	893			0.339	
13	6.37	148917			56.5034	
14	8.835	15784	V		5.9905	
15	9.633	7141	V		2.7104	
	TOTAL	263434			100	

DATE$="18-29-93"
TIME$="07-47-00"

Comments:

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

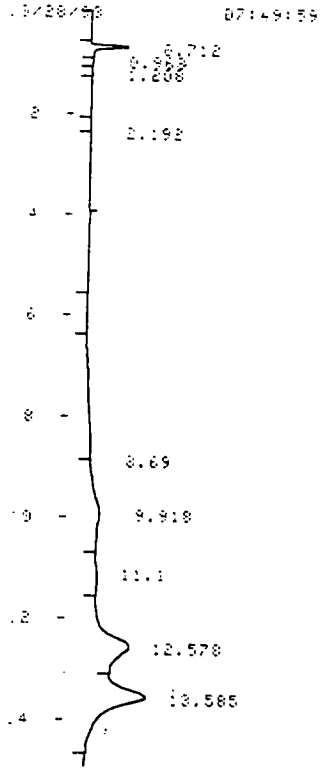
Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 28 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: Blank Volume Injected: 1000 µl Std. Vol. Inj.:

Comments:

.TEST
TSTING 50 sec
LOPE 244.32
ZRO
TART
.9/28/93 07:49:59



CHROMATOGRAM 2 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 2

RKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.712	14945			2.4827	
2	8.69	34930			6.0886	
3	9.918	94589	V		16.4979	
4	11.1	49138	V		8.5652	
5	12.578	193027	V		33.9951	
6	13.585	185765	V		32.3806	
	TOTAL	573692			100	

ZRO
TART

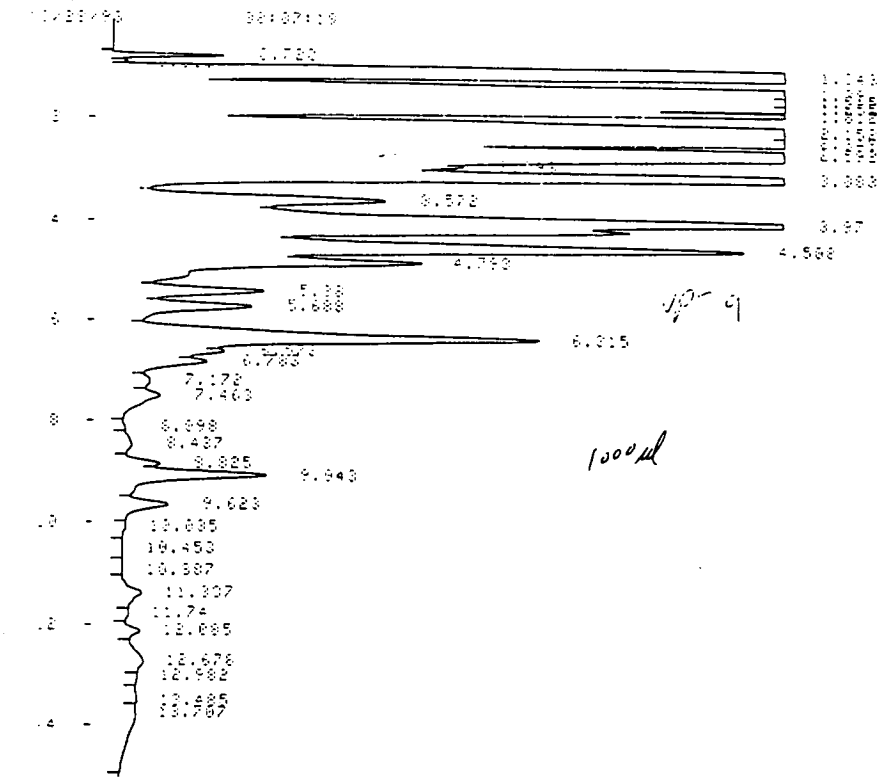
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 28 OCTOBER 1993 Project Manager: Battle Chemist: Dubson Site: NAS Brunswick, ME

Geologist: Sample: VP-9 Volume Injected: 1000 ml Std. Vol. Inj.:

Comments:



CHROMATOGRAM 3 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 3

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.722	41869			0.1296	
2	0.833	5534	V		0.0172	
3	1.049	3489331	V		10.8144	
4	1.39	7341470	VE		22.7532	
5	1.515	4766653	V		14.7422	
6	1.655	1590805	V		4.9303	
7	1.812	628572	V		1.9481	
8	2.152	4203098	V		13.0265	
9	2.348	1923896	V		5.9627	
10	2.592	1919808	V		5.95	
11	2.898	176795	V		0.5479	
12	3.083	1156267	V		3.5836	
13	3.578	347791	V	B	1.0779	
14	3.97	1437507	V		4.4554	
15	4.503	119923	V		2.6032	
16	4.793	430918	V		1.3355	
17	5.03	166567	V		0.5162	
18	5.688	178985	V		0.5547	
19	6.315	588106	V	T	1.8227	
20	6.573	99397	V		0.3081	
21	6.783	110910	V		0.3437	
22	7.172	54984	V		0.1704	
23	7.463	85879	V		0.2646	
24	8.098	11422	V		0.0354	
25	8.437	34104	V		0.106	
26	8.825	40931	V	E	0.1269	
27	9.043	187772	V	Kmp	0.582	
28	9.623	68060	V	O	0.2109	
29	10.035	13842	V		0.0429	
30	10.453	11133	V		0.0345	
31	10.587	9287	V		0.0288	
32	11.337	51562	V		0.1598	
33	11.74	15340	V		0.0477	
34	12.085	30769	V		0.0954	
35	12.678	71984	V		0.2355	
36	12.982	26248	V		0.0814	
37	13.485	39154	V		0.1214	
38	13.707	75346	V		0.2335	
	TOTAL	32265628			100	

END

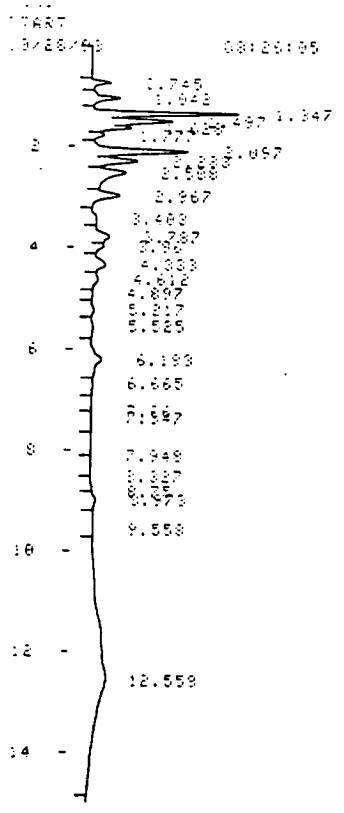
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 28 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: AAS-1-30 Volume Injected: 1000 µl Std. Vol. Inj.:

Comments:



up. AAS-1-30
1000 µl

CHROMATOGRAM 4 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 4

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.745	8681			1.1736	
2	1.042	16977	V		2.2952	
3	1.347	69763	V		9.4318	
4	1.497	50791	V		6.8668	
5	1.629	20064	V		2.7125	
6	1.777	6957	V		0.9406	
7	2.097	64008	V		8.6646	
8	2.283	33233	V		4.493	
9	2.503	41550	V		5.6185	
10	2.967	23809	V		3.2189	
11	3.403	7199	V		0.9733	
12	3.787	23071	V		3.1191	
13	3.96	10147	V		1.3718	
14	4.333	19386	V		2.6209	
15	4.612	8652	V		1.1697	
16	4.897	910	V		0.1231	
17	5.217	3223	V		0.4357	
18	5.525	3310	V		0.4475	
19	6.193	19504	V		2.645	
20	6.665	3678	V		0.4961	
21	7.96	2004	V		0.2709	
22	7.347	3319	V		0.4487	
23	7.940	3823	V		0.5169	
24	8.327	3960	V		0.5354	
25	8.75	4240	V		0.5733	
26	8.973	10443	V		1.4119	
27	9.550	12156	V		1.6435	
28	12.558	264664	V		35.7817	
	TOTAL	739662			100	

ZERO

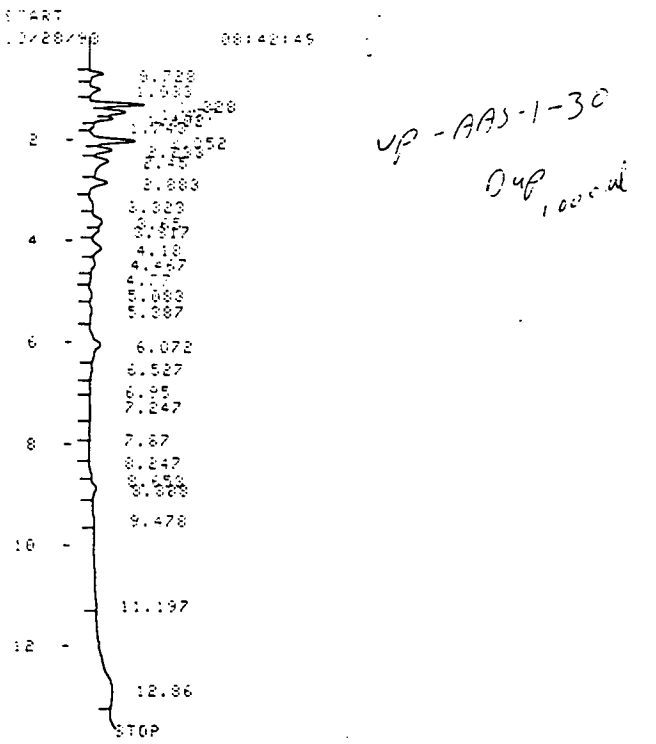
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 28 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: VP-AAS-1-30 Volume Injected: 1000 ml Std. Vol. Inj.:

Comments: Pup.



VP-AAS-1-30
Dup, 1000 ml

CHROMATOGRAM 5 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 5

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.728	7156			2.5696	
2	1.933	7846	V		2.6893	
3	1.988	28994	V		9.7223	
4	1.477	23494	V		8.46	
5	1.696	12677	V		4.5791	
6	1.743	2951	V		1.0626	
7	2.052	34577	V		11.0105	
8	2.233	15912	V		5.7296	
9	2.45	23824	V		8.5788	
10	2.883	14164	V		5.1004	
11	3.123	5420			1.9517	
12	3.65	16403	V		5.9067	
13	3.817	7611	V		2.7406	
14	4.18	15613	V		5.6942	
15	4.467	7337	V		2.6385	
16	4.77	771	V		0.2776	
17	5.083	2831			1.0195	
18	5.367	3105	V		1.1182	
19	6.072	19592			7.0548	
20	6.527	3059	V		1.1017	
21	6.95	807	V		0.2907	
22	7.247	1677	V		0.6039	
23	8.653	931			0.3354	
24	8.888	6092	V		2.1936	
25	9.478	3166	V		1.1402	
26	11.197	5166	V		1.8603	
27	12.86	9177			3.3046	
28	13.863	3737			1.3455	
	TOTAL	277705			100	

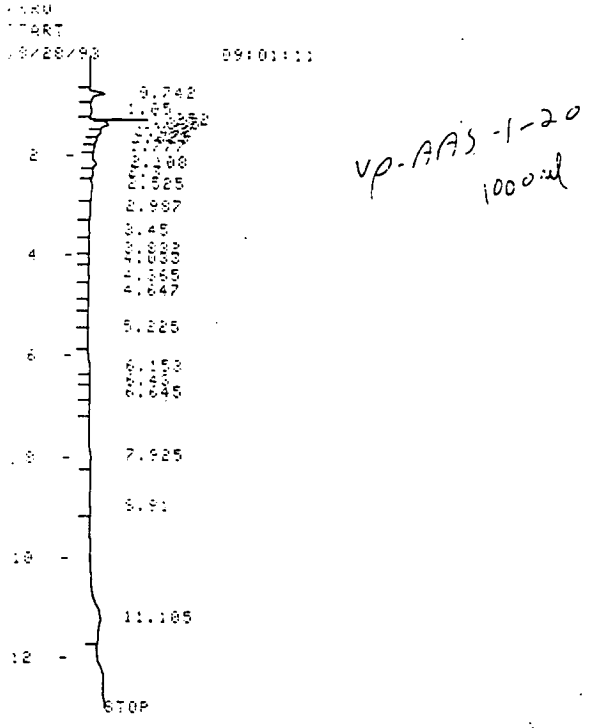
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 28 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: VP-AAS-1-20 Volume Injected: 1000 µl Std. Vol. Inj.:

Comments:



CHROMATOGRAM 6 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 6

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.741	7436			3.8997	
2	1.85	2194	V		2.6265	
3	1.252	6836	V		7.2234	
4	1.335	13522	V		16.1895	
5	1.492	9557	V		11.4428	
6	1.623	4791	V		5.736	
7	1.777	3364	V		4.0281	
8	2.108	8255	V		9.8836	
9	2.3	3856	V		4.6123	
10	2.525	5480	V		6.5612	
11	2.987	2558	V		3.0622	
12	3.45	897	V		1.0745	
13	3.832	1454	V		1.7411	
14	4.833	705	V		0.8445	
15	4.365	1226	V		1.4676	
16	4.647	704	V		0.8432	
17	6.153	2278			2.7276	
18	7.925	2758			3.3022	
19	8.91	1229	V		1.4716	
20	11.105	5231			6.2625	
	TOTAL	83523			100	

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

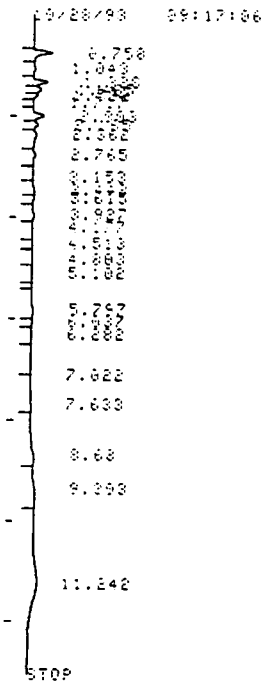
Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.61 Date: 28 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: VP-AAS-1-15 Volume Injected: 1000 µl Std. Vol. Inj.:

Comments:

ZERO
START



VP-AAS-1-15
1000 µl

CHROMATOGRAM 7 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 6 METHOD 561
REPORT NO 7

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.758	9698			3.9304	
2	1.043	2563	V		1.0386	
3	1.029	7567	V		3.0667	
4	1.465	5566	V		2.2558	
5	1.582	2322	V		0.9411	
6	1.717	734	V		0.2976	
7	2.003	7323	V		2.9717	
8	2.165	3775	V		1.5297	
9	2.362	5322	V		2.1569	
10	2.765	3134	V		1.27	
11	3.153	1076			0.4361	
12	3.445	3863	V		1.5656	
13	3.615	1756	V		0.7116	
14	3.927	4034	V		1.6347	
15	4.177	1933	V		0.7835	
16	4.803	595			0.2411	
17	5.102	680	V		0.2754	
18	5.797	5032			2.0392	
19	6.037	1146	V		0.4645	
20	6.282	2125	V		0.8612	
21	7.022	5062	V		2.0516	
22	7.633	10920	V		4.4256	
23	8.63	23927	V		9.6968	
24	9.393	28577	V		11.5812	
25	11.242	108012	V		43.7733	
	TOTAL	246734			100	

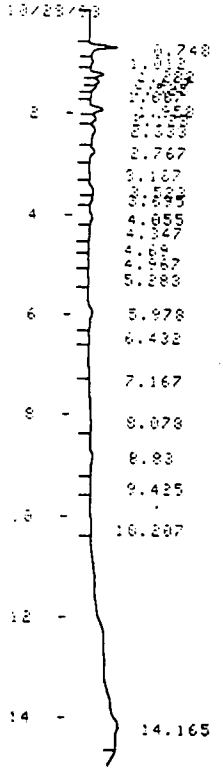
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12193.01 Date: 26 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: VP-AAS-1-10 Volume Injected: 1000 µl Std. Vol. Inj.:

Comments:



VP-AAS-1-10

1000 µl

CHROMATOGRAM 3 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 0

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.748	12306			10.7178	
2	1.012	2471	V		2.1522	
3	1.382	7488	V		6.5151	
4	1.417	6175	V		5.3781	
5	1.525	2678	V		2.3255	
6	1.667	1037	V		0.903	
7	1.955	3487	V		3.2625	
8	2.128	5142	V		4.4783	
9	2.333	7971	V		6.9423	
10	2.767	4987	V		4.3432	
11	3.187	1981	V		1.7257	
12	3.523	5792	V		5.0446	
13	3.695	2837	V		2.4706	
14	4.055	5755	V		5.012	
15	4.347	2902	V		2.5274	
16	4.967	1059			0.9225	
17	5.283	1175	V		1.0231	
18	5.978	8115			7.0674	
19	6.432	871	V		0.7529	
20	7.167	3437			2.9931	
21	8.078	11119	V		9.6843	
22	8.83	6971	V		6.0712	
23	9.425	863			0.7512	
24	10.207	2216			1.9301	
	TOTAL	114817			100	

ZERO
START

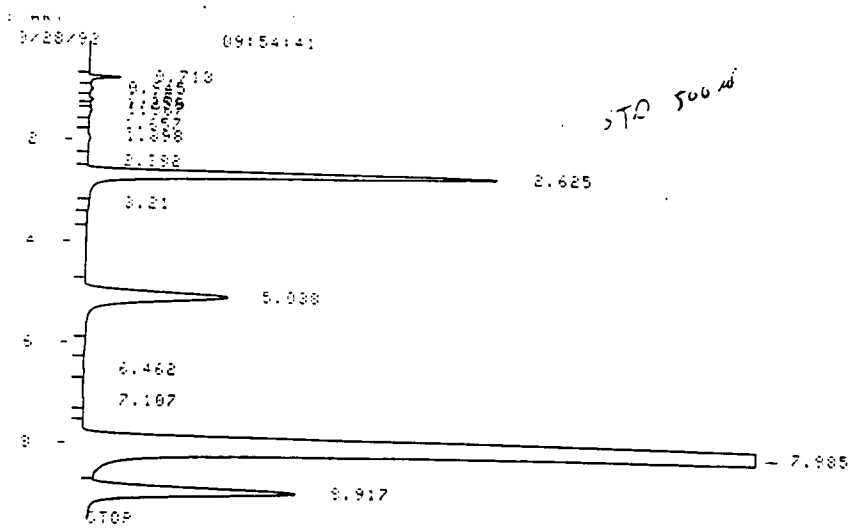
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 28 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: STANDARD Volume Injected: 500 ml Std. Vol. Inj.:

Comments:



CHROMATOGRAM 9 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 9 METHOD 561
REPORT NO 9

PEAK	TIME	AREA	MK	IDNO	CONC	NAME
1	0.713	9818			0.2606	
2	0.945	2307	V		0.0625	
3	1.152	1906	V		0.0515	
4	1.358	969	V		0.0263	
5	1.657	2073	V		0.0562	
6	1.898	508	V		0.0138	
7	2.625	2504	V		0.0678	
8	5.038	288654	SV		7.8222	
9	7.985	177923			4.8215	
10	8.917	2957505			80.1449	
11		246206	V		6.6728	
	TOTAL	3690.98			100	

A.TEST
TESTING 50 sec
SLOPE

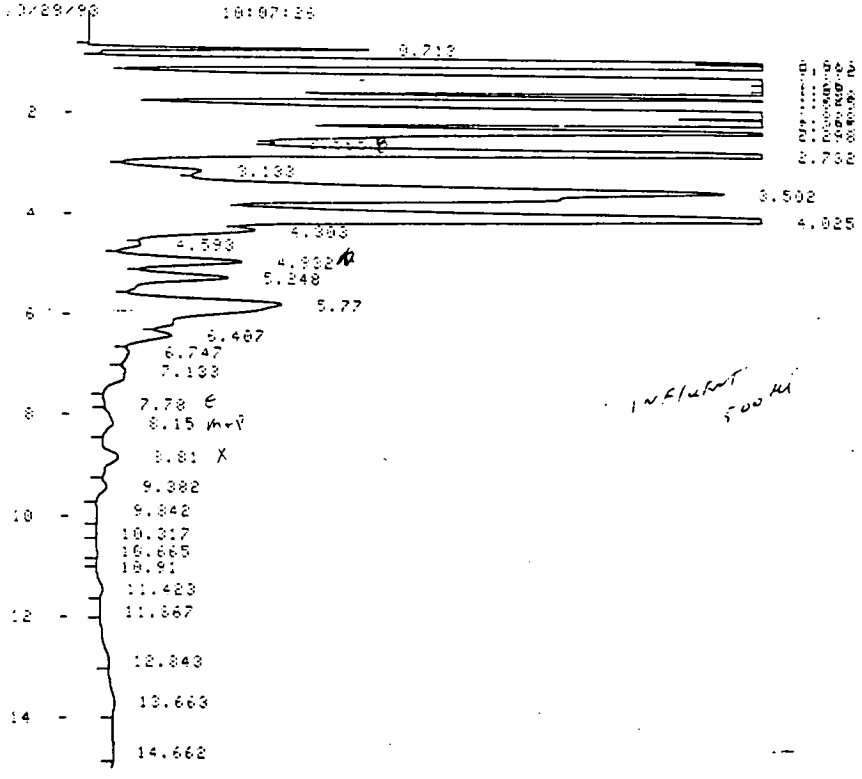
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 28 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: INFLUENT Volume Injected: 500 ml Std. Vol. Inj.:

Comments:



CHROMATOGRAM 10 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 10

P.NO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.713	83250			0.5386	
2	0.913	298676	V		1.9323	
3	0.992	1059017	V		6.8514	
4	1.26	3208168	V		20.7555	
5	1.39	1426445	V		9.2285	
6	1.508	401771	V		2.5993	
7	1.645	351410	V		2.2735	
8	1.928	2085191	V		13.4903	
9	2.095	1079055	V		6.9811	
10	2.298	746351	V		4.8286	
11	2.565	68772	V		0.4449	
12	2.732	788946	V		5.1042	
13	3.133	117461	V	B	0.7599	
14	3.502	1162944	V		7.5238	
15	4.025	1023993	V		6.6248	
16	4.303	185054	V		1.1972	
17	4.593	49962	V		0.3232	
18	4.932	175841	V		1.1376	
19	5.248	191175	V		1.2368	
20	5.77	481534	V	T	3.1153	
21	6.407	116271	V		0.7522	
22	6.747	67318	V		0.4355	
23	7.133	75866	V		0.4908	
24	7.78	16214	V		0.1049	
25	8.15	47080	V		0.3046	
26	8.81	57405	V	X MTP } TOTAL	0.3714	
27	9.382	18374	V	O	0.1189	
28	9.842	2791	V		0.0181	
29	10.317	1132			0.0073	
30	10.665	2321	V		0.015	
31	11.423	7597			0.0491	
32	11.867	2077	V		0.0134	
33	12.843	16216			0.1049	
34	13.663	30236	V		0.1956	
35	14.662	11015	V		0.0713	
	TOTAL	15456910			100	

ZERO
START

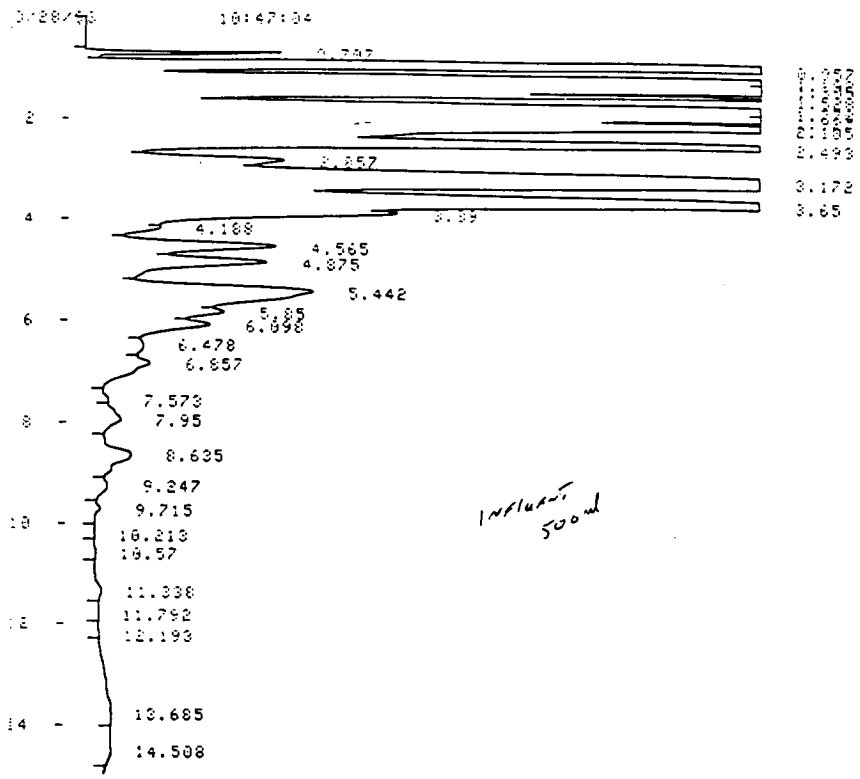
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 28 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: INFLUENT Volume Injected: 500 ml Std. Vol. Inj.:

Comments:



CHROMATOGRAM 11 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 11

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.787	65268			0.3052	
2	0.957	1856481	V		8.6822	
3	1.192	4176828	V		19.5337	
4	1.305	2809094	V		13.1372	
5	1.523	387353	V		1.8115	
6	1.778	2811510	V		13.1485	
7	1.927	1409914	V		6.5937	
8	2.195	1317238	V		6.1603	
9	2.493	1055797	V		4.9376	
10	2.857	218279	V		1.0208	
11	3.172	1649456	V		7.714	
12	3.65	1296925	V		6.0653	
13	3.89	342953	V		1.6039	
14	4.188	67037	V		0.3135	
15	4.565	234709	V		1.0977	
16	4.875	271715	V		1.2707	
17	5.442	498161	V		2.3297	
18	5.85	152965	V		0.7154	
19	6.098	188084	V		0.8796	
20	6.478	97170	V		0.4544	
21	6.857	134532	V		0.6292	
22	7.573	23152	V		0.1083	
23	7.95	72618	V		0.3396	
24	8.635	106269	V		0.497	
25	9.247	27203	V		0.1272	
26	9.715	8296	V		0.0388	
27	10.213	1834			0.0086	
28	10.57	3353	V		0.0157	
29	11.338	9844			0.046	
30	11.792	3197	V		0.015	
31	12.193	2365	V		0.0111	
32	13.685	57714	V		0.2699	
33	14.508	25394	V		0.1188	
	TOTAL	21382672			100	

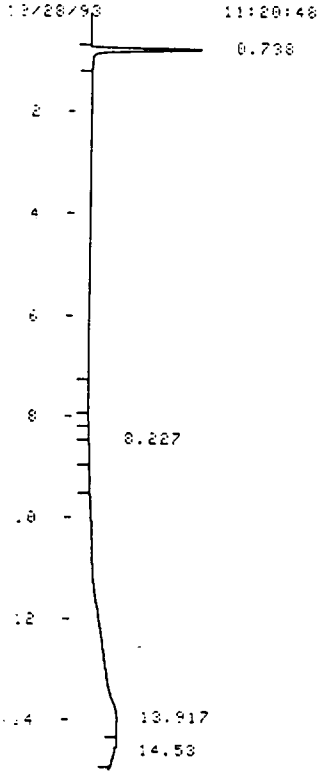
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 28 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: EFFLUENT Volume Injected: 1000ml Std. Vol. Inj.:

Comments:



EFFluent
1000ml

CHROMATOGRAM 12 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 12

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.738	46123			34.986	
2	13.917	66120			50.1547	
3	14.53	19590	V		14.8594	
	TOTAL	131833			100	

ZERO

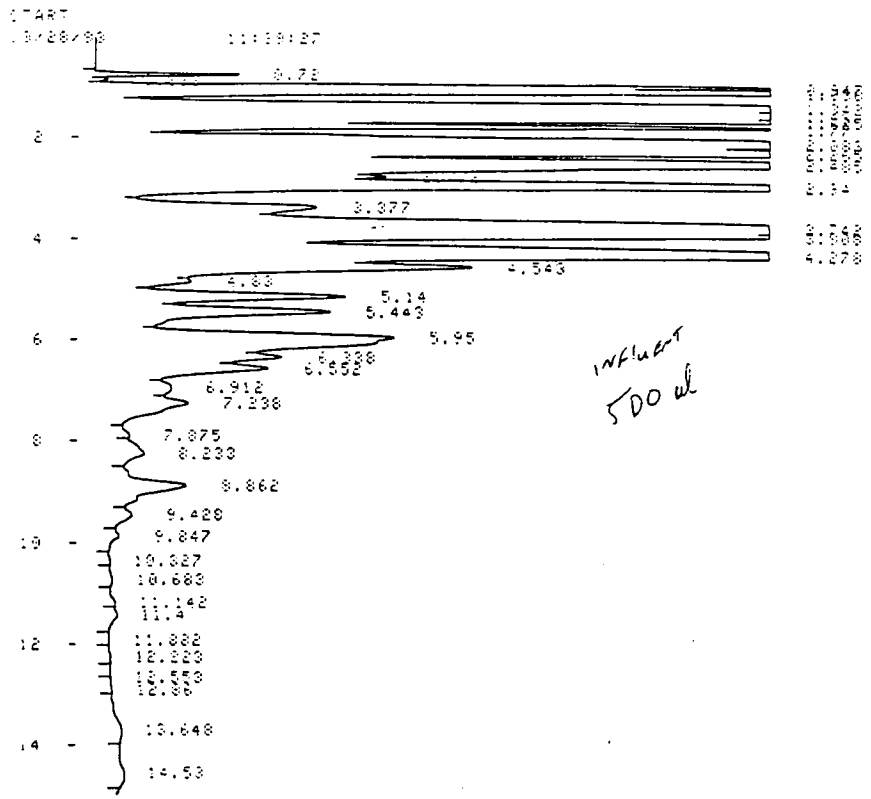
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 28 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: INFLUENT Volume Injected: 500 ul Std. Vol. Inj.:

Comments:



CHROMATOGRAM 13 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 13

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.72	46647			0.2038	
2	0.833	4212	V		0.0184	
3	0.947	336401	V		1.47	
4	1.038	1509527	V		6.5962	
5	1.342	4264195	V		18.6334	
6	1.49	2326035	V		10.1642	
7	1.625	710546	V		3.1049	
8	1.77	395453	V		1.728	
9	2.083	2938625	V		12.841	
10	2.265	1480036	V		6.4674	
11	2.485	1328189	V		5.8038	
12	2.772	132736	V	B	0.58	
13	2.94	1115204	V		4.8731	
14	3.377	279922	V	B	1.2232	
15	3.742	1200761	V		5.2467	
16	3.908	602068	V		2.6309	
17	4.278	1360323	V		5.9442	
18	4.543	426804	V		1.865	
19	4.83	90998	V		0.3976	
20	5.14	263762	V	A	1.1526	
21	5.443	315474	V		1.3785	
22	5.95	589242	V	T	2.5748	
23	6.338	189361	V		0.8275	
24	6.552	221293	V		0.967	
25	6.912	115277	V		0.5037	
26	7.238	176951	V		0.7732	
27	7.875	33471	V	E	0.1463	
28	8.233	95860	V	~~mp~~	0.4189	TOTAL
29	8.862	181118	V	~~o-X~~	0.7914	
30	9.428	45503	V	O	0.1988	TOTAL
31	9.847	18940	V		0.0828	
32	10.327	5611	V		0.0245	
33	10.683	11871	V		0.0519	
34	11.142	12276	V		0.0536	
35	11.4	16438	V		0.0718	
36	11.882	1587	V		0.0069	
37	12.223	2267			0.0099	
38	12.553	701	V		0.0031	
39	12.86	1101	V		0.0048	
40	13.648	18899	V		0.0826	
41	14.53	19107	V		0.0835	
	TOTAL	22884706			100	

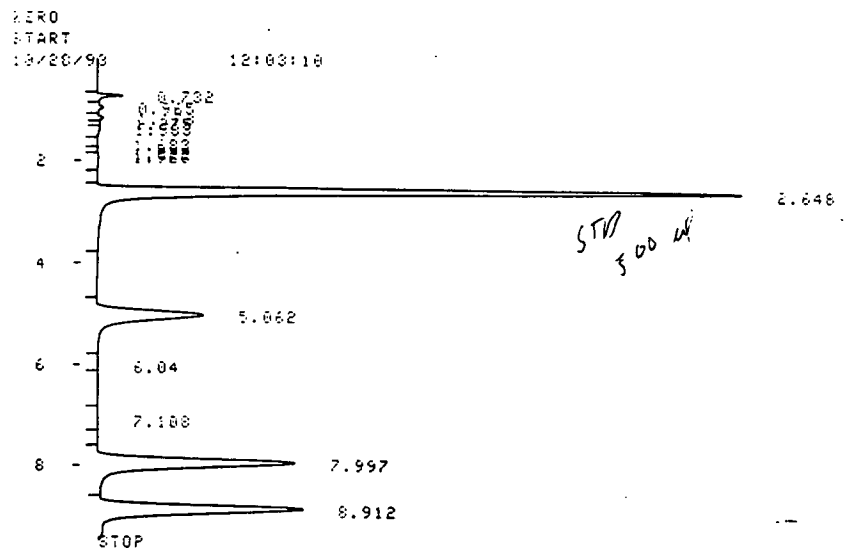
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 28 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: STANDARD Volume Injected: 500 ml Std. Vol. Inj.:

Comments:



CHROMATOGRAM 14 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 14

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.732	8469			0.7845	
2	0.965	3102	V		0.2873	
3	1.173	2595	V		0.2404	
4	1.275	1430	V		0.1325	
5	1.383	1929	V		0.1787	
6	1.683	660	V		0.0611	
7	1.822	626	V		0.058	
8	1.923	1651	V		0.1529	
9	2.648	457450			42.3737	
10	5.062	136194			12.6157	
11	7.108	608			0.0563	
12	7.997	234147			21.6891	
13	8.912	230701	V		21.3699	
	TOTAL	1079561			100	

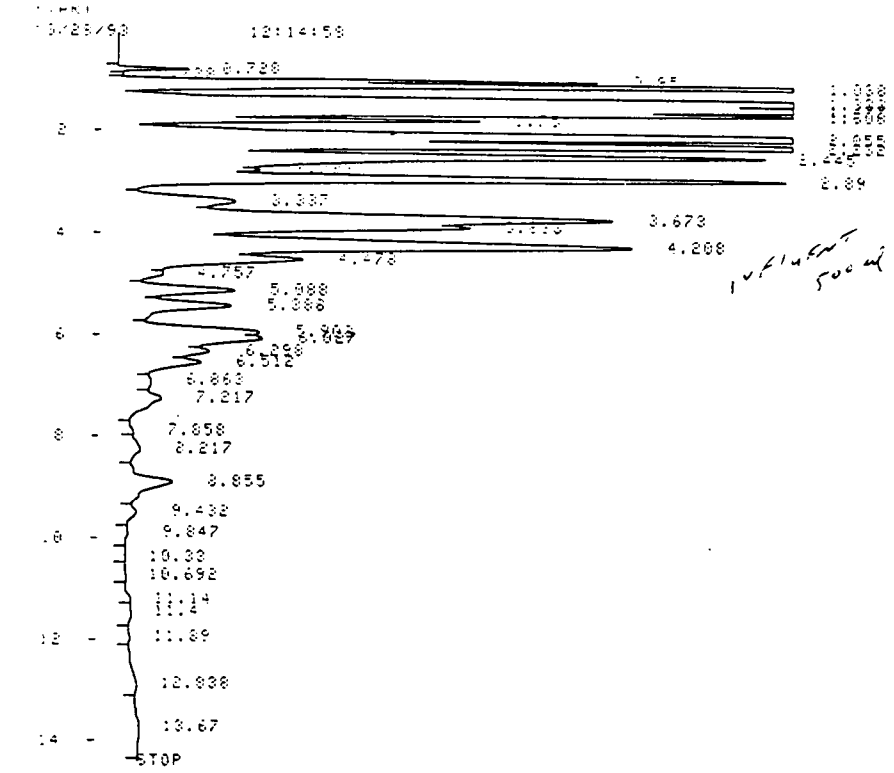
ZERO

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 28 OCTOBER 1993 Project Manager: Battle Site: NAS Brunswick, ME

Geologist: Sample: INFLUENT Volume Injected: 500ml Chemist: Dobson Std. Vol. Inj.:



CHROMATOGRAM 15 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 15

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.728	21450			0.2011	
2	0.838	1866	V		0.0175	
3	0.95	152315	V		1.428	
4	1.038	651246	V		6.1055	
5	1.333	1952524	V		18.3851	
6	1.477	1057129	V		9.9107	
7	1.608	338138	V		3.17	
8	1.75	179823	V		1.6859	
9	2.055	1353684	V		12.6909	
10	2.232	682486	V		6.3984	
11	2.445	620714	V		5.8942	
12	2.723	65058	V		0.6099	
13	2.89	526166	V		4.9329	
14	3.337	149487	V		1.4015	
15	3.673	566045	V		5.3067	
16	3.833	294475	V		2.7607	
17	4.208	652723	V		6.1193	
18	4.478	209381	V		1.963	
19	4.757	43771	V		0.4104	
20	5.088	125742	V		1.1788	
21	5.388	148256	V		1.3899	
22	5.908	139895	V		1.3115	
23	6.927	164933	V		1.5467	
24	6.298	89482	V		0.8389	
25	6.512	106801	V		1.0013	
26	6.863	49200	V		0.4613	
27	7.217	80867	V		0.7581	
28	7.858	13787	V		0.1293	
29	8.217	40432	V		0.3791	
30	8.855	95901	V		0.8991	
31	9.432	19678	V		0.1845	
32	9.847	5105	V		0.0479	
33	10.33	1400			0.0131	
34	10.692	2362	V		0.0221	
35	11.14	5406			0.0507	
36	11.4	9288	V		0.0871	
37	11.89	2701	V		0.0253	
38	12.838	17558			0.1646	
39	13.67	21265	V		0.1994	
	TOTAL	10666571			100	

Comments:

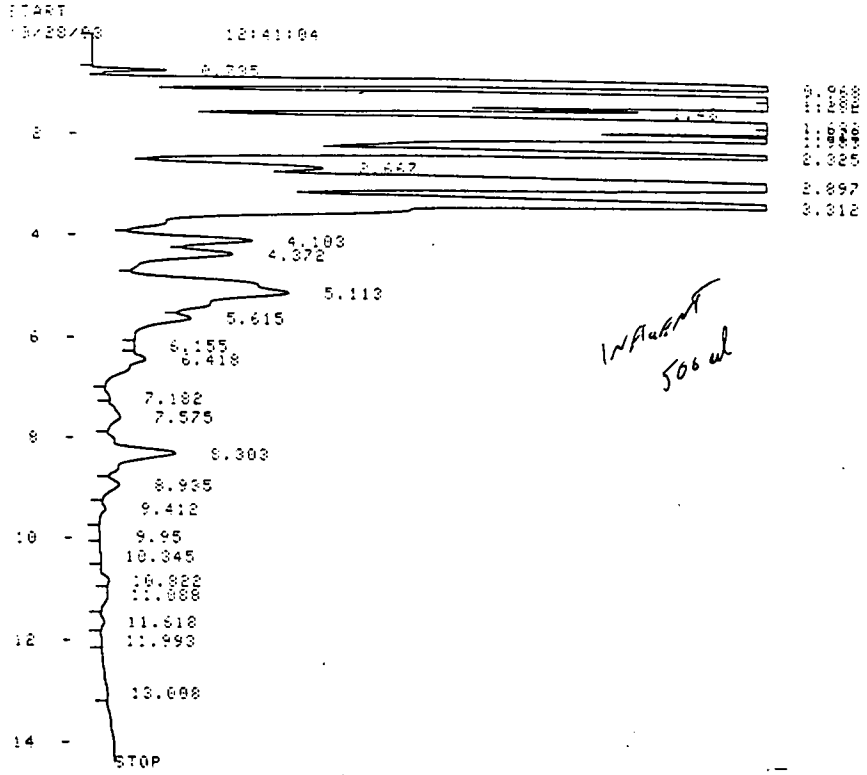
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 28 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: INFLUENT Volume Injected: 500 ml Std. Vol. Inj.:

Comments:



CHROMATOGRAM 16 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 16

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.735	26844			0.1776	
2	0.968	1127141	V		7.4561	
3	1.182	2730981	V		18.0656	
4	1.282	1987497	V		13.1474	
5	1.43	249830	V		1.6526	
6	1.698	1866303	V		12.3457	
7	1.828	971645	V		6.4275	
8	1.983	990839	V		6.5544	
9	2.325	734652	V		4.8598	
10	2.667	222453	V		1.4715	
11	2.897	1221582	V		8.0808	
12	3.312	1302356	V		8.6151	
13	4.103	185327	V		1.2259	
14	4.372	212342	V		1.4046	
15	5.113	575753	V		3.8086	
16	5.615	186404	V		1.2331	
17	6.155	43299	V		0.2864	
18	6.418	116968	V		0.7737	
19	7.182	18363	V		0.1215	
20	7.575	60133	V		0.3978	
21	8.303	159958	V		1.0581	
22	8.935	35978	V		0.238	
23	9.412	9397	V		0.0622	
24	9.95	2240			0.0148	
25	10.345	4662	V		0.0308	
26	10.822	12397	V		0.082	
27	11.088	14362	V		0.095	
28	11.618	4049	V		0.0268	
29	11.993	1389			0.0092	
30	13.008	9158			0.0606	
31	14.512	32764	V		0.2167	
	TOTAL	15117044			100	

END

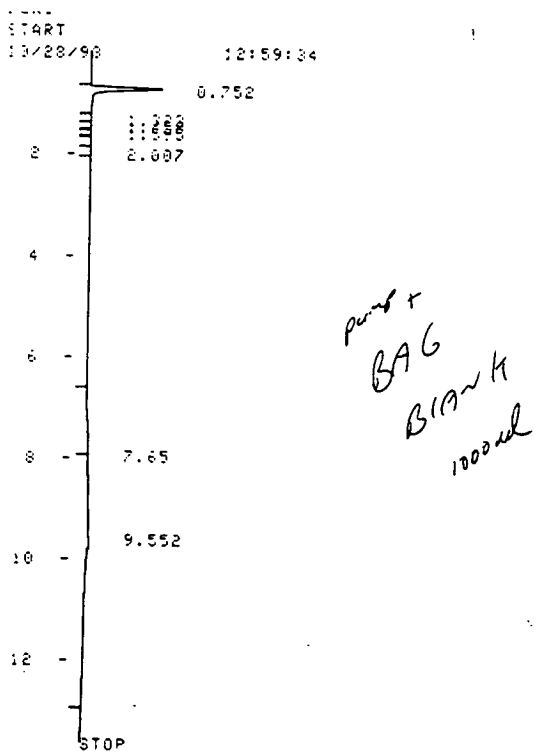
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 28 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: Blank Volume Injected: 1000 ml Std. Vol. Inj.:

Comments:



purge + BAG BLANK 1000 ml

CHROMATOGRAM 17 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 17

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.752	32131	S		27.9563	
2	7.65	14676			12.7695	
3	9.552	68126	V		59.2742	
	TOTAL	114933			100	

STOP.TM(0)=14
ZERO

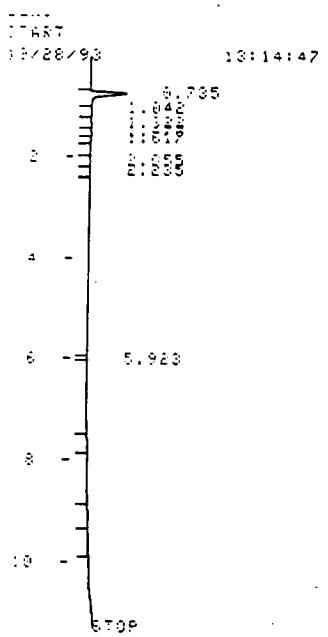
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 28 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: Directors office Volume Injected: 1000 ml Std. Vol. Inj.:

Comments:



Directors office 1000ml

CHROMATOGRAM 18 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 18.

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.735	16461			90.0734	
2	1.042	595	V		3.2566	
3	1.326	675	V		3.6941	
4	1.473	544	V		2.9759	
	TOTAL	18275			100	

ATTEN(0)=3

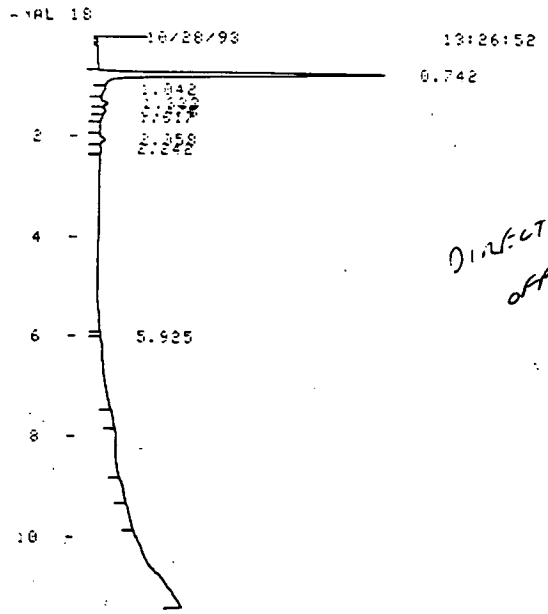
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 28 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: DIRECTORS OFFICE Volume Injected: Std. Vol. Inj.:

Comments:



DIRECTORS OFFICE RECALCULATE

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 6 METHOD 561
REPORT NO 19

PKNO	TIME	AREA	TYPE	IDNO	CONC	NAME
4	1.475	544	V		2.9759	
	TOTAL	18275			100	

ATTEN(0)=6

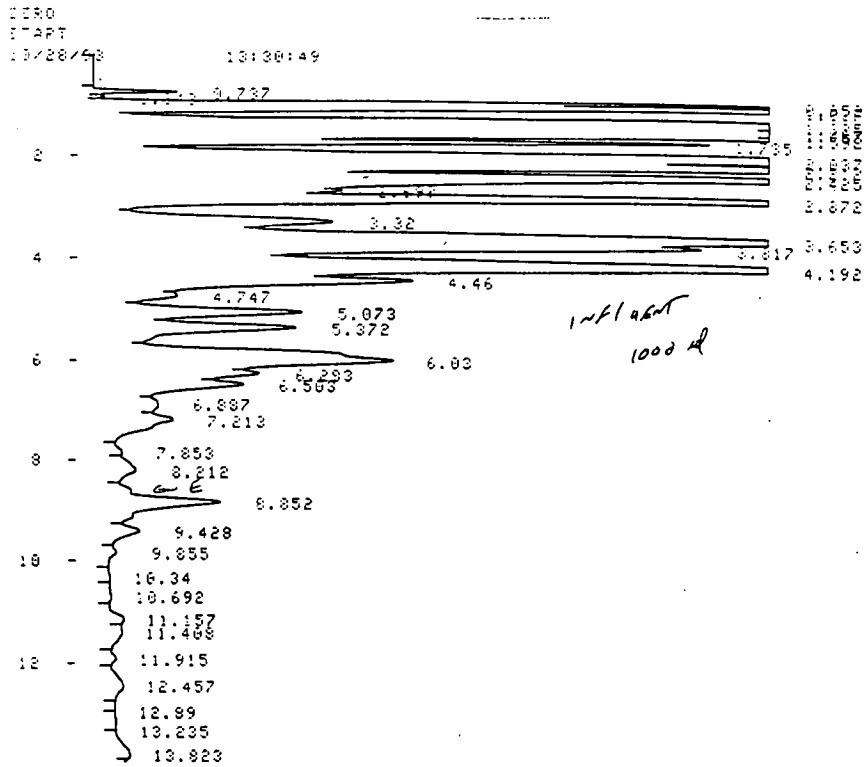
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 28 OCTOBER 1993 Project Manager: Battle Site: NAS Brunswick, ME

Geologist: Sample: INFLUENT Volume Injected: 1000 ml Chemist: Dobson Std. Vol. Inj.:

Comments:



CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 20

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.737	27667			0.1443	
2	0.843	3194	V		0.017	
3	0.952	235347	V		1.255	
4	1.937	1185631	V		6.3224	
5	1.325	3480683	V		18.5609	
6	1.467	1907412	V		10.1714	
7	1.592	574122	V		3.0615	
8	1.735	312820	V		1.6681	
9	2.037	2347542	V		12.5184	
10	2.212	1177177	V		6.2774	
11	2.425	1094944	V		5.8388	
12	2.698	112163	V		0.5981	
13	2.872	897984	V		4.7885	
14	3.32	285968	V	B	1.5249	
15	3.653	972646	V		5.1867	
16	3.817	507183	V		2.7046	
17	4.192	1111834	V		5.9289	
18	4.46	360197	V		1.9208	
19	4.747	77687	V		0.4143	
20	5.073	223275	V	M	1.1906	
21	5.372	265590	V		1.4163	
22	6.03	573771	V	T	3.0597	
23	6.283	159040	V		0.8481	
24	6.503	193240	V		1.0305	
25	6.887	95131	V		0.5073	
26	7.213	140447	V		0.7489	
27	7.853	22715	V		0.1211	
28	8.212	69759	V		0.372	
29	8.852	203477	V	K	1.0851	
30	9.428	46671	V	O	0.2489	
31	9.855	9896	V		0.0528	
32	10.34	2279			0.0122	
33	10.692	4009	V		0.0214	
34	11.157	17629			0.094	
35	11.408	22121	V		0.118	
36	11.915	4746	V		0.0253	
37	12.457	21358			0.1139	
38	13.235	973			0.0052	
39	13.823	5048			0.0269	
TOTAL		18752754			100	

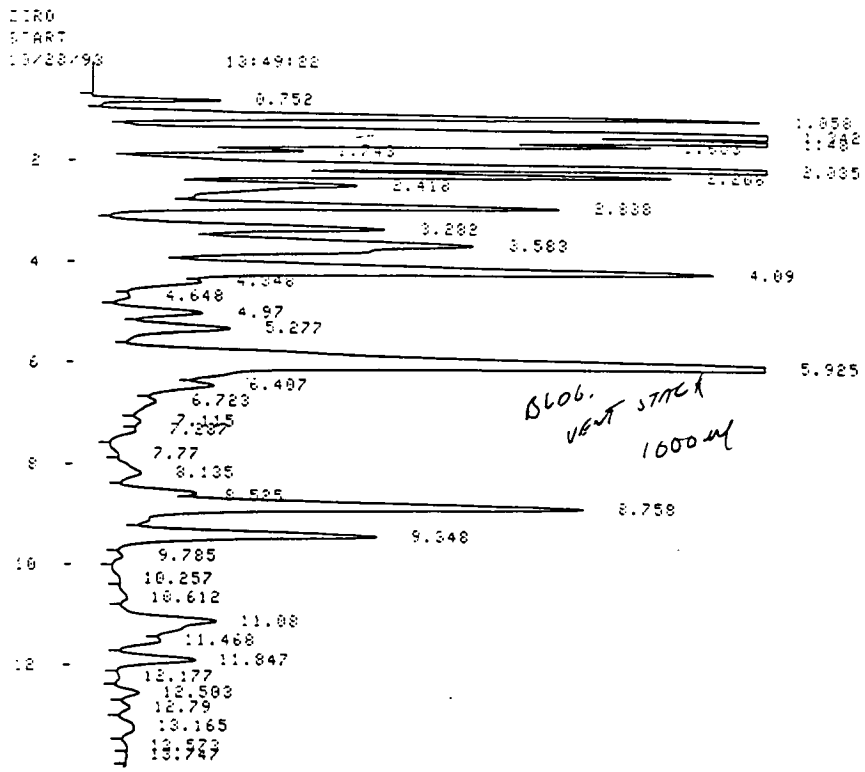
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 28 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: BLDG VENT STACK Volume Injected: 1000 ml Std. Vol. Inj.:

Comments:



CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 21

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.752	54137			0.5828	
2	1.058	446343	V		4.8051	
3	1.342	957142	V		10.304	
4	1.48	504284	V		5.428	
5	1.683	293438	V		3.159	
6	1.743	113330	V		1.22	
7	2.035	762259	V		8.2071	
8	2.208	383167	V		4.1249	
9	2.418	356431	V		3.7725	
10	2.838	366946	V		3.9503	
11	3.282	283847	V	10	3.0557	
12	3.583	627619	V		6.7566	
13	4.09	731897	V		7.8792	
14	4.348	102387	V		1.1022	
15	4.648	30838	V		0.332	
16	4.97	110613	V		1.1908	
17	5.277	167837	V		1.8068	
18	5.925	1227691	V	T	13.2166	
19	6.407	145286	V		1.5632	
20	6.723	89536	V		0.9639	
21	7.115	40004	V		0.4307	
22	7.287	32792	V		0.353	
23	7.77	14897	V		0.1604	
24	8.135	64308	V		0.6923	
25	8.525	80519	V	F	0.8668	
26	8.758	574423	V	R } TOTAL	6.1839	
27	9.348	290722	V	O }	3.1297	
28	9.785	12734	V		0.1371	
29	10.257	13276	V		0.1429	
30	10.612	27202	V		0.2928	
31	11.08	192075	V		2.0678	
32	11.468	49425	V		0.5321	
33	11.847	80246	V		0.8639	
34	12.177	4958	V		0.0534	
35	12.503	21601			0.2325	
36	12.79	12470	V		0.1342	
37	13.165	21174	V		0.228	
38	13.573	4743			0.0511	
39	13.747	2487	V		0.0268	
	TOTA:	9299016			100	

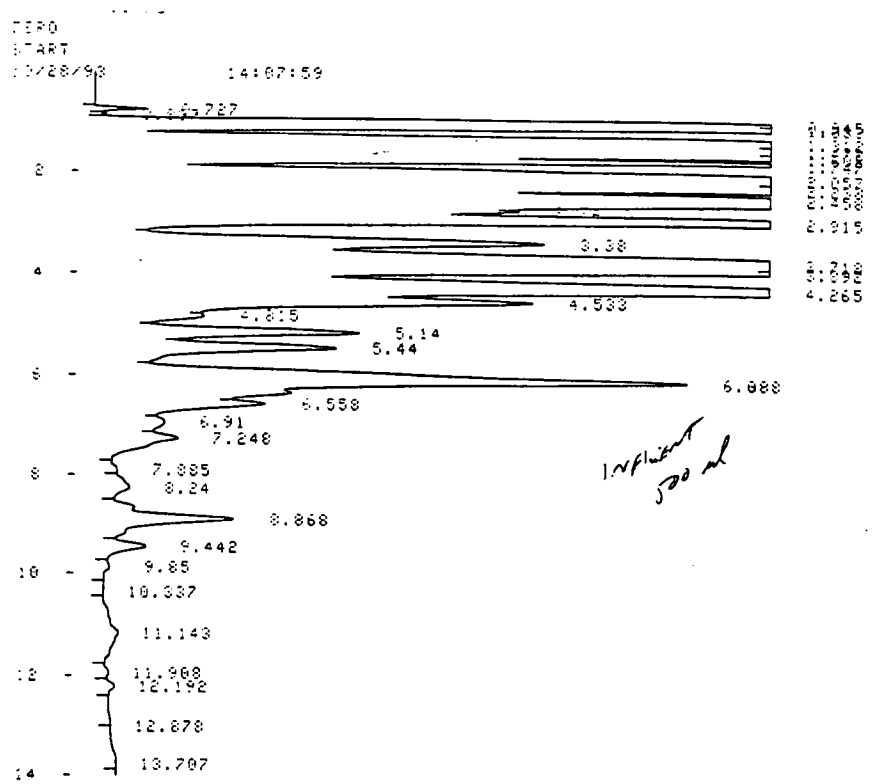
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 28 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: INFLUENT Volume Injected: 500 µl Std. Vol. Inj.:

Comments:



CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 22

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.727	16945			0.0567	
2	0.837	3416	V		0.0114	
3	0.945	377936	V		1.2638	
4	1.033	1962759	V		6.5633	
5	1.312	5652916	VE		18.9025	
6	1.472	3448900	V		11.5328	
7	1.602	1249632	V		4.1787	
8	1.747	527170	V		1.7628	
9	2.057	3949998	V		13.2084	
10	2.238	2011929	V		6.7277	
11	2.458	1934457	V		6.4686	
12	2.74	207990	V		0.6955	
13	2.915	1395714	V		4.6671	
14	3.38	537666	V B		1.7979	
15	3.718	1357399	V		4.539	
16	3.892	661899	V		2.2133	
17	4.265	1411817	V		4.721	
18	4.533	515928	V		1.7252	
19	4.815	101849	V		0.3406	
20	5.14	281152	V		0.9401	
21	5.44	321207	V		1.0741	
22	6.088	1088349	V T		3.6393	
23	6.558	213341	V		0.7134	
24	6.91	107636	V		0.3599	
25	7.248	142026	V		0.4749	
26	7.885	21574	V		0.0721	
27	8.24	61469	V		0.2055	
28	8.868	213953	V		0.7154	
29	9.442	53457	V X		0.1788	
30	9.85	8196	V		0.0274	
31	10.337	1456			0.0049	
32	11.143	49404	V		0.1652	
33	11.908	4030			0.0135	
34	12.192	7847	V		0.0262	
35	12.878	2195	V		0.0073	
36	13.707	1634			0.0055	
	TOTAL	29905120			100	

ZERO

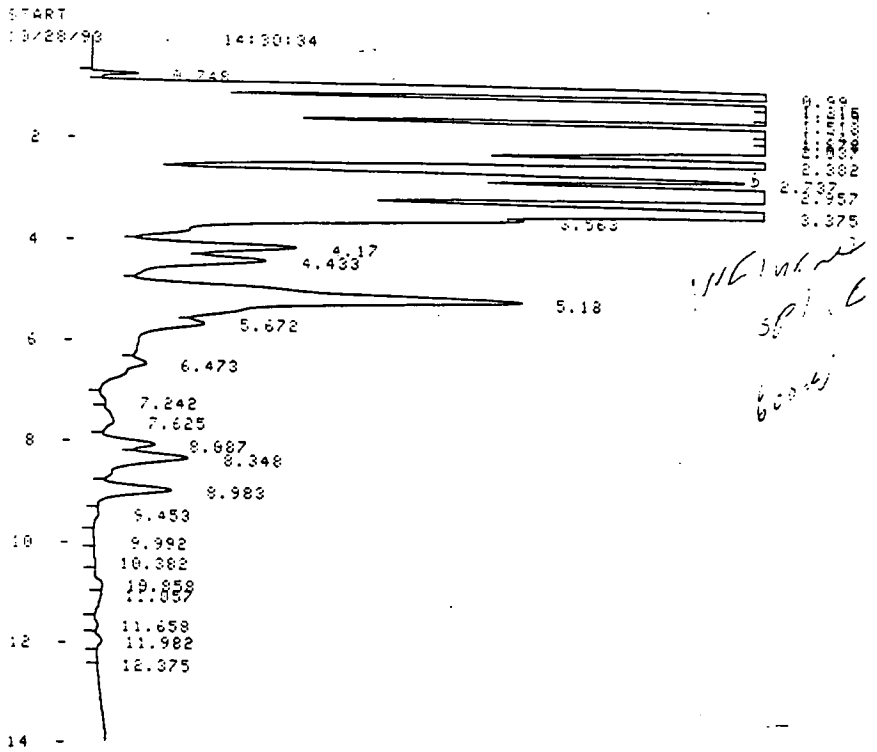
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 18197.01 Date: 28 OCTOBER 1993 Project Manager: Battle Site: NAS Brunswick, ME

Geologist: Sample: Influent + Spike Volume Injected: Chemist: Dobson Std. Vol. Inj.:

Comments:



CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 23

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.748	19931			0.0768	
2	0.99	1983814	V		7.6452	
3	1.215	5185788	VE		19.9849	
4	1.315	3925332	V		15.1274	
5	1.518	443223	V		1.7081	
6	1.743	3364876	V		12.9675	
7	1.878	1670289	V		6.4369	
8	2.037	1833781	V		7.067	
9	2.382	1202080	V		4.6326	
10	2.737	588727	V		2.2688	
11	2.957	1733995	V		6.6824	
12	3.375	1276869	V		4.9208	
13	3.563	471718	V		1.8179	
14	4.17	242970	V		0.9364	
15	4.433	264015	V		1.0175	
16	5.18	919602	V		3.5439	
17	5.672	273057	V		1.0535	
18	6.473	117352	V		0.4523	
19	7.242	16945	V		0.0653	
20	7.625	50215	V		0.1935	
21	8.087	73549	V		0.2834	
22	8.348	149139	V		0.5748	
23	8.983	96261	V		0.371	
24	9.453	7044	V		0.0271	
25	9.992	1602			0.0062	
26	10.382	3099	V		0.0119	
27	10.858	12035	V		0.0464	
28	11.057	10986	V		0.0423	
29	11.658	3270			0.0126	
30	11.982	6669	V		0.0257	
	TOTAL	25948514			100	

SAVE PRINT

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

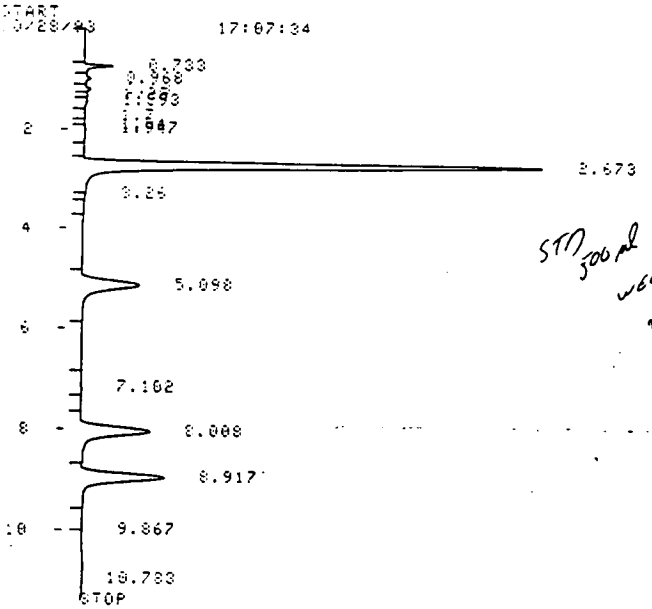
Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 28 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: STD Volume Injected: 500 ml Std. Vol. Inj.:

Comments:

...SYNTAX
...AL DATE$
ERROR 4:TYPE MISMATCH
P.SAVE 1,10
ZERO
START
10/28/93 17:07:34



STD 500 ml
WEAK
will SHOOT
NEW ONE

CHROMATOGRAM 1 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 24

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.733	8916			1.4385	
2	0.968	2908	V		0.4692	
3	1.18	2459	V		0.3967	
4	1.28	1305	V		0.2106	
5	1.293	1676	V		0.2704	
6	1.7	571	V		0.0922	
7	1.84	576	V		0.0929	
8	1.947	1565	V		0.2525	
9	2.673	325304	S		52.4836	
10	5.098	71451			11.5278	
11	7.102	668			0.1078	
12	8.008	82695			13.3417	
13	8.917	95498	V		15.4073	
14	9.867	4768	V		0.7693	
15	10.783	19459	V		3.1394	
	TOTAL	619821			100	

ZERO

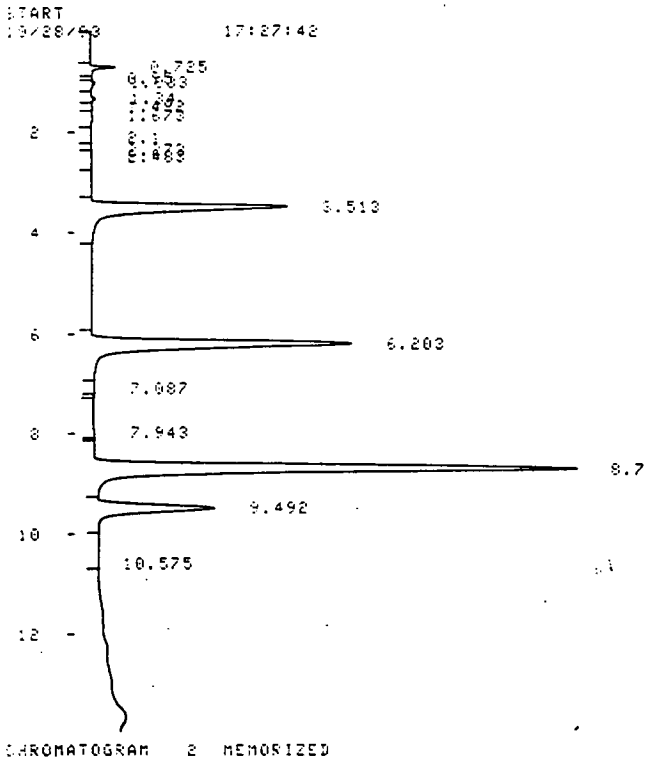
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 28 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: STANDARD Volume Injected: 500ml Std. Vol. Inj.:

Comments:



CHROMATOGRAM 2 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 25

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.725	7789	S		0.7618	
2	1.033	1872	V		0.183	
3	1.34	1904	V		0.1862	
4	1.492	1047	V		0.1024	
5	1.673	1742	V		0.1704	
6	2.483	1215	V		0.1188	
7	3.513	172226			16.8434	
8	6.203	261690	S		25.5928	
9	8.7	459705			44.9582	
10	9.492	112379	V		10.9904	
11	10.575	946	V		0.0925	
	TOTAL	1022516			100	

ZERO

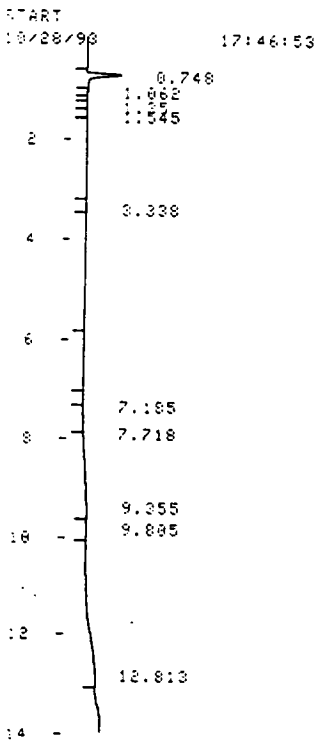
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 28 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: Blank Volume Injected: 100 ml Std. Vol. Inj.:

Comments:



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CHROMATOGRAM 3 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 26

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.748	16191	S		55.0125	
2	7.718	992	V		3.3711	
3	9.355	11054	V		37.5566	
4	9.805	1195	V		4.0598	
TOTAL		29432			100	

SVCA FIELD DATA SHEET

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Project Number: 12197.14

Gas Chromatograph: [illegible]

Project Manager: [illegible]

Station Number:

Anaylsts: S. [illegible] Robson

Date: [illegible]

Sit Location: NAS BRUNSWICK ME SPACE TEST

SAMPLE LOCATION	TIME	DEPTH (ft.)	PURGE TIME (min.)	VACUUM (IN Hg)	VACUUM RELEASE (min.)	VOLUME INJECTION (ul) FID	ECD	SAMPLER NUMBER	COMMENTS
STD	0629					5000			
BLANK	0640					1000			
COMMANDER OFFICE	0726					1000			
DIRECTOR'S OFFICE	0744					1000			
BUILDING STACK	0800					1000			
STACK REANALYSIS						1104			
STD	1140					1140			

SVCA SAMPLE CALCULATIONS

Site: Brunswick NAS Analyst: Scott Gibson

Project No.: 12197.14 Analysis Date: 30 OCT 95

Sample ID	Inj. Vol.	Time	Benzene ppm	Toluene ppm	Ethyl Benzene ppm	Xylene ppm	[illegible]	Total Hydrocarbons as Toluene
~~Comment of~~								~~9.92~~
BLANK	1000	0640	<0.1	<0.1	<0.1	<0.1		9.92
[illegible] office	1000	0726	<0.1	<0.1	<0.1	<0.1		9.94
[illegible] office	1000	0744	<0.1	<0.1	<0.1	<0.1		1.62
STACK	0600	08[illegible]	14.9	85	5.9	38.6	155	882

TECHNOLOGY, INC.

SVCA INSTRUMENT CALIBRATION RECORD

Site: Brunswick NAS
Project No.: 12157.14 Analysis Date: 30 Oct 93
Calculated by: SHA Checked by:

	Benzene 16.7 ppm		Toluene 20.0 ppm		Ethylbenzene 15.3 ppm		O-xylene 11.0 ppm								Inject volume (uL)	Temp (c)
	RT	RF	RT	RF	RT	RF	RT	RF	RT	RF	RT	RF	RT	RF		
629	3.663	0.049	6.332	0.054	8.788	0.084	9.58	0.138							500	
	3.018	0.062	5.695	0.083	8.392	0.173	9.253	0.273								
		0.056		0.069		0.128		0.206								

RF = (std conc.) (std inj vol) / (peak area)

sample conc. = (peak area) (RF) / (samp inj vol)

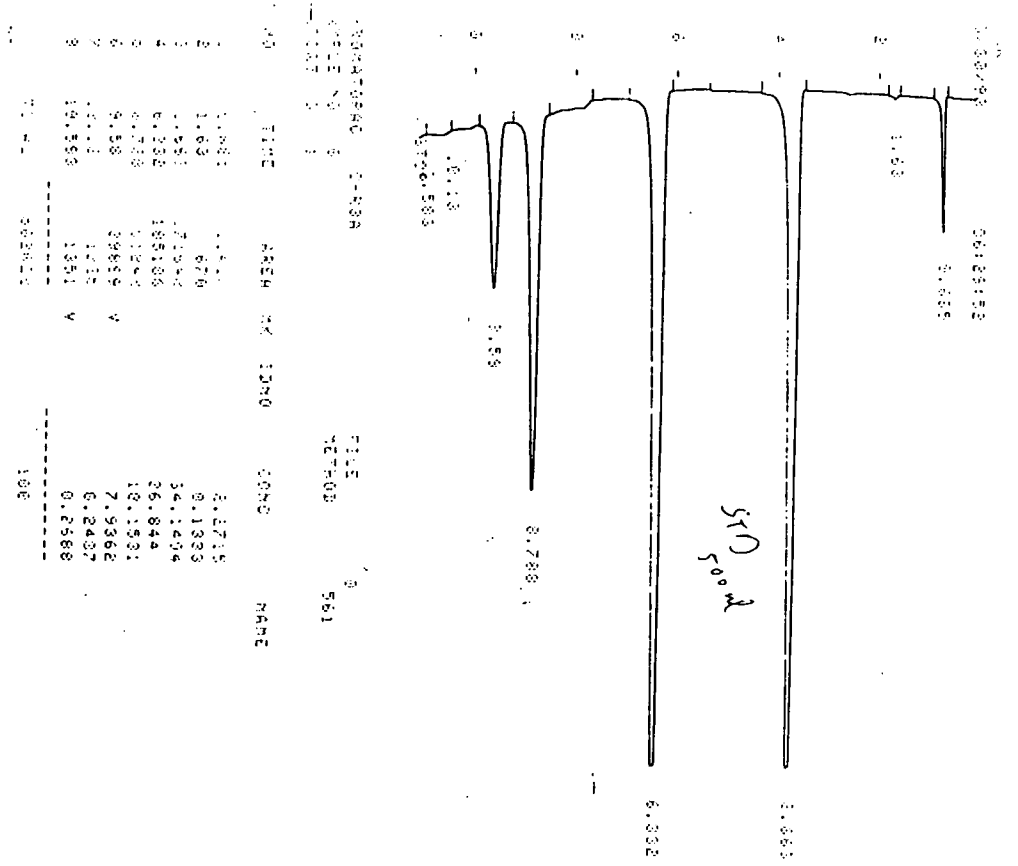
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 30 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS BRUNSWICK, ME

Geologist: Sample: STD Volume Injected: 500 Std. Vol. Inj.:

Comments:

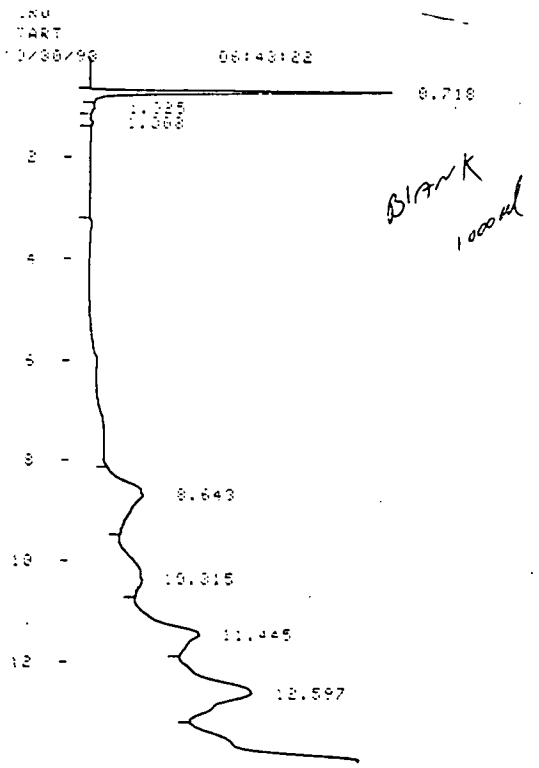


EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 30 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: Blank Volume Injected: 1000 ml Std. Vol. Inj.:



CHROMATOPAC C-R3A FILE 0
SAMPLE NO 3 METHOD 561
REPORT NO 2

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.718	[illegible]			16.1809	
2	1.025	764	V		0.4454	
3	8.643	27150			15.8478	
4	10.315	11103			6.4709	
5	11.445	[illegible]			20.3654	
6	12.597	69810	V		40.6866	
	TOTAL	171579			100	

PKO

Comments:

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 30 OCTOBER 1993 Project Manager: Bottle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: Coordinators OFFICE Volume Injected: 1000 ml Std. Vol. Inj.:

Comments:

COORDINATOR'S OFFICE 1000 ml

CHROMATOPAC C-R3A FILE 0
SAMPLE NO. 0 METHOD 561
REPORT NO 3

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.718	13666			19.2201	
2	12.13	22182			31.3497	
3	13.562	14475	V		49.4381	
	TOTAL	70757			100	

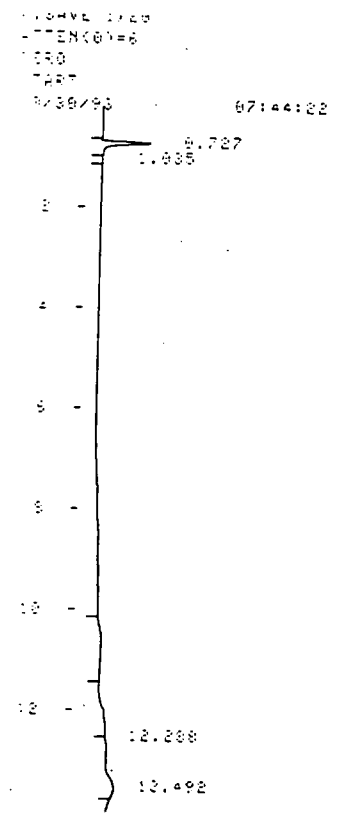
*.SAVE 120
ERROR 1:INVALID SYNTAX

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 30 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: DIRECTORS OFFICE Volume Injected: 1000 ml Std. Vol. Inj.:



DIRECTORS office 1000ml

CHROMATOGRAM 1 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 4

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.727	10176			43.9691	
2	12.288	9919			23.4606	
3	12.492	13657	V		32.6303	
	TOTAL	41054			100	

ATTEN(0)=4

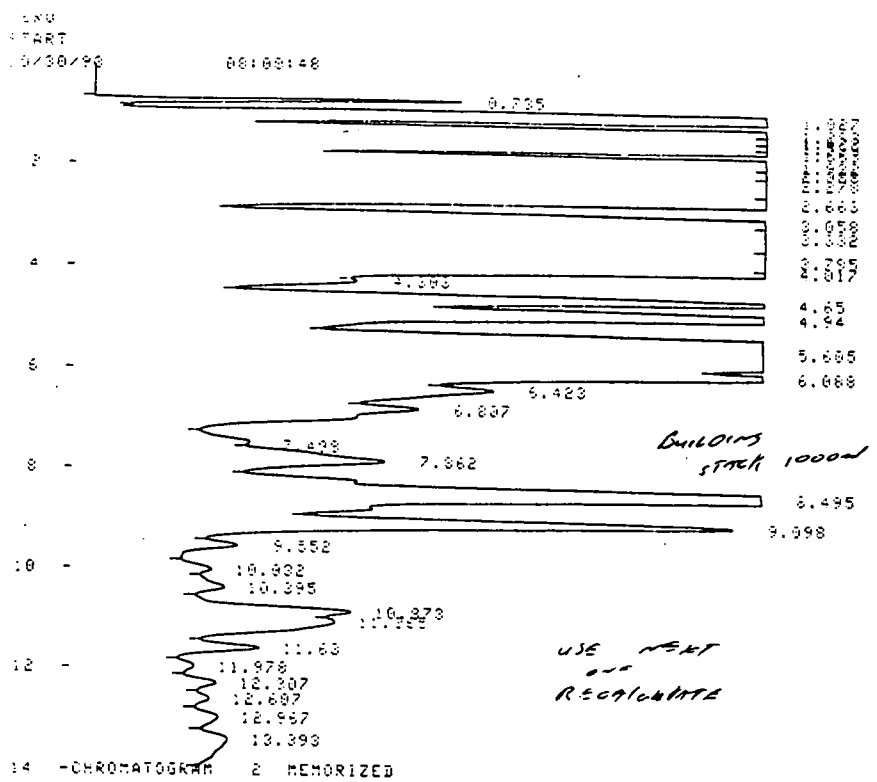
Comments:

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 30 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: BLDG STACK Volume Injected: 1000ml Std. Vol. Inj.:



CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 5

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.735	33599			0.262	
2	1.027	535340	V		4.1747	
3	1.293	1254731	V		9.7848	
4	1.422	800731	V		6.2443	
5	1.533	409967	V		3.197	
6	1.663	178567	V		1.3925	
7	1.932	1325295	V		10.0231	
8	2.088	631744	V		4.9265	
9	2.678	670847	V		5.2268	
10	2.663	636133	V		4.9607	
11	3.056	265401	V		2.0703	
12	3.332	1184703	V		9.2387	
13	3.795	1281032	V		9.9899	
14	4.017	202668	V		1.5805	
15	4.503	58501	V		0.4562	
16	4.65	198749	V		1.5499	
17	4.94	314157	V		2.4499	
18	5.685	1236135	V		9.6397	
19	6.088	252972	V		1.9727	
20	6.423	161049	V		1.2559	
21	6.887	148381	V		1.1181	
22	7.498	37062	V		0.289	
23	7.862	123050	V		0.9594	
24	8.495	460630	V		3.5921	
25	9.098	197414	V		1.4615	
26	9.552	24903	V		0.1942	
27	10.032	16021	V		0.1249	
28	10.395	24861	V		0.1939	
29	10.873	61668	V		0.4804	
30	11.065	77637	V		0.6054	
31	11.63	21480	V		0.1675	
32	11.978	3809			0.0297	
33	12.307	9514	V		0.0742	
34	12.607	7522	V		0.0587	
35	12.967	11681	V		0.0911	
36	13.393	20963	V		0.1636	
	TOTAL	12823320			100	

-TEN(0)=6

Comments:

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

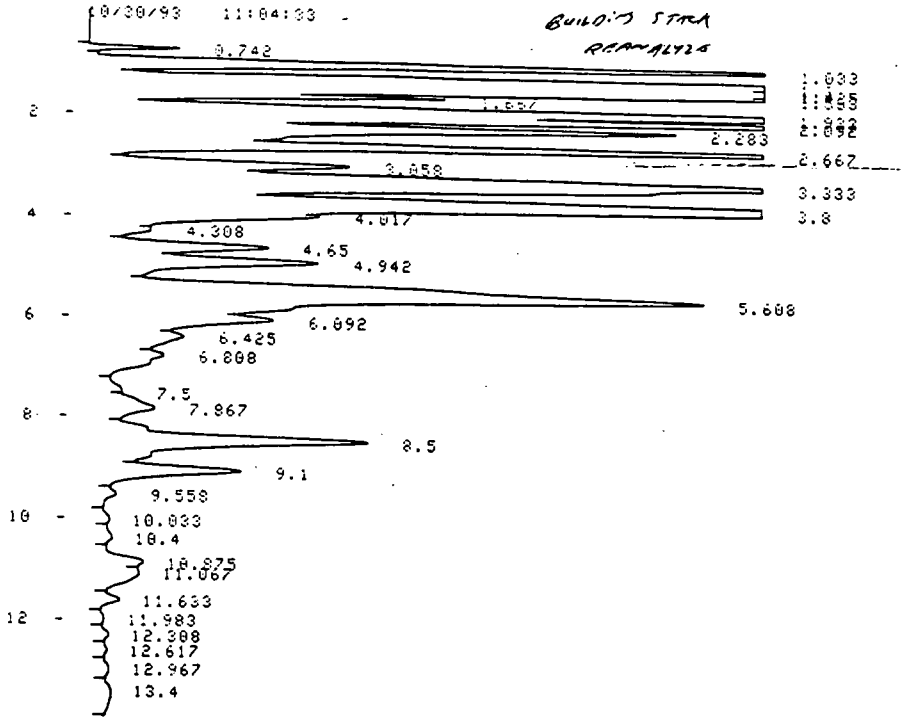
Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 30 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS BRUNSWICK, ME

Geologist: Sample: BUILDING STACK Volume Injected: 100 gal Std. Vol. Inj.:

Comments:

ANAL DATE$2
ERROR# 1:INVALID SYNTAX
ANAL 2



CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 6

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.742	33599			0.2621	
2	1.033	535340	V		4.1754	
3	1.3	1254731	V		9.7862	
4	1.425	800731	V		6.2453	
5	1.533	409967	V		3.1975	
6	1.667	178567	V		1.3927	
7	1.933	1285295	V		10.0246	
8	2.092	631744	V		4.9273	
9	2.283	670247	V		5.2276	
10	2.667	636133	V		4.9615	
11	3.058	265481	V	B	2.0706	
12	3.333	1184703	V		9.24	
13	3.8	1281032	V		9.9913	
14	4.017	202668	V		1.5807	
15	4.308	58501	V		0.4563	
16	4.65	198749	V		1.5501	
17	4.942	314157	V		2.4503	
18	5.608	1236135	V	T	9.6412	
19	6.092	252972	V		1.973	
20	6.425	161049	V		1.2561	
21	6.808	143381	V		1.1183	
22	7.5	37062	V		0.2891	
23	7.867	123030	V		0.9596	
24	8.5	460630	V	EMH	3.5927	
25	9.1	187414	V	KOX	1.4617	
26	9.558	24903	V		0.1942	
27	10.033	16021	V		0.125	
28	10.4	24861	V		0.1939	
29	10.875	61606	V		0.4805	
30	11.067	77637	V		0.6055	
31	11.633	21480	V		0.1675	
32	11.983	3769			0.0294	
33	12.308	9377	V		0.0731	
34	12.617	7302	V		0.057	
35	12.967	11258	V		0.0878	
36	13.4	19896	V		0.1552	
	TOTAL	12821415			100	

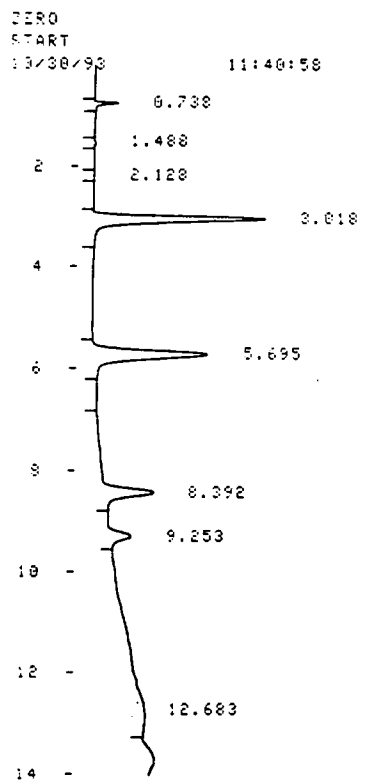
P.SAVE 1,20

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Soil Vapor Contaminant Assessment
Chromatogram Report Sheet

Project Number: 12197.01 Date: 30 OCTOBER 1993 Project Manager: Battle Chemist: Dobson Site: NAS Brunswick, ME

Geologist: Sample: STANDARD Volume Injected: 500 µl Std. Vol. Inj.:



STD
500

CHROMATOGRAM 1 MEMORIZED

CHROMATOPAC C-R3A FILE 0
SAMPLE NO 0 METHOD 561
REPORT NO 7

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	0.738	6562			1.7591	
2	1.488	680			0.1824	
3	3.018	134644			36.0938	
4	5.695	120601			32.3293	
5	8.392	44183			11.844	
6	9.253	20160			5.4043	
7	12.683	46209			12.3871	
	TOTAL	373039			100	

Comments: