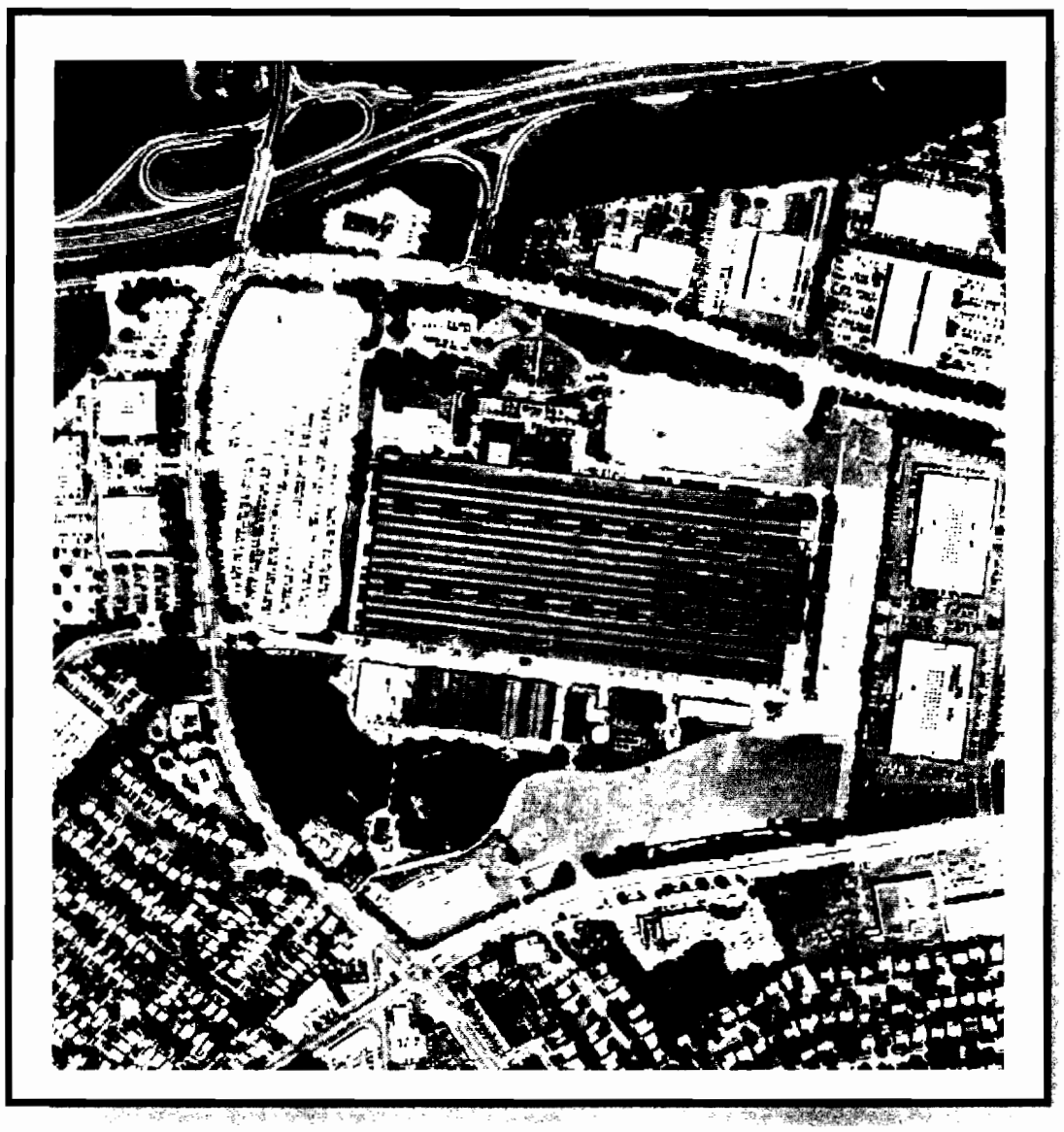
VOLUME I **FINAL REPORT**

Soil Vapor Extraction System Evaluation
Lockheed Martin Corporation
Great Neck, New York



LOCKHEED MARTIN

Tetra Tech
Environmental Engineers & Scientists
TC 1768-05/March 5, 1999

ARCADIS GERAGHTY & MILLER

Michael A. Hansen, P.E.
Senior Engineer

Frank C. Lenzo, P.E.
Associate

SVE System Evaluation Report and Pilot Study Workplan

Former Lockheed Martin Facility
Great Neck, New York

Prepared by:
ARCADIS Geraghty & Miller, Inc.
and GM Consulting Engineers, PC.

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A Soil Vapor Extraction System Evaluation Volumes I, II, III, Lockheed Martin Corporation Great Neck, New York, prepared by Tetra Tech, March 5, 1999.

1. Introduction

ARCADIS Geraghty & Miller, Inc. and its engineering subcontractor, GM Consulting Engineers, P.C. has prepared the following Soil Vapor Extraction (SVE) System Evaluation Report and Pilot Study Workplan for the existing SVE system located at the Former Lockheed Martin facility (site) located in Great Neck, New York. The SVE system was implemented at the site in 1994 in order to remove volatile organic compounds (VOCs) identified in the vadose zone in the former dry well area located to the southeast of the main site building. Removal of the VOCs was intended to remove a possible source of additional groundwater impacts at the site.

Review of the SVE system operating data since system start-up in 1994 indicates that the mass removal rates from the system are currently lower than expected and have declined significantly since operation began in 1994. Although more than 30,000 pounds of VOCs have been recovered by the system to date, an estimated additional 36,000 pounds of VOCs are still assumed to be present in the subsurface (see Attachment A). In addition, the concentrations of these VOCs in soils are in excess of the clean-up goals specified by the Record of Decision (ROD) for the site. Finally, in June of 1998, the three drywells along with approximately 800 tons of surrounding soil were removed by excavation to a depth of approximately 30 feet, thus eliminating another potential source of VOC mass.

Based on these factors it was determined that an evaluation of the SVE system design and performance was required. The goal of this evaluation was to determine if SVE system operation could be enhanced, optimized, and/or modified to provide more efficient and timely VOC recovery from the drywell source area.

This report is organized into four sections. Section 1.0 provides a brief introduction to the report. A discussion of the results of the SVE Evaluation performed by Tetra Tech (Attachment A) as well as a summary of the results and proposed strategy to enhance the SVE system performance is presented in Section 2.0 A workplan outlining a proposed pilot study is presented in Section 3.0. References are provided in Section 4.0.

2. SVE System Evaluation

2.1 Review and Summary of SVE Evaluation Report prepared by Tetra Tech

In early 1998, Lockheed Martin contracted Tetra Tech Inc. (Tetra Tech) of Pasadena, California, to perform an evaluation of the SVE system, as outlined in Section 1.0. An SVE Evaluation Workplan was initially submitted to the NYSDEC in March of 1998. Following workplan approval, Tetra Tech initiated the evaluation. The results of the SVE System Evaluation performed by Tetra Tech are included as Attachment A.

As outlined in Attachment A, and in the SVE Evaluation Workplan (Tetra Tech - 1998) the SVE system has been in operation in the former dry well area at the site since 1994. This system was implemented in order to remove the residual VOCs identified in the subsurface soils in the dry well area during various investigatory programs conducted at the site. SVE system operation in the period between January 1994 and the middle of 1998 has reportedly resulted in recovery of approximately 37,000 pounds of VOCs in the vapor phase. The SVE system, which is currently operating, is now recovering VOCs at a removal rate on the order of less than 50 pounds per month of total VOCs.

As part of the SVE system evaluation, detailed in Attachment A, Tetra Tech has estimated that approximately 36,000 pounds of VOCs likely remain in the area of interest. Therefore, given the fairly low extraction rate currently being achieved, timeframes for removal of a significant portion of the residual VOCs are extensive, estimated by Tetra Tech to be at least 28 years.

Additional relevant items from the evaluation performed by Tetra Tech include the following:

- Review of the lithologic sampling logs for the soil borings installed as part of the evaluation, as well as review of past soil boring data (H_2M - 1997) indicated that a zone of lower permeability soils are present in the subsurface in the dry well area. These lower permeability soils are described as silty sand/clayey sand, where as the balance of the unsaturated zone in the dry well area is made up of gravely sand and/or sandy gravel. The lower permeability soils are reported to extend from between 34 and 50 feet below land surface (bls) with the thickness of the layer varying between 4 and 7 feet. Additional details regarding these observations, including geologic cross-sections for the area of interest are provided in the SVE System Evaluation Report in Attachment A.

- Review of the Tetra Tech lithologic logs and other soil boring data also indicated that a localized zone of perched water is encountered in the dry well area at depths of between 35 and 40 feet bls. This perched water is apparently present in and above the layer of low permeability soils.

- Based on soil analytical data collected by Tetra Tech (Attachment A), it is assumed that 95% of the remaining VOC mass is present in the area where the fine-grained or low permeability soils are present.

2.2 Conclusions from SVE Evaluation Report - Tetra Tech

Following collection of the additional geologic and VOC analytical data, Tetra Tech constructed a numerical airflow and vapor transport model for the dry well area. These models were intended to simulate air flow and VOC migration in the subsurface under both the existing and possible proposed extraction scenarios. Based on this modeling, Tetra Tech estimated that by operating only the existing SVE system, 28 years of operation would be required to recover 90 % of the remaining VOCs and achieve clean-up goals.

2.3 ARCADIS Geraghty & Miller Evaluation and Proposed Modifications

The newly collected soil analytical data reported in Attachment A, combined with the past mass removal from the operating SVE system clearly illustrate the system is not performing as efficiently as needed for timely remediation of the residual VOCs. Given the fairly large mass of residual VOCs present in the subsurface, it would be expected that mass removal rates from the system would be much higher than they are currently.

Based on a review of the SVE Evaluation Report, as well as the other sources of information available, the most likely cause for the poor mass removal rates is that the SVE system is not generating airflow sufficient for timely remediation in the lower permeability soils. This is significant since these soils apparently contain the majority of the remaining VOCs, and that the most important factor is providing efficient mass removal using SVE technology is the generation of significant airflow across the soils impacted by the VOCs.

The absence of airflow in the low permeability soil is likely due to two related factors;

- The four existing SVE wells are all completed with long screened intervals (between 20 and 40 feet long) and these intervals generally cross both the lower and higher permeability portions of the vadose zone soils. Given the nature of subsurface airflow, it is expected that almost all of the airflow from the SVE wells will be generated from the potion of the screened interval completed in the higher permeability soils. Therefore, airflow is not being generated in the lower permeability sediments and the only mass removal from these zones (which contain the majority of the residual VOCs) is via diffusion from these areas. Diffusion provides a very poor mass removal efficiency compared to that of generating airflow directly across the impacted soils.

- The presence of the perched water in and above the lower permeability soil will completely block airflow in this zone. In this scenario all mass removal from the zone containing the perched water (the zone of low permeability soils containing the majority of the residual VOCs) will be via diffusion, which once again is very inefficient.

Based on this evaluation , ARCADIS Geraghty & Miller is proposing a modification to the SVE system. This proposed system modification will employ additional SVE wells, focused in the area of greatest levels of residual VOCs. These new wells will have small, discrete screened intervals corresponding to the zones of variable permeability. In addition, we propose to recover the perched water present in the low permeability unit. The combination of the perched water removal, along with the focused screened intervals of the new extraction wells - located in the areas of higher VOC impact - should provide for maximizing airflow across the most impacted soils, thus providing the most efficient VOC removal possible. It is assumed that the revised system will also employ individual vacuum blowers for each permeability horizon in which one or more SVE wells is completed. This will further limit the possibility for preferential air flow from only one zone.

The actual design and requirements for the proposed modified system will be determined following pilot testing (see Section 3.0). However, conceptually it is assumed that 2 to 3 new SVE wells will be completed with well screens located in the few feet above the low permeability zone, and an additional 2 to 3 wells will be completed with screens only within the low permeability zone. One of the existing system wells, VW-13, completed below the low permeability zone will also likely be included in the system. Assuming this well arrangement, three vacuum blowers will

be provided, one for each zone. The SVE wells located within the low permeability zone will also be used for recovery of the perched water, either via air-lift pumping or via down-hole pumps deployed within the wells. Given the relatively small extent of the perched water zone, it is expected the volume of water to be recovered will be relatively small. The recovered water will be contained in a storage tank and periodically transported to the IRM groundwater treatment system for treatment and disposal. It is assumed the existing off-gas treatment system will be used for the modified SVE system. However, alternate treatment for some or all of the off-gas may be proposed based on the pilot test results.

Based on this proposed approach and the anticipated modifications, ARCADIS Geraghty & Miller expects the upgraded SVE system to operate for a period of 6 to 18 months. System operation will be terminated based on achieving asymptotic recovery of soil vapors.

3. Pilot Study Workplan

As discussed above, implementation of a pilot study will be necessary to determine if the proposed modifications can be successfully applied, and to allow for confirmation of engineering design criteria for full-scale operation of the modified system. The goal of the proposed modifications is to maximize VOC mass removal in the short term to minimize the possible source of shallow groundwater impacts.

This workplan provides a description of the proposed pilot study location, layout, and methodology, including the proposed monitoring program, as well as data evaluation, and reporting plans. Specific objectives for the pilot study include the following:

- gathering data on the amount of perched water present in the dry well area, and the potential recovery rates;
- determining the required well construction and air flow characteristics (i.e., applied vacuum level and extraction airflow rate) necessary to insure reasonable mass removal rates;
- determining the VOC removal efficiency and the overall mass removal from the soil provided with various operating methodologies (i.e., air removal rates and pressures) - this data will also be used to determine possible modifications required for off-gas treatment;
- determination of process information necessary to size, select, and specify any new mechanical and electrical equipment needed for the modified system; and,

- determination of the geometry of the area of influence created by the SVE well operation - this data will be used to determine the total number of new wells required for the full-scale system (currently estimated at 4 to 6 - see Section 2.3).

3.1 Pilot Study Location

The pilot study will be performed in the area of Tetra Tech Soil Borings TT-4 and TT-5. This area was selected based on residual VOC concentrations detected in soil samples collected by Tetra Tech as part of their Evaluation (Attachment A) as well as the presence of a lower permeability silty sand/clayey sand unit from approximately 40 to 50 feet below land surface (bls) in this location. Based on the vertical soil delineation completed by Tetra Tech, the silty sand/clayey sand unit and the zone directly above it (saturated/perched groundwater) appear to contain the highest concentrations of residual VOCs.

3.2 Pilot Study Wells

Two new SVE wells will be installed for use during the pilot study. The new SVE wells will be installed adjacent to the locations of Tetra-Tech borings TT-4 and TT-5, respectively. Both wells will be constructed of 4-inch diameter PVC well materials with a stick-up casing. No well development will be required. One of the new wells will be completed to the top of the lower permeability unit, in the zone of perched water (total depth approximately 45 feet) with approximately 5 to 10 feet of well screen. The second new well will be completed to the bottom of the lower permeability unit (total depth approximately 50 feet) with approximately 5 feet of screen. The specific well completion details (total depth, screen interval, etc.) will be field determined based on the results of additional lithologic samples collected during installation of the well borings. Both wells will be equipped with a 5-foot long section of blank casing at their base to serve as a sump for collection of the perched water in and above the low permeability zone.

3.3 Pilot Study Methodology

It is anticipated the pilot study will be performed over a period of three to five days. Prior to initiating the test, the existing SVE wells and vapor monitoring points will be gauged to determine where perched and/or shallow groundwater is present. In addition, perched water and/or shallow groundwater samples may be collected, if present, and analyzed for VOCs. The purpose of these analyses to evaluate VOC concentrations in the perched water in the SVE area.

Following the pre-pilot activities, the two new SVE wells will be installed as outlined above. At the completion of well installation the method for removing the perched groundwater will be selected.

Prior to start-up of the SVE pilot testing, the perched water will begin to be recovered. Because the volume of perched groundwater to be extracted is expected to be limited, it will be stored in a temporary holding tank, and periodically transferred to the IRM groundwater treatment system for treatment and disposal. It is anticipated that perched water recovery will be performed for one to two days.

Once the perched groundwater has been removed from the test location, each new SVE well will be tested individually by connecting it to one of the existing blowers and/or a portable blower to apply vacuum for the pilot study. The portable blower will be capable of developing a vacuum of at least 15 inches of mercury, in order to be able to generate sufficient airflow in the lower permeability soils. Vacuum application to each well is anticipated to be between 8 and 24 hours at each location. During testing, a minimum of three different applied vacuum levels will be evaluated for each SVE test well and data will be collected during each of the corresponding flow regimes.

The pilot study equipment setup will include an air dilution valve on the suction side of the blower to control the vacuum to the SVE test well. The extracted soil vapor will be treated using a temporary vapor phase carbon vessel prior to discharge to the atmosphere. The soil vapor extraction line will be equipped with a sampling port for the collection of air samples and to measure vacuum applied to the SVE wells. Airflow measurements will be collected from the discharge stack using an anemometer. The anticipated SVE pilot study equipment setup is shown on Figure 3-1.

3.4 Pilot Study Performance Monitoring, Evaluation, and Reporting

During the testing at each well, the following system performance data will be collected;

- Vacuum and airflow rates from the extraction well;
- Perched water recovery rates;
- Induced vacuum levels at existing vapor monitoring points (for collection of spatial SVE system performance data);
- VOC concentrations in the extracted soil vapor; and

- VOC concentrations in the treated off-gas.

At each well, the maximum vacuum that can be developed by the blower will be applied initially. Samples of the extracted soil vapor will be collected for laboratory analysis of VOCs at the start-up of each test phase, midway through each test phase, and at the end of each test phase. During and between collection of laboratory samples additional vapor samples will be collected for field analysis with a photo-ionization detector (PID) along with field measurements of the remaining performance monitoring parameters. At the end of the test run, the vacuum applied at the well will then be stepped down, twice, with field measurements collected at each interval to evaluate the change in airflow and observed subsurface vacuum with changing applied vacuum levels. The attached Table 3-1 contains a summary of the proposed data to be collected and the frequency of collection for the pilot study.

After the field study has been completed, ARCADIS Geraghty & Miller will evaluate the results to determine the feasibility of possible system modifications for the SVE system. If it is determined that modifications sufficient to provide a reasonable increase in VOC recovery, specific design criteria for such system modifications will also be determined. A pilot study summary report, for NYSDEC review, will then be prepared. This report will include the baseline and performance monitoring results, along with a conceptual design of the full-scale system.

Following implementation of the modified system, a design report including system specifications and as-built plans will be provided.

3.5 Modified System Operation and Shut-down Criteria

Following modifications, the system will be restarted and resume continuous operation. It is assumed that operating data for the modified system will be collected and reported per the existing approved IRM workplan.

In accordance with the ROD, a request will be made to the NYSDEC to terminate operation of the SVE system when either soil concentrations meet the site specific soil clean-up objectives, or when the SVE system is no longer effective in removing VOC mass. Based on the anticipated response to the system modifications, it is anticipated that the period of additional operation will be between 6 and 18 months.

4. References

Tetra Tech, Inc. 1998. Final Workplan for Soil Vapor Extraction System Evaluation. Former Lockheed Martin Facility, 365 Lakeville Road, Great Neck, New York. March 1998.

H_2M Associate, Inc. 1997. Scope of Work for Soil Vapor Extraction System Evaluation. Lockheed Martin Tactical Defense Systems, 365 Lakeville Road, Great Neck, New York. July 1997.

Tables

Table 3-1. Summary of Data Collection for SVE Pilot Study,
Former Lockheed Martin Corporation Facility, Great Neck, New York.

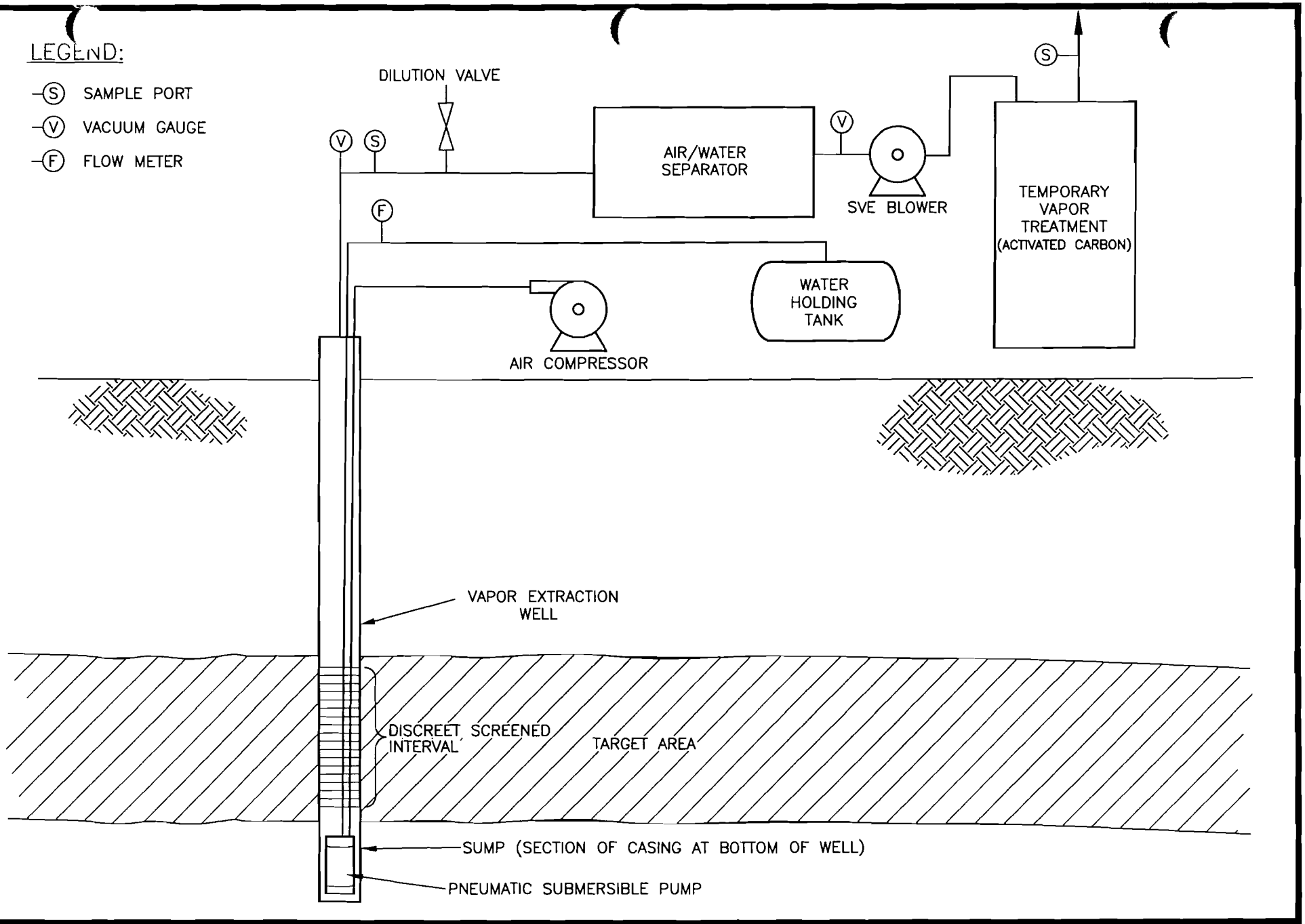
Phase	Data Collected	Frequency
Baseline (prior to test)	Depth to water measurements from existing SVE wells and monitoring points	One time
	Groundwater samples from existing SVE wells and observation points (analyzed for VOCs)	One time
During test (to be duplicated at each test well)	Vacuum and air extraction rates at extraction wellhead	Hourly during test
	Induced vacuum at observation points	Hourly during test
	Effluent soil vapor sample from extraction line (for laboratory analysis)	Three times during maximum vacuum development (start, middle, end of run)
	Effluent vapor sample from extraction line (to be field screened with PID/FID)	Hourly during test and between laboratory sampling
	Off-gas sample from vapor treatment (to be field screened with PID/FID)	Hourly during test

Notes:

PID Photo Ionization Detector

FID Flame Ionization Detector

Figures



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ARCADIS GERAGHTY & MILLER

DRAWN M. WASILEWSKI	DATE 2/23/99	PROJECT MANAGER F. LENZO	DEPARTMENT MANAGER D. SOUSA
		LEAD DESIGN PROF.	CHECKED J. HORST
SVE PILOT STUDY EQUIPMENT SETUP		PROJECT NUMBER	FIGURE NUMBER
FORMER LOCKHEED MARTIN FACILITY GREAT NECK, NEW YORK		NY01227.000A	3-1

Attachment A

Soil Vapor Extraction System Evaluation

Lockheed Martin Corporation
Soil Vapor Extraction System
Evaluation Report

Prepared for:
Lockheed Martin Corporation

Prepared by:
Tetra Tech, Inc.

Dan Batrack
Program Manager

Nisha Bansal
Project Manager

for:
Jia-Ling Wu, P.E. PhD
Project Engineer

Phil Skorge
Project Geologist

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Section 1

Introduction

On behalf of Lockheed Martin Corporation (Lockheed Martin), Tetra Tech, Inc. has prepared the following report evaluating the soil vapor extraction (SVE) system located at the Lockheed Martin Great Neck facility. The SVE system was installed to reduce concentrations of volatile organic compounds (VOCs) within a former dry well area located at the southeast corner of the facility. The Lockheed Martin facility (New York State Department of Environmental Conservation (NYSDEC) Site ID# 130045) is located at 365 Lakeville Road in Great Neck, New York.

The objective of this evaluation is to determine whether the existing system is capable of reducing volatile organic compound (VOC) concentrations as established in NYSDEC's Record of Decision (ROD), dated July 1997. Subsurface soil sampling was conducted to obtain current chemical data around the dry well area where the SVE system is operating. The data was used to estimate the current lateral and vertical extent of VOC impacted soil, and to determine the total current VOC mass in the subsurface. Air flow and VOC transport modeling was conducted to determine if the existing SVE system is capable of attaining the cleanup goals as presented in the ROD.

This report is organized into the following sections:

- Section 2 – Site History, presenting a brief description of site location, previous investigations, previous VOC mass estimates, and site geology;
- Section 3 – Data Collection for SVE Evaluation, presenting the rationale and results for collection of geotechnical, soil matrix, and soil vapor data;
- Section 4 – Current VOC Mass Estimation, presenting the VOC mass calculation and distribution of chemicals;
- Section 5 - Assessment of SVE System, presenting the results of the air flow and VOC mass transport models;
- Section 6 – References.

Section 2

Site History

Investigations conducted at the Lockheed Martin facility in 1990 detected VOCs in the subsurface soil near the dry well area (H2M, July 1997). Further assessment of the area detected VOCs from the near surface to groundwater. As required by NYSDEC in the ROD, a SVE system was installed to recover VOCs from the soil around the dry well area. The existing SVE system operated at the site from January 1994 through June 1998.

This section presents the site location and description, the previous investigations conducted at the dry well areas, previous VOC mass estimates, and site geology and hydrogeology.

2.1 SITE LOCATION AND DESCRIPTION

The Lockheed Martin facility consists of approximately 94 acres and is located at 365 Lakeville Road in Great Neck, New York - s*ee Figure 2-1*. The facility was constructed in 1941 and formerly consisted of manufacturing operations for the design and production of a wide range of defense related equipment, navigational systems, and radar tracking systems. The facility is currently undergoing decommissioning and closure.

Three dry wells were formerly located at the southeast corner of the main manufacturing building. Various chemicals, including chlorinated solvents and other organic compounds, were detected in the soils beneath the dry wells. Figure 2-2 shows the locations of the former dry wells at the facility.

FIGURE 2-1
SITE LOCATION MAP

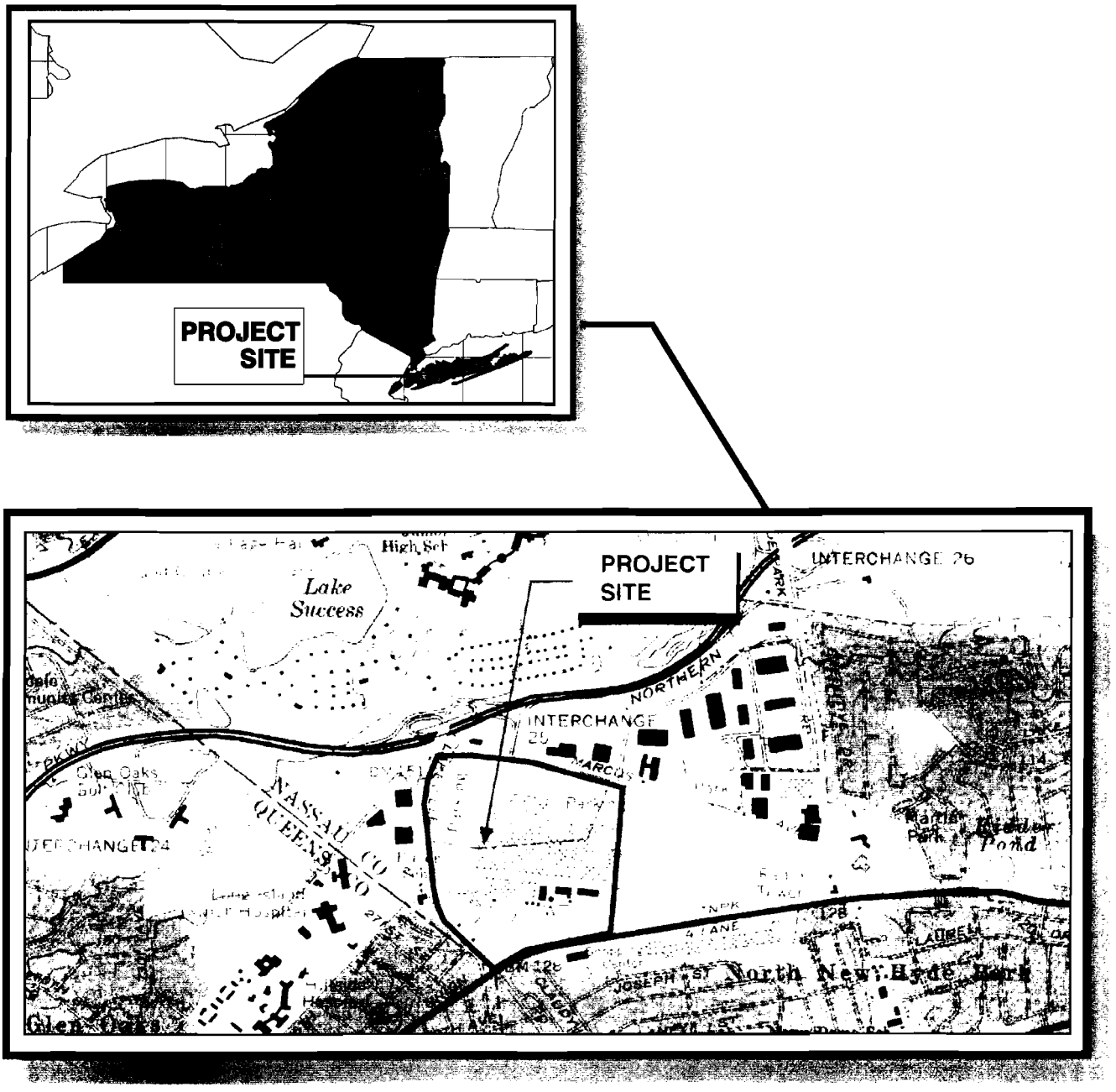
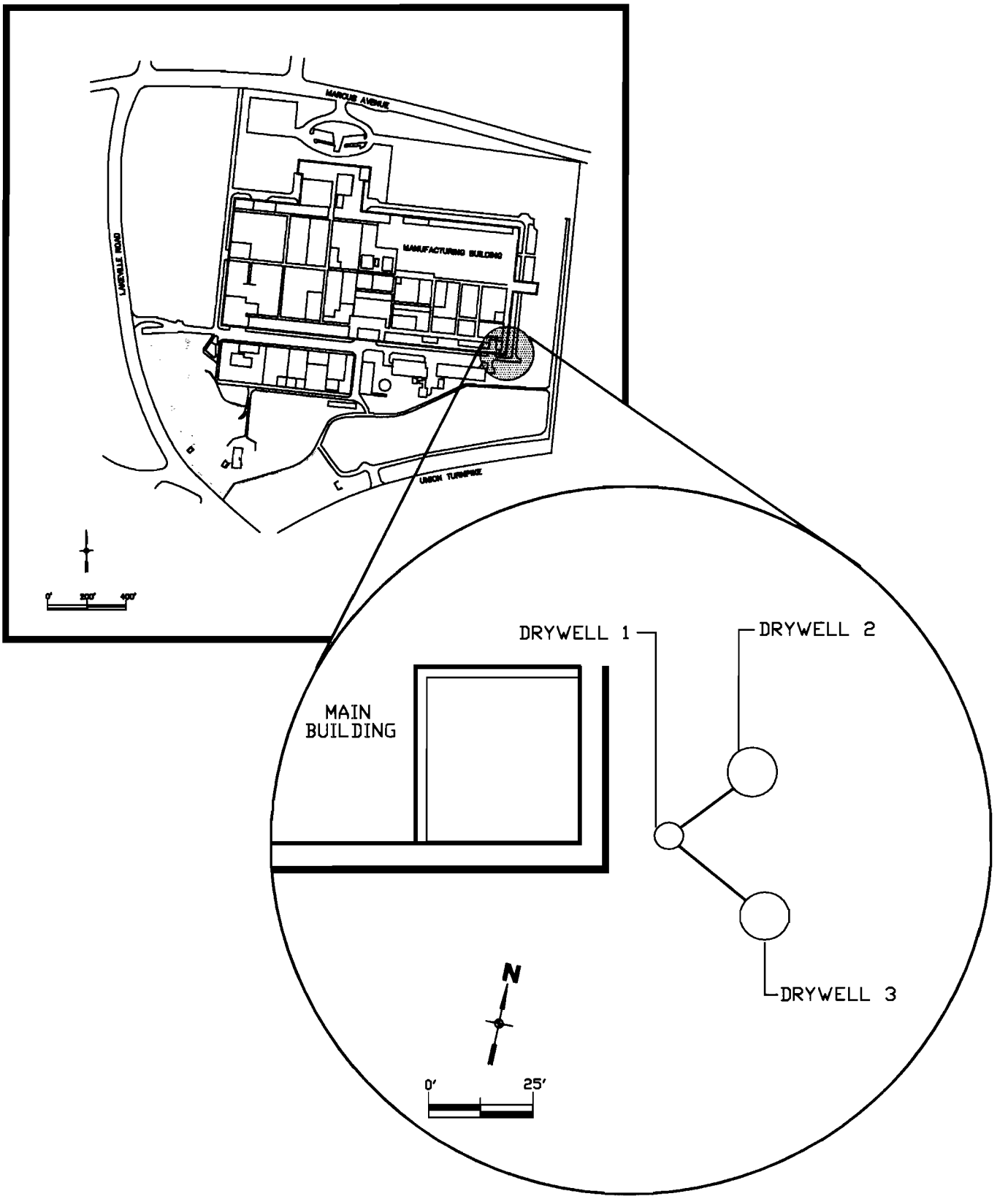


FIGURE 2-2
SITE OVERVIEW



2.2 PREVIOUS INVESTIGATIONS AT THE DRY WELL AREA

Previous subsurface investigations at the dry well area were conducted in 1988, 1990, 1993, 1996, and 1997 (H2M, July 1997). Data obtained from these previous investigations were used to delineate the extent and estimate the mass of VOCs in the subsurface soils in the dry well area. A summary of the investigations is presented below.

1988 Investigation

In 1988, a total of fourteen soil borings (B-1 through B-14) were drilled at the dry well area. Samples were collected at depths ranging from 5 to 32 feet below ground surface (bgs) and analyzed for VOCs and petroleum hydrocarbon compounds (PHC). No analytical data was available from borings B-2 through B-5. VOCs were not detected in samples collected from borings B-1 and B-6 through B-14. PHCs were detected at a maximum concentration of 41 parts per million (ppm) in boring B-10 (H2M, 1997).

1990 Investigation

In 1990 and 1991, eighteen soil borings (SVB1 through SVB18) were drilled to depths of 25 to 90 feet below ground surface (bgs) in the area of the southeast corner of the main building. Soil samples were collected at selected intervals to evaluate the vertical and horizontal extent of impacted soil. VOC impacted soil extended to the groundwater table, approximately 80 feet bgs. Total VOCs ranged from non-detectable concentrations to 2,200 ppm. The highest concentrations of VOCs were detected in soil samples collected in the vicinity immediately around the dry wells. The maximum concentrations of total VOCs were detected in boring SVB-17 at the 20 to 22 foot depth. The primary VOCs detected included tetrachloroethene (PCE), trichloroethene (TCE), toluene, ethylbenzene, xylenes, and 1,2-dichloroethene (H2M, July 1997).

Four of the borings were converted into vapor extraction wells (VW-1, VW-2, VW-13 and VW-14). Ten borings were converted into vapor monitoring wells (VW-3 through VW-12). Well construction details are presented in Section 5.2 of this report. Further discussion of the 1990 investigation is presented in the Scope of Work for Soil Vapor Extraction System Evaluation, (H2M, July 1997).

1993 Remedial Investigation

As part of a remedial investigation conducted in November 1993, five soil borings (B-15 through B-19) were conducted to a depth of 20 feet bgs near the southeast corner of the main building. The VOCs detected were PCE with a maximum concentration of 18,000 ppm, TCE (7,800 ppm), toluene (280 ppm), and xylenes (440 ppm). VOCs were detected at the highest concentrations in borings B-18 and B-19 at the 6 to 8 foot depth interval. Further discussion of the 1993 remedial investigation is presented in the Scope of Work for Soil Vapor Extraction System Evaluation (H2M, July 1997).

1996 Supplemental Remedial Investigation

A supplemental remedial investigation was conducted in November 1996, consisting of eight additional borings completed to a depth of 30 feet bgs. Three soil borings (SB-1, SB-5, and SB-6) were drilled through the center of each of the three dry wells and the remaining five borings were drilled in the area surrounding the dry wells. The highest concentrations of VOCs were detected in the three dry well borings. Primary VOCs detected included cis-1,2-dichloroethene at a maximum concentration of 3.3 ppm, PCE (4,400 ppm), and TCE (1,600 ppm). Further discussion of the 1996 supplemental remedial investigation is presented in the Scope of Work for Soil Vapor Extraction System Evaluation (H2M, July 1997).

1997 Investigation

In June 1997, three borings (D1, D2, and D3) were conducted through the center of each of the three dry wells at the same locations as in 1996. The three borings were drilled to a depth of 85 feet bgs. A total of 18 soil samples were collected at 40, 50, 60, 70, 78, and 85 feet bgs. The primary VOCs detected were PCE, TCE, toluene, ethylbenzene, and xylenes. Maximum concentrations (PCE at 610 ppm, TCE at 400 ppm, toluene at 28 ppm, ethylbenzene at 29 ppm, and xylenes at 180 ppm) were detected from boring D1 at the 50 foot depth. Further discussion of the 1997 investigation is presented in the Scope of Work for Soil Vapor Extraction System Evaluation (H2M, July 1997).

Dry Well Excavations

In June 1998, H2M excavated the three dry wells from the southeast portion of the site. The excavations extended to a depth of approximately 30 feet. A total of 833 tons of soil was removed from the dry wells (H2M, January 1999).

2.3 SVE SYSTEM OPERATION

In the ROD, NYSDEC established soil cleanup levels for the VOCs detected in the dry well area. A summary of the NYSDEC recommended soil cleanup objectives (RSCOs) established in the ROD is presented in Table 2-1.

In accordance with the ROD, a request will be made to the NYSDEC to terminate operation of the SVE system when either soil concentrations meet the site specific soil cleanup objectives, or when the SVE system is no longer effective in removing VOC mass. The system would be shutdown, allowed to equilibrate, and restarted to determine if additional VOCs could be removed. At such time, soil sampling will be conducted and compared to the RSCOs to assess the adequacy of the source area remediation.

Table 2-1

NYSDEC Recommended Soil Cleanup Objectives

Dry Well Area

Analyte of Concern	NYSDEC RSCO (ug/kg)
1,2-Dichloroethene (total)	885
Chlorobenzene	4,950
1,2-Dichlorobenzene	23,970
Ethylbenzene	16,500
Tetrachloroethene	4,155
Toluene	4,500
Trichlorofluoroethane (Freon 113)	18,450
1,1,1-Trichloroethane	2,280
Trichloroethene	1,890
Xylenes (total)	3,600

Note: NYSDEC Recommended Soil Cleanup Objectives and Cleanup Levels Division of Hazardous Waste Remediation - Technical and Administrative Guidance Memorandum (NYSDEC TAGM No. 92-4046, revised 4/95). Site-specific Total Organic Carbon concentration of 30,000 mg/kg was used to calculate the site-specific RSCOs.

To reduce VOC concentrations to below NYSDEC RSCO levels, an SVE system was installed in January 1994 in the dry well area. The system consists of two vacuum blowers, four vapor extraction wells, a piping network, and catalytic oxidizer with a wet scrubber for emission control. Ten vapor wells for monitoring are located in the vicinity of the SVE system. Since operation of the SVE system from January 1994 to June 1998, approximately 37,723 pounds of VOCs have been removed and treated (H2M, June 1998). The existing SVE system has been operating at the site from January 1994 through June 15, 1998. Further details of the current SVE system are provided in Section 5.2.

2.4 PREVIOUS VOC MASS CALCULATIONS

The total mass of VOCs present in the soil at the dry well area prior to SVE operation was calculated by Unisys Corporation (Unisys) in approximately 1993 and by H2M Group (H2M) in 1996. A theoretical mass estimate using limited data was performed in approximately 1993

by Unisys - *see Section 2.4.1*. A second mass estimate was performed in 1996 by H2M using soil mass and average VOC concentration calculations - *see Section 2.4.2*.

2.4.1 VOC Mass Estimate by Unisys Corporation

In October and November 1991, Unisys conducted a pilot test to assess the feasibility of the SVE system to treat VOC impacted soils within the dry well area. One of the objectives of the pilot test was to collect analytical data for VOC mass estimation. A single VOC concentration data point was used by Unisys to extrapolate a theoretical exponential concentration curve to calculate a VOC mass of 200,000 pounds - *see Appendix A*.

Unisys applied a "standard chemical concentration reduction curve" to a single VOC concentration measured during the initial SVE pilot test. Based on the application of a theoretical VOC reduction rate applied over an assumed 450-day time period, Unisys estimated that 200,000 pounds of VOCs were present in the dry well area. Both the VOC removal rate and the period of anticipated SVE operation were estimated by Unisys based on data observed on other SVE projects. It should be noted that Unisys did not use the soil chemical analytical data available from the soil borings drilled from 1988 to 1991 to estimate the total VOC mass.

2.4.2 VOC Mass Estimate by H2M

In 1996, H2M calculated the mass of VOCs in the dry well area using data from soil samples collected in 1988, 1990, and 1991. H2M plotted the total VOC soil analytical results on a geologic cross section to estimate the volume of soil impacted by VOCs. H2M performed volume and mass estimates based on the following assumptions:

1) The extent of impacted soil was cylindrical in shape and encompassed two areas:

   - Area 1 contained high VOC concentrations in the immediate vicinity of the dry wells and encompassed a diameter of 125 feet with a depth of 30 feet.
   - Area 2 contained lower VOC concentrations surrounding Area 1 and encompassed a diameter of 225 feet with a depth of 90 feet.

2) The area of impacted soil did not extend greater than 10 feet below the groundwater table.

3) The analytical data was representative of average soil conditions.

Based on the volume estimates, mass calculations were performed for each area using the following calculation:

Total VOC mass = (soil volume) x (soil density) x (average total VOC concentration)

A summary of H2M's volume and mass estimates are presented in Table 2-2 as follows:

Table 2-2

H2M Volume and Mass Calculations

Area	Soil Volume (yd^3)	Soil Mass (lbs.)	Total VOC Mass (lbs.)
1	13,900	41×10^6	52,000
2	120,000	3.56×10^8	18,000
Totals	133,900	3.97×10^8	70,000

Based on the sum of Areas 1 and 2, H2M estimated a total VOC mass of 70,000 pounds in the soil underlying the dry well area. Further details on H2M's mass calculations are provided in Appendix A.

2.5 SITE GEOLOGY AND HYDROGEOLOGY

Based on boring logs completed at the site, the uppermost subsurface soils at the dry well area consist of Upper Pleistocene glacial deposits. Subsurface soils to a depth of 80 feet bgs consist primarily of gravelly sand, sandy gravel, cobbles, and boulders. Borings completed west of the dry well area contained thick cobble and boulder layers. Thin fine-grained soil zones (clay, sandy clay, and silty sand) are present at a depth of approximately 30 to 50 feet below ground surface (bgs). Thickness of the fine-grained zones is approximately 15 feet.

Based on measurements collected from on-site monitoring wells, the depth to the first aquifer at the dry well area varies between 80 and 85 feet bgs. Groundwater is present within a gravelly sand / sandy gravel matrix.

A localized perched water lens exists in the immediate vicinity of the dry well area (around vent wells VW-13 and VW-14) at a depth between 35 and 40 feet bgs. Based on the absence of perched water in borings completed outside the immediate dry well area, the perched water appears to be no larger than approximately 50 feet in diameter. Perched water is likely to have been caused by surface infiltration located near the dry well area. Water appears to have pooled within fine-grained sediments at the 35 to 40 foot depth interval.

Section 3

Data Collection for SVE Evaluation

This section describes the data collected for the SVE evaluation. Current geotechnical and chemical data were required for a current assessment of site conditions, including soil VOC chemical data, soil vapor concentrations, soil moisture content and geotechnical parameters. This section discusses data gaps, field methods and the analytical results.

3.1 DATA GAPS

Geotechnical and chemical data were collected at the dry well area to evaluate the SVE system. Additional data were needed to determine lithology and geotechnical properties; assess the current lateral and vertical extent of the VOC plume; and estimate the current mass of VOCs in the subsurface soils.

Eight soil borings were completed in the dry well area for data collection. Soil matrix and soil gas samples were collected from the borings to obtain the data needed for the SVE evaluation. Soil matrix samples were collected to characterize site geology, estimate geotechnical parameters, and to obtain soil VOC analytical data. Multi-depth, nested soil vapor monitoring probes were installed in six of the borings to allow collection of soil vapor samples in various soil horizons. The following sections describe the data collection methods and present the results.

3.2 SOIL BORING LOCATIONS

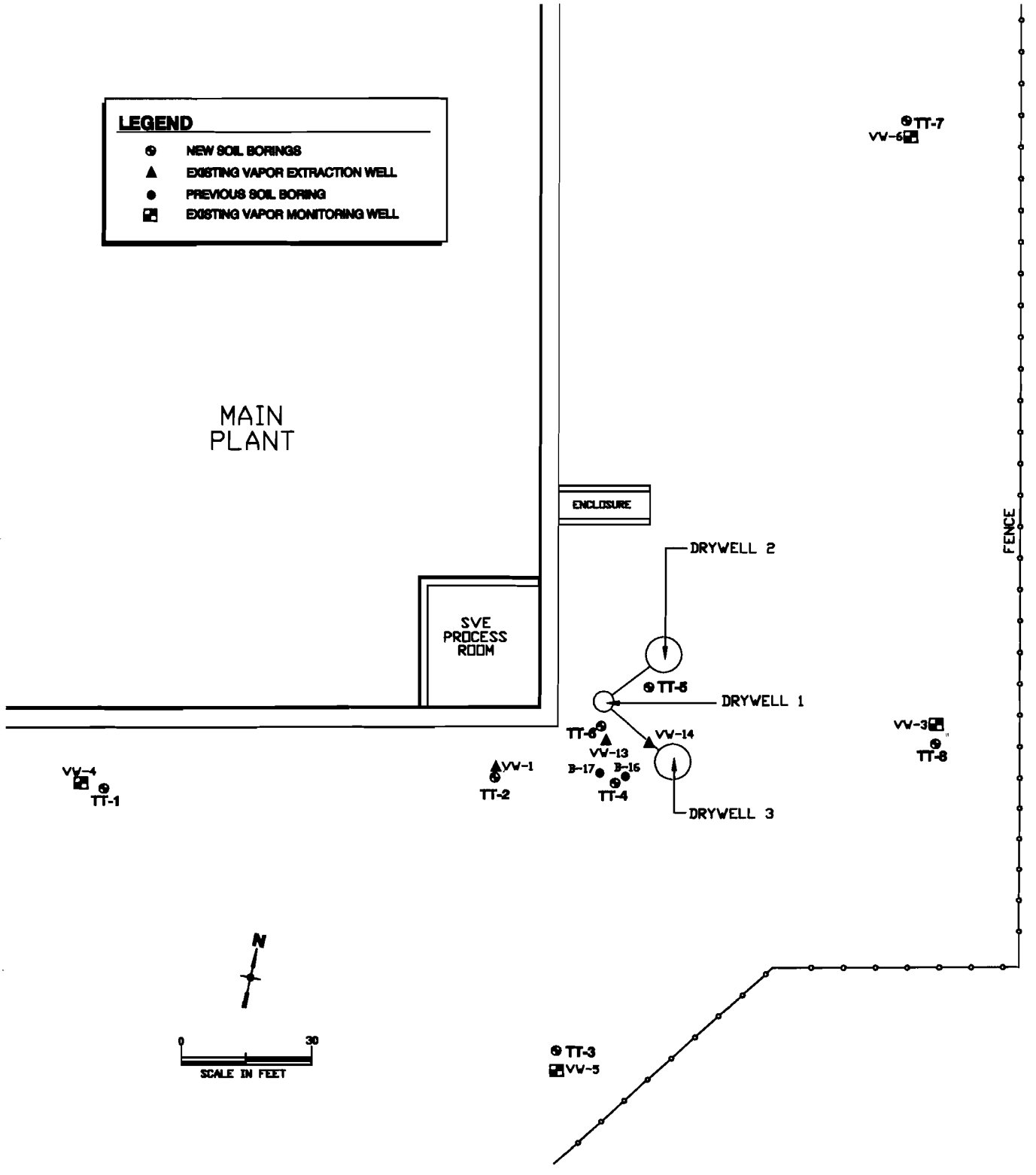
To obtain geotechnical and chemical data for the SVE system evaluation, eight soil borings were drilled at the Lockheed Martin Great Neck facility. Soil borings were placed adjacent to previous investigation areas to provide direct correlation with data collected during the previous site investigations. Five of the eight soil borings were completed adjacent to locations where soil borings previously detected the highest VOC concentrations. To confirm delineation of the plume, the remaining three borings were completed at locations where previous soil borings reported low or non-detectable VOC concentrations. Figure 3-1 shows the locations of the soil borings. A summary of the borings is presented in Table 3-1.

Table 3-1

Soil Boring Locations

Tetra Tech Soil Boring	Soil Boring Location	Purpose of Soil Boring
TT-1	west of VOC plume, adjacent to VW-4	Obtain current data in area of previously detected high VOCs
TT-2	southwest of dry well #1, adjacent to VW-1	Obtain current data in area of previously detected high VOCs
TT-3	south of VOC plume, adjacent to VW-5	Obtain current data at southern edge of the VOC plume
TT-4	south of dry well #1, between B-16 and B-17	Obtain current data in area of previously detected high VOCs
TT-5	east of dry well #1, adjacent to VW-14	Obtain current data in area of previously detected high VOCs
TT-6	adjacent to dry well #1 and VW-13	Obtain current data in area of previously detected high VOCs
TT-7	north of VOC plume, adjacent to VW-6	Obtain current data at northern edge of the VOC plume
TT-8	east of VOC plume, adjacent to VW-3	Obtain current data at eastern edge of the VOC plume

FIGURE 3-1
SOIL BORING LOCATIONS



3.3 SOIL MATRIX SAMPLING

Based on groundwater depth, the eight soil borings were extended to approximately 80 feet bgs. The intent was to determine the extent of VOCs to the depth of first groundwater. Continuous coring was conducted in selected borings to characterize lithology. Soil samples were collected for both geotechnical and chemical analyses. In accordance with the Soil Vapor Extraction System Evaluation Work Plan (Tetra Tech, July 1998), soil samples for chemical analyses were collected at 10-foot intervals beginning at 10 feet bgs, and at each major change in lithology.

Sludge materials were encountered at approximately 42 feet bgs in boring TT-5. In accordance with the Work Plan, a sample was collected from the sludge materials for further chemical analyses and characterization.

Soil matrix sample collection procedures are presented in Section 3.3.1. Geotechnical data are presented in Section 3.3.2, and chemical data are presented in Section 3.3.3.

3.3.1 Soil Matrix Sample Collection Procedures

Drilling and Sample Collection

To complete the soil borings, Tetra Tech utilized hollow stem drilling methods to reach the desired boring depths. In areas of previously undefined lithology, continuous coring was conducted to provide a detailed evaluation of lithology. A split spoon sampler fitted with sampling sleeves was used for the collection of discrete undisturbed soil samples.

The sampler was loaded with clean stainless steel sample liners. All sample liners were washed prior to use. Advancement of the hollow stem auger continued to the sampling depth. The split spoon sampler was then driven into the soil for sample collection.

One sample liner with 100% recovery (completely filled with soil so that there was little void space) was delivered to the laboratory for analysis. The second sample liner was used for on-site head-space analysis. A third sample liner was used to log lithology.

Sample Handling

Soil samples collected for chemical analysis were immediately capped and placed in a cooler with blue-ice pending delivery to the analytical laboratory. Each sample liner was covered with plastic end caps over teflon sheets. A label was placed on the sample liner that included a unique sample number, date and time that the sample was collected, name of the person handling the sample, and the specific analyses being requested from the laboratory. The sample liner used for headspace analysis was emptied into a sealable zip-lock plastic bag.

All soil samples for chemical analysis were placed in a cooler on blue ice pending shipment to a certified New York State Department of Health approved analytical laboratory. A Chain-of-Custody form was completed to record sample identification numbers, date and time of collection, and analyses requested. Copies of the Chain-of-Custody forms are presented in Appendix F.

Headspace Analysis

Headspace analyses were performed as a field screening technique using calibrated organic vapor detectors. After being left at ambient temperature for approximately 10 minutes, the head-space in the bag was analyzed using a Photovac Microtip photoionization detector (PID). The PID instrument registers the concentration of total organic vapors in the headspace which is an indication of the presence of volatile organic compounds in the soil. The PID measures the concentration of airborne ionizable gases and vapors in the C_2 to C_{12} range.

Lithological Logging

A field geologist logged all boreholes using ASTM procedures and techniques. Each soil sample collected was inspected for color, moisture, sorting, grain size, and any other pertinent soil characteristics observed. The soil was classified using the Unified Soil Classification System, and all information was documented on the boring log form. Copies of the boring logs are presented in Appendix B.

Equipment Decontamination

During sampling, a restricted work zone was established. Only authorized team members were permitted to enter this zone. A decontamination area and a clean zone were established at the perimeter of the restricted work zone for preparation and breakdown of sampling appurtenances. The decontamination area was established to contain decontamination rinsate solution for subsequent disposal. The decontamination staging area included buckets for decontamination of equipment.

Equipment used for sampling which was in direct contact with the soil media, underwent the following decontamination process:

- ✓ Loose dirt was brushed off with a steel-bristle brush in the decontamination area;
- ✓ Equipment was washed in a non-phosphate detergent solution using plastic scrub brushes;
- ✓ Following the detergent wash, equipment was rinsed with tap water; and
- ✓ As a final step, equipment was rinsed with distilled water and allowed to air dry.
- ✓ The clean equipment was transferred to the clean zone.
- ✓ Decontamination solutions were transferred to 55-gallon drums for storage prior to disposal.
- ✓ Hollow-stem augers were decontaminated using an on-site steam cleaner.

Borehole Abandonment

Borings TT-2 and TT-4 were backfilled with bentonite grout. The other six borings were converted into nested soil gas probes - *see Section 3.4.*

Waste Management

Equipment rinse water and drill cuttings were generated during the sampling program. The wastes were contained in Department of Transportation (DOT) approved 55-gallon drums and stored at a designated staging area. All drums were appropriately labeled and logged on a drum inventory form. All drill cuttings and associated waste were characterized and disposed of in accordance with the NYSDEC Final Division Technical and Administrative Guidance Memorandum - Disposal of Drill Cuttings. Equipment rinse water was transported to the on-site groundwater Interim Remedial Measures (IRM) system for treatment.

3.3.2 Geotechnical Data

Ten soil samples were collected for geotechnical analyses. The soil samples were analyzed for total organic carbon, bulk density, moisture content, and soil porosity. The geotechnical data are summarized in Table 3-2. Copies of the laboratory reports are presented in Appendix C.

Table 3-2

Summary of Geotechnical Data

Sample No.	Total Organic Carbon	Bulk Density	Moisture Content	Soil Porosity
TT2-40	0.100U %	121.03 pcf	11.35%	0.2795
TT2-52	0.100U %	110.42 pcf	11.39%	0.3413
TT2-62	0.43%	109.08 pcf	10.95%	0.3644
TT2-72	0.24%	114.75 pcf	13.37%	0.3084
TT2-82	0.19%	115.21 pcf	14.02%	0.3038
TT4-50	0.30%	113.28 pcf	15.19%	0.3177
TT4-60	0.36%	107.78 pcf	13.73%	0.3418
TT4-70	0.64%	113.01 pcf	17.06%	0.309
TT6-30	0.98%	127.67 pcf	11.72%	0.245
TT6-40	0.22%	131.34 pcf	11.14%	0.2181

Note: pcf = pounds / cubic foot

3.3.3 Chemical Data

A total of 61 soil samples were collected for chemical analysis. All soil samples were analyzed for VOCs. As requested by NYSDEC, one sample collected from sludge materials was further analyzed for semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), and metals. A summary of the sampling locations and depths is presented in Table 3-3.

Table 3-3

Soil Sampling Locations and Depths

Boring Number	No. of Soil Samples	Sampling Depths	Chemical Analyses
TT1	7	14′, 22′, 42′, 52′, 62′, 72′, 80′	VOCs
TT2	8	10′, 22′, 34′, 40′, 52′, 62′, 72′, 82′	VOCs
TT3	8	12′, 22′, 37′, 42′, 52′, 62′, 72′, 83′	VOCs
TT4	8	10′, 18′, 30′, 36′, 50′, 60′, 70′, 80′	VOCs
TT5	6	32′, 42′, 52′, 62′, 72′, 82′	VOCs
TT6	9	10′, 20′, 30′, 35′, 40′, 50′, 60′, 70′, 80′	VOCs
TT7	7	10′, 22′, 28′, 42′, 52′, 62′, 82′	VOCs
TT8	8	12′, 22′, 34′, 42′, 52′, 62′, 72′, 82′	VOCs

Note: The sample collected at the 42-foot depth from soil boring TT-5 was also analyzed for SVOCs, PCBs and metals

Chemical Analysis Methods

All soil samples collected were analyzed for Target Compound List (TCL) VOCs + Freon-113 using NYSDEC Method 95-1. The sludge material sample was analyzed for TCL VOCs, TCL SVOCs, TAL Metals, and TCL PCBs (report only format).

Laboratory performance quality control (QC) was conducted to ensure the laboratory systems (instrumentation, sample preparation, analysis, data reduction, etc.) are operating within acceptable QC guidelines during data generation. Laboratory QC samples consisted of method blanks, laboratory control samples, and calibration verification samples. In addition, matrix-specific QC which includes matrix spikes, matrix spike duplicates, sample duplicates, and the use of surrogate compounds were utilized to determine the effect of the sample matrix on the data being generated - *see Appendix F for copies of the laboratory QC reports.*

Chemical Data Results

Eighteen VOCs were detected in the soil around the dry well area. Tetrachloroethene (PCE) and trichloroethene (TCE) were detected most frequently and at the highest concentrations, followed by ethyl benzene, toluene and xylenes. Other VOCs detected include acetone, benzene, 2-butanone, chloroform, 1,2-dichloroethane, 1,2-dichloroethene, 2-hexanone, 4-methyl-2-pentanone, methylene chloride, 1,1,1-trichloroethane, 1,1,2-trichloroethane, 1,1,2,2-tetrachloroethane, and Freon-113.

The chemical analysis results are summarized in Table 3-4. Copies of the laboratory data reports are presented in Appendix F.

Table 3-4
Summary of VOCs Detected in Soil Samples

Sample No.	Concentration of VOCs Detected in Soil (µg/kg)																		
	Acetone	Benzene	2-Butanone	Chloroform	1,2-DCA	1,2-DCE (total)	Ethyl benzene	2-Hexanone	4-Methyl-2-pentanone	Methylene Chloride	1,1,1-TCA	1,1,2-TCA	TCE	PCE	1,1,2,2-PCA	Toluene	Xylenes (total)	Freon 113	Total VOCs
TT1-14	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0
TT1-22	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3 J	ND	ND	ND	ND	3
TT1-42	10 J	ND	3 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3 J	ND	ND	ND	ND	16
TT1-52	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0
TT1-62	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	320 J	390 J	ND	ND	ND	ND	710
TT1-72	47 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	26 J	ND	ND	ND	ND	73
TT1-80	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	170 J	ND	ND	ND	ND	170
TT2-10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0
TT2-22	130	ND	52	ND	ND	ND	ND	14	2 J	ND	ND	ND	1 J	18	ND	ND	ND	ND	217
TT2-34	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0
TT2-40	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0
TT2-52	7 J	ND	ND	ND	ND	8 J	ND	ND	ND	ND	ND	ND	2 J	4 J	ND	ND	ND	ND	21
TT2-62	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	11 J	ND	ND	ND	ND	11
TT2-72	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0
TT2-82	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0
TT3-12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0
TT3-22	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0
TT3-37	ND	ND	ND	ND	ND	37	ND	ND	ND	ND	ND	ND	9 J	22	ND	ND	ND	ND	68
TT3-42	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2 J	13	ND	ND	ND	ND	15
TT3-52	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	570 J	ND	ND	ND	ND	570
TT3-62	21	ND	6 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	1 J	8 J	ND	ND	ND	ND	36
TT3-72	18	ND	4 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2 J	ND	ND	ND	ND	24
TT3-83	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0
TT4-10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0
TT4-18	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	22	180	ND	ND	2 J	ND	204
TT4-30	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1900	57000 D	ND	180 J	240 J	ND	59320
TT4-36	ND	ND	ND	ND	ND	ND	26000 J	ND	ND	ND	ND	ND	160000	2800000	ND	68000 J	120000 J	ND	3174000
TT4-50	ND	ND	ND	ND	ND	ND	260 J	ND	ND	ND	ND	ND	920 J	15000	ND	450 J	1500	ND	18130

Table 3-4 (Continued)
Summary of VOCs Detected in Soil Samples

Sample No.	Concentration of VOCs Detected in Soil (µg/kg)																	
	Acetone	Benzene	2-Butanone	Chloroform	1,2-DCA	1,2-DCE (total)	Ethyl benzene	2-Hexanone	4-Methyl-2-pentanone	Methylene Chloride	1,1,1-TCA	1,1,2-TCA	TCE	PCE	1,1,2,2-PCA	Toluene	Xylenes (total)	Freon 113	Total VOCs
TT4-60	ND	ND	ND	ND	ND	ND	210 J	ND	ND	ND	ND	ND	320 J	15000	ND	220 J	1100 J	ND	16850
TT4-70	ND	ND	ND	ND	ND	ND	960 J	ND	ND	ND	ND	ND	2300	84000 D	ND	1300 J	5500	ND	94060
TT4-80	ND	ND	ND	ND	ND	ND	2000 J	ND	ND	ND	ND	ND	6800 J	180000	ND	3400 J	11000 J	ND	203200
TT5-32	ND	ND	ND	ND	ND	3800 J	3900 J	ND	ND	ND	ND	ND	39000	430000	ND	6100 J	14000 J	ND	496800
TT5-42*	ND	ND	ND	ND	ND	ND	190000 J	ND	ND	ND	ND	ND	4600000	5600000	ND	2300000	1100000	960000	14750000
TT5-52	ND	ND	ND	ND	ND	2900 J	10000 J	ND	ND	ND	ND	ND	240000	410000	ND	120000	57000	39000	878900
TT5-62	15	ND	4 J	ND	ND	9 J	4 J	ND	ND	ND	2 J	ND	220	140	ND	79	18	24	515
TT5-72	ND	ND	ND	ND	ND	ND	2 J	ND	ND	ND	ND	ND	26	56	ND	18	8 J	ND	110
TT5-82	ND	ND	ND	ND	ND	ND	2100 J	ND	ND	ND	ND	ND	14000	83000	ND	11000	13000	2600 J	125700
TT6-10	ND	ND	ND	8 J	ND	ND	ND	ND	ND	ND	ND	ND	15 J	520	ND	ND	ND	ND	543
TT6-20	71	ND	17 J	ND	ND	17 J	12 J	ND	8 J	ND	ND	ND	740	390	ND	290	92	24 J	1661
TT6-30	38000 J	ND	17 J	ND	ND	68000 J	65000 J	ND	ND	ND	ND	ND	820000	3700000 D	ND	400000	370000	28000 J	5489017
TT6-35	23	6 J	7 J	4 J	2 J	33	21	ND	6 J	13	ND	13	91 D	ND	4J	ND	140	56	419
TT6-40	17	ND	5 J	ND	ND	ND	2 J	3 J	4 J	ND	ND	ND	32	180	ND	13	22	ND	278
TT6-50	66	ND	ND	ND	ND	220	12 J	ND	ND	ND	ND	10 J	490JD	2400D	ND	150	70	6 J	3424
TT6-60	ND	ND	ND	ND	ND	ND	570 J	ND	ND	ND	ND	ND	7700	23000	ND	4600	3400	330 J	39600
TT6-70	11	ND	ND	ND	ND	ND	3 J	ND	ND	ND	ND	ND	16	100	ND	18	15	ND	163
TT6-80	ND	ND	ND	ND	ND	ND	1100 J	ND	ND	ND	ND	ND	180 J	320 J	ND	200 J	470 J	ND	2270
TT7-10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0
TT7-22	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0
TT7-28	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1 J	ND	ND	ND	ND	ND	1
TT7-42	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0
TT7-52	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0
TT7-62	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0
TT7-82	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0
TT8-12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0
TT8-22	13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	13
TT8-34	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0

Table 3-4 (Continued)
Summary of VOCs Detected in Soil Samples

Sample No.	Concentration of VOCs Detected in Soil (µg/kg)																	
	Acetone	Benzene	2-Butanone	Chloroform	1,2-DCA	1,2-DCE (total)	Ethyl benzene	2-Hexanone	4-Methyl-2-pentanone	Methylene Chloride	1,1,1-TCA	1,1,2-TCA	TCE	PCE	1,1,2,2-PCA	Toluene	Xylenes (total)	Freon 113	Total VOCs
TT8-42	ND	ND	720 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	2000	7600	ND	ND	ND	ND	10320
TT8-52	ND	ND	1 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	3 J	79	ND	ND	5 J	ND	88
TT8-62	7 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7
TT8-72	13	ND	2 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3 J	ND	ND	ND	ND	18
TT8-82	8 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	8

ND = Not Detected Above Sample Quantitation Limit

J = Compound meets the identification criteria, but the result is less than the sample quantititation limit and greater than zero

D = Compound identified in an analysis at a secondary dilution factor

DCA = Dichloroethane; DCE = Dichloroethene, TCA = Trichloroethane, TCE = Trichloroethene; PCE = Tetrachloroethene; PCA = Tetrachloroethane

* Sample was also analyzed for SVOCs, PCBs and metals Results are presented in Appendix f

3.4 SOIL VAPOR SAMPLING

To allow future VOC vapor monitoring and sampling, nested soil vapor monitoring probes were installed in six of the eight soil borings. Monitoring probes were installed in borings TT-1, TT-3, TT-5, TT-6, TT-7 and TT-8 - *see Figure 3-1 for boring locations.* Depths of the monitoring probes were determined during the field program and were based on VOC field screening results and lithology. Probes were targeted at depths where high concentrations of VOCs were detected, and where fine-grained soil materials were identified. The soil vapor samples were analyzed using a method similar to EPA Method 8260. A summary of the soil vapor sampling locations and depths is presented in Table 3-5.

Table 3-5

Soil Vapor Sampling Locations and Depths

Boring Number	Soil Vapor Sampling Depths	Chemical Analyses
TT1	62', 72'	VOCs
TT3	52', 62', 72'	VOCs
TT5	37', 62', 73'	VOCs
TT6	29', 38', 60', 70'	VOCs
TT7	34', 60'	VOCs
TT8	42', 62'	VOCs

Soil vapor sample collection procedures are presented in Section 3.4.1, with the soil vapor data presented in Section 3.4.2.

3.4.1 Soil Vapor Sample Collection Procedures

Installation of Soil Vapor Probes

Each soil vapor probe consisted of 1/4" polyethylene tubing with a soil vapor inlet located at the down-hole end of the tubing and a sample collection port at the surface end. The construction procedure for each of the nested soil vapor probes were as follows:

1. Bentonite chips were poured through the center of the drill pipe to seal off the saturated zone and the vadose zone below the deepest probe location;
2. The soil vapor probe was installed into the borehole. Each probe was set within a 2-foot thick filter pack consisting of #3 coarse sand. The filter pack allows free migration of vapors from the surrounding formations into the probe inlets. Three inches of #00 fine-grained sand, that serves as a transition sand, were placed above and below the filter pack.
3. One foot of granular bentonite was placed above the #00 fine sand. Bentonite chips were then added up to the next soil vapor probe location and hydrated;
4. The drill casing was pulled to the next probe interval. Procedures 2 through 4 were repeated for each soil vapor probe depth location.
5. Following installation of the final soil vapor probe, all probes were capped, labeled and secured within a well box. The well box was set within a concrete pad and locked.

Soil vapor probe construction diagrams are presented in Appendix D.

Soil Vapor Sampling

Soil gas sampling and analysis was conducted approximately two days after installation of the probes. Prior to sample collection, a purge test was performed to evaluate the appropriate volume of gas to be purged. The purge test consisted of extracting 1, 2, 4, 6, 8 and 10 times the polyethylene tubing and sample probe volume prior to analysis. Analytical results associated with each purge volume was plotted to determine the optimum purge volume for the

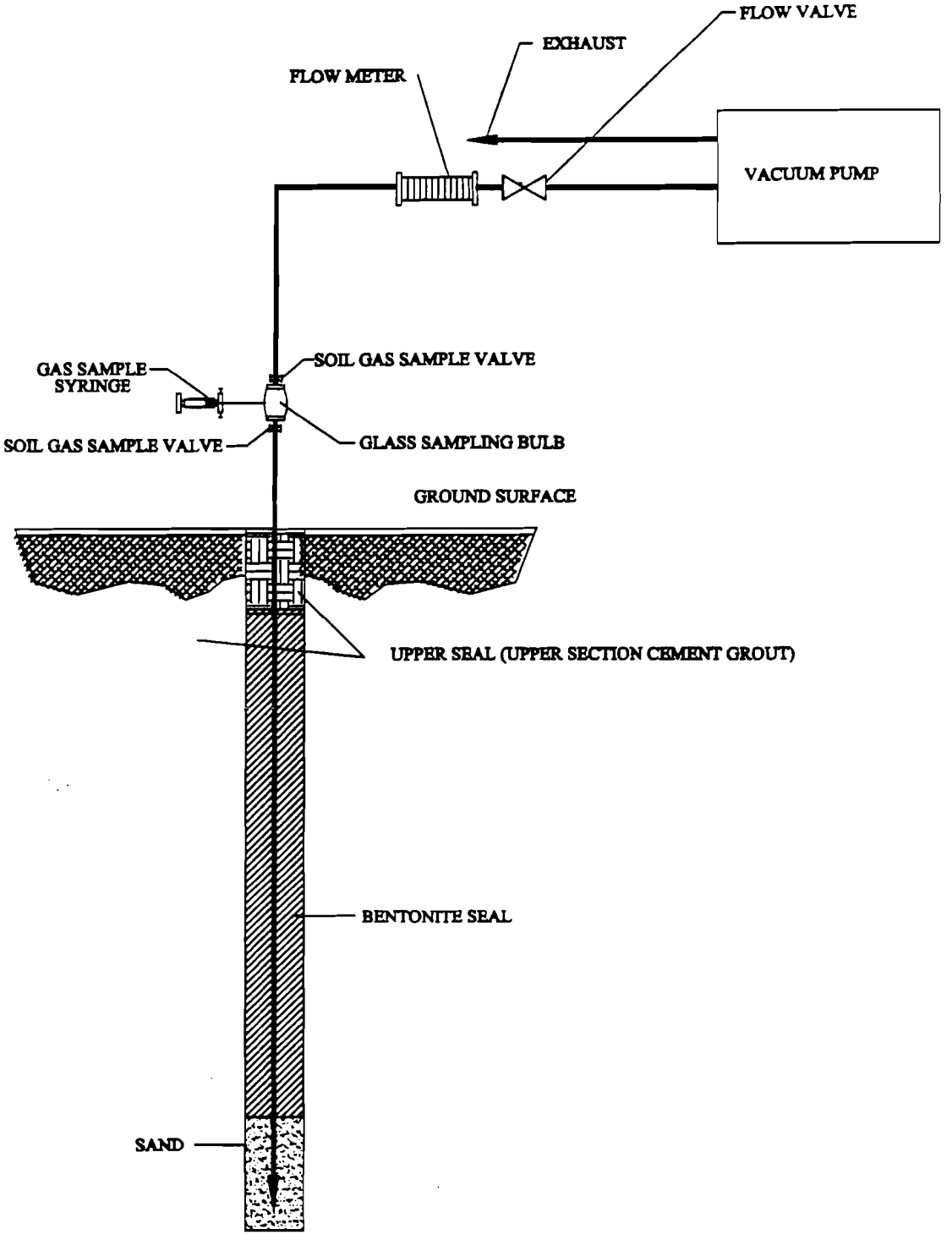
remaining samples of each location. Based on the results of the purge tests, seven to ten purge volumes were used as the optimum purge volume for all subsequent tests.

Soil vapor samples were collected using a soil vapor sampling system shown in Figure 3-2. Soil vapor samples were collected in a glass sampling bulb fitted with Teflon stopcocks and a viton rubber sampling port. The bulb was connected to a vacuum gauge, flowmeter and portable sampling pump. During the sampling, a pentane-soaked kimwipe was exposed to the sampling train. The detection of any pentane in the sample would have indicated the intrusion of ambient air into the sampling train, thus invalidating the results of that sample. Once the sampling system was determined to be leak-tight, the bulb was opened, and flow was maintained for seven to ten purge volumes. The stopcocks were then closed and the sample was retained within the container.

As an additional quality control measure, five isotopically-labeled surrogate compounds were added through the septum into the sampling bulb. The recovery of more than 75% of these compounds demonstrates that the bulbs have remained leak-tight up to the actual analysis. All surrogate recoveries exceeded 75% for this project.

Soil vapor samples were analyzed using a Hewlett Packard model 5890 Gas Chromatograph (GC) interfaced with a Hewlett Packard model 5972 mass spectrometer. These detectors were used to analyze soil vapor samples for VOCs using a method similar to EPA Method 8240. The practical quantitation limits (PQLs) for the VOCs were one microgram per liter (μg/L). Instrument detection limits were about 0.1 μg/L. The targeted VOCs are listed in Table 3-6.

FIGURE 3-2
SCHEMATIC OF SOIL GAS SAMPLING TRAIN



NOT TO SCALE

Table 3-6

Target Volatile Organic Compound List

Vinyl Chloride	1,2-Dichloroethane	trans-1,3-dichloropropene
Bromomethane	1,1,1-Trichloroethane	1,1,2-Trichloroethane
Chloroethane	Carbon Tetrachloride	Dibromochloromethane
1,1-Dichloroethene	Benzene	Bromoform
Methylene Chloride	Trichloroethene	Toluene
1,2-Dichloroethene	1,2-Dichloropropane	Tetrachloroethene
1,1-Dichloroethane	Bromodichoromethane	Chlorobenzene
Chloroform	cis-1,3-dichloropropene	Ethylbenzene
Total Xylenes	Styrene	1,1,1,2-Tetrachloroethane
1,1,2,2-Tetrachloroethane	Freon-11	Freon-12
Freon-113		

Two rounds of soil vapor sampling was conducted at selected vapor probes to ensure that VOC concentrations detected were representative of equilibrium subsurface conditions. Two rounds of sampling were conducted at all vapor probes from boring TT6 (vapor probes TT6-29, TT6-38, TT6-60, and TT-70). The second round of sampling was conducted approximately 6 days after the first round of sampling.

3.4.2 Soil Vapor Data

Seventeen VOCs were detected in the soil vapor around the dry well area. Similar to the soil sampling data, tetrachloroethene (PCE) and trichloroethene (TCE) were detected most frequently and at the highest concentrations. Other VOCs detected include 1,2-DCE, toluene, benzene, chloroform, 1,1-dichloroethane, 1,1-dichloroethene, ethylbenzene, methylene chloride, 1,1,1-trichloroethane, 1,1,1,2-tetrachloroethane, xylenes, vinyl chloride, Freon-11, Freon-12, and Freon-113.

The soil vapor analysis data are summarized in Table 3-7. Copies of the laboratory data reports are presented in Appendix E.

Table 3-7

Summary of VOCs Detected in Soil Vapor Samples

Sample No.	Concentration of VOCs Detected in Soil Vapor (µg/L)																
	Benzene	Chloro form	DCA	1,1-DCE	1,2-DCE (total)	Ethyl benzene	Methylene Chloride	TCA	TCE	PCE	PCA	Toluene	Xylenes (total)	Vinyl Chloride	Freon 11	Freon 12	Freon 113	Total VOCs
TT1-62	ND	ND	ND	ND	4.2	ND	ND	ND	6.3	6.5	ND	1.9	ND	0.6	ND	ND	6.6	26.1
TT1-72	ND	ND	ND	ND	15	ND	ND	ND	1.8	2.3	ND	ND	ND	4.3	ND	ND	12	35.4
TT3-52	ND	ND	ND	ND	4.4	ND	ND	ND	2.5	4.7	ND	1	ND	ND	ND	ND	2.3	14.9
TT3-62	ND	ND	ND	ND	ND	ND	ND	ND	1	2.5	ND	ND	ND	ND	ND	ND	ND	3.5
TT3-72	ND	ND	ND	ND	ND	ND	ND	ND	1	1.6	ND	0.6	ND	ND	ND	ND	1.1	4.3
TT5-37	6.8	1.9	ND	72	1849	24	ND	145	11214	3410.1	1.3	1673	52	4.9	6.8	62.2	5693	24216
TT5-62	4.5	ND	ND	2.5	166	ND	ND	13	6296	2937.7	ND	1498	ND	ND	ND	ND	104	11021.7
TT5-73	0.9	ND	ND	ND	32	24	ND	2.1	1678	1685.2	ND	615	61	ND	ND	ND	25	4123.2
TT6-29	1.8	0.5	ND	52	1911	2.6	0.5	5.3	778	592	ND	132	ND	9.6	ND	ND	361	3846.3
TT6-29r	1.6	ND	ND	63	2744	6.1	0.6	4	886	923	ND	150	ND	8.4	ND	ND	311	5097.7
TT6-38	10	7.8	8.7	54	468	3.9	41.9	23	3064	720	ND	351	1.8	9.7	5.1	ND	2714	7482.9
TT6-38r	9.8	6.6	8.1	ND	404	3.2	27.5	26	3643	544	ND	168	ND	7.1	ND	ND	3492	8339.3
TT6-60	ND	ND	ND	0.6	19	27	ND	ND	141	33	ND	ND	ND	ND	ND	ND	16	236.6
TT6-60r	0.6	ND	ND	ND	49	3.4	ND	0.7	663	399	ND	125	ND	ND	ND	ND	ND	1240.7
TT6-70	ND	ND	ND	ND	45	ND	ND	ND	91	33	ND	16	ND	ND	ND	ND	13	198
TT6-70r	0.5	ND	ND	ND	23	ND	ND	ND	388	85	ND	41	ND	ND	ND	ND	3.5	541
TT7-34	ND	ND	ND	ND	ND	ND	ND	ND	2.7	2.4	ND	1.1	ND	ND	ND	ND	ND	6.2
TT7-60	ND	ND	ND	ND	ND	ND	ND	ND	3.3	3.3	ND	1.1	ND	ND	ND	ND	0.8	8.5
TT8-42	ND	ND	ND	ND	449	ND	ND	1.2	447	127	ND	ND	ND	2.6	ND	ND	86	1112.8
TT8-42d	ND	ND	ND	ND	368	ND	ND	1	325	66	ND	ND	ND	2.1	ND	ND	72	834.1
TT8-62	ND	ND	ND	ND	0.9	ND	ND	ND	1.2	0.9	ND	ND	ND	ND	ND	ND	0.7	3.7
TT8-62d	ND	ND	ND	ND	0.6	ND	ND	ND	1.2	1	ND	ND	ND	ND	ND	ND	0.8	3.6

ND = Not Detected Above Reporting Limit of 0.5 µg/L
r = rebound
d = duplicate
DCA = 1,1-Dicholorethane; DCE = Dichloroethene; TCA = 1,1,1-Trichloroethane; TCE = Trichloroethene; PCA = 1,1,1,2-Tetrachloroethane; PCE = Tetrachloroethene

3.5 EXTENT OF VOC PLUME

The soil matrix and soil gas data indicate that the highest concentrations of total VOCs were in borings TT-4, TT-5, and TT-6, located in the immediate vicinity of the dry wells. VOC concentrations in the soil decrease in each direction away from the dry well area. The estimated lateral extent of the VOC plume is shown in Figure 3-3.

VOCs were detected in the dry well area from the near surface to first groundwater at 80 feet bgs. The highest VOCs in these borings were detected in silty sands and clayey sands located between 30 and 40 feet bgs. Figures 3-4 and 3-5 are cross-sections that illustrate the subsurface geology in the dry well area.

FIGURE 3-3
ESTIMATED LATERAL EXTENT
OF VOC IMPACTED SOIL

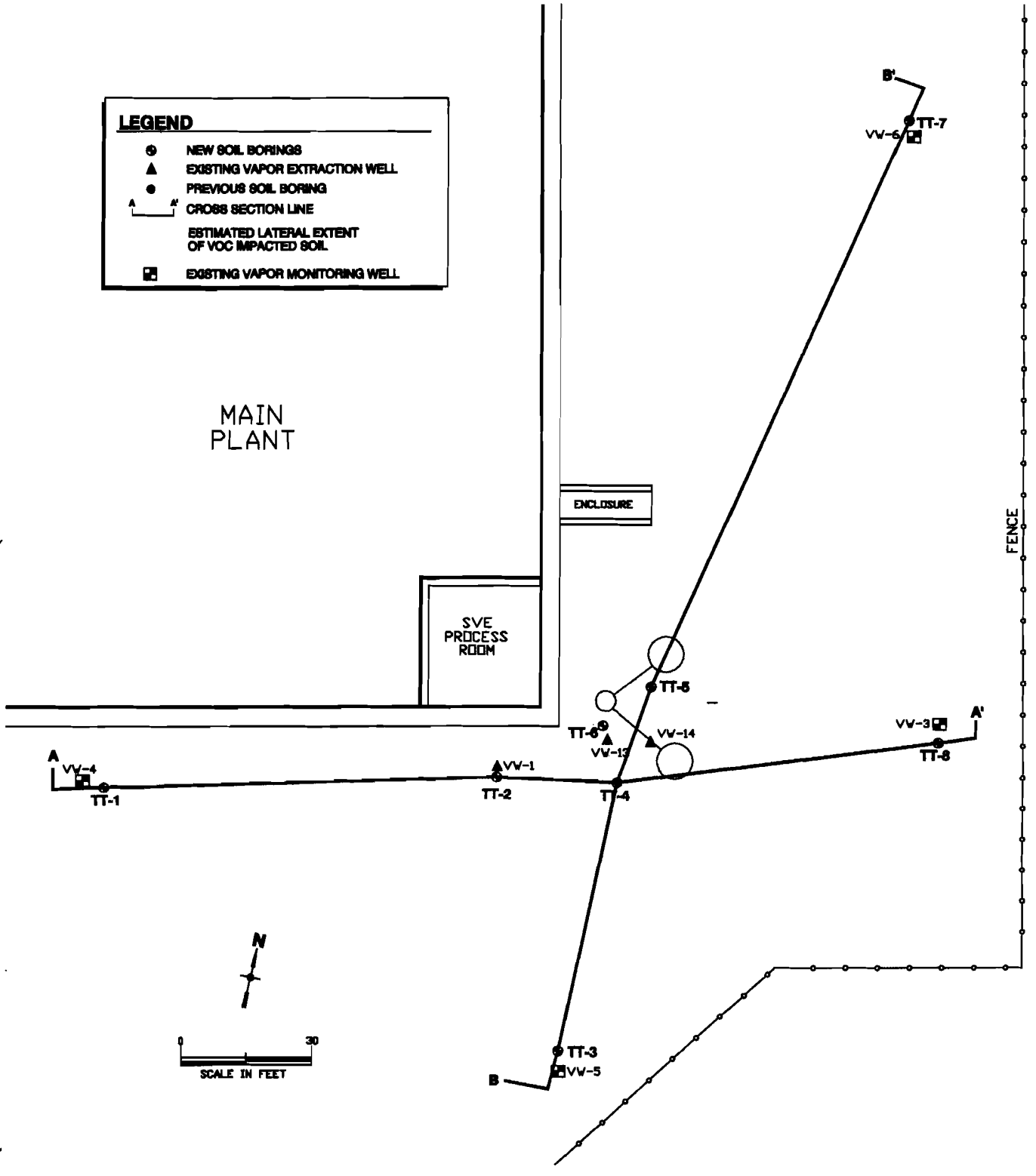
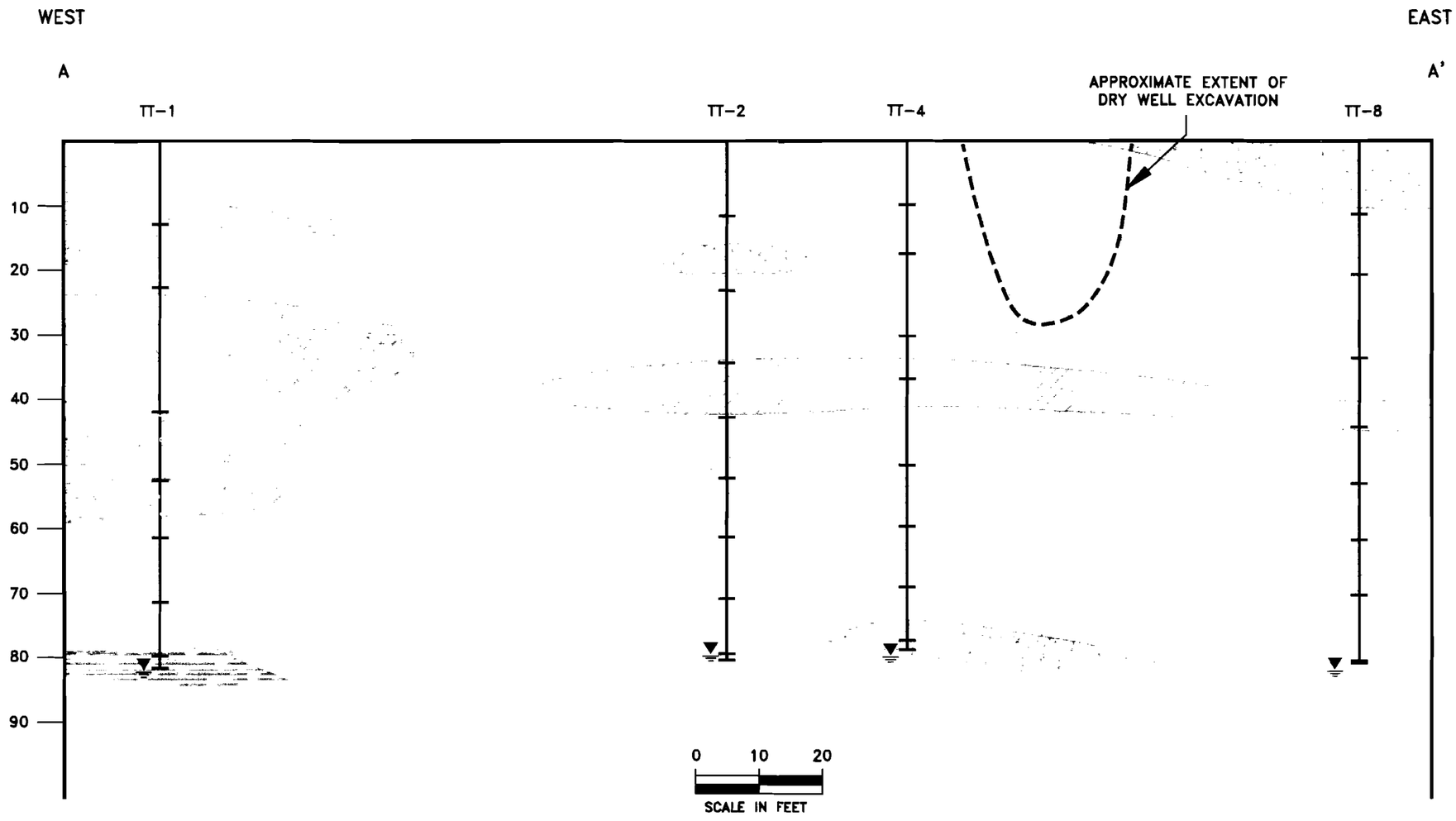


FIGURE 3-4
CROSS SECTION A-A'



LEGEND

TT-2 — AUGUST 1998 SOIL BORING, SAMPLE COLLECTED

GROUNDWATER LEVEL AS OBSERVED DURING DRILLING

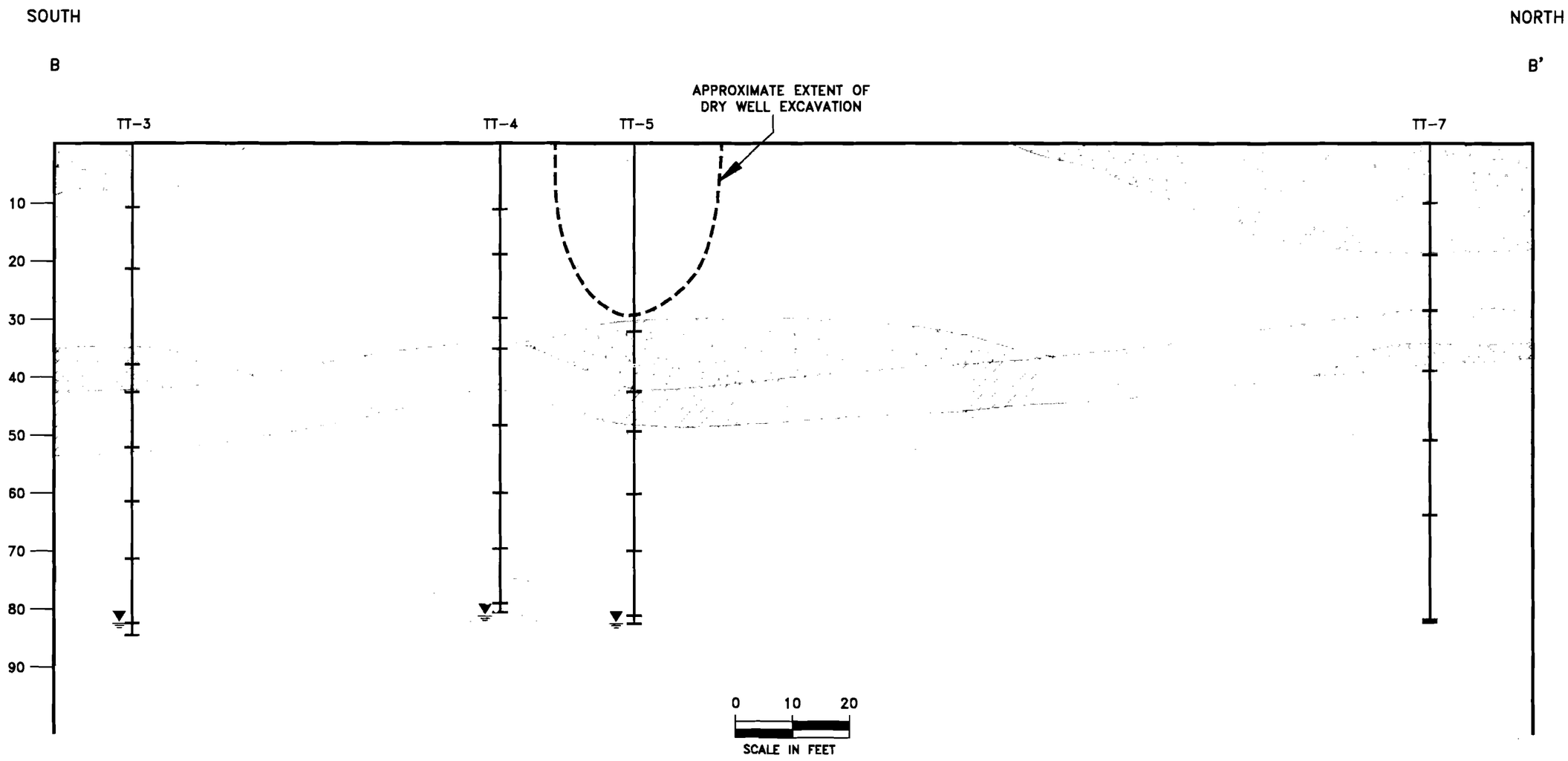
SANDY GRAVEL AND COBBLES (GW)

GRAVELLY SAND, POORLY SORTED SAND (SW)

SILTY SAND, CLAYEY SAND (SM/SC)

WELL SORTED SAND (SP)

FIGURE 3-5
CROSS SECTION B-B'



LEGEND

TT-4 — AUGUST 1998 SOIL BORING — SAMPLE COLLECTED

GROUNDWATER LEVEL AS OBSERVED DURING DRILLING

SANDY GRAVEL AND COBBLES (GW)

GRAVELLY SAND, POORLY SORTED SAND (SW)

SILTY SAND, CLAYEY SAND (SM/SC)

SILTY CLAY, SANDY CLAY (CL)

Section 4

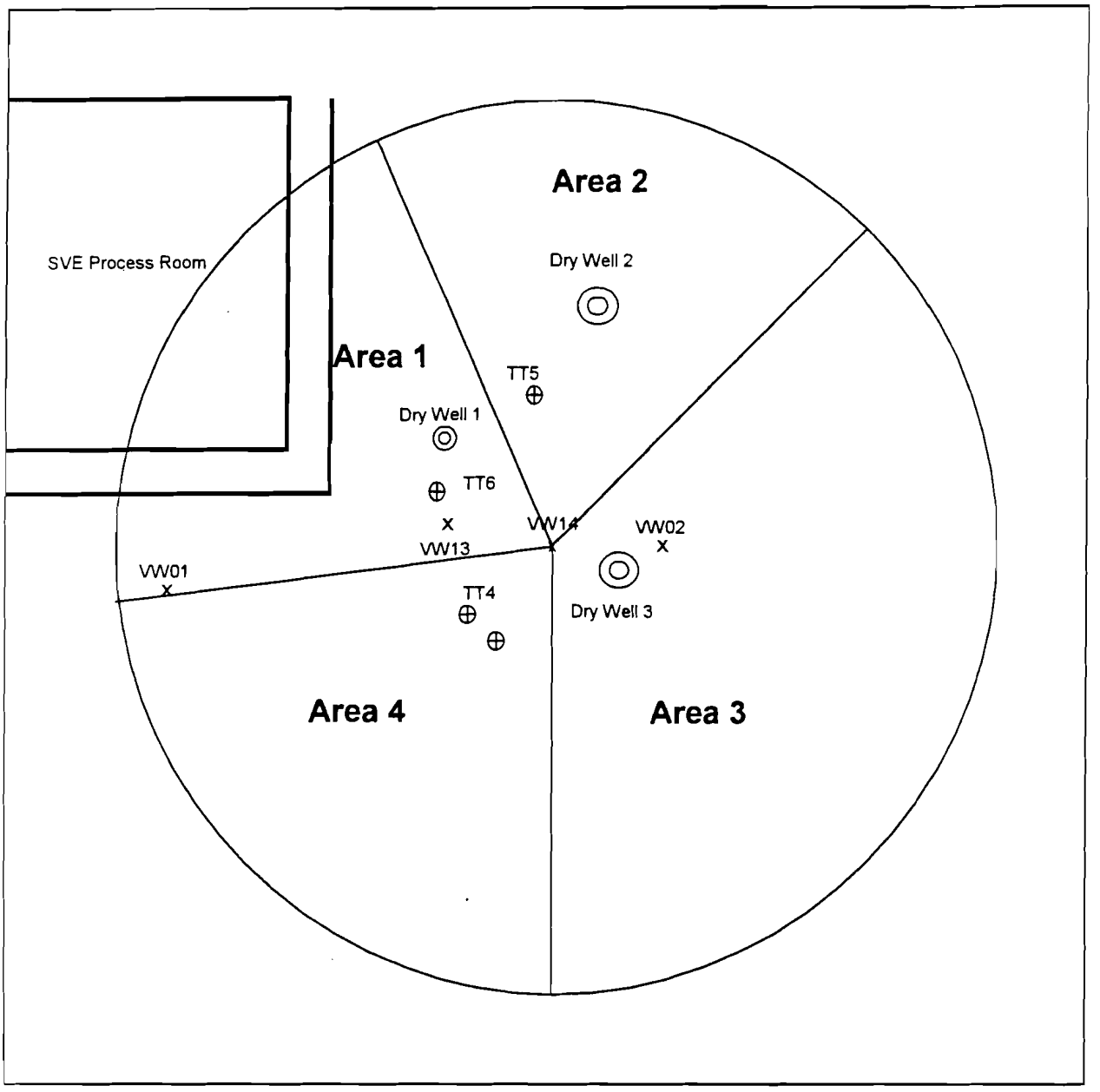
Current VOC Mass Estimation

The current mass of VOCs present in the subsurface soils was calculated using the analytical results of soil samples collected in August 1998. As presented in Section 3, eight soil borings (TT-1 through TT-8) were drilled and sampled to obtain current analytical data for estimation of VOC mass. A total of 61 soil samples were collected and analyzed for VOCs as summarized in Table 3-2 - *see Section 3*. Analytical results of soil samples collected from the borings indicate that the highest concentrations of VOCs are limited to the immediate vicinity of the dry wells.

4.1 VOC MASS CALCULATIONS

The current mass of VOCs present in the subsurface soils was determined by calculating the average concentration of each compound (i.e., PCE, TCE, 1,2-DCE, etc.) present in the area surrounding the former dry wells. The average concentration of each compound was calculated for each 5-foot depth interval from the surface to groundwater. Further, the lateral distribution of chemicals was also calculated based on the spatial distance from the former dry wells using the August 1998 chemical data. Overall, the average concentration of each chemical compound was calculated for 17 vertical layers in four lateral sections surrounding the former dry wells. The division of the four lateral sections of varying VOC concentrations is shown in Figure 4-1. The calculated average chemical concentration for each 5-foot depth interval within each lateral area is presented in Tables 4-1 through 4-4.

Figure 4-1
Mass Distribution Areas



LEGEND

x Existing extraction well

⊕ Soil boring installed by Tetra Tech

◎ Dry Well

Table 4-1
VOCs Mass Estimate for Area 1

Depth (ft) bgs.	Soil USC	PCE[1] (ug/kg)	TCE[1] (ug/kg)	1,2-DCE[1] (ug/kg)	Toluene[1] (ug/kg)	Ethyl Benzene[1] (ug/kg)	Xylenes[1] (ug/kg)	Bulk Density (pcf)	Area (ft^2)	Soil Volume (ft^3)	Soil Dry Weight (lbs.)	PCE Mass (lbs.)	TCE Mass (lbs.)	1,2-DCE Mass (lbs.)	Toluene Mass (lbs.)	Ethyl Benzene Mass (lbs.)	Xylenes Mass (lbs.)
0-5	SW	520	15	0	0	0	0	111 4	1,116	6.E+03	6 22E+05	0.3	0 01	0 0	0 0	0 0	0 0
6-10	SW	**520**	**15**	**0**	**0**	**0**	**0**	111.4	1,116	6 E+03	6.22E+05	0.3	0 01	0 0	0 0	0 0	0 0
11-15	SW	630	203	5	145	6	46	111 4	1,116	6 E+03	6 22E+05	0.4	0 13	0 0	0 1	0 0	0 0
16-20	GW	**740**	**390**	**17**	**290**	**12**	**92**	111 4	1,116	6 E+03	6.22E+05	0 5	0 24	0 0	0 2	0 0	0 1
21-25	SW	1,850,370	410,195	34,009	245,145	32,596	185,046	111 4	1,116	6 E+03	6 22E+05	1150 2	254 98	21 1	152 4	20 3	115 0
26-30	SW/SC	**3,700,000**	**820,000**	**68,000**	**490,000**	**65,000**	**370,000**	111 9	1,116	6 E+03	6 24E+05	2310.3	512 01	42 5	306 0	40 6	231 0
31-35	SC	1,850,090	410,016	34,017	245,007	32,511	185,070	126 7	1,116	6.E+03	7.07E+05	1308.0	289 88	24 0	173 2	23 0	130 8
36-40	CL	**180**	**32**	**33**	**13**	**21**	**140**	126 7	1,116	6 E+03	7 07E+05	0 1	0.02	0 0	0 0	0 0	0 1
41-45	SC	1,290	261	0	82	17	105	126.7	1,116	6 E+03	7.07E+05	0.9	0.18	0 0	0 1	0 0	0 1
46-50	SW/SC	**2,400**	**490**	**220**	**150**	**12**	**70**	111 9	1,116	6 E+03	6 24E+05	1 5	0 31	0 1	0 1	0 0	0 0
51-55	SW/SC	12,700	4,095	0	2,375	291	1,735	111.9	1,116	6 E+03	6 24E+05	7.9	2 56	0 0	1 5	0 2	1 1
56-60	SW	**23,000**	**7,700**	**0**	**4,600**	**570**	**3,400**	108 4	1,116	6.E+03	6 05E+05	13 9	4 66	0 0	2 8	0 3	2 1
61-65	SW	11,550	3,858	0	2,309	287	1,708	108 4	1,116	6 E+03	6 05E+05	7 0	2 33	0 0	1 4	0 2	1 0
66-70	SW	**100**	**16**	**0**	**18**	**3**	**15**	113.9	1,116	6 E+03	6 36E+05	0 1	0 01	0 0	0 0	0 0	0 0
71-75	SW	210	98	0	109	552	243	113.9	1,116	6.E+03	6.36E+05	0.1	0 06	0 0	0 1	0 4	0 2
76-80	SW	**320**	**180**	**0**	**200**	**1,100**	**470**	113 9	1,116	6.E+03	6.36E+05	0.2	0 11	0 0	0 1	0 7	0 3
81-85	SW	320	180	0	200	1,100	470	113.9	1,116	6.E+03	6.36E+05	0.2	0 11	0 0	0 1	0 7	0 3
										Total	**1.09E+07**	**4,802**	**1,068**	**88**	**638**	**86**	**482**

[1] Numbers in bold are actual sampling results, others are estimated

Total VOCs =	**7,164 lbs**

Table 4-2

VOCs Mass Estimate for Area 2

Depth (ft) bgs.	Soil USC	PCE[1] (ug/kg)	TCE[1] (ug/kg)	1,2-DCE[1] (ug/kg)	Toluene[1] (ug/kg)	Ethyl Benzene[1] (ug/kg)	Xylenes[1] (ug/kg)	Bulk Density (pcf)	Area (ft^2)	Soil Volume (ft^3)	Soil Dry Weight (lbs.)	PCE Mass (lbs.)	TCE Mass (lbs.)	1,2-DCE Mass (lbs.)	Toluene Mass (lbs.)	Ethyl Benzene Mass (lbs.)	Xylenes Mass (lbs.)
0-5	SW	500	20	5	5	5	10	111 4	977	5 E+03	5 44E+05	0 3	0 01	0 0	0.0	0 0	0 0
6-10	SW	700	50	10	10	10	20	111 4	977	5 E+03	5 44E+05	0 4	0 03	0 0	0 0	0 0	0 0
11-15	SW	1,000	100	20	20	20	50	111.4	977	5 E+03	5 44E+05	0 5	0 05	0 0	0 0	0 0	0 0
16-20	GW	1,500	150	35	35	35	75	111 4	977	5 E+03	5.44E+05	0 8	0 08	0 0	0 0	0 0	0 0
21-25	SW	2,000	200	50	50	50	100	111 4	977	5 E+03	5 44E+05	1 1	0 11	0 0	0 0	0 0	0 1
26-30	SW/SC	216,000	19 600	1,925	3,075	1,975	7,050	111 9	977	5 E+03	5 47E+05	118 1	10 71	1.1	1 7	1 1	3 9
31-35	SC	**430,000**	**39,000**	**3,800**	**6,100**	**3,900**	**14,000**	126 7	977	5 E+03	6 19E+05	266 1	24 14	2 4	3 8	2 4	8 7
36-40	CL	3 015,000	2,319,500	3,575	1,153,050	96,950	557,000	126 7	977	5 E+03	6 19E+05	1866.1	1435 61	2 2	713 7	60 0	344 7
41-45	SC	**5,600,000**	**4,600,000**	3,350	**2,300,000**	**190,000**	**1,100,000**	126.7	977	5 E+03	6 19E+05	3466 0	2847 08	2 1	1423 5	117 6	680 8
46-50	SW/SC	3,005 000	2,420,000	3,125	1,210,000	100,000	578,500	111.9	977	5.E+03	5.47E+05	1642 6	1322 85	1 7	661 4	54 7	316 2
51-55	SW/SC	**410,000**	**240,000**	**2,900**	**120,000**	**10,000**	**57,000**	111 9	977	5 E+03	5 47E+05	224 1	131 19	1 6	65 6	5 5	31 2
56-60	SW	205,070	120,110	1,455	60,040	5,002	28,509	108 4	977	5 E+03	5.30E+05	108 6	63 60	0 8	31 8	2 6	15 1
61-65	SW	**140**	**220**	**9**	**79**	**4**	**18**	108 4	977	5 E+03	5 30E+05	0 1	0 12	0 0	0 0	0 0	0 0
66-70	SW	98	123	5	49	3	13	113 9	977	5 E+03	5.56E+05	0 1	0 07	0 0	0 0	0 0	0 0
71-75	SW	**56**	**26**	**0**	**18**	**2**	**8**	113.9	977	5 E+03	5 56E+05	0 0	0 01	0 0	0 0	0 0	0 0
76-80	SW	41,528	7,013	0	5,509	1,052	6,504	113 9	977	5.E+03	5 56E+05	23 1	3 90	0 0	3 1	0 6	3 6
81-85	SW	**83,000**	**14,000**	**0**	**11,000**	**2,100**	**13,000**	113.9	977	5.E+03	5 56E+05	46.2	7.79	0 0	6.1	1 2	7 2
										Total	**9.50E+06**	**7,764**	**5,847**	**12**	**2,911**	**246**	**1,412**

[1] Numbers in bold are actual sampling results, others are estimated

Total VOCs = 18,191 lbs

Table 4-3

VOCs Mass Estimate for Area 3

Depth (ft) bgs.	Soil USC	PCE[1] (ug/kg)	TCE[1] (ug/kg)	1,2-DCE[1] (ug/kg)	Toluene[1] (ug/kg)	Ethyl Benzene[1] (ug/kg)	Xylenes[1] (ug/kg)	Bulk Density (pcf)	Area (ft^2)	Soil Volume (ft^3)	Soil Dry Weight (lbs.)	PCE Mass (lbs.)	TCE Mass (lbs.)	1,2-DCE Mass (lbs.)	Toluene Mass (lbs.)	Ethyl Benzene Mass (lbs.)	Xylenes Mass (lbs.)
0-5	SW	500	20	20	20	20	20	111.4	1,814	9.E+03	1.01E+06	0.5	0.02	0.0	0.0	0.0	0.0
6-10	SW	700	50	50	50	50	50	111.4	1,814	9.E+03	1.01E+06	0.7	0.05	0.1	0.1	0.1	0.1
11-15	SW	1,000	100	100	100	100	100	111.4	1,814	9.E+03	1.01E+06	1.0	0.10	0.1	0.1	0.1	0.1
16-20	GW	1,500	150	150	150	150	300	111.4	1,814	9.E+03	1.01E+06	1.5	0.15	0.2	0.2	0.2	0.3
21-25	SW	2,000	200	200	200	200	500	111.4	1,814	9.E+03	1.01E+06	2.0	0.20	0.2	0.2	0.2	0.5
26-30	SW/SC	2,500	3,600	1,000	2,500	1,000	2,500	111.9	1,814	9.E+03	1.01E+06	2.5	3.65	1.0	2.5	1.0	2.5
31-35	SC	712,500	41,800	18,909	125,553	18,205	99,535	126.7	1,814	9.E+03	1.15E+06	818.8	48.04	21.7	144.3	20.9	114.4
36-40	CL	1,400,000	80,000	16,455	69,777	16,103	56,768	126.7	1,814	9.E+03	1.15E+06	1608.8	91.93	18.9	80.2	18.5	65.2
41-45	SC	**52,000**	**14,000**	**14,000**	**14,000**	**14,000**	**14,000**	126.7	1,814	9.E+03	1.15E+06	59.8	16.09	16.1	16.1	16.1	16.1
46-50	SW/SC	26,270	7,028	7,028	7,028	7,038	7,140	111.9	1,814	9.E+03	1.01E+06	26.7	7.13	7.1	7.1	7.1	7.2
51-55	SW/SC	**540**	**55**	**55**	**55**	**76**	**280**	111.9	1,814	9.E+03	1.01E+06	0.5	0.06	0.1	0.1	0.1	0.3
56-60	SW	390	108	53	60	64	180	108.4	1,814	9.E+03	9.83E+05	0.4	0.11	0.1	0.1	0.1	0.2
61-65	SW	**240**	**160**	**52**	**64**	**52**	**80**	108.4	1,814	9.E+03	9.83E+05	0.2	0.16	0.1	0.1	0.1	0.1
66-70	SW	190	107	52	58	52	67	113.9	1,814	9.E+03	1.03E+06	0.2	0.11	0.1	0.1	0.1	0.1
71-75	SW	**140**	**53**	**53**	**53**	**53**	**53**	113.9	1,814	9.E+03	1.03E+06	0.1	0.05	0.1	0.1	0.1	0.1
76-80	SW	**200**	**51**	**51**	**51**	**51**	**58**	113.9	1,814	9.E+03	1.03E+06	0.2	0.05	0.1	0.1	0.1	0.1
81-85	SW	**120**	**51**	**51**	**51**	**51**	**58**	113.9	1,814	9.E+03	1.03E+06	0.1	0.05	0.1	0.1	0.1	0.1
										Total	**1.76E+07**	**2,524**	**168**	**66**	**251**	**65**	**207**

[1] Numbers in bold are actual sampling results, others are estimated.

Total VOCs =	3,281 lbs

Table 4-4

VOCs Mass Estimate for Area 4

Depth (ft) bgs.	Soil USC	PCE[1] (ug/kg)	TCE[1] (ug/kg)	1,2-DCE[1] (ug/kg)	Toluene[1] (ug/kg)	Ethyl Benzene[1] (ug/kg)	Xylenes[1] (ug/kg)	Bulk Density (pcf)	Area (ft^2)	Soil Volume (ft^3)	Soil Dry Weight (lbs.)	PCE Mass (lbs.)	TCE Mass (lbs.)	1,2-DCE Mass (lbs.)	Toluene Mass (lbs.)	Ethyl Benzene Mass (lbs.)	Xylenes Mass (lbs.)
0-5	SW	180	22	0	0	0	0	111.4	1,116	6.E+03	6.22E+05	0.1	0.01	0.0	0.0	0.0	0.0
6-10	SW	180	22	0	0	0	0	111.4	1,116	6.E+03	6.22E+05	0.1	0.01	0.0	0.0	0.0	0.0
11-15	SW	180	22	0	0	0	0	111.4	1,116	6.E+03	6.22E+05	0.1	0.01	0.0	0.0	0.0	0.0
16-20	GW	**180**	**22**	**0**	**0**	**0**	**0**	111.4	1,116	6.E+03	6.22E+05	0.1	0.01	0.0	0.0	0.0	0.0
21-25	SW	28,590	961	0	0	0	0	111.4	1,116	6.E+03	6.22E+05	17.8	0.60	0.0	0.0	0.0	0.0
26-30	SW/SC	**57,000**	**1,900**	**0**	**180**	**0**	**240**	111.9	1,116	6.E+03	6.24E+05	35.6	1.19	0.0	0.1	0.0	0.1
31-35	SC	1,428,500	80,950	0	34,090	13,000	60,120	126.7	1,116	6.E+03	7.07E+05	1009.9	57.23	0.0	24.1	9.2	42.5
36-40	CL	**2,800,000**	**160,000**	**0**	**68,000**	**26,000**	**120,000**	126.7	1,116	6.E+03	7.07E+05	1979.6	113.12	0.0	48.1	18.4	84.8
41-45	SC	1,407,500	80,460	0	34,225	13,130	60,750	126.7	1,116	6.E+03	7.07E+05	995.1	56.88	0.0	24.2	9.3	42.9
46-50	SW/SC	**15,000**	**920**	**0**	**450**	**260**	**1,500**	111.9	1,116	6.E+03	6.24E+05	9.4	0.57	0.0	0.3	0.2	0.9
51-55	SW/SC	15,000	620	0	335	235	1,300	111.9	1,116	6.E+03	6.24E+05	9.4	0.39	0.0	0.2	0.1	0.8
56-60	SW	**15,000**	**320**	**0**	**220**	**210**	**1,100**	108.4	1,116	6.E+03	6.05E+05	9.1	0.19	0.0	0.1	0.1	0.7
61-65	SW	49,500	1,310	0	760	585	3,300	108.4	1,116	6.E+03	6.05E+05	29.9	0.79	0.0	0.5	0.4	2.0
66-70	SW	**84,000**	**2,300**	**0**	**1,300**	**960**	**5,500**	113.9	1,116	6.E+03	6.36E+05	53.4	1.46	0.0	0.8	0.6	3.5
71-75	SW	132,000	4,550	0	2,350	1,480	8,250	113.9	1,116	6.E+03	6.36E+05	83.9	2.89	0.0	1.5	0.9	5.2
76-80	SW	**180,000**	**6,800**	**0**	**3,400**	**2,000**	**11,000**	113.9	1,116	6.E+03	6.36E+05	114.4	4.32	0.0	2.2	1.3	7.0
81-85	SW	180,000	6,800	0	3,400	2,000	1,100	113.9	1,116	6.E+03	6.36E+05	114.4	4.32	0.0	2.2	1.3	0.7
										Total	**1.09E+07**	**4,462**	**244**	**0**	**104**	**42**	**191**

[1] Numbers in bold are actual sampling results, others are estimated

Total VOCs =	5,043 lbs

In order to quantify and calculate the mass of VOCs, the following assumptions were made:

1. The soil impacted with VOCs is cylindrical in shape encompassing a diameter of 80 feet with the center at extraction well VW-14 - *see Figure 4-1*;

2. The dry well vicinity was divided into 4 areas for the purpose of VOC mass estimation. The four areas are shown in Figure 4-1. The vertical soil concentration profiles of each area can be represented by specific analytical results:

   Area 1 – Estimation based on soil data collected from boring TT-6,

   Area 2 – Estimation based on soil data collected from boring TT-5,

   Area 3 – Estimation based on an approximation of soil data collected from borings TT-4, TT-5, and TT-6 for soils greater than 40 feet bgs, in addition to data collected from Dry Well 3 in June 1997 for soils less than 40 feet bgs,

   Area 4 – Estimation based on soil data collected from boring TT-4;

3. The vadose zone depth of 85 feet bgs was used for estimating the mass of VOCs.

After determining the average VOC concentration (C) for each compound, the total VOC mass was calculated by applying (C) to the corresponding soil volume and associated soil bulk density. The equation for soil VOC mass calculation is as follows:

$$VOC\ Mass = 10^{-9}\, CV\rho_b$$

Parameters:

C = Soil VOC Concentration (µg/kg)

V = Soil Volume (ft^3)

ρ_b = Soil Bulk Density (lbs/ft^3)

4.2 CURRENT VOC MASS DISTRIBUTION

Based on chemical data, mass calculations of VOCs were conducted and summarized for each of the four areas in Tables 4-1 through 4-4. Table 4-5 presents a summary of total mass estimates of VOCs for each area. The current distribution of VOC mass for each of the four areas is summarized below.

Area 1

The mass of VOCs for Area 1 surrounding dry well #1 is approximately 7,200 lbs. The mass of 99% of the VOCs is located from 20 to 35 feet bgs. Note that the nearest extraction well VW-13 has a screen interval from 45 to 85 feet bgs.

Area 2

The mass of VOCs for Area 2 surrounding dry well #2 is approximately 18,000 lbs, and represents more than half of the total remaining mass. The mass of 96% of the VOCs is located from 31 to 55 feet bgs. There is no active extraction well within this area.

Table 4-5

Summary of VOC Mass Estimate

Area	Mass of VOC Compound in pounds (lbs.)						VOC Mass Subtotal by Area (lbs.)
	PCE	TCE	1,2-DCE	Toluene	Ethyl benzene	Xylenes	
1	4,800	1,100	88	640	90	480	7,200
2	7,800	5,800	12	2,900	250	1,400	18,000
3	2,500	170	66	250	65	210	3,300
4	4,500	240	0	100	42	190	5,100
VOC Mass Subtotal by Compound (lbs.)	20,000	7,300	170	3,900	450	2,300	**34,000 lbs. Total VOC Mass**

Area 3

The mass of VOCs for Area 3 surrounding dry well #3 is approximately 3,300 lbs.

Area 4

The mass of VOCs for Area 4 is approximately 5,100 lbs. The mass of 90% of the VOCs is located from 31 to 45 feet bgs. Additionally, there is no active extraction well within this area.

Total VOC Mass

As presented in Table 4-5, the total estimated mass of VOCs currently remaining in the soils located in the immediate vicinity of the dry wells is 34,000 lbs. The VOC mass remaining includes approximately 20,000 lbs of PCE, 7,300 lbs of TCE, 170 lbs of 1,2-DCE, 3,900 lbs of toluene, 440 lbs of ethylbenzene, and 2,300 lbs of xylenes.

In addition to the current VOC mass, a calculation of the VOC mass extracted by the SVE system from 1991 through 1998 was also determined. The total VOC mass extracted was determined by reviewing all historical operation and monitoring records. Based on the concentrations of VOCs in the airstream and volume of air extracted, an estimated 38,000 lbs of VOCs were removed from 1991 through 1998.

Based on the calculated extraction of 38,000 lbs of VOCs from 1991 through 1998 and an additional 34,000 lbs of VOCs that currently remain in place, an estimated total of 71,000 lbs of VOCs are estimated to have been in the subsurface soil prior to operation of the SVE system.

Vertical Distribution of VOC Mass

To determine the vertical distribution of VOC mass, total VOC concentrations at the site were estimated in 5-foot depth intervals for each of the four areas (Areas 1, 2, 3, and 4). Vertical concentration profile data was calculated based on VOC analytical data collected in August 1998. A summary of total VOC vertical profile concentrations at each depth interval for the four areas are presented in Table 4-6.

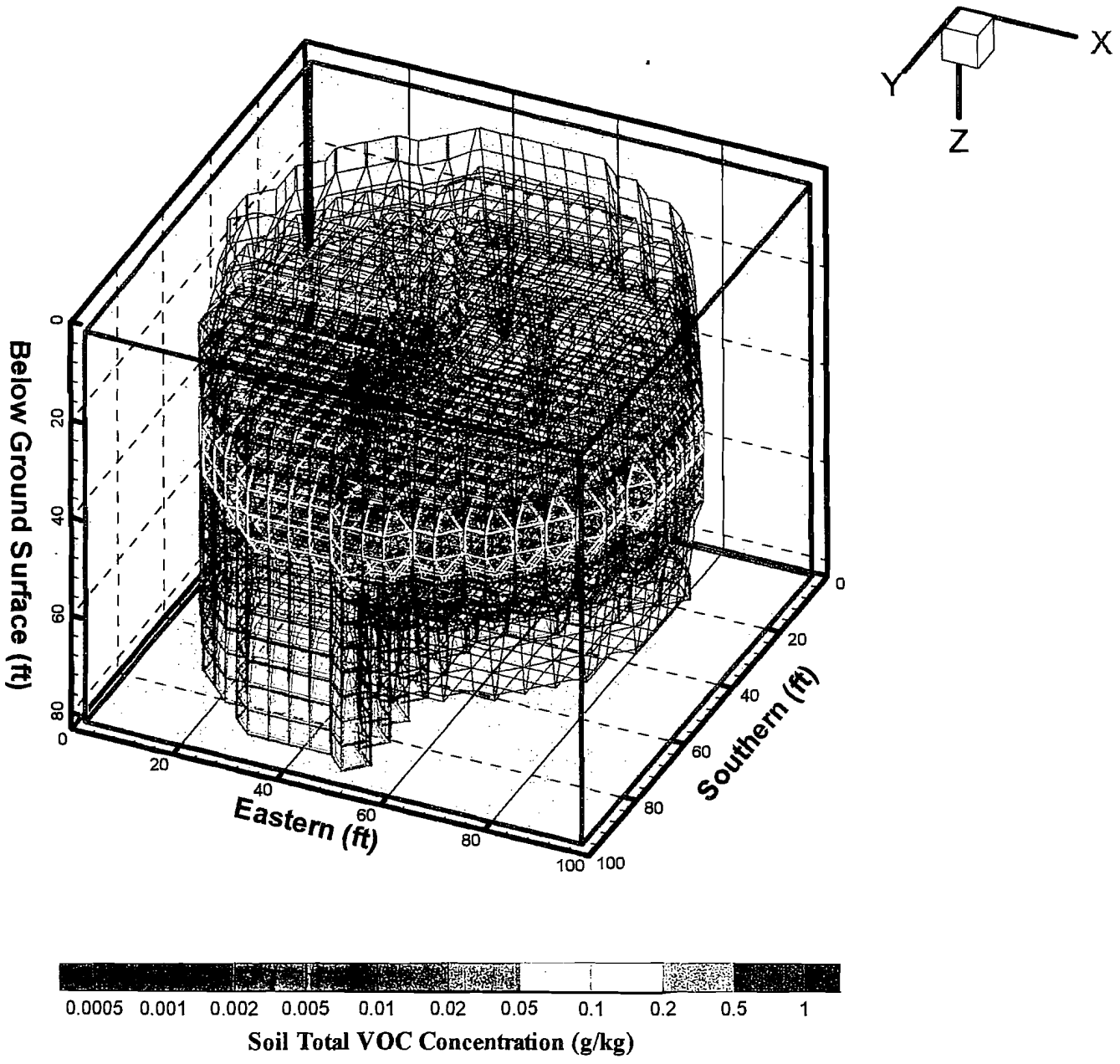
As shown in Table 4-6, most of the remaining VOC mass is located between 26 and 50 feet bgs. Based on site geology, the VOC mass appears to be located primarily within fine-grained soil zones. Figure 4-2 presents a three-dimensional (3-D) plot of the current VOC mass distribution in the soil.

Table 4-6

Summary of Vertical Mass Profiles for Total VOCs

Depth (ft)	Vertical Mass Profiles of Total VOCs by Area (lbs.)			
	Area 1	Area 2	Area 3	Area 4
0-5	0.3	0.3	0.5	0.1
6-10	0.3	0.4	1.2	0.1
11-15	0.6	0.6	1.5	0.1
16-20	1.0	0.9	2.6	0.1
21-25	1700	1.3	3.3	18
26-30	3400	137	13	37
31-35	1900	310	1200	1100
36-40	0.22	4400	1900	2200
41-45	1.3	8500	140	1100
46-50	2.0	4000	62	11
51-55	13	460	1.2	11
56-60	24	220	1.0	10
61-65	12	0.2	0.8	34
66-70	0.1	0.2	0.7	60
71-75	0.9	0.0	0.6	94
76-80	1.4	34	0.7	130
81-85	1.4	68	0.6	123
Total VOC Mass by Area (lbs.)	7100	18000	3300	4900

Figure 4-2 Mass Distribution of Remaining VOC In The Dry Well Area



4.3 ASSUMPTIONS OF VOC MASS ESTIMATE

The VOC mass estimate for each area was based on limited data and the assumptions used in the calculations. The assumptions included an estimate the size of the area impacted with VOCs. In order to provide a conservative estimate of the current VOC mass, the following two items were assumed:

1. The VOC plume is contained within a circular area with a diameter of 80 feet, where high VOC concentrations are present.

2. The soil concentrations in the each of the 4 areas were assumed to be uniform for each depth interval. The concentrations in each interval were represented by a high concentration profile at the dry wells.

Based on the analytical data, the amount of VOC mass represents a conservative estimate. Further, if the circular area was assumed to have a diameter of 60 feet (instead of 80 feet), the estimate of remaining VOCs would be 20,000 lbs or 40% less.

Section 5

Assessment of Current SVE System

5.1 TECHNICAL APPROACH

The objective of this evaluation is to determine whether the existing SVE system is capable of reducing volatile organic compound (VOC) concentrations to below soil cleanup levels established by NYSDEC in the Record of Decision (ROD).

The existing configuration of the SVE system was evaluated to determine if RSCOs can be attained without modifications to the system (i.e., without adding new wells or equipment). Air flow was modeled using the AIR3D numerical model developed by the United States Geological Survey (USGS). Data from the air flow model was then input into the VT3D numerical model to calculate VOC mass transport. The VOC mass transport model was used to predict VOC removal rates and the total mass of VOCs that will be removed using the existing system. A description of the existing SVE system and its standard operating parameters is presented in Section 5.2. The air flow modeling results are discussed in Section 5.3, and the VOC mass transport modeling results are presented in Section 5.4.

5.2 DESCRIPTION OF CURRENT SVE SYSTEM

The SVE system is located at the southeast corner of the Great Neck facility's main building and operated from January 1994 until June 15, 1998. During this period, approximately 37,723 pounds of VOCs were recovered from wells VW-1, VW-2, VW-13 and VW-14. The depths and screened intervals for the four wells are summarized in Table 5-1.

Table 5-1

Summary of Existing Extraction Wells

Extraction Well	Well Depth (feet)	Screened Interval (feet)
VW1	91	51 - 91
VW2	45	24 - 45
VW13	85	45 - 85
VW14	40	20 - 40

In addition to the extraction wells, ten vapor wells were used for monitoring VOC concentrations in soil vapor. The depths and screened intervals for the vapor monitoring wells are summarized in Table 5-2.

Table 5-2

Summary of Existing Vapor Monitoring Wells

Vapor Monitoring Well	Well Depth (feet)	Screened Interval (feet)
VW3	93	73 - 93
VW4	90	60 - 90
VW5	93	63 - 93
VW6	90	70 - 90
VW7	47	37 - 47
VW8	87	67 - 87
VW9	90	70 - 90
VW10	90	70 - 90
VW11	90	70 - 90
VW12	90	70 - 90

Figure 5-1 presents an overview of the extraction wells, monitoring wells and the current lateral extent of the VOC plume.

Each of the four extraction wells are connected to a common manifold via 4-inch diameter, Schedule 40 PVC piping. From the manifold, the piping is connected in parallel to two centrifugal blowers. VOC vapors are treated using a catalytic oxidizer with a wet scrubber for emission control. Figure 5-2 shows a schematic of the SVE system currently installed at the site.

Prior to shutdown, the SVE system was operating at the following parameters:

- Soil vapor flow rate*: 150 to 300 scfm
- Vacuum on suction side of blower: 20 to 25 inches of water
- Continuous operation with ability to take individual vent wells on and off-line
- Influent air temperature: 70°F to 74°F
- Effluent air temperature: 120°F to 140°F at blower
- Total organic vapor concentration: Up to 10,000 ppm of total VOCs

** The design capacity of the existing SVE system is 400-500 scfm, as outlined in the SVE IRM work plan*

5.3 AIR FLOW MODELING

To determine whether the existing system will meet the remedial goals established by the ROD, the air flow and vacuum distribution were evaluated across the dry well area. The AIR3D numerical air flow code was utilized to simulate the effectiveness of the existing vapor extraction system under different system configurations.

The locations, depths, screened intervals of the existing wells, and the extraction flow rates, were input into AIR3D to model the VOC capture zone and soil air flushing frequency. Actual operating data obtained during the SVE pilot test and system operation was used to calibrate the model and verify calculated flow rates and area of influence.

FIGURE 5-1
OVERVIEW OF EXISTING EXTRACTION WELLS

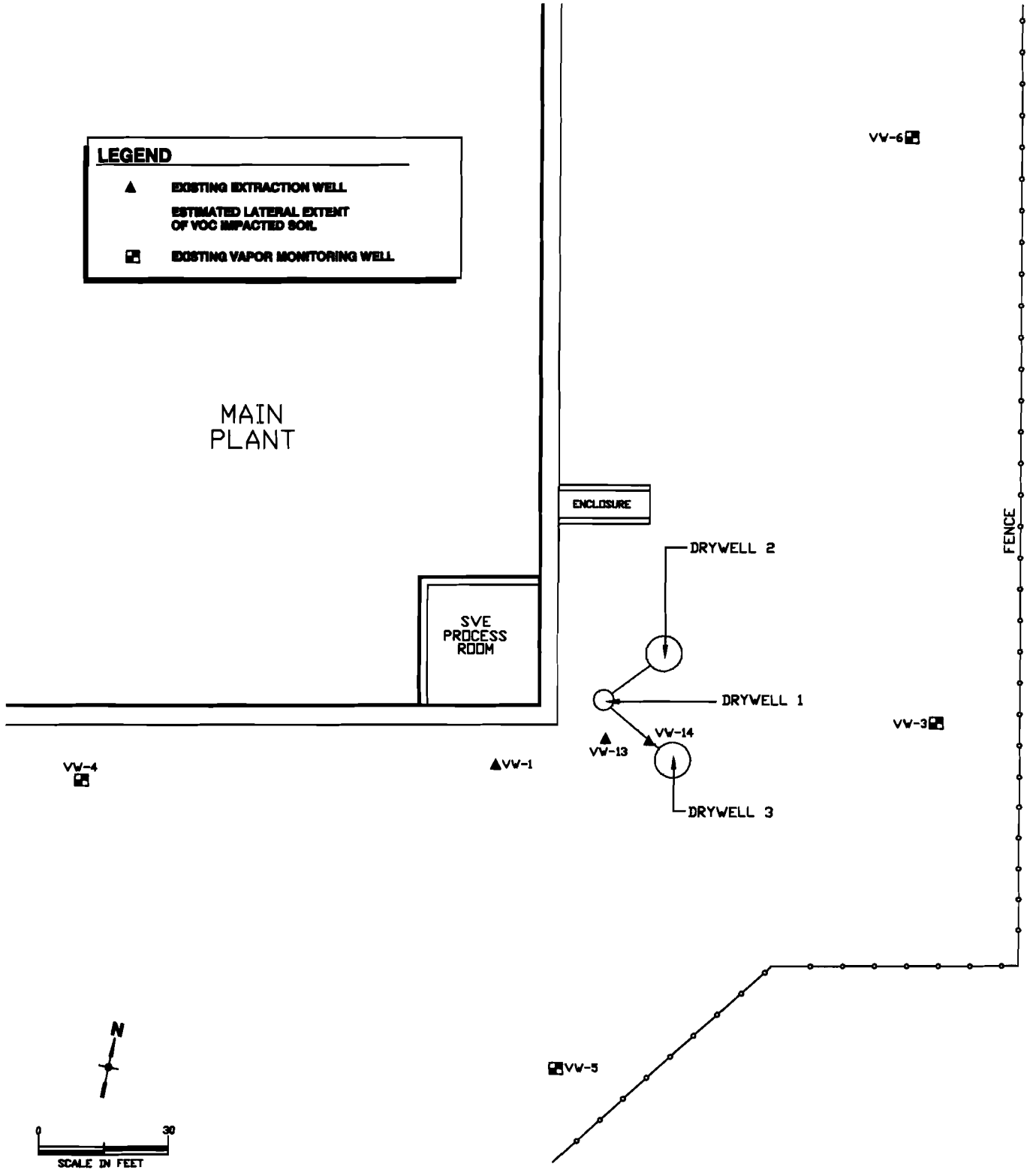
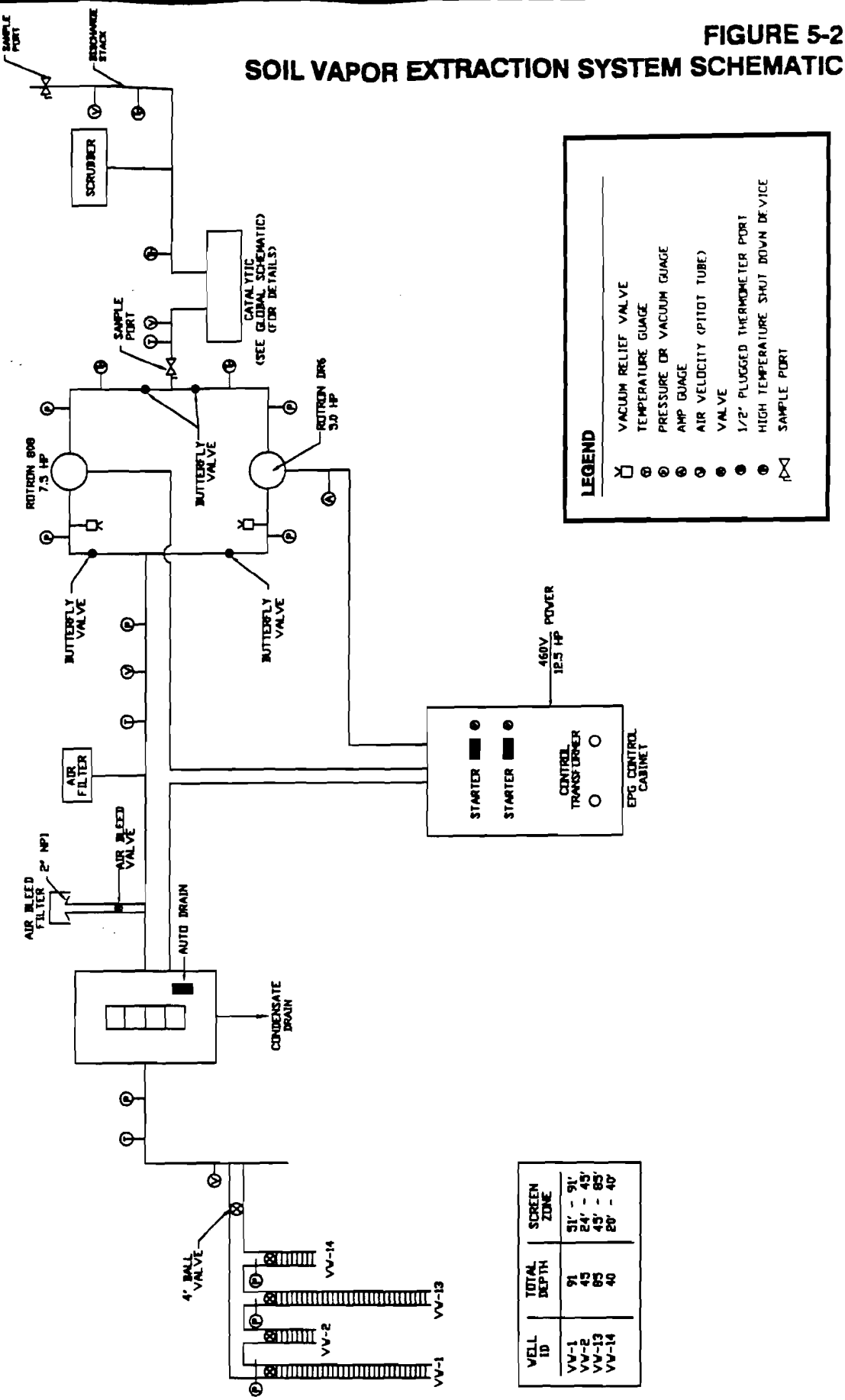


FIGURE 5-2
SOIL VAPOR EXTRACTION SYSTEM SCHEMATIC



WELL ID	TOTAL DEPTH	SCREEN ZONE
VV-1	91	91' - 91'
VV-2	45	24' - 45'
VV-13	85	45' - 85'
VV-14	40	20' - 40'

5.3.1 Model Domain

The model domain covers an area of 36,000,000 square feet (6000 by 6000 feet) and is centered at extraction well VW-14. A fine grid, with a cell size of 2 feet by 2 feet, was used to cover the central dry well area. As shown on Figure 5-3 at the end of this section, the central area measured 100 feet by 100 feet and is covered by 2500 cells (50 x 50) using the fine grid. The cell size was gradually increased toward the model side boundaries.

Vertically, the 85-foot-thick unsaturated zone was divided into seventeen 5-foot thick layers. A large plane area model domain for air flow was adequate for a constant boundary condition in this type of application.

5.3.2 Model Calibration

The AIR3D model was calibrated to ensure that the simulated volumetric flow rates agreed with field values observed during the historical SVE operation. Model calibration included inputting average values for air filled soil porosity and assumed values for soil air permeability. The soil parameters used for this model were based on lithological and geotechnical data obtained from soil samples collected in August 1998.

5.3.2.1 Air Filled Soil Porosity

Air filled soil porosity was calculated by subtracting water filled soil porosity (water moisture content by volume) from total soil porosity. The soil porosity parameters are summarized in Table 5-3. The average values of air filled soil porosity listed in the table were applied in the model.

Table 5-3

Summary of Soil Parameters Used in Modeling Simulations

Depth bgs.	Soil USC	Soil Samples	Average Soil Bulk Density		Average Moisture Content (%)		Average Soil Porosity	Average Air Fill Porosity	Average Total Organic Carbon Content (TOC)	Distribution Coefficient Kd=Koc*TOC (l/mg)
			(pcf)	(g/cm^3)	By Weight	By Volume				
0 to 25 ft	SW	TT2-62, TT4-60, TT2-72, TT4-70, TT2-82	112.5	1.803	15.69	25.02	0.3219	0.0717	0.342%	1.7
26 to 30 ft	SW/SC	TT2-52,TT4-50	111.9	1.793	13.29	23.87	0.3295	0.0908	0.200%	1.0
31 to 45 ft	SC/CL	TT2-40, TT6-30, TT6-40	126.7	2.030	11.40	23.14	0.2475	0.0161	0.433%	2.2
46 to 55 ft	SW/SC	TT2-52, TT4-50	111.9	1.793	13.29	23.87	0.3295	0.0908	0.200%	1.0
56 to 65 ft	SW	TT2-62, TT4-60	108.4	1.737	17.82	21.43	0.3531	0.1388	0.395%	2.0
66 to 75 ft	SW	TT2-72, TT4-70	113.9	1.825	15.22	27.74	0.3087	0.0313	0.440%	2.2
76 to 85 ft	SW	TT2-82	115.2	1.846	14.02	25.89	0.3038	0.0449	0.190%	1.0

5.3.2.2 Soil Air Permeability

Soil air permeability values correlate with soil types. For the site, a layer cake model was assumed, such that a homogeneous air permeability field was used for each layer. For layers with similar soil types, equivalent air permeability values were assumed. A review of the site geology shows that the subsurface can be divided into three general soil types: (1) clayey sands and clays, located at 30 to 45 feet bgs; (2) sands and clayey sands, located at 26 to 30 feet bgs, and 45 to 55 feet bgs; and (3) sands and gravels, located at 0 to 25 feet bgs, and 55 to 85 feet bgs. The soil layers and corresponding soil air permeability values are listed in Table 5-4.

Table 5-4

Calibrated Soil Air Permeability Values

Depth Range (feet bgs)	Soil Type[1]	Soil Air Permeability [2] (darcys)
0 - 25	Sands and Gravels (SW/GW)	74
26 - 30	Sands and Clayey Sands (SW/SC)	7.4
30 - 45	Clayey Sands and Clays (SC/CL)	2
45 - 50	Sands and Clayey Sands (SW/SC)	7.4
55 - 85	Sands and Gravels (SW/GW)	74

[1] Unified Soil Classification System (USCS) codes are shown in parentheses
[2] An anisotropy ratio, (horizontal - vertical ratio of soil air permeability) of 5:1 was assumed for all soil types

The actual soil air permeability values were calibrated by using the field SVE operational data. The model assumed that the soil column from the surface to 80 feet bgs was unsaturated. The field pneumatic data from the SVE pilot test conducted for well VW01 in November 1991 by Unisys Corporation were used initially to estimate the soil air permeability for the sand and gravel soil group (SW/GW), as cross correlated to the well screen interval of 51 to 91 feet

bgs. The field SVE data from four operational cases were also used for the calibrations of soil air permeability. The vacuums were specified for each well as the operation condition. Flow rates from the model simulations were compared to the actual extraction flow rates for each trial run. The air permeability values were modified, as necessary, to allow the best match of model simulated flow rates to actual operation flow rates for each well. The results are summarized in Table 5-5. Based on the calibration results, the soil air permeability values are 2, 7.4 and 74 darcys for the three soil types, as shown in Table 5-4.

Table 5-5

SVE Operation Data for AIR3D Model Calibration

SVE Operating Cases	SVE Operation Date	Vacuum Readings (inch H_2O)				Reported Total Volumetric Flow Rate (scfm)	Total Volumetric Flow Rate (scfm) Simulated by AIR3D
		VW01	VW02	VW13	VW14		
Pilot Test Data	Oct-91	20	-	-	-	350	334
Pilot Test Data	Oct-91	14	-	-	-	262	232
Case 1	Apr-95	-	38	-	35	219	205
Case 2	Apr-97	10	15	11	12	263	309
Case 3	Feb-98	12	-	12	-	265	271
Case 4	May-98	10	-	12	10	268	312

5.3.3 Subsurface Air Flow Simulation Results

To evaluate the air pressure distribution within the subsurface, four different SVE scenarios were modeled using the existing extraction wells (hereinafter referred to as Cases #1 to #4). The case scenarios varied in terms of extraction flow rate, vacuum and the wells used for extraction. A summary of the four case scenarios is presented in Table 5-6.

Table 5-6

Air Flow Model Case Scenarios

Case Scenario	Extraction Wells	Total Extraction Flow Rate (scfm)	Vacuum (inches of water)
1	VW2 and VW14	205	38 in VW2 35 in VW14
2	VW1, VW2, VW13 and VW14	309	10 in VW1 15 in VW2 11 in VW13 12 in VW14
3	VW1 and VW13	271	12 in VW2 12 in VW14
4	VW1, VW13 and VW14	312	10 in VW1 12 in VW13 10 in VW14

For each case scenario, pressure distributions were evaluated at five discrete soil layers, at 5-foot thicknesses. Individual simulations were run at 10 to 15 feet, 25 to 30 feet, 35 to 40 feet, 45 to 50 feet, and 65 to 70 feet. A total of 20 different simulations were run to assess the air flow parameters of the current SVE system.

The model outputs, which show the spatial air pressure distributions in the subsurface around the dry well area for each model simulation, are shown as Figures 5-4 through 5-23 and are presented at the end of this section. The figures are depicted in two-dimensional (2-D) plane view. The cutoff vacuum used to determine the area of influence was assumed to be 0.5 inches of water. The results of the four case models are further discussed in the following subsections.

5.3.3.1 Case #1

In Case #1, extraction was conducted from shallow wells VW2 and VW14. The pressure fields created by the SVE indicate that the vacuum area of influence covered the dry well area only at the depth interval of 25 to 40 ft bgs. The pressure distributions are shown in Figures 5-4 through 5-8.

5.3.3.2 Case #2

In Case #2, extraction was conducted from VW2 and VW14, and two deep vapor extraction wells VW1 and VW13. The vacuum area of influence appears to be adequate for the vadose zone except at the depth interval of 0 to 15 ft bgs. The pressure distributions are shown in Figures 5-9 through 5-13.

5.3.3.3 Case #3

In Case #3, extraction was conducted only from the two deep wells VW1 and VW13. The shallow vadose zone from ground surface to 35 feet bgs had very low vacuum influence. A stronger vacuum area of influence was observed at depths below 35 feet bgs. The pressure distributions are shown in Figures 5-14 through 5-18.

5.3.3.4 Case #4

In Case #4, extraction was conducted from VW1, VW13 and VW14, which was the most recent SVE well configuration operated at the site. The shallow vadose zone from ground surface to 25 feet bgs had low vacuum influence. A stronger vacuum area of influence was observed at depths below 25 feet bgs. The pressure distributions are shown in Figures 5-19 through 5-23.

5.3.4 Evaluation of Air Flow Simulation Data

The air flow model simulations indicate that the vadose zone in the dry well area has adequate vacuum area of influence for an effective SVE operation. However, approximately 33,680 lbs of VOCs still remain in the vadose zone, mostly in the finer grained, low-permeability soils. The existing SVE system has not been capable of removing VOCs more rapidly, due to the extraction wells being screened across different soil types. For wells screened across both

high and low-permeability soils, air will flow preferentially through the high-permeability soils. As a result, VOCs are removed more readily from high-permeability soils than low-permeability soils under the same vacuum conditions. Furthermore, based on the modeling results, vacuums of less than 0.5 inches of water are not sufficient to induce air flow in low-permeability soils at the site. To further evaluate the SVE system, VOC mass transport modeling studies were conducted - *see Section 5.4.*

5.4 VOC MASS TRANSPORT MODELING

Estimation of the VOC mass removal rate at the site was performed utilizing the VT3D model. The VT3D model uses input from the AIR3D to calculate the rate of removal and estimated time to complete remediation of the site. Total VOC mass and compound specific vapor pressures, together with air flow rates, were used to calculate VOC removal rates.

5.4.1 Model Domain

The VOC mass transport model domain covers the dry well area and is centered at extraction well VW-14. A fine grid, with a cell size of 4 feet by 4 feet, was used to cover the dry well area. As shown on Figure 5-24 at the end of this section, the central area measured 100 feet by 100 feet and is covered by 1250 cells (25 x 25 cells). Vertically, the 85-foot-thick unsaturated zone was divided into seventeen 5-foot thick layers. The model has total grids of 25x25x17. This model domain in plane was much smaller than the flow model domain, because there are no boundary condition problems in the mass transport model. The air flow results from the central dry well area were extracted from the flow model outputs and input into the VT3D model.

5.4.2 Physical and Chemical Parameters

Soil physical and chemical parameters used in the VOC mass transport model, including bulk density, total organic carbon, and the distribution coefficient are listed in Table 5-3. The

VOC molecular weight of 145 grams/mole was used, which was weighted by mass percentages of each VOC with their molecular weights. Similar calculations were performed for total VOC solubility in water (397 mg/l) and density of total VOC liquids (1439 g/l).

5.4.3 VOC Mass Transport Simulation Results

VOC mass transport was simulated using the Case #4 well configuration, because it was the configuration used most recently during full-scale SVE operation. In Case #4, extraction was conducted from VW1, VW13 and VW14. Based on the modeling results, approximately 5,500 lbs, or only 17% of the remaining VOCs, will be recovered from the vadose zone in a three-year period using the current SVE system.

Table 5-7 summarizes the VT3D modeling results. Figures 5-25 through 5-28 present the calculated VOC vapor concentrations and the cumulative anticipated VOC mass recovered (from each well individually, and combined).

5.4.4 Evaluation of VOC Transport Data

The VT3D modeling results show that the current SVE system will remove less than 17% of the total remaining VOC mass in the vadose zone within three years. As shown in Figure 5-28b, the transport model projects that operation of the existing SVE system, as currently configured, would require at least 28 years to remove 93% of the remaining VOCs at the site.

Table 5-7 VT3D Modeling Simulation Results for Case 4:

VOC Vapor Concentrations and Recovering VOC Mass From Extraction Wells

Time (month)	VW01		VW13		VW14		Combined VOC Vapor Concentration (ug/l)	Monthly Recovering VOC Mass (lbs)	Total Cumulative VOC Mass (lbs)
	VOC Vapor Concentration (ug/l)	Recovering VOC Mass (lbs)	VOC Vapor Concentration (ug/l)	Recovering VOC Mass (lbs)	VOC Vapor Concentration (ug/l)	Recovering VOC Mass (lbs)			
1	272	70.6	364	157.9	1258	199.5	502	428.0	428.0
2	130	33.8	400	173.6	1225	194.3	471	401.7	829.7
3	87	22.7	379	164.5	1082	171.6	421	358.8	1188.5
4	56	14.5	333	144.4	1058	167.7	383	326.7	1515.1
5	33	8.7	272	118.2	1023	162.2	339	289.0	1804.2
6	19	5.0	214	92.9	946	150.0	291	247.9	2052.0
7	11	3.0	169	73.1	890	141.2	255	217.3	2269.3
8	7	1.9	138	59.7	866	137.4	233	199.0	2468.3
9	6	1.4	119	51.5	838	132.8	218	185.7	2654.0
10	5	1.2	109	47.1	812	128.8	208	177.1	2831.1
11	4	1.2	104	45.0	784	124.4	200	170.5	3001.6
12	4	1.1	102	44.1	752	119.2	193	164.5	3166.1
13	4	1.1	101	43.8	725	115.0	188	160.0	3326.0
14	4	1.2	101	43.8	698	110.6	183	155.6	3481.7
15	5	1.2	101	43.9	643	101.9	172	147.0	3628.6
16	5	1.2	102	44.1	534	84.7	152	129.9	3758.5
17	5	1.2	102	44.2	425	67.4	132	112.8	3871.3
18	5	1.2	102	44.1	357	56.6	120	102.0	3973.3
19	5	1.2	100	43.3	323	51.3	112	95.8	4069.1
20	5	1.3	98	42.4	308	48.8	108	92.4	4161.5
21	5	1.3	97	41.9	300	47.5	106	90.7	4252.2
22	5	1.3	96	41.7	295	46.8	105	89.9	4342.1
23	5	1.3	96	41.7	293	46.4	105	89.3	4431.4
24	5	1.3	96	41.6	291	46.1	104	89.0	4520.4
25	5	1.3	96	41.5	289	45.8	104	88.6	4609.0
26	5	1.3	94	41.0	287	45.6	103	87.9	4696.9
27	5	1.3	90	39.3	286	45.4	101	85.9	4782.8
28	5	1.3	88	38.3	285	45.2	99	84.8	4867.6
29	5	1.3	87	37.9	284	45.0	99	84.2	4951.8
30	5	1.3	87	37.7	283	44.8	98	83.8	5035.6
31	5	1.3	86	37.5	282	44.6	98	83.4	5119.0
32	5	1.3	86	37.3	281	44.5	98	83.1	5202.1
33	5	1.3	86	37.1	280	44.3	97	82.8	5284.9
34	5	1.3	85	36.9	279	44.2	97	82.4	5367.3
35	5	1.3	84	36.7	278	44.0	96	82.0	5449.3
36	5	1.3	84	36.2	275	43.7	95	81.2	5530.5
Total		195.8		2145.7		3189.0		5530.5	

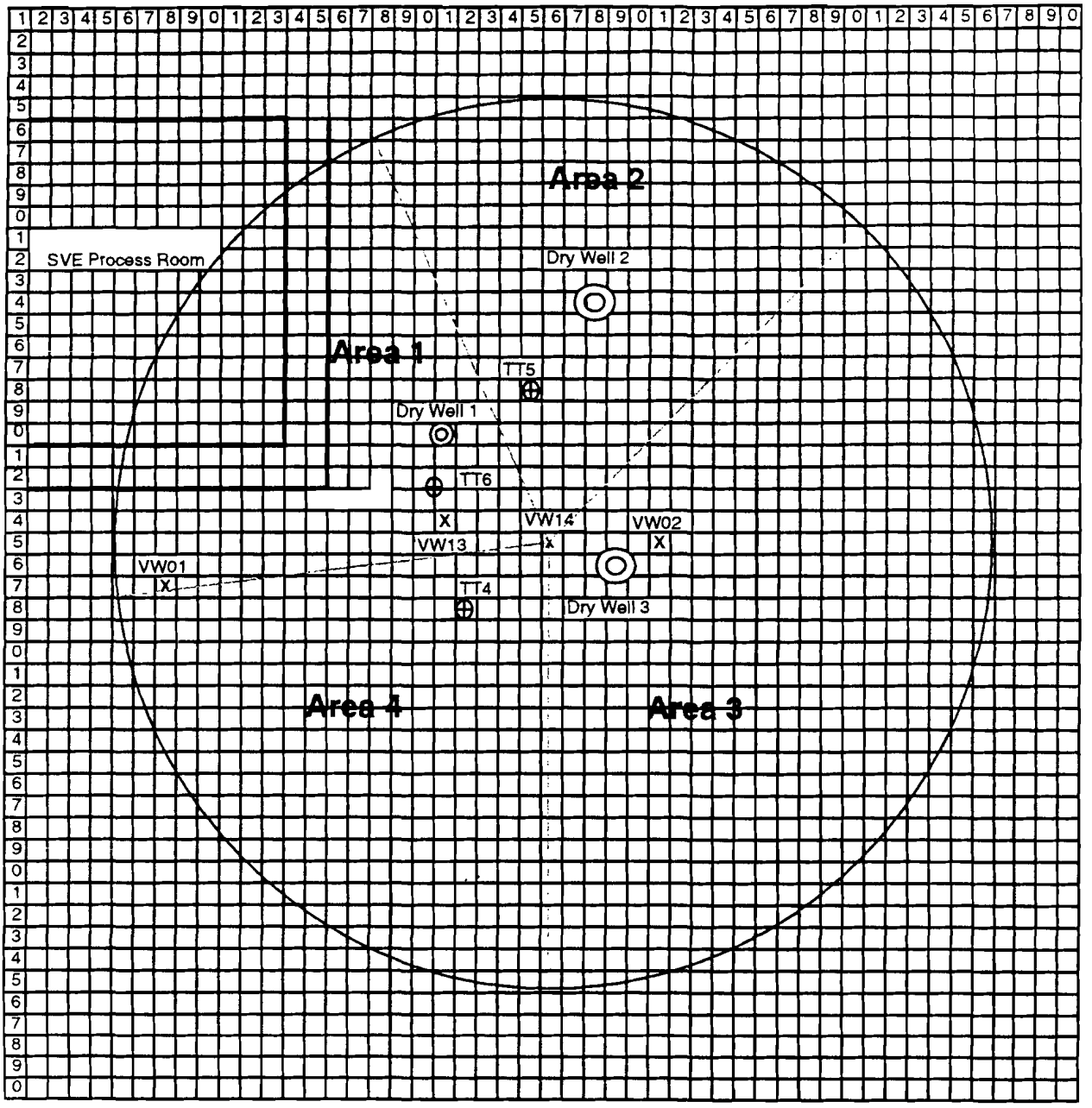
5.5 CONCLUSIONS

Based on current soil analytical data and the modeling results, the following conclusions can be drawn regarding operation of the current SVE system:

- The total VOC mass that may still remain in the vadose zone of the dry well area is conservatively estimated at approximately 34,000 pounds;
- More than 95% of the total remaining VOC mass is likely located in soils possessing lower permeability;
- The existing extraction wells are not located nor screened appropriately to remove VOCs from the low-permeability soils due to likely preferential air flow through portions of the well screen present within the high-permeability soils;
- Under the current well configuration, the model projects that approximately 28 years would be required to remove 93% of the total VOC mass at the site.

Modifications to the existing well configuration are required to enhance system performance in order to optimize mass removal from the impacted soils in the former dry well area and achieve practicable maximum treatment levels.

Figure 5-3
AIR3D Model Plane Grids



LEGEND

x Existing extraction well

⊕ Soil boring installed by Tetra Tech

◎ Dry Well

□ Cell Size = 2 x 2 feet

Figure 5-4 AIR3D Modeling Results: Pressure Distribution

Case 1: 2 Extraction Wells -- VW02 and VW14
Total Extraction Flow Rate = 205 scfm
Vacuum: VW02 = 38 inch H2O, VW14 = 35 inch H2O
Layer 3: Depth = 10 to 15 ft bgs

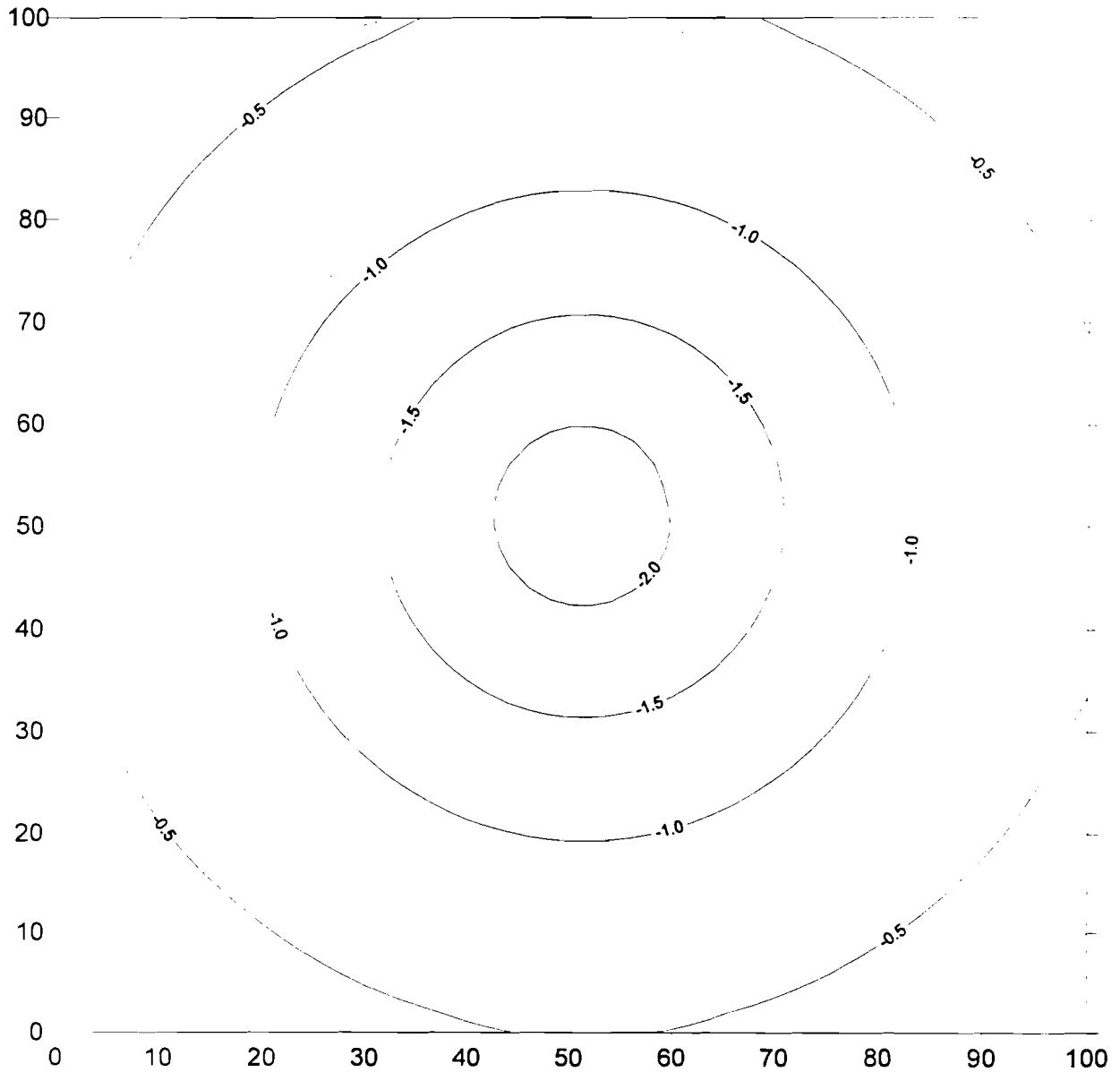


Figure 5-5 AIR3D Modeling Results: Pressure Distribution

Case 1: 2 Extraction Wells – VW02 and VW14
Total Extraction Flow Rate = 205 scfm
Vacuum: VW02 = 38 inch H2O, VW14 = 35 inch H2O
Layer 6: Depth = 25 to 30 ft bgs

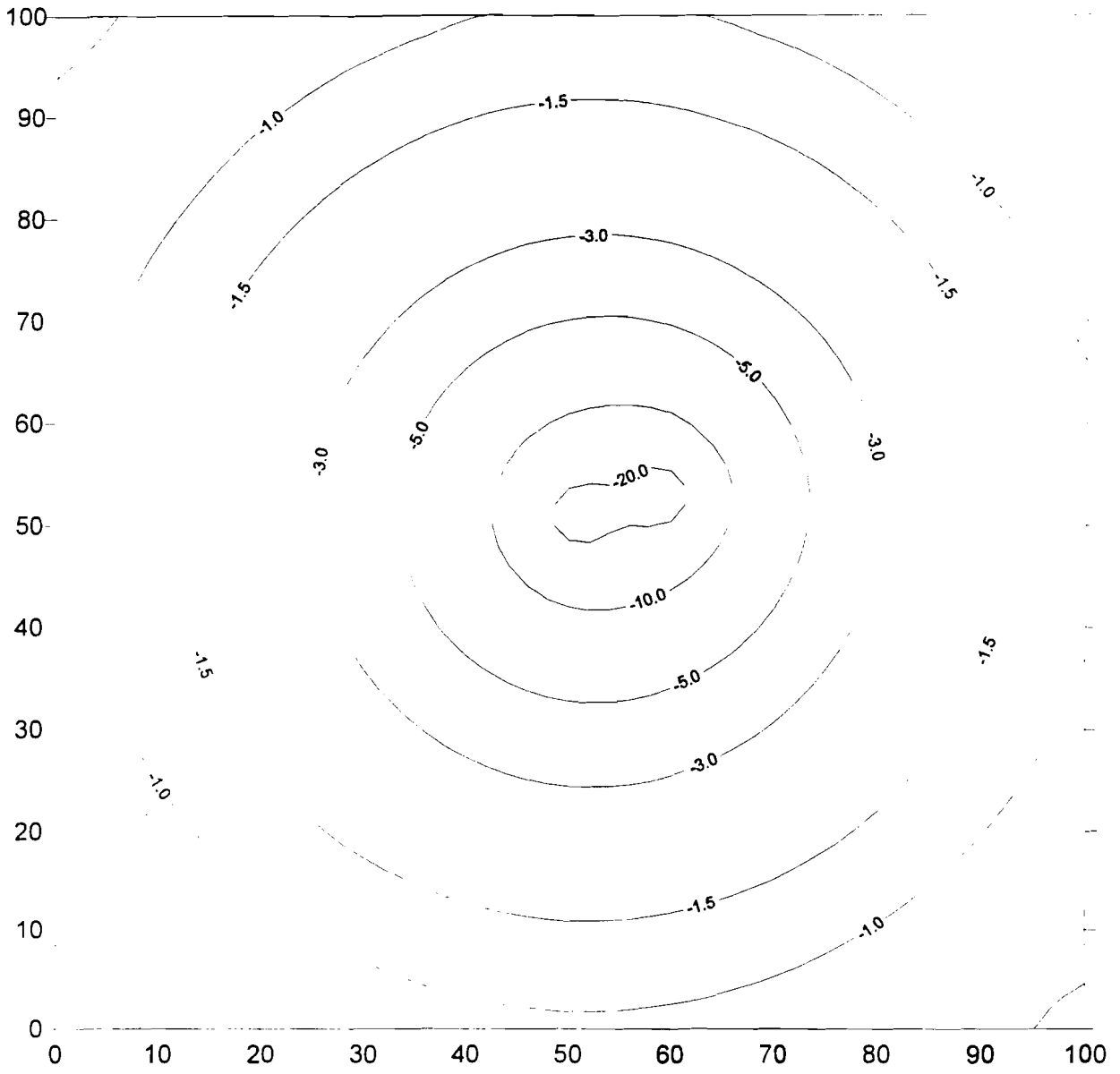


Figure 5-6 AIR3D Modeling Results: Pressure Distribution

Case 1: 2 Extraction Wells -- VW02 and VW14
Total Extraction Flow Rate = 205 scfm
Vacuum: VW02 = 38 inch H2O, VW14 = 35 inch H2O
Layer 8: Depth = 35 to 40 ft bgs

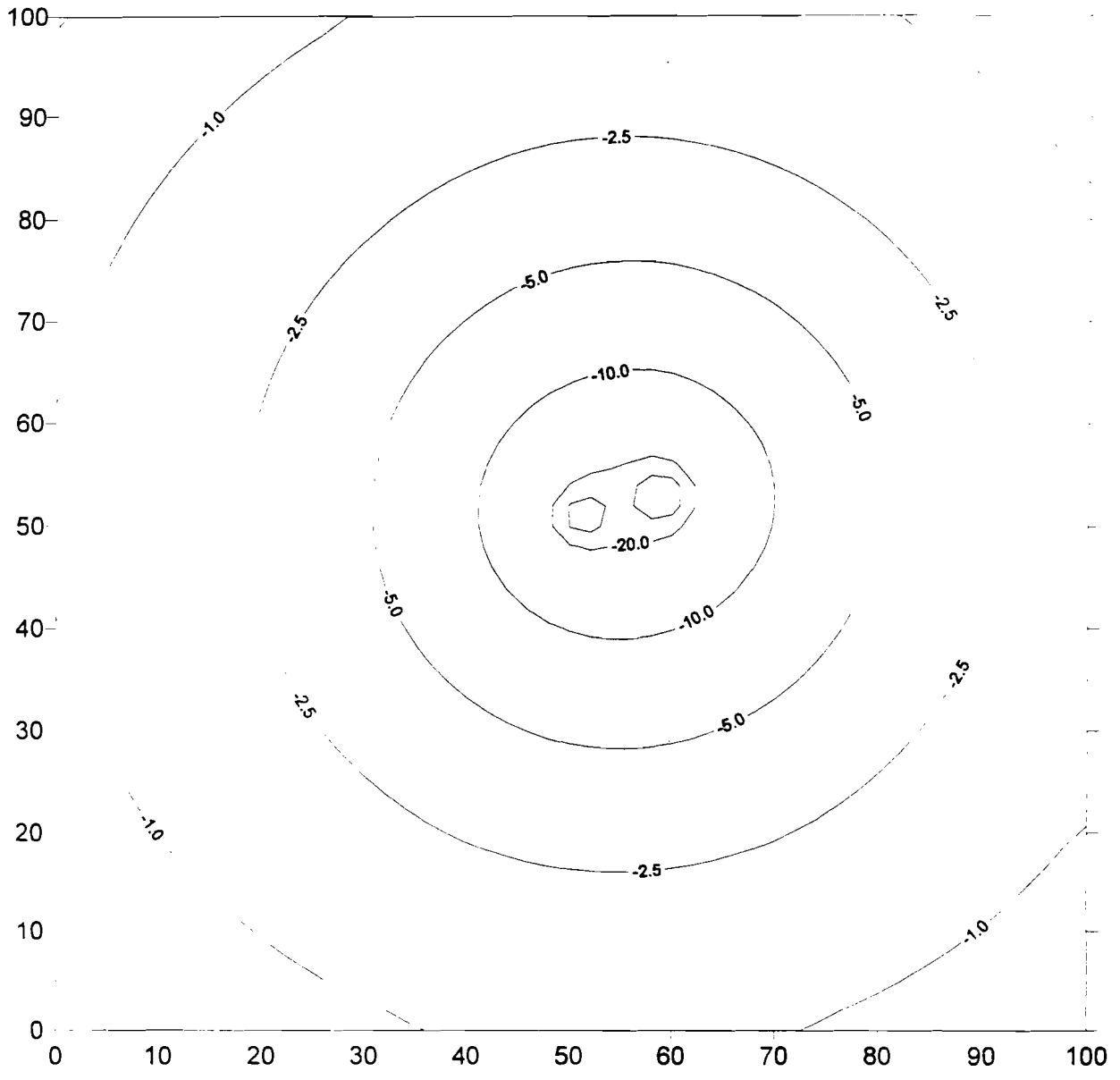


Figure 5-7 AIR3D Modeling Results: Pressure Distribution

Case 1: 2 Extraction Wells – VW02 and VW14
Total Extraction Flow Rate = 205 scfm
Vacuum: VW02 = 38 inch H2O, VW14 = 35 inch H2O
Layer 10: Depth = 45 to 50 ft bgs

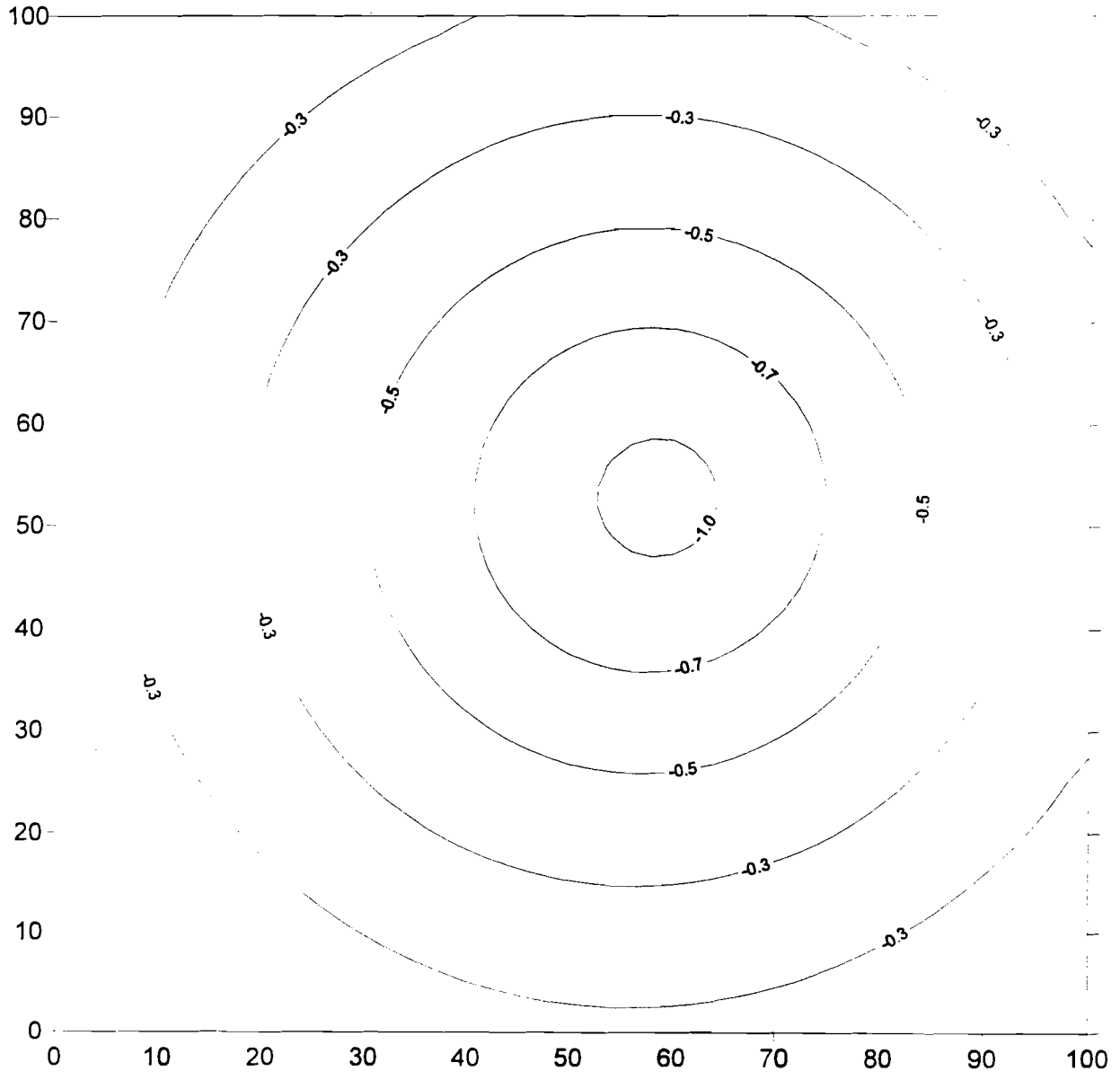


Figure 5-8 AIR3D Modeling Results: Pressure Distribution

Case 1: 2 Extraction Wells -- VW02 and VW14
Total Extraction Flow Rate = 205 scfm
Vacuum: VW02 = 38 inch H2O, VW14 = 35 inch H2O
Layer 14: Depth = 65 to 70 ft bgs

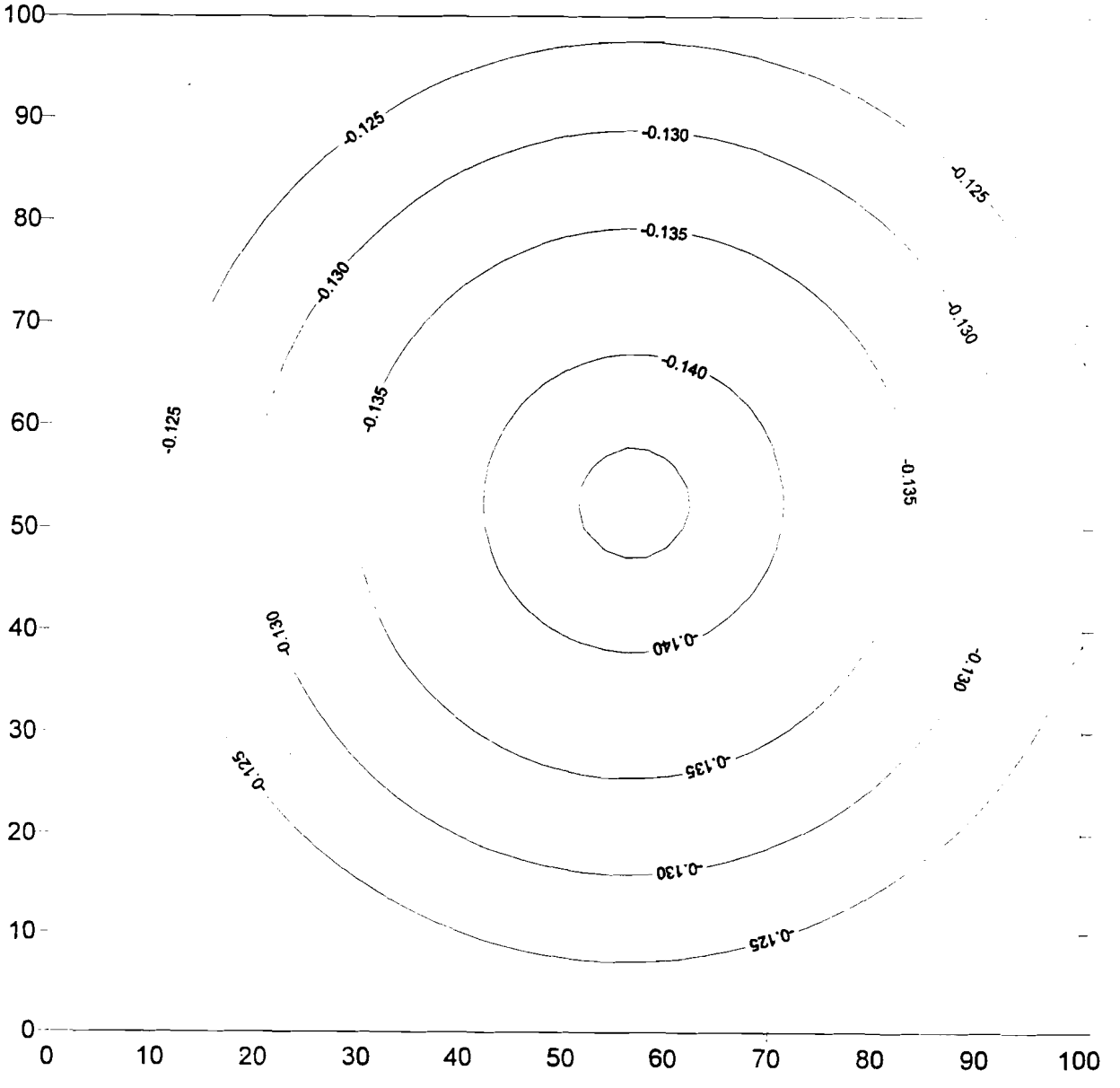


Figure 5-9 AIR3D Modeling Results: Pressure Distribution

Case 2: 4 Extraction Wells -- VW01, VW02, VW13 and VW14
Total Extraction Flow Rate = 309 scfm
Vacuum: VW01 = 10 inch H2O, VW02 = 15 inch H2O
VW13 = 11 inch H2O, VW14 = 12 inch H2O
Layer 3: Depth = 10 to 15 ft bgs

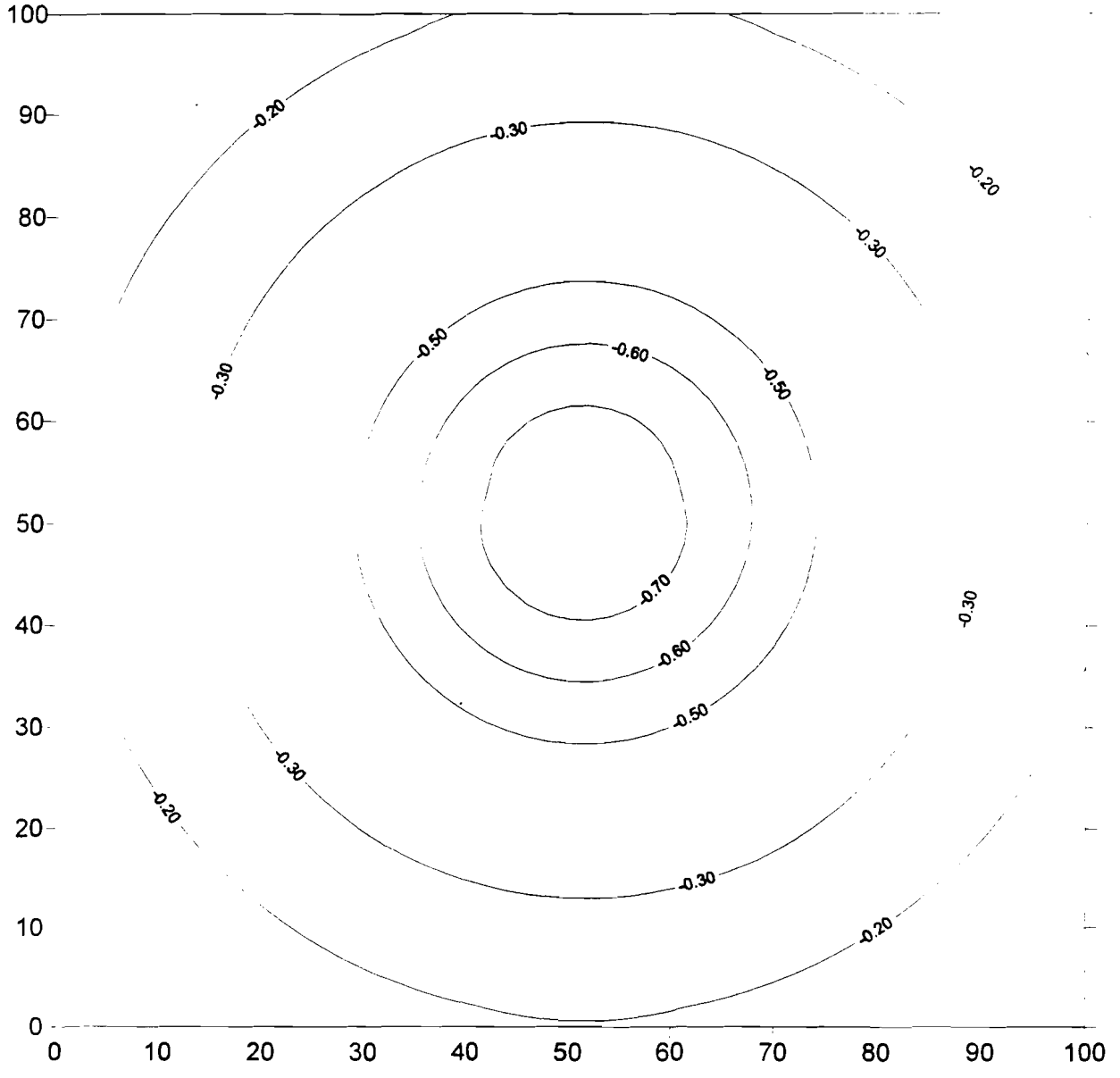


Figure 5-10 AIR3D Modeling Results: Pressure Distribution

Case 2: 4 Extraction Wells – VW01, VW02, VW13 and VW14
Total Extraction Flow Rate = 309 scfm
Vacuum: VW01 = 10 inch H2O, VW02 = 15 inch H2O
VW13 = 11 inch H2O, VW14 = 12 inch H2O
Layer 6: Depth = 25 to 30 ft bgs

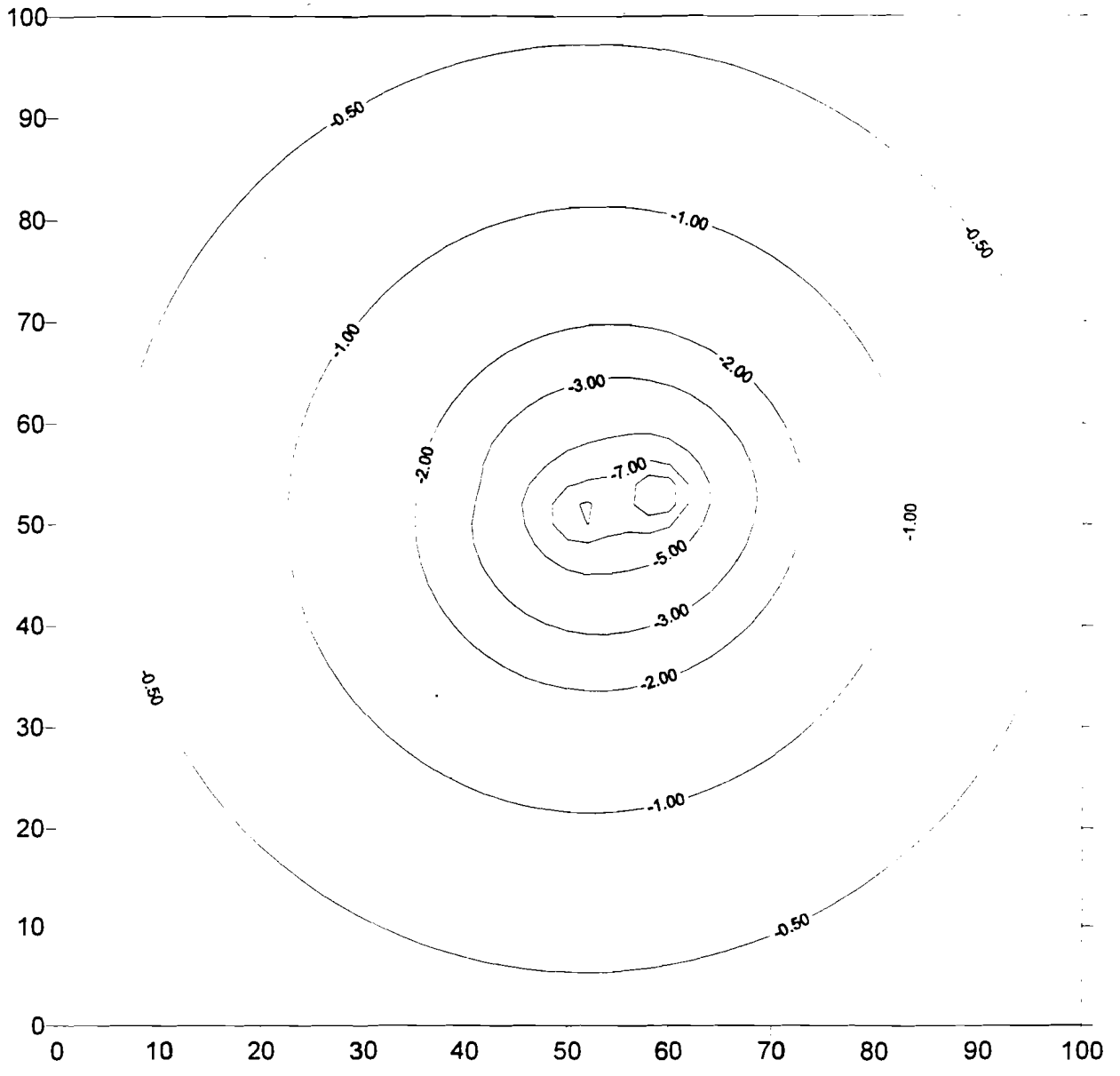


Figure 5-11 AIR3D Modeling Results: Pressure Distribution

Case 2: 4 Extraction Wells -- VW01, VW02, VW13 and VW14
Total Extraction Flow Rate = 309 scfm
Vacuum: VW01 = 10 inch H2O, VW02 = 15 inch H2O
VW13 = 11 inch H2O, VW14 = 12 inch H2O
Layer 8: Depth = 35 to 40 ft bgs

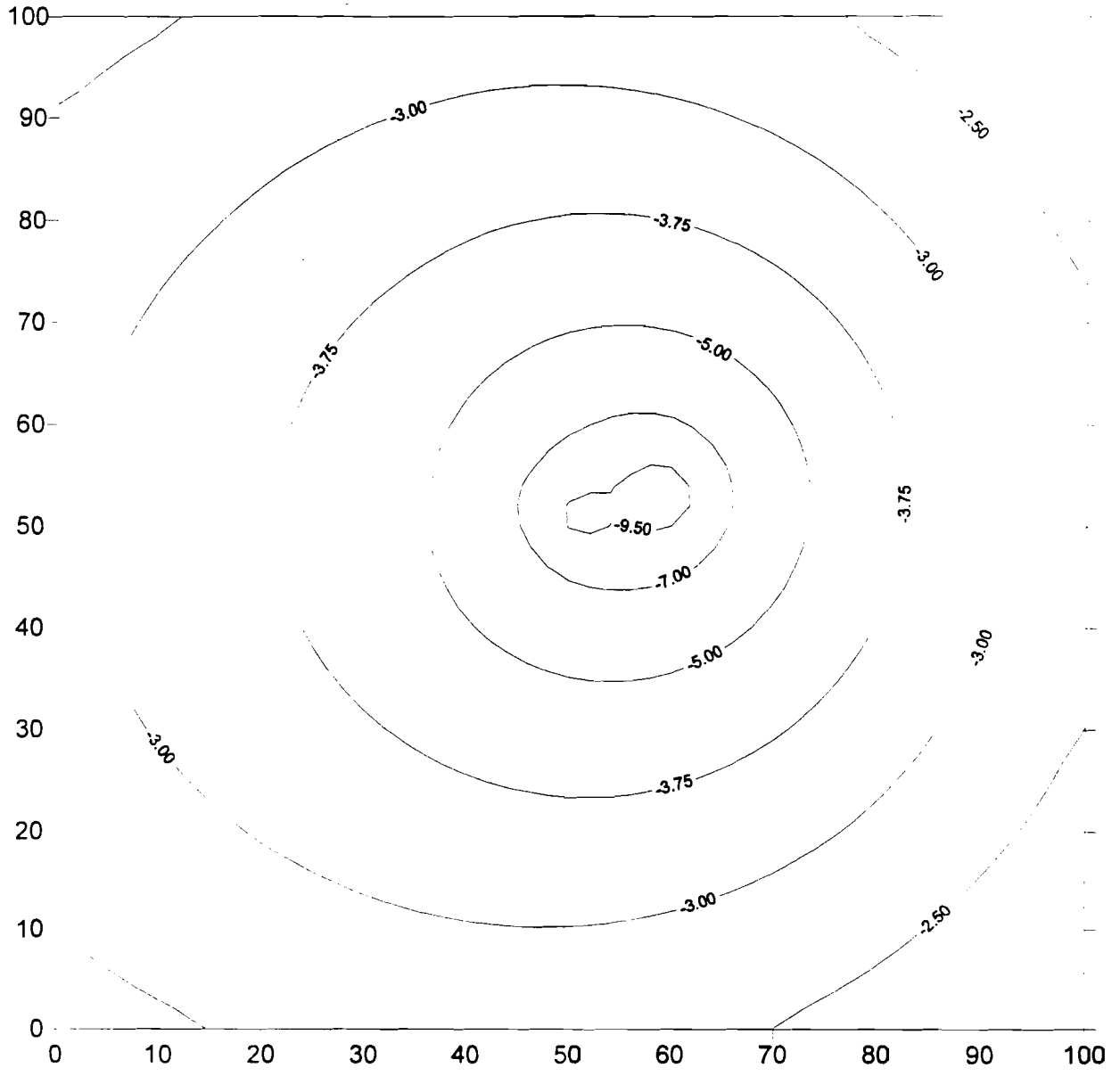


Figure 5-12 AIR3D Modeling Results: Pressure Distribution

Case 2: 4 Extraction Wells – VW01, VW02, VW13 and VW14
Total Extraction Flow Rate = 309 scfm
Vacuum: VW01 = 10 inch H2O, VW02 = 15 inch H2O
VW13 = 11 inch H2O, VW14 = 12 inch H2O
Layer 10: Depth = 45 to 55 ft bgs

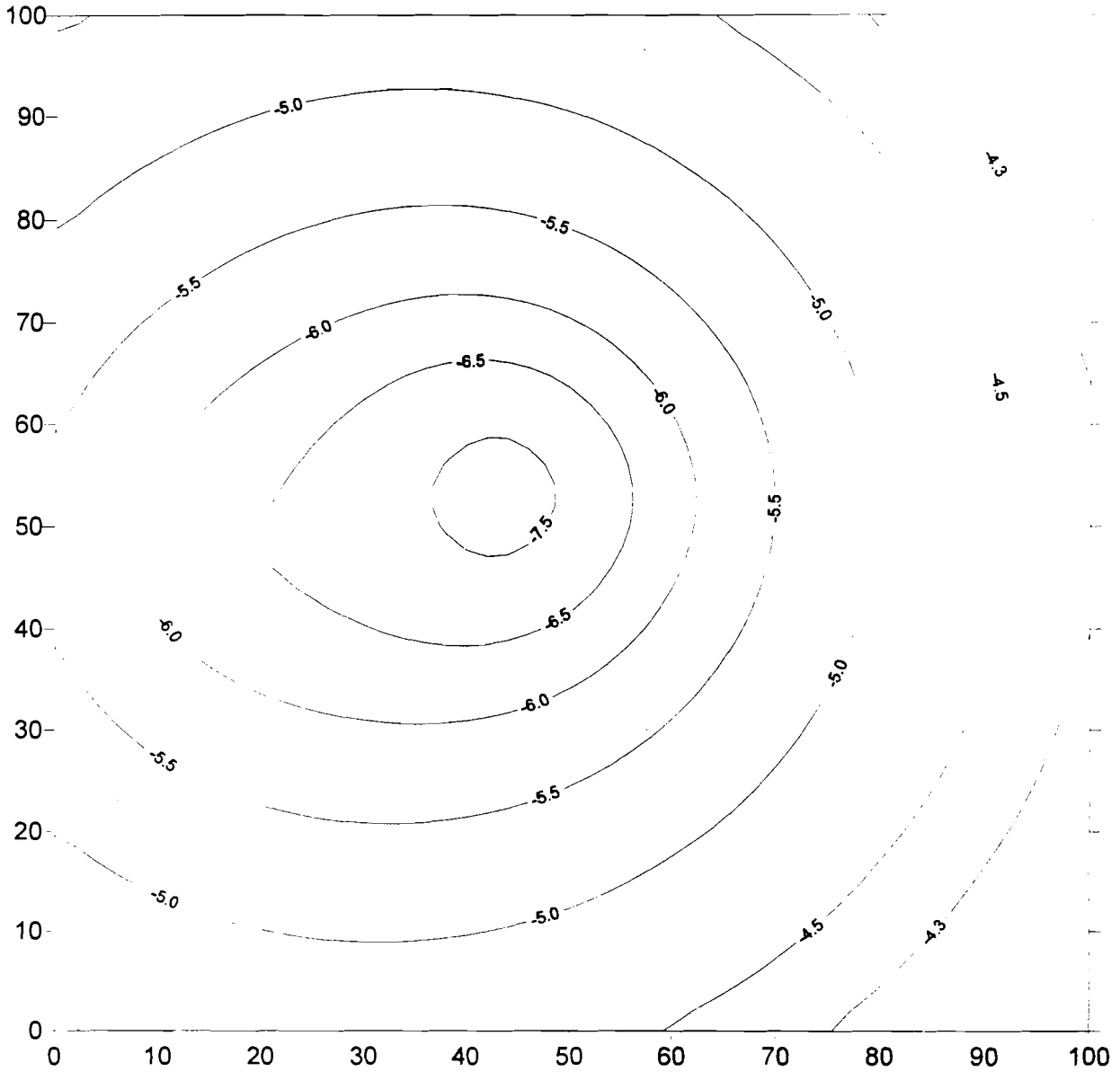


Figure 5-13 AIR3D Modeling Results: Pressure Distribution

Case 2: 4 Extraction Wells -- VW01, VW02, VW13 and VW14
Total Extraction Flow Rate = 309 scfm
Vacuum: VW01 = 10 inch H2O, VW02 = 15 inch H2O
VW13 = 11 inch H2O, VW14 = 12 inch H2O
Layer 14: Depth = 65 to 70 ft bgs

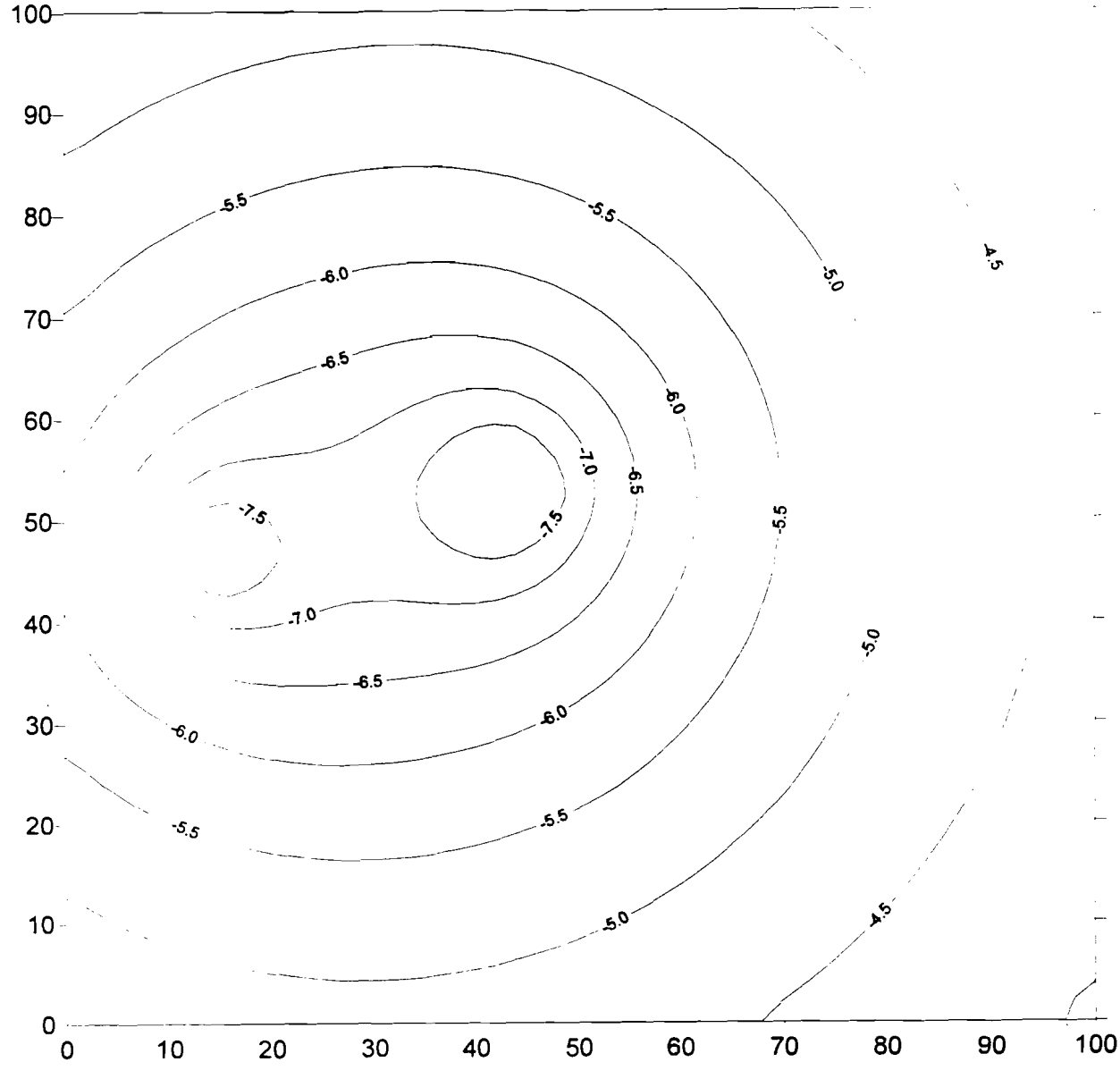


Figure 5-14 AIR3D Modeling Results: Pressure Distribution

Case 3: 2 Extraction Wells -- VW01 and VW13
Total Extraction Flow Rate = 271 scfm
Vacuum: VW01 = 12 inch H2O, VW13 = 12 inch H2O
Layer 3: Depth = 10 to 15 ft bgs

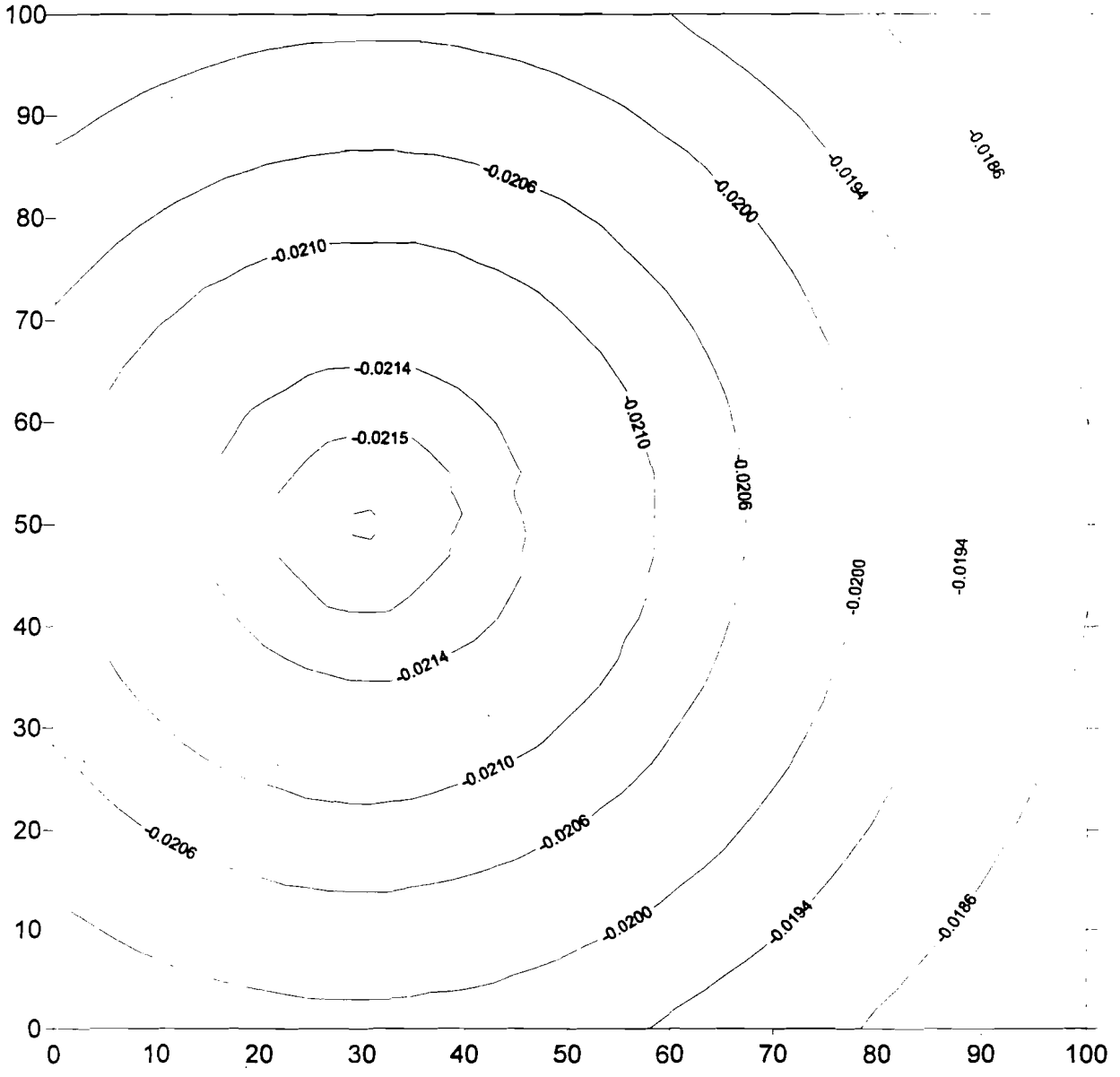


Figure 5-15 AIR3D Modeling Results: Pressure Distribution

Case 3: 2 Extraction Wells – VW01 and VW13
Total Extraction Flow Rate = 271 scfm
Vacuum: VW01 = 12 inch H2O, VW13 = 12 inch H2O
Layer 6: Depth = 25 to 35 ft bgs

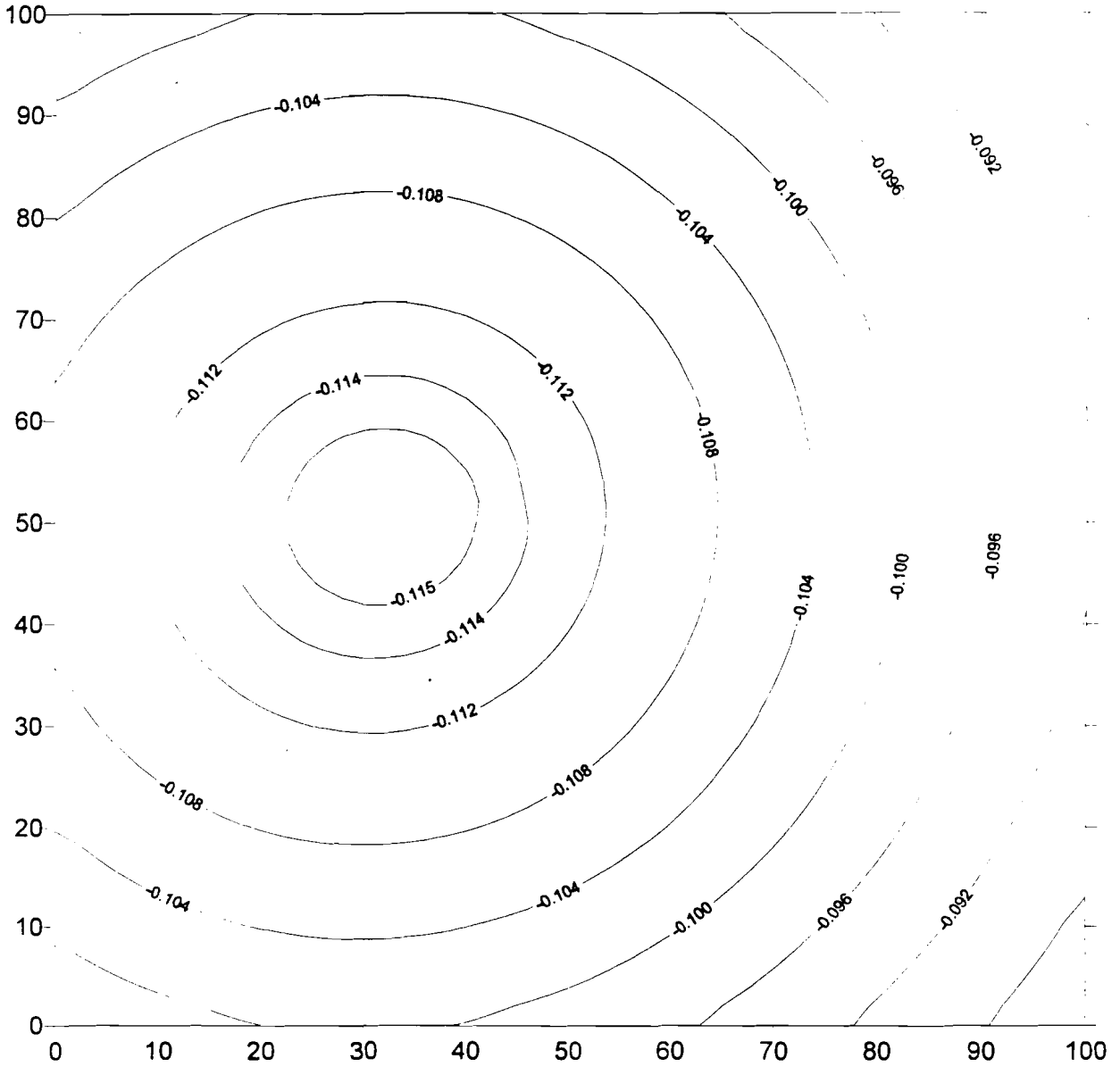


Figure 5-16 AIR3D Modeling Results: Pressure Distribution

Case 3: 2 Extraction Wells – VW01 and VW13
Total Extraction Flow Rate = 271 scfm
Vacuum: VW01 = 12 inch H2O, VW13 = 12 inch H2O
Layer 8: Depth = 35 to 40 ft bgs

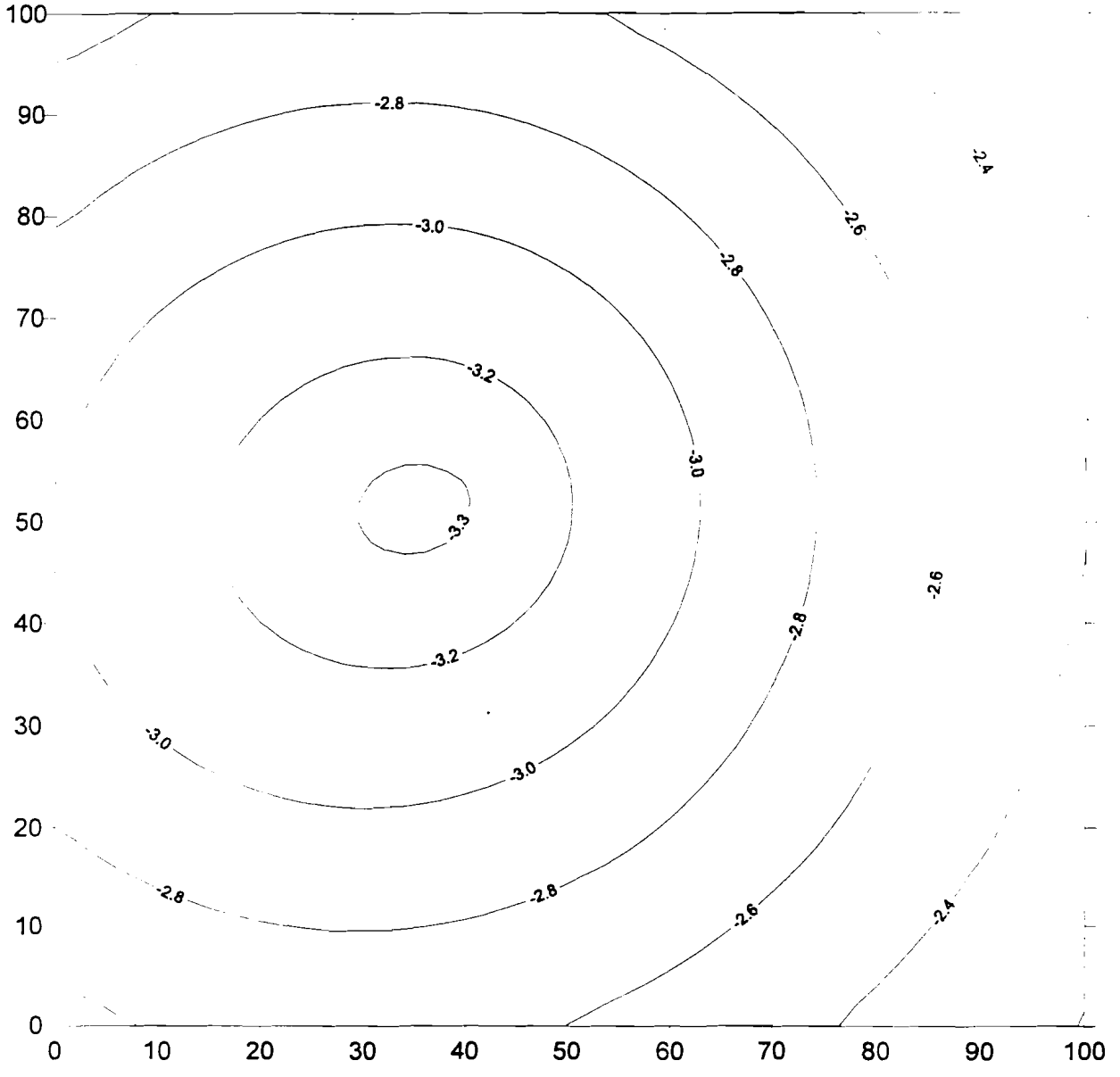


Figure 5-17 AIR3D Modeling Results: Pressure Distribution

Case 3: 2 Extraction Wells -- VW01 and VW13
Total Extraction Flow Rate = 271 scfm
Vacuum: VW01 = 12 inch H2O, VW13 = 12 inch H2O
Layer 10: Depth = 45 to 50 ft bgs

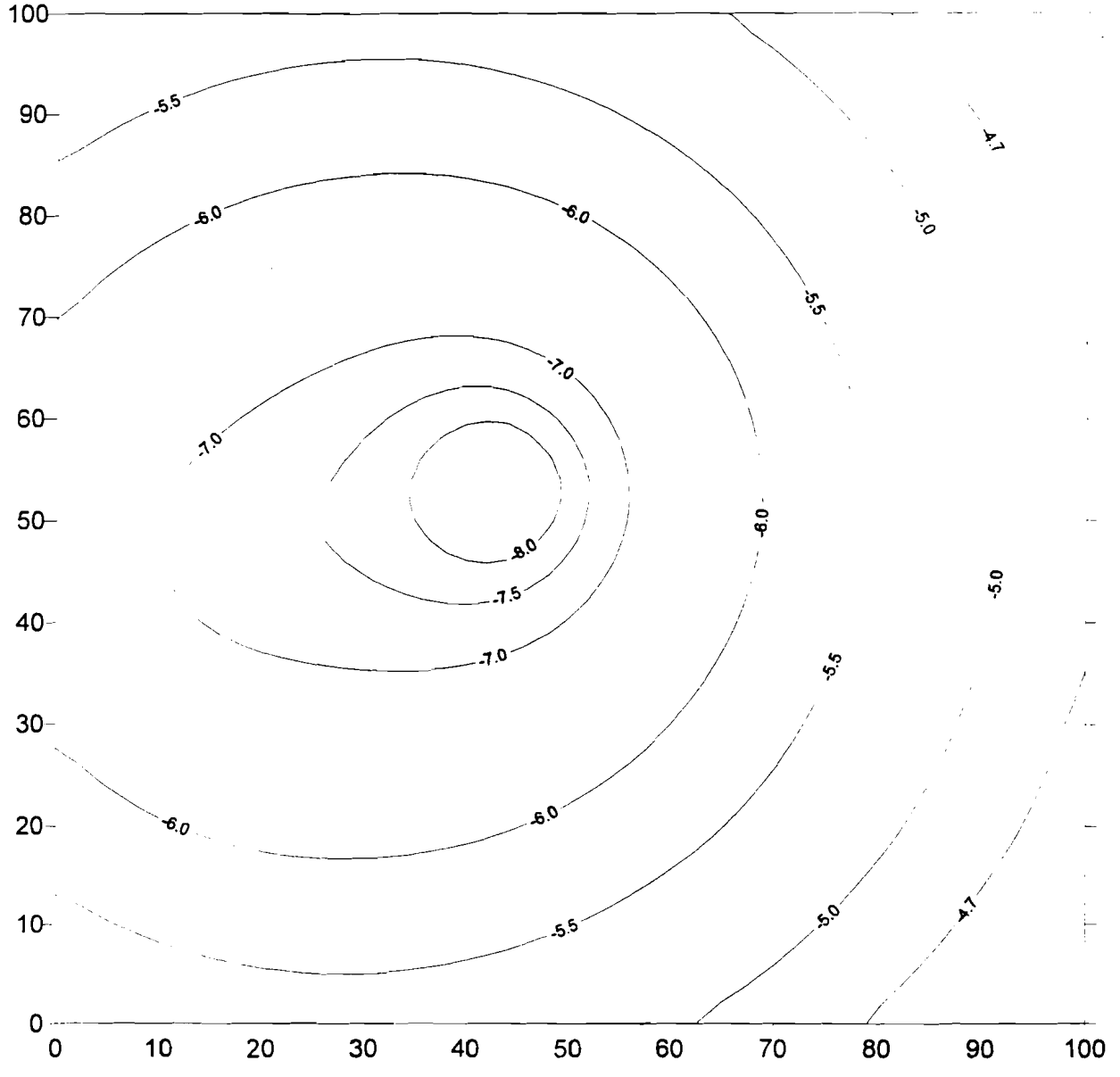


Figure 5-18 AIR3D Modeling Results: Pressure Distribution

Case 3: 2 Extraction Wells – VW01 and VW13
Total Extraction Flow Rate = 271 scfm
Vacuum: VW01 = 12 inch H2O, VW13 = 12 inch H2O
Layer 14: Depth = 65 to 70 ft bgs

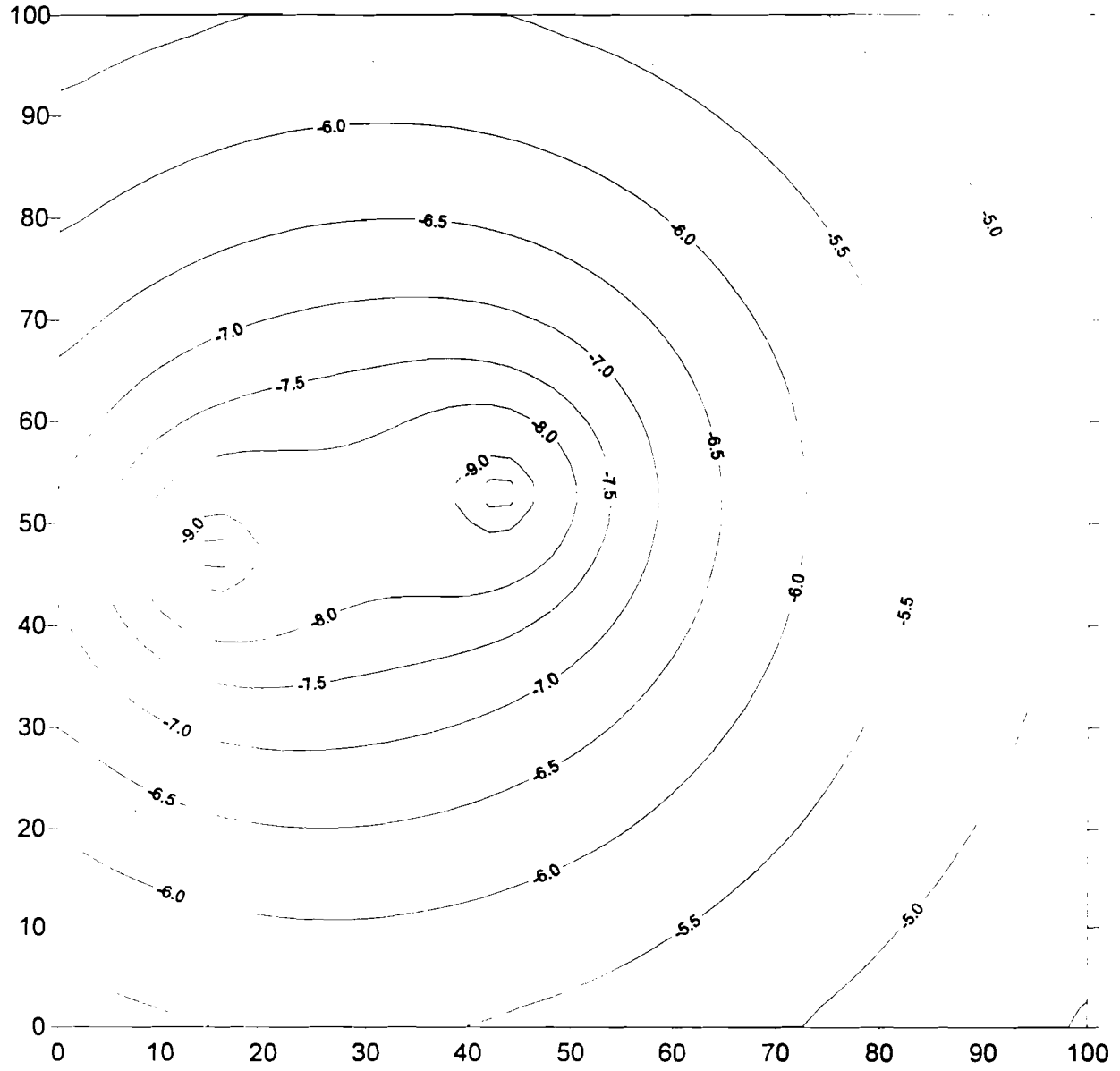


Figure 5-19 AIR3D Modeling Results: Pressure Distribution

Case 4: 3 Extraction Wells – VW01, VW13 and VW14
Total Extraction Flow Rate = 312 scfm
Vacuum: VW01 = 10 inch H2O, VW13 = 12 inch H2O
VW14 = 10 inch H2O
Layer 3: Depth = 10 to 15 ft bgs

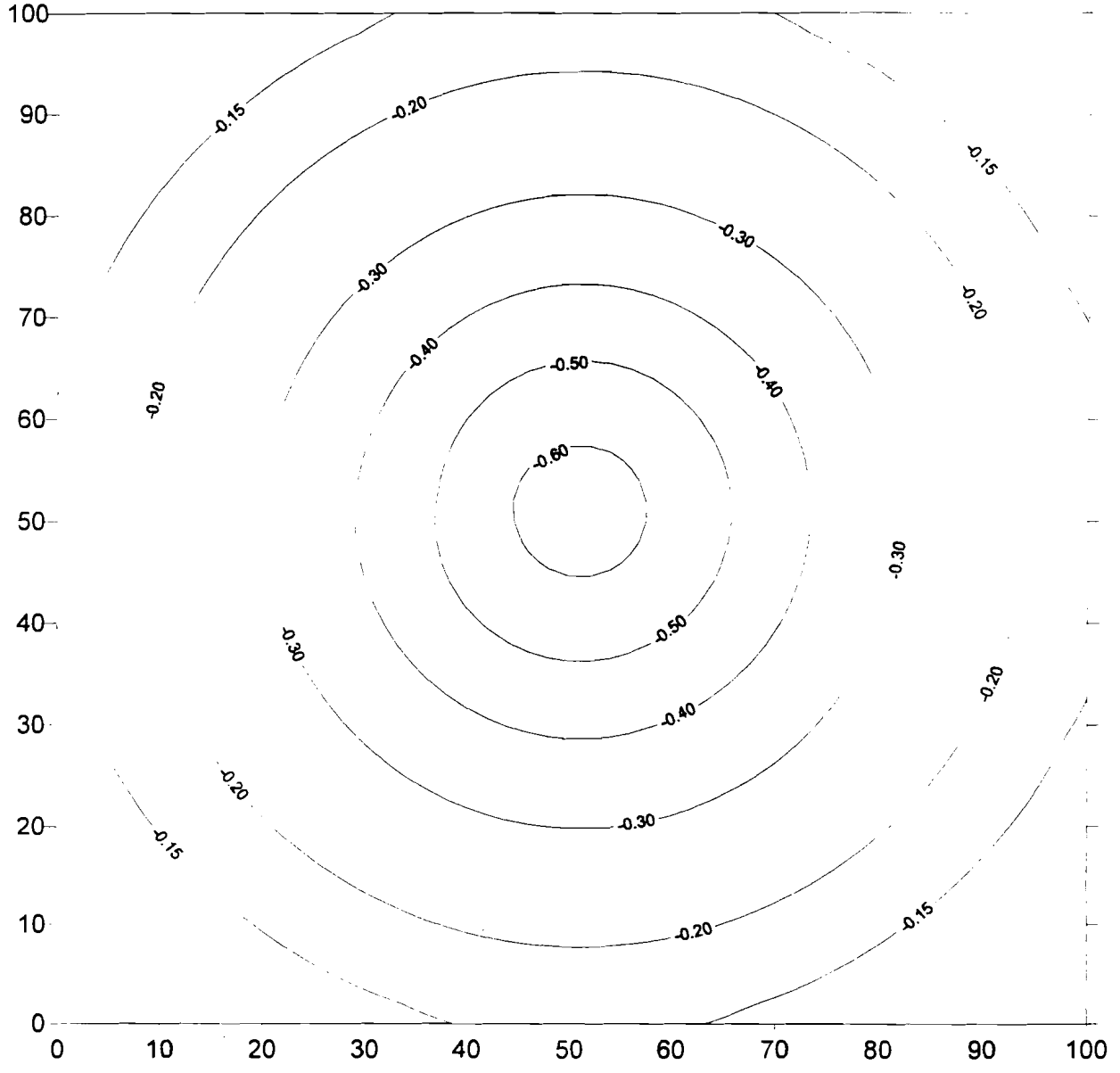


Figure 5-20 AIR3D Modeling Results: Pressure Distribution

Case 4: 3 Extraction Wells -- VW01, VW13 and VW14
Total Extraction Flow Rate = 312 scfm
Vacuum: VW01 = 10 inch H2O, VW13 = 12 inch H2O
VW14 = 10 inch H2O
Layer 6: Depth = 25 to 30 ft bgs

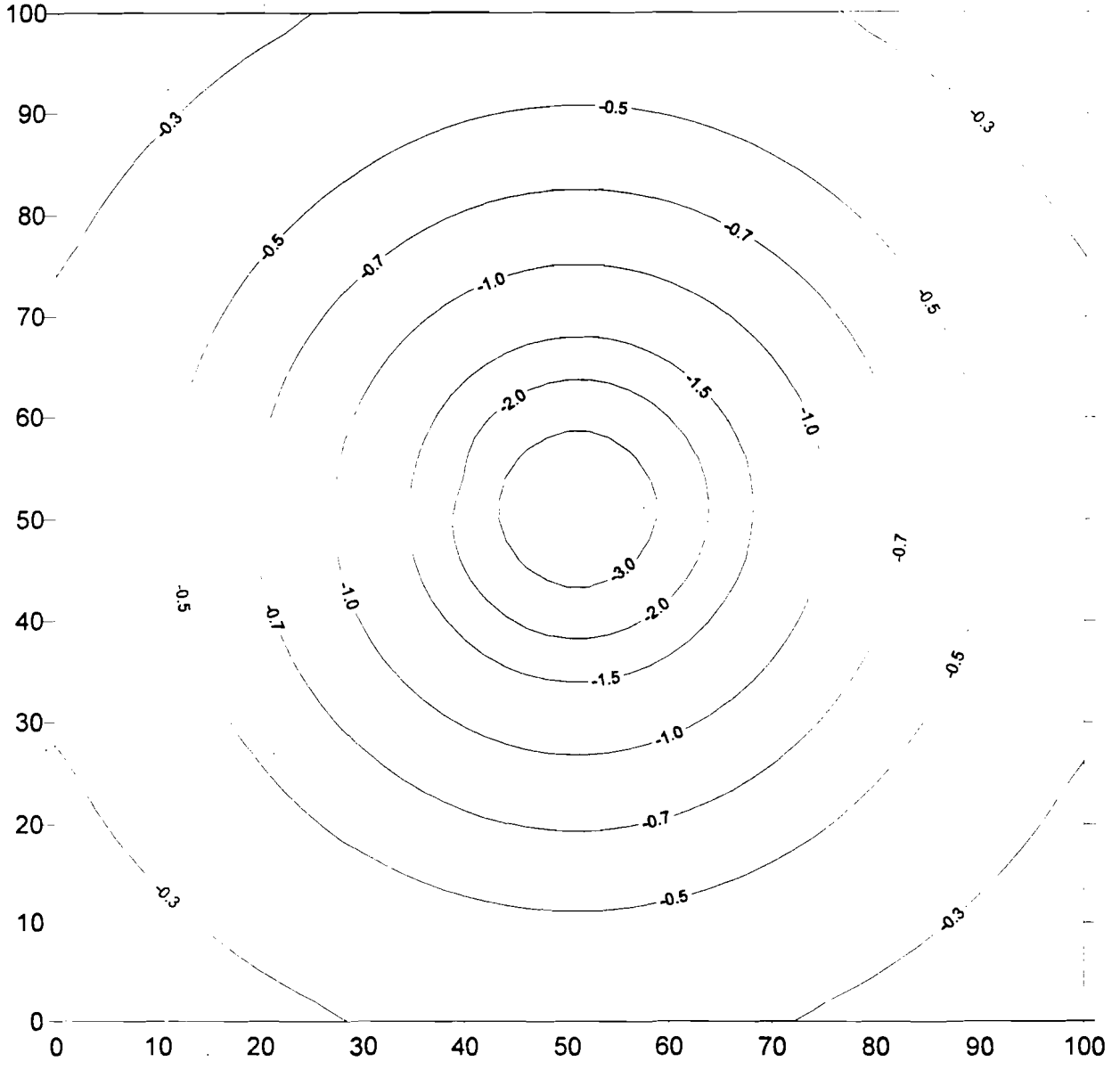


Figure 5-21 AIR3D Modeling Results: Pressure Distribution

Case 4: 3 Extraction Wells – VW01, VW13 and VW14
Total Extraction Flow Rate = 312 scfm
Vacuum: VW01 = 10 inch H2O, VW13 = 12 inch H2O
VW14 = 10 inch H2O
Layer 8: Depth = 35 to 40 ft bgs

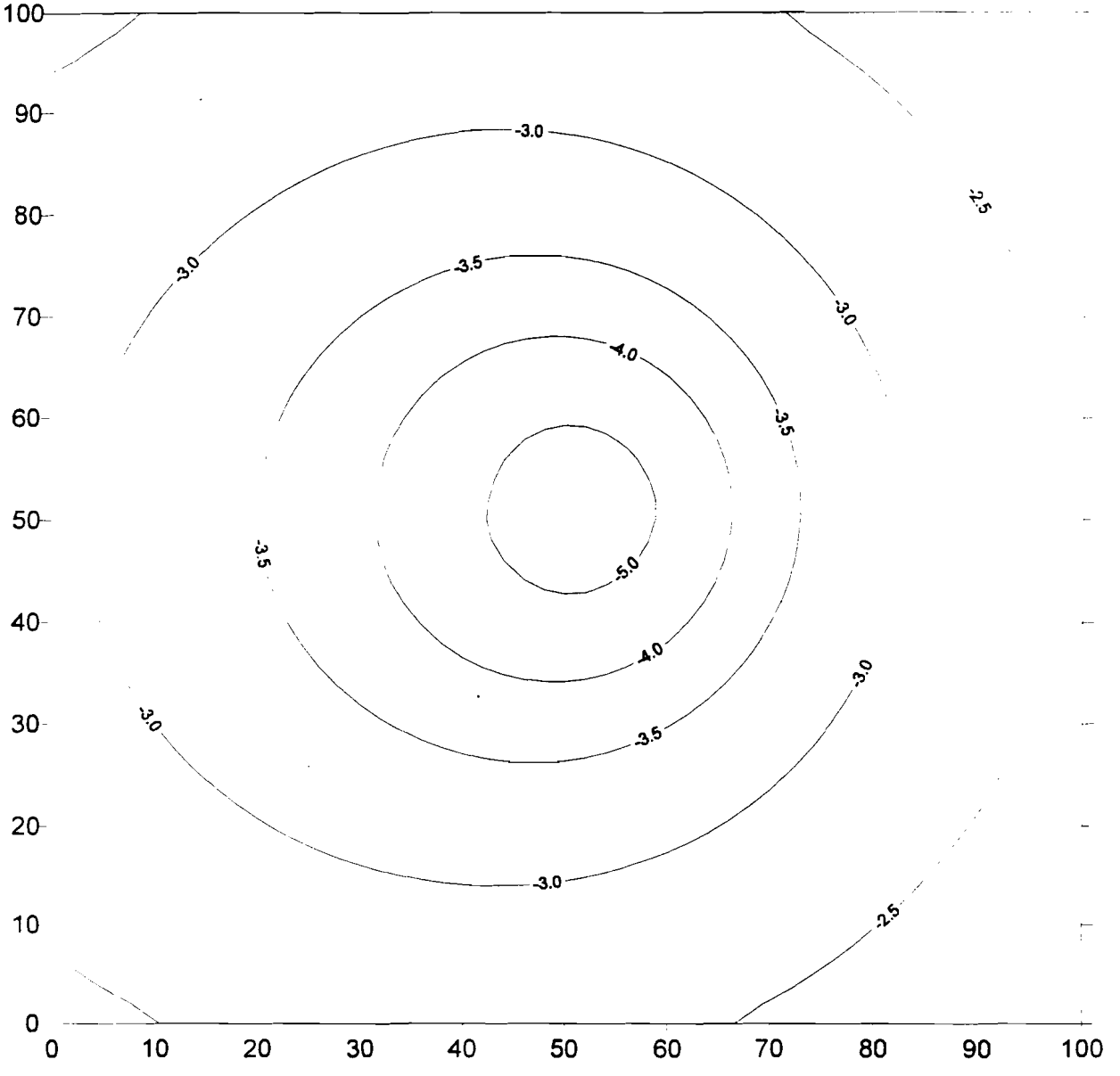


Figure 5-22 AIR3D Modeling Results: Pressure Distribution

Case 4: 3 Extraction Wells -- VW01, VW13 and VW14
Total Extraction Flow Rate = 312 scfm
Vacuum: VW01 = 10 inch H2O, VW13 = 12 inch H2O
VW14 = 10 inch H2O
Layer 10: Depth = 45 to 50 ft bgs

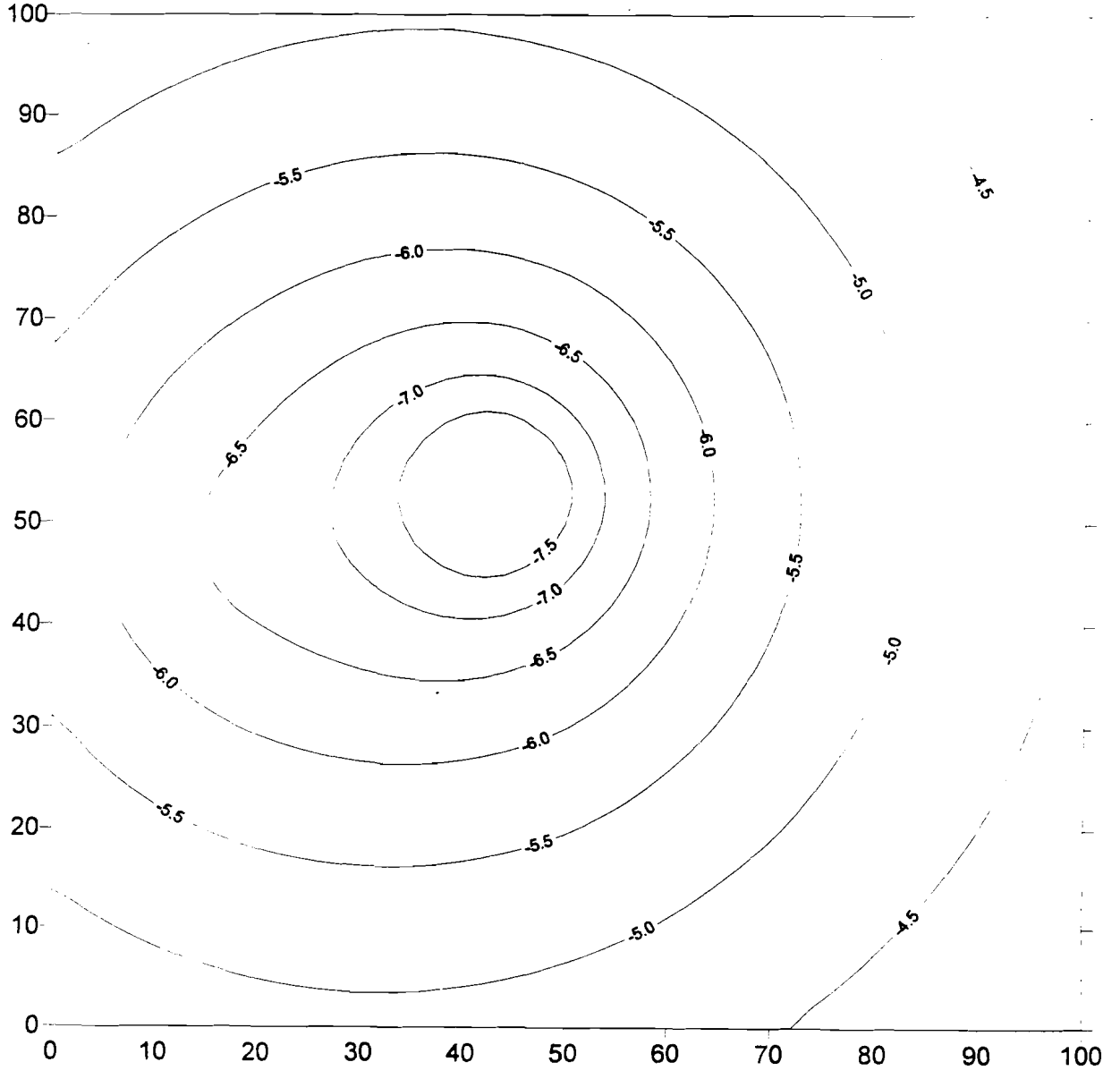


Figure 5-23 AIR3D Modeling Results: Pressure Distribution

Case 4: 3 Extraction Wells – VW01, VW13 and VW14
Total Extraction Flow Rate = 312 scfm
Vacuum: VW01 = 10 inch H2O, VW13 = 12 inch H2O
VW14 = 10 inch H2O
Layer 14: Depth = 65 to 70 ft bgs

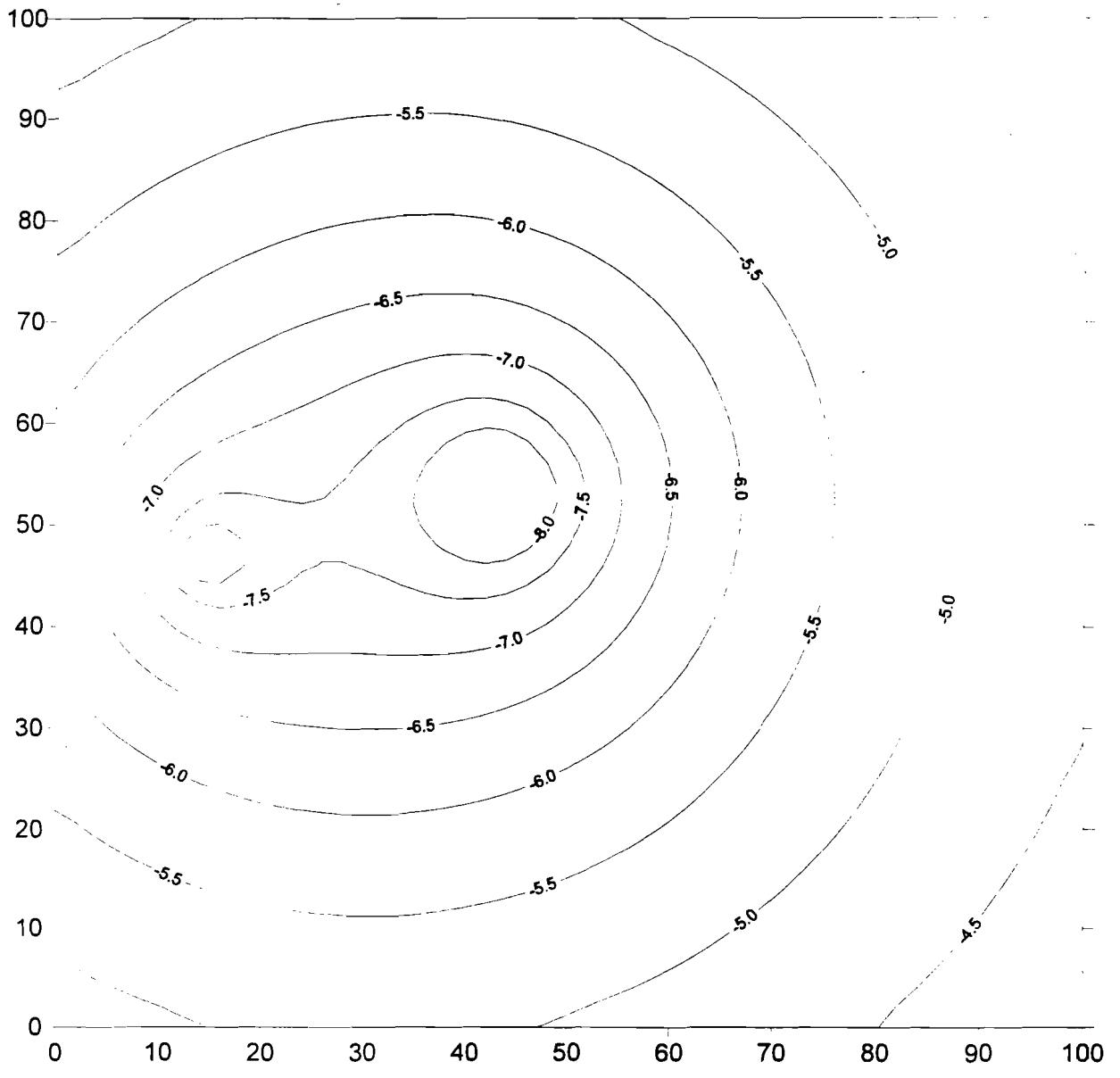
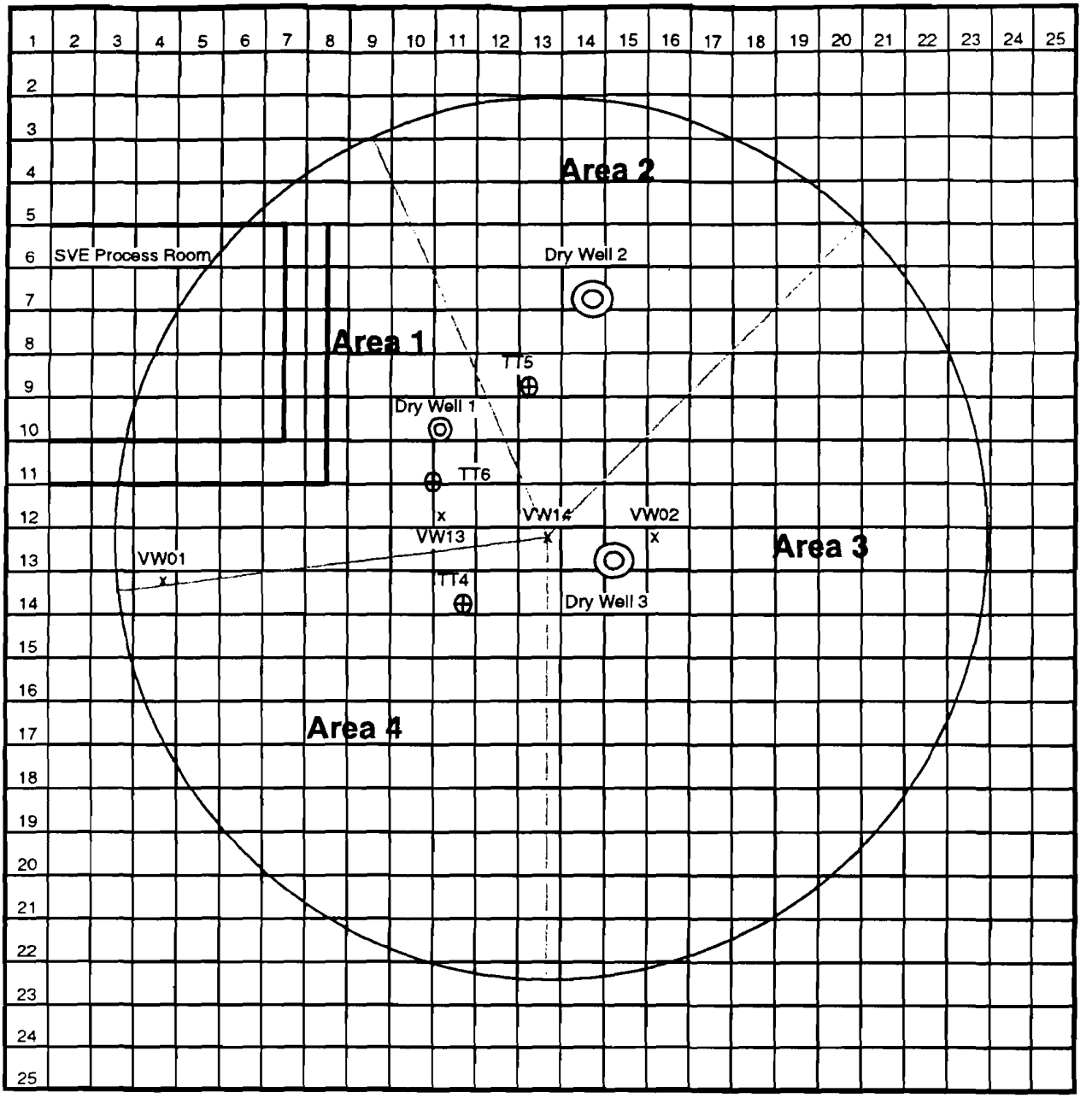


Figure 5-24
VT3D Model Plane Grids



LEGEND

x Existing extraction well

⊕ Soil boring installed by Tetra Tech

◎ Dry Well

□ Cell Size = 4 x 4 feet

Figure 5-25 VT3D Modeling Results for Case 4
VOC Vapor Concentrations and Cumulative VOC Mass Recovered from VW01

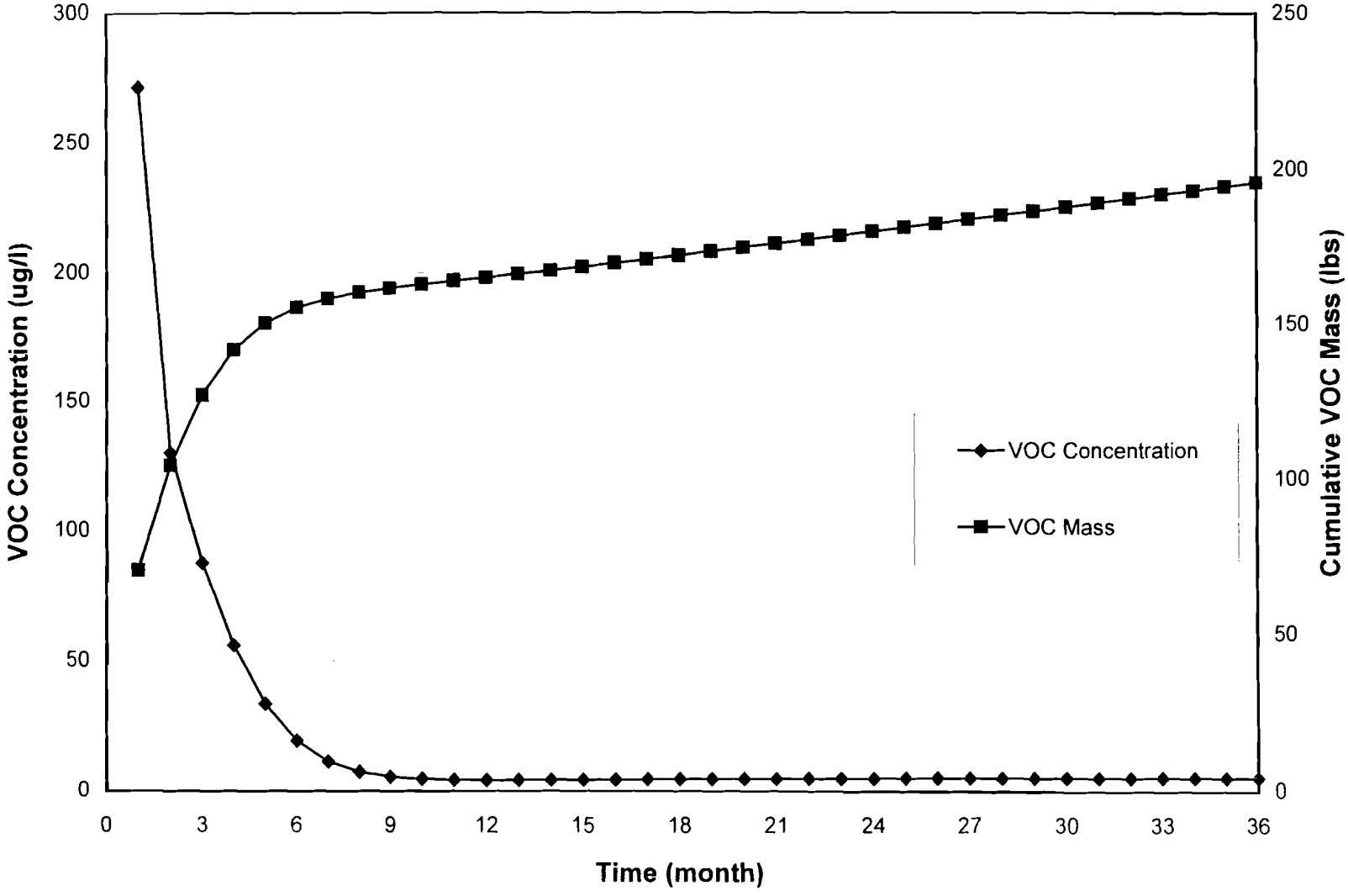


Figure 5-26 VT3D Modeling Results for Case 4
VOC Vapor Concentrations and Cumulative Mass Recovered from VW13

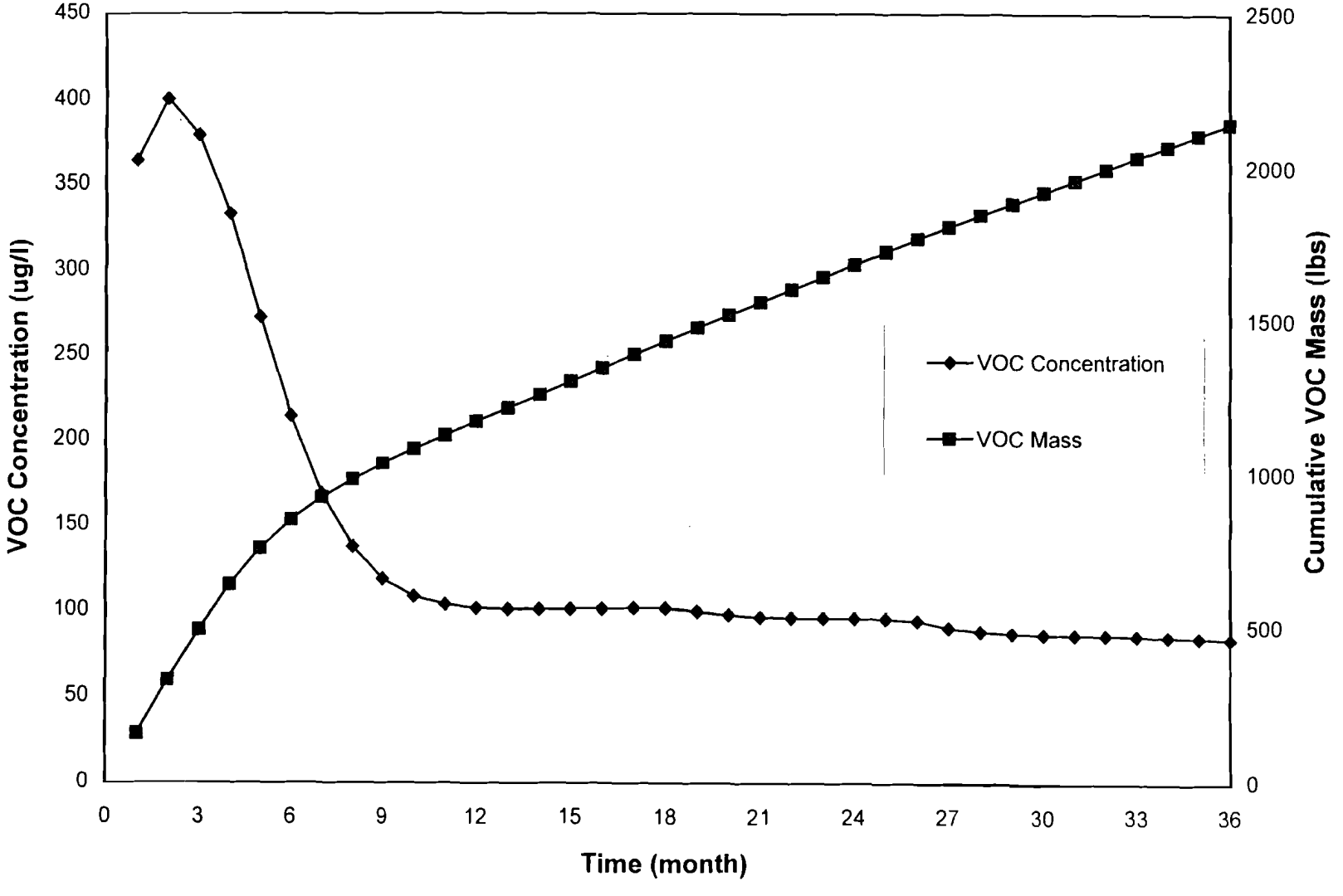


Figure 5-27 VT3D Modeling Results for Case 4
VOC Vapor Concentrations and Cumulative Mass Recovered from VW14

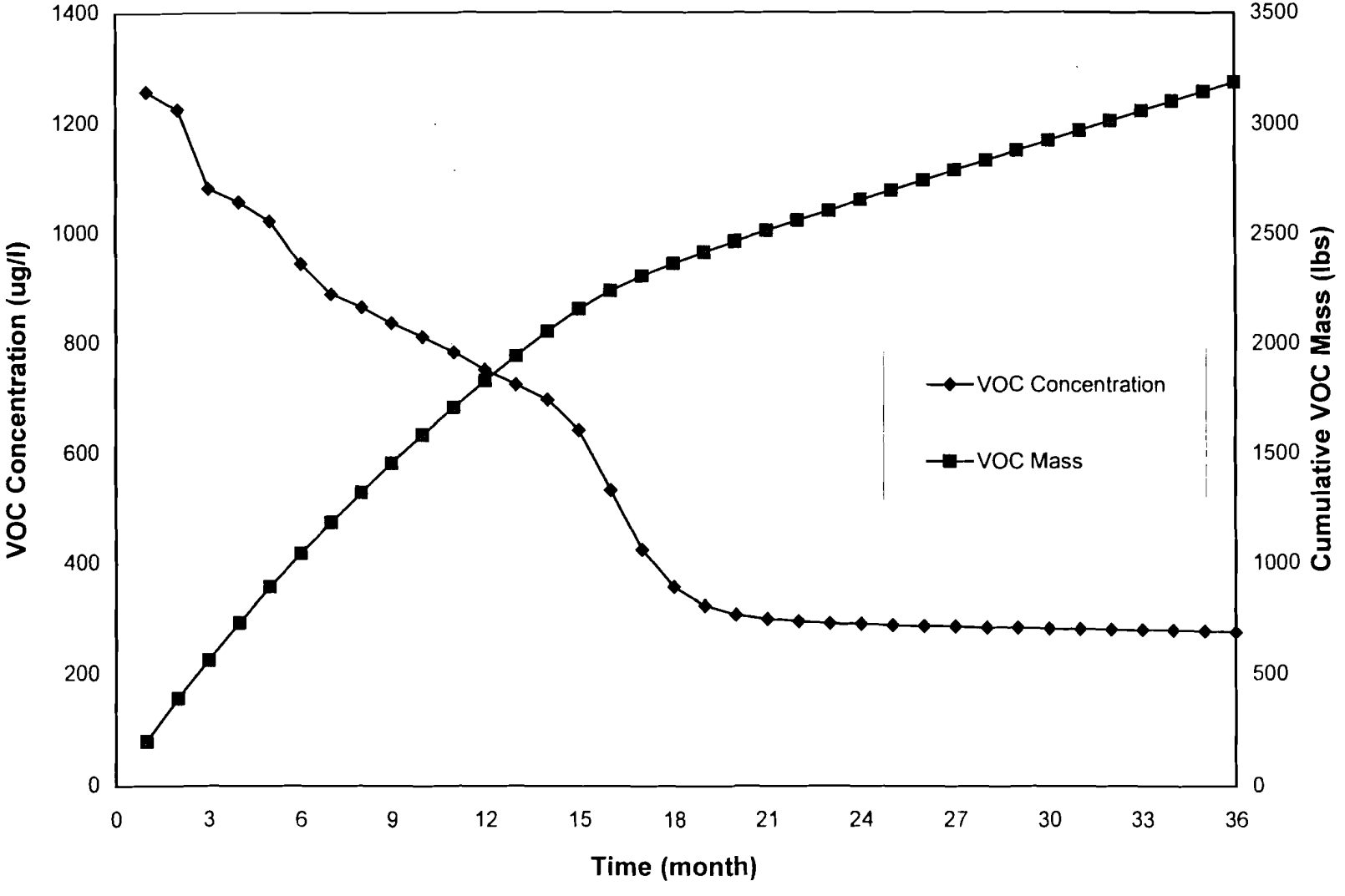


Figure 5-28a VT3D Modeling Results for Case 4
Combined VOC Vapor Concentrations and Cumulative Recovering VOC Mass

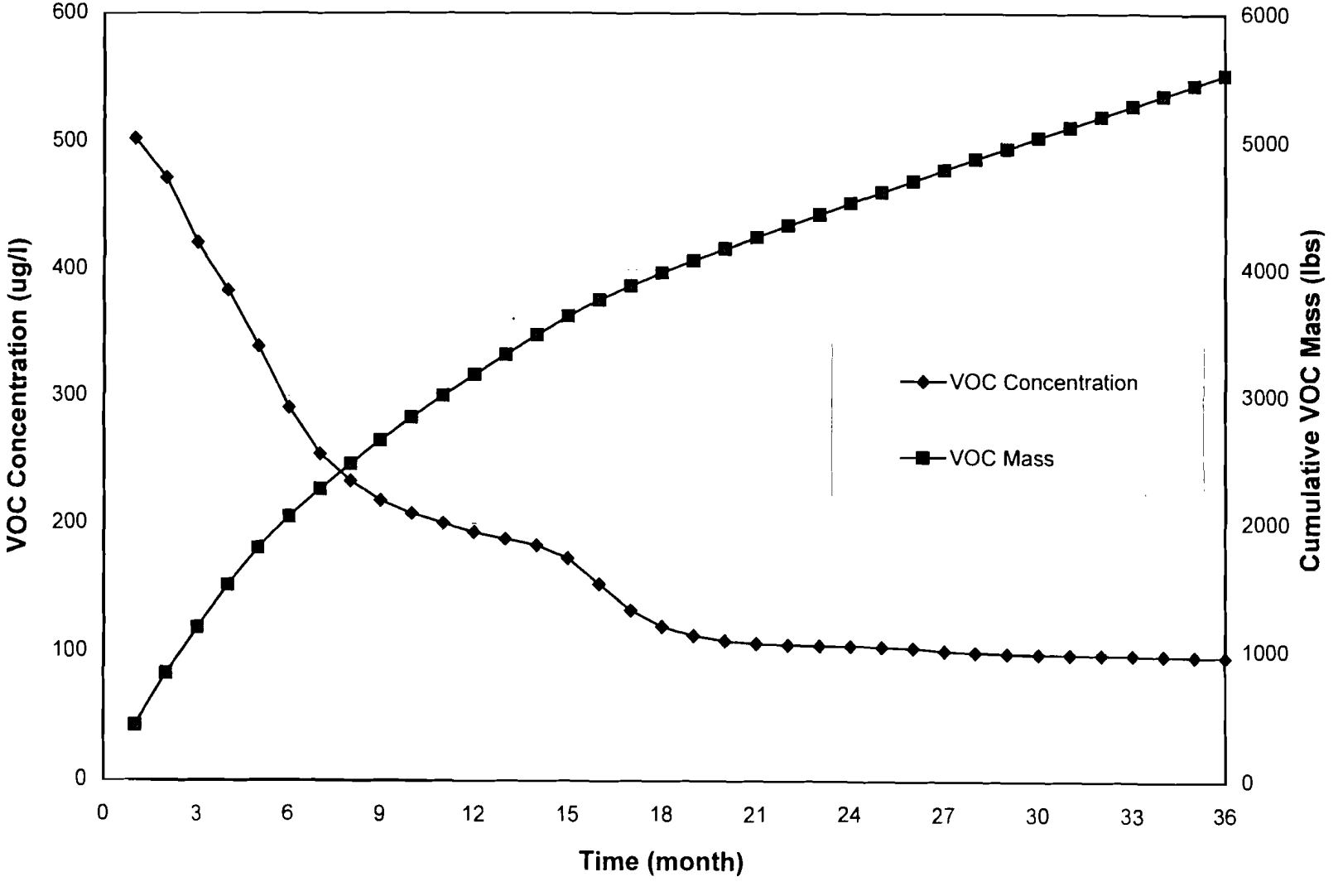
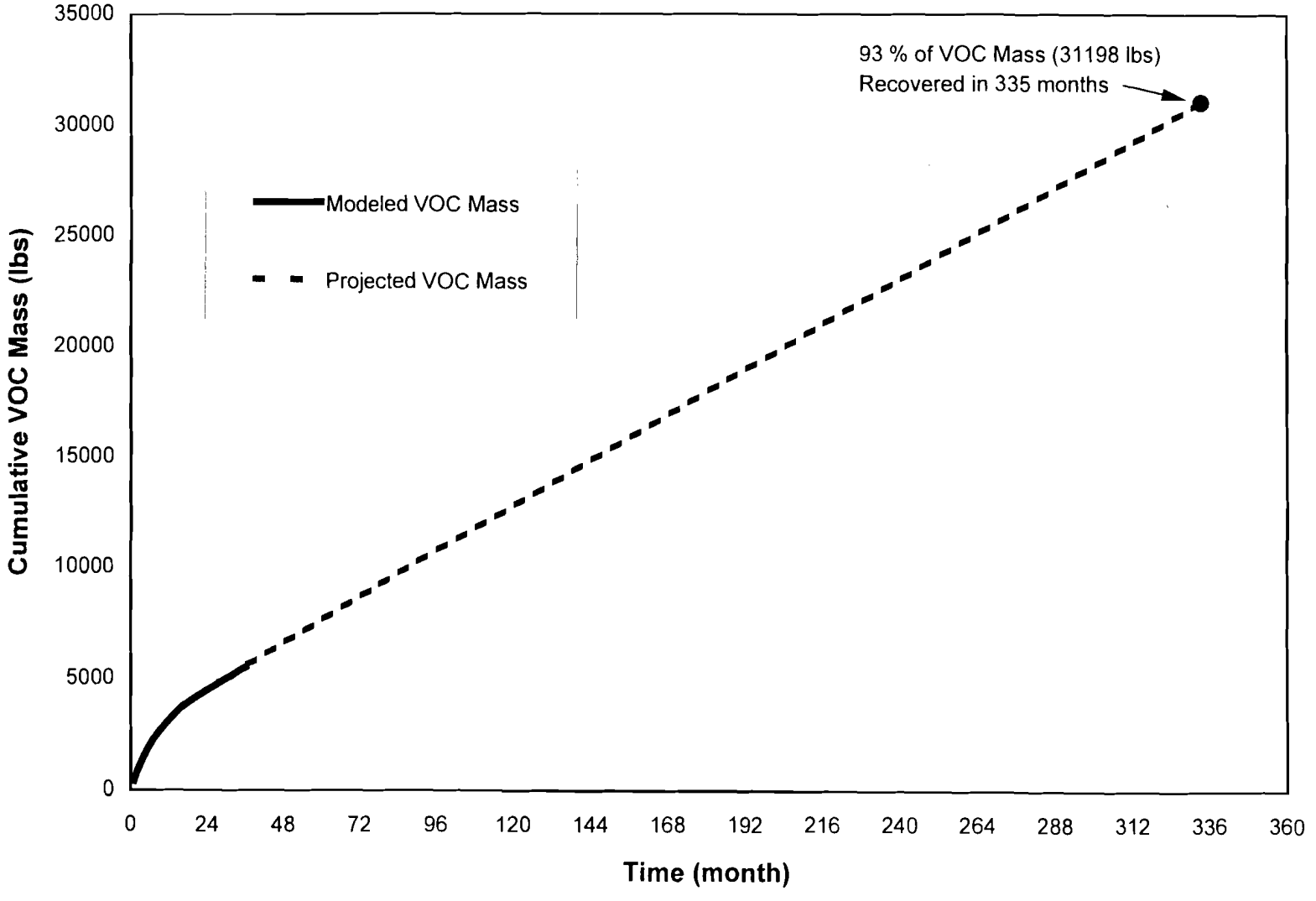


Figure 5-28b VT3D Modeling Results for Case 4
Cumulative Recovery of 93% of Total VOC Mass



Section 6

References

1. Final Division Technical and Administrative Guidance Memorandum (TAGM) - Disposal of Drill Cuttings
   New York State Department of Environmental Conservation, November 21, 1989

2. Record of Decision
   Great Neck, New York
   New York State Department of Environmental Conservation, March 1997

3. Interim Remedial Measure Operable Unit II Soil Remediation Work Plan
   Great Neck, New York
   Unisys Corporation, November 15, 1993

4. Start Up Report - May 1994
   IRM Operable Unit II - SVE System
   Great Neck, New York
   Unisys Corporate Environmental Affairs, June 6, 1994

5. June 1994 through May 1995 Monthly Reports
   IRM Operable Unit II - SVE System
   Great Neck, New York
   Unisys Corporate Environmental Affairs

6. June 1995 through February 1996 Monthly Reports
   IRM Operable Unit II - SVE System
   Great Neck, New York
   Loral Environmental

7. March 1996 through June 1998 Monthly Reports
   IRM Operable Unit II - SVE System
   Great Neck, New York
   H2M Associates, Inc.

8. Feasibility Study Report Operable Unit I
Great Neck, New York
H2M Associates, Inc., January 1997

9. Phase I Environmental Assessment Report
Lockheed Martin Tactical Defense Systems
H2M Associates, Inc., April 1997

10. Scope of Work for Soil Vapor Extraction System Evaluation
Lockheed Martin Tactical Defense Systems
H2M Associates, Inc., July 1997

11. Soil Vapor Extraction System Evaluation Work Plan
Lockheed Martin Corporation
Great Neck, New York
Tetra Tech, Inc., July 14, 1998

12. Fax transmittal of dry well excavation information
from Sui Leong of H2M Group to Nisha Bansal of Tetra Tech, Inc.
January 21, 1999

Appendix A

UNISYS CORPORATION

THEORETICAL VOC EXTRACTION CURVE

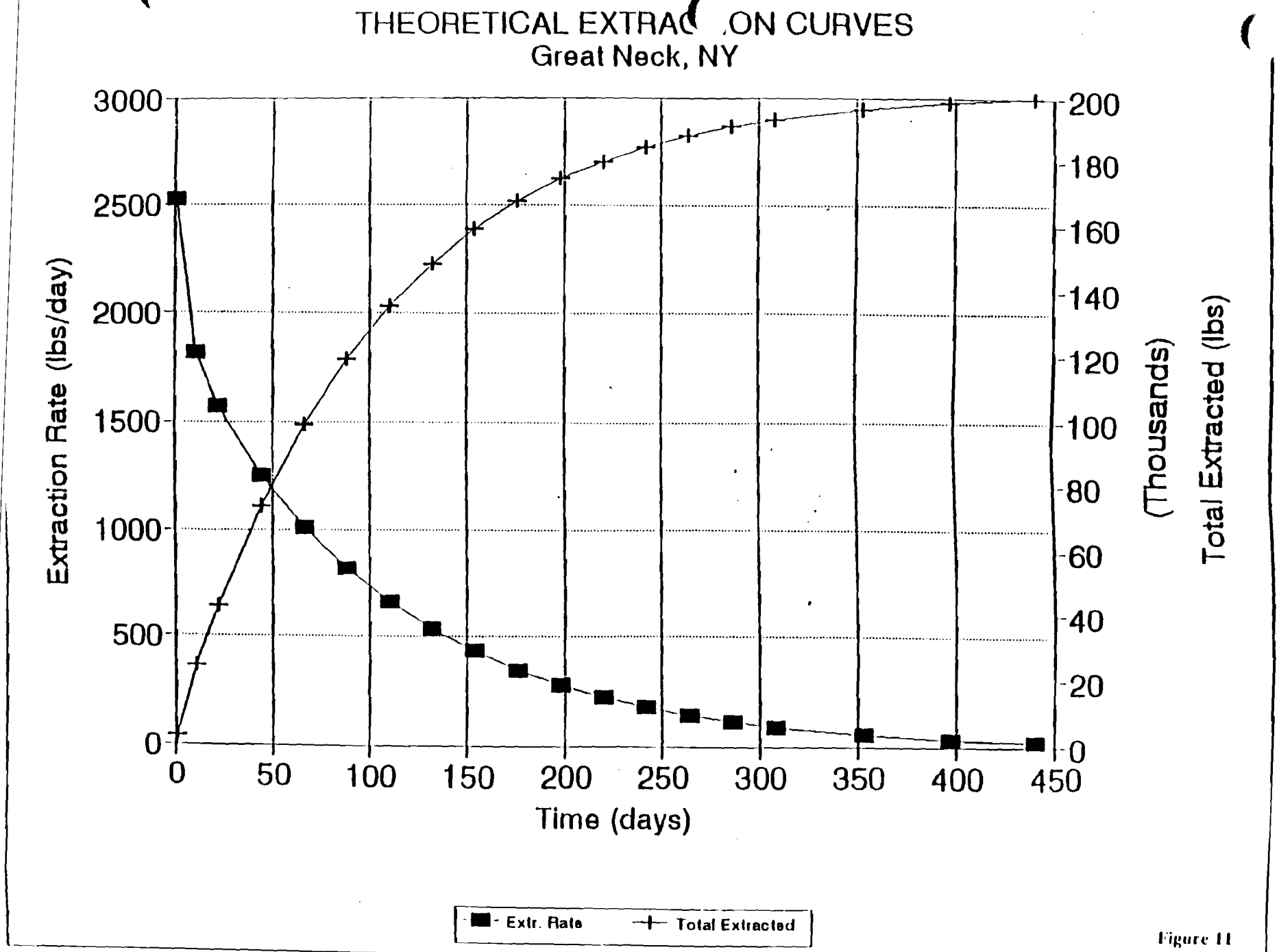

THEORETICAL EXTRAC .ON CURVES
Great Neck, NY
Extraction Rate (lbs/day)
Total Extracted (lbs (Thousands)
Time (days)
3000
2500
2000
1500
1000
500
0
200
180
160
140
120
100
80
60
40
20
0
0
50
100
150
200
250
300
350
400
450
Extr. Rate
Total Extracted

Figure 11

H2M CORPORATION

VOC MASS CALCULATIONS

FEASIBILITY STUDY REPORT

OPERABLE UNIT I

LOCKHEED MARTIN TACTICAL DEFENSE SYSTEMS DIVISION
(Former Unisys Corp. Site)

Great Neck, New York
NYSDEC Site No.130045

Prepared for:
New York State
Department of Environmental Conservation

On behalf of:
Lockheed Martin Tactical Defense Systems Division of
Lockheed Martin Tactical Systems, Inc.

JANUARY 1997

Prepared by:
H2MGROUP

H2MGROUP

VOC MASS CALCULATION FOR SOIL

Available data was used to estimate the mass of VOCs adsorbed to impacted soils located in the vicinity of the former dry wells. Data utilized included soil samples collected prior to the RI in 1988, 1990, and 1991 and soil samples collected during the RI. Total VOC (TVOC) analytical results were plotted on a cross section in order to estimate the volume of soil impacted by VOCs. Review of the plotted data indicated an area of relatively high VOCs in the immediate vicinity of the dry wells (area 1) and a much larger area (area 2) with lower VOC concentrations surrounding area 1. Results of the VOC mass estimation are summarized below.

Area	Soil Volume (yd^3)	Soil Mass (lb)	TVOC Mass (lb)
1	13,900	41×10^6	52,000
2	120,000	3.56×10^6	18,000
Total	**133,900**	**3.97×10^6**	**70,000**

The quantities given above are only estimates and several assumptions were made in order to calculate the mass of TVOCs. These assumptions include the area of impacted soil is cylindrical in shape with a diameter of 125 feet in Area 1 and 225 feet in Area 2; the analytical data is representative of average current soil conditions, and the zone of impacted soil does not extend more than 10 feet below the groundwater table. These quantities will be reevaluated as more data becomes available.

Area 1

Soil volume = $\pi(63\ ft)^2(30\ ft)$
= $374,069\ ft^3$
= $13,900\ yd^3$

Soil mass = $374,069\ ft^3 \times 110\ lb/ft^3 \times 1\ lb./2.2\ kg$
= $18.7 \times 10^6\ kg$
= $41 \times 10^6\ lb$

TVOC mass = $18.7 \times 10^6\ kg \times 10^{-6}\ kg/mg \times 1,250\ mg/kg$
= 23,400 kg
= 52,000 lb

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Area 2

Soil volume = $[\pi(113\ ft)^2\ (90\ ft)] - 374{,}100\ ft^3$
$= 3.24 \times 10^6\ ft^3$
$= 120{,}000\ yd^3$

Soil mass = $3.24 \times 10^6\ ft^3 \times 110\ lb/ft^3 \times 1\ lb/2.2\ kg$
$= 1.62 \times 10^8\ kg$
$= 3.56 \times 10^8\ lb$

TVOC mass = $1.62 \times 10^8\ kg \times 10^{-6}\ kg/mg \times 45\ mg/kg$
$= 7{,}200\ kg$
$= 18{,}000\ lb$

Estimated Total VOCs in Soil = Approximately 70,000 lb

Pre RI Soil Sampling Data

Great Neck, NY

Boring	Vapor Well	Boring Depth (ft.)	Date Drilled	Sample Number	Sample Depth (ft)	PHC (ppm)	Total VOCs	Total SVOCs	Total Pest./PCBs	Parameters
B-1	no	4	1/13/88	B-1	10..12	ND	ND	--	--	vocs, phc, metals
B-2	no	20	3/31/88	B-2	10..12	+	+	--	--	vocs, phc, metals
B-3	no	29	3/31/88	B-3	25..27	+	+	--	--	vocs, phc, metals
B-4	no	35	4/5/88	B-4	20..22	+	+	--	--	vocs, phc, metals
B-4	no	35	4/5/88	B-4	30..32	+	+	--	--	vocs, phc, metals
B-4	no	35	4/5/88	B-4	35..37	+	+	--	--	vocs, phc, metals
B-5	no	18	4/5/88	B-5	15..17	+	+	--	--	vocs, phc, metals
B-6	no	30	4/11/88	B-6	25..27	ND	ND	--	--	vocs, phc, metals
B-7	no	30	4/11/88	B-7	30-32	16	ND	--	--	vocs, phc, metals
B-8	no	30	4/11/88	B-8	30..32	ND	ND	--	--	vocs, phc, metals
B-9	no	32	4/12/88	B-9	30..32	ND	ND	--	--	vocs, phc, metals
B-10	no	12	4/12/88	B-10	5..7	41	ND	--	--	vocs, phc, metals
B-11	no	30	3/31/88	B-11	30-32	ND	ND	--	--	vocs, phc, metals
B-12	no	30	3/31/88	B-12	30-32	ND	ND	--	--	vocs, phc, metals
B-13	no	30	3/31/88	B-13	25..27	ND	ND	--	--	vocs, phc, metals
B-14	no	30	4/12/88	B-14	25..27	ND	ND	--	--	vocs, phc, metals
SVB1	no	50	6/12/90	--	--	--	--	--	--	not sampled
SVB2	VW1	91	6/14/90	SVB2-50-51.5	50-51.5	--	18	--	--	vocs
SVB2	"	91	6/14/90	SBVB2-85-86.5	85-86.5	--	94,000	--	--	vocs
SVB3	VW2	45	6/18/90	--	--	--	--	--	--	not sampled
SVB4	VW3	93	6/18/90	SVB4-80-81.5	80-81.5	--	ND	--	--	vocs
SVB5	VW4	80	6/21/90	SVB5-60-61.5	60..61.5	--	*	--	--	vocs
SVB5	"	80	6/21/90	SBV5-50-51.5	50..51.5	--	6300	--	--	vocs
SVB5	"	80	6/21/90	SVB5-12	12	--	*	--	--	vocs
SVB5	"	80	6/21/90	SVB5-70-71.5	70-71.5	--	*	--	--	vocs
SVB5	"	80	6/21/90	SVB5-80-81.5	80-81.5	--	8400	--	--	vocs
SVB6	no	37	6/21/90	SVB6-12	12	--	--	--	--	#2 fuel oil (ND)
SVB7	VW5	93	--	--	--	--	--	--	--	NA
SVB8	no	25	6/25/90	--	--	--	--	--	--	NA

note: all results in ppb unless otherwise noted, -- not analyzed, * detected in blank or below mdl, ND not detested, + data not available.

SOILBOR XLS

HZM GROUP

Pre RI Soil Sampling Data

Great Neck, NY

Boring	Vapor Well	Boring Depth (ft.)	Date Drilled	Sample Number	Sample Depth (ft)	PHC (ppm)	Total VOCs	Total SVOCs	Total Pest./PCBs	Parameters
SVB9	VW6	90	--	--	--	--	--	--	--	NA
SVB10	VW7	48	7/30/91	SVB102022	20..22	--	*	--	--	tcl vocs
SVB10	"	48	33449	SVB104042	40..42	--	5	--	--	tcl vocs
SVB11	VW8	90	7/24/91	SVB112022	20..22	--	ND	--	--	tcl vocs
SVB11	"	90	7/24/91	SVB114042	40..42	--	59	--	--	tcl vocs
SVB11	"	90	7/24/91	SVB116062	60..62	--	ND	--	--	tcl vocs
SVB11	"	90	7/24/91	SVB118082	80..82	--	27	--	--	tcl vocs
SVB12	no	3	7/25/90	--	--	--	--	--	--	not sampled
SVB13	VW9	90	7/26/91	SVB132022	20..22	--	*	--	--	tcl vocs
SVB13	"	90	7/26/91	SVB134042	40..42	--	*	--	--	tcl vocs
SVB13	"	90	7/26/91	SVB136062	60..62	--	*	--	--	tcl vocs
SVB13	"	90	7/26/91	SVB138082	80..82	--	65	--	--	tcl vocs
SVB14	VW10	90	8/16/91	SVB142022	20..22	--	*	--	--	tcl vocs
SVB14	"	90	8/16/91	SVB144042	40..42	--	*	--	--	tcl vocs
SVB14	"	90	8/16/91	SVB146062	60..62	--	*	--	--	tcl vocs
SVB14	"	90	8/16/91	SVB148082	80..82	--	15	--	--	tcl vocs
SVB15	VW11	90	8/6/91	SVB152022	20..22	--	*	--	--	tcl vocs
SVB15	"	90	8/6/91	SVB154042	40..42	--	*	--	--	tcl vocs
SVB15	"	90	8/6/91	SVB156062	60..62	--	*	--	--	tcl vocs
SVB15	"	90	8/6/91	SVB158082	80..82	--	ND	--	--	tcl vocs
SVB16	VW12	90	8/14/91	SVB162022	20..22	--	7	--	--	tcl vocs
SVB16	"	90	8/14/91	SVB164042	40..42	--	6	--	--	tcl vocs
SVB16	"	90	8/14/91	SVB166062	60..62	--	6	--	--	tcl vocs
SVB16	"	90	8/14/91	SVB168082	80..82	--	30	--	--	tcl vocs
SVB17	VW13	90	8/22/91	SVB17	20..22	--	1,330,000	--	--	tcl vocs
SVB17	"	90	8/22/91	SVB-17	60-62	--	308,000	--	--	tcl vocs
SVB17	"	90	8/22/91	SVB-17	40-42	--	*	--	--	tcl vocs
SVB17	"	90	8/22/91	SVB-17	80-82	--	130,000	--	--	tcl vocs
SVB17	"	90	8/22/91	SVB-17B	20-22	--	1,899,000	--	--	tcl vocs

note: all results in ppb unless otherwise noted, -- not analyzed, * detected in blank or below mdl, ND not detested, + data not available.

H2MGROUP

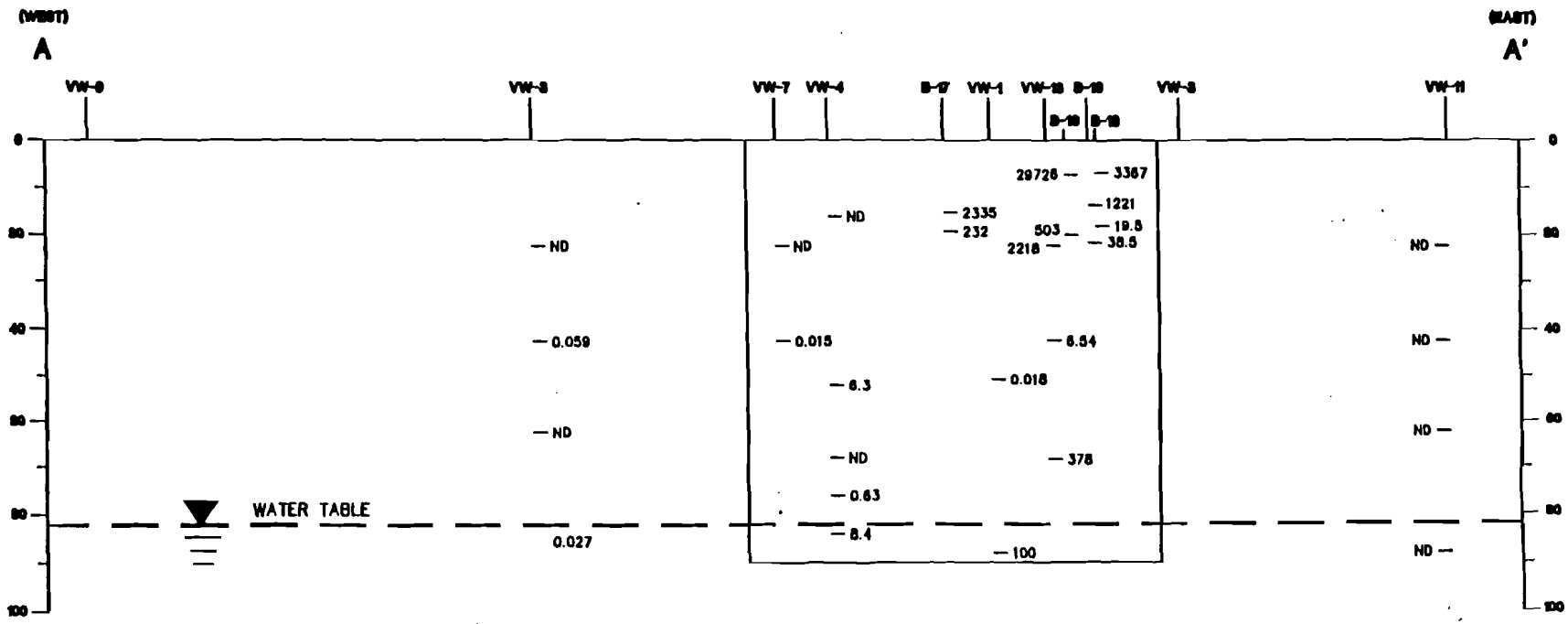
Pre RI Soil Sampling Data

Great Neck, NY

Boring	Vapor Well	Boring Depth (ft.)	Date Drilled	Sample Number	Sample Depth (ft)	PHC (ppm)	Total VOCs	Total SVOCs	Total Pest./PCBs	Parameters
SVB17	"	90	8/22/91	SVB-17 011	40-42	--	--	--	--	tcl vocs
SVB17	"	90	8/22/91	SVB-17 RE	60-62	--	348,000	--	--	tcl vocs
SVB17	"	90	8/22/91	SVB-17 RE	80-82	--	130,000	--	--	tcl vocs
SVB17	"	90	8/22/91	SVB-17B RE	20-22	--	2,200,000	--	--	tcl vocs
SVB17	"	90	8/22/91	SVB-17 002 RE	40-42	--	15.5	--	--	tcl vocs
SVB17	"	90	8/22/91	SVB-17 011 RE	40-42	--	*	--	--	tcl vocs
SVB17	"	90	8/22/91	SVB-17	20-Dec	--	--	1140	48/890	tcl sem-voc,pest/PCB
SVB17	"	90	8/22/91	SVB-17 RE	20-Dec	--	--	1640	--	tcl seml-vols
SVB17	"	90	8/22/91	SVB-17	30-40	--	--	ND	ND/ND	tcl sem-voc,pest/PCB
SVB17	"	90	8/22/91	SVB-17	50-60	--	--	6270	--	tcl sem-voc
SVB17	"	90	8/22/91	SVB-17	70-80	--	--	5370	ND/2730	tcl sem-voc,pest/PCB
SVB17	"	90	8/22/91	SVB-17	20-Dec	--	--	--	--	tcl pest/PCB
SVB17	"	90	8/22/91	SVB-17	30-40	--	--	--	--	tcl pest/PCB
SVB-17	"		SVB-18	50-60	--	--	--	--	tcl pest/PCB	LBG
SVB17	"	90	8/22/91	SVB-17	70-80	--	--	--	--	tcl pest/PCB
SVB17	"	90	8/22/91	SVB-17	20-Dec	--	--	--	--	tal metals plus cyanide
SVB17	"	90	8/22/91	SVB-17	30-40	--	--	--	--	tal metals plus cyanide
SVB17	"	90	8/22/91	SVB-17	50-60	--	--	--	--	tal metals plus cyanide
SVB17	"	90	8/22/91	SVB-17	70-80	--	--	--	--	tal metals plus cyanide
SVB18	VW14	42	8/23/91	--	--	--	--	--	88/3060--	tcl pest/PCB

note: all results in ppb unless otherwise noted, -- not analyzed, * detected in blank or below mdl, ND not detested, + data not available.

H2MGROUP



ALL CONCENTRATIONS TOTAL VOLATILE ORGANIC COMPOUNDS IN Mg / Kg

DATE	11/17/95
SCALE	AS NOTED
DRAWN BY	D.A.P.
CHK. BY	F.J.F.
PROJ. MGR.	F.J.F.
PROJ. NO.:	87041
CS.I.C.D.	X

LORAL DEFENSE SYSTEMS - EAST
GEOLOGIC CROSS-SECTION A-A'
SOIL QUALITY

LORAL

FIGURE 1

FILE NAME: Q:\CEA\PROJ\87041\87041-34

NOTE:

REMEDIATION AREA SHOWN IS FOR 0 TO 80 FEET BELOW GRADE. REFER TO CROSS SECTIONS FOR VERTICAL DISTRIBUTION.

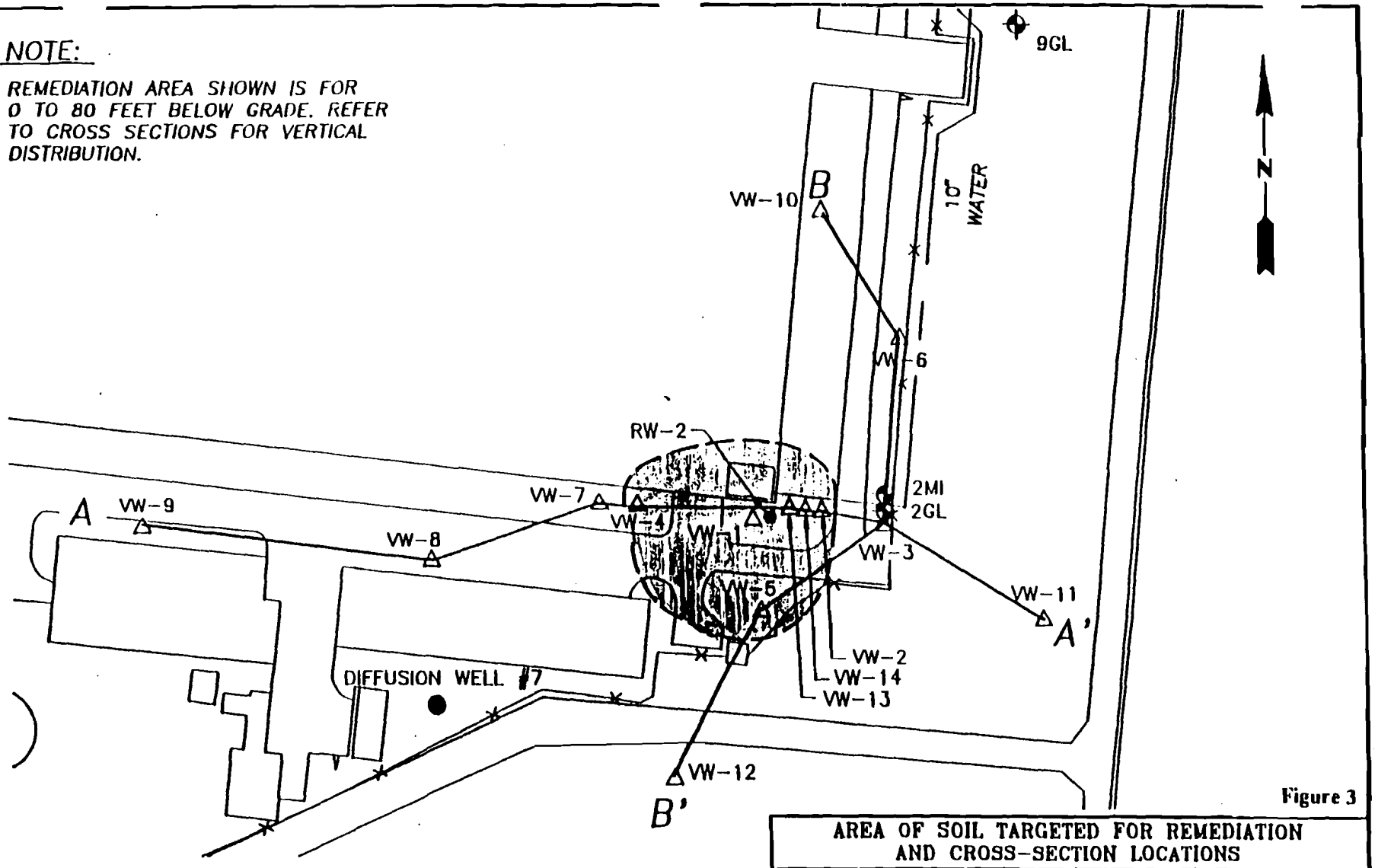


Figure 3

AREA OF SOIL TARGETED FOR REMEDIATION AND CROSS-SECTION LOCATIONS

UNISYS DEFENSE SYSTEMS, INC.
SHIPBOARD AND GROUND SYSTEMS FACILITY
GREAT NECK, NEW YORK

DATE	REVISED

PREPARED BY:
LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Ground-Water Consultants
72 Danbury Road
Wilton, CT 06897
(203) 762-1207

DATE: 1/27/92

LEGEND

VW-8 VAPOR EXTRACTION WELL

A—A' CROSS-SECTION LOCATION

BOUNDARY OF AREA TARGETED FOR REMEDIATION

0 120
SCALE IN FEET

Appendix B

TETRA TECH BORING LOG

BORING I.D. NO. TT-1

CLIENT LOCKHEED MARTIN T.C. 1768-05 LOCATION GREAT NECK DATE 8/25/98

DRILL METHOD HSA AUGER DIAMETER 8.00" OD FIELD GEOLOGIST Phil Skorge

DEPTH (feet)	BLOW COUNT	OVA (ppm)	USCS	GEOLOGIC DESCRIPTION
			SW	
5	5/5 4/5	ND		SAND - Yellowish Brown, poorly sorted fine to coarse sand, trace gravel, loose, moist. Cobbles @ 7.0 feet.
10	10/12 12/18		GW	SANDY GRAVEL/COBBLES - No recovery for lab sample. Yellowish Brown 30% sand, fine to coarse gravel, moist. Rock stuck in shoe. Some dark gray to black soil in cuttings @ 8'-10', ~30ppm P.I.D. readings.
	11/18 18/28			Collected sample @ 14.0 feet for laboratory analysis.
15	50=6"			No recovery. Cobbles. Cuttings @ 15.0 feet measured up to 110ppm. No recovery.
			SW	GRAVELLY SAND - Orange Brown, 20% gravel, poorly sorted fine to coarse sand, moist. 210ppm in soil cuttings.
20	13/19 23/25			
	24/31 36/40	8.0	GW	SANDY GRAVEL/COBBLES - Yellowish Brown, 30% sand, fine to medium gavel.
25	32/38 44/50			No recovery. Cobbles. No recovery. Cobbles.
30	40/38 42/42			Cobbles, 5% recovery. 5ppm in soil cuttings.
35	24/31 35/38			Cobbles, <5% recovery.
40	32/34 38/41	4.0		41.5'-42.0': Gravelly Sand, Gray Brown, 40% gravel, fine sand, otherwise cobbles. Refusal @ 42.0 feet, boulders.
				Total Depth 42.0 feet. Terminated per soil refusal. Backfill with bentonite grout.
45				

REVIEWING GEOLOGIST Rich Baldwin SIGNATURE _____ REG. NO. _____

TETRA TECH BORING LOG

BORING I.D. NO. TT-1a

CLIENT LOCKHEED MARTIN T.C. 1768-05 LOCATION GREAT NECK DATE 8/25/98

DRILL METHOD HSA AUGER DIAMETER 8.00" OD FIELD GEOLOGIST Phil Skorge

DEPTH (feet)	BLOW COUNT	OVA (ppm)	USCS	GEOLOGIC DESCRIPTION
				Continued from refusal of boring TT-1.
50	30/20 18/18	ND	SW	SAND - Light Yellowish Brown, poorly sorted fine to coarse sand, (mostly fine to medium), moist, faint odor.
			GW	SANDY GRAVEL - Light Gray to Yellowish Brown, 40% sand, fine to medium gravel, moist, no odor.
55				No recovery.
	34/29 35/38	34.0		
	25/38 48/50	20.0	SW	GRAVELLY SAND - Light Yellowish Brown, 30% gravel, fine to coarse sand, moist.
60	15/19 21/33	41.0		No gravel, fine to coarse sand (mainly fine to medium).
	15/22 37/39	212.0		Solvent odor @ 62.0 feet.
	15/18 20/24	120.0		
65	12/15 17/21	145.0		20% gravel, mainly coarse sand.
				No recovery.
	13/18 18/19	68.0		Trace gravel, mainly medium to coarse sand.
70				20% gravel, mainly fine to medium sand.
	15/17 17/17	144.0		
	18/23 27/32	150.0		Mainly coarse sand, 30% gravel.
75	16/24 27/31	204.0		<5% recovery, cobbles.
				Dark Yellowish Brown, 5% gravel, fine grained sand, laminations, mainly medium to coarse sand.
	18/24 29/34	282.0	SP	SAND - Light Yellowish Brown, moderately sorted fine to medium sand, moist, heavy odor.
80				▼: Groundwater encountered @ 82.5 feet.
				Total Depth 83.0 feet. Terminated boring. Groundwater encountered @ 82.5 feet. Soil gas probes set at 73' and 63'.
85				
90				

REVIEWING GEOLOGIST Rich Baldwin SIGNATURE _____ REG. NO. _____

TETRA TECH BORING LOG

BORING I.D. NO. TT-2

CLIENT LOCKHEED MARTIN T.C. 1768-05 LOCATION GREAT NECK DATE 8/19/98

DRILL METHOD HSA AUGER DIAMETER 8.00" OD FIELD GEOLOGIST Phil Skorge

DEPTH (feet)	BLOW COUNT	OVA (ppm)	USCS	GEOLOGIC DESCRIPTION
			SW	
	5/8 11/13	2.0		GRAVELLY SAND - Dark Brown, 10% fines, poorly sorted fine to coarse sand (mostly fine), 20% gravel, moist.
	7/5 5/5	1.0		
5	2/2 3/3			Cobble/Boulder @ 4.0 feet
	4/4 5/6	3.0		
	4/6 7/7	1.5		
10				
	7/11 12/14	4.0		
	9/17 26/29	4.0		SAND - Yellowish Brown, moderately sorted fine to medium sand, trace gravel, moist.
15	10/17 21/26	11.0		30% gravel/cobbles, faint odor, moist
				Cobbles/Boulders @ 16'-19'. No samples attempted.
20				
	6/12 14/17	3.0		30% gravel/cobbles, poorly sorted sand, faint odor.
	6/13 14/16	2.5		5% gravel..
25				No recovery, cobbles.
	7/12 15/19	3.0		5% gravel, poorly sorted fine to coarse sand, no odor.
30	8/12 19/20	2.0		
	6/11 13/12 6/10 13/18	1.0 3.5		Dark Brown
35	6/7 9/12	4.0	SC	CLAYEY SAND - 30% clay, 10% silt, fine to coarse sand (mainly fine sand), 5% gravel, moist.
	6/9 11/13	2.0	SM	SILTY SAND - 10% clay, 20% silt, poorly sorted fine to coarse sand, 5% gravel, moist.
	8/14	4.0	SW	SAND - 5% fines, poorly sorted fine to coarse sand, 5% gravel.
40	18/21		SM	SILTY SAND - 20% silt, fine sand, no gravel.
	11/16 19/23	2.5	SW	GRAVELLY SAND - Dark Brown, poorly sorted fine to coarse sand, 5% gravel, moist.
	8/11 12/15	5.0		Yellowish Brown and Dark Brown, 3" silty sand zone.
45				

REVIEWING GEOLOGIST Rich Baldwin SIGNATURE _____ REG. NO. _____

TETRA TECH BORING LOG

BORING I.D. NO. TT-2

CLIENT LOCKHEED MARTIN T.C. 1768-05 LOCATION GREAT NECK DATE 8/19/98

DRILL METHOD HSA AUGER DIAMETER 8.00" OD FIELD GEOLOGIST Phil Skorge

DEPTH (feet)	BLOW COUNT	OVA (ppm)	USCS	GEOLOGIC DESCRIPTION
	7/10 14/19	1.5	SW	Yellowish Brown, 10% gravel.
			SM	SILTY SAND - Light Brown, 30% fines, fine to coarse sand, moist.
	NR	5.0	SW	SAND - Light Brown, 5% fines, poorly sorted fine to coarse sand, moist.
50	10/17 2/24	7.0		Yellowish Brown, with laminations, 5% gravel, trace fines.
	11/19 25/28	3.0		Yellowish Brown, no laminations.
	8/17 19/22	5.0		10% gravel.
55	9/14 17/24	5.0		Orange Brown, mainly coarse sand.
	8/11 17/21	7.0		Light Brown, with laminations, no gravel.
60	7/10 14/15	52.0		Fine to coarse sand, no laminations, 3" gray layer, solvent odor.
	12/19 24/29	58.0		
	6/13 20/26	234.0		Solvent odor.
65	11/17 23/29	253.0		Fine to coarse sand, solvent odor.
	8/11 14/19	225.0		Light Gray, fine to coarse sand, strong odor.
70	9/12 18/23	165.0		
	7/10 14/18	476.0		
	9/18 21/25	206.0		5% gravel, more coarse sand than above.
75	10/11 14/17	86.0		10% gravel, more coarse sand than above.
	7/10 12/15	85.0		No gravel, less coarse sand than above.
	9/12 18/25	130.0		
80	7/14 17/19	200.0		▼: Gray, moderately sorted fine to medium sand, heavy odor, wet. Groundwater encountered @ 80.0 feet.
				Total Depth 82.0 feet. Terminated boring. Backfill with bentonite grout. Groundwater encountered @ 80.0 feet.
85				
90				

REVIEWING GEOLOGIST Rich Baldwin SIGNATURE _____ REG. NO. _____

TETRA TECH BORING LOG

BORING I.D. NO. TT-3

CLIENT LOCKHEED MARTIN T.C. 1768-05 LOCATION GREAT NECK DATE 8/28/98

DRILL METHOD HSA AUGER DIAMETER 8.00" OD FIELD GEOLOGIST Phil Skorge

DEPTH (feet)	BLOW COUNT	OVA (ppm)	USCS	GEOLOGIC DESCRIPTION
5	22/15 19/25	0.0	GW	SANDY GRAVEL - Dark Brown, 30% poorly sorted fine to coarse sand, fine to medium gravel, moist.
10	12/15 12/12	0.0	SW	GRAVELLY SAND - Dark Brown, 15% gravel, poorly sorted fine to coarse sand, moist.
15	12/10 10/11	0.0		20% gravel. Yellowish Brown, 5% gravel.
20	14/15 14/14	0.0		No gravel.
	8/9 9/10	0.0		Trace gravel (<5%).
25	9/10 9/11	0.0		
	9/12 15/28	0.0		10% fines, cobble in shoe.
30				No recovery, cobbles. No recovery, cobbles.
35	9/12 15/16	0.0	CL	SANDY CLAY - Dark Brown, non-plastic fines, 20% sand (mainly fine sand), moist.
40				Cobbles.
	15/17 18/18	0.0	SM	SILTY SAND - Dark Brown, 30% fines, fine to coarse (mainly fine sand), Trace gravel, moist.
45	9/12 28/29	0.0		20% fines, mainly medium to coarse sand.

REVIEWING GEOLOGIST Rich Baldwin SIGNATURE _____ REG. NO. _____

TETRA TECH BORING LOG

BORING I.D. NO. TT-3

CLIENT LOCKHEED MARTIN T.C. 1768-05 LOCATION GREAT NECK DATE 8/28/98

DRILL METHOD HSA AUGER DIAMETER 8.00" OD FIELD GEOLOGIST Phil Skorge

DEPTH (feet)	BLOW COUNT	OVA (ppm)	USCS	GEOLOGIC DESCRIPTION
	10/14 17/19	2.0	SM	
	8/15 17/22	21.0		
50	15/17 17/22	8.0		
	18/20 22/28	72.0		
	35/33 25/28	0.0	SW	GRAVELLY SAND - Grey Brown to Yellow Brown, 20% gravel, poorly sorted fine to coarse sand, moist.
55	24/26 28/31	13.0		Trace gravel (<5%).
	32/37 40/44	70.0		With laminations, odor.
60	25/29 30/30	38.0		No odor.
	22/26 27/29	206.0		
	24/26 29/32	12.0		20% gravel, some cobbles from 60' to 65'.
65	17/20 21/24	18.0		30% gravel, cobble in shoe.
	19/22 22/26	28.0		
70				
	15/19 22/25	3.0		10% gravel.
75				No recovery, cobbles.
80				
	21/22 24/25	240.0		▼ GRAVELLY SAND - Orange Brown, 20% gravel, poorly sorted fine to coarse sand, (mostly coarse), wet. Groundwater encountered @ 81.5 feet, odor.
	19/19 20/21	1904.0		Black, oily, poorly sorted sand (sludge), heavy odor.
85				Total Depth 84.0 feet. Terminated boring. Groundwater encountered @ 81.5 feet. Soil gas probes set @ 52', 62' and 72'.
90				

REVIEWING GEOLOGIST Rich Baldwin SIGNATURE _____ REG. NO. _____

TETRA TECH BORING LOG

BORING I.D. NO. TT-4

CLIENT LOCKHEED MARTIN T.C. 1768-05 LOCATION GREAT NECK DATE 8/24/98

DRILL METHOD HSA AUGER DIAMETER 8.00" OD FIELD GEOLOGIST Phil Skorge

DEPTH (feet)	BLOW COUNT	OVA (ppm)	SAMPLE	GRAPHIC COLUMN	USCS	GEOLOGIC DESCRIPTION
					SW	
5						
10						GRAVELLY SAND - Dark Brown, poorly sorted fine to coarse sand, 20% gravel, moist.
	NR	0.0				Cobbles/boulders at 12'-14'.
15						
	8/6 7/7	19.0				Yellowish Brown, no gravel.
20						
25						
						10% fines.
30	4/7 10/11	80.0				
	5/8 9/12	361.0				Gray Brown, mainly fine grained sand 10% fines, solvent odor.
					SM	SILTY SAND - Gray Brown, 20% fines, poorly sorted fine to coarse sand, wet (perched water), strong odor.
35						
		2500+				
40						
	5/10 12/13	1012.0			SW	SAND - Gray Brown, poorly sorted fine to coarse sand, 10% gravel, wet, strong odor.
	7/10 12/14	2500+				5% gravel.
45						

REVIEWING GEOLOGIST Rich Baldwin SIGNATURE _____ REG. NO. _____

TETRA TECH BORING LOG

BORING I.D. NO. TT-4

CLIENT LOCKHEED MARTIN T.C. 1768-05 LOCATION GREAT NECK DATE 8/24/98

DRILL METHOD HSA AUGER DIAMETER 8.00" OD FIELD GEOLOGIST Phil Skorge

DEPTH (feet)	BLOW COUNT	OVA (ppm)	USCS	GEOLOGIC DESCRIPTION
	6/11 14/16	2500+	SW	Mainly fine to medium sand.
	8/12 19/24	556.0		Fine to coarse sand, poorly sorted.
50				
	6/10 13/17	201.0		Yellowish Brown.
55				
	10/14 16/19	293.0		Fine to medium sand, moderately sorted.
60				
	7/8 10/12	30.0		
65				
	6/12 13/15			Mainly medium to coarse sand.
70				
	9/16 23/30		GW	SANDY GRAVEL - Gray Orange, 40% fine to coarse sand, fine to medium gravel, moist.
75				
	8/12 14/17			▼: Groundwater Encountered @ 80'.
80				Total Depth 80.0 feet. Terminated boring. Backfill with bentonite grout. Groundwater encountered @ 80.0'.
85				
90				

REVIEWING GEOLOGIST Rich Baldwin SIGNATURE _____ REG. NO. _____

TETRA TECH BORING LOG

BORING I.D. NO. TT-5

CLIENT LOCKHEED MARTIN T.C. 1768-05 LOCATION GREAT NECK DATE 8/26/98

DRILL METHOD HSA AUGER DIAMETER 8.00" OD FIELD GEOLOGIST Phil Skorge

DEPTH (feet)	BLOW COUNT	OVA (ppm)	SAMPLE	GRAPHIC COLUMN	USCS	GEOLOGIC DESCRIPTION
5	4/6 9/11	0.0			FILL	SAND - Light yellowish Brown, poorly sorted fine to coarse sand, trace gravel, moist.
10	4/7 7/9	0.0				Dark Brown, 10% gravel.
15	5/8 9/11	0.0				20% gravel.
20	4/6 7/6	0.0				Light Yellowish Brown.
25	6/7 9/9	0.0				
30	6/8 11/13	8.0			GW	SANDY GRAVEL - Dark Gray, 20% sand, fine to medium gravel, heavy odor, damp, (native).
35	6/8 10/11	2500+				Damp to wet, (perched water), heavy odor.
40	11/13 14/18	674.0			SC	CLAYEY SAND - Dark Brown, 30% fines, mainly fine sand, 10% gravel, odor. Black @ bottom 6" of sample, heavy odor, wet.
45						

REVIEWING GEOLOGIST Rich Baldwin SIGNATURE _____ REG. NO. _____

TETRA TECH BORING LOG

BORING I.D. NO. TT-5

CLIENT LOCKHEED MARTIN T.C. 1768-05 LOCATION GREAT NECK DATE 8/26/98

DRILL METHOD HSA AUGER DIAMETER 8.00" OD FIELD GEOLOGIST Phil Skorge

DEPTH (feet)	BLOW COUNT	OVA (ppm)	SAMPLE	GRAPHIC COLUMN	USCS	GEOLOGIC DESCRIPTION
	6/9 11/15	2500+			SC	
	13/27 50/6	528.0			SW	SAND - Light Brown, poorly sorted fine to coarse sand, (mainly fine to medium), moist. Some black soil in sample.
50	8/12 14/17	2500+				
55	7/10 11/16	326.0				Gray Brown, mainly medium to coarse sand, 10% gravel.
60	6/12 19/26	75.0				No gravel, moist.
65	6/11 12/15	11.0				10% fine gravel.
70	6/8 12/15	31.0				Orange Brown.
75	6/11 14/14	38.0				
80	6/12 13/12	380.0				▼: Groundwater Encountered @ 81'.
						Total Depth 82.0 feet. Terminated boring. Groundwater encountered @ 81.0'. Soil gas probes set @ 37', 50', 62' and 72'.
85						
90						

REVIEWING GEOLOGIST Rich Baldwin SIGNATURE _____ REG. NO. _____

TETRA TECH BORING LOG

BORING I.D. NO. TT-6

CLIENT LOCKHEED MARTIN T.C. 1768-05 LOCATION GREAT NECK DATE 8/24/98

DRILL METHOD HSA AUGER DIAMETER 8.00" OD FIELD GEOLOGIST Phil Skorge

DEPTH (feet)	BLOW COUNT	OVA (ppm)	USCS	GEOLOGIC DESCRIPTION
5	2/2 3/5	0.0	SW	SAND - Orange Brown, poorly sorted fine to coarse sand, 10% gravel, moist.
10	8/9 9/16	0.0		Cobbles from 7' to 10'.
15	9/17 20/22	150.0	GW	Cobbles. SANDY GRAVEL - Grayish Brown, 30% poorly sorted fine to coarse sand, fine to medium gravel, faint odor, moist.
20	8/9 8/8	91.0	SW	GRAVELLY SAND - Yellowish Brown, poorly sorted fine to coarse sand 20% gravel, faint odor, moist.
25	6/9 10/13			No recovery.
30	4/7 8/10	2100	SC	CLAYEY SAND - Gray, 40% fines, fine to medium sand, odor, damp.
35	4/6 9/11	102.0	CL	SANDY SILTY CLAY - Brown Gray, non-plastic fines, 20% fine sand, faint odor, moist.
40	7/9 12/13	820.0		Gray Black and Gray Green, trace gravel, 40% fine to coarse sand, strong odor, wet, (perched water).
45				

REVIEWING GEOLOGIST Rich Baldwin SIGNATURE _____ REG. NO. _____

TETRA TECH BORING LOG

BORING I.D. NO. TT-6

CLIENT LOCKHEED MARTIN T.C. 1768-05 LOCATION GREAT NECK DATE 8/24/98

DRILL METHOD HSA AUGER DIAMETER 8.00" OD FIELD GEOLOGIST Phil Skorge

DEPTH (feet)	BLOW COUNT	OVA (ppm)	USCS	GEOLOGIC DESCRIPTION
	4/7 7/7	2500+	CL	
50	7/13 19/22	23.0	SW	SAND - Gray Brown, poorly sorted fine to coarse sand, trace gravel, damp.
55	9/11 14/26	35.0		
	7/10 16/23			
60	4/5 8/8	141.0		Mainly fine to medium sand.
65	4/6 7/5	34.0		Mainly coarse sand, 20% gravel.
70	2/2 4/4	10.0		
75	2/4 4/5	40.0		
80	2/2 3/5	17.0		▼: Groundwater encountered @ 80.0 feet. Black sand @ 81.0 feet
85				Total Depth 82.0 feet. Terminated boring. Backfill with bentonite chips. Groundwater encountered @ 80.0 feet. Soil gas probes set at 30', 45', 60' and 70'.
90				

REVIEWING GEOLOGIST Rich Baldwin SIGNATURE _____ REG. NO. _____

TETRA TECH BORING LOG

BORING I.D. NO. TT-7

CLIENT LOCKHEED MARTIN T.C. 1768-05 LOCATION GREAT NECK DATE 8/28/98

DRILL METHOD HSA AUGER DIAMETER 8.00" OD FIELD GEOLOGIST Phil Skorge

DEPTH (feet)	BLOW COUNT	OVA (ppm)	USCS	GEOLOGIC DESCRIPTION
			GW	
5	4/6 9/11	0.0		
10	6/8 11/14	0.0		SANDY GRAVEL - Dark Brown, 20% fine to coarse sand, fine to medium gravel, moist.
15	6/9 11/12	0.0		40% sand.
			SW	GRAVELLY SAND - Gray Brown, 10% gravel, poorly sorted fine to coarse sand, (mostly fine to medium), moist.
20	8/10 11/14	0.0		
	7/11 15/19	0.0		30% fines, trace gravel.
25	6/13 15/20	0.0		10% fines, 10% gravel.
	6/9 10/12	0.0		
			SM	SILTY SAND - 40% fines, fine to coarse sand, mainly fine sand, moist.
30	5/6 9/10	0.0		
	6/10 11/13	0.0		
	8/11 16/17	0.0		
			CL	SANDY CLAY - Dark Brown, non-plastic fines, 30% sand, mainly fine sand, moist.
35	11/19 27/37	0.0		
			SW	SAND - Dark Brown, poorly sorted fine to coarse sand, 10% gravel, moist.
	10/14 19/23	0.0		
40	6/15 17/19	0.0		
	7/10 11/14	0.0		
	8/11 15/17	0.0		No recovery.
45				

REVIEWING GEOLOGIST Rich Baldwin SIGNATURE _____ REG. NO. _____

TETRA TECH BORING LOG

BORING I.D. NO. TT-7

CLIENT LOCKHEED MARTIN T.C. 1768-05 LOCATION GREAT NECK DATE 8/28/98

DRILL METHOD HSA AUGER DIAMETER 8.00" OD FIELD GEOLOGIST Phil Skorge

DEPTH (feet)	BLOW COUNT	OVA (ppm)	SAMPLE	GRAPHIC COLUMN	USCS	GEOLOGIC DESCRIPTION
	6/9 11/14	0.0			SW	10% fines, moderately sorted fine sand, trace gravel.
	7/10 13/14	0.0				Light Brown, poorly sorted fine to coarse sand.
50	6/10 11/12	0.0				
	7/12 14/17	0.0				No fines.
	8/10 11/14	0.0				
55	6/11 15/18	0.0				
	11/14 19/21	0.0				
	10/14 17/23	0.0				
60	8/10 11/15	0.3				
	7/14 12/14					No recovery.
	7/9 11/10					
65	6/9 10/12	0.0				
	6/8 11/14	0.0				
70	9/15 17/21	0.0				No recovery.
	NR	0.0				Not enough for laboratory sample.
75	6/8 11/15					Mainly medium to coarse sand.
80	6/11 12/14					
						Total Depth 82.0 feet. Terminated boring. Set soil gas probes at 34' and 60'.
85						
90						

REVIEWING GEOLOGIST Rich Baldwin SIGNATURE _____ REG. NO. _____

TETRA TECH BORING LOG

BORING I.D. NO. TT-8

CLIENT LOCKHEED MARTIN T.C. 1768-05 LOCATION GREAT NECK DATE 8/31/98

DRILL METHOD HSA AUGER DIAMETER 8.00" OD FIELD GEOLOGIST Phil Skorge

DEPTH (feet)	BLOW COUNT	OVA (ppm)	USCS	GEOLOGIC DESCRIPTION
			GW	Cobbles and gravel.
5				No recovery.
10			SW	
	8/27 29/30	0.0		SAND - Dark Brown, poorly sorted fine to coarse sand (mainly fine sand), 10% gravel, moist.
15	7/8 11/13	0.0		Yellowish Brown, mainly medium to coarse sand.
20	6/7 10/12	0.00		No gravel, even distribution of fine, medium, and coarse sand.
	6/9 11/14	0.0		
25	5/7 6/10	0.0		
	7/8 11/14	0.0		
30	7/9 10/13	1.0		Orange Brown
	6/11 15/17	0.0		10% gravel, 10% fines.
	11/14 17/18	0.0		
35	6/19 27/29	0.0		No gravel
	8/14 15/18	0.0		30% gravel.
40	8/11 15/17	0.0		10% gravel.
	7/11 12/15	32.0	SC	CLAYEY SAND - Brown Gray, 40% fines (non-plastic fines), fine to medium sand, 10% gravel, moist.
45	9/15 21/22	5.0		30% fines, non-plastic.

REVIEWING GEOLOGIST Rich Baldwin SIGNATURE _____ REG. NO. _____

TETRA TECH BORING LOG

BORING I.D. NO. TT-8

CLIENT LOCKHEED MARTIN T.C. 1768-05 LOCATION GREAT NECK DATE 8/31/98

DRILL METHOD HSA AUGER DIAMETER 8.00" OD FIELD GEOLOGIST Phil Skorge

DEPTH (feet)	BLOW COUNT	OVA (ppm)	USCS	GEOLOGIC DESCRIPTION
	6/10	9.0	SC	
	11/13		SW	SAND - Orange Brown, poorly sorted fine to coarse sand, 10% gravel
	6/10	10.0		
	12/13			
50	9/10	1.0		
	11/13			
	7/10	1.0		
	12/13			
	6/11	1.0		
	12/15			
55	7/10	0.0		
	12/14			
	7/8	0.0		
	11/13			
60	9/11	0.0		
	12/16			
	6/10	0.0		Dark Brown, mainly coarse sand.
	11/14			
	9/11	0.0		No gravel.
65	11/14			
	4/5	0.0		
	7/7			
	5/7	0.0		Orange Brown.
	9/10			
70				
	8/11	0.0		
	12/15			
75				
	7/12	0.0		
	13/16			
80				
	6/9	0.0		▼: Groundwater encountered @ ~81.0 feet.
	10/13			
				Total Depth 82.0 feet. Terminated boring. Groundwater encountered @ ~81.0 feet. No odors. Soil gas probes set @ 42' and 62'.
85				
90				

REVIEWING GEOLOGIST Rich Baldwin SIGNATURE _____ REG. NO. _____

Appendix C

EMCON
DENSITY TEST

Project:	CAS - LOCKHEAD MARTIN/GREAT NECK	Proj. No.	01880.001.009	Tested by:	K.H.
				Entered by:	K.H.
Sample:	TT2-40'	Date:	9-3-98	Checked by:	R.S.A.

Remarks:

Dimensions of Specimen:

	Length (Inches)		Diameter (Inches)
1.	5.985	1.	1.410
2.	5.985	2.	1.410
3.	5.985	3.	1.410
4.	5.985	4.	1.410
5.	5.985	5.	1.410

Avg.	5.985	In	Ave. 1.410	In
	15.202	CM	3.581	CM
Area	1.561	In^2	10.074	CM^2
Volume	9.3452768	In^3	0.0054081	Cft.

Weight of Specimen:

Initial Weigh	330.6	Grams
	0.728	Lbs.
Dry Weight	296.9	Grams
	0.654	Lbs.
Moisture Content:	11.35	%
Density, Wet Initial	134.77	pcf
Density, Dry	121.03	pcf

Remarks: 1. Soil Description: Yellowish Brown cmf SAND, little Silt, little mf Gravel (visual)

2. Specific Gravity: 2.6909

EMCON
DENSITY TEST

Project:	CAS - LOCKHEAD MARTIN/GREAT NECK	Proj. No.	01880.001.009	Tested by:	K.H.
				Entered by:	K.H.
Sample:	TT2-52'	Date:	9-3-98	Checked by:	R.S.A.

Remarks:

Dimensions of Specimen:

	Length (Inches)		Diameter (Inches)
1.	5.800	1.	1.410
2.	5.800	2.	1.410
3.	5.800	3.	1.410
4.	5.800	4.	1.410
5.	5.800	5.	1.410

Weight of Specimen:

Initial Weigh	292.4	Grams
	0.644	Lbs.
Dry Weight	262.5	Grams
	0.578	Lbs.
Moisture Content:	11.39	%
Density, Wet Initial	123.00	pcf
Density, Dry	110.42	pcf

Avg.	5.800	In	Ave.	1.410	In
	14.732	CM		3.581	CM
Area	1.561	In^2		10.074	CM^2
Volume	9.0564086	In^3	0.0052410	Cft.	

Remarks: 1. Soil Description: Yellowish Brown cmf SAND, little Silt, little mf Gravel (visual)

2. Specific Gravity: 2.6852

EMCON
DENSITY TEST

Project:	CAS - LOCKHEAD MARTIN/GREAT NECK	Proj. No.	01880.001.009	Tested by:	K.H.
				Entered by:	K.H.
Sample:	TT2-62'	Date:	9-3-98	Checked by:	R.S.A.

Remarks:

Dimensions of Specimen:

	Length (Inches)		Diameter (Inches)
1.	5.985	1.	1.410
2.	5.985	2.	1.410
3.	5.985	3.	1.410
4.	5.985	4.	1.410
5.	5.985	5.	1.410

Avg.	5.985	In	Ave. 1.410	In
	15.202	CM	3.581	CM
Area	1.561	In^2	10.074	CM^2
Volume	9.3452768	In^3	0.0054081	Cft.

Weight of Specimen:

Initial Weigh	296.9	Grams
	0.654	Lbs.
Dry Weight	267.6	Grams
	0.589	Lbs.
Moisture Content:	10.95	%
Density, Wet Initial	121.03	pcf
Density, Dry	109.08	pcf

Remarks: 1. Soil Description: Yellowish Brown cmf SAND, trace Silt, trace mf Gravel (visual)

2. Specific Gravity: 2.6737

EMCON
DENSITY TEST

Project:	CAS - LOCKHEAD MARTIN/GREAT NECK	Proj. No.	01880.001.009	Tested by:	K.H.
				Entered by:	K.H.
Sample:	TT2-72'	Date:	9-3-98	Checked by:	R.S.A.

Remarks:

Dimensions of Specimen:

	Length (Inches)		Diameter (Inches)
1.	5.800	1.	1.410
2.	5.810	2.	1.410
3.	5.800	3.	1.410
4.	5.800	4.	1.410
5.	5.800	5.	1.410

Avg.	5.802	In	Ave. 1.410	In
	14.737	CM	3.581	CM
Area	1.561	In^2	10.074	CM^2
Volume	9.0595315	In^3	0.0052428	Cft.

Weight of Specimen:

Initial Weigh	309.4	Grams
	0.681	Lbs.
Dry Weight	272.9	Grams
	0.601	Lbs.
Moisture Content:	13.37	%

Density, Wet Initial	130.10	pcf
Density, Dry	114.75	pcf

Remarks: 1. Soil Description: Brown cmf SAND, trace Silt, trace mf Gravel (visual)

2. Specific Gravity: 2.6583

EMCON
DENSITY TEST

Project:	CAS - LOCKHEAD MARTIN/GREAT NECK	Proj. No.	01880.001.009	Tested by:	K.H.
				Entered by:	K.H.
Sample:	TT2-82'	Date:	9-3-98	Checked by:	R.S.A.

Remarks:

Dimensions of Specimen:

	Length (Inches)		Diameter (Inches)
1.	5.800	1.	1.410
2.	5.800	2.	1.410
3.	5.800	3.	1.410
4.	5.800	4.	1.410
5.	5.800	5.	1.410

Weight of Specimen:

Initial Weigh	312.3	Grams
	0.688	Lbs.
Dry Weight	273.9	Grams
	0.603	Lbs.
Moisture Content:	14.02	%

Avg.	5.800	In	Ave.	1.410	In
	14.732	CM		3.581	CM
Area	1.561	In^2		10.074	CM^2
Volume	9.0564086	In^3	0.0052410	Cft.	

Density, Wet Initial	131.37	pcf
Density, Dry	115.21	pcf

Remarks: 1. Soil Description: Brown cmf SAND, trace Silt, trace mf Gravel (visual)

2. Specific Gravity: 2.6515

COLUMBIA ANALYTICAL SERVICES, INC.
1 Mustard S ., Suite 250, P.O. Box 90859, Rochester, NY 14609-0859
(716) 288-5380 • FAX (716) 288-8475

CHAIN OF CUSTODY/LABORATORY ANALYSIS REQUEST FORM

(800) 695-7222

DATE 8/24/98 PAGE 1 OF 1

PROJECT NAME

PROJECT MANAGER/CONTACT Mark Wilson

COMPANY/ADDRESS CAS
1 Mustard St. Roch. NY. 14609

TEL ( ) FAX ( )

SAMPLER'S SIGNATURE

ANALYSIS REQUESTED

SAMPLE I.D.	DATE	TIME	LAB I.D.	SAMPLE MATRIX	# OF CONTAINERS	GC/MS VOA's ☐ 8260 ☐ 624	GC/MS SVOA's ☐ 8270A ☐ 625	GC VOA's ☐ 8010/8020 ☐ 601/602	PESTICIDES/PCB's ☐ 8080 ☐ 608	STAR'S LIST 8021 VOA's ☐ TOTAL ☐ TCLP	STAR'S LIST 8270 SVOA's ☐ TOTAL ☐ TCLP	TCLP ☐ METALS ☐ VOA's ☐ SVOA's ☐ H/P	WASTE CHARACTERIZATION ☐ React ☐ Corros. ☐ Ignit.	METALS, TOTAL (LIST BELOW)	METALS, DISSOLVED (LIST BELOW)	PRESERVATION pH < 2.0	PRESERVATION pH > 12	PRESERVATION Other
TT2-40'	8/24/98		234293	Soil	1													
TT2-52'	↓		234294	↓	1													
TT2-62'			234295		1													
TT2-72'			234296		1													
TT2-82'			234297		1													

RELINQUISHED BY:
Signature: Tom Hastings
Printed Name: Tom Hastings
Firm: CAS
Date/Time: 8/24/98 16:00

RECEIVED BY:
Signature
Printed Name
Firm
Date/Time

RELINQUISHED BY:
Signature
Printed Name
Firm
Date/Time

RECEIVED BY:
Signature
Printed Name
Firm
Date/Time

RELINQUISHED BY:
Signature
Printed Name
Firm
Date/Time

RECEIVED BY:
Signature
Printed Name
Firm
Date/Time

TURNAROUND REQUIREMENTS
__ 24 hr. __ 48 hr. __ 5 day
__ Standard (10-15 working days)
__ Provide Verbal Preliminary Results
__ Provide FAX Preliminary Results
Requested Report Date _____

REPORT REQUIREMENTS
__ 1. Routine Report
__ 2. Routine Rep. w/CASE Narrative
__ 3. EPA Level III Validatable Package
__ 4. N.J. Reduced Deliverables Level IV
__ 5. NY ASP/CLP Deliverables
__ 6. Site specific QC.

INVOICE INFORMATION:
P.O. #:
Bill To:

SAMPLE RECEIPT:
Shipping Via: UPS-Rd
Shipping #:
Temperature:
Submission No: 8-311

SPECIAL INSTRUCTIONS/COMMENTS:
METALS
ORGANICS: ☐ TCL ☐ PPL ☐ AE Only ☐ BN Only ☐ Special List

65 RAMAPO VALLEY ROAD
MAHWAH, NJ 07430
201-512-3292
FAX 201-512-3362

309 WEST RIDLEY AVE.
RIDLEY PARK, PA 19078
6[illegible]21-3083
FAX [illegible]21-4589

EMCON
DENSITY TEST

Project:	CAS - LOCKHEAD MARTIN/GREAT NECK	Proj. No.	01880.001.009	Tested by:	K.H.
				Entered by:	K.H.
Sample:	TT4-50'	Date:	9-3-98	Checked by:	R.S.A.

Remarks:

Dimensions of Specimen:

	Length (Inches)		Diameter (Inches)
1.	5.980	1.	1.410
2.	5.982	2.	1.410
3.	5.983	3.	1.410
4.	5.984	4.	1.410
5.	5.985	5.	1.410

Avg.	5.983	In	Ave.	1.410 In
	15.196	CM		3.581 CM
Area	1.561	In^2		10.074 CM^2
Volume	9.3418416	In^3	0.0054062	Cft.

Weight of Specimen:

Initial Weigh	320.0	Grams
	0.705	Lbs.
Dry Weight	277.8	Grams
	0.612	Lbs.
Moisture Content:	15.19	%

Density, Wet Initial	130.49	pcf
Density, Dry	113.28	pcf

Remarks:
1. Soil Description: Brown cmf SAND, little Silt, little mf Gravel (visual)
2. Specific Gravity: 2.6598

EMCON
DENSITY TEST

Project:	CAS - LOCKHEAD MARTIN/GREAT NECK	Proj. No.	01880.001.009	Tested by:	K.H.
				Entered by:	K.H.
Sample:	TT4-60'	Date:	9-3-98	Checked by:	R.S.A.

Remarks:

Dimensions of Specimen:

	Length (Inches)		Diameter (Inches)
1.	5.985	1.	1.410
2.	5.985	2.	1.410
3.	5.985	3.	1.410
4.	5.985	4.	1.410
5.	5.985	5.	1.410

Avg.	5.985	In	Ave. 1.410	In
	15.202	CM	3.581	CM
Area	1.561	In^2	10.074	CM^2
Volume	9.3452768	In^3	0.0054081	Cft.

Weight of Specimen:

Initial Weigh	300.7	Grams
	0.662	Lbs.
Dry Weight	264.4	Grams
	0.582	Lbs.
Moisture Content:	13.73	%

Density, Wet Initial	122.58	pcf
Density, Dry	107.78	pcf

Remarks: 1. Soil Description: Brown cm+f SAND, trace (+) Silt (visual)

2. Specific Gravity: 2.6234

EMCON
DENSITY TEST

Project:	CAS - LOCKHEAD MARTIN/GREAT NECK	Proj. No.	01880.001.009	Tested by:	K.H.
				Entered by:	K.H.
Sample:	TT4-70'	Date:	9-3-98	Checked by:	R.S.A.

Remarks:

Dimensions of Specimen:

	Length (Inches)		Diameter (Inches)
1.	5.985	1.	1.410
2.	5.988	2.	1.410
3.	5.985	3.	1.410
4.	5.989	4.	1.410
5.	5.985	5.	1.410

Avg.	5.986	In	Ave.	1.410 In
	15.205	CM		3.581 CM
Area	1.561	In^2		10.074 CM^2
Volume	9.3474629	In^3	0.0054094	Cft.

Weight of Specimen:

Initial Weigh	324.6	Grams
	0.715	Lbs.
Dry Weight	277.3	Grams
	0.611	Lbs.
Moisture Content:	17.06	%
Density, Wet Initial	132.29	pcf
Density, Dry	113.01	pcf

Remarks: 1. Soil Description: Brown cmf SAND, trace Silt, trace mf Gravel (visual)

2. Specific Gravity: 2.6201

EMCON
DENSITY TEST

Project:	CAS - LOCKHEAD MARTIN/GREAT NECK	Proj. No.	01880.001.009	Tested by:	K.H.
				Entered by:	K.H.
Sample:	TT6-30'	Date:	9-3-98	Checked by:	R.S.A.

Remarks:

Dimensions of Specimen:

	Length (Inches)		Diameter (Inches)
1.	5.985	1.	1.410
2.	5.985	2.	1.410
3.	5.985	3.	1.410
4.	5.985	4.	1.410
5.	5.985	5.	1.410

Avg.	5.985	In	Ave. 1.410	In
	15.202	CM	3.581	CM
Area	1.561	In^2	10.074	CM^2
Volume	9.3452768	In^3	0.0054081	Cft.

Weight of Specimen:

Initial Weigh	349.9	Grams
	0.771	Lbs.
Dry Weight	313.2	Grams
	0.690	Lbs.
Moisture Content:	11.72	%

Density, Wet Initial	142.63	pcf
Density, Dry	127.67	pcf

Remarks: 1. Soil Description: Brown cmf SAND, trace Silt, trace mf Gravel (visual) odorous

2. Specific Gravity: 2.7089

COL[illegible]IA ANALYTICAL SERVICES, INC.
1 Mustard St., Suite 250, Rochester, NY 14609-6925
(716) 288-5380 • FAX (716) 288-8475

CHAIN OF [illegible]STODY/LABORATORY ANALYSIS REQUE[illegible] FORM

(800) 695-7222

DATE 8/25/98 PAGE 1 OF 1

PROJECT NAM.:
PROJECT MANAGER/CONTACT Mark Wilson
COMPANY/ADDRESS CAS
1 Mustard St. Roch. N.Y. 14609
TEL ( ) FAX ( )
SAMPLER'S SIGNATURE

ANALYSIS REQUESTED

SAMPLE I.D.	DATE	TIME	FOR OFFICE USE ONLY LAB I.D.	SAMPLE MATRIX	# OF CONTAINERS	GC/MS VOA's ☐ 8260 ☐ 624 ☐ 95-1	GC/MS SVOA's ☐ 8270 ☐ 625 ☐ 95-2	GC VOA's ☐ 8021 ☐ 601/602	PESTICIDES/PCB's ☐ 8081 ☐ 608 ☐ 95-3	STAR'S LIST 8021 VOA's ☐ TOTAL ☐ TCLP	STAR'S LIST 8270 SVOA's ☐ TOTAL ☐ TCLP	TCLP ☐ METALS ☐ VOA's ☐ SVOA's ☐ H/P	WASTE CHARACTERIZATION ☐ React ☐ Corros. ☐ Ignit.	METALS, TOTAL (LIST BELOW)	METALS, DISSOLVED (LIST BELOW)	PRESERVATION pH < 2.0	PRESERVATION pH > 12	PRESERVATION Other
TT4-50'	8/24/98		234780	Soil	1													
TT4-60'	↓		234781	↓	1													
TT4-70'			234782		1													
TT6-30'	↓		234789	↓	1													

RELINQUISHED BY:
Signature: Tom Keating
Printed Name: Tom Keating
Firm: CAS
Date/Time: 8/25/98 16:00

RECEIVED BY:
Signature
Printed Name
Firm
Date/Time

RELINQUISHED BY:
Signature
Printed Name
Firm
Date/Time

RECEIVED BY:
Signature
Printed Name
Firm
Date/Time

RELINQUISHED BY:
Signature
Printed Name
Firm
Date/Time

RECEIVED BY:
Signature
Printed Name
Firm
Date/Time

TURNAROUND REQUIREMENTS
__ 24 hr. __ 48 hr. __ 5 day
__ Standard (10-15 working days)
__ Provide Verbal Preliminary Results
__ Provide FAX Preliminary Results
Requested Report Date _____

REPORT REQUIREMENTS
__ 1. Routine Report
__ 2. Routine Rep. w/CASE Narrative
__ 3. EPA Level III Validatable Package
__ 4. N.J. Reduced Deliverables Level IV
__ 5. NY ASP/CLP Deliverables
__ 6. Site specific QC.

INVOICE INFORMATION:
P.O. #:
Bill To:

SAMPLE RECEIPT:
Shipping Via: UPS-Gal
Shipping #:
Temperature:
Submission No: 8-311

SPECIAL INSTRUCTIONS/COMMENTS:
METALS
ORGANICS: ☐ TCL ☐ PPL ☐ AE Only ☐ BN Only ☐ Special List

EMCON
DENSITY TEST

Project:	CAS - LOCKHEAD MARTIN/GREAT NECK	Proj. No.	01880.001.009	Tested by:	K.H.
				Entered by:	K.H.
Sample:	TT6-40'	Date:	9-3-98	Checked by:	R.S.A.

Remarks:

Dimensions of Specimen:

	Length (Inches)		Diameter (Inches)
1.	5.985	1.	1.410
2.	5.985	2.	1.410
3.	5.985	3.	1.410
4.	5.990	4.	1.410
5.	5.989	5.	1.410

Avg.	5.987	In	Ave.	1.410 In
	15.206	CM		3.581 CM
Area	1.561	In^2		10.074 CM^2
Volume	9.3480874	In^3	0.0054098	Cft.

Weight of Specimen:

Initial Weigh	358.2	Grams
	0.789	Lbs.
Dry Weight	322.3	Grams
	0.710	Lbs.
Moisture Content:	11.14	%
Density, Wet Initial	145.97	pcf
Density, Dry	131.34	pcf

Remarks: 1. Soil Description: Brown cmf SAND, some clayey Silt, little mf Gravel (visual)

2. Specific Gravity: 2.6909

CO...MBIA ANALYTICAL SERVICES, INC.
1... rd St., Suite 250, Rochester, NY 14609-6925
(716) 288-5380 • FAX (716) 288-8475

CHAIN O... CUSTODY/LABORATORY ANALYSIS REQU... T FORM

(800) 695-7222

DATE 8/25/98 PAGE 1 OF 1

PROJECT NAME _____
PROJECT MANAGER/CONTACT Mark Wilson
COMPANY/ADDRESS CAS
1 Mustard St. Roch. N.Y. 14609
TEL ( ) _____ FAX ( ) _____
SAMPLER'S SIGNATURE _____

ANALYSIS REQUESTED

SAMPLE I.D.	DATE	TIME	FOR OFFICE USE ONLY LAB I.D.	SAMPLE MATRIX	# OF CONTAINERS	GC/MS VOA's ☐ 8260 ☐ 624 ☐ 95-1	GC/MS SVOA's ☐ 8270 ☐ 625 ☐ 95-2	GC VOA's ☐ 8021 ☐ 601/602	PESTICIDES/PCB's ☐ 8081 ☐ 608 ☐ 95-3	STAR'S LIST 8021 VOA's ☐ TOTAL ☐ TCLP	STAR'S LIST 8270 SVOA's ☐ TOTAL ☐ TCLP	TCLP ☐ METALS ☐ VOA's ☐ SVOA's ☐ H/P	WASTE CHARACTERIZATION ☐ React ☐ Corros. ☐ Ignit.	METALS, TOTAL (LIST BELOW)	METALS, DISSOLVED (LIST BELOW)	PRESERVATION pH < 2.0	PRESERVATION pH > 12	PRESERVATION Other
TT6-40'	8/24/98		234791	Soil	1													

RELINQUISHED BY:
Signature: Tom Hastings
Printed Name: Tom Hastings
Firm: CAS
Date/Time: 8/25/98 16:00

RECEIVED BY:
Signature
Printed Name
Firm
Date/Time

RELINQUISHED BY:
Signature
Printed Name
Firm
Date/Time

RECEIVED BY:
Signature
Printed Name
Firm
Date/Time

RELINQUISHED BY:
Signature
Printed Name
Firm
Date/Time

RECEIVED BY:
Signature
Printed Name
Firm
Date/Time

TURNAROUND REQUIREMENTS
__ 24 hr. __ 48 hr. __ 5 day
__ Standard (10-15 working days)
__ Provide Verbal Preliminary Results
__ Provide FAX Preliminary Results
Requested Report Date _____

REPORT REQUIREMENTS
__ 1. Routine Report
__ 2. Routine Rep. w/CASE Narrative
__ 3. EPA Level III Validatable Package
__ 4. N.J. Reduced Deliverables Level IV
__ 5. NY ASP/CLP Deliverables
__ 6. Site specific QC.

INVOICE INFORMATION:
P.O. #:
Bill To:

SAMPLE RECEIPT:
Shipping Via: UPS-Rd
Shipping #:
Temperature:
Submission No. 8-351

SPECIAL INSTRUCTIONS/COMMENTS:
METALS
ORGANICS: ☐ TCL ☐ PPL ☐ AE Only ☐ BN Only ☐ Special List

COLUMBIA ANALYTICAL SERVICES

Reported: 09/28/98

Tetra Tech Inc.
Project Reference:GREAT NECK PLUME
Client Sample ID :TT2-10'

Date Sampled :08/20/98 Order #:234290 Sample Matrix:SOIL/SEDIMENT
Date Received:08/22/98 Submission #:9808000311

ANALYTE	PQL	RESULT	UNITS	DATE ANALYZED	ANALYTICAL DILUTION
PERCENT SOLIDS	1.0	94.1	%	09/03/98	1.0

COLUMBIA ANALYTICAL SERVICES

Reported: 09/28/98

Tetra Tech Inc.
Project Reference:GREAT NECK PLUME
Client Sample ID :TT2-22'

Date Sampled :08/20/98 **Order #:**234291 **Sample Matrix:**SOIL/SEDIMENT
Date Received:08/22/98 **Submission #:**9808000311

ANALYTE	PQL	RESULT	UNITS	DATE ANALYZED	ANALYTICAL DILUTION
PERCENT SOLIDS	1.0	96.4	%	09/03/98	1.0

COLUMBIA ANALYTICAL SERVICES

Reported: 09/28/98

Tetra Tech Inc.
Project Reference:GREAT NECK PLUME
Client Sample ID :TT2-34'

Date Sampled :08/21/98 **Order #:**234292 **Sample Matrix:**SOIL/SEDIMENT
Date Received:08/22/98 **Submission #:**9808000311

ANALYTE	PQL	RESULT	UNITS	DATE ANALYZED	ANALYTICAL DILUTION
PERCENT SOLIDS	1.0	90.5	%	09/03/98	1.0

COLUMBIA ANALYTICAL SERVICES

Reported: 09/28/98

Tetra Tech Inc.
Project Reference:GREAT NECK PLUME
Client Sample ID :TT2-40'

Date Sampled :08/21/98 **Order #:**234293 **Sample Matrix:**SOIL/SEDIMENT
Date Received:08/22/98 **Submission #:**9808000311

ANALYTE	PQL	RESULT	UNITS	DATE ANALYZED	ANALYTICAL DILUTION
PERCENT SOLIDS	1.0	95.8	%	09/03/98	1.0
TOTAL ORGANIC CARBON	0.10	0.100 U	%	09/09/98	1.0

COLUMBIA ANALYTICAL SERVICES

Reported: 09/28/98

Tetra Tech Inc.
Project Reference:GREAT NECK PLUME
Client Sample ID :TT2-52'

Date Sampled :08/21/98 **Order #:**234294 **Sample Matrix:**SOIL/SEDIMENT
Date Received:08/22/98 **Submission #:**9808000311

ANALYTE	PQL	RESULT	UNITS	DATE ANALYZED	ANALYTICAL DILUTION
PERCENT SOLIDS	1.0	86.7	%	09/03/98	1.0
TOTAL ORGANIC CARBON	0.10	0.100 U	%	09/09/98	1.0

COLUMBIA ANALYTICAL SERVICES

Reported: 09/28/98

Tetra Tech Inc.
Project Reference:GREAT NECK PLUME
Client Sample ID :TT2-62'

Date Sampled :08/21/98 **Order #:**234295 **Sample Matrix:**SOIL/SEDIMENT
Date Received:08/22/98 **Submission #:**9808000311

ANALYTE	PQL	RESULT	UNITS	DATE ANALYZED	ANALYTICAL DILUTION
PERCENT SOLIDS	1.0	94.7	%	09/03/98	1.0
TOTAL ORGANIC CARBON	0.10	0.43	%	09/09/98	1.0

COLUMBIA ANALYTICAL SERVICES

Reported: 09/28/98

Tetra Tech Inc.
Project Reference:GREAT NECK PLUME
Client Sample ID :TT2-72'

Date Sampled :08/21/98 **Order #:**234296 **Sample Matrix:**SOIL/SEDIMENT
Date Received:08/22/98 **Submission #:**9808000311

ANALYTE	PQL	RESULT	UNITS	DATE ANALYZED	ANALYTICAL DILUTION
PERCENT SOLIDS	1.0	95.4	%	09/03/98	1.0
TOTAL ORGANIC CARBON	0.10	0.24	%	09/09/98	1.0

COLUMBIA ANALYTICAL SERVICES

Reported: 09/28/98

Tetra Tech Inc.
Project Reference:GREAT NECK PLUME
Client Sample ID :TT2-82'

Date Sampled :08/21/98 **Order #:234297** **Sample Matrix:SOIL/SEDIMENT**
Date Received:08/22/98 **Submission #:9808000311**

ANALYTE	PQL	RESULT	UNITS	DATE ANALYZED	ANALYTICAL DILUTION
PERCENT SOLIDS	1.0	91.5	%	09/03/98	1.0
TOTAL ORGANIC CARBON	0.10	0.19	%	09/09/98	1.0

COLUMBIA ANALYTICAL SERVICES

Reported: 09/28/98

Tetra Tech Inc.
Project Reference:GREAT NECK PLUME
Client Sample ID :TT4-10'

Date Sampled :08/24/98 **Order #:**234774 **Sample Matrix:**SOIL/SEDIMENT
Date Received:08/25/98 **Submission #:**9808000311

ANALYTE	PQL	RESULT	UNITS	DATE ANALYZED	ANALYTICAL DILUTION
PERCENT SOLIDS	1.0	88.9	%	09/15/98	1.0

COLUMBIA ANALYTICAL SERVICES

Reported: 09/28/98

Tetra Tech Inc.
Project Reference:GREAT NECK PLUME
Client Sample ID :TT4-18'

Date Sampled :08/24/98 **Order #:**234776 **Sample Matrix:**SOIL/SEDIMENT
Date Received:08/25/98 **Submission #:**9808000311

ANALYTE	PQL	RESULT	UNITS	DATE ANALYZED	ANALYTICAL DILUTION
PERCENT SOLIDS	1.0	95.0	%	09/15/98	1.0

COLUMBIA ANALYTICAL SERVICES

Reported: 09/28/98

Tetra Tech Inc.
Project Reference:GREAT NECK PLUME
Client Sample ID :TT4-30'

Date Sampled :08/24/98 **Order #:**234777 **Sample Matrix:**SOIL/SEDIMENT
Date Received:08/25/98 **Submission #:**9808000311

ANALYTE	PQL	RESULT	UNITS	DATE ANALYZED	ANALYTICAL DILUTION
PERCENT SOLIDS	1.0	87.7	%	09/15/98	1.0

COLUMBIA ANALYTICAL SERVICES

Reported: 09/28/98

Tetra Tech Inc.
Project Reference:GREAT NECK PLUME
Client Sample ID :TT4-36'

Date Sampled :08/24/98 **Order #:234779** **Sample Matrix:SOIL/SEDIMENT**
Date Received:08/25/98 **Submission #:9808000311**

ANALYTE	PQL	RESULT	UNITS	DATE ANALYZED	ANALYTICAL DILUTION
PERCENT SOLIDS	1.0	90.9	%	09/15/98	1.0

COLUMBIA ANALYTICAL SERVICES

Reported: 09/28/98

Tetra Tech Inc.
Project Reference:GREAT NECK PLUME
Client Sample ID :TT4-50'

Date Sampled :08/24/98 **Order #:**234780 **Sample Matrix:**SOIL/SEDIMENT
Date Received:08/25/98 **Submission #:**9808000311

ANALYTE	PQL	RESULT	UNITS	DATE ANALYZED	ANALYTICAL DILUTION
PERCENT SOLIDS	1.0	94.0	%	09/09/98	1.0
TOTAL ORGANIC CARBON	0.10	0.30	%	09/09/98	1.0

COLUMBIA ANALYTICAL SERVICES

Reported: 09/28/98

Tetra Tech Inc.
Project Reference:GREAT NECK PLUME
Client Sample ID :TT4-60'

Date Sampled :08/24/98 **Order #:**234781 **Sample Matrix:**SOIL/SEDIMENT
Date Received:08/25/98 **Submission #:**9808000311

ANALYTE	PQL	RESULT	UNITS	DATE ANALYZED	ANALYTICAL DILUTION
PERCENT SOLIDS	1.0	95.7	%	09/09/98	1.0
TOTAL ORGANIC CARBON	0.10	0.36	%	09/09/98	1.0

COLUMBIA ANALYTICAL SERVICES

Reported: 09/28/98

Tetra Tech Inc.
Project Reference:GREAT NECK PLUME
Client Sample ID :TT4-70'

Date Sampled :08/24/98 **Order #:**234782 **Sample Matrix:**SOIL/SEDIMENT
Date Received:08/25/98 **Submission #:**9808000311

ANALYTE	PQL	RESULT	UNITS	DATE ANALYZED	ANALYTICAL DILUTION
PERCENT SOLIDS	1.0	92.3	%	09/09/98	1.0
TOTAL ORGANIC CARBON	0.10	0.64	%	09/09/98	1.0

COLUMBIA ANALYTICAL SERVICES

Reported: 09/28/98

Tetra Tech Inc.
Project Reference:GREAT NECK PLUME
Client Sample ID :TT4-80'

Date Sampled :08/24/98 **Order #:**234783 **Sample Matrix:**SOIL/SEDIMENT
Date Received:08/25/98 **Submission #:**9808000311

ANALYTE	PQL	RESULT	UNITS	DATE ANALYZED	ANALYTICAL DILUTION
PERCENT SOLIDS	1.0	90.4	%	09/15/98	1.0

COLUMBIA ANALYTICAL SERVICES

Reported: 09/28/98

Tetra Tech Inc.
Project Reference:GREAT NECK PLUME
Client Sample ID :TT6-10'

Date Sampled :08/24/98 **Order #:**234787 **Sample Matrix:**SOIL/SEDIMENT
Date Received:08/25/98 **Submission #:**9808000311

ANALYTE	PQL	RESULT	UNITS	DATE ANALYZED	ANALYTICAL DILUTION
PERCENT SOLIDS	1.0	94.7	%	09/15/98	1.0

COLUMBIA ANALYTICAL SERVICES

Reported: 09/28/98

Tetra Tech Inc.
Project Reference:GREAT NECK PLUME
Client Sample ID :TT6-20'

Date Sampled :08/24/98 **Order #:234788** **Sample Matrix:SOIL/SEDIMENT**
Date Received:08/25/98 **Submission #:9808000311**

ANALYTE	PQL	RESULT	UNITS	DATE ANALYZED	ANALYTICAL DILUTION
PERCENT SOLIDS	1.0	92.5	%	09/15/98	1.0

COLUMBIA ANALYTICAL SERVICES

Reported: 09/28/98

Tetra Tech Inc.
Project Reference:GREAT NECK PLUME
Client Sample ID :TT6-30'

Date Sampled :08/24/98 **Order #:**234789 **Sample Matrix:**SOIL/SEDIMENT
Date Received:08/25/98 **Submission #:**9808000311

ANALYTE	PQL	RESULT	UNITS	DATE ANALYZED	ANALYTICAL DILUTION
PERCENT SOLIDS	1.0	91.7	%	09/09/98	1.0
TOTAL ORGANIC CARBON	0.10	0.98	%	09/09/98	1.0

COLUMBIA ANALYTICAL SERVICES

Reported: 09/28/98

Tetra Tech Inc.
Project Reference:GREAT NECK PLUME
Client Sample ID :TT6-35'

Date Sampled :08/24/98 **Order #:234790** **Sample Matrix:SOIL/SEDIMENT**
Date Received:08/25/98 **Submission #:9808000311**

ANALYTE	PQL	RESULT	UNITS	DATE ANALYZED	ANALYTICAL DILUTION
PERCENT SOLIDS	1.0	90.0	%	09/15/98	1.0

COLUMBIA ANALYTICAL SERVICES

Reported: 10/06/98

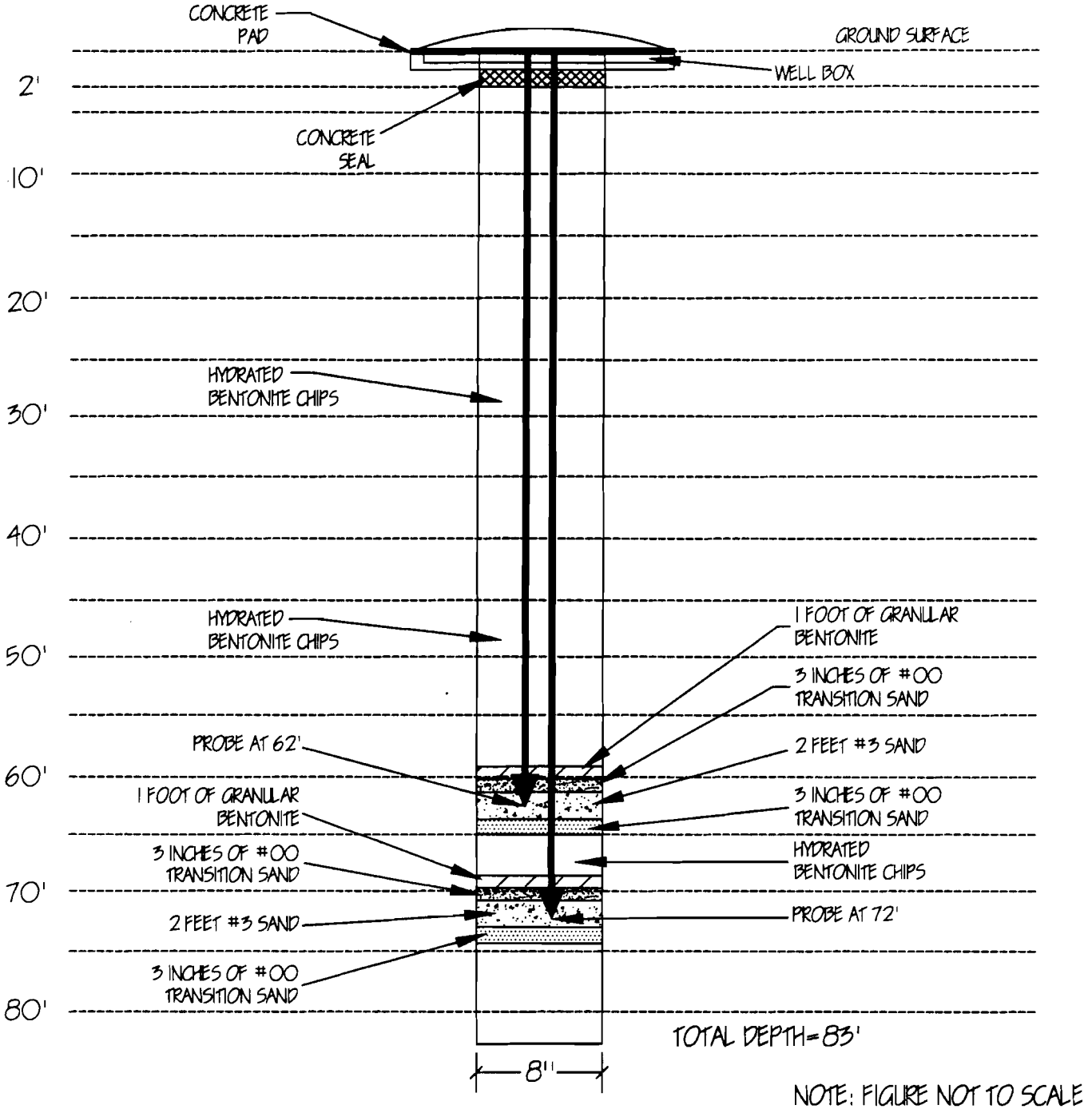
Tetra Tech Inc.
Project Reference:GREAT NECK PLUME
Client Sample ID :TT6-40'

Date Sampled : 08/24/98 Order #: 234791 Sample Matrix: SOIL/SEDIMENT
Date Received: 08/25/98 Submission #:9808000351

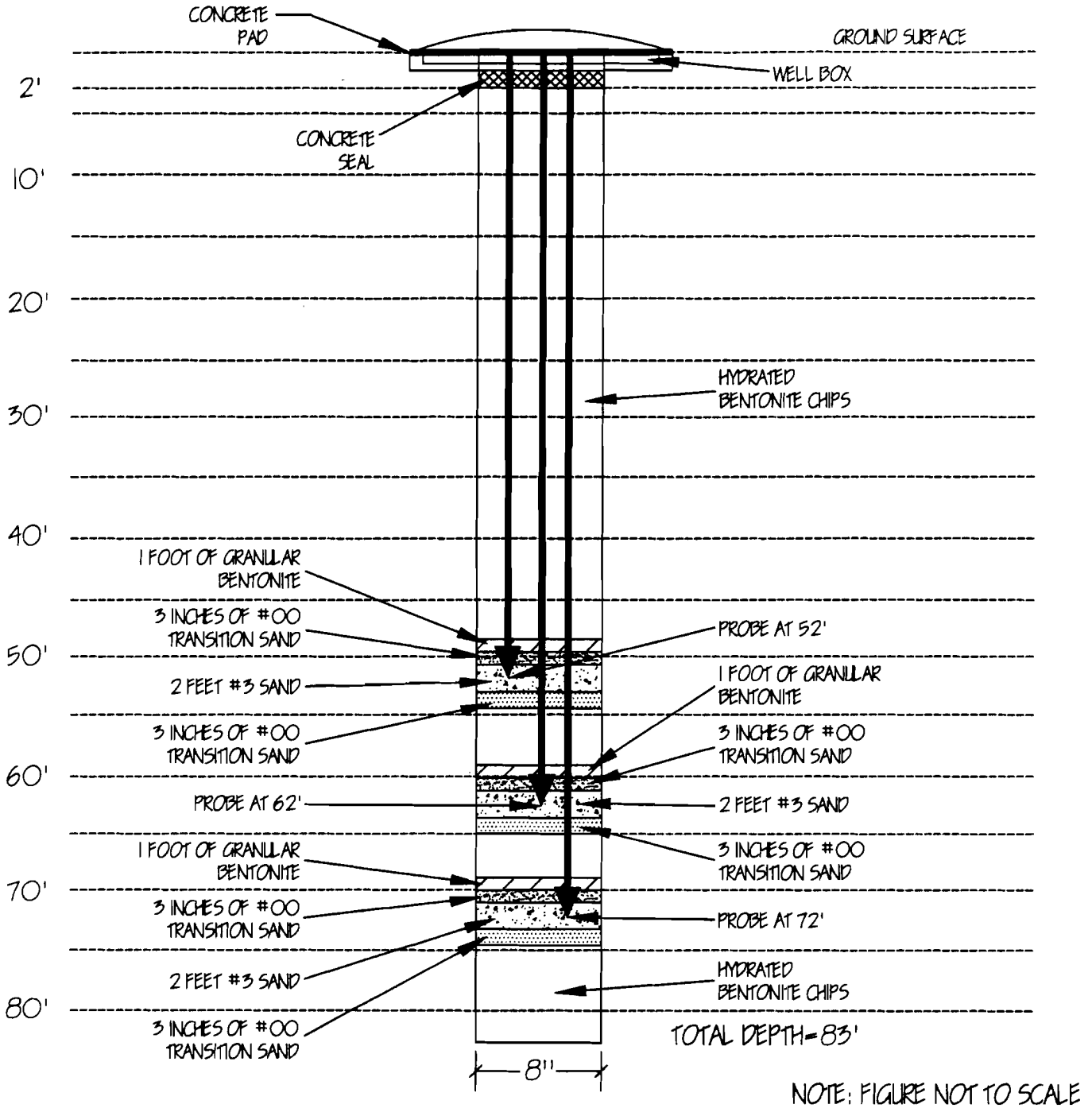
ANALYTE	PQL	RESULT	DRY WEIGHT UNITS	DATE ANALYZED	ANALYTICAL DILUTION
WET CHEMISTRY					
PERCENT SOLIDS	1.0	89.7	%	09/09/98	1.0
TOTAL ORGANIC CARBON	0.10	0.220	%	09/09/98	1.0

Appendix D

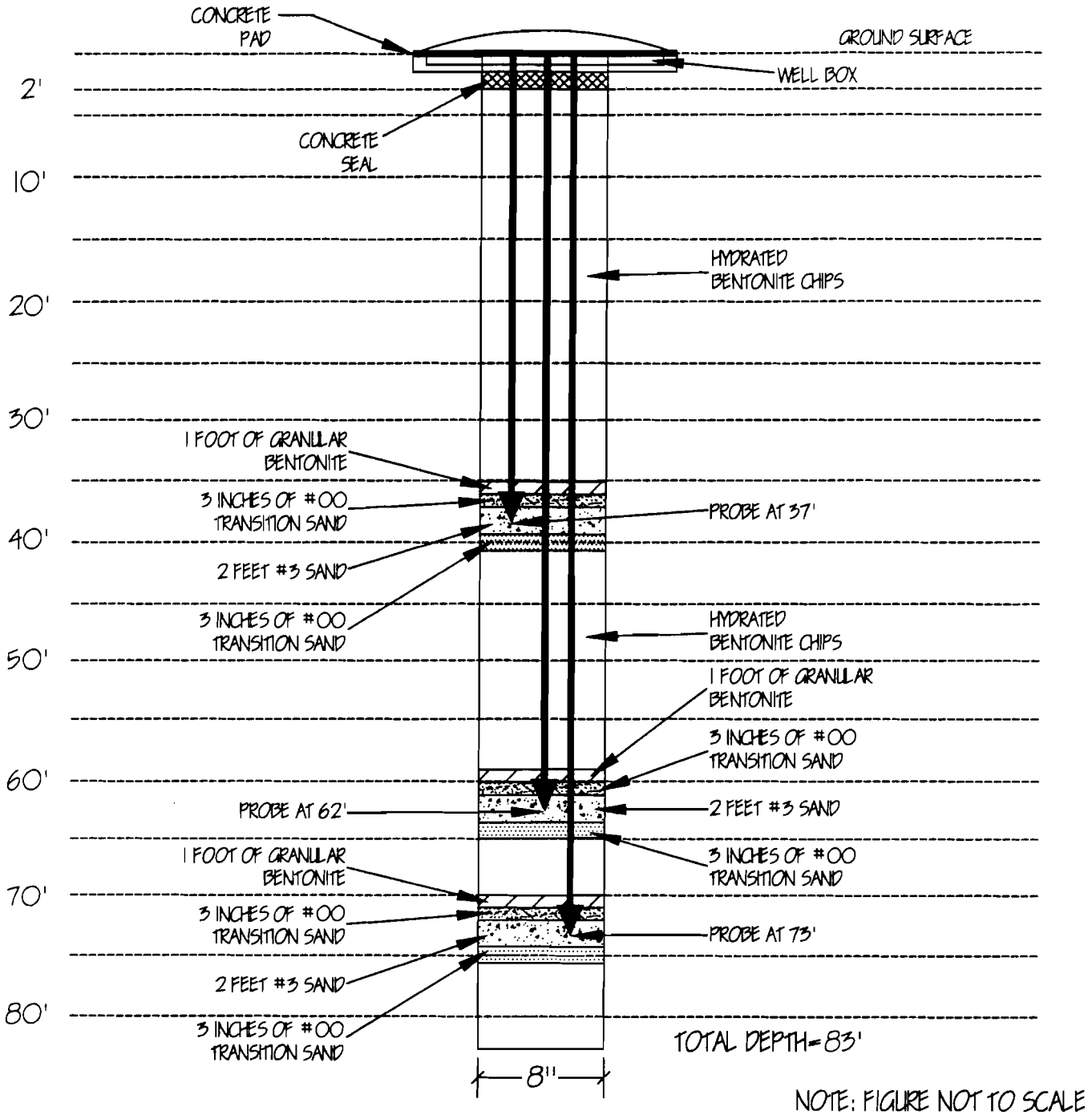
SOIL VAPOR PROBE SCHEMATIC TT-1



SOIL VAPOR PROBE SCHEMATIC TT-3

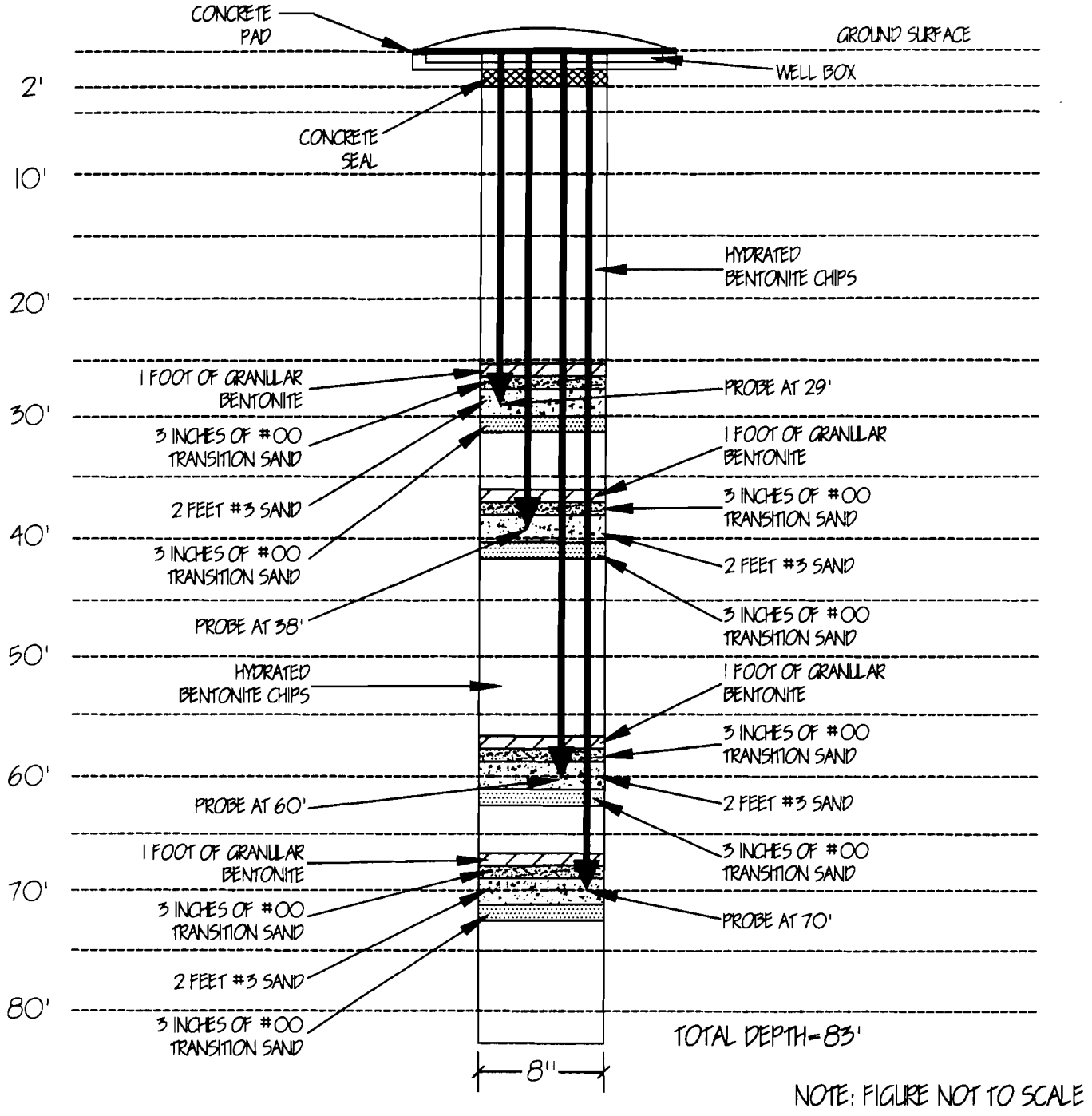


SOIL VAPOR PROBE SCHEMATIC TT-5



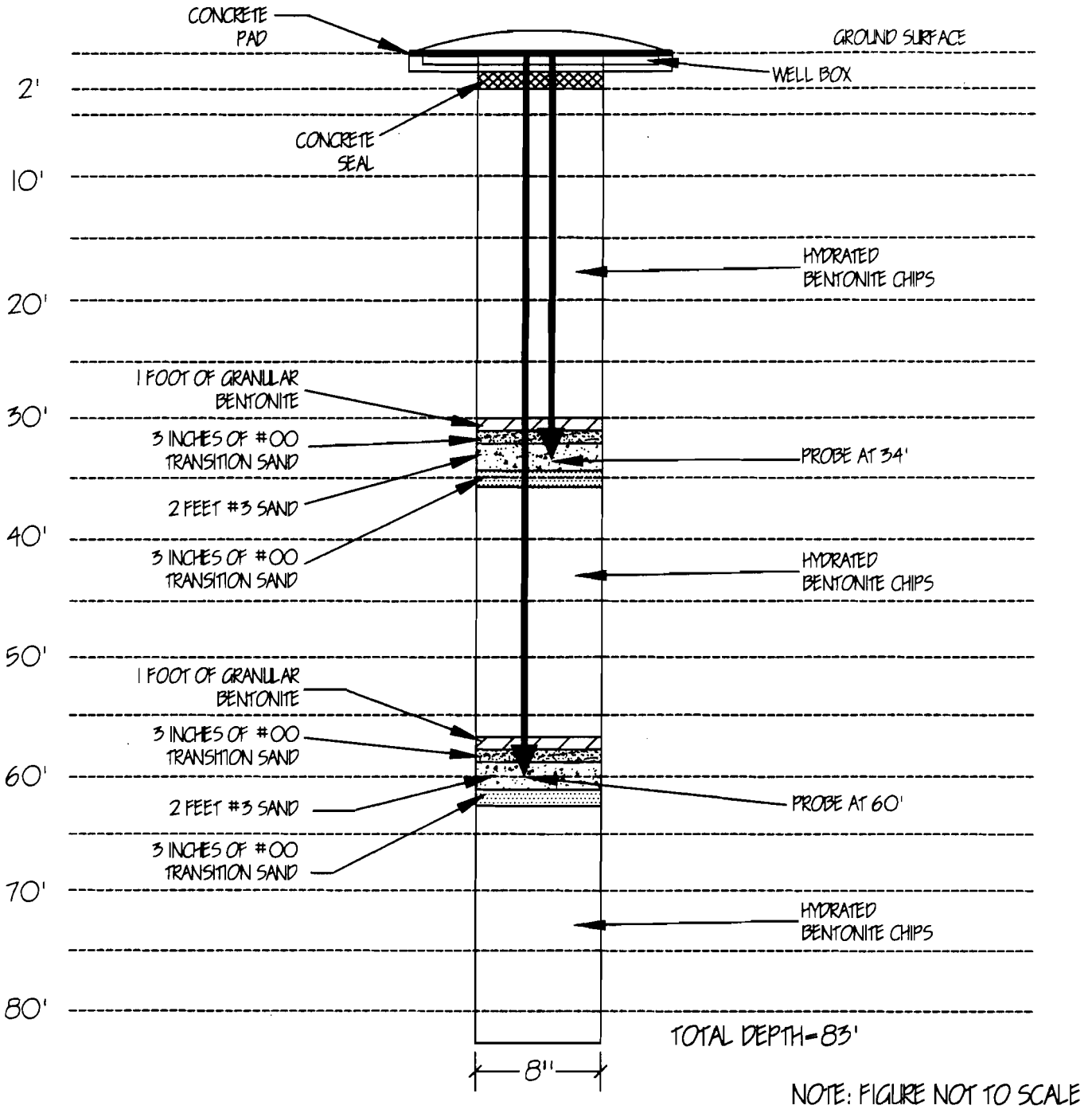
NOTE: FIGURE NOT TO SCALE

SOIL VAPOR PROBE SCHEMATIC TT-6



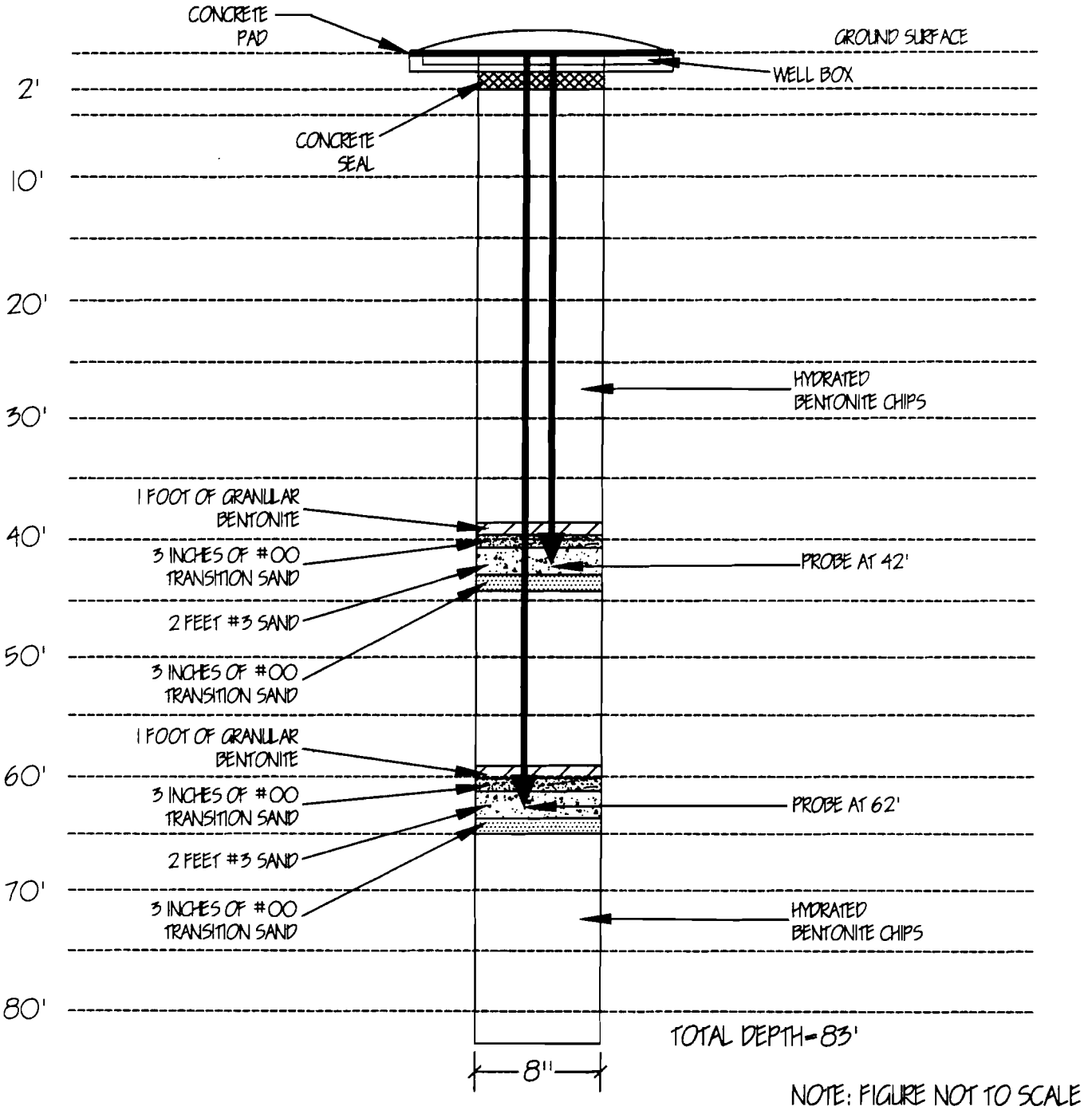
NOTE: FIGURE NOT TO SCALE

SOIL VAPOR PROBE SCHEMATIC TT-7



NOTE: FIGURE NOT TO SCALE

SOIL VAPOR PROBE SCHEMATIC TT-8



Appendix E

On Site Soil • Soil Vapor • GH_2O
Sampling and GCMS Analysis

Hydro Geo Spectrum

October 1, 1998

Nisha Bansal
TetraTech
670 N. Rosemead
Pasadena, CA 91107-2160

Dear Nisha:

Enclosed please find the report on the soil vapor sampling/analysis performed at the Lockheed-Martin facility in Great Neck, N.Y. between August 27 and September 4, 1998. You will find one bound and one unbound copy with the following sections:

i. Technical approach with results and discussion.
ii. Spreadsheets of results.
iii. Raw data in LARWQCB format.
iv. QA/QC section in LARWQCB format.
v. Chromatograms (unbound copy only).

If you have any questions or additional requirements, please do not hesitate to call. It was a pleasure working with you, and I look forward to future projects.

Sincerely,

Raphe Pavlick
Director

400 So. Barrington • Suite #3 • P.O. Box 49259 • Los Angeles, CA 90049
Phone • (310) 440 - 5077 • Fax (310) 471 - 6879 • E-mail soilgas@aol.com

SOIL VAPOR TECHNICAL APPROACH

Nested soil vapor probes were installed using an auger rig as follows: after maximum depth was reached, a one-quarter inch polyethylene probe was dropped to the bottom, surrounded by approximately 1 foot of #3 sand, the grouted to the next depth where another probe was dropped and the procedure repeated until all the probes were installed. The probes were allowed to sit at least one day to reach equilibrium conditions in the subsurface. Sampling is done as follows: The tubing exiting the surface of the ground is connected to a glass sampling bulb fitted with Teflon stopcocks and a viton rubber sampling port. This bulb is connected in turn to a vacuum gauge, flowmeter, and portable sampling pump. Initially both stopcocks are closed, and the absence of flow and the presence of a slight vacuum is noted. This demonstrates that the sampling train on the far end of the bulb is leak-tight. Then the first stopcock (pump end) is opened; the absence of flow demonstrates that the sampling bulb itself is leaktight. The ground end of the bulb is then opened, and a flow of 0.6 cfm is maintained for seven to ten purge volumes. During the sampling an open container containing a pentane-soaked kimwipe is exposed to the sampling train. Any trace of pentane detected in the sample indicates the intrusion of ambient air into the sampling train, invalidating the results of that sample. No such leaks were detected with any of the samples. The stopcocks were then closed (pump end first), and the sample retained in the container. Approximately 25 NG each of deutero-chloroform, deutero-acetone, deuterated-methylene chloride, deuterated-toluene and deutero-benzene were added through the septum into the bulb. The recovery of these isotopically-labeled surrogate compounds demonstrates that the bulbs have remained leak-free up until the actual analysis. A recovery of 90% is desirable; a recovery of less than 75% invalidates the sample results. These bulbs were then delivered to the mobile laboratory for analysis by GCMS.

The analyses of the soil vapor samples proceeded as follows. A 1 ml aliquot of soil vapor was withdrawn from each bulb and injected into a Hewlett-Packard model 5890 gas chromatograph interfaced to a Hewlett-Packard model 5972 mass spectrometer. Chromatography was performed in such a way that the combination of retention times and mass fragmentation allowed for the complete separation of all the target compounds. The mass spec was operated in *full scan* mode between 35 and 350 amu. This allows for the identification of any volatile organic species that may be present in the soil vapor.

The following laboratory QA/QC was performed. An initial five-point calibration was run on July 10, 1998. A laboratory control standard (LCS) from *Absolute Standards* Volatiles Mix was run at the end of the same day and at the end of the sampling days. The daily standard, run on the sampling days, was made from Supelco certified Custom 1 mix. The initial calibration was also run on this standard stock. The surrogate calibration curve was run on Aldrich certified material. All results were within the LAWQCB and HGS requirements.

Two notable additions to the LAWQCB requirements were deemed necessary:

i. Five isotopically-labeled surrogates, D6-Benzene, D2-Methylene Chloride, D8-Toluene, D6-Acetone and D-Chloroform, were added to the collection vessel, a 125-ml glass bulb fitted with Teflon stopcocks and a viton rubber septum, to measure recovery percentages. The benzene, toluene, methylene chloride and chloroform surrogates are used to verify the recovery of the BTEX and chlorinated hydrocarbons respectively; a recovery of at least 90% is desired. The deuterated acetone is a measure of the possible presence of water vapor in the sample and general condition of the chromatographic system in terms of hydration; a recovery of 75% indicates acceptability of the complete sampling and analysis procedure; below this level, water vapor presence in the sampling line should be investigated or chromatographic dehydration procedures should be considered.

ii. Isopentane vapor was used to surround the sampling train at the surface to identify possible ambient intrusion into the sampling train or down the outside surface of the sampling tubing connected to the subsurface.

RESULTS AND DISCUSSION

Only one sample failed surrogate recovery requirements, TT1-72; this sample was retaken and analyzed again with good surrogate recovery.
Two different purge volume tests were performed to verify the slightly lower number of purge volumes that were required as well as the narrower range of acceptability. This probably had to do with the soil types or amounts of moisture in the soils.
The rebounds in general showed increases with time, mainly with the "heavier" compounds such as PCE and, to a lesser degree, PCE. The rebounds were taken approximately six days after installation, whereas the normal samples were taken two days after installation.
Two duplicates were taken on the same day, and these results were within acceptable range.
It should be noted that small differences exist in rounding of numbers between the LARWQCB forms and the EXCEL spreadsheet; the differences are insignificant, generally having to do with decimal points, and should be of no concern.

All QA/QC requirements of both HydroGeoSpectrum (HGS) and LARWQCB were met.

LOCATION-DEPTH(ft)	VC µg/L	1,1-DCE µg/L	1,2-DCE µg/L	1,1,1-TCA µg/L	TCE µg/L	PCE µg/L	BTEX µg/L	HC µg/L	Freon-113 µg/L	OTHER µg/L
TT1-62	0.6	N	4.2	N	6.3	6.5	N/1.9/N/N	N	6.6	N
TT1-72 low surr	*1.1*	*N*	*9.6*	*N*	*5.2*	*6.3*	*N/1.4/N/N*	*N*	*6.4*	N
TT1-72	4.3	N	15	N	1.8	2.3	N	N	12	N
TT3-52	N	N	4.4	N	2.5	4.7	N/1/N/N	N	2.3	N
TT3-62	N	N	N	N	1	2.5	N	N	N	N
TT3-72	N	N	N	N	1	1.6	N/0.6/N/N	N	1.1	N
TT5-37	4.9	72	1849	145	11214	3410	6.8/1673/24/52	1000	5693	PCA,Fr11,F12,PCA,Chloroform
TT5-62	N	2.5	166	13	6296	2938	4.5/1498/N/N	90	104	N
TT5-73	N	N	32	2.1	1678	1685	0.9/615/24/61	N	25	N
TT6-29	9.6	52	1911	5.3	778	592	1.8/132/2.6/N	N	361	DCM,Chloroform
TT6-29rebound	8.4	63	2744	4	886	923	1.6/150/6.1/N	210	311	DCM
TT6-38	9.7	54	468	23	3064	720	10/351/3.9/1.8	400	2714	DCM,DCA,Fr11
TT6-38 rebound	7.1	N	404	26	3643	544	9.8/168/3.2/N	300	3492	DCM,DCA,Chloroform,
TT6-60	N	0.6	19	N	141	33	N/27/N/N	N	16	N
TT6-60rebound	N	N	49	0.7	663	399	0.6/125/3.4/N	N	N	N
TT6-70	N	N	45	N	91	33	N/16/N/N	N	13	N
TT6-70 rebound	N	N	23	N	388	85	0.5/41/N/N	N	3.5	N
TT7-34	N	N	N	N	2.7	2.4	N/1.1/N/N	N	N	N
TT7-60	N	N	N	N	3.3	3.3	N/1.1/N/N	N	0.8	N
TT8-42	2.6	N	449	1.2	447	127	N/0.4/N/N	30	86	N
TT8-42 dup	2.1	N	368	1	325	66	N	20	72	N
TT8-62	N	N	0.9	N	1.2	0.9	N	N	0.7	N
TT8-62 dup	N	N	0.6	N	1.2	1	N	N	0.8	N

VC = Vinyl Chloride
DCE = Dichloroethylene
TCA = Trichloroethane
TCE = Trichloproethylene

PCE = Tetrachloroethylene
BTEX = Benz/Tol/
EthylBenz/Xylenes
HC = Hydrocarbons

DCA = Dichloroethane
PCA = Tetrachloroethane
DCM = Methylene Chloride

DATA

SOIL GAS SAMPLE RESULTS

SITE NAME: GreatNeck/Tt | LAB NAME: HydroGeoSpectrum (HGS) | DATE: 29 AUG 1998

ANALYST: Raphe Pavlick | COLLECTOR: Rodney Brott | INSTRUMENT ID: 2415A8201

NORMAL INJECTION VOLUME 1 ml

Sample ID:		TT6 VOB8281-09032			TT6 VOB8282-09033			TT6 VOB8283-09034			TT6 VOB8283D-09034		
Sampling Depth (ft)		29			70			38			38 df5		
Purge Volume (ml)		3075			5125			3525			3525		
Vacuum		NO			NO			NO			NO		
Sampling Time		27Aug			27Aug			27Aug			27Aug		
Injection Time		1149			129			1227			1459		
Injection Volume		1ml			1ml			1ml			0.2ml		
Dilution Factor		1			1			1			5		
COMPOUND		RT	AREA	CONC	RT	AREA	CONC	RT	AREA	CONC	RT	AREA	CONC
Vinyl Chloride	MS	1.85	9817	9.5				1.78	9931	9.6			
1,1-Dichloroethene	MS	4.26	101804	52.0				4.21	106206	54.3	4.14	20345	52.0
Methylene Chloride	MS	3.10	1130	0.5	3.07	961	0.4	3.05	94106	41.9	2.98	18159	40.4
1,2-Dichloroethene (total)	MS	5.03	9043340	1911.2	5.01	211694	44.7	5.00	2214427	468.0	4.95	442514	467.6
1,1-Dichloroethane	MS							4.77	37195	8.7			
Chloroform	MS	5.31	2021	0.5				5.27	31829	7.8			
1,1,1-Trichloroethane	MS	6.27	18123	5.3				6.26	76598	22.5			
Benzene	MS	7.74	12787	1.7				7.74	72894	10.1			
Trichloroethene	MS	7.48	2498548	777.5	7.47	291616	90.7	7.47	8837211	2750.2	7.42	1969022	3063.9
Toluene	MS	10.73	634100	132.3	10.71	77440	16.1	10.72	1682390	351.0	10.67	335861	350.4
Tetrachloroethene	MS	9.96	1481638	591.6	9.95	81567	32.5	9.94	1803930	720.3	9.90	382620	763.9
Ethylbenzene	MS	13.12	7950	2.6				13.15	11811	3.9			
Xylene (total)	MS							16.70	26606	1.8			
FREON-11	MS							3.99	22142	5.1			
FREON-113	MS	5.57	1592382	361.0	5.54	57334	13.0	5.54	11363258	2576.1	5.49	2394744	2714.5
Deutero-chloroform	MS	5.28	51827	81%	5.27	55682	87%	5.25	64095	101%	5.19	12476	98%
D6-BENZENE	MS	7.67	118390	83%	7.66	127198	89%	7.65	130998	91%	7.61	26495	92%
D6-ACETONE	MS	3.26	71664	93%	3.22	69678	90%	3.20	75248	98%	3.12	14676	95%
D2-Dichloromethane	MS	3.08	43888	91%	3.06	43614	90%	3.05	46640	96%	2.96	9785	101%
D8-TOLUENE	MS	10.63	56857	81%	10.61	61432	87%	10.58	61207	87%	10.55	13724	98%
Total Number of Peaks by GCMS:		12 + Surrogates			6 + Surrogates			15 + Surrogates			7 + Surrogates		

Unidentified peaks and/or other analytical remarks: UNITS: mcg/L

SOIL GAS SAMPLE RESULTS

SITE NAME: GreatNeck/Tt | LAB NAME: HydroGeoSpectrum (HGS) | DATE: 29 AUG 1998

ANALYST: Raphe Pavlick | COLLECTOR: Rodney Brott | INSTRUMENT ID: 2415A8201

NORMAL INJECTION VOLUME 1 ml

Sample ID:		TT6 VOB8284-09035			TT6 VOB8285-09036			TT6 VOB8286-09037				
Sampling Depth (ft)		60 purg			60 purg			60 purg				
Purge Volume (ml)		564			1692			2820				
Vacuum		NO			NO			NO				
Sampling Time		27Aug			27Aug			27Aug				
Injection Time		1249			1305			1323				
Injection Volume		1ml			1ml			1ml				
Dilution Factor		1			1			1				
COMPOUND		RT	AREA	CONC	RT	AREA	CONC	RT	AREA	CONC	RT	AREA	CONC
1,1-Dichloroethene	MS	4.24	1377	0.7	4.21	1262	0.6	4.25	1494	0.7			
1,2-Dichloroethene (total)	MS	5.02	81244	17.1	4.99	91841	19.4	5.01	72186	15.2			
Trichloroethene	MS	7.46	417267	129.8	7.44	452025	140.6	7.45	313058	97.4			
Toluene	MS	10.68	76735	16.0	10.68	130485	27.2	10.68	100053	20.8			
Tetrachloroethene	MS	9.93	35184	14.0	9.92	81622	32.5	9.92	75971	30.3			
FREON-113	MS	5.56	46317	10.5	5.52	71137	16.1	5.54	59244	13.4			
Deutero-chloroform	MS	5.25	57353	90%	5.23	63697	100%	5.25	57177	90%			
D6-BENZENE	MS	7.64	125928	88%	7.64	141492	99%	7.62	128118	89%			
D6-ACETONE	MS	3.25	68840	89%	3.20	81238	105%	3.25	68845	89%			
D2-Dichloromethane	MS	3.08	44564	92%	3.01	50268	104%	3.09	44616	92%			
D8-TOLUENE	MS	10.58	61208	87%	10.56	68218	97%	10.55	64263	91%			
Total Number of Peaks by GCMS:		6 + Surrogates			6 + Surrogates			6 + Surrogates				

Unidentified peaks and/or other analytical remarks: UNITS: mcg/L

SOIL GAS SAMPLE RESULTS

SITE NAME: GreatNeck/Tt | LAB NAME: HydroGeoSpectrum (HGS) | DATE: 29 AUG 1998

ANALYST: Raphe Pavlick | COLLECTOR: Rodney Brott | INSTRUMENT ID: 2415A8201

NORMAL INJECTION VOLUME 1 ml

Sample ID:		TT6 VOB8287-09038			TT6 VOB8288-09039			Blank VOB8280-09031					
Sampling Depth (ft)		60 purg			60 purg			BLANK					
Purge Volume (ml)		3948			7050			NA					
Vacuum		NO			NO			NO					
Sampling Time		27Aug			27Aug			27Aug					
Injection Time		1339			1354			1055					
Injection Volume		1ml			1ml			1ml					
Dilution Factor		1			1			1					
COMPOUND		RT	AREA	CONC	RT	AREA	CONC	RT	AREA	CONC	RT	AREA	CONC
1,1-Dichloroethene	MS	4.20	1116	0.5	4.19	876	0.4	NONE DETECTED					
1,2-Dichloroethene (total)	MS	4.99	71640	15.1	4.98	69907	14.7						
Trichloroethene	MS	7.45	296837	92.3	7.44	247195	76.9						
Toluene	MS	10.68	98884	20.6	10.66	87582	18.2						
Tetrachloroethene	MS	9.90	78389	31.3	9.91	73354	29.2						
FREON-113	MS	5.53	58061	13.1	5.51	56983	12.9						
Deutero-chloroform	MS	5.22	56704	89%	5.22	51338	81%	5.28	63842	100%			
D6-BENZENE	MS	7.62	129644	90%	7.62	120015	84%	7.67	144669	101%			
D6-ACETONE	MS	3.19	69164	90%	3.19	63069	82%	3.27	79826	103%			
D2-Dichloromethane	MS	3.03	39377	81%	3.03	39096	81%	3.08	48968	101%			
D8-TOLUENE	MS	10.57	65039	93%	10.56	55117	78%	10.64	66334	94%			
Total Number of Peaks by GCMS:		6 + Surrogates			6 + Surrogates			0 + Surrogates					

Unidentified peaks and/or other analytical remarks: UNITS: mcg/L

SOIL GAS SAMPLE RESULTS

SITE NAME: GreatNeck/Tt LAB NAME: HydroGeoSpectrum (HGS) DATE: 2 SEP 1998

ANALYST: Raphe Pavlick COLLECTOR: Rodney Brott INSTRUMENT ID: 2415A8201

NORMAL INJECTION VOLUME 1 ml

Sample ID:		TT1 VOB8331-09077			TT1 VOB8330-09076			AMBIENT BLANK VOB8327					
Sampling Depth (ft)		62			73								
Purge Volume (ml)		3000			3300			NA					
Vacuum		NO			NO			NO					
Sampling Time		01Sep			01Sep			0932					
Injection Time		1245			1220			0932					
Injection Volume		1ml			1ml			1ml					
Dilution Factor		1			1			1					
COMPOUND		RT	AREA	CONC	RT	AREA	CONC	RT	AREA	CONC	RT	AREA	CONC
Vinyl Chloride	MS	1.91	633	0.6	1.71	1105	1.0	NONE DETECTED					
1,2-Dichloroethene (total)	MS	5.07	19989	4.2	4.97	45552	9.6						
Trichloroethene	MS	7.47	20335	6.3	7.43	16587	5.1						
Toluene	MS	10.68	9282	1.9	10.70	6593	1.3						
Tetrachloroethene	MS	9.92	16224	6.4	9.92	15772	6.3						
FREON-113	MS	5.57	29238	6.6	5.50	28131	6.3						
Deutero-chloroform	MS	5.29	59328	93%	5.22	38655	61%	5.30	93346	106%			
D6-BENZENE	MS	7.65	140704	98%	7.63	89400	62%	7.66	173554	95%			
D6-ACETONE	MS	3.31	71645	93%	3.15	44937	58%	3.31	88475	93%			
D2-Dichloromethane	MS	3.13	43931	91%	2.97	29376	61%	3.16	49308	101%			
D8-TOLUENE	MS	10.58	72153	103%	10.59	37012	53%	10.60	103762	94%			
Total Number of Peaks by GCMS:		6 + Surrogates			6 + Surrogates			0 + Surrogates					

Unidentified peaks and/or other analytical remarks: UNITS: mcg/L

SOIL GAS SAMPLE RESULTS

SITE NAME: GreatNeck/Tt | LAB NAME: HydroGeoSpectrum (HGS) | DATE: 2 SEP 1998

ANALYST: Raphe Pavlick | COLLECTOR: Rodney Brott | INSTRUMENT ID: 2415A8201

NORMAL INJECTION VOLUME 1 ml

Sample ID:		TT7 VOB8328-09074			TT7 VOB8329-09075								
Sampling Depth (ft)		34			60								
Purge Volume (ml)		2250			2850								
Vacuum		NO			NO								
Sampling Time		01Sep			01Sep								
Injection Time		1150			125								
Injection Volume		1ml			1ml								
Dilution Factor		1			1								
COMPOUND		RT	AREA	CONC	RT	AREA	CONC	RT	AREA	CONC	RT	AREA	CONC
Trichloroethene	MS	7.47	8640	2.6	7.46	10507	3.2						
Toluene	MS	10.69	5187	1.0	10.76	5233	1.0						
Tetrachloroethene	MS	9.92	5900	2.3	9.92	8288	3.3						
FREON-113	MS				5.56	3407	0.7						
Deutero-chloroform	MS	5.29	53100	83%	5.25	60888	95%						
D6-BENZENE	MS	7.66	112866	79%	7.65	140783	98%						
D6-ACETONE	MS	3.31	58615	76%	3.22	74534	97%						
D2-Dichloromethane	MS	3.15	44553	92%	3.06	43629	90%						
D8-TOLUENE	MS	10.58	34684	49%	10.59	71824	102%						

Total Number of Peaks by GCMS: 3 + Surrogates 4 + Surrogates

Unidentified peaks and/or other analytical remarks: UNITS: mcg/L

SOIL GAS SAMPLE RESULTS

SITE NAME: GreatNeck/Tt LAB NAME: HydroGeoSpectrum (HGS) DATE: 2 SEP 1998

ANALYST: Raphe Pavlick COLLECTOR: Rodney Brott INSTRUMENT ID: 2415A8201

NORMAL INJECTION VOLUME 1 ml

Sample ID:		TT6 VOB8332-09077			TT6 VOB8334-09080								
Sampling Depth (ft)		60			70								
Purge Volume (ml)		2850			3300								
Vacuum		NO			NO								
Sampling Time		01Sep			01Sep								
Injection Time		1302			1337								
Injection Volume		1ml			1ml								
Dilution Factor		1			1								
COMPOUND		RT	AREA	CONC	RT	AREA	CONC	RT	AREA	CONC	RT	AREA	CONC
1,2-Dichloroethene (total)	MS	5.04	230415	48.7	5.01	106633	22.5						
1,1,1-Trichloroethane	MS	6.26	2386	0.7									
Benzene	MS	7.72	4411	0.6	7.68	3893	0.5						
Trichloroethene	MS	7.46	2128784	662.5	7.43	1248286	388.4						
Toluene	MS	10.69	597874	124.7	10.65	196264	40.9						
Tetrachloroethene	MS	9.93	999918	399.2	9.90	212084	84.6						
Ethylbenzene	MS	13.10	10110	3.3									
FREON-113	MS				5.55	15364	3.4						
Deutero-chloroform	MS	5.28	51405	81%	5.26	66463	104%						
D6-BENZENE	MS	7.66	114743	80%	7.63	149128	104%						
D6-ACETONE	MS	3.29	60783	79%	3.27	77661	101%						
D2-Dichloromethane	MS	3.11	37696	78%	3.10	47637	98%						
D8-TOLUENE	MS	10.58	57148	81%	10.54	70368	100%						

Total Number of Peaks by GCMS: 7 + Surrogates 6 + Surrogates

Unidentified peaks and/or other analytical remarks: UNITS: mcg/L

SOIL GAS SAMPLE RESULTS

SITE NAME: GreatNeck/Tt LAB NAME: HydroGeoSpectrum (HGS) DATE: 2 SEP 1998

ANALYST: Raphe Pavlick COLLECTOR: Rodney Brott INSTRUMENT ID: 2415A8201

NORMAL INJECTION VOLUME 1 ml

Sample ID:		TT5 VOB8335-09081			TT5 VOB8335D-09081			TT5 VOB8341-09087			TT5 VOB8341D-09087		
Sampling Depth (ft)		37 PURG			37 DF10			37 PURG			37 PURG		
Purge Volume (ml)		540			540			8640			8640		
Vacuum		NO			NO			NO			NO		
Sampling Time		01Sep			01Sep			01Sep			01Sep		
Injection Time		1353			1506			1627			1650		
Injection Volume		1ml			0.1ml			1ml			0.1ml		
Dilution Factor		1			10			1			10		
COMPOUND		RT	AREA	CONC	RT	AREA	CONC	RT	AREA	CONC	RT	AREA	CONC
Vinyl Chloride	MS	1.85	3741	3.6				1.75	5007	4.8			
1,1-Dichloroethene	MS	4.22	95386	48.8				4.18	140409	71.8			
1,2-Dichloroethene (total)	MS	5.00	4709300	995.2	5.02	450627	952.3	4.96	8749639	1849.1	5.03	882907	1865.9
Chloroform	MS	5.26	6299	1.5				5.22	8073	1.9			
1,1,1-Trichloroethane	MS	6.24	394780	116.0	6.25	39295	115.4	6.22	494596	145.3			
Benzene	MS	7.68	36076	5.0				7.68	48921	6.8			
Trichloroethene	MS	7.43	14757130	4592.6	7.43	1944141	6050.4	7.42	20173584	6278.3	7.44	3603306	11214.
Toluene	MS	10.64	3587101	748.5	10.67	361627	754.6	10.67	8019286	1673.4	10.68	808002	1686.1
Tetrachloroethene	MS	9.89	4269118	1704.7	9.90	429869	1716.5	9.90	7656217	3057.3	9.90	853972	3410.1
Ethylbenzene	MS	13.07	41010	13.5				13.05	72912	24.1			
Xylene (total)	MS							16.61	254903	52.3			
1,1,1,2-Tetrachloroethane	MS	9.03	5989	2.1				9.04	3818	1.3			
FREON-11	MS	4.00	31145	7.2				3.93	29324	6.8			
FREON-12	MS	2.05	64470	172.0				1.96	23329	62.2			
FREON-113	MS	5.54	20281172	4597.9	5.54	2697425	6115.2	5.51	18743008	4249.2	5.56	2511284	5693.2
Deutero-chloroform	MS	5.25	62951	99%	5.26	6836	107%	5.21	60972	96%	5.27	5780	91%
D6-BENZENE	MS	7.61	135867	95%	7.63	15048	105%	7.61	129155	90%	7.63	13452	94%
D6-ACETONE	MS	3.26	75299	98%	3.27	7908	102%	3.15	70006	91%	3.29	6998	91%
D2-Dichloromethane	MS	3.08	50861	105%	3.09	4383	91%	2.99	43678	90%	3.10	5502	114%
D8-TOLUENE	MS	10.54	67679	96%	10.54	6954	99%	10.56	69946	100%	10.56	7555	108%
Total Number of Peaks by GCMS:		14 + Surrogates			6 + Surrogates			15 + Surrogates			5 + Surrogates		

Unidentified peaks and/or other analytical remarks: UNITS: mcg/L

SOIL GAS SAMPLE RESULTS

SITE NAME: GreatNeck/Tt | LAB NAME: HydroGeoSpectrum (HGS) | DATE: 2 SEP 1998

ANALYST: Raphe Pavlick | COLLECTOR: Rodney Brott | INSTRUMENT ID: 2415A8201

NORMAL INJECTION VOLUME 1 ml

Sample ID:		TT6 VOB8336-09082			TT6 VOB8336D-09082			TT6 VOB8338-09084			TT6 VOB8338D-09084		
Sampling Depth (ft)			29			29			38			38 DF5	
Purge Volume (ml)			1950			1950			2250			2250	
Vacuum			NO			NO			NO			NO	
Sampling Time			01Sep			01Sep			01Sep			01Sep98	
Injection Time			1412			2020			1733			1753	
Injection Volume			1ml			0.2ml			1ml			0.2ml	
Dilution Factor			1			5			1			5	
COMPOUND		RT	AREA	CONC	RT	AREA	CONC	RT	AREA	CONC	RT	AREA	CONC
Vinyl Chloride	MS	1.86	8623	8.3				1.91	7259	7.0			
1,1-Dichloroethene	MS	4.25	123616	63.2									
Methylene Chloride	MS	3.14	1362	0.6				3.16	61838	27.5			
1,2-Dichloroethene (total)	MS	5.02	12057678	2548.2	5.01	2596639	2743.8	5.05	1911009	403.8	4.98	393525	415.8
1,1-Dichloroethane	MS							4.84	34583	8.1			
Chloroform	MS							5.29	27116	6.6			
1,1,1-Trichloroethane	MS	6.25	13579	3.9				6.27	86849	25.5			
Benzene	MS	7.67	11342	1.5				7.70	70156	9.8			
Trichloroethene	MS	7.44	2845641	885.6	7.47	582547	906.4	7.45	9590205	2984.6	7.43	2341424	3643.4
Toluene	MS	10.66	719611	150.1	10.74	148347	154.7	10.67	804288	167.8	10.68	172181	179.6
Tetrachloroethene	MS	9.90	2310449	922.6	9.95	492672	983.6	9.91	1361748	543.7	9.91	293095	585.2
Ethylbenzene	MS	16.62	18385	6.0				16.63	9717	3.2			
FREON-113	MS	5.56	1373775	311.4				5.57	12275586	2782.9	5.51	3080971	3492.4
Deutero-chloroform	MS	5.26	63774	100	5.25	13954	79%	5.28	63155	99%	5.22	12294	96%
D6-BENZENE	MS	7.63	147782	103	7.67	32969	91%	7.64	134573	94%	7.61	31223	109%
D6-ACETONE	MS	3.26	74416	96	3.22	16486	87%	3.31	75133	97%	3.16	14276	92%
D2-Dichloromethane	MS	3.11	49145	102	3.04	10185	105%	3.15	45380	94%	2.99	11155	115%
D8-TOLUENE	MS	10.54	73539	105	10.65	18842	85%	10.56	72572	103%	10.56	14925	106%
Total Number of Peaks by GCMS:		11 + Surrogates			4 + Surrogates			12 + Surrogates			5 + Surrogates		

Unidentified peaks and/or other analytical remarks: UNITS: mcg/L

SOIL GAS SAMPLE RESULTS

SITE NAME: GreatNeck/Tt | LAB NAME: HydroGeoSpectrum (HGS) | DATE: 2 SEP 1998

ANALYST: Raphe Pavlick | COLLECTOR: Rodney Brott | INSTRUMENT ID: 2415A8201

NORMAL INJECTION VOLUME 1 ml

Sample ID:		TT5 VOB8337-09083			TT5 VOB8337D-09083			TT5 VOB8339-09085					
Sampling Depth (ft)		62			62 DF10			73					
Purge Volume (ml)		3000			3000			3300					
Vacuum		NO			NO			NO					
Sampling Time		01Sep			01Sep			01Sep					
Injection Time		1433			1448			1522					
Injection Volume		1ml			0.1ml			1ml					
Dilution Factor		1			10			1					
COMPOUND		RT	AREA	CONC	RT	AREA	CONC	RT	AREA	CONC	RT	AREA	CONC
1,1-Dichloroethene	MS	4.23	4945	2.5									
1,2-Dichloroethene (total)	MS	5.00	786268	166.1	4.92	75796	160.1	5.02	149891	31.6			
1,1,1-Trichloroethane	MS	6.24	45782	13.4				6.24	7188	2.1			
Benzene	MS	7.67	32446	4.5				7.68	6456	0.9			
Trichloroethene	MS	7.43	16132098	5020.5	7.42	2023019	6295.9	7.44	5392215	1678.1			
Toluene	MS	10.66	7179885	1498.3	10.66	655370	1367.6	10.66	2945055	614.5			
Tetrachloroethene	MS	9.89	7334732	2928.9	9.88	735677	2937.7	9.89	4220292	1685.2			
Ethylbenzene	MS							13.08	71875	23.8			
Xylene (total)	MS							16.60	298874	61.1			
FREON-113	MS	5.54	459895	104.2				5.54	112259	25.4			
Deutero-chloroform	MS	5.25	69795	109%	5.16	6659	104%	5.27	65916	103%			
D6-BENZENE	MS	7.62	133526	93%	7.59	15592	109%	7.63	143530	100%			
D6-ACETONE	MS	3.22	79347	103%	3.08	8098	105%	3.27	74446	96%			
D2-Dichloromethane	MS	3.07	48681	101%	2.91	4731	98%	3.09	46775	97%			
D8-TOLUENE	MS	10.54	69746	99%	10.57	6883	98%	10.56	68210	97%			
Total Number of Peaks by GCMS:		8 + Surrogates			4 + Surrogates			9 + Surrogates					

Unidentified peaks and/or other analytical remarks: UNITS: mcg/L

SOIL GAS SAMPLE RESULTS

SITE NAME: GreatNeck/Tt | LAB NAME: HydroGeoSpectrum (HGS) | DATE: 2 SEP 1998

ANALYST: Raphe Pavlick | COLLECTOR: Rodney Brott | INSTRUMENT ID: 2415A8201

NORMAL INJECTION VOLUME 1 ml

Sample ID:		TT5 VOB8340-09086			TT5 VOB8340D-09086			BLANK VOB8333-09079					
Sampling Depth (ft)		37 PURG			37 PURG								
Purge Volume (ml)		8640			8640			NA					
Vacuum		NO			NO			NO					
Sampling Time		01Sep			01Sep			01Sep					
Injection Time		1544			1606			1322					
Injection Volume		1ml			0.1ml			1ml					
Dilution Factor		1			10			1					
COMPOUND		RT	AREA	CONC	RT	AREA	CONC	RT	AREA	CONC	RT	AREA	CONC
Vinyl Chloride	MS	1.90	4346	4.2				NONE DETECTED					
1,1-Dichloroethene	MS	4.26	167962	85.9									
1,2-Dichloroethene (total)	MS	5.02	11602548	2452.1	4.97	1138710	2406.5						
Chloroform	MS	5.26	7792	1.9									
1,1,1-Trichloroethane	MS	6.25	484757	142.4									
Benzene	MS	7.68	52659	7.3									
Trichloroethene	MS	7.43	22141461	6890.7	7.42	3859526	12011.						
Toluene	MS	10.65	11790035	2460.3	10.65	1117789	2332.6						
Tetrachloroethene	MS	9.89	13481024	5383.3	9.90	1557485	6219.4						
Ethylbenzene	MS	13.07	164172	54.4									
Xylene (total)	MS	16.54	620424	42.4									
1,1,1,2-Tetrachloroethane	MS	9.02	2771	0.9									
FREON-11	MS	4.04	28703	6.6									
FREON-113	MS	5.55	18960041	4298.4	5.50	2441493	5535.0						
Deutero-chloroform	MS	5.26	59233	93%	5.21	6500	102%	5.25	70292	110%			
D6-BENZENE	MS	7.62	148665	104%	7.61	15068	105%	7.63	158222	110%			
D6-ACETONE	MS	3.28	75238	97%	3.18	7041	91%	3.29	77273	100%			
D2-Dichloromethane	MS	3.12	44639	92%	2.98	4447	92%	3.11	46813	97%			
D8-TOLUENE	MS	10.54	71777	102%	10.53	6815	97%	10.54	73944	105%			

Total Number of Peaks by GCMS: 14 + Surrogates | 5 + Surrogates | 0 + Surrogates

Unidentified peaks and/or other analytical remarks: UNITS: mcg/L

SOIL GAS SAMPLE RESULTS

SITE NAME: GreatNeck/Tt LAB NAME: HydroGeoSpectrum (HGS) DATE: 3 SEP 1998

ANALYST: Raphe Pavlick COLLECTOR: Rodney Brott INSTRUMENT ID: 2415A8201

NORMAL INJECTION VOLUME 1 ml

Sample ID:		TT3 VOB8353-09096			TT3 VOB8354-09097			TT3 VOB8355-09098			BLANK VOB8356-09099		
Sampling Depth (ft)		62			52			72					
Purge Volume (ml)		3000			2700			3300			NA		
Vacuum		NO			NO			NO			NO		
Sampling Time		02Sep			02Sep			02Sep			P98) N		
Injection Time		1142			1157			1346			1401		
Injection Volume		1ml			1ml			1ml			1ml		
Dilution Factor		1			1			1			1		
COMPOUND		RT	AREA	CONC	RT	AREA	CONC	RT	AREA	CONC	RT	AREA	CONC
1,2-Dichloroethene (total)	MS				5.02	20607	4.3				NONE DETECTED		
Trichloroethene	MS	7.45	3386	1.0	7.44	8137	2.5	7.46	3337	1.0			
Toluene	MS				10.69	4569	0.9	10.69	2813	0.5			
Tetrachloroethene	MS	9.92	6161	2.4	9.91	11826	4.7	9.92	3946	1.5			
FREON-113	MS				5.54	10020	2.2	5.59	4699	1.0			
Deutero-chloroform	MS	5.27	64021	100%	5.27	67799	106%	5.28	58244	91%	5.28	64656	101%
D6-BENZENE	MS	7.64	152543	106%	7.64	150157	105%	7.64	138848	97%	7.64	152375	106%
D6-ACETONE	MS	3.30	77410	100%	3.28	69224	90%	3.31	65622	85%	3.25	78218	101%
D2-Dichloromethane	MS	3.14	48727	101%	3.13	47539	98%	3.14	44504	92%	3.10	48018	99%
D8-TOLUENE	MS	10.57	74526	106%	10.57	73715	105%	10.59	69112	98%	10.57	75777	108%

Total Number of Peaks by GCMS: 2 + Surrogates 5 + Surrogates 4 + Surrogates 0 + Surrogates

Unidentified peaks and/or other analytical remarks: UNITS: mcg/L

SOIL GAS SAMPLE RESULTS

SITE NAME: GreatNeck/Tt LAB NAME: HydroGeoSpectrum (HGS) DATE: 4 SEP 1998

ANALYST: Raphe Pavlick COLLECTOR: Rodney Brott INSTRUMENT ID: 2415A8201

NORMAL INJECTION VOLUME 1 ml

Sample ID:		TT8 VOB8393-09133			TT8 VOB8395-09135			TT8 VOB8394-09134			TT8 VOB8397-09137	
Sampling Depth (ft)		42			42			62			62	
Purge Volume (ml)		2250			2250			3000			3000	
Vacuum		NO			NO			NO			NO	
Sampling Time		03Sep			03Sep			03Sep			03Sep	
Injection Time		1020			1249			1035			1321	
Injection Volume		1ml			1ml			1ml			1ml	
Dilution Factor		1			1			1			1	
COMPOUND		RT	AREA	CONC	RT	AREA	CONC	RT	AREA	CONC	RT	AREA	CONC
Vinyl Chloride	MS	1.90	2753	2.6	1.89	2211	2.1						
1,2-Dichloroethene (total)	MS	5.05	2123754	448.8	5.05	1743051	368.3	5.04	4652	0.9	5.06	2978	0.6
1,1,1-Trichloroethane	MS	6.29	4328	1.2	6.29	3465	1.0						
Trichloroethene	MS	7.48	1437993	447.5	7.48	1046448	325.6	7.46	3847	1.2	7.45	3648	1.1
Toluene	MS	10.75	2006	0.4									
Tetrachloroethene	MS	9.94	318949	127.3	9.95	164952	65.8	9.92	2390	0.9	9.97	2668	1.0
FREON-113	MS	5.58	377278	85.5	5.59	317715	72.0	5.57	3506	0.7	5.58	3451	0.8
Deutero-chloroform	MS	5.30	56562	89%	5.30	59004	93%	5.28	61491	96%	5.30	64450	101%
D6-BENZENE	MS	7.67	133467	93%	7.67	136394	95%	7.65	135944	95%	7.65	154236	108%
D6-ACETONE	MS	3.31	69841	91%	3.31	69486	90%	3.27	71472	93%	3.30	76197	99%
D2-Dichloromethane	MS	3.15	41418	86%	3.14	43009	89%	3.10	44249	91%	3.14	50217	104%
D8-TOLUENE	MS	10.60	69359	99%	10.61	75412	107%	10.59	63018	90%	10.60	57234	81%
Total Number of Peaks by GCMS:		7 + Surrogates			6 + Surrogates			4 + Surrogates			4 + Surrogates	

Unidentified peaks and/or other analytical remarks: UNITS: mcg/L

SOIL GAS SAMPLE RESULTS

SITE NAME: GreatNeck/Tt LAB NAME: HydroGeoSpectrum (HGS) DATE: 4 SEP 1998

ANALYST: Raphe Pavlick COLLECTOR: Rodney Brott INSTRUMENT ID: 2415A8201

NORMAL INJECTION VOLUME 1 ml

Sample ID:	TT1
	VOB8396-09136
Sampling Depth (ft)	72 resample
Purge Volume (ml)	3300
Vacuum	NO
Sampling Time	03Sep
Injection Time	1304
Injection Volume	1ml
Dilution Factor	1

COMPOUND		RT	AREA	CONC	RT	AREA	CONC	RT	AREA	CONC	RT	AREA	CONC
Vinyl Chloride	MS	1.88	4391	4.2									
1,2-Dichloroethene (total)	MS	5.05	72452	15.3									
Trichloroethene	MS	7.49	5817	1.8									
Tetrachloroethene	MS	9.95	5696	2.2									
FREON-113	MS	5.57	51965	11.7									
Deutero-chloroform	MS	5.28	134575	211%									
D6-BENZENE	MS	7.65	301983	211%									
D6-ACETONE	MS	3.27	158867	206%									
D2-Dichloromethane	MS	3.10	103333	214%									
D8-TOLUENE	MS	10.60	137362	196%									

Total Number of Peaks by GCMS: 5 + Surrogates

Unidentified peaks and/or other analytical remarks: UNITS: mcg/L

NOTE: Twice amount surrogates added to sample.

QA/QC

LABORATORY CONTROL STANDARD (LCS) BY FULL SCAN MASS SPEC

1 ng Detection Limit Check

SITE NAME: Initial | LAB NAME: HydroGeoSpectrum | DATE: 10July98

STD LOT#: Custom-1 | TIME: 14:54

ANALYST: Raphe Pavli | INSTRUMENT ID: 2415A8201

	Rt	Response	Conc µg/L	AccRge
Vinyl Chlori	1.75	1142	1.1104	1 ± 50%
Bromometh	1.39	331	1.0553	1 ± 50%
Chloroetha	2.28	1238	0.9258	1 ± 50%
1,1-Dichlor	4.18	1964	1.005	1 ± 50%
Methylene	3.1	2532	1.1284	1 ± 50%
1,2-Dichlor	4.99	5099	1.0776	1 ± 50%
1,1-Dichlor	4.73	4673	1.0961	1 ± 50%
Chloroform	5.23	4735	1.16	1 ± 50%
1,2-Dichlor	5.57	2468	1.0414	1 ± 50%
2-Butanone	5.52	13102	1.2034	1 ± 50%
1,1,1-Trichl	6.21	3927	1.1542	1 ± 50%
Carbon Tet	6.37	3062	0.9677	1 ± 50%
Benzene	7.66	8171	1.1415	1 ± 50%
Trichloroet	7.43	3792	1.1801	1 ± 50%
1,2-Dichlor	7.12	2692	0.9637	1 ± 50%
Bromodichl	6.49	4123	1.093	1 ± 50%
cis-1,3-Dic	7.22	4723	1.075	1 ± 50%
trans-1,3-D	7.81	3571	1.2078	1 ± 50%
1,1,2-Trichl	7.73	2620	1.0679	1 ± 50%
Dibromochl	7.73	3359	0.9917	1 ± 50%
Bromoform	8.86	2900	0.9266	1 ± 50%
4-Methyl-2-	9.75	14186	1.2638	1 ± 50%
Toluene	10.66	5700	1.1895	1 ± 50%
Tetrachloro	9.89	2657	1.061	1 ± 50%
2-Hexanon	9.75	13997	1.2593	1 ± 50%
Chlorobenz	11.43	6180	1.0762	1 ± 50%
Ethylbenze	13.1	2796	0.9266	1 ± 50%
Xylene (tot	17.35	15190	1.04	1 ± 50%
Styrene	16.36	7407	1.2558	1 ± 50%
1,1,1,2-Tet	9.01	2611	0.9674	1 ± 50%
1,1,2,2-Tet	9.88	5756	1.1995	1 ± 50%
FREON-11	3.96	4980	1.1541	1 ± 50%
FREON-12	1.69	335	0.8938	1 ± 50%
FREON-11	5.47	5004	1.1344	1 ± 50%
Freon-22	1.42	525	0.9571	1 ± 50%
Freon-141B	4.01	5767	1.0108	1 ± 50%

Laboratory Control Standard (LCS)

Data File : E:\VOB7743.D Vial: 1
Acq On : 10 Jul 1998 4:54 pm Operator: Raphe HGS
Sample : LCS 50NG Inst : GC/MS #1
Misc : 10JULY98 Multiplr: 1.00
MS Integration Params: rteint.p GC Integration Params: rteint2.p

Method : C:\HPCHEM\1\METHODS\10JUL98.M (RTE Integrator)
Title : FULL SCAN

Min. RRF : 0.000 Min. Rel. Area : 50% Max. R.T. Dev 0.50min
Max. RRF Dev : 15% Max. Rel. Area : 150%

Compound		AvgRF	CCRF	%Dev	AccRge	Dev(min)
1	Vinyl	1028.435	1017.33	1.1	25	-0.01
2	Brom	313.657	310.09	1.1	25	-0.03
3	Chlor	1.337	1.355 E3	-1.4	25	-0.03
4	1,1-D	1.954	2.183 E3	-11.7	15	0
6	Meth	2.244	2.471 E3	-10.1	15	-0.03
7	1,2-D	4.732	4.936 E3	-4.3	15	-0.02
8	1,1-D	4.263	4.427 E3	-3.8	15	-0.02
9	Chlor	4.082	4.245 E3	-4	15	0
10	1,2-	2.37	2.452 E3	-3.5	15	-0.02
12	1,1,	3.402	3.517 E3	-3.4	15	0
13	Carb	3.164	3.128 E3	1.1	15	0
14	Ben	7.158	7.746 E3	-8.2	15	0
15	Tric	3.213	3.527 E3	-9.8	15	-0.02
16	1,2-	2.793	3.046 E3	-9.1	15	0
17	Bro	3.772	4.149 E3	-10	15	0
18	cis-	4.394	4.228 E3	3.8	15	0
19	tran	2.957	3.153 E3	-6.6	15	-0.07
20	1,1,	2.453	2.596 E3	-5.8	15	0
21	Dibr	3.387	3.680 E3	-8.7	15	-0.02
22	Bro	3.13	3.301 E3	-5.5	15	-0.02
24	Tolu	4.792	5.237 E3	-9.3	15	0
25	Tetr	2.504	2.704 E3	-8	15	-0.02
27	Chlo	5.742	6.319 E3	-10	15	0
28	Ethy	3.018	3.308 E3	-9.6	15	0.02
29	Xyle	14.606	14.922 E3	-2.2	15	-0.02
30	Styr	5.898	6.113 E3	-3.6	15	0.02
31	1,1,	2.842	2.989 E3	-5.2	15	0
32	1,1,	4.342	4.891 E3	-12.6	15	0
33	FRE	4.315	4.374 E3	-1.4	20	-0.02
35	FRE	374.788	382.38	-2	20	-0.06
36	FRE	4.411	4.532 E3	-2.7	20	0

Evaluate Continuing Calibration Report

Data File : C:\HPCHEM\1\DATA\VOB8275.D Vial: 1
Acq On : 29 Aug 1998 8:01 am Operator: Raphe HGS
Sample : STANDARD 50ng Inst : GC/MS Ins
'isc : 29AUG98 Multiplr: 1.00
iS Integration Params: rteint.p

Method : C:\HPCHEM\1\METHODS\10JUL98.M (RTE Integrator)
Title : FULL SCAN
Response via : Multiple Level Calibration

Min. RRF : 0.000 Min. Rel. Area : 50% Max. R.T. Dev 0.50min
Max. RRF Dev : 15% Max. Rel. Area : 150%

		Compound	AvgRF	CCRF		%Dev	AccRge	Dev(min)
1		Vinyl Chloride	1028.435	1102.260		-7.2	20	-0.35
2		Bromomethane	313.657	307.140		2.1	20	-0.31
3		Chloroethane	1.337	1.098	E3	17.9	20	-0.36
4		1,1-Dichloroethene	1.954	1.965	E3	-0.6	15	-0.06
5		Acetone	5.745	5.854	E3	-1.9	15	-0.24
6		Methylene Chloride	2.244	2.271	E3	-1.2	15	-0.30
7		1,2-Dichloroethene (total)	4.732	4.930	E3	-4.2	15	-0.03
8		1,1-Dichloroethane	4.263	4.083	E3	4.2	15	-0.05
9		Chloroform	4.082	4.114	E3	-0.8	15	-0.01
10		1,2-Dichloroethane	2.370	2.120	E3	10.5	15	-0.03
11		2-Butanone	10.888	11.608	E3	-6.6	15	-0.05
12		1,1,1-Trichloroethane	3.402	3.251	E3	4.4	15	0.02
13		Carbon Tetrachloride	3.164	3.085	E3	2.5	15	0.02
14		Benzene	7.158	7.163	E3	-0.1	15	0.05
		Trichloroethene	3.213	3.162	E3	1.6	15	0.02
16		1,2-Dichloropropane	2.793	2.966	E3	-6.2	15	0.01
17		Bromodichloromethane	3.772	3.812	E3	-1.1	15	0.00
18		cis-1,3-Dichloropropene	4.394	4.272	E3	2.8	15	0.02
19		trans-1,3-Dichloropropene	2.957	2.969	E3	-0.4	15	-0.03
20		1,1,2-Trichloroethane	2.453	2.747	E3	-12.0	15	0.04
21		Dibromochloromethane	3.387	3.374	E3	0.4	15	0.01
22		Bromoform	3.130	2.981	E3	4.8	15	0.02
23		4-Methyl-2-Pentanone	11.225	11.712	E3	-4.3	15	0.06
24		Toluene	4.792	4.894	E3	-2.1	15	0.09
25		Tetrachloroethene	2.504	2.657	E3	-6.1	15	0.04
26		2-Hexanone	11.115	11.712	E3	-5.4	15	0.06
27		Chlorobenzene	5.742	6.244	E3	-8.7	15	0.12
28		Ethylbenzene	3.018	3.209	E3	-6.3	15	0.14
29		Xylene (total)	14.606	14.779	E3	-1.2	15	0.19
30		Styrene	5.898	5.749	E3	2.5	15	0.26
31	T	1,1,1,2-Tetrachloroethane	2.842	2.869	E3	-1.0	15	0.05
32		1,1,2,2-Tetrachloroethane	4.342	4.482	E3	-3.2	15	0.06
33		FREON-11	4.315	3.479	E3	19.4	20	-0.21
35		FREON-12	374.788	407.100		-8.6	20	-0.39
36		FREON-113	4.411	3.959	E3	10.2	20	0.02
43		Freon-22	549.764	443.560		19.3	20	-0.08
44		Freon-141B	5.705	4.749	E3	16.8	20	-0.08

Evaluate Laboratory Control Standard Report

Data File : D:\VOB8302.D
Acq On : 29 Aug 98 6:44 pm
Sample : LCS 50NG
Misc : ACTA/TT 29AUG98
MS Integration Params: rteint.p

Vial: 1
Operator: Raphe HGS
Inst : GC/MS Ins
Multiplr: 1.00

Method : C:\HPCHEM\1\METHODS\10JUL98.M (RTE Integrator)
Title : FULL SCAN
Response via : Multiple Level Calibration

Min. RRF : 0.000 Min. Rel. Area : 50% Max. R.T. Dev 0.50min
Max. RRF Dev : 15% Max. Rel. Area : 150%

		Compound	AvgRF	CCRF		%Dev	AccRge	Dev(min)
1		Vinyl Chloride	1028.435	1124.270		-9	25	-0.11
2		Bromomethane	313.657	323.610		-3	25	-0.11
3		Chloroethane	1.337	1.177		12	25	-0.10
4		1,1-Dichloroethene	1.954	2.019	E3	-3.3	20	-0.05
6		Methylene Chloride	2.244	2.130	E3	5.1	20	-0.10
7		1,2-Dichloroethene (total)	4.732	4.879	E3	-3.1	20	-0.02
8		1,1-Dichloroethane	4.263	3.858	E3	9.5	20	-0.03
9		Chloroform	4.082	3.863	E3	5.4	20	0.03
10		1,2-Dichloroethane	2.370	1.987	E3	16.2	20	0.00
[illegible]		1,1,1-Trichloroethane	3.402	3.242	E3	4.7	20	0.03
[illegible]		Carbon Tetrachloride	3.164	2.702	E3	14.6	20	0.04
14		Benzene	7.158	6.747	E3	5.7	20	0.05
15		Trichloroethene	3.213	3.042	E3	5.3	20	0.03
16		1,2-Dichloropropane	2.793	2.738	E3	2.0	20	0.03
17		Bromodichloromethane	3.772	3.653	E3	3.2	20	0.03
18		cis-1,3-Dichloropropene	4.394	3.809	E3	13.3	20	0.04
19		trans-1,3-Dichloropropene	2.957	3.167	E3	-7.1	20	0.00
20		1,1,2-Trichloroethane	2.453	2.778	E3	-13.2	20	0.05
21		Dibromochloromethane	3.387	3.400	E3	-0.4	20	0.03
22		Bromoform	3.130	3.073	E3	1.8	20	0.04
24		Toluene	4.792	4.635	E3	3.3	20	0.09
25		Tetrachloroethene	2.504	2.642	E3	-5.5	20	0.05
27		Chlorobenzene	5.742	6.084	E3	-6.0	20	0.10
28		Ethylbenzene	3.018	3.121	E3	-3.4	20	0.12
29		Xylene (total)	14.606	14.920	E3	-2.1	20	0.12
30		Styrene	5.898	5.997	E3	-1.7	20	0.17
31	T	1,1,1,2-Tetrachloroethane	2.842	2.760	E3	2.9	20	0.07
32		1,1,2,2-Tetrachloroethane	4.342	4.800	E3	-10.5	20	0.05
33		FREON-11	4.315	3.452	E3	20.0	25	-0.05
35		FREON-12	374.788	410.920		-9.6	25	-0.14
[illegible]		FREON-113	4.411	3.797	E3	13.9	25	0.00

Evaluate Continuing Calibration Report

Data File : C:\HPCHEM\1\DATA\VOB8326.D Vial: 1
Acq On : 2 Sep 1998 8:16 am Operator: Raphe HGS
Sample : STANDARD 50NG Inst : GC/MS Ins
Misc : 02SEP98 Multiplr: 1.00
.S Integration Params: rteint.p

Method : C:\HPCHEM\1\METHODS\10JUL98T.M (RTE Integrator)
Title : FULL SCAN
Response via : Multiple Level Calibration

Min. RRF : 0.000 Min. Rel. Area : 50% Max. R.T. Dev 0.50min
Max. RRF Dev : 15% Max. Rel. Area : 150%

		Compound	AvgRF	CCRF		%Dev	AccRge	Dev(min)
1		Vinyl Chloride	1028.435	1048.500		-2.0	20	-0.01
2		Bromomethane	313.657	361.660		-15.3	20	-0.01
3		Chloroethane	1.337	1.306	E3	2.3	20	0.00
4		1,1-Dichloroethene	1.954	2.057	E3	-5.3	15	0.02
5		Acetone	5.745	6.555	E3	-14.1	15	0.00
6		Methylene Chloride	2.244	2.460	E3	-9.6	15	0.00
7		1,2-Dichloroethene (total)	4.732	5.321	E3	-12.4	15	0.02
8		1,1-Dichloroethane	4.263	4.288	E3	-0.6	15	0.02
9		Chloroform	4.082	4.288	E3	-5.0	15	0.04
10		1,2-Dichloroethane	2.370	2.297	E3	3.1	15	0.02
11		2-Butanone	10.888	11.091	E3	-1.9	15	0.04
12		1,1,1-Trichloroethane	3.402	3.538	E3	-4.0	15	0.03
13		Carbon Tetrachloride	3.164	2.901	E3	8.3	15	0.04
14		Benzene	7.158	7.514	E3	-5.0	15	0.06
		Trichloroethene	3.213	3.364	E3	-4.7	15	0.04
16		1,2-Dichloropropane	2.793	3.060	E3	-9.6	15	0.06
17		Bromodichloromethane	3.772	3.869	E3	-2.6	15	0.07
18		cis-1,3-Dichloropropene	4.394	4.465	E3	-1.6	15	0.07
19		trans-1,3-Dichloropropene	2.957	3.071	E3	-3.9	15	0.00
20		1,1,2-Trichloroethane	2.453	2.606	E3	-6.2	15	0.08
21		Dibromochloromethane	3.387	3.572	E3	-5.5	15	0.04
22		Bromoform	3.130	3.215	E3	-2.7	15	0.06
23		4-Methyl-2-Pentanone	11.225	11.103	E3	1.1	15	0.09
24		Toluene	4.792	5.081	E3	-6.0	15	0.11
25		Tetrachloroethene	2.504	2.842	E3	-13.5	15	0.06
26		2-Hexanone	11.115	11.103	E3	0.1	15	0.09
27		Chlorobenzene	5.742	6.464	E3	-12.6	15	0.11
28		Ethylbenzene	3.018	3.287	E3	-8.9	15	0.14
29		Xylene (total)	14.606	15.238	E3	-4.3	15	0.21
30		Styrene	5.898	5.855	E3	0.7	15	0.24
31	T	1,1,1,2-Tetrachloroethane	2.842	2.949	E3	-3.8	15	0.08
32		1,1,2,2-Tetrachloroethane	4.342	4.814	E3	-10.9	15	0.08
33		FREON-11	4.315	3.744	E3	13.2	20	0.03
35		FREON-12	374.788	310.200		17.2	20	-0.05
36		FREON-113	4.411	4.225	E3	4.2	20	0.04
43		Freon-22	549.764	603.060		-9.7	20	0.09
44		Freon-141B	5.705	5.098	E3	10.6	20	0.03

Evaluate Laboratory Control Standard Report

Data File : C:\HPCHEM\1\DATA\VOB8350.D
Acq On : 2 Sep 1998 9:21 pm
Sample : LCS 50NG
'isc : 02SEP98
iS Integration Params: rteint.p

Vial: 1
Operator: Raphe HGS
Inst : GC/MS Ins
Multiplr: 1.00

Method : C:\HPCHEM\1\METHODS\10JUL98.M (RTE Integrator)
Title : FULL SCAN
Response via : Multiple Level Calibration

Min. RRF : 0.000 Min. Rel. Area : 50% Max. R.T. Dev 0.50min
Max. RRF Dev : 15% Max. Rel. Area : 150%

	Compound	AvgRF	CCRF		%Dev	AccRge	Dev(min)
1	Vinyl Chloride	1028.435	1135.22		-10	25	-0.16
2	Bromomethane	313.657	299.02		4	25	-0.15
3	Chloroethane	1.337	1.146		14	25	-0.17
4	1,1-Dichloroethene	1.954	1.941	E3	0.7	20	-0.11
6	Methylene Chloride	2.244	2.159	E3	3.8	20	-0.17
7	1,2-Dichloroethene (total)	4.732	4.638	E3	2.0	20	-0.03
8	1,1-Dichloroethane	4.263	3.786	E3	11.2	20	-0.04
9	Chloroform	4.082	3.720	E3	8.9	20	0.00
10	1,2-Dichloroethane	2.370	1.951	E3	17.7	20	0.00
12	1,1,1-Trichloroethane	3.402	3.097	E3	9.0	20	0.03
13	Carbon Tetrachloride	3.164	2.598	E3	17.9	20	0.04
14	Benzene	7.158	6.585	E3	8.0	20	0.04
15	Trichloroethene	3.213	2.980	E3	7.3	20	0.03
16	1,2-Dichloropropane	2.793	2.614	E3	6.4	20	0.04
	Bromodichloromethane	3.772	3.504	E3	7.1	20	0.03
18	cis-1,3-Dichloropropene	4.394	3.861	E3	12.1	20	0.04
19	trans-1,3-Dichloropropene	2.957	3.317	E3	-12.2	20	0.00
20	1,1,2-Trichloroethane	2.453	2.693	E3	-9.8	20	0.07
21	Dibromochloromethane	3.387	3.242	E3	4.3	20	0.04
22	Bromoform	3.130	2.952	E3	5.7	20	0.03
24	Toluene	4.792	4.496	E3	6.2	20	0.11
25	Tetrachloroethene	2.504	2.523	E3	-0.8	20	0.06
27	Chlorobenzene	5.742	5.898	E3	-2.7	20	0.11
28	Ethylbenzene	3.018	3.015	E3	0.1	20	0.13
29	Xylene (total)	14.606	14.476	E3	0.9	20	0.16
30	Styrene	5.898	5.374	E3	8.9	20	0.25
31	1,1,1,2-Tetrachloroethane	2.842	2.632	E3	7.4	20	0.08
32	1,1,2,2-Tetrachloroethane	4.342	4.876	E3	-12.3	20	0.07
33	FREON-11	4.315	3.476	E3	19.4	25	-0.12
35	FREON-12	374.788	368.400		1.7	25	-0.21
36	FREON-113	4.411	3.740	E3	15.2	25	-0.01

Evaluate Continuing Calibration Report

Data File : C:\HPCHEM\1\DATA\VOB8351.D
Acq On : 3 Sep 1998 7:12 am
Sample : STANDARD 50NG
Misc : 03SEP98
IS Integration Params: rteint.p

Vial: 1
Operator: Raphe HGS
Inst : GC/MS Ins
Multiplr: 1.00

Method : C:\HPCHEM\1\METHODS\10JUL98.M (RTE Integrator)
Title : FULL SCAN
Response via : Multiple Level Calibration

Min. RRF : 0.000 Min. Rel. Area : 50% Max. R.T. Dev 0.50min
Max. RRF Dev : 15% Max. Rel. Area : 150%

	Compound	AvgRF	CCRF		%Dev	AccRge	Dev(min)
1	Vinyl Chloride	1028.435	1008.860		1.9	20	0.00
2	Bromomethane	313.657	334.700		-6.7	20	-0.02
3	Chloroethane	1.337	1.226	E3	8.3	20	0.01
4	1,1-Dichloroethene	1.954	1.915	E3	2.0	15	0.05
5	Acetone	5.745	5.977	E3	-4.0	15	0.02
6	Methylene Chloride	2.244	2.238	E3	0.3	15	0.01
7	1,2-Dichloroethene (total)	4.732	4.897	E3	-3.5	15	0.04
8	1,1-Dichloroethane	4.263	4.040	E3	5.2	15	0.04
9	Chloroform	4.082	4.021	E3	1.5	15	0.06
10	1,2-Dichloroethane	2.370	2.052	E3	13.4	15	0.05
11	2-Butanone	10.888	10.681	E3	1.9	15	0.05
12	1,1,1-Trichloroethane	3.402	3.315	E3	2.6	15	0.06
13	Carbon Tetrachloride	3.164	2.788	E3	11.9	15	0.05
14	Benzene	7.158	7.034	E3	1.7	15	0.07
15	Trichloroethene	3.213	3.166	E3	1.5	15	0.05
	1,2-Dichloropropane	2.793	2.800	E3	-0.3	15	0.07
17	Bromodichloromethane	3.772	3.728	E3	1.2	15	0.07
18	cis-1,3-Dichloropropene	4.394	4.167	E3	5.2	15	0.07
19	trans-1,3-Dichloropropene	2.957	3.048	E3	-3.1	15	0.01
20	1,1,2-Trichloroethane	2.453	2.613	E3	-6.5	15	0.08
21	Dibromochloromethane	3.387	3.359	E3	0.8	15	0.06
22	Bromoform	3.130	3.007	E3	3.9	15	0.06
23	4-Methyl-2-Pentanone	11.225	10.600	E3	5.6	15	0.11
24	Toluene	4.792	4.782	E3	0.2	15	0.13
25	Tetrachloroethene	2.504	2.714	E3	-8.4	15	0.08
26	2-Hexanone	11.115	10.600	E3	4.6	15	0.11
27	Chlorobenzene	5.742	6.222	E3	-8.4	15	0.15
28	Ethylbenzene	3.018	3.109	E3	-3.0	15	0.17
29	Xylene (total)	14.606	15.197	E3	-4.0	15	0.26
30	Styrene	5.898	5.861	E3	0.6	15	0.25
31	1,1,1,2-Tetrachloroethane	2.842	2.766	E3	2.7	15	0.10
32	1,1,2,2-Tetrachloroethane	4.342	4.593	E3	-5.8	15	0.07
33	FREON-11	4.315	3.551	E3	17.7	20	0.04
35	FREON-12	374.788	380.160		-1.4	20	-0.04
36	FREON-113	4.411	3.959	E3	10.2	20	0.05
43	Freon-22	549.764	527.400		4.1	20	0.10
44	Freon-141B	5.705	4.703	E3	17.6	20	0.04

Evaluate Lab Control Standard Report

Data File : C:\HPCHEM\1\DATA\VOB8390.D
Acq On : 3 Sep 1998 11:05 pm
Sample : LCS 50NG
Misc : 03SEP98
Integration Params: rteint.p

Vial: 1
Operator: Raphe HGS
Inst : GC/MS Ins
Multiplr: 1.00

Method : C:\HPCHEM\1\METHODS\10JUL98.M (RTE Integrator)
Title : FULL SCAN
Response via : Multiple Level Calibration

Min. RRF : 0.000 Min. Rel. Area : 50% Max. R.T. Dev 0.50min
Max. RRF Dev : 15% Max. Rel. Area : 150%

		Compound	AvgRF	CCRF		%Dev	AccRge	Dev(min)
1		Vinyl Chloride	1028.435	1017.34		1.1	25	0.03
2		Bromomethane	313.657	331.54		-5.7	25	0.02
3		Chloroethane	1.337	1,316		1.6	25	0.03
4		1,1-Dichloroethene	1.954	2.119	E3	-8.4	20	0.03
6		Methylene Chloride	2.244	2.602	E3	-16.0	20	0.03
7		1,2-Dichloroethene (total)	4.732	5.459	E3	-15.4	20	0.00
8		1,1-Dichloroethane	4.263	4.402	E3	-3.3	20	0.02
9		Chloroform	4.082	4.435	E3	-8.6	20	0.04
10		1,2-Dichloroethane	2.370	2.289	E3	3.4	20	0.02
12		1,1,1-Trichloroethane	3.402	3.545	E3	-4.2	20	0.02
13		Carbon Tetrachloride	3.164	3.053	E3	3.5	20	0.03
14		Benzene	7.158	7.652	E3	-6.9	20	0.03
15		Trichloroethene	3.213	3.469	E3	-8.0	20	0.02
16		1,2-Dichloropropane	2.793	3.118	E3	-11.6	20	0.04
[illegible]		Bromodichloromethane	3.772	4.038	E3	-7.1	20	0.04
		cis-1,3-Dichloropropene	4.394	4.128	E3	6.1	20	0.04
19		trans-1,3-Dichloropropene	2.957	3.428	E3	-15.9	20	-0.01
21		Dibromochloromethane	3.387	3.745	E3	-10.6	20	0.03
22		Bromoform	3.130	3.385	E3	-8.1	20	0.03
24		Toluene	4.792	5.194	E3	-8.4	20	0.09
25		Tetrachloroethene	2.504	2.936	E3	-17.3	20	0.03
27		Chlorobenzene	5.742	6.690	E3	-16.5	20	0.10
28		Ethylbenzene	3.018	3.407	E3	-12.9	20	0.08
29		Xylene (total)	14.606	15.243	E3	-4.4	20	0.15
30		Styrene	5.898	6.096	E3	-3.4	20	0.18
31	T	1,1,1,2-Tetrachloroethane	2.842	3.039	E3	-6.9	20	0.06
32		1,1,2,2-Tetrachloroethane	4.342	4.970	E3	-14.5	20	0.06
33		FREON-11	4.315	3.905	E3	9.5	25	0.03
35		FREON-12	374.788	311.660		16.8	25	-0.01
36		FREON-113	4.411	4.309	E3	2.3	25	0.03

Evaluate Continuing Calibration Report

Data File : C:\HPCHEM\1\DATA\VOB8391.D Vial: 1
Acq On : 4 Sep 1998 9:49 am Operator: Raphe HGS
Sample : STANDARD 50NG Inst : GC/MS Ins
Misc : 04SEP98 Multiplr: 1.00
MS Integration Params: rteint.p

Method : C:\HPCHEM\1\METHODS\10JUL98.M (RTE Integrator)
Title : FULL SCAN
Response via : Multiple Level Calibration

Min. RRF : 0.000 Min. Rel. Area : 50% Max. R.T. Dev 0.50min
Max. RRF Dev : 15% Max. Rel. Area : 150%

		Compound	AvgRF	CCRF		%Dev	AccRge	Dev(min)
1		Vinyl Chloride	1028.435	1020.520		0.8	20	0.00
2		Bromomethane	313.657	356.600		-13.7	20	-0.01
3		Chloroethane	1.337	1.245	E3	6.9	20	0.01
4		1,1-Dichloroethene	1.954	1.984	E3	-1.5	15	0.03
5		Acetone	5.745	5.961	E3	-3.8	15	0.01
6		Methylene Chloride	2.244	2.369	E3	-5.6	15	0.01
7		1,2-Dichloroethene (total)	4.732	5.163	E3	-9.1	15	0.03
8		1,1-Dichloroethane	4.263	4.131	E3	3.1	15	0.03
9		Chloroform	4.082	4.148	E3	-1.6	15	0.05
10		1,2-Dichloroethane	2.370	2.195	E3	7.4	15	0.03
11		2-Butanone	10.888	11.506	E3	-5.7	15	0.05
12		1,1,1-Trichloroethane	3.402	3.363	E3	1.1	15	0.05
13		Carbon Tetrachloride	3.164	2.808	E3	11.3	15	0.03
14		Benzene	7.158	7.420	E3	-3.7	15	0.05
		Trichloroethene	3.213	3.295	E3	-2.6	15	0.03
16		1,2-Dichloropropane	2.793	2.944	E3	-5.4	15	0.06
17		Bromodichloromethane	3.772	3.829	E3	-1.5	15	0.06
18		cis-1,3-Dichloropropene	4.394	4.393	E3	0.0	15	0.07
19		trans-1,3-Dichloropropene	2.957	3.202	E3	-8.3	15	0.00
20		1,1,2-Trichloroethane	2.453	2.663	E3	-8.6	15	0.07
21		Dibromochloromethane	3.387	3.510	E3	-3.6	15	0.05
22		Bromoform	3.130	3.100	E3	1.0	15	0.05
23		4-Methyl-2-Pentanone	11.225	11.445	E3	-2.0	15	0.08
24		Toluene	4.792	5.004	E3	-4.4	15	0.09
25		Tetrachloroethene	2.504	2.780	E3	-11.0	15	0.05
26		2-Hexanone	11.115	11.445	E3	-3.0	15	0.08
27		Chlorobenzene	5.742	6.459	E3	-12.5	15	0.13
29		Xylene (total)	14.606	15.064	E3	-3.1	15	0.17
30		Styrene	5.898	5.772	E3	2.1	15	0.23
31	T	1,1,1,2-Tetrachloroethane	2.842	2.971	E3	-4.5	15	0.08
32		1,1,2,2-Tetrachloroethane	4.342	4.858	E3	-11.9	15	0.06
33		FREON-11	4.315	3.648	E3	15.5	20	0.03
35		FREON-12	374.788	360.740		3.7	20	-0.05
36		FREON-113	4.411	4.123	E3	6.5	20	0.06
43		Freon-22	549.764	460.120		16.3	20	0.11
44		Freon-141B	5.705	4.925	E3	13.7	20	0.03

Evaluate Lab Control Standard Report

Data File : C:\HPCHEM\1\DATA\VOB8418.D
Acq On : 4 Sep 1998 7:15 pm
Sample : LCS 50NG
Misc : Heather 04SEP98
IS Integration Params: rteint.p

Vial: 1
Operator: Raphe HGS
Inst : GC/MS Ins
Multiplr: 1.00

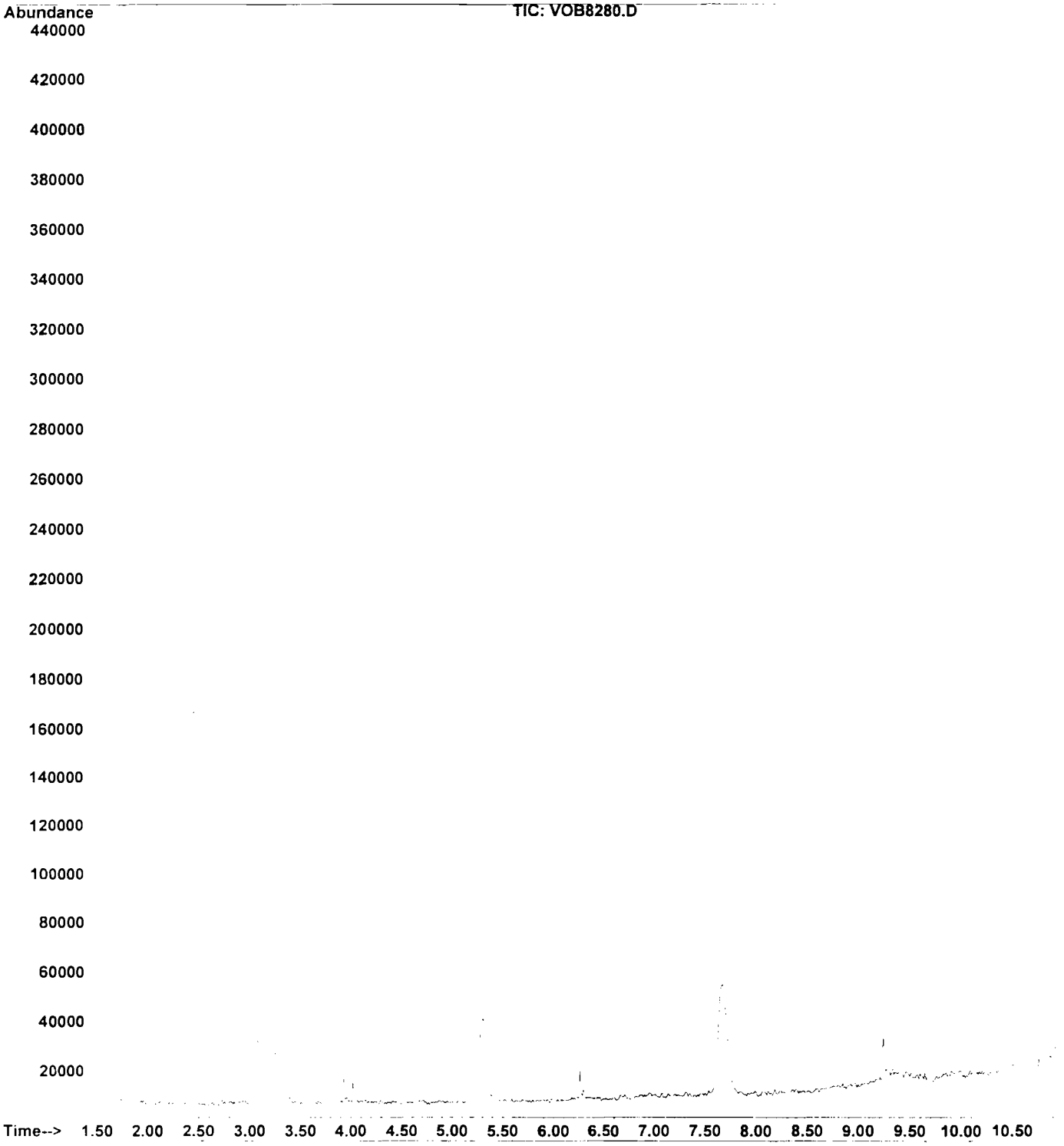
Method : C:\HPCHEM\1\METHODS\10JUL98.M (RTE Integrator)
Title : FULL SCAN
Response via : Multiple Level Calibration

Min. RRF : 0.000 Min. Rel. Area : 50% Max. R.T. Dev 0.50min
Max. RRF Dev : 15% Max. Rel. Area : 150%

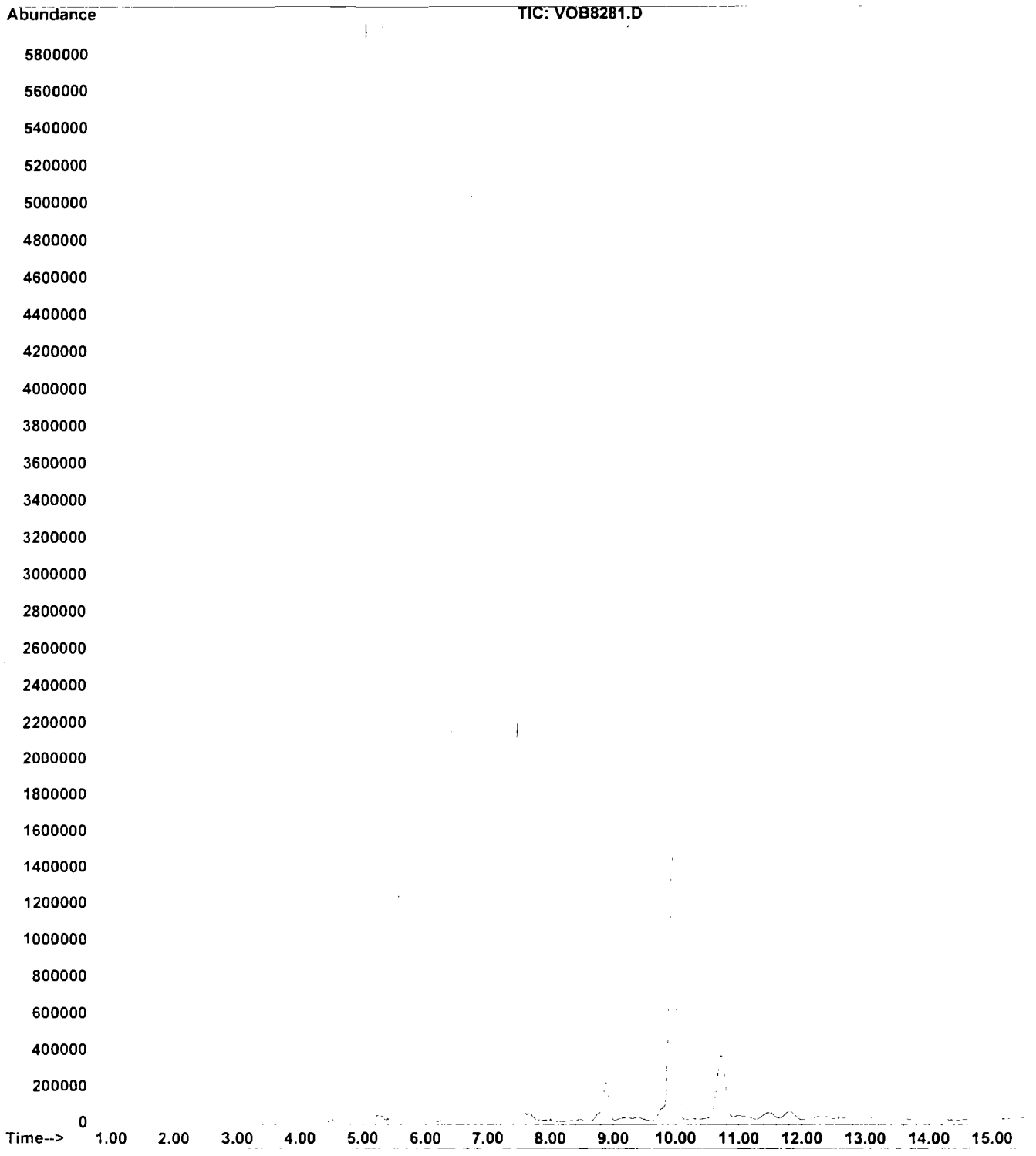
	Compound	AvgRF	CCRF		%Dev	AccRge	Dev(min)
1	Vinyl Chloride	1028.435	1142.83		-11	25	0.00
2	Bromomethane	313.657	330.5		-5.4	25	0.00
3	Chloroethane	1.337	1.179		11	25	0.02
4	1,1-Dichloroethene	1.954	2.076	E3	-6.2	20	0.00
6	Methylene Chloride	2.244	2.311	E3	-3.0	20	0.00
7	1,2-Dichloroethene (total)	4.732	5.014	E3	-6.0	20	0.03
8	1,1-Dichloroethane	4.263	4.138	E3	2.9	20	0.02
9	Chloroform	4.082	4.055	E3	0.7	20	0.04
10	1,2-Dichloroethane	2.370	2.134	E3	10.0	20	0.03
12	1,1,1-Trichloroethane	3.402	3.290	E3	3.3	20	0.04
13	Carbon Tetrachloride	3.164	2.767	E3	12.5	20	0.04
14	Benzene	7.158	7.161	E3	-0.0	20	0.05
15	Trichloroethene	3.213	3.116	E3	3.0	20	0.04
16	1,2-Dichloropropane	2.793	2.894	E3	-3.6	20	0.05
	Bromodichloromethane	3.772	3.806	E3	-0.9	20	0.05
	cis-1,3-Dichloropropene	4.394	3.721	E3	15.3	20	0.05
19	trans-1,3-Dichloropropene	2.957	3.333	E3	-12.7	20	0.00
20	1,1,2-Trichloroethane	2.453	2.796	E3	-14.0	20	0.07
21	Dibromochloromethane	3.387	3.368	E3	0.6	20	0.05
22	Bromoform	3.130	2.982	E3	4.7	20	0.05
24	Toluene	4.792	4.841	E3	-1.0	20	0.10
25	Tetrachloroethene	2.504	2.640	E3	-5.4	20	0.04
27	Chlorobenzene	5.742	6.049	E3	-5.3	20	0.12
28	Ethylbenzene	3.018	3.055	E3	-1.2	20	0.10
29	Xylene (total)	14.606	13.969	E3	4.4	20	0.17
30	Styrene	5.898	5.586	E3	5.3	20	0.23
31	1,1,1,2-Tetrachloroethane	2.842	2.747	E3	3.3	20	0.08
32	1,1,2,2-Tetrachloroethane	4.342	4.872	E3	-12.2	20	0.08
33	FREON-11	4.315	3.496	E3	19.0	25	0.02
35	FREON-12	374.788	305.300		18.5	25	-0.02
36	FREON-113	4.411	3.948	E3	10.5	25	0.03

CHROMATOGRAMS

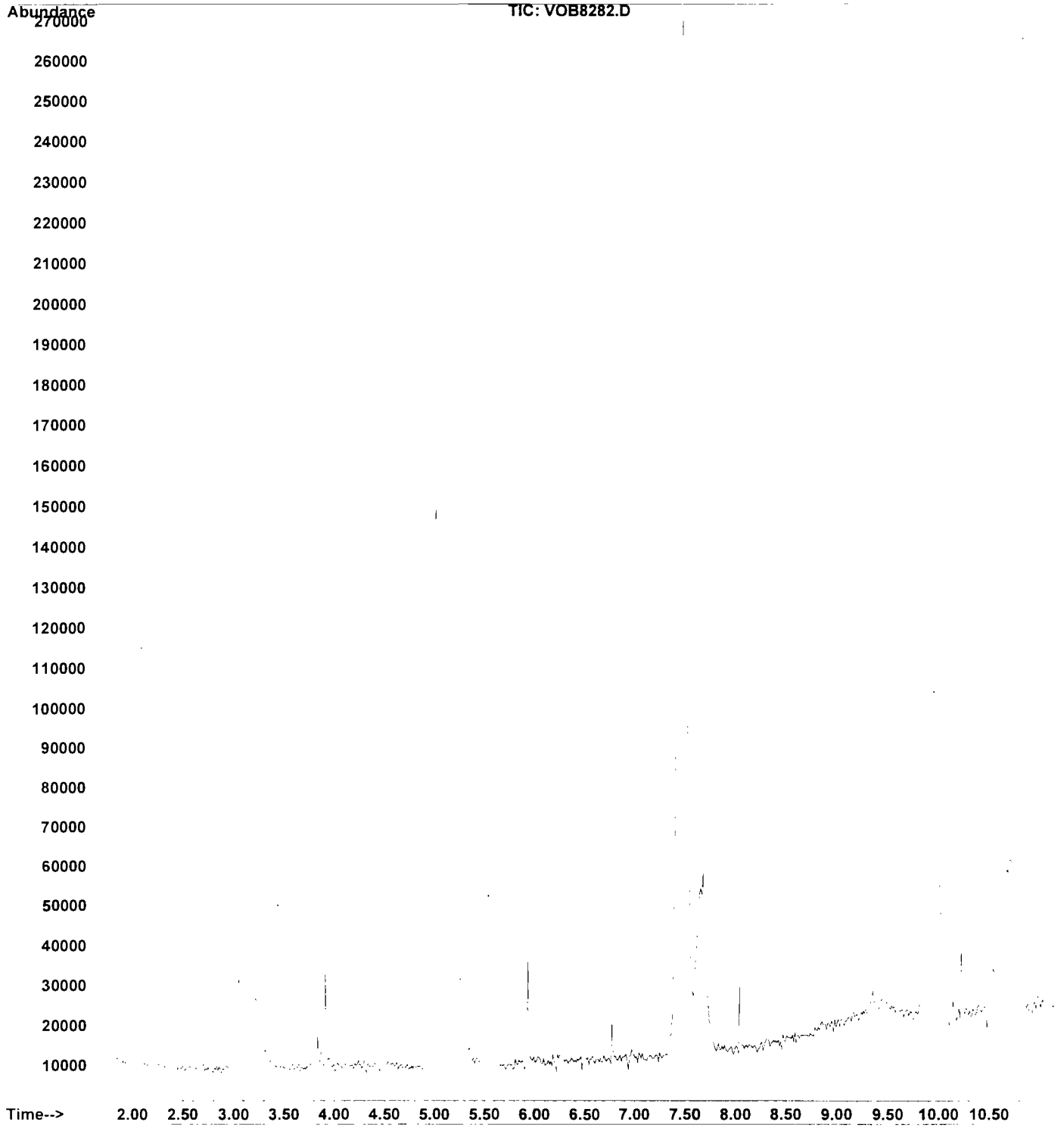
File : C:\HPCHEM\1\DATA\VOB8280.D
Operator : Raphe HGS
Acquired : 29 Aug 1998 10:55 am using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: B-09031-BLANK
Misc Info : GREAT NECK/TT 29AUG98 1836/8-27-98 B3
Vial Number: 1



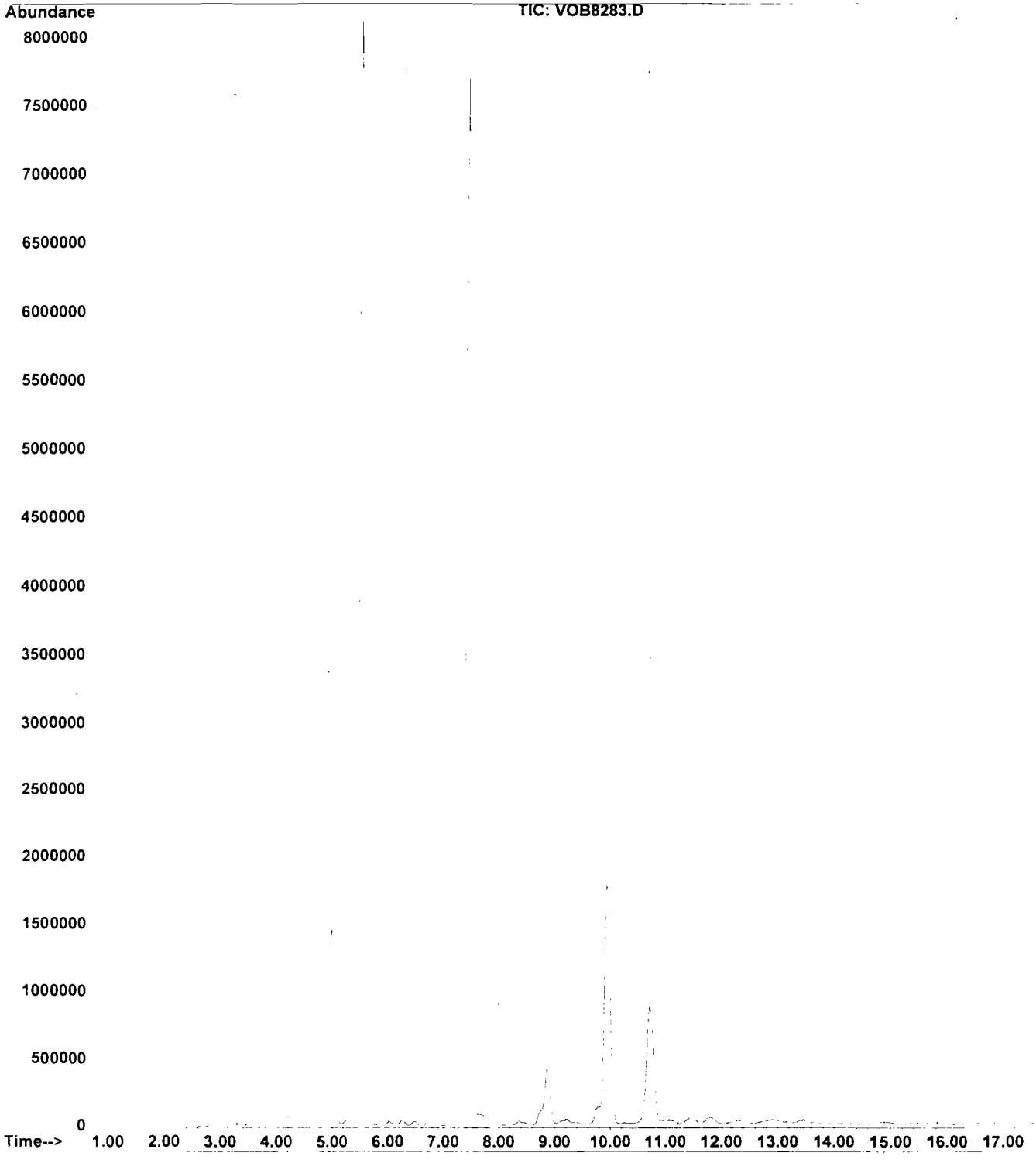
File : C:\HPCHEM\1\DATA\VOB8281.D
Operator : Raphe HGS
Acquired : 29 Aug 1998 11:49 am using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT6-09032-29
Misc Info : GREAT NECK/TT 29AUG98 1820/8-27-98 R6
Vial Number: 1



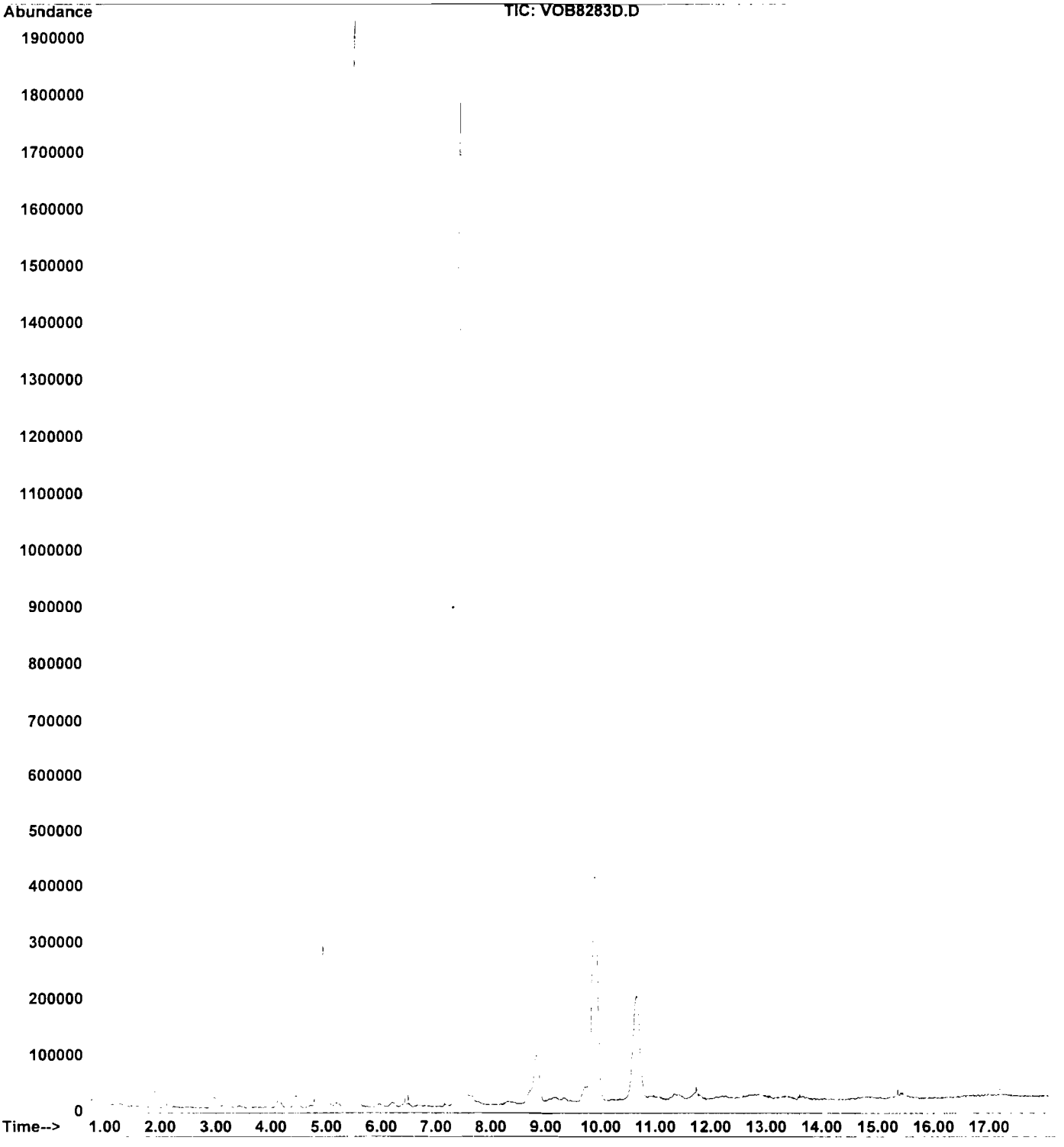
File : C:\HPCHEM\1\DATA\VOB8282.D
Operator : Raphe HGS
Acquired : 29 Aug 1998 12:09 pm using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT6-09033-70
Misc Info : GREAT NECK/TT 29AUG98 1751/8-27-98 L6
Vial Number: 1



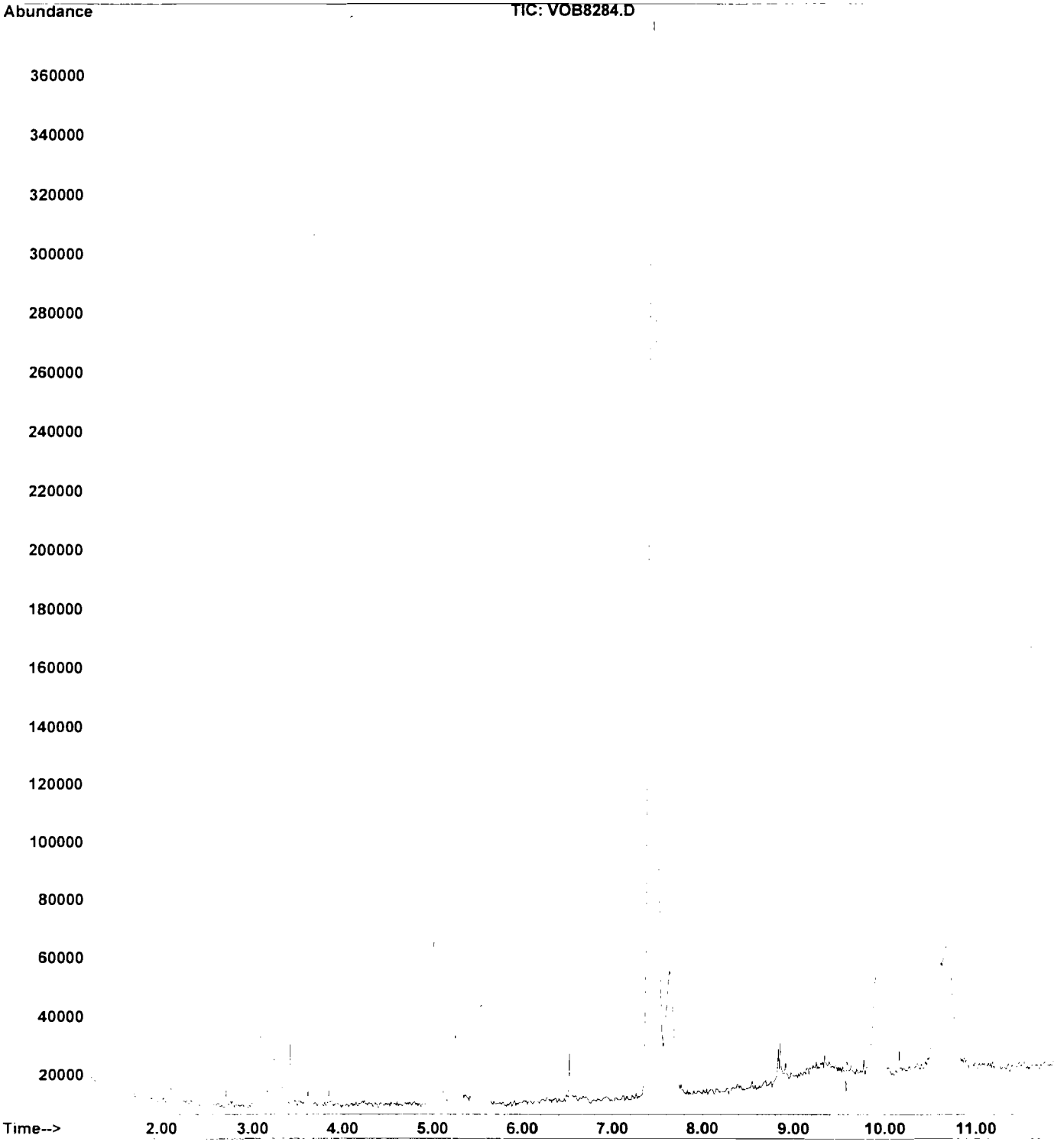
File : C:\HPCHEM\1\DATA\VOB8283.D
Operator : Raphe HGS
Acquired : 29 Aug 1998 12:27 pm using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT6-09034-38
Misc Info : GREAT NECK/TT 29AUG98 1803/8-27-98 E4
Vial Number: 1



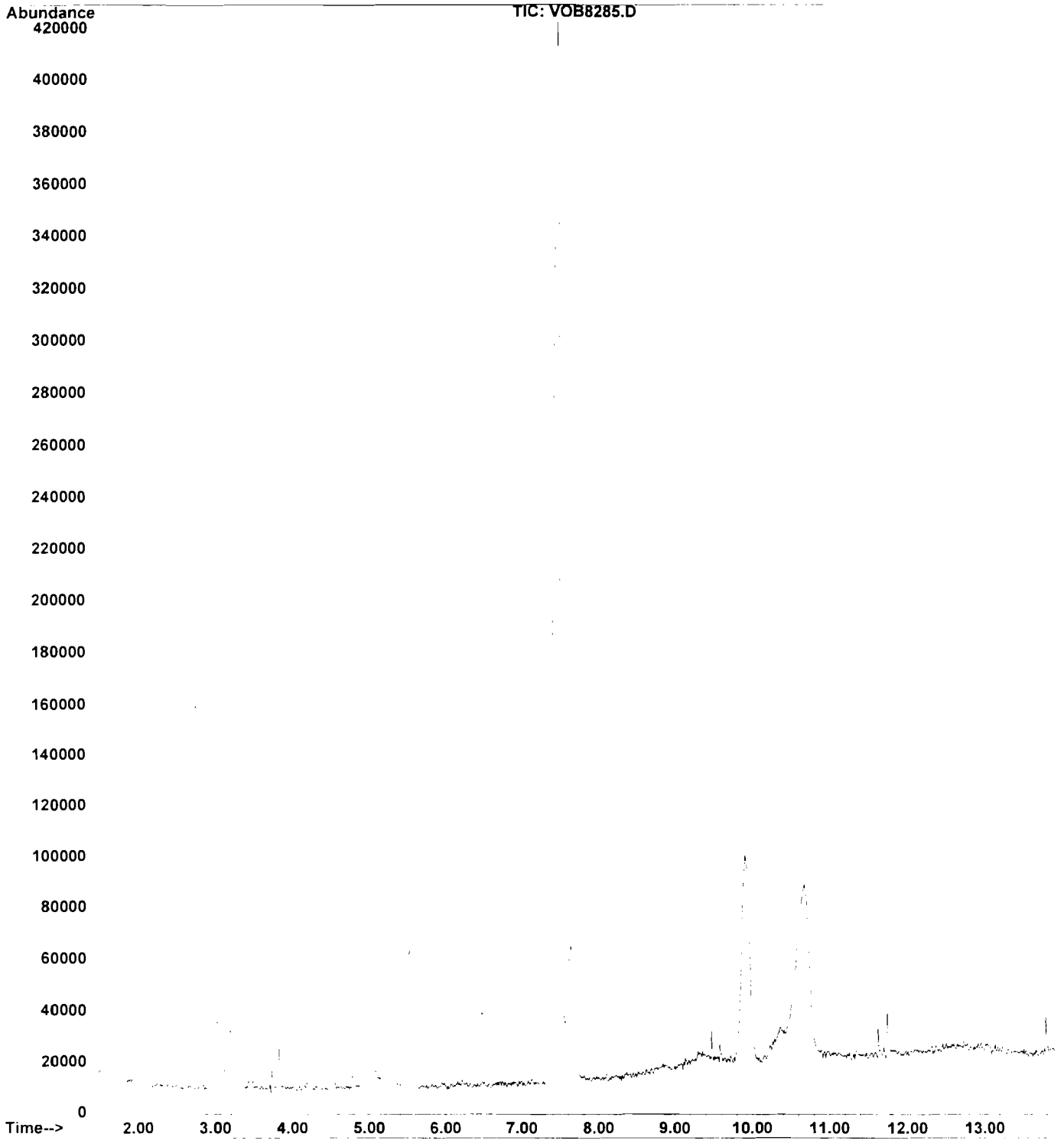
File : C:\HPCHEM\1\DATA\VOB8283D.D
Operator : Raphe HGS
Acquired : 29 Aug 1998 2:59 pm using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT6-09034-38 df5
Misc Info : GREATNECKTT 29AUG98 1803/8-27-98 E4
Vial Number: 1



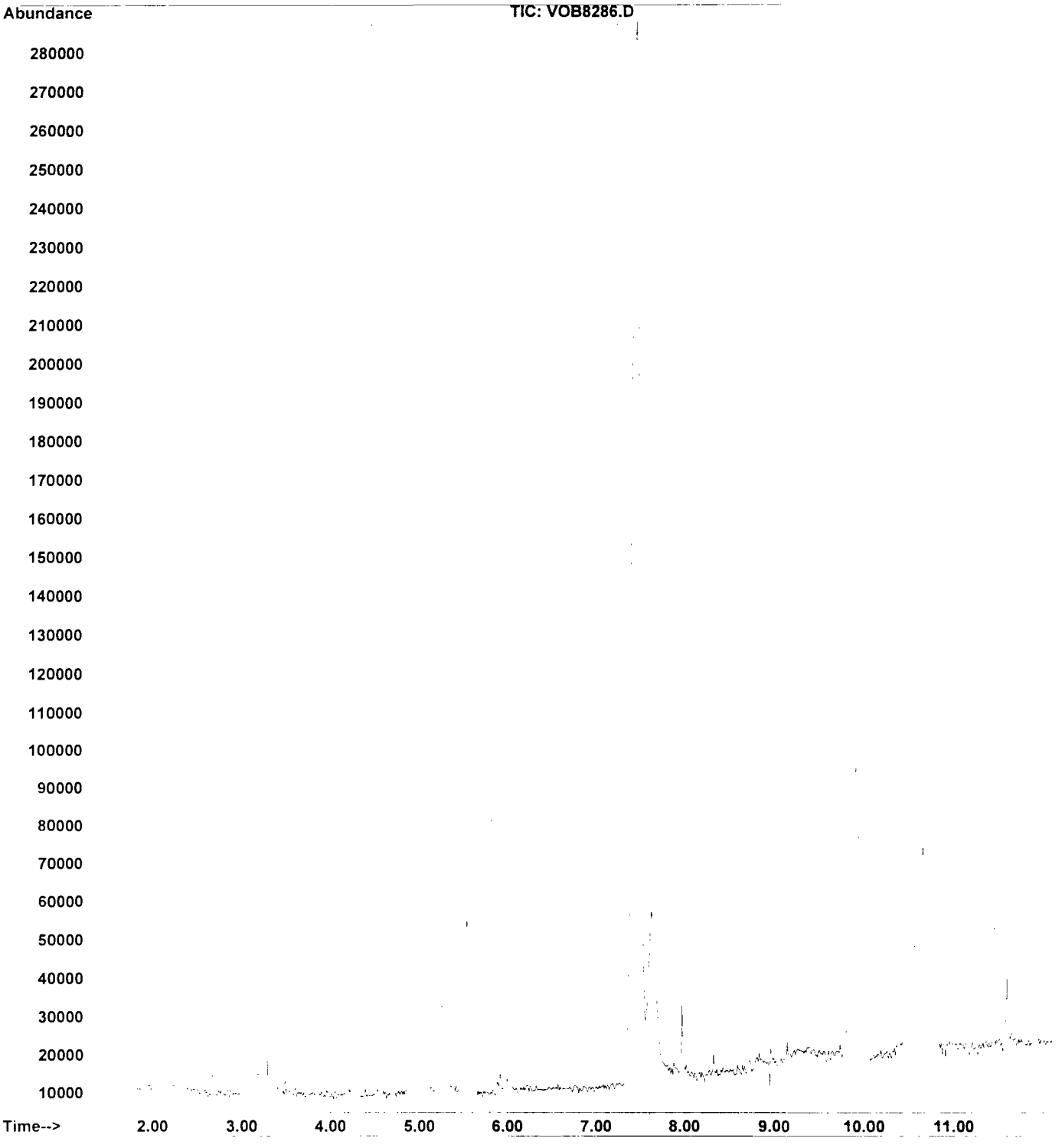
File : C:\HPCHEM\1\DATA\VOB8284.D
Operator : Raphe HGS
Acquired : 29 Aug 1998 12:49 pm using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT6-09035-60 purge 5'
Misc Info : GREAT NECK/TT 29AUG98 1635/8-27-98 Y2
Vial Number: 1



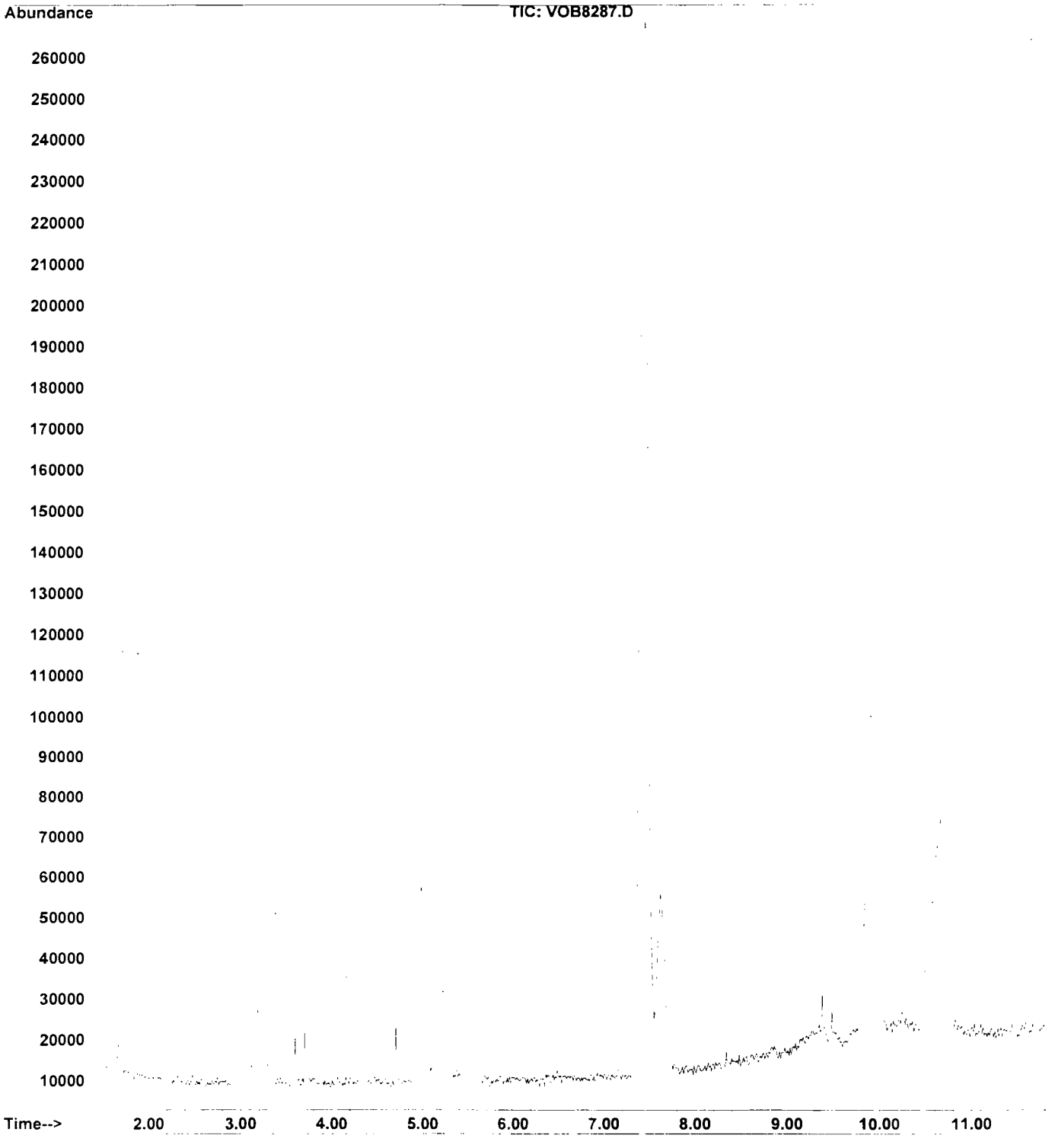
File : C:\HPCHEM\1\DATA\VOB8285.D
Operator : Raphe HGS
Acquired : 29 Aug 1998 1:05 pm using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT6-09036-60 purge 14'
Misc Info : GREAT NECK/TT 29AUG98 1644/8-27-98 B2
Vial Number: 1



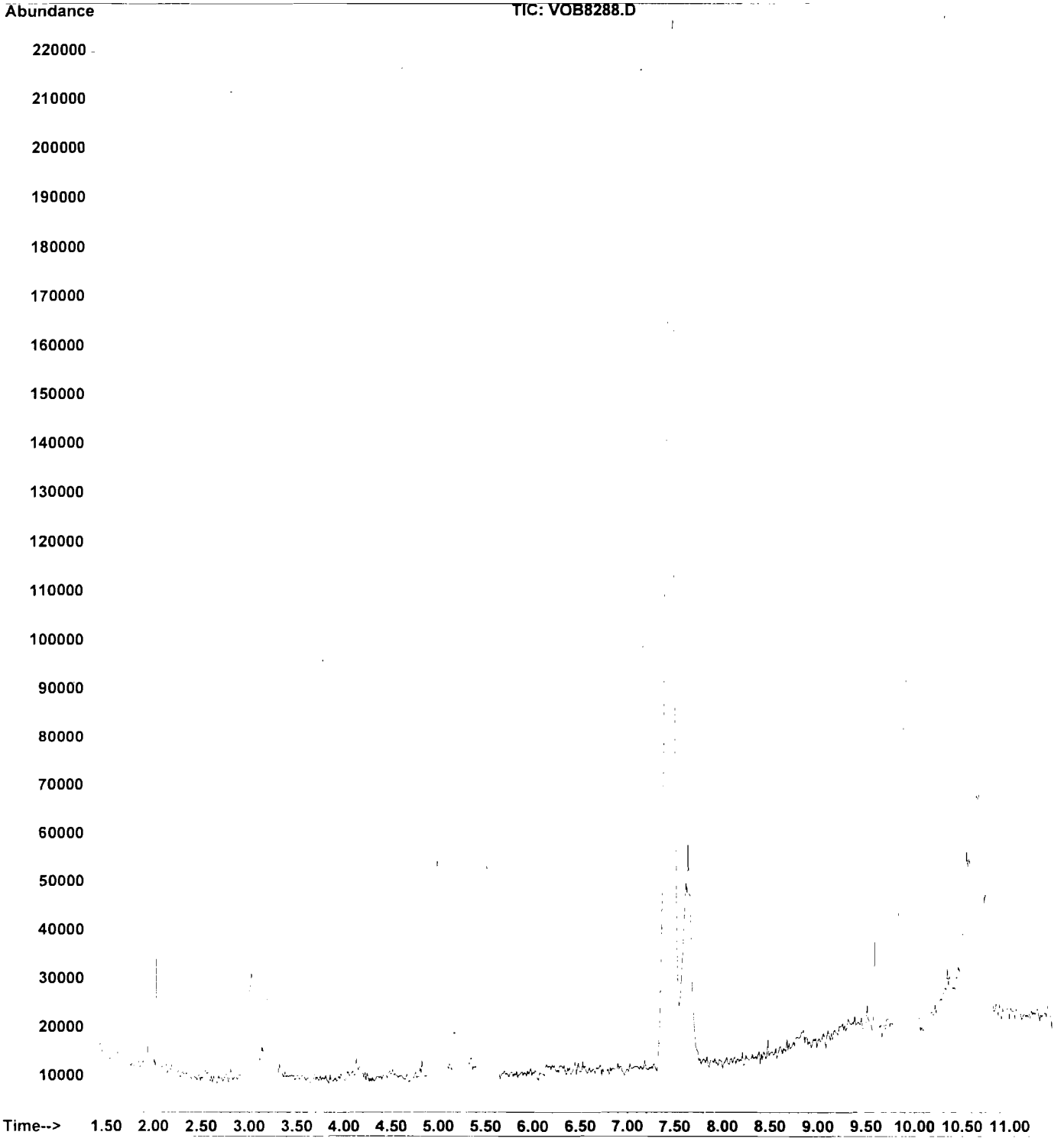
File : C:\HPCHEM\1\DATA\VOB8286.D
Operator : Raphe HGS
Acquired : 29 Aug 1998 1:23 pm using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT6-09037-60 purge 24'
Misc Info : GREAT NECK/TT 29AUG98 1654/8-27-98 N11
Vial Number: 1



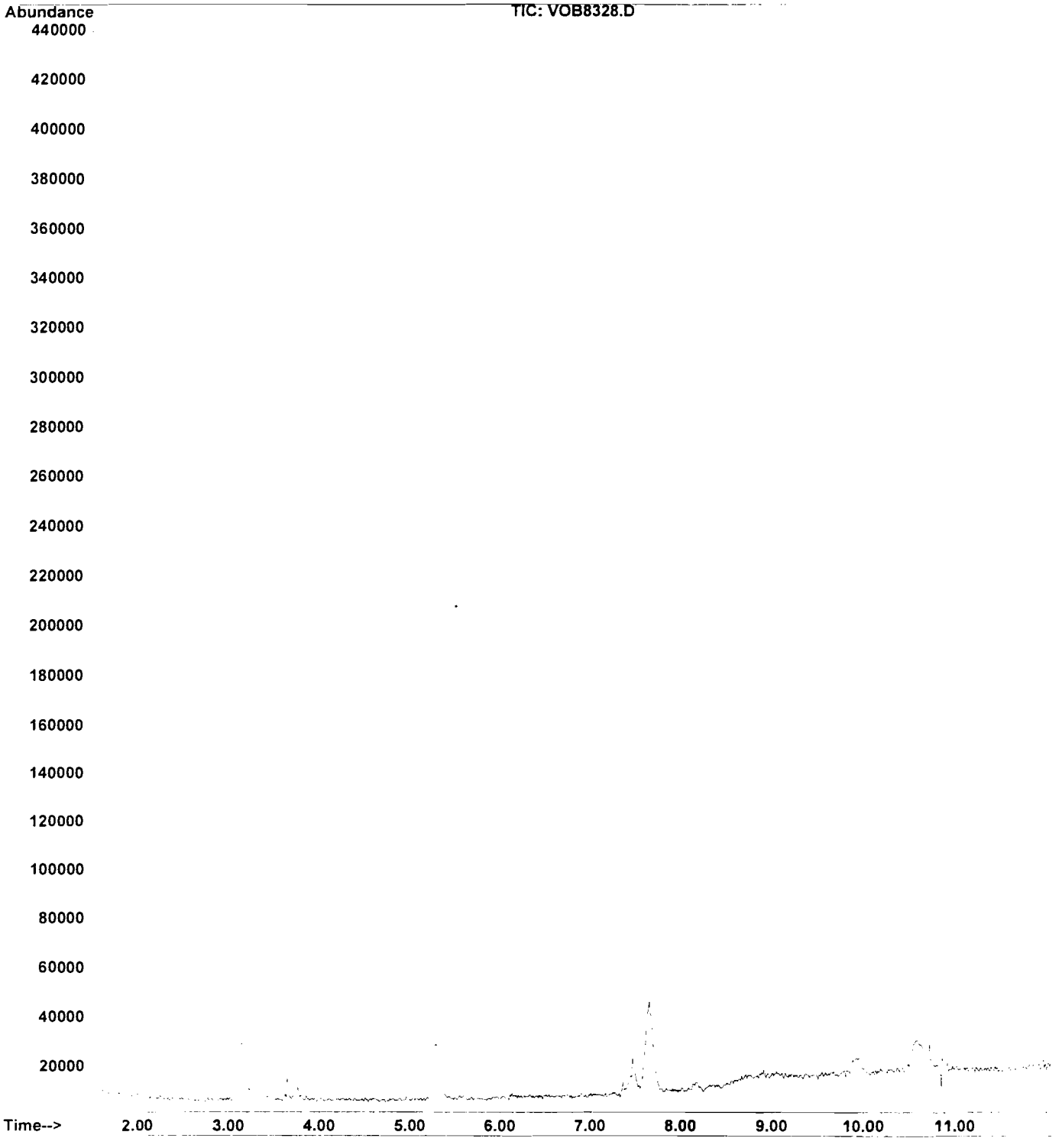
File : C:\HPCHEM\1\DATA\VOB8287.D
Operator : Raphe HGS
Acquired : 29 Aug 1998 1:39 pm using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT6-09038-60 purge 30'
Misc Info : GREAT NECK/TT 29AUG98 1703/8-27-98 A9
Vial Number: 1



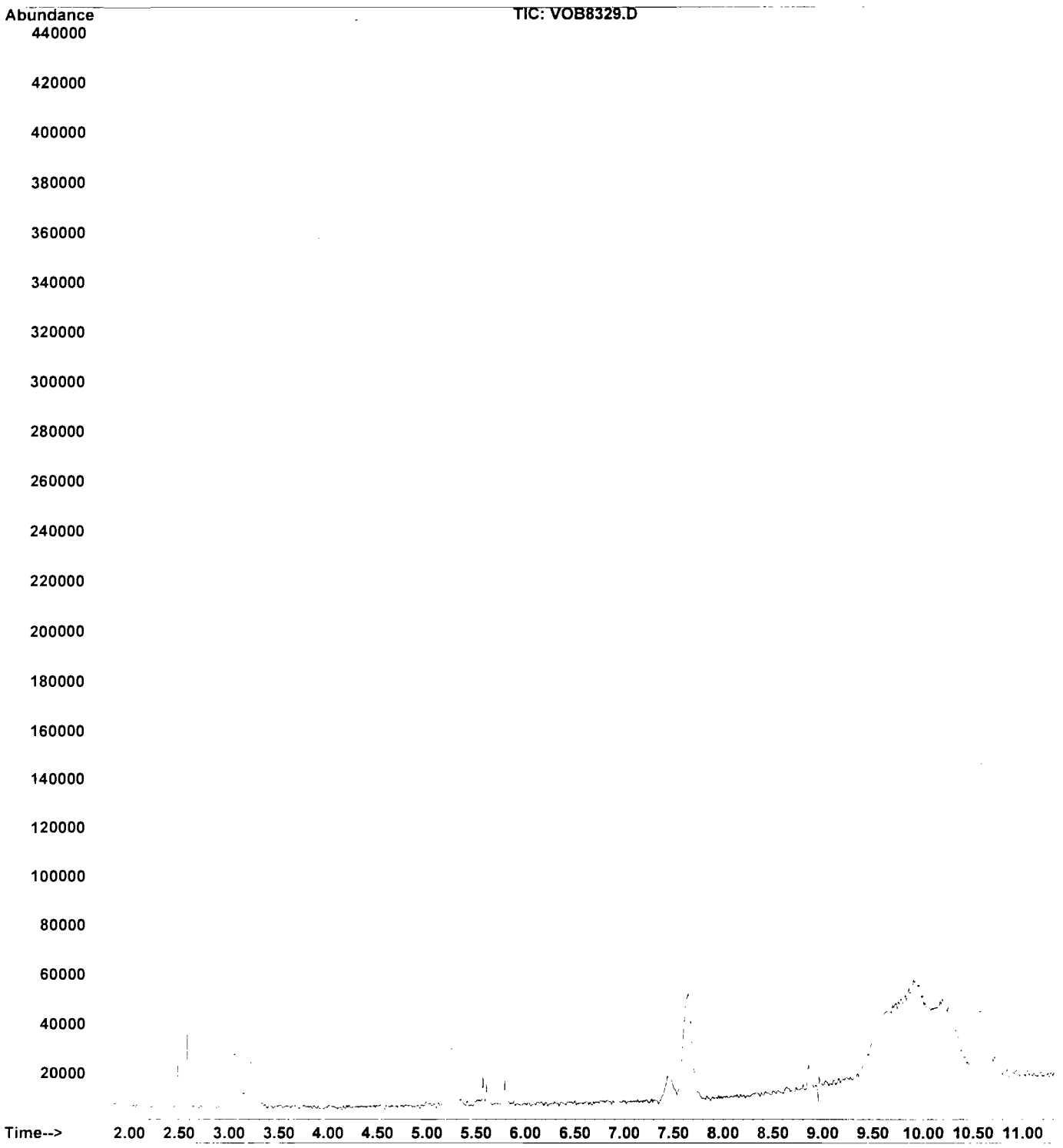
File : C:\HPCHEM\1\DATA\VOB8288.D
Operator : Raphe HGS
Acquired : 29 Aug 1998 1:54 pm using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT6-09039-60 purge 47'
Misc Info : GREAT NECK/TT 29AUG98 1717/8-27-98 N1
Vial Number: 1



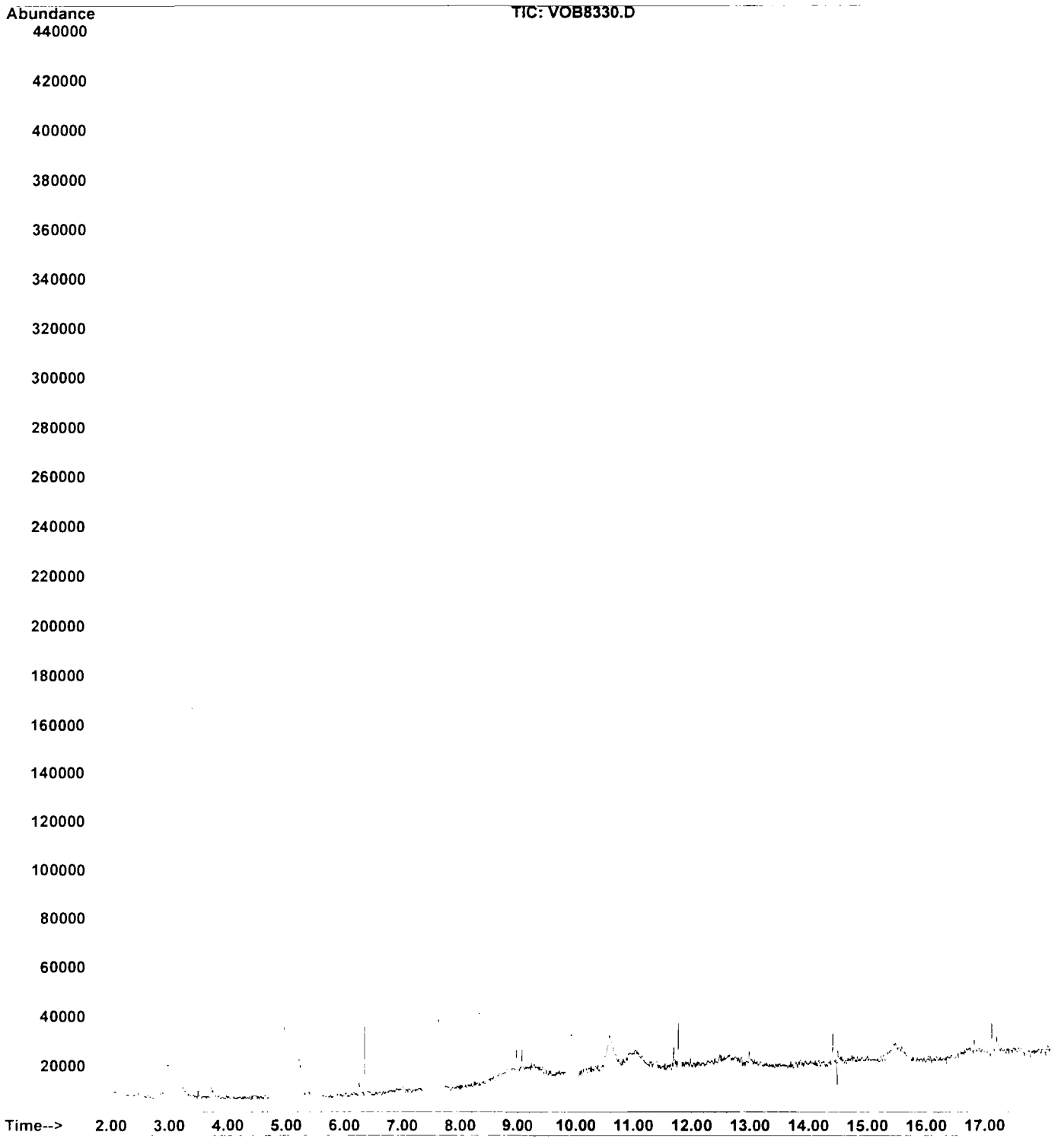
File : C:\HPCHEM\1\DATA\VOB8328.D
Operator : Raphe HGS
Acquired : 2 Sep 1998 11:50 am using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT7-09074-34
Misc Info : Great Neck/TT 02SEP98 1836(01SEP98) S1
Vial Number: 1



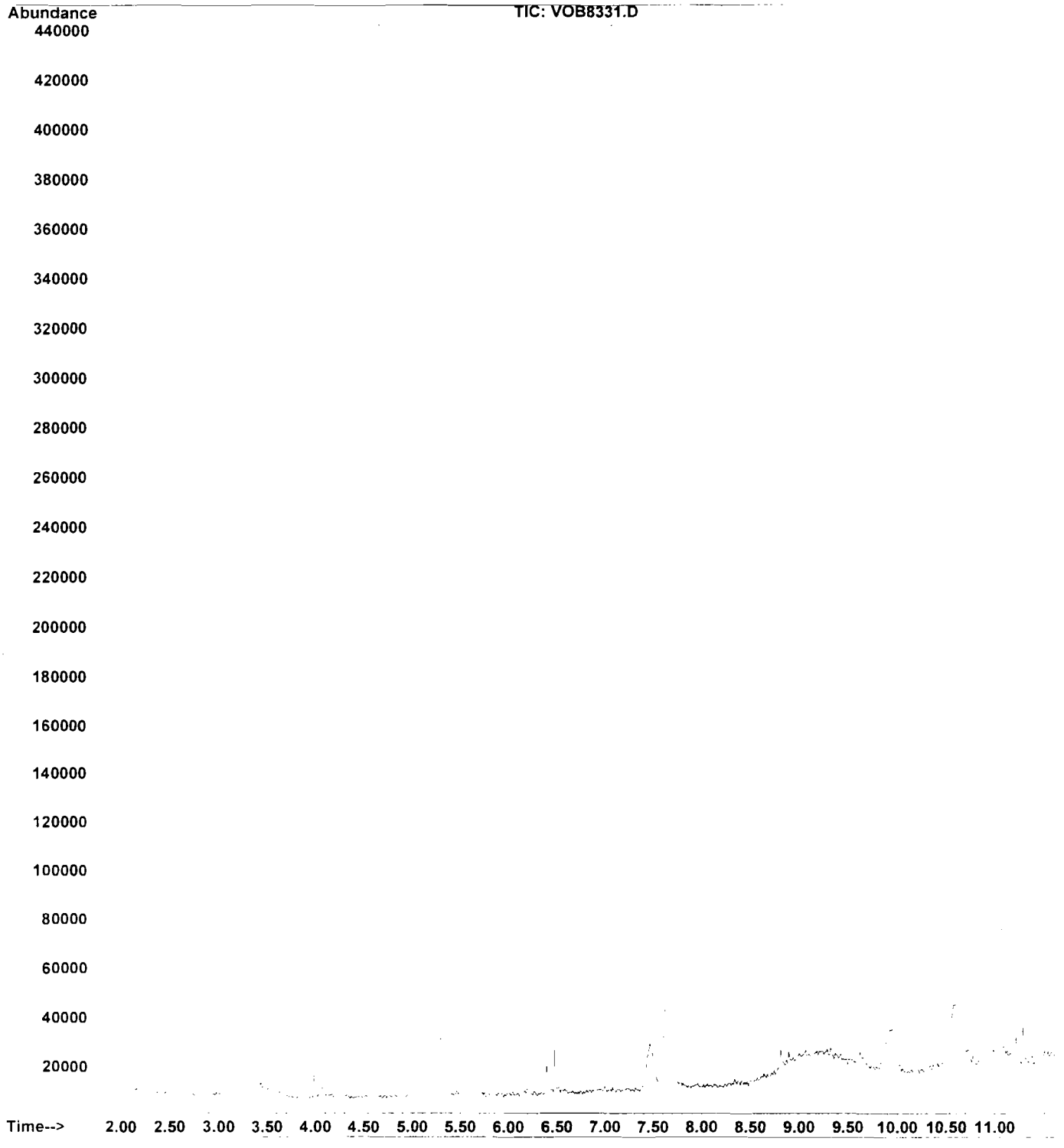
File : C:\HPCHEM\1\DATA\VOB8329.D
Operator : Raphe HGS
Acquired : 2 Sep 1998 12:05 pm using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT7-09075-60
Misc Info : Great Neck/TT 02SEP98 1841(01SEP98) A5
Vial Number: 1



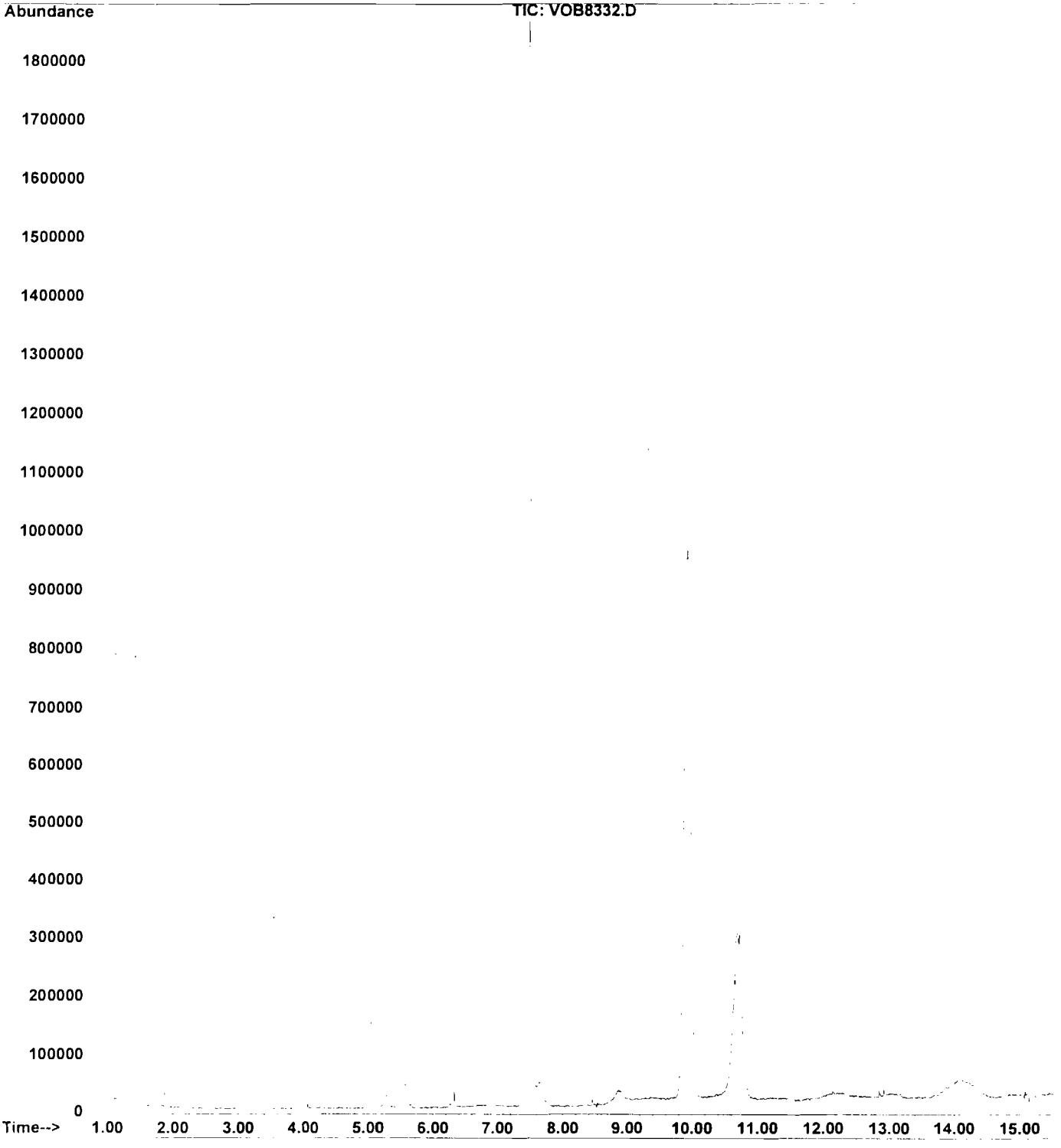
File : C:\HPCHEM\1\DATA\VOB8330.D
Operator : Raphe HGS
Acquired : 2 Sep 1998 12:20 pm using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT1-09076-73
Misc Info : Great Neck/TT 02SEP98 1738(01SEP98) R2
Vial Number: 1



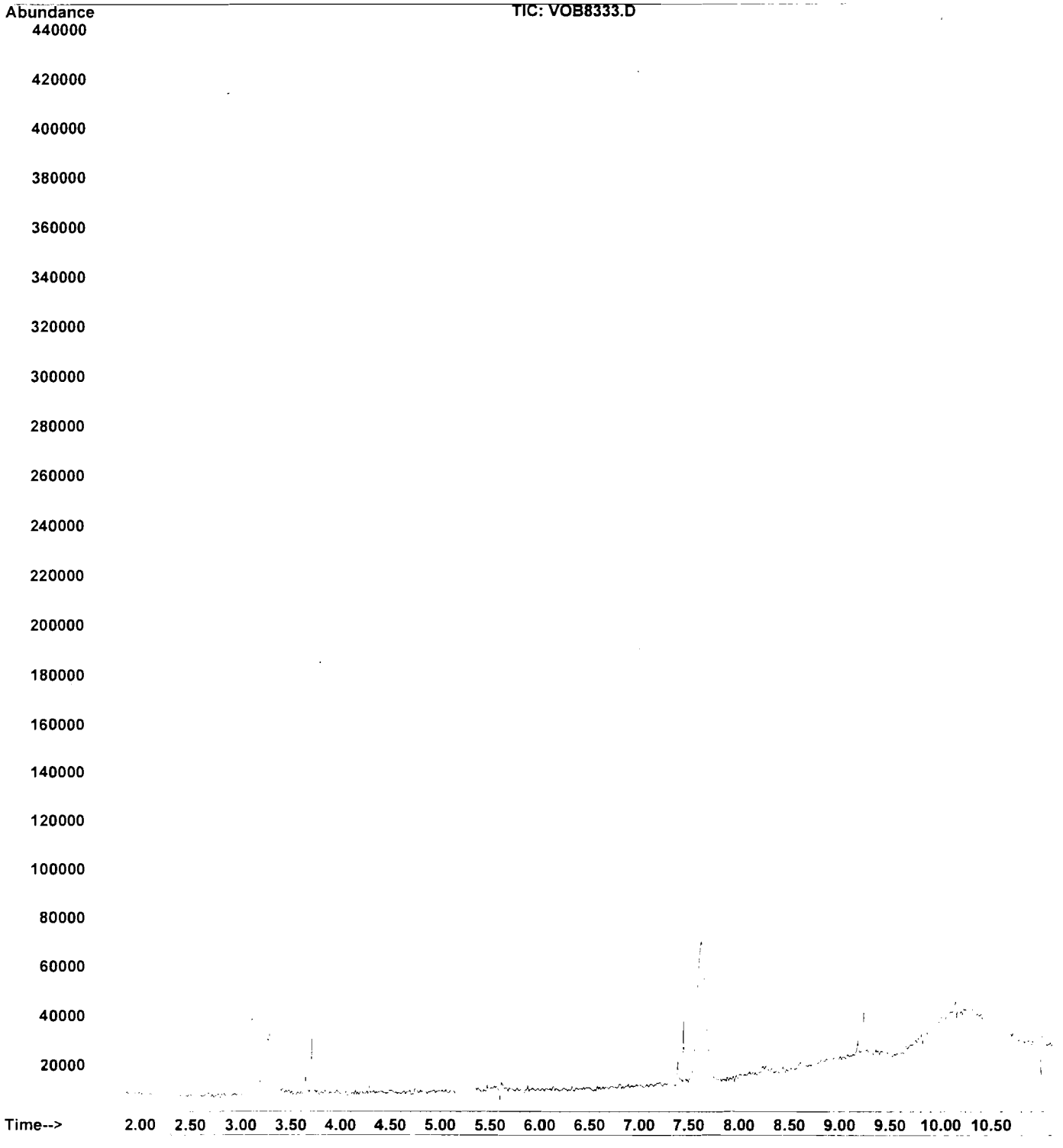
File : C:\HPCHEM\1\DATA\VOB8331.D
Operator : Raphe HGS
Acquired : 2 Sep 1998 12:45 pm using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT1-09077-62
Misc Info : Great Neck/TT 02SEP98 1736(01SEP98) Y6
Vial Number: 1



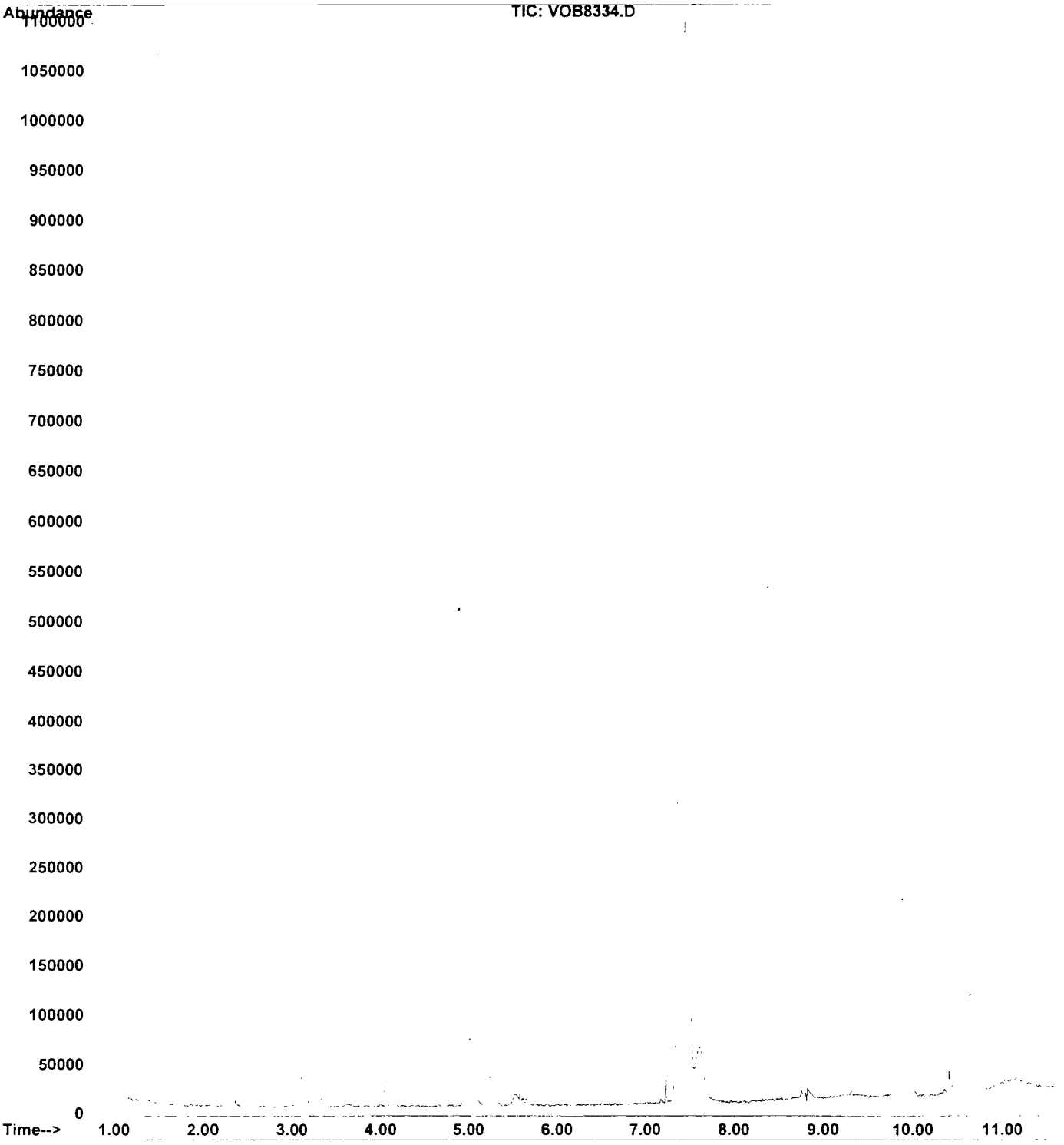
File : C:\HPCHEM\1\DATA\VOB8332.D
Operator : Raphe HGS
Acquired : 2 Sep 1998 1:02 pm using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT1-09077-62
Misc Info : Great Neck/TT 02SEP98 1656(01SEP98) E2
Vial Number: 1



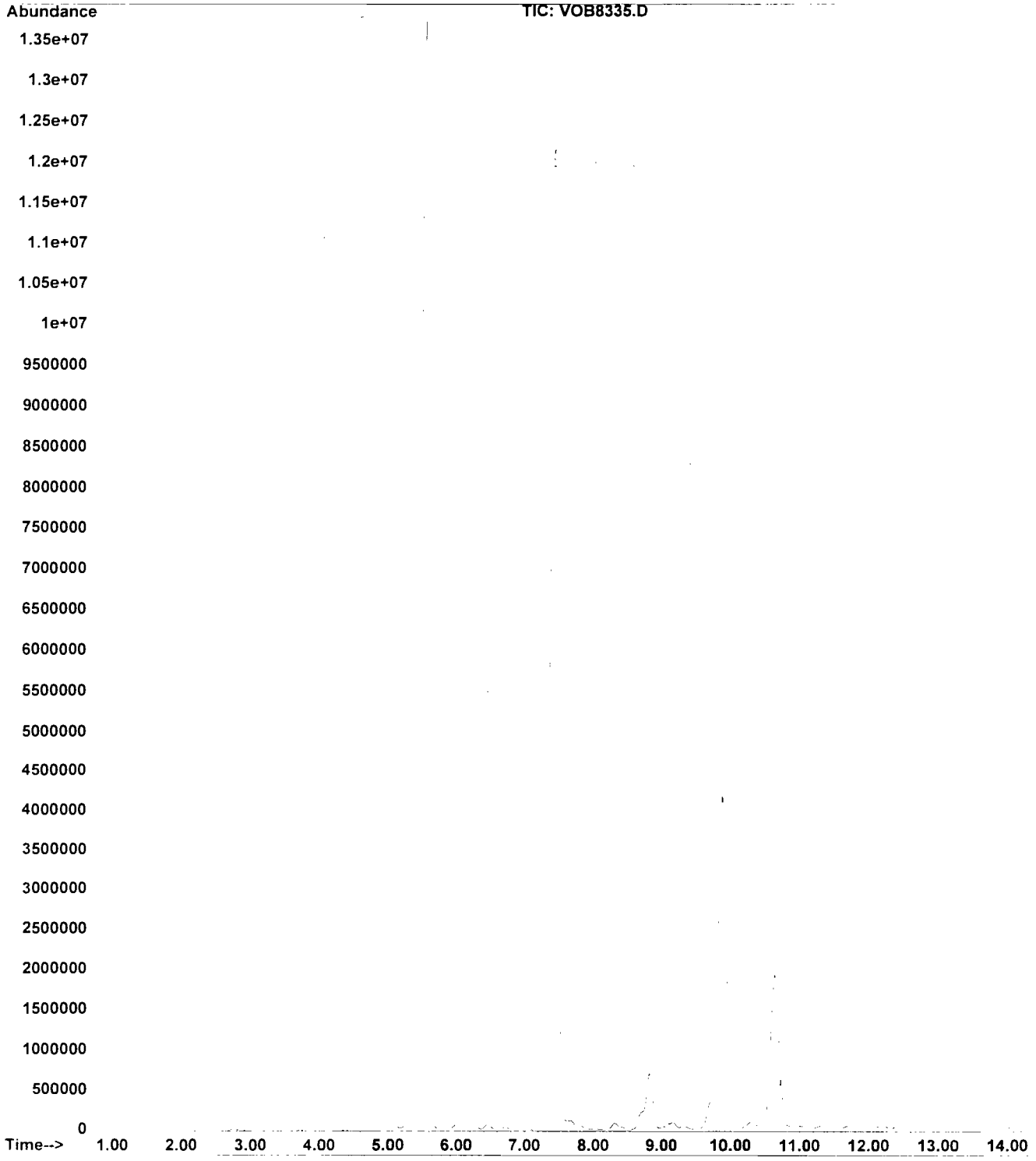
File : C:\HPCHEM\1\DATA\VOB8333.D
Operator : Raphe HGS
Acquired : 2 Sep 1998 1:22 pm using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: BLANK-09079
Misc Info : Great Neck/TT 02SEP98 1621(01SEP98) GN9
Vial Number: 1



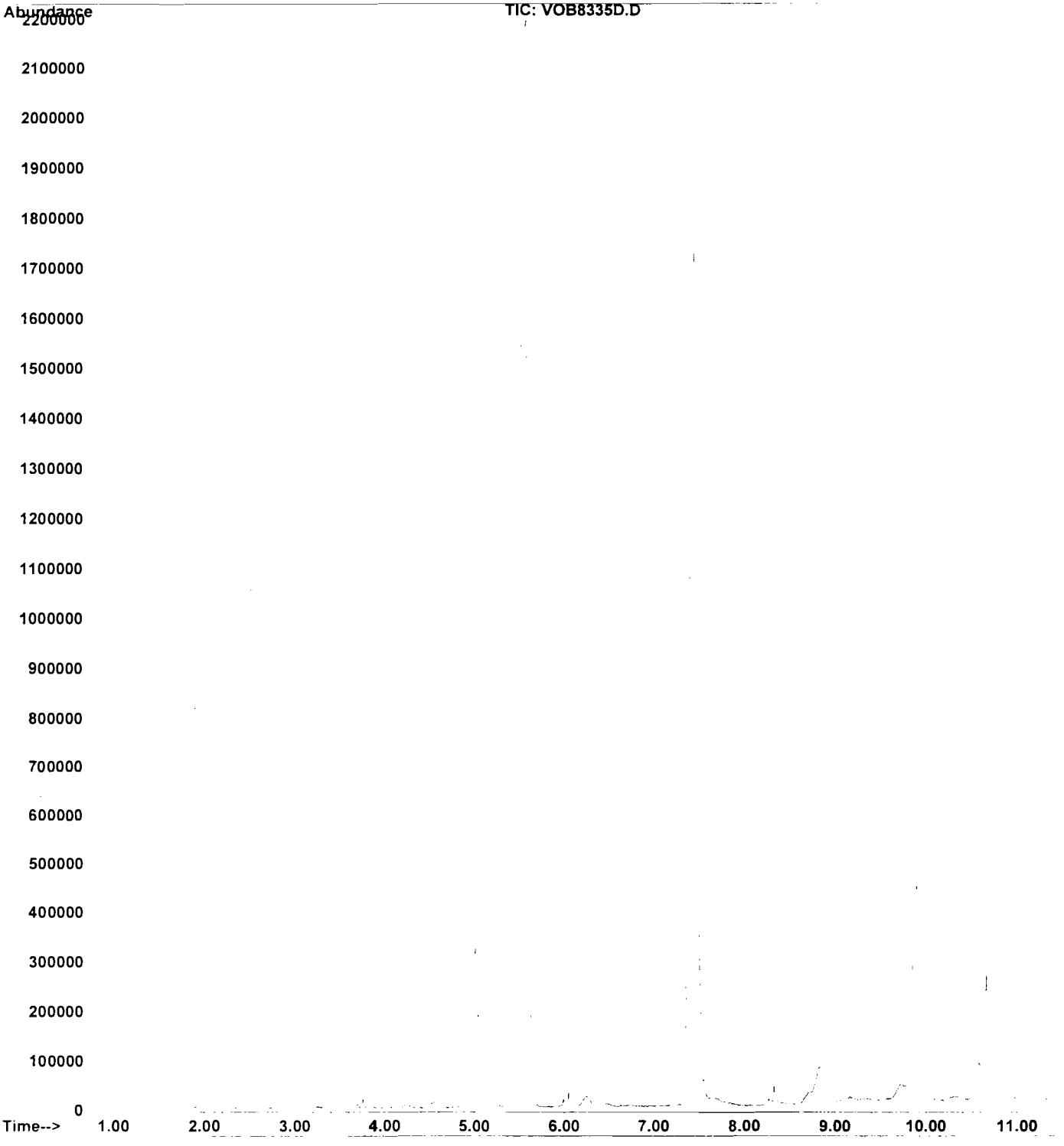
File : C:\HPCHEM\1\DATA\VOB8334.D
Operator : Raphe HGS
Acquired : 2 Sep 1998 1:37 pm using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT6-09080-70
Misc Info : Great Neck/TT 02SEP98 1604(01SEP98) GN6
Vial Number: 1



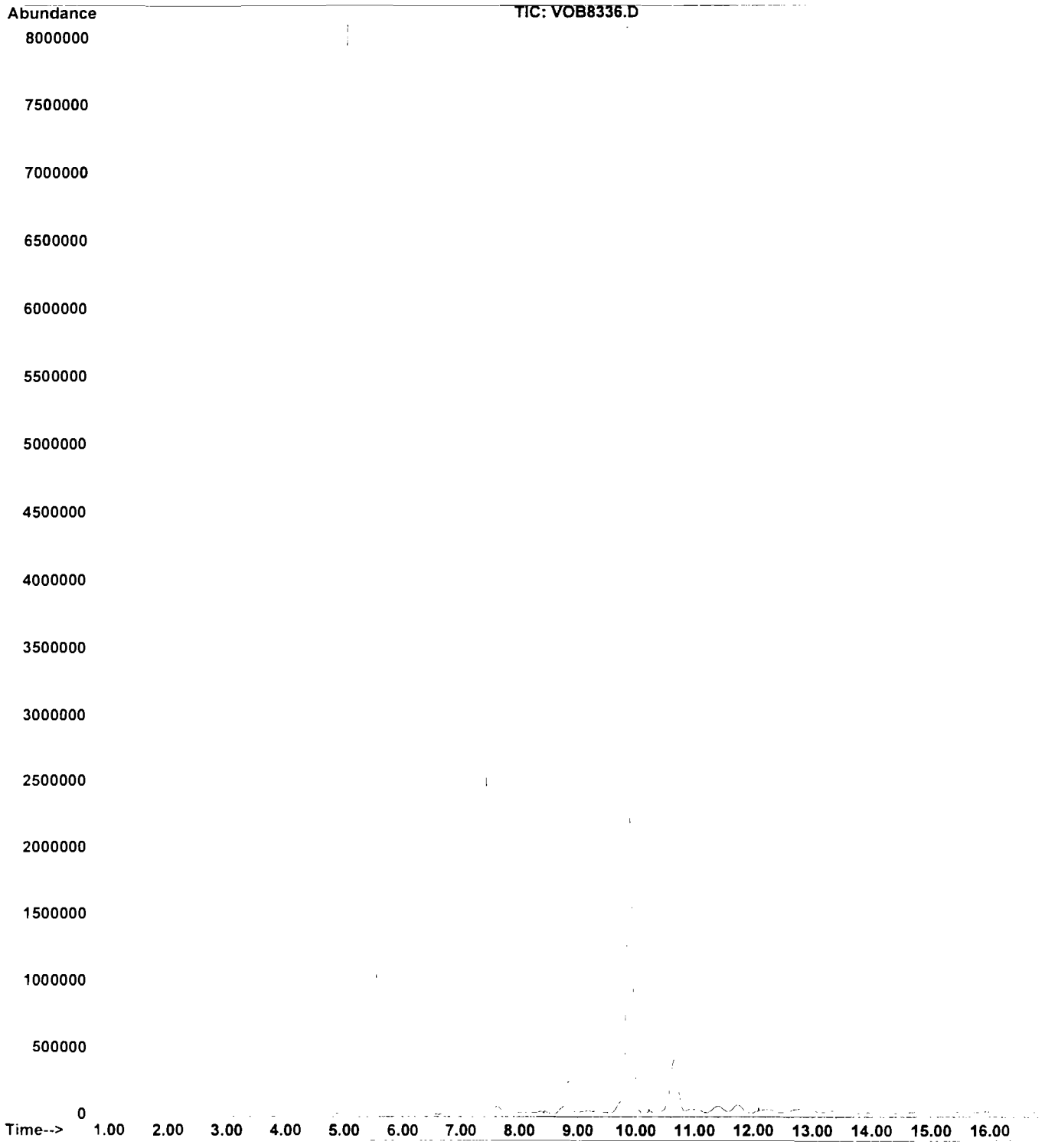
File : C:\HPCHEM\1\DATA\VOB8335.D
Operator : Raphe HGS
Acquired : 2 Sep 1998 1:53 pm using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT5-09081-37 PURGE 3.6'
Misc Info : Great Neck/TT 02SEP98 1431(01SEP98) GN1
Vial Number: 1



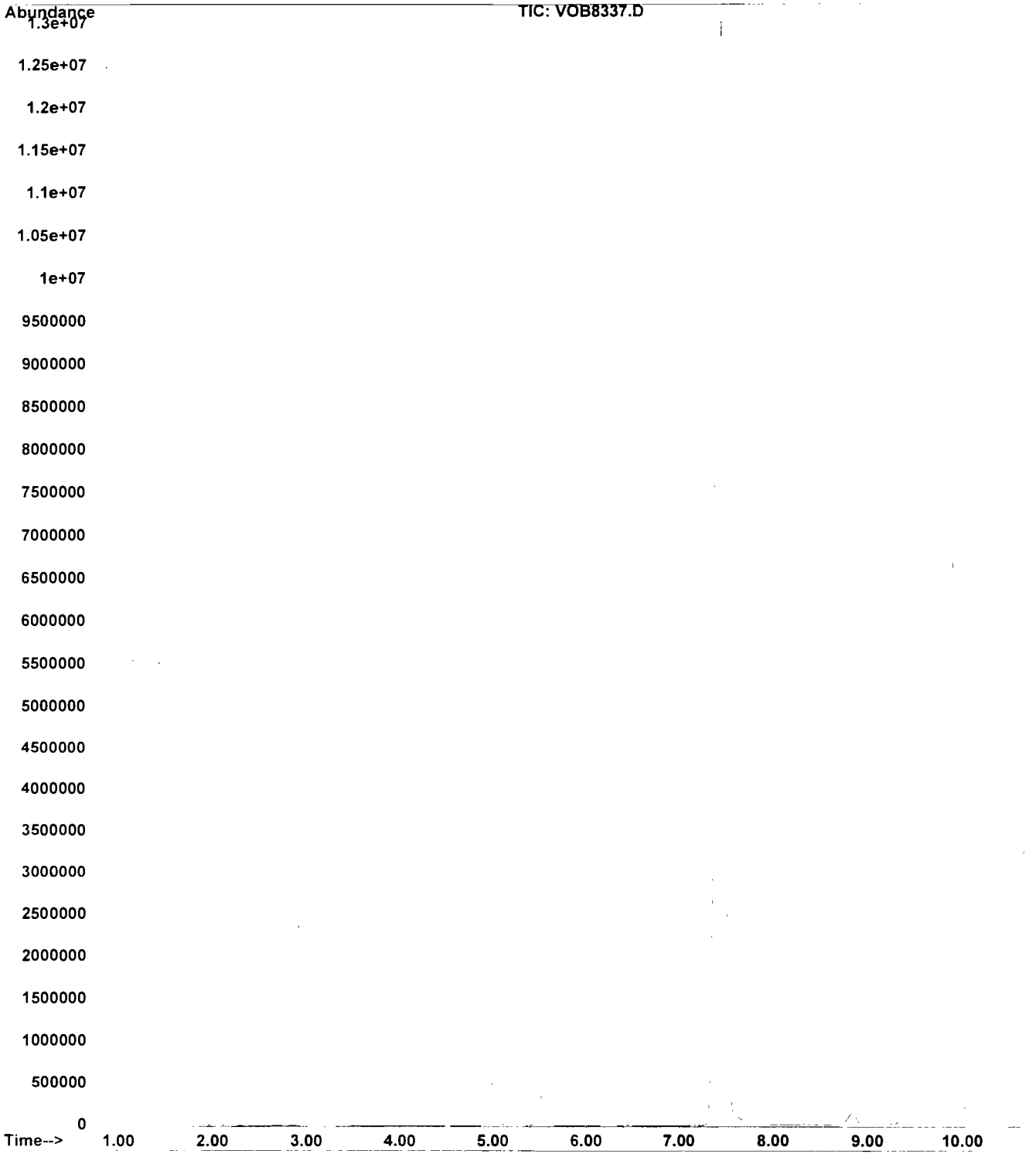
File : C:\HPCHEM\1\DATA\VOB8335D.D
Operator : Raphe HGS
Acquired : 2 Sep 1998 3:06 pm using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT5-09081-37 DF10
Misc Info : Great Neck/TT 02SEP98 1431(01SEP98) GN1
Vial Number: 1



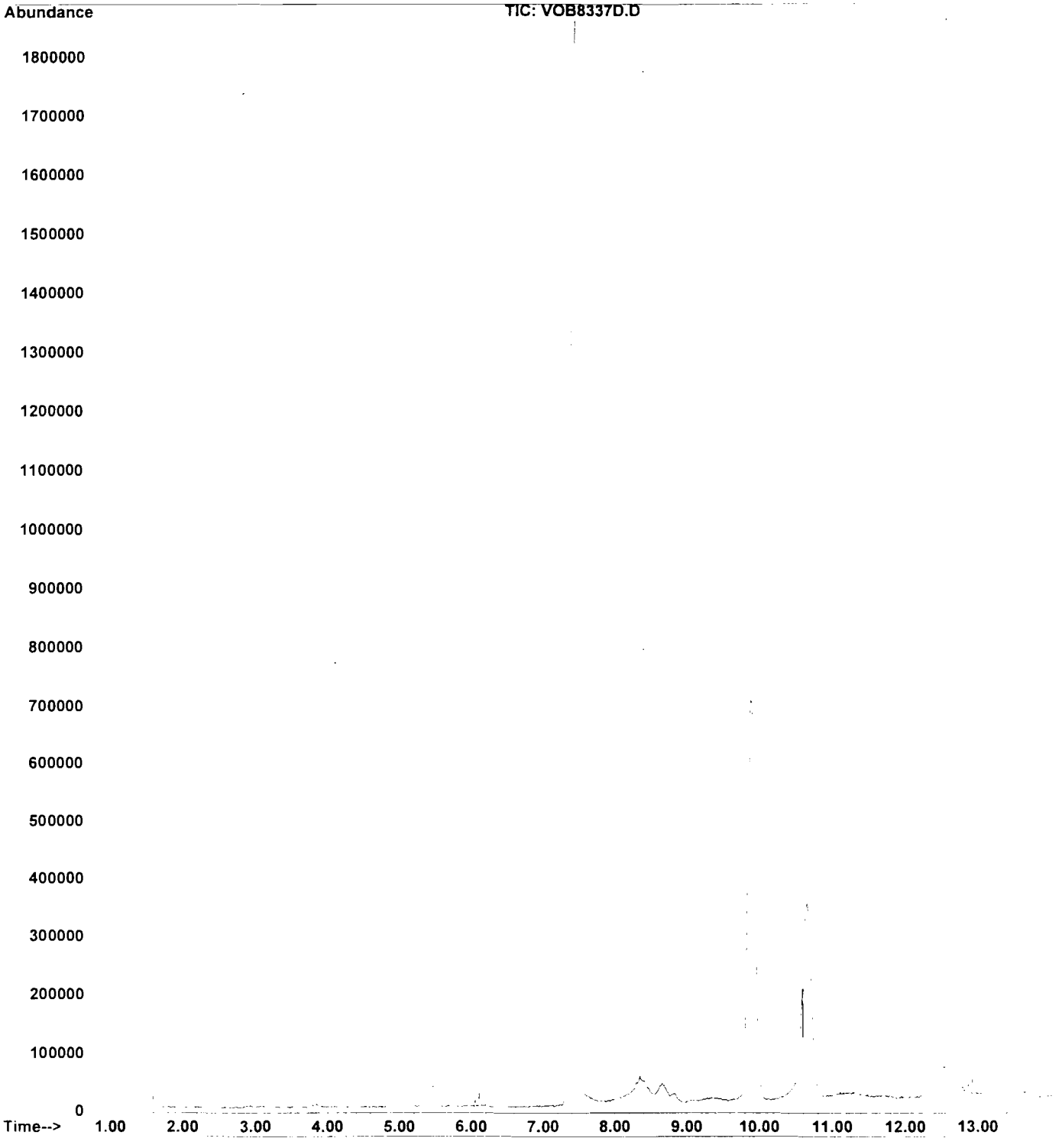
File : C:\HPCHEM\1\DATA\VOB8336.D
Operator : Raphe HGS
Acquired : 2 Sep 1998 2:12 pm using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT6-09082-29
Misc Info : Great Neck/TT 02SEP98 1618(01SEP98) GN8
Vial Number: 1



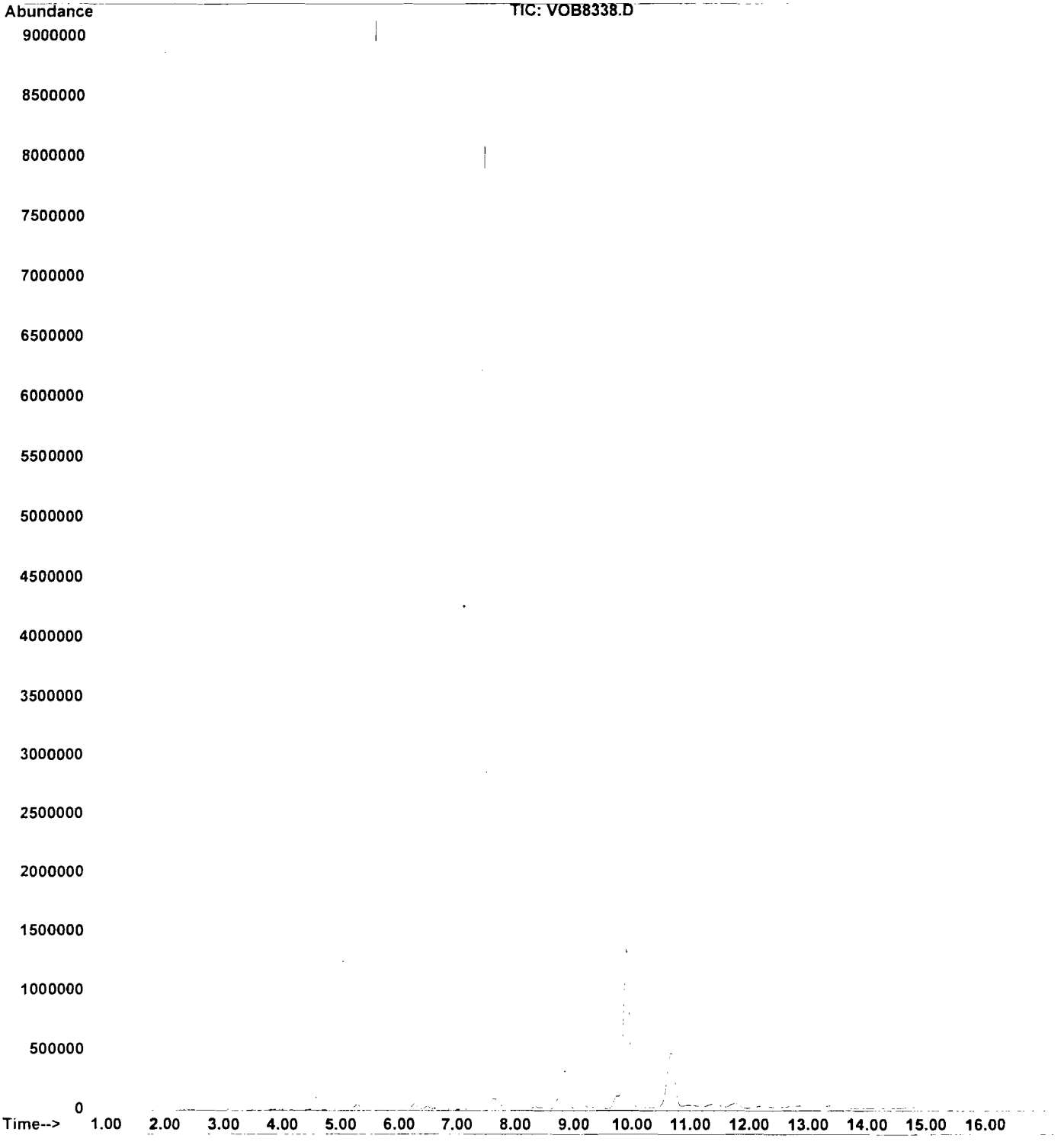
File : C:\HPCHEM\1\DATA\VOB8337.D
Operator : Raphe HGS
Acquired : 2 Sep 1998 2:33 pm using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT5-09083-62
Misc Info : Great Neck/TT 02SEP98 1545(01SEP98) GN5
Vial Number: 1



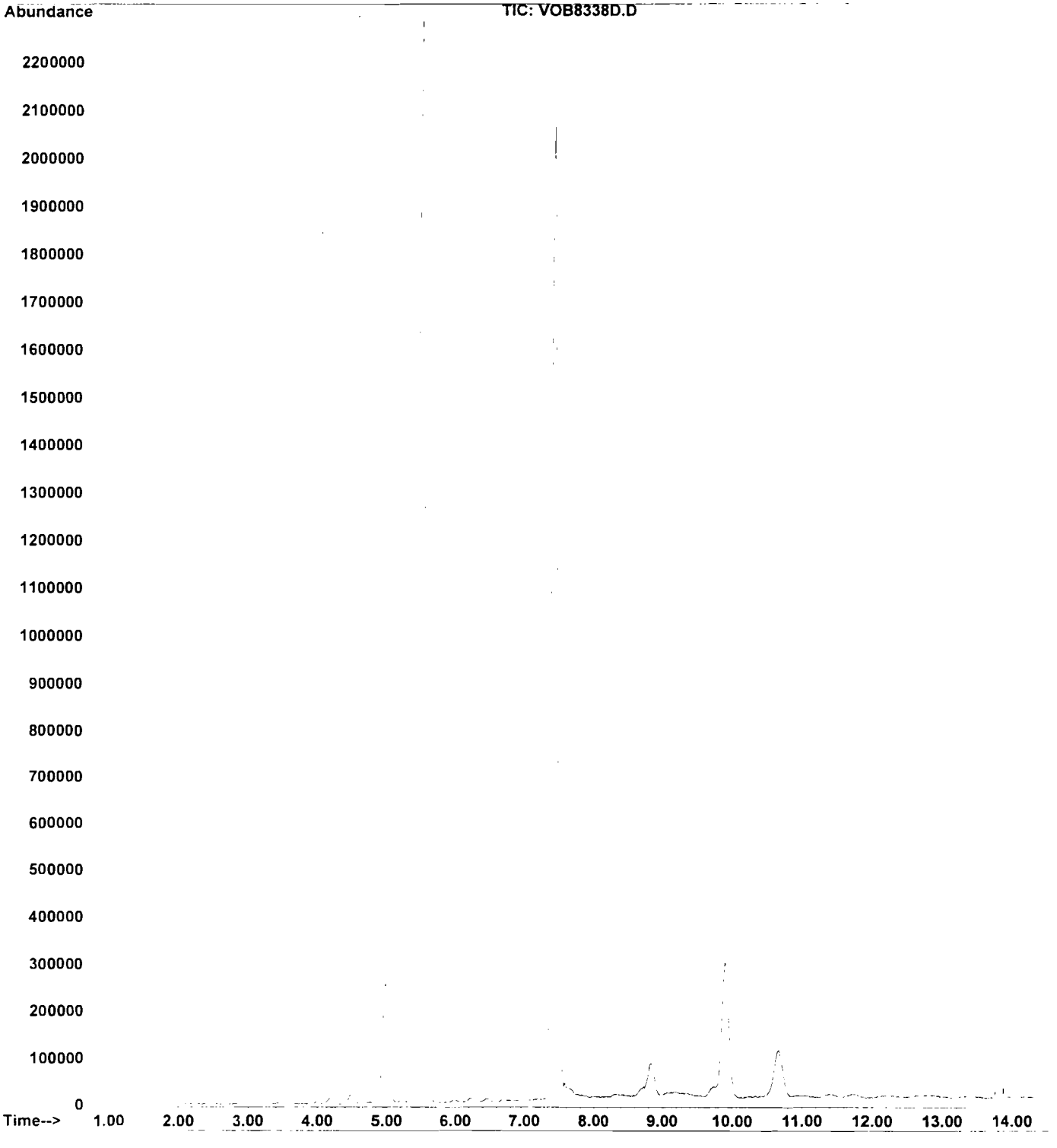
File : C:\HPCHEM\1\DATA\VOB8337D.D
Operator : Raphe HGS
Acquired : 2 Sep 1998 2:48 pm using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT5-09083-62 DF10
Misc Info : Great Neck/TT 02SEP98 1545(01SEP98) GN5
Vial Number: 1



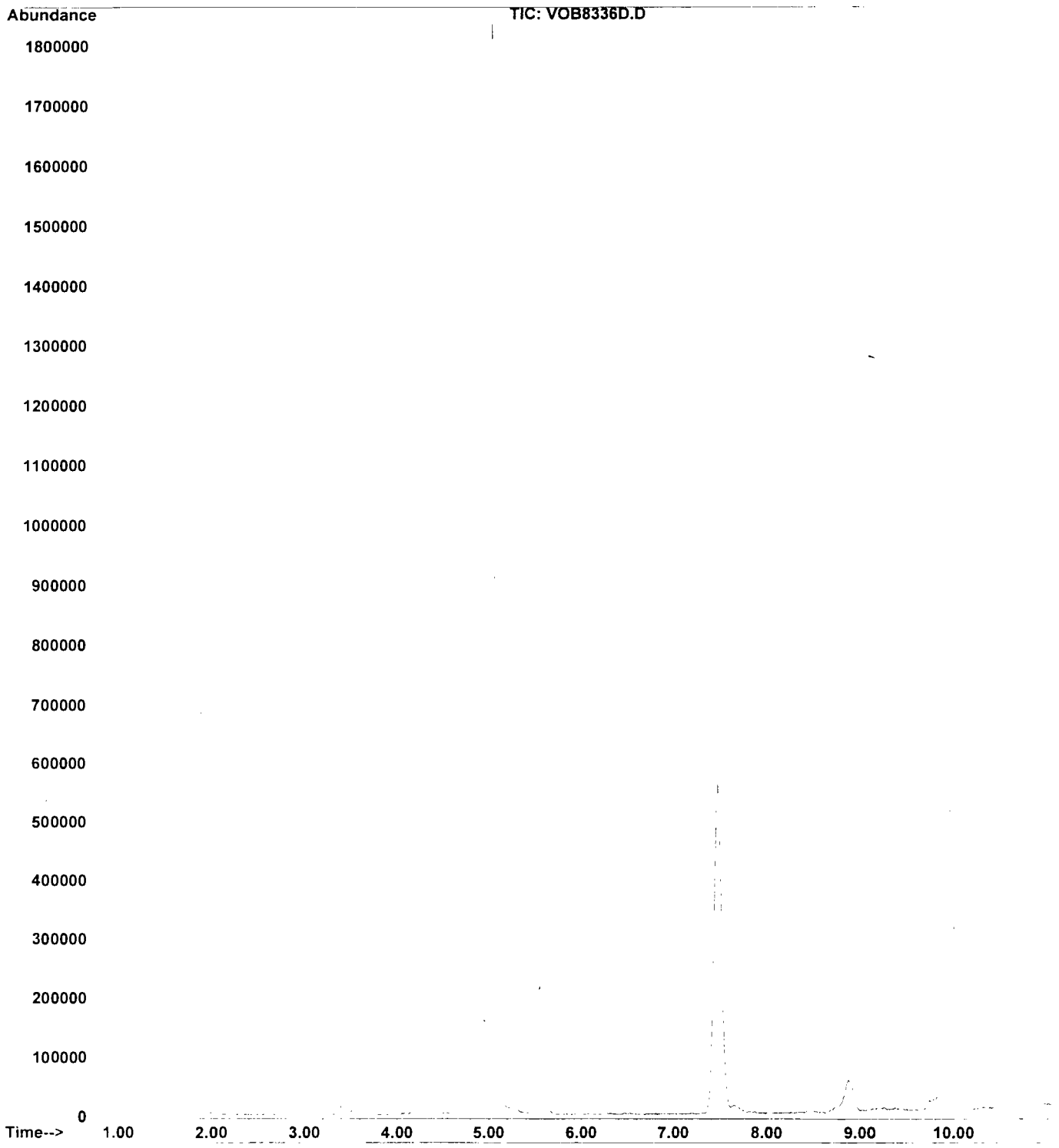
File : C:\HPCHEM\1\DATA\VOB8338.D
Operator : Raphe HGS
Acquired : 2 Sep 1998 5:33 pm using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT6-09084-38
Misc Info : GreatNeck/TT 02SEP98 1607(01SEP98) GN7
Vial Number: 1



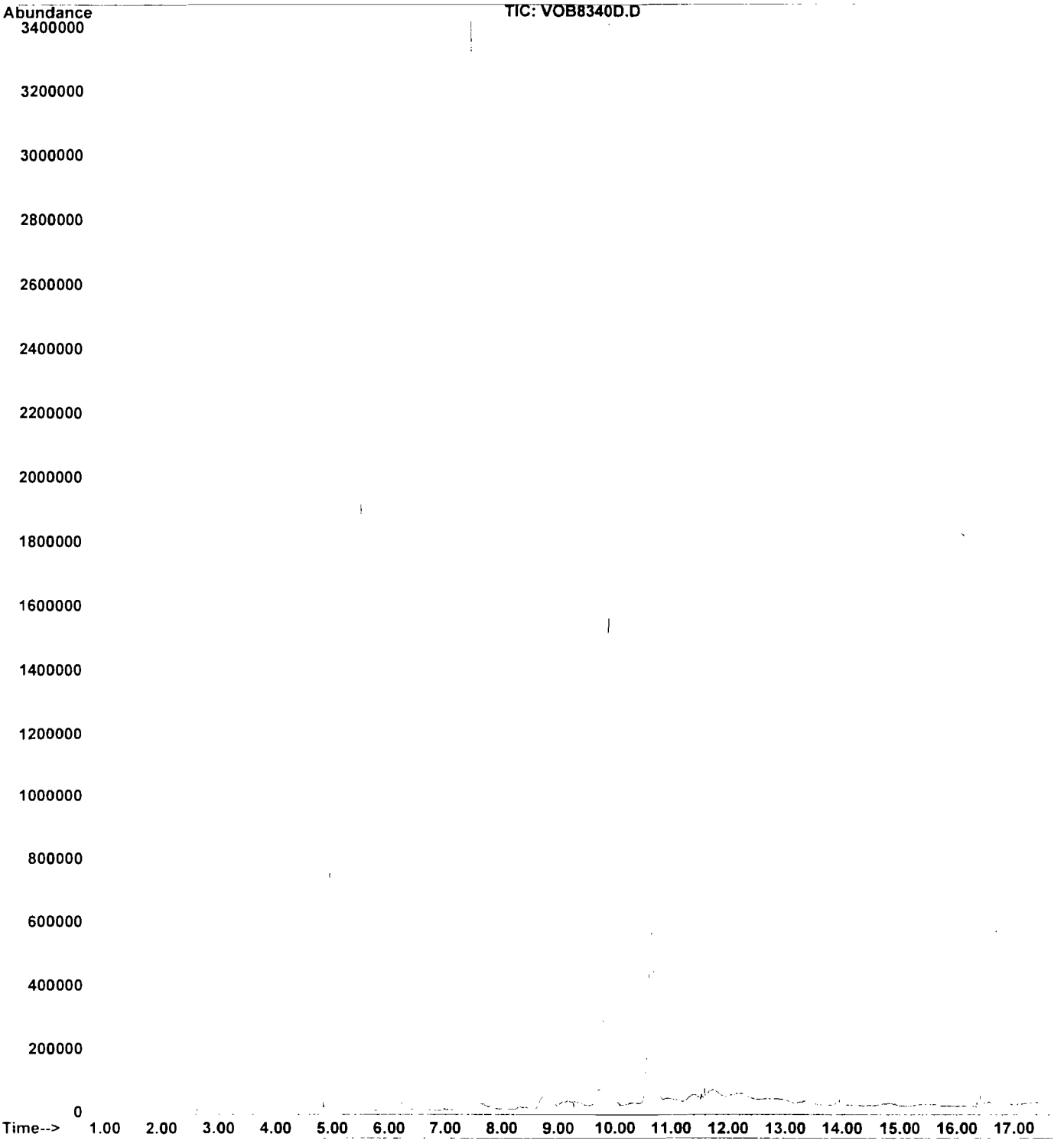
File : C:\HPCHEM\1\DATA\VOB8338D.D
Operator : Raphe HGS
Acquired : 2 Sep 1998 5:53 pm using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT6-09084-38 DF5
Misc Info : GreatNeck/TT 02SEP98 1607(01SEP98) GN7
Vial Number: 1



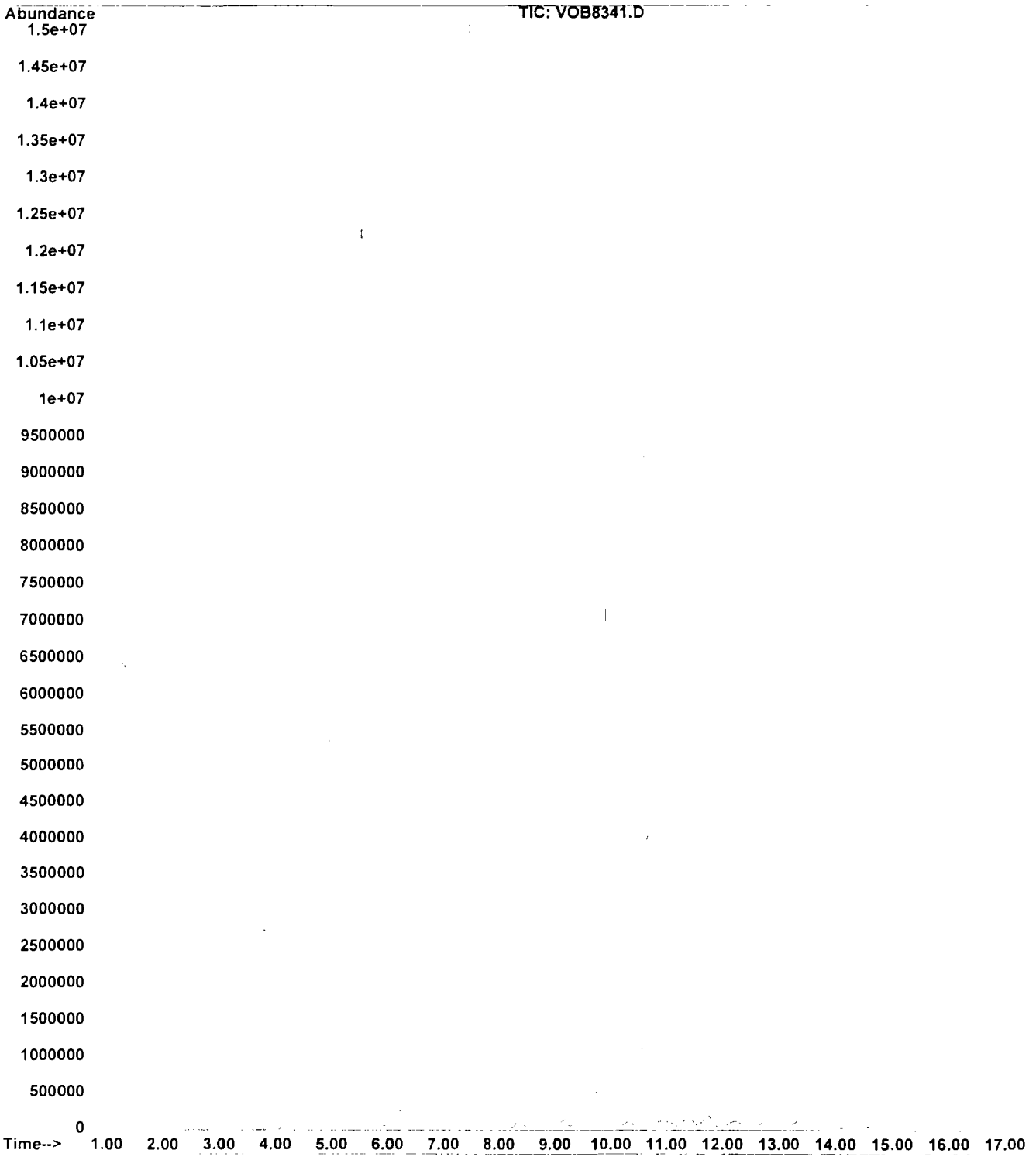
File : C:\HPCHEM\1\DATA\VOB8336D.D
Operator : Raphe HGS
Acquired : 2 Sep 1998 8:20 pm using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT6-09082-29
Misc Info : GreatNeck/TT 02SEP98 1618(01SEP98) GN8
Vial Number: 1



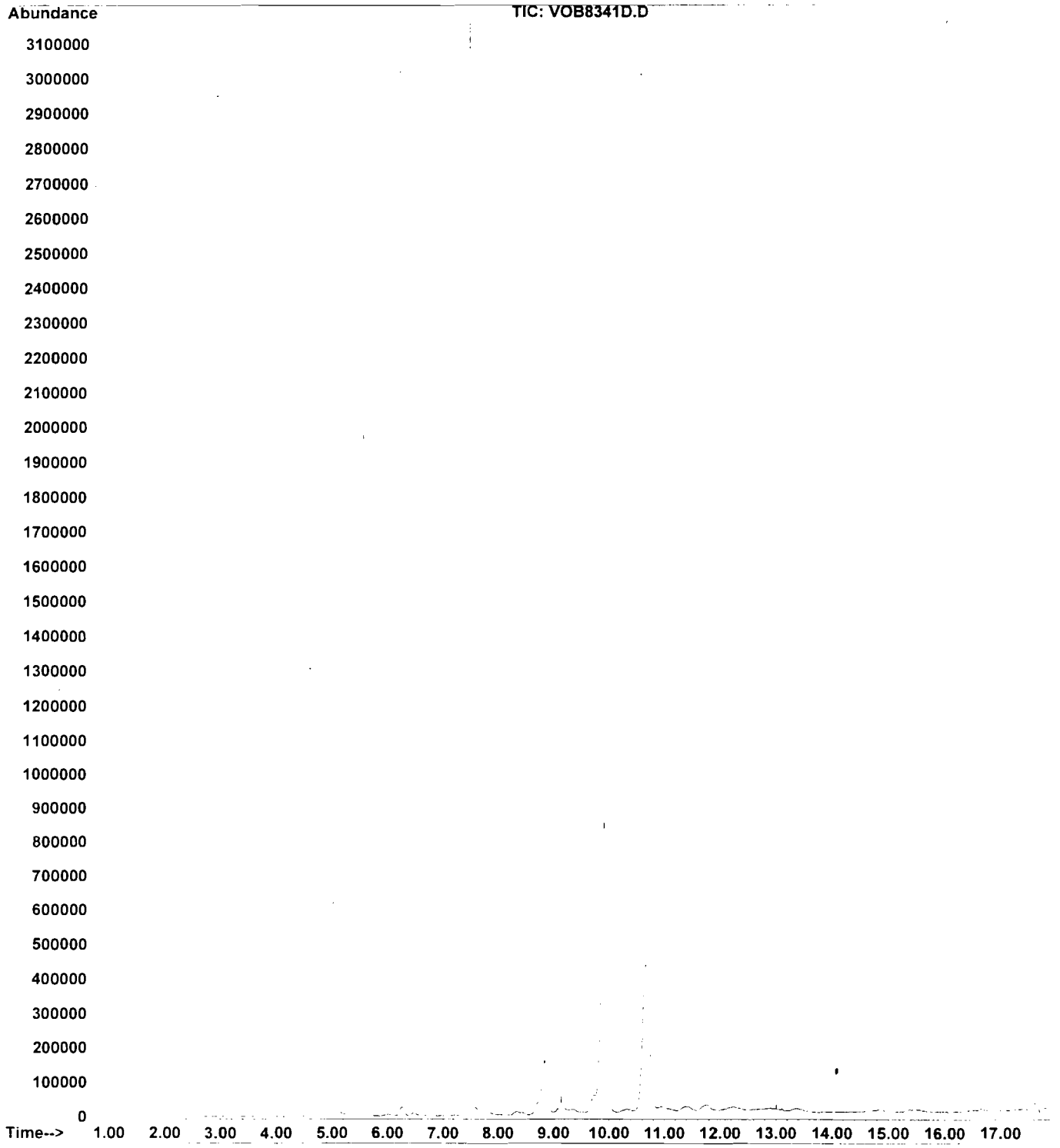
File : C:\HPCHEM\1\DATA\VOB8340D.D
Operator : Raphe HGS
Acquired : 2 Sep 1998 4:06 pm using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT5-09086-37 PURGE 58' DF10
Misc Info : Great Neck/TT 02SEP98 1525(01SEP98) GN3
Vial Number: 1



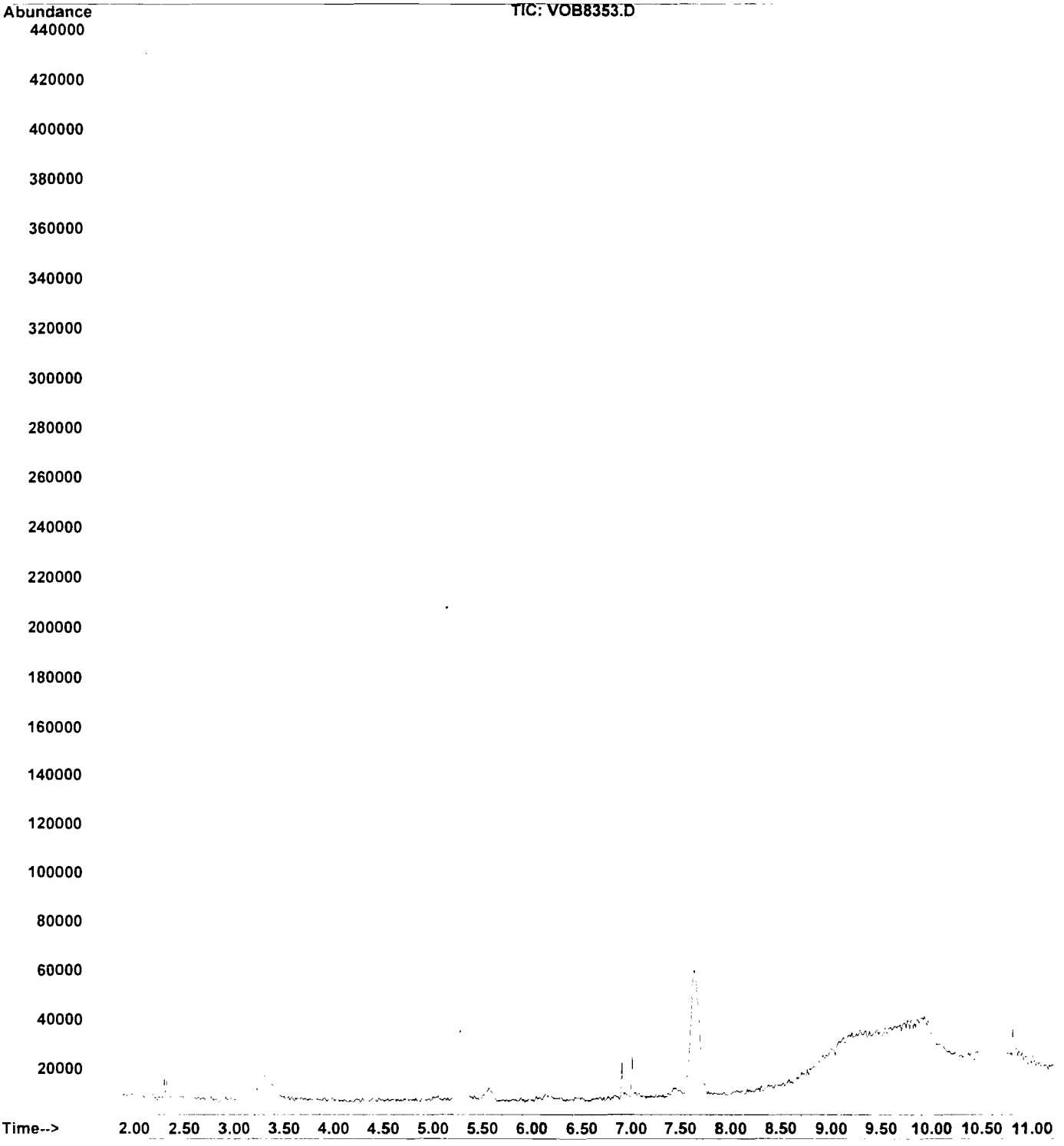
File : C:\HPCHEM\1\DATA\VOB8341.D
Operator : Raphe HGS
Acquired : 2 Sep 1998 4:27 pm using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT5-09087-37 PURGE 14'
Misc Info : Great Neck/TT 02SEP98 1442(01SEP98) GN2
Vial Number: 1



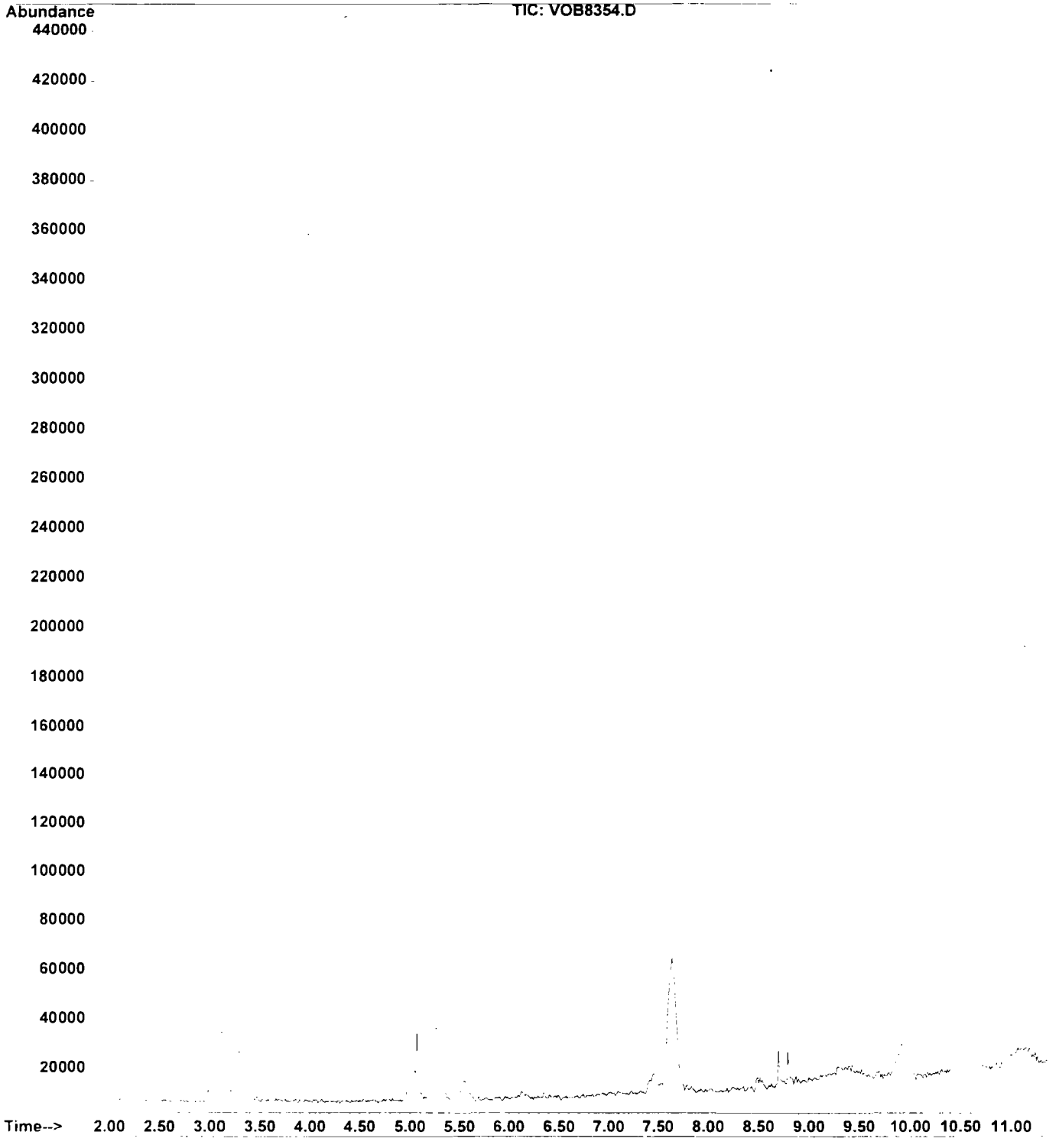
File : C:\HPCHEM\1\DATA\VOB8341D.D
Operator : Raphe HGS
Acquired : 2 Sep 1998 4:50 pm using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT5-09087-37 PURGE 14' DF10
Misc Info : Great Neck/TT 02SEP98 1442(01SEP98) GN2
Vial Number: 1



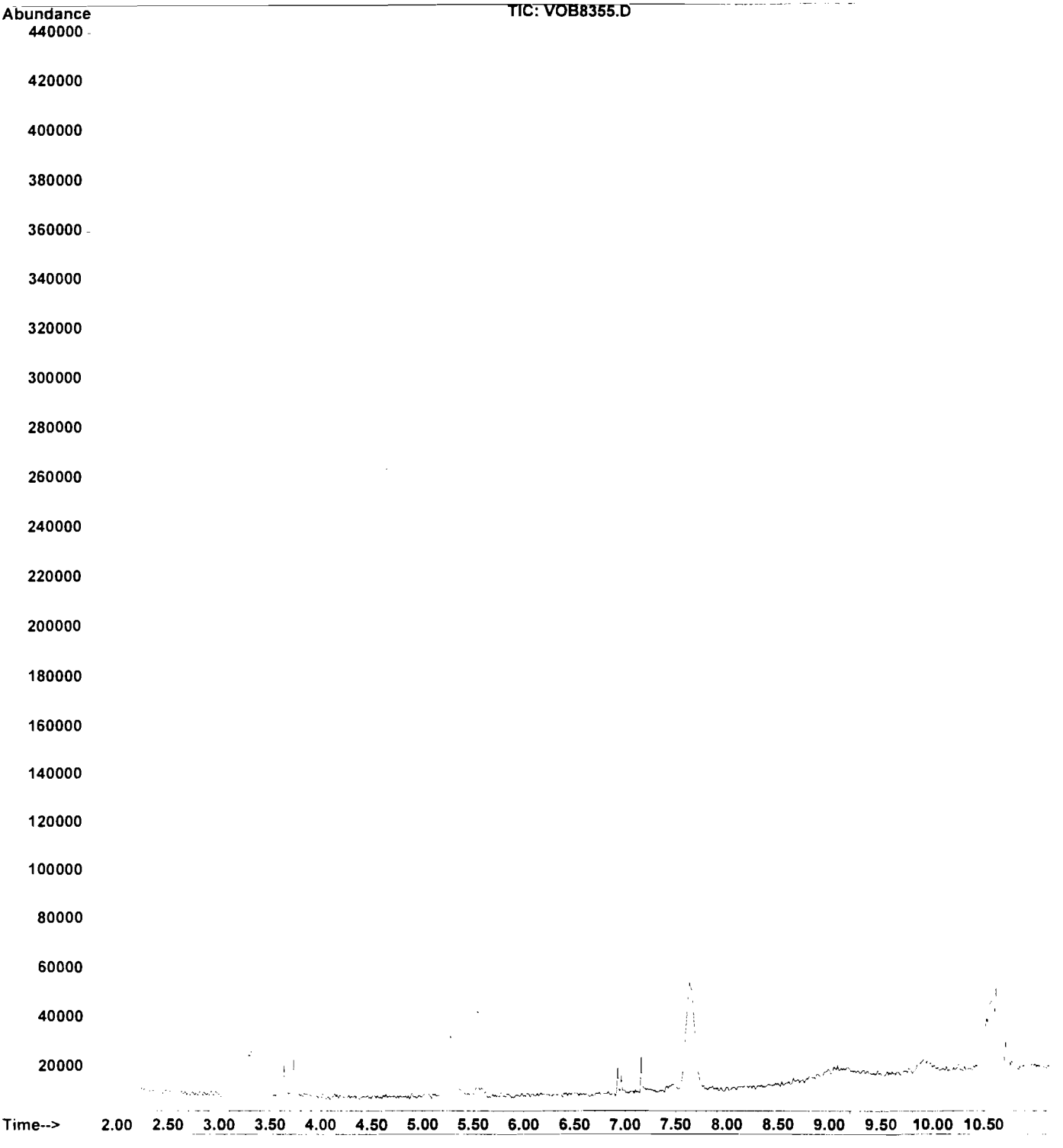
File : C:\HPCHEM\1\DATA\VOB8353.D
Operator : Raphe HGS
Acquired : 3 Sep 1998 11:42 am using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT3-09096-62
Misc Info : 03SEP98 1340(02SEP98) L4
Vial Number: 1



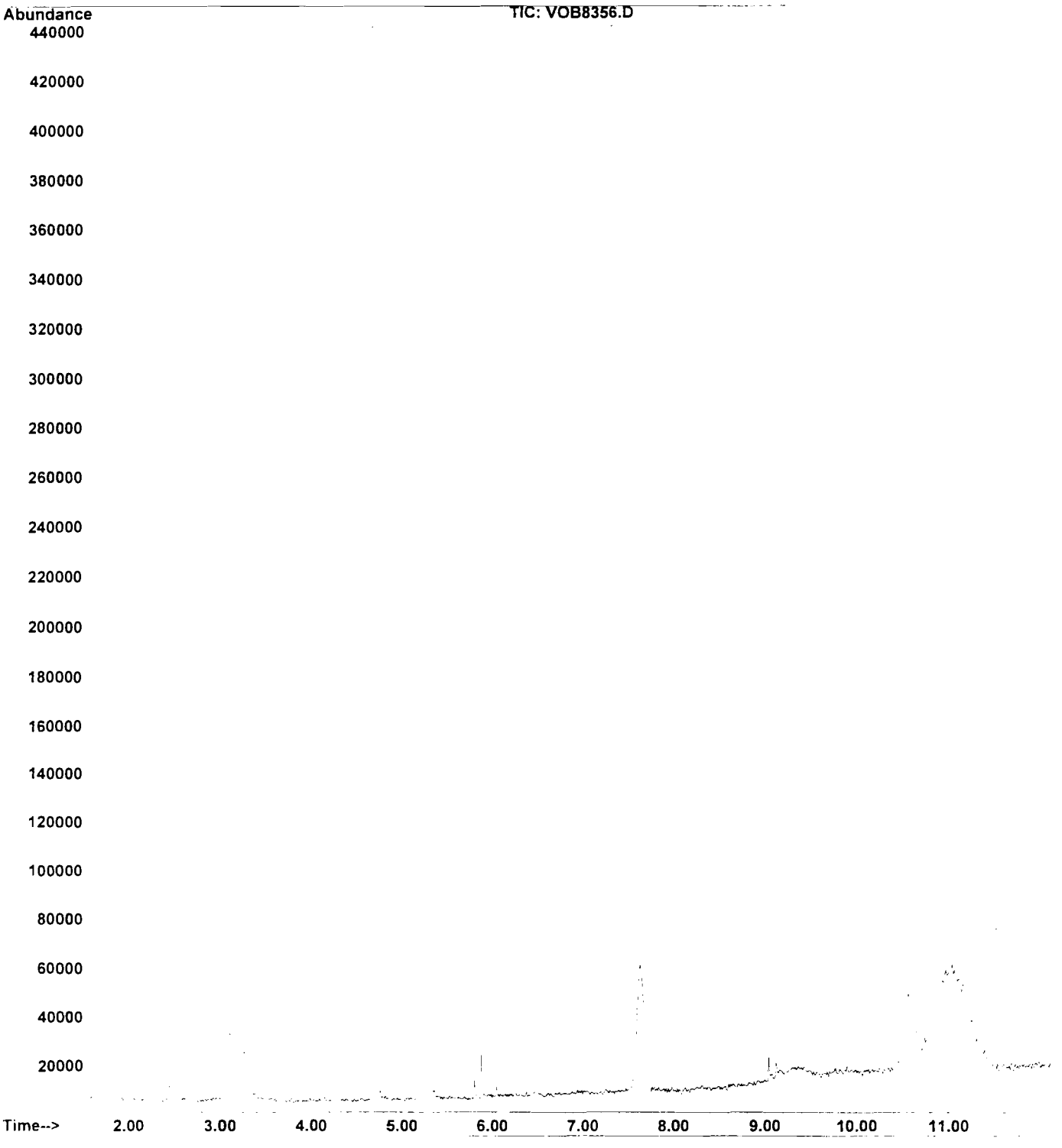
File : C:\HPCHEM\1\DATA\VOB8354.D
Operator : Raphe HGS
Acquired : 3 Sep 1998 11:57 am using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT3-09097-52
Misc Info : 03SEP98 1338(02SEP98) N6
Vial Number: 1



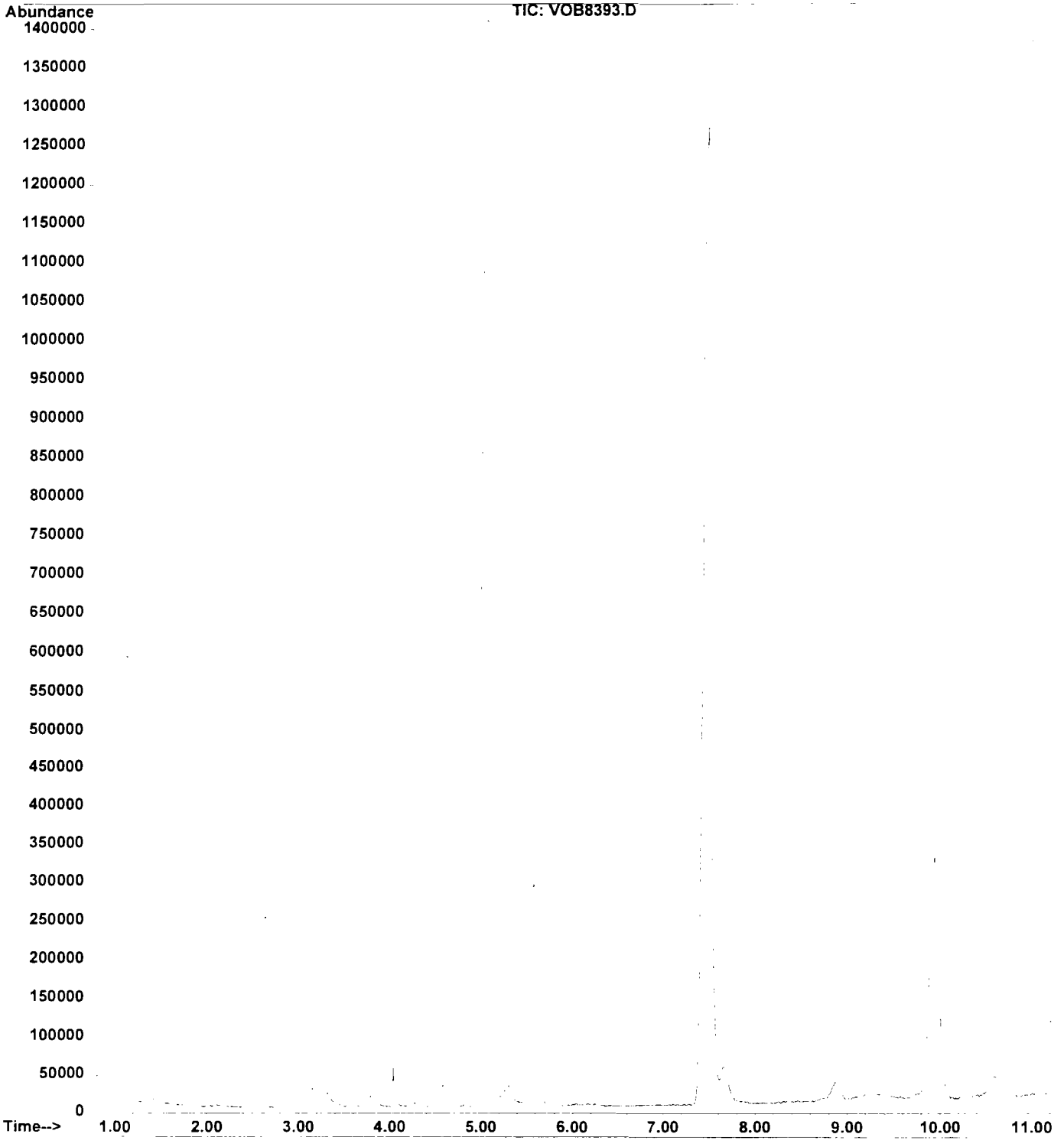
File : C:\HPCHEM\1\DATA\VOB8355.D
Operator : Raphe HGS
Acquired : 3 Sep 1998 1:46 pm using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT3-09098-72
Misc Info : 03SEP98 1348(02SEP98) S2
Vial Number: 1



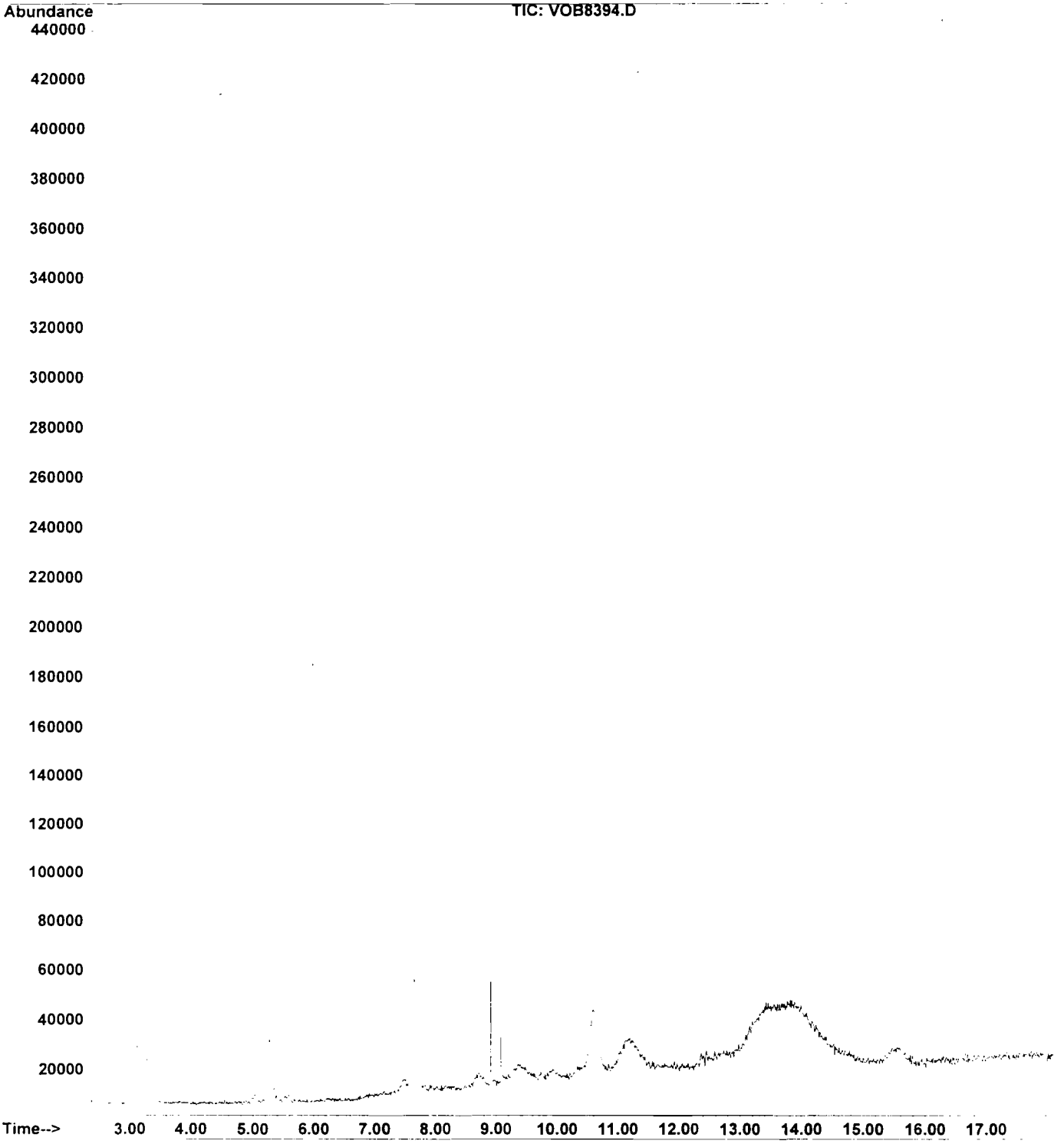
File : C:\HPCHEM\1\DATA\VOB8356.D
Operator : Raphe HGS
Acquired : 3 Sep 1998 2:01 pm using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: BLANK-09099
Misc Info : 03SEP98 1350(02SEP98) N12
Vial Number: 1



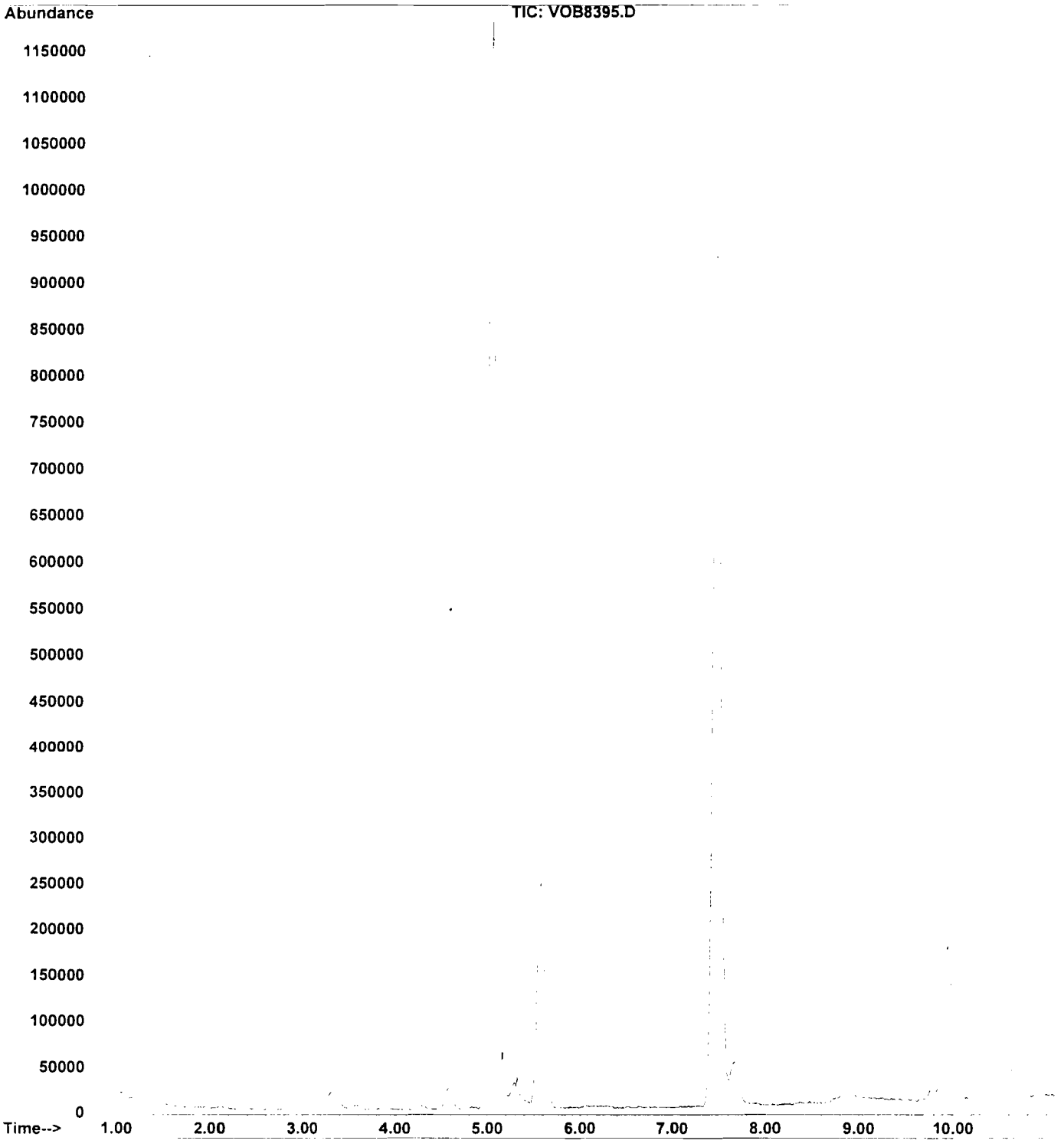
File : C:\HPCHEM\1\DATA\VOB8393.D
Operator : Raphe HGS
Acquired : 4 Sep 1998 10:20 am using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT8-09133-42
Misc Info : GreatNeck/TT 04SEP98 1825(03sep98) E6
Vial Number: 1



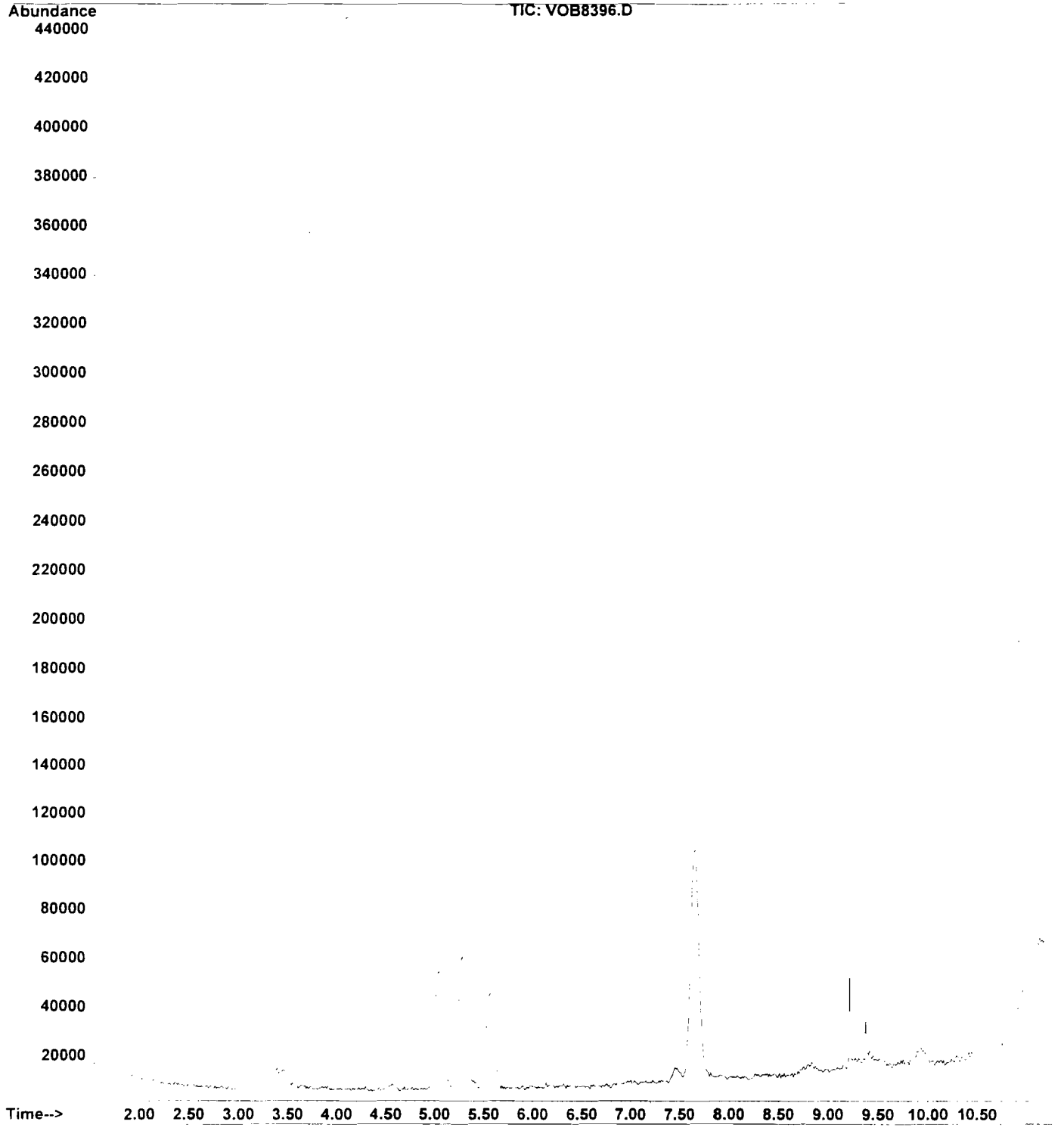
File : C:\HPCHEM\1\DATA\VOB8394.D
Operator : Raphe HGS
Acquired : 4 Sep 1998 10:35 am using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT8-09134-62
Misc Info : GreatNeck/TT 04SEP98 1832(03sep98)Y2
Vial Number: 1



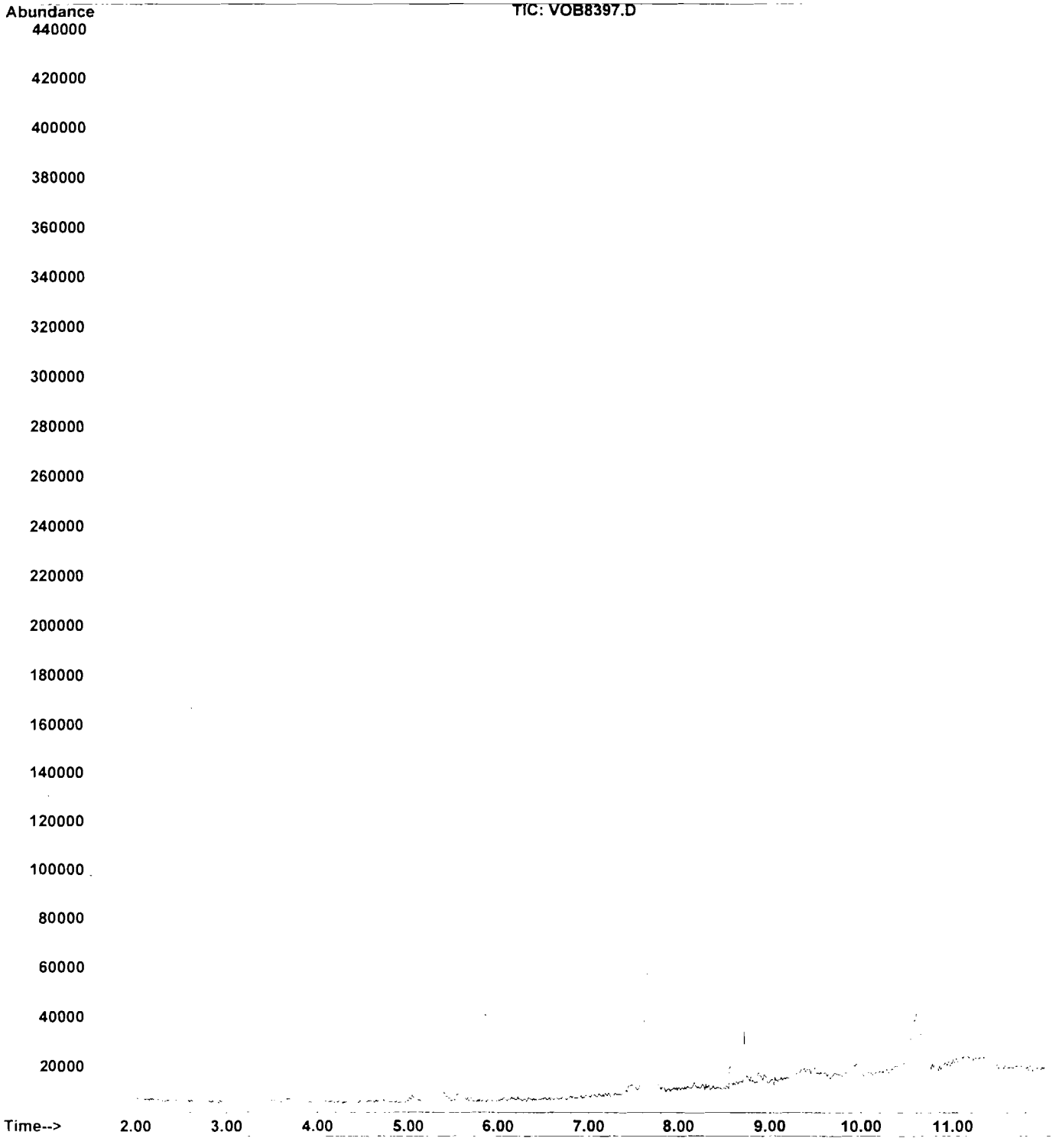
File : C:\HPCHEM\1\DATA\VOB8395.D
Operator : Raphe HGS
Acquired : 4 Sep 1998 12:49 pm using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT8-09135-42
Misc Info : GreatNeck/TT 04SEP98 1610(03sep98)L6
Vial Number: 1



File : C:\HPCHEM\1\DATA\VOB8396.D
Operator : Raphe HGS
Acquired : 4 Sep 1998 1:04 pm using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT1-09136-72 RESAMPLE
Misc Info : GreatNeck/TT 04SEP98 1643(03sep98)L3
Vial Number: 1



File : C:\HPCHEM\1\DATA\VOB8397.D
Operator : Raphe HGS
Acquired : 4 Sep 1998 1:21 pm using AcqMethod 10JUL98
Instrument : GC/MS Ins
Sample Name: TT8-09137-62
Misc Info : GreatNeck/TT 04SEP98 1615(03sep98)F9
Vial Number: 1



Chains of Custody

HydroGeoSpectrum SOIL (POR CHAIN OF CUSTODY

PROJECT Great Neck Plume Verification CLIENT Lockheed Martin DATE 8-27-98

SAMPLE ID-Depth(ft)	INSTALLED	SAMPLED	BULB ID	FLOW ml/min	TIME min	Purge Vol	MISC Leak Check
TT-6-60', 8 pv	8-25-98	1630 → 1635 8-27-98	42	150	5	564ml	PID 800 ppm
" 2.4 pv		→ 1644	B2		14	1692ml	
" 4 pv		→ 1654	N11		24	2820ml	
" 5.6 pv		→ 1703	A9		30	3948ml	
" 8 pv		→ 1717	N1		47	7050ml	
TT-6-70'		1717 → 1751 8-27-98	L6		34	5125ml	PID 10 ppm
TT-6-38'		1739 → 1803 8-27-98	E11		24	3525ml	PID 141 ppm
TT-6-29'	8-25-98	1800 → 1830 8-27-98	R6	150	20	3075ml	PID 2100 ppm
BLANK		8-27-98 1836	B3				

SURROGATES: D6-Benzene____ D8-Toluene____ D-Chloroform____ D6-DMK____ D-DCM____

RELINQUISHED BY: [signature] RECEIVED BY [signature] DATE/TIME 8-27-98/1930

RELINQUISHED BY [signature] RECEIVED BY [signature] DATE/TIME 8-29-98

HydroGeoSpectrum SOIL (POR CHAIN OF CUSTODY

PROJECT Great Neck Plume Verification Project CLIENT Lockheed Martin DATE ~~8-1-98~~ 9-1-98 RB

SAMPLE ID-Depth(ft)	INSTALLED	SAMPLED	BULB ID	FLOW ml/min	TIME min	Purge Vol	MISC Leak Check
TT-5-37' - 1	8-26-98	9-1-98/1431	GN1	150	3.6		1/4
TT-5-37' - 2	8-26-98	9-1-98/1442	GN2	150	14.4		Normal
TT-5-37' - 3	8-26-98	9-1-98/1525	GN3	150	57.6		4X
TT-5-73	8-26-98	9-1-98/1523	GN4	150	22		
TT-5-62	8-26-98	9-1-98/1545	GN5	150	~~20~~		
TT-6-70	8-25-98	9-1-98/1604	GN6	150	21		Resample
TT-6-35	8-25-98	9-1-98/1607	GN7	150	15		Resample
TT-6-29	8-25-98	9-1-98/1618	GN8	150	13		Resample
BLANK	—	9-1-98/1621	GN9	—	—		
TT-6-60	8-25-98	9-1-98/1656	E2	150	19		Resample
✓ TT-1-73	8-27-98	9-1-98/1738	R2	150	22		
TT-1-62	8-27-98	9-1-98/1736	Y6	150	20		
✓ TT-7-34	8-30-98	9-1-98/1836	S1	150	15		
✓ TT-7-60	8-30-98	9-1-98/1841	A5	150	19		

SURROGATES: D6-Benzene RBA D8-Toluene ____ D-Chloroform ____ D6-DMK ____ D-DCM ____

RELINQUISHED BY: Rodney Brott RECEIVED BY FEDEX DATE/TIME 9-1-98/1930

RELINQUISHED BY Fedex RECEIVED BY [signature] DATE/TIME 9-2-98

HydroGeoSpectrum SOIL (POR CHAIN OF CUSTODY

PROJECT Grand Neck Pump Verification CLIENT Lockheed Martin DATE 9-2-98

SAMPLE ID-Depth(ft)	INSTALLED	SAMPLED	BULB ID	FLOW ml/min	TIME min	Purge Vol	MISC Leak Check
TT3-52	8-31-98	9-2-98/1338	N6	150			
TT3-62	8-31-98	9-2-98/1340	L4	150			
TT3-72	8-31-98	9-2-98/1348	S2	150			

SURROGATES: D6-Benzene____ D8-Toluene____ D-Chloroform____ D6-DMK____ D-DCM____

RELINQUISHED BY: [signature] **RECEIVED BY** FEDEX **DATE/TIME** 9-2-98-1730

RELINQUISHED BY_____ **RECEIVED BY**_____ **DATE/TIME**_____

HydroGeoSpectrum SOIL / POR CHAIN OF CUSTODY

PROJECT Great Neck Plume Verification Project CLIENT Lockheed Martin DATE 9-3-98

SAMPLE ID-Depth(ft)	INSTALLED	SAMPLED	BULB ID	FLOW ml/min	TIME min	Purge Vol	MISC Leak Check
TT-8-42	8-31-98	9-3-98/1610	L6	150	15		
TT-8-62	8-31-98	9-3-98/1615	F9	150	20		
TT-1-72	8-27-98	9-3-98/1643	L3	150	22		Resample
TT-8-42	8-31-98	9-3-98/1825	E6	150	15		Dup
TT-8-62	8-31-98	9-3-98/1830	Y2	150	20		Dup
Blank	—	9-3-98/1835	S4	—	—		

SURROGATES: D6-Benzene____ D8-Toluene____ D-Chloroform____ D6-DMK____ D-DCM____

RELINQUISHED BY [signature] RECEIVED BY Fedex DATE/TIME 9-3-98/1930

RELINQUISHED BY Fedex RECEIVED BY [signature] DATE/TIME 9-4-98