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EVALUATION OF INTERIM REMEDIAL ALTERNATIVES STILL DISCHARGE AREA

Envirotek II Site

Tonawanda, New York

March 1991

BLASLAND, BOUCK & LEE, INC.
ENGINEERS & SCIENTISTS

REPORT

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STILL DISCHARGE AREA

ENVIROTEK II SITE
TONAWANDA, NY

MARCH 1991

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SECTION 1 - INTRODUCTION

1.1 Introduction

This report presents an evaluation of alternative interim remedial approaches for addressing the soil within the Still Discharge Area at the Envirotek II site. This evaluation of remedial alternatives was performed in accordance with the Administrative Order on Consent (Index No. CERCLA-00206) between the USEPA Region II and a group of Potentially Responsible Parties (PRPs) signed on May 14, 1990 (consent order). Attachment I (EPA's Envirotek II Work Plan) of this consent order includes a provision (2.B.iv), which required that a soil sampling and analysis program be implemented to evaluate the distribution of volatile organic compounds in the soil within the Still Discharge Area. This provision of the consent order also required that the results of this program be used to evaluate several alternative remedial technologies in terms of their effectiveness for the remediation of soil contamination in the Still Discharge Area. The Removal Action Supplemental Work Plan approved by the EPA for this site assumed that a more direct method of addressing the Still Discharge Area would be implemented involving the excavation and disposal of obviously contaminated soil. The limits of this soil removal program were to be determined based on field observations.

To gain a better understanding of the distribution of volatile organic compounds in the soil within this area prior to initiating any soil removal activities, the PRPs performed a soil gas survey. This soil gas survey was implemented as a voluntary supplement to the scope of work performed under the existing consent order. The results of this soil gas survey indicated that the performance of the limited soil removal activities proposed within the Supplemental Work Plan might not be a technically appropriate method for addressing the volatile organic contamination of the soil identified in this area. Therefore, after discussions with EPA's On-Scene Coordinator, the PRPs decided to proceed with the implementation of a soil sampling and analysis program and an evaluation of interim remedial alternatives consistent with the original requirements of the consent order as previously referenced above. A vapor extraction pilot test was also performed to support the evaluation of this technology as a possible remedial alternative. This vapor extraction pilot test was an additional voluntary supplement to the scope of work implemented under the existing consent order.

In addition to presenting the results of the interim remedial alternatives evaluation, this report presents a detailed summary of the soil gas survey, the soil sampling and analysis program, and the vapor extraction pilot test performed to support this evaluation.

SECTION 2 - BACKGROUND

2.1 Background

The Envirotek II site is located within the former Roblin Steel complex in Tonawanda, New York (Figure 1). This site includes a 2.5 acre facility once leased by Envirotek, Ltd., as well as the southeast portion of the hanger building located immediately to the west of the property formerly leased by Envirotek. The site was operated by Envirotek, Ltd., as a solvent recovery operation from 1981 until June of 1989.

2.2 Site Conditions

A site inspection of the facility by the USEPA in 1989 identified a large number of drums and containers within the buildings at the site. A number of concrete-lined pits containing drums as well as other liquid and solid materials were also identified.

Since this inspection was performed, activities have been implemented to remove all of the drums, containers, uncontainerized liquids, and waste materials for appropriate off site disposal. The activities performed included: site preparation work, drum excavation and staging activities; waste sampling and analysis; and arrangements for waste transportation and disposal. All of these activities have been completed in accordance with the Removal Action Supplemental Work Plan.

SECTION 3 - RESULTS OF INVESTIGATION ACTIVITIES

3.1 Overview

This section presents the results of the investigation activities performed in the Still Discharge Area to evaluate the nature and extent of any impacts associated with the former still discharges and to support the evaluation of alternative remedial technologies for this area. The investigation activities implemented included: a soil gas survey; a soil sampling and analysis program; and a vapor extraction pilot test. The results of each of these investigation activities are presented below.

3.2 Soil Gas Survey

To assess the horizontal and vertical extent of volatile organic compounds in the soil within the Still Discharge Area, a soil gas survey was performed by Tracer Research Corporation (Tracer) on September 7 - 9, 1990. This soil gas survey involved the collection and on-site analysis of soil vapor samples from eight locations in the immediate vicinity of the Still Discharge Area (Figure 2). Although we originally planned to collect samples from locations 1 through 10 indicated on Figure 2, based on the levels of volatile constituents detected at locations 3 and 8, we focused our investigation on locations 5 and 10. Therefore, no samples were collected from the locations identified as 4 and 9 on Figure 2. Soil vapor samples were collected from multiple depths at most of the sampling locations such that the data might provide an indication of the vertical extent of volatile constituents in the soil. A total of 18 soil gas samples were collected from the eight sampling locations.

To avoid multiple mobilizations of the soil gas survey team and equipment, the soil gas survey activities that were required as part of the Sampling Plan Implementation were performed in conjunction with the voluntary soil gas survey of the Still Discharge Area. Approval to perform the combined soil gas survey was obtained from the USEPA's On-Scene coordinator prior to its implementation. The performance of this combined soil gas survey involved the collection of soil gas samples from a total of 24 additional sampling locations. The locations of these additional sampling locations are also indicated on Figure 2. A single soil vapor sample was collected from a depth of approximately 4 feet at each of these locations.

Each of the soil vapor samples collected as part of the combined survey were analyzed on-site by Tracer with a portable gas chromatograph utilizing both a photoionization detector and an electron capture detector in order to quantify concentrations of tetrachloroethylene (PCE), trichloroethylene (TCE), 1,1,1-Trichloroethane (TCA), as well as benzene, toluene, ethylbenzene, and xylenes (BTEX).

A detailed discussion of the soil gas sampling methodology, procedures and equipment utilized by Tracer is presented in their report attached as Appendix A. Tracer's report also presents a discussion of the on-site analytical procedures and QA/QC procedures utilized during the soil gas survey.

The analytical results generated through the on-site analysis of the soil gas samples are attached on Table 1. The analytical results generated during the soil gas survey identified two general areas in which elevated levels of volatile organic constituents were observed in the soil vapor. These areas include the still discharge pipe area, and an area to the west of Building 153.

The compound that was detected at the highest concentrations in each of these areas was PCE. Both TCE and TCA were also consistently detected in the same samples where PCE was present. However, the concentration of TCE and TCA were typically much lower than the PCE concentrations. The analytical results did not indicate the presence of benzene in any of the samples collected. Toluene, ethylbenzene and xylenes were also observed in the majority of samples collected in the still discharge area. However, these compounds were not detected in any of the samples collected outside the Still Discharge Area. To illustrate the distribution of volatile constituents detected through the performance of the soil gas surveys, iso-concentration contour maps were prepared by Tracer based on the observed PCE, TCE, TCA, benzene, toluene, and xylene concentrations. These figures are included in Appendix A.

The soil gas survey performed in the immediate vicinity of the Still Discharge Area included the collection of soil gas samples from multiple depths. The results of these sample have been used to evaluate the vertical extent of volatile organic contamination in the soil. These results suggest that the volatile organic contamination of the soil in this area may extend vertically to the water table. Furthermore, the highest concentrations of many of these volatile organic compounds were detected at the sampling location immediate adjacent to the building foundations within the Still Discharge Area.

A second area in which elevated levels of volatile constituents were observed in the soil gas is located along the western side of Building 153. Two of the possible sources of the observed volatile constituents in this area might be either the preferential migration of volatile compounds from the Still

Discharge Area along the building foundation or possibly an isolated spill or release in this vicinity unrelated to the Still Discharge Area.

Volatile constituents were also observed adjacent to Building 13, located west-northwest of the first area. Given the much lower concentrations of volatiles observed in this area and its location directly downgradient of the other two areas, the presence of the volatile constituents identified in this area probably represents the western extent of volatile organic vapors associated with the Still Discharge Area and the area adjacent to Building 153. The results of the soil gas survey do not suggest the presence of an additional source associated with the soil in this area.

3.3 Soil Sampling and Analysis Program

The results of the soil gas survey indicate the likely presence of soil contamination directly adjacent to the building foundations in the Still Discharge Area. Therefore, we were concerned that the limited soil excavation program, incorporated as part of the Removal Action Supplementary Work Plan, may not be a technically effective approach for addressing the soil in this area. Therefore, the PRPs decided to implement the following soil sampling and analysis program to further evaluate the nature and extent of the volatile organic contamination identified in the Still Discharge Area. This soil sampling and analysis program was developed to be consistent with the original requirements for the Still Discharge Area presented in the consent order.

On October 11 and 12, 1990, a total of six soil borings were drilled at the locations indicated on the attached Figure 3. Each boring was continuously sampled from the ground surface to the water table using 2-inch diameter split-spoon sampling devices. To insure sample integrity, the split-spoon samplers were decontaminated prior to each use by washing with a detergent solution then rinsed sequentially with potable water, methanol, and triple rinsing with distilled water. Each sampler was then allowed to air dry prior to use. Immediately following retrieval of each split-spoon sampler, a representative sample of the soil recovered was placed directly into a laboratory-provided sample container for possible laboratory analysis. A second representative portion of the sample was placed into a clean jar, covered with aluminum foil, and left standing for at least several minutes to allow volatile organics present in the soil to volatilize into the head space of the jar. An Organic Vapor Analyzer (OVA) was then used to screen each sample for relative concentrations of volatile organic constituents by inserting the probe of the OVA through the aluminum foil and directly reading the maximum concentration from the field instrument. Each sample collected was also visually inspected in the field to determine the color, grain size, classification, and moisture content of the materials encountered. This information was recorded on logs that were maintained for each borehole. Any evidence of contamination (i.e., staining, odor, etc.) was also recorded on the boring logs. The boring logs are presented in Appendix B.

Based on the results of the field observations and OVA screening, one sample was selected from each borehole for laboratory analysis. The samples that were selected were analyzed for volatile organics, semivolatile organics, total petroleum hydrocarbons, PCBs, metals, and cyanides. The soil samples selected for laboratory analysis included three samples collected immediately above the water table (8 to 10 feet below ground surface) from borings B-4, B-5, and B-6, which are located at various distances away from Building 153. This zone immediately above the water table appears to have been impacted the most based on both OVA screening results and visual observations. Four of the six soil samples collected from this zone immediately above the water table were observed to be saturated with separate phase hydrocarbons. These separate phase hydrocarbons appeared to consist of an oil that has a consistency similar to motor oil. In addition, the samples from this zone also exhibited the highest OVA readings indicating that significant concentration of volatile compounds are dissolved in the separate phase hydrocarbons. The source of the separate phase hydrocarbons observed above the water table in this area remains undefined at this time.

To evaluate the distribution of chemical constituents of concern within the soil above the water table fluctuation zone, the samples selected for analysis from each of the three remaining soil borings (B-1, B-2, and B-3) were collected from the depth interval above the water table fluctuation zone that exhibited the highest OVA readings. These three borings were also located at various distances from Building 153.

The results of the volatile organic analyses performed (by USEPA Method 8240) on the soil samples from the Still Discharge Area are summarized on Table 2. These results indicate the presence of a number of both chlorinated and aromatic hydrocarbon compounds including: PCE, TCE, TCA, toluene, and xylenes. A review of the OVA screening data in conjunction with the laboratory analytical results suggest that the soils containing the highest levels of volatiles are located in the vicinity of borings B-1, B-2, and B-5. The predominance of OVA reading in excess of 1,000 ppm in the shallow soil from boring B-1 and B-2 may indicate that the immediate area in which surficial discharges occurred was primarily on the eastern side of the concrete sidewalk that bisects this area. The dramatic decrease in OVA readings, as well as the laboratory analytical results for boring B-3, suggest the boring is approaching the northern horizontal extent of the area impacted by the former still discharge. The analytical results of the samples collected on the western side of the concrete walkway indicate the presence of volatile organics at considerably lower concentrations than the area on the eastern side of the walkway. However, additional investigation of the area toward the west would be necessary to delineate the horizontal extent of the volatile organic compounds in this direction.

Although no soil borings were performed directly adjacent to the building foundations in this area, the levels of volatile organic compounds observed in the soil and the observed presence of separate phase hydrocarbons in the borings B-1, B-2, B-3, and B-4, suggest that the soil impacted by VOCs and separate phase hydrocarbons probably extends beneath the building foundations to the south and east of this area. The lack of observable separate phase hydrocarbons in either B-3 and B-6 indicates the extent of the separate phase hydrocarbons observed on the water table probably is limited to within 30 feet of the north side of Building 153. However, the extent of the separate phase hydrocarbons that may be present under the buildings toward the south and east, as well as toward the west, have yet to be determined.

The results of base neutral organic analyses are also presented on Table 2. Although these analyses tentatively identified the presence of a number of semivolatile compounds at concentrations below the quantitative limits in each of the soil samples collected, only the sample from boring B-2 was found to contain base neutral compounds at concentrations in excess of the quantitative limits of the analytical method. The base neutral compounds observed in the highest concentrations in this soil sample include pyrene, phenanthrene, bis(2-ethylhexyl)phthalate, and fluoranthene. The results of the PCB analyses indicated no detectable PCBs in any of the samples analyzed. The results of the metals, cyanide, and petroleum hydrocarbon analyses are also summarized on Table 2. These results indicate the presence of some metals including iron, magnesium, and calcium, at slightly higher levels than would be typical of naturally occurring levels of these inorganics. However, no background data exists with which to compare these results. Some of these inorganics may be attributable to the historical steel making operations at this site. There is no indication that these inorganics are related to the former still discharge. The petroleum hydrocarbon analyses indicate the soil in this area contains concentrations of total recoverable petroleum hydrocarbons ranging from 230 mg/kg to 16,800 mg/kg. As would be anticipated, the highest concentrations of hydrocarbons were detected in the soil samples collected within the zone impacted by separate phase hydrocarbons above the water table. The source of these hydrocarbons has yet to be determined.

3.4 Vapor Extraction Test

Vapor extraction was identified as one of the alternative remedial technologies to be evaluated in terms of its ability to address the soil contamination identified in the Still Discharge Area due to the anticipation that volatile compounds would be the primary constituent of concern in this area. Therefore, the PRPs elected to perform a vapor extraction pilot test as a voluntary addition to the scope of work required under the existing consent order. The purpose of this pilot test was to provide performance data necessary to evaluate the potential effectiveness of such a vapor extraction system. To facilitate the performance of this test, vapor probes were installed in three of the soil borings drilled during the soil sampling program described above. Each vapor probe was constructed with a 5-foot length of 2-inch diameter, 0.02 machine slot, PVC well screen set from approximately 2.5 feet to 7.5 feet below ground surface. PVC riser pipe was used to extend the vapor probe above the ground surface. A filter pack was placed around the screen of each vapor probe and extending one foot above the top of the screen. A hydrated bentonite seal was then placed above the filter pack in each of these probes and they were completed with a concrete plug at the surface. The vapor probe locations are indicated on Figure 3. The boring logs and construction details for each of these vapor probes are presented in Appendix B.

The equipment used to perform the vapor extraction pilot test included a 5-horsepower regenerative blower rated for a maximum of 225 cubic feet per minute (CFM) of air flow. The blower was connected to the extraction well (VP-1) with 2-inch diameter PVC pipe. The blower exhaust was piped through two vapor phase carbon units to remove the organic constituents in the off gas. A vacuum gauge was installed at the head of the extraction well to measure the pressure created in this well by the blower. A second vacuum gauge was installed directly up stream of the blower. The top of the two vapor probes used as observation points were sealed with airtight caps fitted with vacuum gauges. Three air sampling points were installed including: one between the blower and the first carbon unit; a second between the two carbon units; and the third located after the second carbon unit. The ground surface around the extraction well, extending beyond the closest observation probe, was covered with plastic sheeting to limit air infiltration through the ground surface during the test. This was done to increase the horizontal radius of influence around the extraction well.

Immediately following the start-up of the vapor extraction test, readings of the pressure observed in the extraction well and the observation probes were recorded. Readings of the observed pressure were recorded from each point at regular intervals throughout the test. After stabilization of the system, an initial air sample (VS-1) was collected of the extracted air from the sampling port prior to the carbon units. Additional air samples (VS-2, VS-3, and VS-4) were collected at four hour intervals during the first 12 hours of the test. Two final grab air samples (VS-5 and VS-6) were collected immediately prior to the completion of the test. Sample VS-5 was collected from the sample port prior to the carbon units and VS-6 was collected immediately after the carbon units.

Each of the air samples collected during the vapor extraction test were submitted for laboratory analysis of their volatile organic content. The analytical results of these samples is summarized on Table 3.

Throughout the duration of the vapor extraction test, a stable vacuum of approximately 20 inches of water (0.95 atm) was maintained in the extraction well. However, no pressure drop was observed in either of the two adjacent vapor probes. The closest vapor probe to the extraction well was 10 feet away from the extraction well. This indicates that the radius of influence developed through the performance of the vapor extraction test was less than 10 feet. The reason for this limited radius of influence may be attributable to air infiltration from the surface due to the shallow, porous nature of the unsaturated zone and the lack of an effective surface seal over the entire Still Discharge Area. We would anticipate that the radius of influence achievable with a full scale soil venting system could be increased significantly by utilizing a higher rate of extraction and/or placing a more effective surficial seal over the area. This might be accomplished by paving the area with asphalt or grading the area and covering it with plastic sheeting.

SECTION 4 - EVALUATION OF INTERIM REMEDIAL ALTERNATIVES

4.1 General

This section presents an evaluation of several possible interim remedial alternatives that could be implemented as part of the current removal action activities to address the soil in the Still Discharge Area. The following alternatives have been selected for consideration:

- Excavation and Off-Site Disposal Alternative
- Vapor Extraction Alternative
- Bioremediation Alternative
- No-Action Alternative

Each of these alternative methods have been evaluated in terms of their potential effectiveness in addressing the soil contamination identified in the Still Discharge Area. The primary considerations on which the each of the interim remedial alternatives were evaluated included the following:

- Whether the remedial technology is capable of completely addressing the extent of contamination identified in the soil within this area;
- The remedial technology's effectiveness as a source control measure;
- Whether the interim measure would be consistent with the anticipated long-term remedial goals for the site;and
- Whether sufficient data is available to support the implementation of the remedial technology as part of the current removal action program.

4.2 Excavation and Off-Site Disposal Alternative

The first remedial alternative evaluated was limited soil excavation from the Still Discharge Area and off-site disposal as part of the ongoing removal action.

Normally, one of the primary benefits of implementing a limited soil excavation program as part of a Removal Action is the immediate removal of contaminated soils, which represents a continuing source of contaminants to ground water. An additional benefit of such a soil removal alternative, as compared with an in-situ approach to remediation, is that no residual constituents are left in the unsaturated zone. However, the investigation results available for the Still Discharge Area indicate that both contaminated soil and separate phase hydrocarbons probably extend beneath the existing structures on three sides of this area. Therefore, the ability of a soil excavation alternative to completely address this source area would be seriously limited. This is due to the fact that excavations performed directly adjacent to building foundations are typically sloped out away from the building foundation to avoid the possibility of undermining the foundation and compromising the building's structural integrity. Utilizing such a standard excavation technique in this case would result in the contaminated soil adjacent to and underlying the building being left in place.

Although a number of exotic engineering approaches might be utilized to protect the structural integrity of the buildings while removing soil located adjacent to and/or beneath the building, the development of such techniques for the existing site conditions would require considerable additional geotechnical investigations to provide detailed information regarding the existing foundations and surrounding materials. In addition, as many of the buildings in the former Roblin's complex are of questionable structural integrity, the increased risks associated with attempting an exotic engineering approach to implementing the soil excavation would also have to be evaluated. Insufficient information is currently available to support the use of such an exotic engineering technique. The implementation of a soil removal alternative at this time would have to utilize conventional excavation methods. This would result in a large amount of the impacted soil and separate phase hydrocarbons remaining in place. This remedial technology is not capable of completely addressing the soil contamination identified in the Still Discharge Area. Additionally, the separate phase hydrocarbons identified at the site cannot be completely addressed through the performance of a limited soil excavation program, and much of the clean soil used to replace the contaminated soil removed by such a program would become recontaminated by the migration of separate phase hydrocarbons back into this area.

In summary, a limited soil excavation and disposal program, utilizing conventional excavation methods, could only accomplish the immediate removal of a portion of the contaminated soil associated with this area, while the soil containing the highest levels of contamination and separate phase hydrocarbons would not be addressed. Furthermore, the clean fill placed in the excavated area would be recontaminated by the migration of VOCs and separate phase hydrocarbons from the adjacent areas not addressed through this limited soil excavation. Based on this evaluation, the use of an excavation alternative is not an appropriate interim remedial approach for addressing the Still Discharge Area as part of the Removal Action.

4.3 Vapor Extraction Alternative

Vapor extraction remedial techniques involve the removal of volatile contaminants from the subsurface by withdrawing soil vapor through a series of extraction wells. This method of remediating soils has been found to be effective under the right circumstances. However, the effectiveness of this method is highly dependent on site conditions. As volatile organic compounds were anticipated to be the primary contaminants of concern in this area, vapor extraction was identified as a remedial technology to be considered.

To provide performance data on the operation of a vapor extraction system at this site, Blasland & Bouck implemented a vapor extraction pilot test, as detailed in the preceding section of this report. The results of this vapor extraction pilot test indicated that the soil conditions in the Still Discharge Area would be acceptable for the use of vapor extraction. In fact, the relatively low percentage of fines in the soil and the high permeability of the soil to air would make this site particularly well-suited for the use of vapor extraction as a method for addressing volatile contamination in the soil. However, the investigations implemented in this area indicate the presence of a significant thickness of separate phase hydrocarbons in the soil above the water table surface in this area of the site. The separate phase hydrocarbons appeared to consist primarily of oily material similar in viscosity to motor oil. Typically, vapor extraction is not an effective method of removing nonvolatile oils from the subsurface.

Therefore, due to the presence of the separate phase hydrocarbons above the water table, vapor extraction would not be an effective interim remedial method for addressing the soil in the Still Discharge Area as part of the current removal action.

4.4 Bioremediation Alternative

Bioremediation of soil is a process involving the remediation of biodegradable constituents by enhancing the growth and activity of the aerobic microbial populations. The process involves the management of ecological factors (such as nutrient availability, pH, and moisture) such that biological activity is stimulated. Microorganisms that metabolize non-chlorinated hydrocarbons primarily use these contaminants as a source of carbon and energy, while converting it to carbon dioxide and water. Bioremediation of material containing chlorinated aliphatics presents a more complex condition that may necessitate the addition of a more readily degradable substrate to induce the microbial activity necessary for complete mineralization of these contaminants.

For the purpose of this evaluation, three bioremediation alternatives were selected to be evaluated in terms of the practicality of each as an interim remedial measure for addressing the soil in the Still Discharge Area. These techniques included: unsaturated zone in-situ bioremediation, solid phase, and liquid/slurry-phase bioremediation.

The unsaturated zone in-situ bioremediation process involves installing an injection and extraction system, which promotes the controlled transport of nutrients between injection and extraction points without further migration of contaminants. The process delivers oxygen, nutrients, and moisture to the exposed area, converting the region into a bioactive zone. Factors that influence this technique include the constituents of concern, microbial characteristics, nutrient requirements, soil chemistry, and particularly site hydrogeology. However, as of this time, the site hydrology has not been adequately characterized to support the development of a program such as this which necessitates hydraulic control. It should also be noted that bacteria do not, in the vast majority of cases, degrade oil that is not dissolved or adsorbed onto a substrate. Therefore, until the observed presence of phase separated hydrocarbons at the site have been recovered and controlled, they will continue to be a source of soil contamination to the bioactive area. Due to these limitations (i.e., lack of sufficient data and the presence of a continual source), unsaturated zone in-situ bioremediation would not be an effective interim remedial technology for addressing the soil in the Still Discharge Area.

Solid phase and liquid slurry bioremediation techniques are managed processes that involve the excavation, then application and incorporation of contaminated soils to an aboveground treatment unit. After the material is treated it can then be used as backfill for the excavation. Solid phase biotreatment uses a land based unit, while liquid slurry requires a reactor similar to conventional biological suspended growth treatment. Both processes rely on cultivation of the bacterial consortium, which metabolize the contaminants within a treatment unit. Operating conditions within the treatment unit are monitored and controlled in order to enhance the efficiency of the system. However, each of these remedial techniques is based on the excavation of the contaminated soil. Therefore, all of the practical restrictions identified for the excavation and off-site disposal alternative (Section 4.2) would apply to both solid phase and liquid slurry technologies. Therefore, these alternatives would not be effective methods of remediating the soil in the Still Discharge Area as part of the current removal action activities.

4.5 No-Action Alternative (Deferral to Comprehensive Site Remediation)

The following presentation of the No-Action alternative represents an evaluation of whether it would be technically more appropriate to defer the remediation of the soil in the Still Discharge Area until further site characterization has been completed, which would support the development of a more comprehensive remediation program. At the time that the Removal Action Work Plan was prepared, it had been assumed that the soil contamination in the vicinity of the Still Discharge Area was limited to a distinct area that could be effectively remediated through excavation as part of the Removal Action. However, the investigation activities implemented in this area have shown that the soil contamination in the Still Discharge Area extends horizontally beneath the foundations of the buildings around this area. In addition, separate phase hydrocarbons have been observed in the soil above the water table in this area of the site. Given these site conditions, the implementation of any of the previously evaluated remedial alternatives would be ineffective at addressing the soil contamination in the Still Discharge Area.

As previously discussed, our evaluation suggests that the limited soil excavation, vapor extraction, and bioremediation approaches would be ineffective as a method of remediating the soil in the Still Discharge Area. In fact, the soil remediated by any of these methods would be quickly recontaminated by separate phase hydrocarbons from the surrounding area.

Based on the results of this evaluation of remedial alternatives, the effective remediation of the soil in the Still Discharge Area would best be accomplished by a more comprehensive remedial program designed to address the separate phase hydrocarbons identified above the water table, as well as the soil in this area. However, the development of such a program would require additional investigation to further evaluate the nature and extent of the separate phase hydrocarbons present at the site. Characterization of the hydrogeologic conditions at the site would also be necessary to develop such a remedial program. Therefore, the remediation of the soil in the Still Discharge Area should be deferred until adequate investigation has been performed to support the development of such a remedial program.

4.6 Summary of Evaluation Results

The evaluation of potential interim remedial alternatives performed by Blasland & Bouck involved the consideration of several possible technologies that might be utilized for addressing the soil in the Still Discharge Area as part of the current Removal Action activities. The alternatives considered in the previous sections of this report included the following:

- Excavation and Off-Site Disposal Alternative
- Vapor Extraction Alternative
- Bioremediation Alternative
- No-Action Alternative

The results of our evaluation of these alternatives indicate that the implementation of an interim remedial program using any of these technologies would not be effective in addressing the soil in the Still Discharge Area. The reason each of these alternatives was found to be ineffective at this time are summarized below.

The first alternative evaluated, involving excavation and off-site disposal, would be ineffective in addressing the soil in the Still Discharge Area due to the inability of this method to address the separate phase hydrocarbons observed in the subsurface in this area. The presence of the separate phase hydrocarbons under the buildings around this area would result in the recontamination of the soil addressed by this method.

Tables

Table 1

Summary of Soil Vapor Samples - Analytical Results

Envirotek II Site

Sample	TCA ug/l	TCE ug/l	PCE ug/l	Benzene ug/l	Toluene ug/l	EthylBen ug/l	Xylene ug/l
Air Sample	0.005	0.003	0.02	<0.2	<0.1	<0.1	<0.1
GP-1-2'	5000	3100	19000	<35	340	400	370
GP-1-5.5'	2100	1100	4800	<18	10	<12	17
GP-2-6'	1600	540	2400	<34	<2	<2	<2
GP-2-2'	12000	1500	8500	<420	1300	340	500
GP-3-2'	8100	2400	6000	<68	140	14	82
GP-3-6'	830	260	1800	<17	<2	<2	<2
GP-5-2'	1100	210	740	<17	6	<2	7
GP-5-6'	450	77	400	<7	<2	<2	<2
GP-6-2'	450	290	2500	<4	<2	<2	<2
GP-6-6'	1100	290	5300	<4	<2	<2	<2
GP-6-9'	2100	680	16000	<35	160	120	72
GP-7-2'	670	830	26000	<4	8	2	57
GP-7-6'	1100	440	2500	<4	<2	<2	<2
GP-7-9'	1000	680	2000	<17	12	<2	8
GP-8-2'	700	980	9600	<17	4	<2	7
GP-8-6'	770	240	1400	<17	<2	<2	<2
GP-8-9'	820	140	1200	<17	15	<4	36
GP-10-2'	930	340	2800	<17	6	<2	<2
GP-11-3'	3	0.5	2	<0.3	<0.2	<0.2	<0.2
GP-12-4'	0.7	0.3	0.9	<0.2	<0.1	<0.1	<0.1
GP-13-3'	0.2	0.06	0.6	<0.2	<0.1	<0.1	<0.1
GP-14-4'	21	57	320	<2	<1	<1	<1
GP-15-4'	58	<49	610	<2	<1	<1	<1
GP-16-4'	350	110	1900	<3	<2	<2	<2
GP-17-4'	270	170	1300	<3	<2	<2	<2
GP-18-4'	130	57	260	<2	<0.2	<0.2	<0.2
GP-19-4'	67	21	61	<2	<0.2	<0.2	<0.2
GP-20-3'	136	14	40	<0.8	2	<0.6	4
GP-21-4'	0.2	0.4	4	<0.3	<0.2	<0.2	<0.2
GP-22-4'	0.04	0.1	0.8	<0.3	<0.2	<0.2	<0.2
GP-23-3'	0.1	0.005	0.7	<0.2	<0.1	<0.1	<0 1
GP-24-2.5'	0.01	0.03	0.1	<0.2	<0.1	<0.1	<0.1
GP-25-4'	0.01	0.08	0.2	<0.2	<0.1	<0.1	<0.1
GP-26-4'	0.1	<0.01	2	<0.2	<0.1	<0.1	<0.1
GP-27-4'	0.4	0.005	0.8	<0.2	<0.1	<0.1	<0.1
GP-28-4'	2	2	16	<0.3	<0.2	<0.2	<0.2
GP-29-4'	4	8	23	<0.3	<0.2	<0.2	<0.2
GP-30-4'	1	2	6	<0.2	<0.1	<0.1	<0.1
GP-31-3'	23	15	25	<0.3	<0.2	<0.2	<0.2
GP-32-4'	23	20	7	<0.3	<0.2	<0.2	<0.2
GP-33-4'	5	76	4	<0.3	<0.2	<0.2	<0.2
GP-34-2.5'	2	2	0.3	<0.2	<0.1	<0.1	<0.1

TABLE 2

ENVIROTEK II SITE
TONAWANDA, NEW YORK
SUMMARY OF SOIL BORING ANALYTICAL RESULTS
STILL DISCHARGE AREA
OCTOBER 1990

VOLATILE ORGANIC COMPOUNDS	B-1 (4-6)	B-2 (6-8)	B-3 (6-8)	B-4 (8-10)	B-5 (8-10)	B-6 (8-10)
1,2-Dichloroethene (total)	--	--	--	2.2	14	--
1,1,1-Trichloroethane	BMDL	--	BMDL	1.2	14	BMDL
Trichloroethene	BMDL	--	BMDL		3.6	BMDL
Tetrachloroethene	145	128	7.8	1.3	13	121
Toluene	--	--	--	1.2	82	BMDL
Ethylbenzene	9.9	BMDL	--	10	27	--
Xylene (total)	106	397	--	50	126	41

SEMI VOLATILE ORGANIC COMPOUNDS	B-1 (4-6)	B-2 (6-8)	B-3 (6-8)	B-4 (8-10)	B-5 (8-10)	B-6 (8-10)
2-Methylphenol	--	--	--	BMDL	--	--
2,4-Dimethylphenol	--	--	--	--	--	BMDL
Napthalene	--	1800	--	--	--	BMDL
2-Methylnapthalene	--	BMDL	--	--	--	--
Acenaphthene	--	BMDL	--	--	--	--
Fluorene	--	2900	--	--	--	--
Phenanthrene	BMDL	18000	--	BMDL	--	--
Anthracene	--	BMDL	--	--	--	--
Di-n-Butylphthalate	--	BMDL	--	--	--	--
Fluoranthene	--	3700	--	--	--	--
Pyrene	BMDL	24000	--	BMDL	BMDL	BMDL
Benzo(a)Anthracene	--	BMDL	--	--	--	--
Chrysene	--	1700	--	BMDL	BMDL	BMDL
Bis(2-Ethylhexyl)Phthalate	4000	9000	BMDL	BMDL	BMDL	BMDL
Benzo(b)Fluoranthene	--	1800	--	--	--	--
Benzo(k)Fluoranthene	--	BMDL	--	--	--	--
Benzo(a)Pyrene	--	BMDL	--	--	--	--
Indeno (1,2,3-cd)Pyrene	--	BMDL	--	--	--	--
Benzo(g,h,i)Perylene	--	BMDL	--	--	--	--

Notes:

Concentrations presented in mg/kg.
-- = Not detected.
BMDL = Below Method Detection Limit

TABLE 2
(Cont'd)

ENVIROTEK II SITE
TONAWANDA, NEW YORK
SUMMARY OF ANALYTICAL RESULTS
STILL DISCHARGE AREA
OCTOBER 1990

INORGANIC COMPOUNDS	B-1 (4-6)	B-2 (6-8)	B-3 (6-8)	B-4 (8-10)	B-5 (8-10)	B-6 (8-10)
Aluminum	36100	20100	41200	36500	50400	48700
Antimony	2.9 BN	13.4 BN	2.7 BWN	6.2 BN	3.2 BWN	4.6 BWN
Arsenic	28.4 N	19.1 N	6.8 BN	12.0 N	5.7 BN	4.4 BN
Barium	199	131	325	283	271	608
Beryllium	0.20 U	3.2	8.4	8.1	10.8	10.7
Cadmium	11.8 N*	10.2 N*	3.1 N*	1.2 N*	4.6 N*	6.2 N*
Calcium	85900	29400	103000	143000	127000	118000
Chromium	62.2 N*	112 N*	118 N*	12.4 N*	16 N*	24.8 N*
Cobalt	7.6 B	5.3 B	5.1 B	3.7 B	4.6 B	4.7 B
Copper	98.9	253	79.7	9.7	23.2	30.3
Iron	118000 E*	77100 E*	60400 E*	55600 E*	51900 E*	60900 E*
Lead	769 *	1870 *	196 *	97.7 *	518 *	515 *
Magnesium	13100	5200	35400	38500	48600	51400
Manganese	2070 E*	1760 E*	5110 E*	4090 E*	3490 E*	3680 E*
Mercury	0.95	3.0	0.12 U	0.12 U	0.15 U	0.14 U
Nickel	14.4 N	28.7 N	16.5 N	3.0 BN	4.6 BN	5.7 BN
Potassium	2310	907 B	2100	2540	2660	2860
Selenium	4.1 B	2.7 B	4.7 B	5.2 B	5.3 B	5.3 B
Silver	1.0 UN	1.2 UN	1.0 UN	0.85 UN	1.3 UN	1.2 N
Sodium	451 B	326 B	663 B	697 B	870 B	916 B
Thallium	0.23 UWN	0.25 UWN	0.24 UWN	0.21 UWN	0.27 UWN	0.25 UWN
Vanadium	34.5 N*	58.1 N*	43.9 N*	32.9 N*	57.6 N*	3.7 UN*
Zinc	3010 *	4350 *	515 *	222 *	1550 *	1360 *
MISCELLANEOUS COMPOUNDS						
Total cyanide	4.0	5.5	6.1	5.7	13	11
Total recoverable petroleum hydrocarb	1250	10600	230	8910	10600	16800

Notes:

Concentrations reported in mg/kg.
U = Not detected.
B = Concentration less than Contract Required Detection Limit, but greater than or equal to the Instrument Detection Limit.
E = Reported value is estimated due to the presence of interference(s).
N = Spike sample recovery not within control limits.
W = Post-digestion spike for Furnance AA analysis is out of control limits (85-115%), while sample absorbance is less than 50% of spike absorbance.
* = Duplicate analysis not within control limits.

TABLE 3

SUMMARY OF ANALTYICAL RESULTS
AIR SAMPLES
VAPOR EXTRACTION PILOT TEST
ENVIROTEK II SITE
TONAWANDA, NEW YORK

OCTOBER 1990

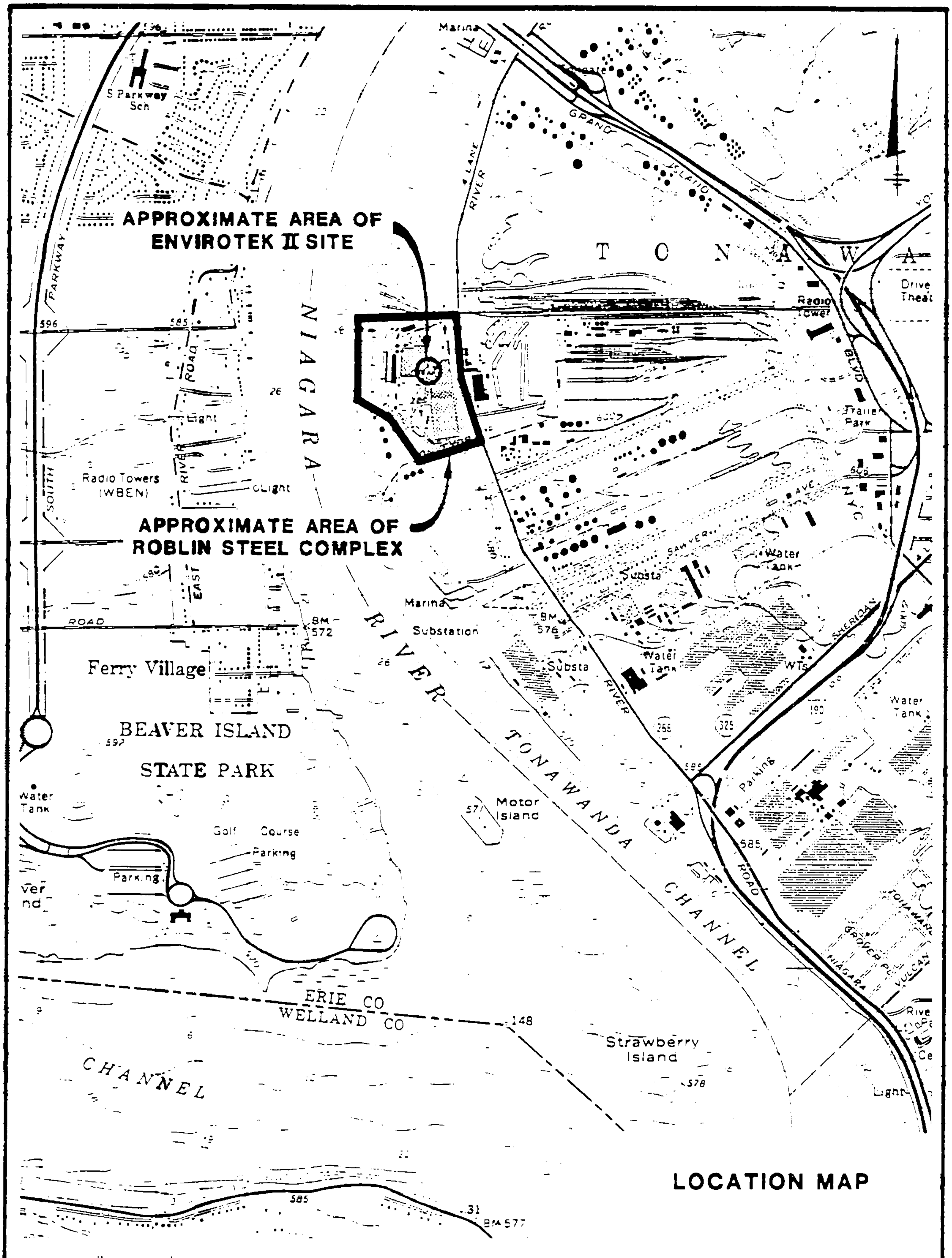
Compound	Pre-Carbon Air Sample					Post-Carbon Air Sample	
	VS-1	VS-2	VS-3	VS-4	VS-5	VS-6	Duplicate RVS-6
Time of Sample Collection (Hours Since Start of Test)	1 Hr.	4 Hr.	8 Hr.	12 Hr.	23 Hr.	23 Hr.	27 Hr.
Trichlorofluoromethane	0.28	1.48	0.31	0.15	0.15	0.06	<.05
1,1-Dichloroethene	100.36	11.92	61.67	56.38	53.56	<1.0	<1.0
Cis-1,2-dichloroethene	66.34	8.93	39.52	37.53	39.05	<1.0	<1.0
1,1,1-Trichloroethane	223.09 E	29.96	209.24	181.21	187.63	<1.0	<1.0
Trichloroethene	109.69	18.66	68.09	63.97	71.04	1.12	<1.0
1,1,2-Trichloroethane	0.86	<0.05	0.72	0.66	0.85	<0.05	<1.0
Tetrachloroethene	219.43 E	175.73 E	206.43 E	209.74 E	202.68 E	15.53	0.2
trans 1,2-dichloroethene	3.08	<1.0	5.51	6.08	6.54	<1.0	<0.1
Toluene	<1.0	1.3	1.5	1.7	1.7	<1.0	--
Xylenes (Total)	1.8	3.3	3.5	3.7	4.1	<1.0	--
Chlorobenzene	<1.0	2.0	<1.0	<1.0	<1.0	<1.0	--
Methyl tertiary butyl ether	6.0	4.6	3.9	3.7	<1.0	<1.0	--
Chloroform	0.34	<0.1	0.28	0.27	0.28	<0.1	--

Notes:

Concentrations reported in ug/l.
Injection volume 100 ug/l (this replaced 800 ug/l) injuection on previous analyses of same samples.
E = Denotes peak exceeded dynamic range of equipment.
-- = Not analyzed.

Figures

FIGURE 1


APPROXIMATE AREA OF ENVIROTEK II SITE

APPROXIMATE AREA OF ROBLIN STEEL COMPLEX

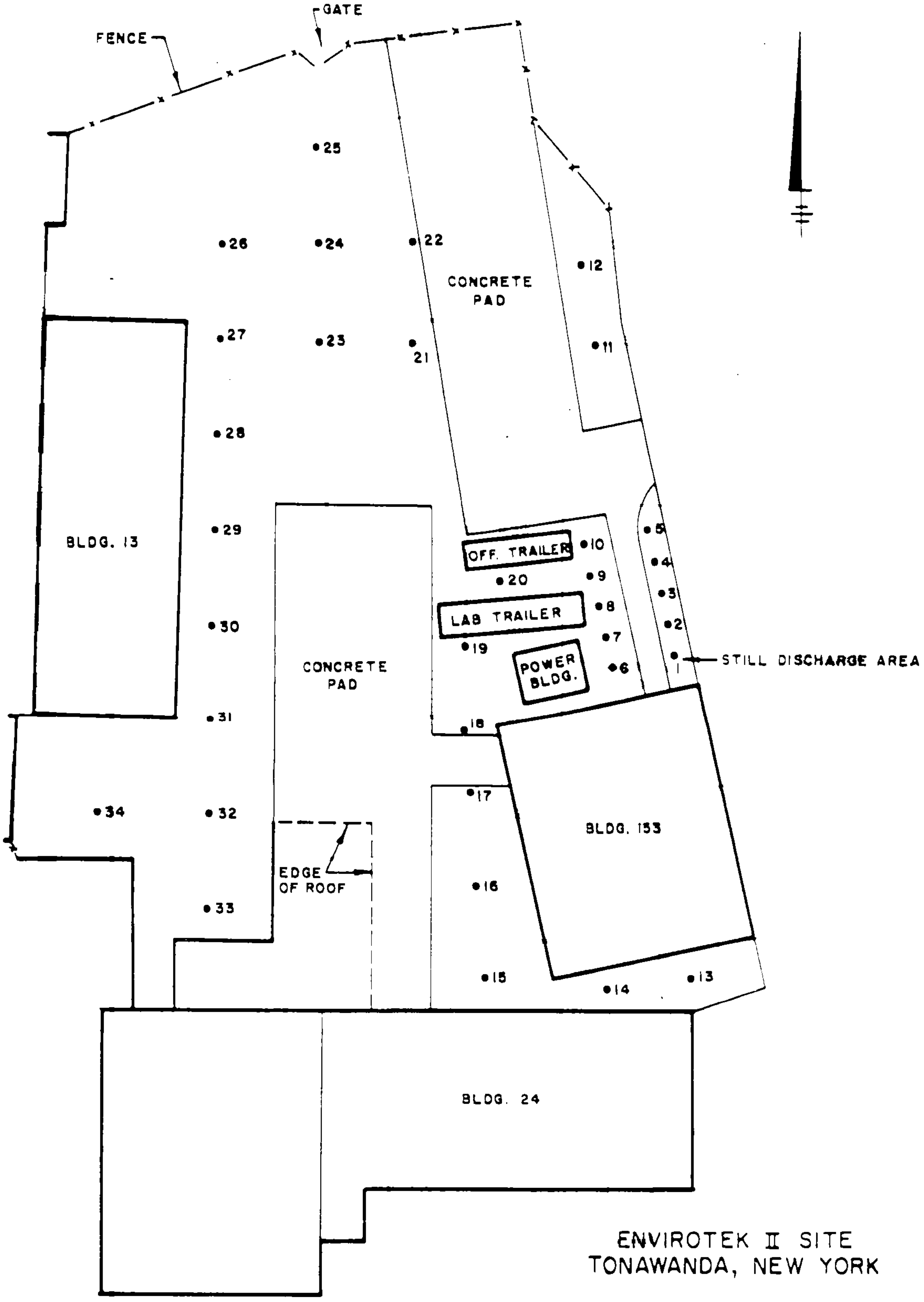
LOCATION MAP

SCALE: 1" = 2000'

6/90
580.01.06

BLASLAND & BOUCK ENGINEERS, P.C.
ENGINEERS & GEOSCIENTISTS

FIGURE 2



ENVIROTEK II SITE
TONAWANDA, NEW YORK

LEGEND

● SOIL GAS SAMPLE LOCATION

SOIL GAS SAMPLE LOCATIONS

SCALE
0 50'

NOTE: SAMPLES WERE NOT COLLECTED AT POINTS 4 AND 9

(9/11/90)

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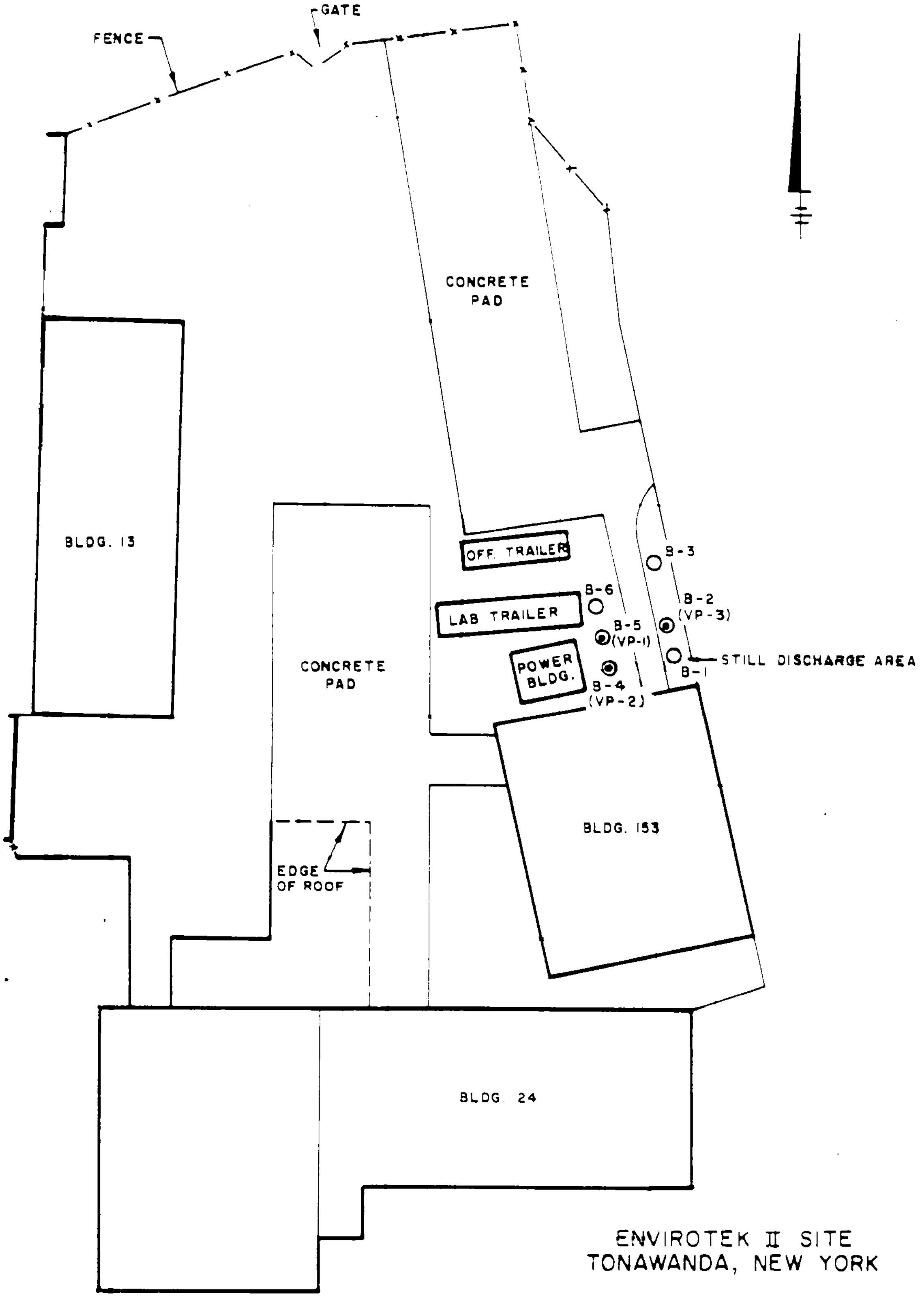
ENGINEERS & GEOSCIENTISTS

FIGURE 3



ENVIROTEK II SITE
TONAWANDA, NEW YORK

SOIL BORING AND VAPOR PROBE LOCATION MAP

LEGEND

○ SOIL BORING LOCATION

◉ SOIL BORING LOCATION WITH VAPOR PROBE INSTALLED

SCALE

0 50'

(10/22/90)

BLASLAND & BOUCK ENGINEERS, P.C.
ENGINEERS & GEOSCIENTISTS

Appendices

APPENDIX A

SOIL GAS INVESTIGATION REPORT
TRACER RESEARCH CORP.

Tracer Research Corporation

PREPARED FOR:

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SHALLOW SOIL GAS INVESTIGATION
ENVIROTEK II SITE
TONAWANDA, NEW YORK

SEPTEMBER 1990

SUBMITTED BY:
Karen S. Suess
Tracer Research Corporation

750ENVIR.MSG
2-90-750-S

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INTRODUCTION

A shallow soil gas investigation was performed by Tracer Research Corporation (TRC) at the Envirotek II site located in Tonawanda, New York. The investigation was conducted September 7-9, 1990 under contract to Blasland & Bouck Engineers, P.C. The purpose of the investigation was to determine the areal extent of possible shallow subsurface contamination near a solvent recovery overspill area.

During this survey, a total of forty-two soil gas samples were collected and analyzed. Samples were analyzed for volatile organic compounds from the following suite:

benzene
toluene
ethylbenzene
xylenes
total hydrocarbons (THC)
1,1,1-trichloroethane (TCA)
trichloroethene (TCE)
tetrachloroethene (PCE)

Xylenes are reported as the total of the three xylene isomers and total hydrocarbons are reported as gasoline range compounds consisting of approximately C_4-C_9 aliphatic, alicyclic and aromatic compounds.

The compounds in this suite were chosen as target compounds because of their suspected presence in the subsurface and amenability to soil gas technology. Soil gas samples were screened on a gas chromatograph equipped with a flame ionization detector (FID) and electron capture detector (ECD).

SHALLOW SOIL GAS INVESTIGATION - METHODOLOGY

Shallow soil gas investigation refers to a method developed by TRC for investigating underground contamination from volatile organic chemicals (VOCs) such as industrial solvents, cleaning fluids and petroleum products by looking for their vapors in the shallow soil gas. The method involves pumping a small amount of soil gas out of the ground through a hollow probe driven into the ground and analyzing the gas for the presence of volatile contaminants. The presence of VOCs in shallow soil gas indicates the observed compounds may either be in the vadose zone near the probe or in groundwater below the probe. The soil gas technology is most effective in mapping low molecular weight halogenated solvent chemicals and petroleum hydrocarbons possessing high vapor pressures and low aqueous solubilities. These compounds readily partition out of the groundwater and into the soil gas as a result of their high gas/liquid partitioning coefficients. Once in the soil gas, VOCs diffuse vertically and horizontally through the soil to the ground surface where they dissipate into the atmosphere. The contamination acts as a source and the above ground atmosphere acts as a sink, and typically a concentration gradient develops between the two. The concentration gradient in soil gas between the source and ground surface may be locally distorted by hydrologic and geologic anomalies (e.g. clays, perched water); however, soil gas mapping generally remains effective because distribution of the contamination is usually broader in areal extent than the local geologic barriers and is defined using a large data base. The presence of geologic obstructions on a small scale tends to create anomalies in the soil gas-groundwater correlation, but generally does not obscure the broader areal picture of the contaminant distribution.

Soil gas contaminant mapping helps to reduce the time and cost required to delineate underground contamination by volatile contaminants. The soil gas investigation does this by outlining the general areal extent of contamination. Conventional bore holes or observation wells are used to verify both the presence and extent of the subsurface contamination as indicated in the soil gas survey. In this manner, soil gas contaminant mapping can assist in determining the placement of monitoring wells. Thus, the likelihood of drilling unnecessary monitoring wells is reduced. The soil gas survey is not intended to be a substitute for conventional methodology, but rather to enable conventional methods to be used efficiently.

EQUIPMENT

Tracer Research Corporation utilized a one ton Ford analytical field van that was equipped with one gas chromatograph and two Spectra Physics computing integrators. In addition, the van has two built-in gasoline powered generators that provide the electrical power (110 volts AC) to operate all of the gas chromatographic instruments and field equipment. There was not sufficient access to the sampling locations for the field van. Therefore, the sampling probes were hand pounded into the ground.

SAMPLING PROCEDURES

Sampling probes consist of 7-14 foot lengths of 3/4 inch diameter hollow steel pipe that are fitted with detachable drive tips. Soil gas probes were advanced 2-9 feet below grade. Once inserted into the ground, the above-ground end of the sampling probes were fitted with a steel reducer and a length of polyethylene tubing leading to a vacuum pump. Gas flow is monitored by a vacuum gauge to insure that an adequate flow is obtained.

To adequately purge the volume of air within the probe, 2 to 5 liters of gas is evacuated with a vacuum pump. During the soil gas evacuation, samples are collected in a glass syringe by inserting a syringe needle through a silicone rubber segment in the evacuation line and down into the steel probe. Ten milliliters of gas are collected for immediate analysis in the TRC analytical field van. Soil gas is subsampled (duplicate injections) in volumes ranging from 1 uL to 2 mL, depending on the VOC concentration at any particular location.

Sample probe vacuums ranged from four to eight inches Hg. The maximum pump vacuum was measured at twenty-four inches Hg.

ANALYTICAL PROCEDURES

A Varian 3300 gas chromatograph, equipped with a flame ionization detector (FID) and an electron capture detector (ECD), was used for the soil gas analyses. The FID was used for the analysis of benzene, toluene, ethylbenzene, xylenes, and total hydrocarbons. The ECD was used for the analysis of TCA, TCE, and PCE. Compounds were separated on a 3' or 6' by 1/8" OD packed column with OV-101 as the stationary phase in a temperature controlled oven of 50°C. Nitrogen was used as the carrier gas.

Hydrocarbon and halocarbon compounds detected in the soil gas were identified by chromatographic retention time. Quantification of compounds was achieved by comparison of the detector response of the sample with the response measured for calibration standards (external standardization). Instrument calibration checks were run periodically throughout the day and system blanks were run at the beginning of the day to check for contamination in the soil gas sampling equipment. Air samples were also routinely analyzed to check for background levels in the atmosphere.

Detection limits for the compounds of interest are a function of the injection volume as well as the detector sensitivity for individual compounds. Thus, the detection limit varies with the sample size. Generally, the larger the injection size the greater the sensitivity. However, peaks for compounds of interest must be kept within the linear range of the analytical equipment. If any compound has a high concentration, it is necessary to use small injections, and in some cases to dilute the sample to keep it within linear range. This may cause decreased detection limits for other compounds in the analyses.

The detection limits for the selected compounds were approximately 0.2 ug/L (0.05 ppm) for hydrocarbons and 0.01 ug/L (0.002 ppm) for halocarbons, depending on the conditions of the measurement, in particular, the sample size. Some of the detection limits are large due to the high concentrations of detected compounds which requires small injection sizes. If any component being analyzed is not detected, the detection limit for that compound in that analysis is given as a "less than" value (e.g. <0.1 ug/L). Detection limits obtained from GC analyses are calculated from the current response factor, the sample size, and the estimated minimum peak size (area) that would have been visible under the conditions of the measurement.

QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

Tracer Research Corporation's normal quality assurance procedures were followed in order to prevent any cross-contamination of soil gas samples.

- Steel probes are used only once during the day and then washed with high pressure soap and hot water spray or steam-cleaned to eliminate the possibility of cross-contamination. Enough probes are carried on each van to avoid the need to reuse any during the day.
- Probe adaptors (TRC's patented design) are used to connect the sample probe to the vacuum pump. The adaptor is designed to eliminate the possibility of exposing the sample stream to any part of the adaptor. Associated tubing connecting the adaptor to the vacuum pump is replaced periodically as needed during the job to insure cleanliness and good fit. At the end of each day the adaptor is cleaned with soap and water and baked in the GC oven.
- Silicone tubing (which acts as a septum for the syringe needle) is replaced as needed to insure proper sealing around the syringe needle. This tubing does not directly contact soil gas samples.
- Glass syringes are usually used for only one sample per day and are washed and baked out at night. If they must be used twice, they are purged with carrier gas (nitrogen) and baked out between probe samplings.
- Injector port septa through which soil gas samples are injected into the chromatograph are replaced on a daily basis to prevent possible gas leaks from the chromatographic column.

- Analytical instruments are calibrated each day by analytical standards from Chem Service, Inc. Calibration checks are also run after approximately every five soil gas sampling locations.
- Subsampling syringes are checked for contamination prior to sampling each day by injecting nitrogen carrier gas into the gas chromatograph.
- Prior to sampling each day, system blanks are run to check the sampling apparatus (probe, adaptor, 10 cc syringe) for contamination by drawing ambient air from above ground through the system and comparing the analysis to a concurrently sampled ambient air analysis.
- All sampling and subsampling syringes are decontaminated each day and no such equipment is reused before being decontaminated. Microliter size subsampling syringes are reused only after a nitrogen carrier gas blank is run to insure it is not contaminated by the previous sample.
- Soil gas pumping is monitored by a vacuum gauge to insure that an adequate gas flow from the vadose zone is maintained. A reliable gas sample can be obtained if the sample vacuum gauge reading is at least 2 inches Hg less than the maximum pump vacuum.

RESULTS

A total of forty-two soil gas samples were collected and analyzed in the field at the Envirotek II site. Analytical data is condensed in Appendix A. Isoconcentration contour maps with sampling locations and compound concentrations (Figures 1-7) are in Appendix B. Figure 1 is a map showing the sampling locations.

Ambient air samples were collected during the course of the investigation to help evaluate the level of significance for the selected VOC's. The level of significance is simply the level above which concentrations are considered to be significant in terms of groundwater or soil contamination. TCA, TCE and PCE were detected in the ambient air samples. TCA concentrations were detected at 0.002, 0.003, and 0.004 ug/L; TCE concentrations were detected at 0.003 ug/L in two of the samples. PCE concentrations ranged from 0.0005 to 0.02 ug/L. The level of significance for each target compound is based on several factors; concentrations in ambient air, background levels, and TRC's past experience. Based on the evaluation of these factors, the level of significance for the selected target compounds was determined to be approximately 0.1 ug/L (0.1 ppm). In other words, soil gas concentrations of benzene, toluene, ethylbenzene, xylenes, THC, TCA, TCE, and PCE greater than 0.1 ug/L (0.1 ppm) may indicate possible VOC contamination in the vicinity.

All of the selected compounds, except for benzene, were detected in soil gas samples. TCA, TCE, and PCE were detected in significant concentrations over the entire survey area. The highest concentrations of halocarbons were detected in the vicinity of sampling locations 1-10. TCA concentrations ranged from 0.002 to 2,200 ppm at GP-2. TCE concentrations ranged from non-detect (<0.002 ppm) to 590 ppm at GP-1. PCE concentrations ranged from 0.02 to 3,900 ppm at GP-7. The eastern boundary of these plumes are not defined due to insufficient sampling locations.

Toluene, ethylbenzene, and xylenes were only detected in sampling locations 1-10, and 20. Concentrations at these locations ranged from 0.5 to 350 ppm for toluene, 0.5 to 94 ppm for ethylbenzene, and 0.9 to 120 ppm for xylenes. Hydrocarbons were non-detect at all remaining sampling locations. The eastern boundary of these plumes are also not defined due to insufficient sampling locations.

CONCLUSIONS

Significant concentrations of TCA, TCE, PCE, toluene, ethylbenzene, xylenes, and THC were detected in the soil gas at the Envirotek II site. The isoconcentration contours for all of the selected compounds indicate a possible source area, for subsurface contamination, to the north of Building 153. This area may coincide with the location of the solvent recovery overspill area. Further investigations are needed to define the extent of subsurface contamination to the east of Building 153.

APPENDIX A: ANALYTICAL DATA

BLASLAND & BOUCK/ENVIROTEK II/TONAWANDA, NEW YORK JOB#2-90-750-S
09-09-90
CONDENSED DATA

SAMPLE	TCA ug/l	TCE ug/l	PCE ug/l	BENZENE ug/l	TOLUENE ug/l	ETHYL BENZENE ug/l	XYLENE ug/l	THC ug/l
AIR	0.004	0.003	0.01	<0.2	<0.1	<0.1	<0.1	<0.5
GP-21-4'	0.2	0.4	4	<0.3	<0.2	<0.2	<0.2	4
GP-22-4'	0.04	0.2	0.8	<0.3	<0.2	<0.2	<0.2	<1
GP-25-4'	0.01	0.08	0.2	<0.2	<0.1	<0.1	<0.1	<0.5
GP-24-2.5'	0.02	0.03	0.2	<0.2	<0.1	<0.1	<0.1	<0.5
GP-23-3'	0.1	0.005	0.8	<0.2	<0.1	<0.1	<0.1	5
GP-27-4'	0.4	0.005	0.8	<0.2	<0.1	<0.1	<0.1	<0.5
GP-26-4'	0.1	<0.01	2	<0.2	<0.1	<0.1	<0.1	<0.5
GP-28-4'	2	2	16	<0.3	<0.2	<0.2	<0.2	8
GP-29-4'	4	8	22	<0.3	<0.2	<0.2	<0.2	11
GP-30-4'	1	2	6	<0.2	<0.1	<0.1	<0.1	5
GP-31-3'	23	14	25	<0.3	<0.2	<0.2	<0.2	40
GP-34-2.5'	2	2	0.2	<0.2	<0.1	<0.1	<0.1	1
GP-32-4'	23	20	8	<0.3	<0.2	<0.2	<0.2	22
GP-33-4'	5	80	4	<0.3	<0.2	<0.2	<0.2	34
GP-19-4'	70	22	61	<2	<0.2	<0.2	<0.2	60
GP-18-4'	130	57	270	<2	<0.2	<0.2	<0.2	170
GP-17-4'	270	170	1300	<3	<2	<2	<2	530
GP-16-4'	350	110	1900	<3	<2	<2	<2	1300
GP-15-4'	60	<49	610	<2	<1	<1	<1	290
GP-14-4'	20	60	320	<2	<1	<1	<1	130
GP-13-3'	0.2	0.06	0.6	<0.2	<0.1	<0.1	<0.1	3
GP-12-4'	0.7	0.3	0.9	<0.2	<0.1	<0.1	<0.1	2

Analyzed by: K. Ptak
Checked by: S. Cherba
Proofed by: ____________

BLASLAND & BOUCK/ENVIROTEK II/TONAWANDA, NEW YORK JOB#2-90-750-S

09/07/90

CONDENSED DATA

SAMPLE	TCA ug/l	TCE ug/l	PCE ug/l	BENZENE ug/l	TOLUENE ug/l	ETHYL BENZENE ug/l	XYLENE ug/l	THC ug/l
AIR	**0.005**	**0.003**	**0.02**	**<0.2**	**<0.1**	**<0.1**	**<0.1**	**<0.5**
GP-1-2'	5000	3100	19000	<35	340	400	370	9100
GP-1-5.5'	**2100**	**1100**	**4800**	<18	**10**	**<12**	**17**	**2700**
GP-6-2'	450	290	2500	<4	<2	<2	<2	1200
GP-6-6'	1100	290	5300	<4	<2	<2	<2	1800
GP-6-9'	**2100**	**680**	**16000**	**<35**	**160**	120	72	4100
GP-7-2'	670	830	26000	<4	8	2	57	5400
GP-7-6'	1100	440	2500	<4	<2	<2	<2	1700
09/08/90								
AIR	0.002	<0.0004	0.0005	<0.2	<0.1	<0.1	<0.1	<0.5
GP-7-9'	1000	680	2000	<17	12	<2	8	1400
GP-2-6'	1600	540	2400	<34	<2	<2	<2	2200
GP-2-2'	12000	1500	8500	<420	1300	340	500	16000
GP-3-2'	8100	2400	6000	<68	140	14	82	6300
GP-3-6'	830	260	1800	<17	<2	<2	<2	880
GP-8-2'	700	980	9600	<17	4	<2	7	940
GP-8-6'	770	240	1400	<17	<2	<2	<2	1200
GP-8-9'	820	140	1200	<17	15	<4	36	900
GP-10-2'	930	340	2800	<17	6	<2	<2	300
GP-5-2'	1100	210	740	<17	6	<2	7	1100
GP-5-6'	450	77	400	<7	<2	<2	<2	310
GP-11-3'	3	0.5	2	<0.3	<0.2	<0.2	<0.2	6
GP-20-3'	136	14	40	<0.8	2	<0.6	4	100

Analyzed by: K. Ptak
Checked by: S. Cherby
Proofed by:

BLASLAND & BOUCK/ENVIROTEK II/TONAWANDA, NEW YORK JOB#2-90-750-S
09/07/90
CONDENSED DATA

SAMPLE	TCA ppm	TCE ppm	PCE ppm	BENZENE ppm	TOLUENE ppm	ETHYL BENZENE ppm	XYLENE ppm
GP-1-2'	940	590	2900	<11	92	94	87
GP-1-5.5'	390	210	720	<6	3	<3	4
GP-6-2'	84	55	380	<1	<0.5	<0.5	<0.5
GP-6-6'	210	55	800	<1	<0.5	<0.5	<0.5
GP-6-9'	390	130	2400	<11	43	28	17
GP-7-2'	120	160	3900	<1	2	0.5	13
GP-7-6'	210	84	380	<1	<0.5	<0.5	<0.5
09/08/90							
GP-7-9'	190	130	300	<5	3	<0.5	2
GP-2-6'	300	100	360	<11	<0.5	<0.5	<0.5
GP-2-2'	2200	280	1300	<130	350	80	120
GP-3-2'	1500	460	900	<22	38	3	19
GP-3-6'	160	49	270	<5	<0.5	<0.5	<0.5
GP-8-2'	130	190	1400	<5	1	<0.5	2
GP-8-6'	140	46	210	<5	<0.5	<0.5	<0.5
GP-8-9'	150	27	180	<5	4	<0.9	8
GP-10-2'	170	65	420	<5	1	<0.5	<0.5
GP-5-2'	210	40	110	<5	1	<0.5	2
GP-5-6'	84	15	60	<2	<0.5	<0.5	<0.5
GP-11-3'	0.6	0.1	0.3	<0.1	<0.05	<0.05	<0.05
GP-20-3'	25	3	6	<0.2	0.5	<0.1	0.9

Analyzed by: K. Ptak
Checked by: S. Cherba
Proofed by: ______

BLASLAND & BOUCK/ENVIROTEK II/TONAWANDA, NEW YORK JOB#2-90-750-S
09-09-90
CONDENSED DATA

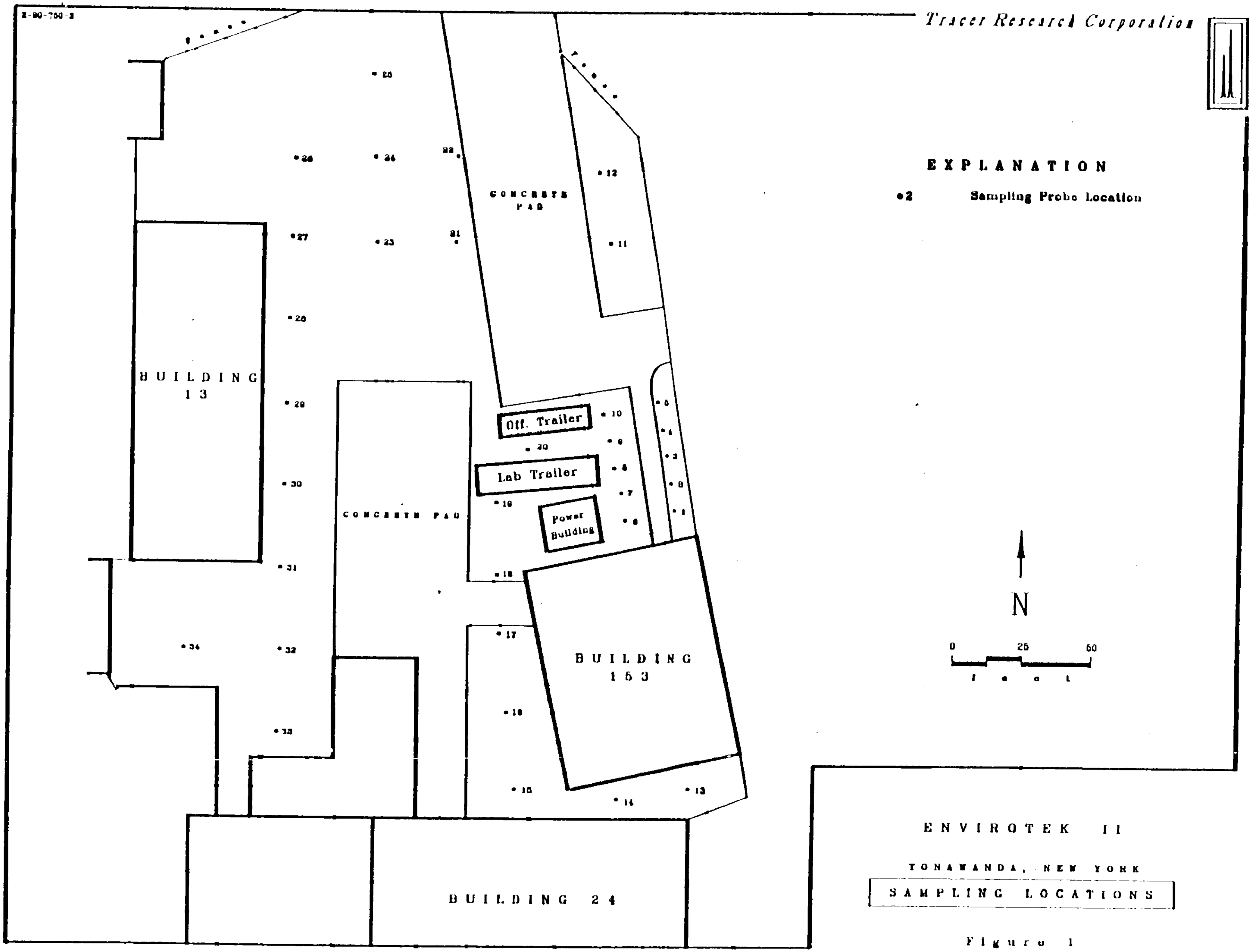
SAMPLE	TCA ppm	TCE ppm	PCE ppm	BENZENE ppm	TOLUENE ppm	ETHYL BENZENE ppm	XYLENE ppm
GP-21-4'	0.04	0.08	0.6	<0.1	<0.05	<0.05	<0.05
GP-22-4'	0.007	0.02	0.1	<0.1	<0.05	<0.05	<0.05
GP-25-4'	0.002	0.02	0.03	<0.06	<0.03	<0.02	<0.02
GP-24-2.5'	0.002	0.006	0.02	<0.06	<0.03	<0.02	<0.02
GP-23-3'	0.02	0.001	0.1	<0.06	<0.03	<0.02	<0.02
GP-27-4'	0.07	0.001	0.1	<0.06	<0.03	<0.02	<0.02
GP-26-4'	0.02	<0.002	0.3	<0.06	<0.03	<0.02	<0.02
GP-28-4'	0.4	0.4	2	<0.1	<0.05	<0.05	<0.05
GP-29-4'	0.7	2	3	<0.1	<0.05	<0.05	<0.05
GP-30-4'	0.2	0.4	0.9	<0.06	<0.03	<0.02	<0.02
GP-31-3'	4	3	4	<0.1	<0.05	<0.05	<0.05
GP-34-2.5'	0.4	0.4	0.04	<0.06	<0.03	<0.02	<0.02
GP-32-4'	4	4	1	<0.1	<0.05	<0.05	<0.05
GP-33-4'	0.9	14	0.6	<0.1	<0.05	<0.05	<0.05
GP-19-4'	12	4	9	<0.6	<0.05	<0.05	<0.05
GP-18-4'	24	11	39	<0.6	<0.05	<0.05	<0.05
GP-17-4'	50	32	200	<1	<0.5	<0.5	<0.5
GP-16-4'	66	21	290	<1	<0.5	<0.5	<0.5
GP-15-4'	11	<9	92	<0.6	<0.3	<0.2	<0.2
GP-14-4'	4	11	48	<0.6	<0.3	<0.2	<0.2
GP-13-3'	0.04	0.01	0.09	<0.06	<0.03	<0.02	<0.02
GP-12-4'	0.1	0.06	0.1	<0.06	<0.03	<0.02	<0.02

Analyzed by: K. Ptak
Checked by: S. Cherba
Proofed by: ______________

APPENDIX B: FIGURES

E-80-750-2

Tracer Research Corporation



EXPLANATION

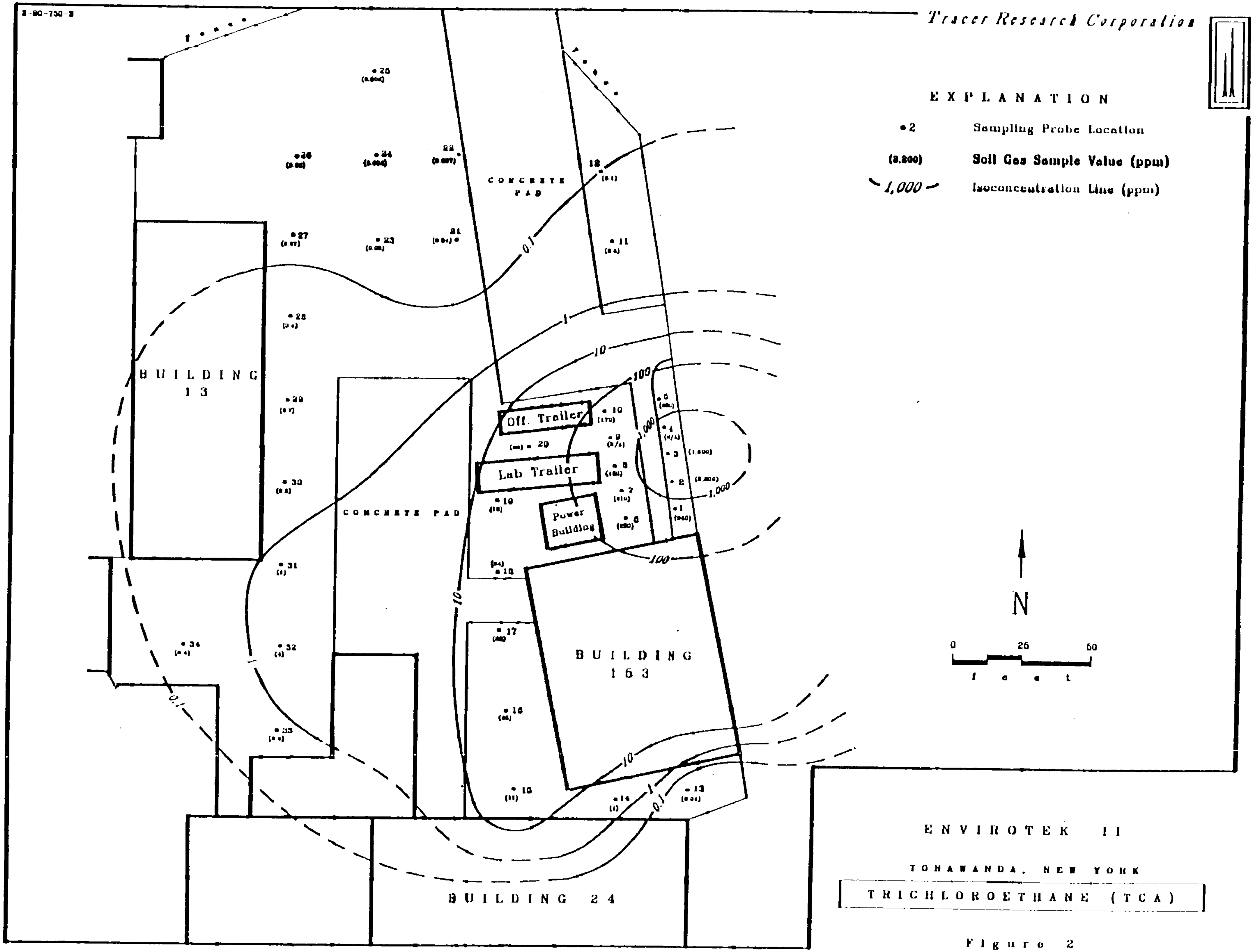
●2 Sampling Probe Location

ENVIROTEK II

TONAWANDA, NEW YORK

SAMPLING LOCATIONS

Figure 1

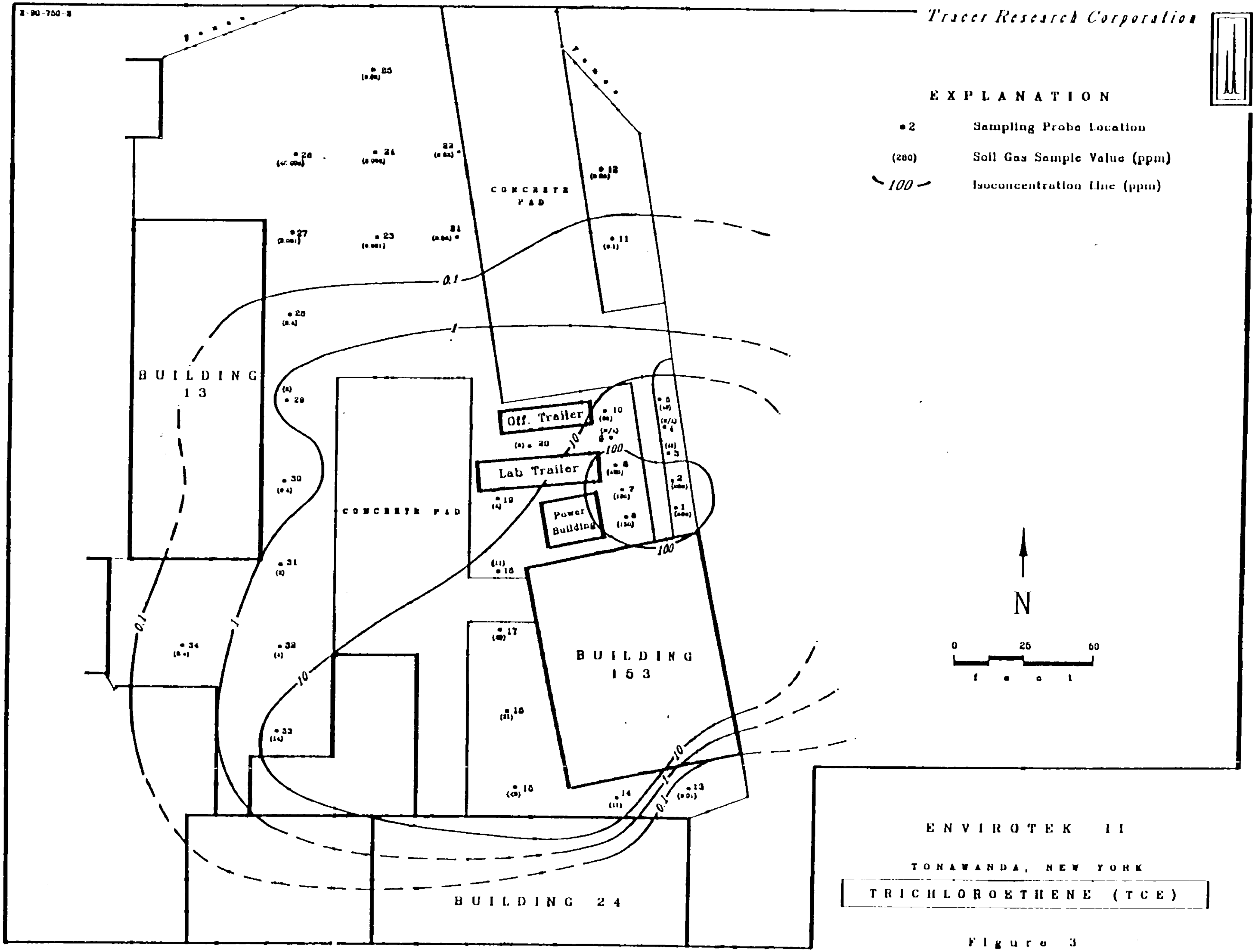


ENVIROTEK II

TONAWANDA, NEW YORK

TRICHLOROETHANE (TCA)

Figure 2

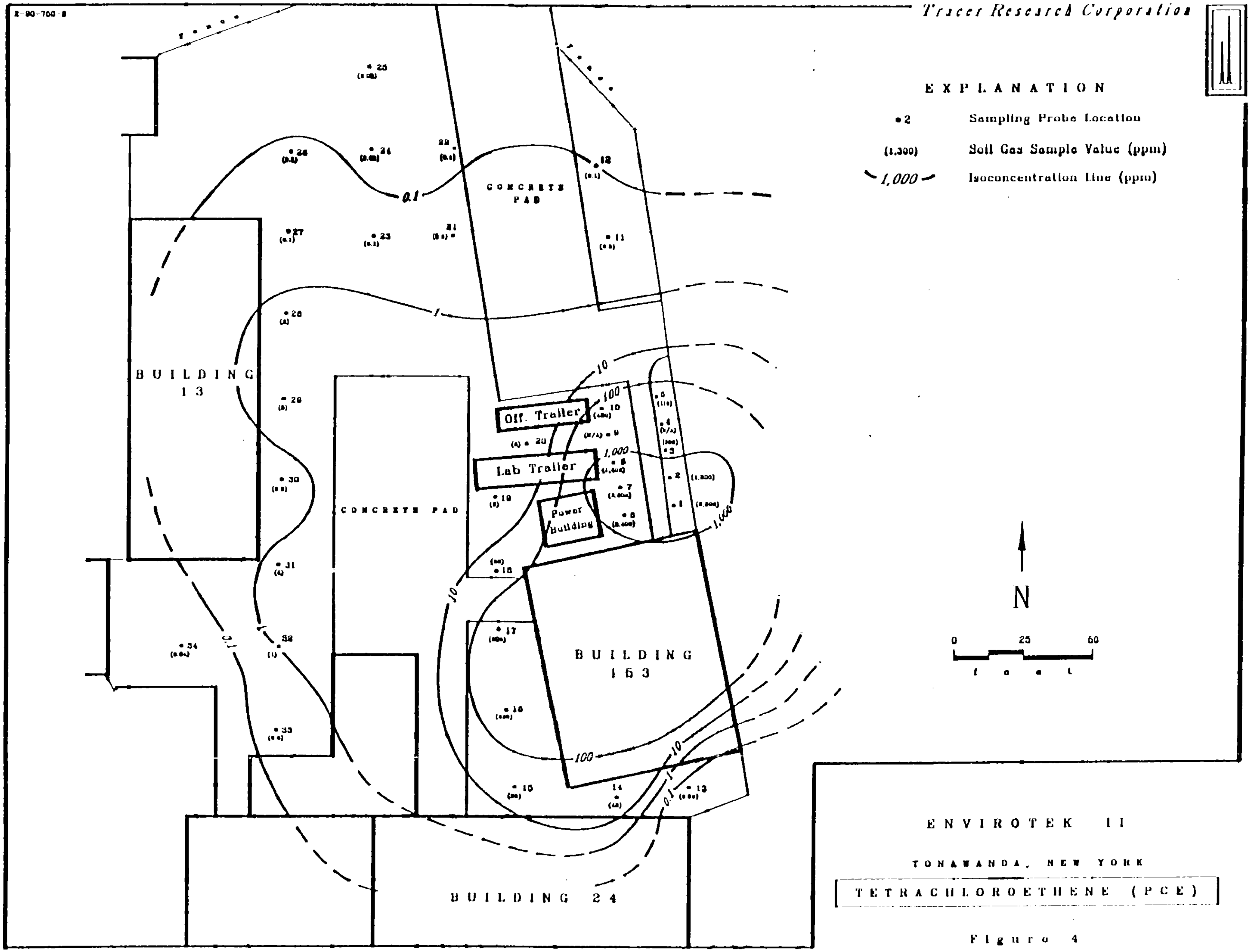


ENVIROTEK II

TONAWANDA, NEW YORK

TRICHLOROETHENE (TCE)

Figure 3

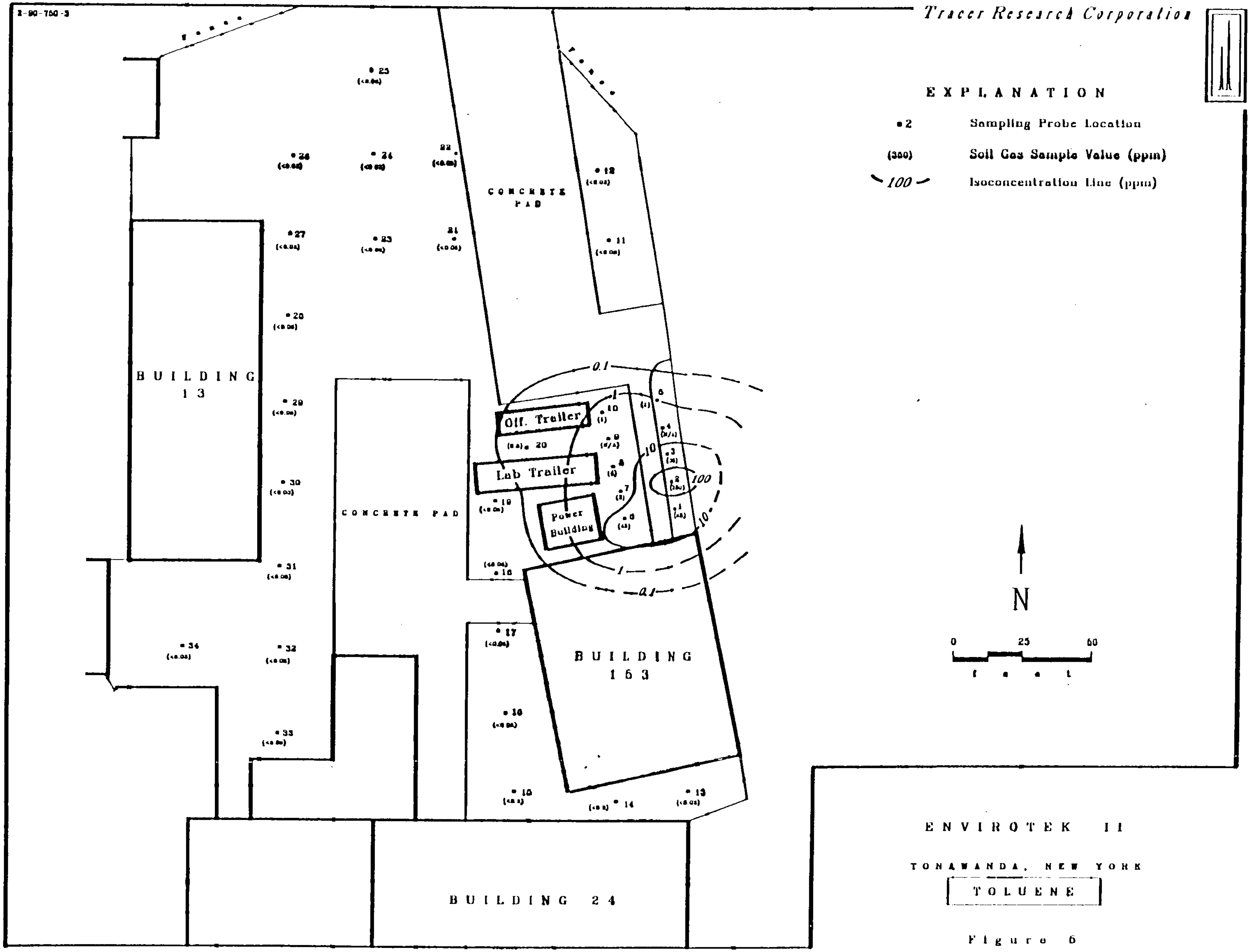


ENVIROTEK II

TONAWANDA, NEW YORK

TETRACHLOROETHENE (PCE)

Figure 4



EXPLANATION

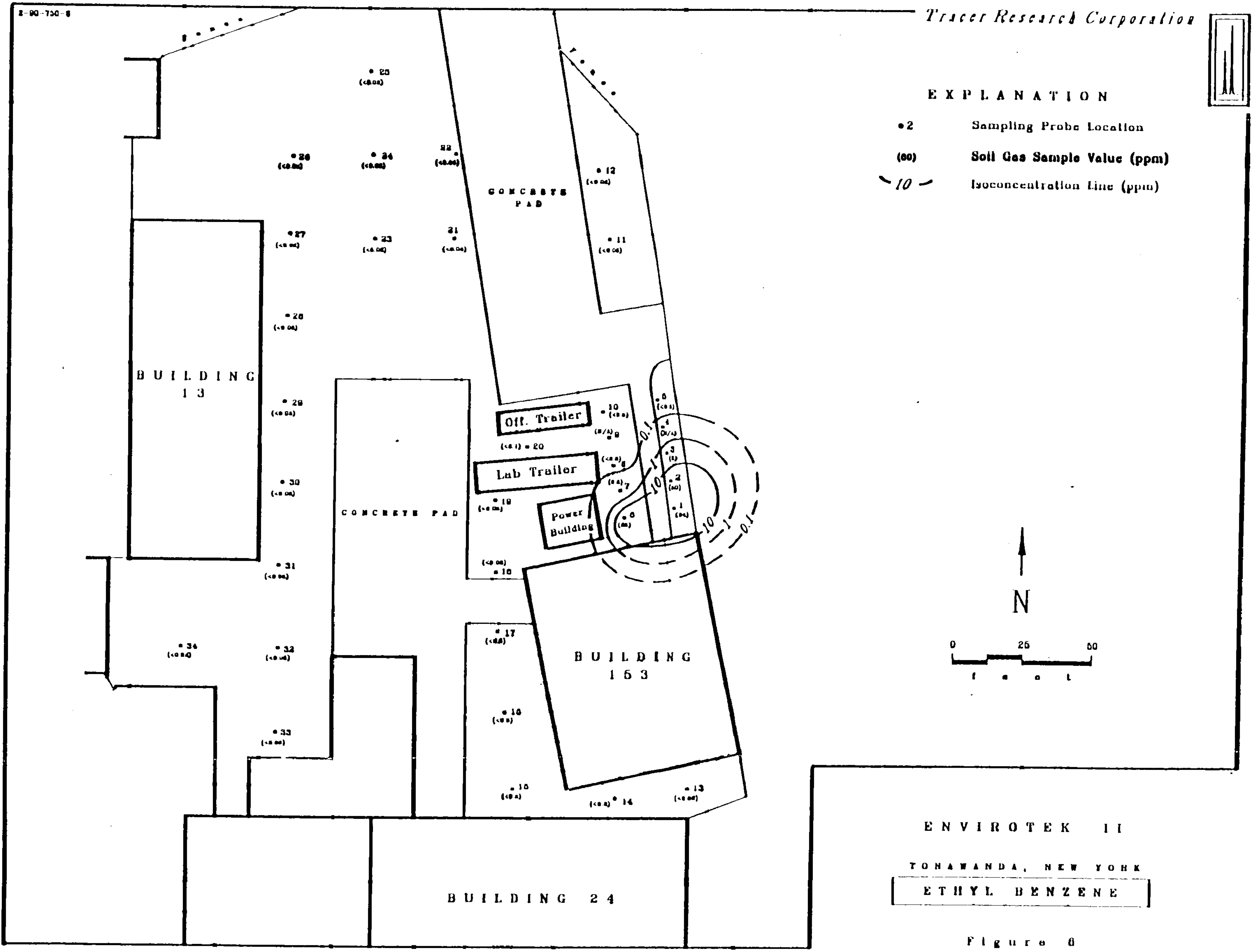
• 2	Sampling Probe Location
(380)	**Soil Gas Sample Value (ppm)**
100	Isoconcentration Line (ppm)

ENVIROTEK II

TONAWANDA, NEW YORK

TOLUENE

Figure 6



Tracer Research Corporation

EXPLANATION

•2 Sampling Probe Location

(00) Soil Gas Sample Value (ppm)

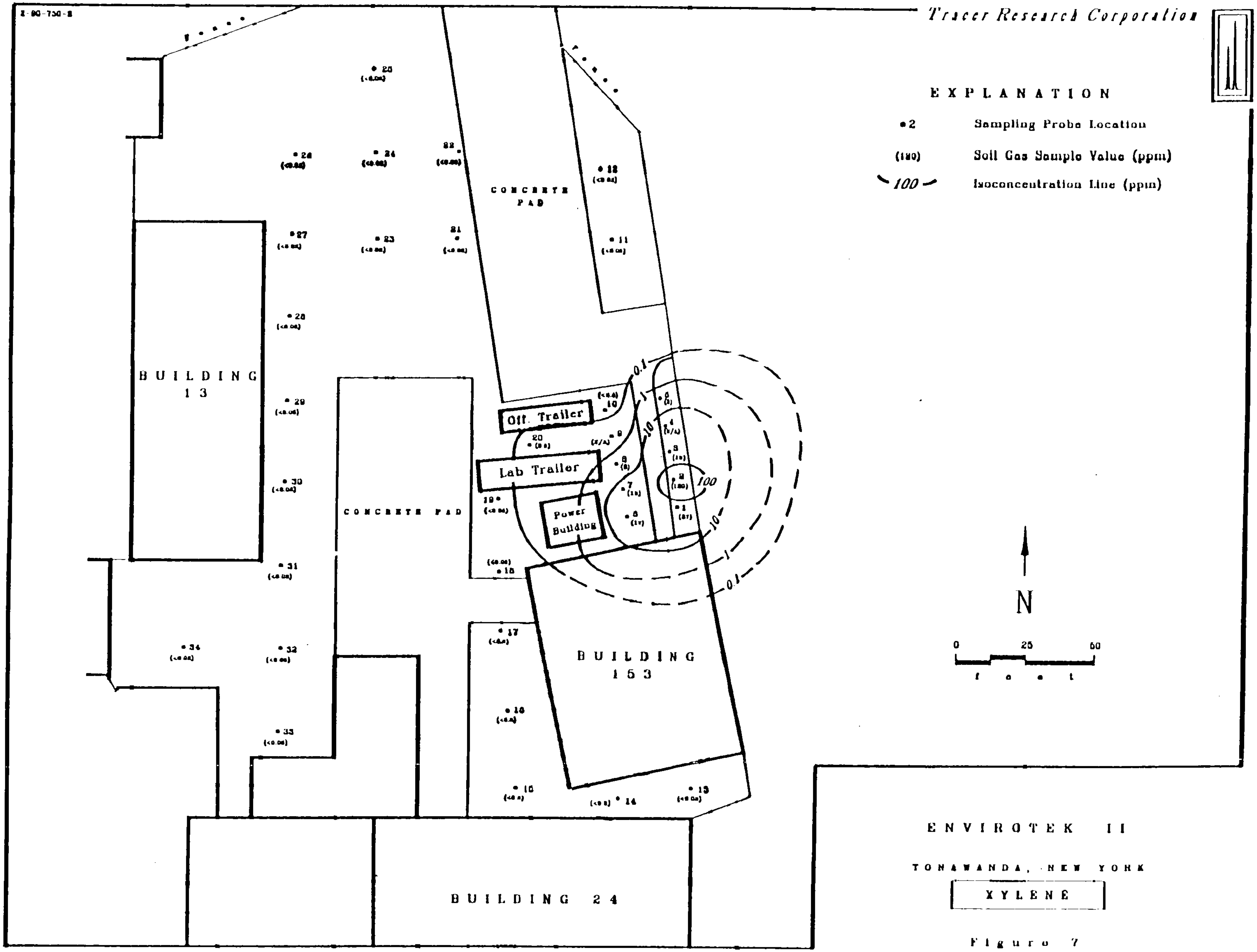
10 Isoconcentration Line (ppm)

ENVIROTEK II

TONAWANDA, NEW YORK

ETHYL BENZENE

Figure 6



ENVIROTEK II

TONAWANDA, NEW YORK

XYLENE

Figure 7

APPENDIX B

BORING LOGS AND VAPOR PROBE CONSTRUCTION DETAILS

SUBSURFACE LOG B-1

DEPTH (FT)	SAMPLE NO	RECOVERY (FEET)	BLOWS (PER 0.5 FT)	OVA BACKGROUND/READING	DESCRIPTION
0	S1	1.0	4	1.8 ppm/ 5000 ppm	Brown to dark brown, medium to coarse sand, some medium gravel and cinders, some brick and wood fragments, moist, loose, slight odor, FILL.
1			5		
			11		
			62		
2	S2	1.0	22	1.8 ppm/ 7000 ppm	
3			11		
			7		
			6		
4	S3	0.7	4	1.8 ppm/ 500 ppm	
5			5		Grading to black, coarse sand, some medium gravel, some silt, trace clay, slight hydrocarbon odor, black staining, wet, loose to firm.
			7		
			9		
6	S4	1.0	9	1.8 ppm/ 10,000 ppm	
7			7		
			10		
			13		
8	S5	0.5	7	1.8 ppm/ 9000 ppm	Separate phase hydrocarbons in the soil from 7.5' to 8.5', strong odor and staining.
9			8		Water at 8.5'.
			14		
			21		
10					Bottom of boring at 10'.

Notes:

1. Borehole grouted with cement from 10' to 1.5', concrete from 1.5' to grade.
2. OVA headspace readings were taken directly from soil sample jars within 6 hours of collection.

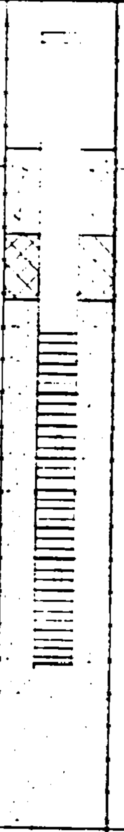
SURFACE ELEVATION ________
DATE STARTED 10/11/90
DATE COMPLETED 10/11/90
CLASSIFIED BY DLC

PROJECT Envirotek
PROJECT NO 580.01
NO. B-1
SHEET 1 OF 1

BLASLAND & BOUCK ENGINEERS, P.C.

SUBSURFACE LOG B-2 (VP-3)

DEPTH (FT)	SAMPLES	SAMPLE NO	RECOVERY (FEET)	BLOWS (PER 0.5 FT)	OVA BACKGROUND/READING	GEOLOGIC COLUMN	WELL COLUMN	DESCRIPTION
0 1		S1	1.3		1.6 ppm/ 7800 ppm			Brown to black, medium to coarse sand, some medium gravel, trace silt, moist, loose to firm, slight hydrocarbon odor, discontinuous film, FILL.
2 3		S2	0.8	10 9 10 11	1.6 ppm/ 100 ppm			
4 5		S3	0.5	8 3 6 5	1.6 ppm/ 1200 ppm			
6 7		S4	0.5	7 8 9 10	1.6 ppm/ 10,000 ppm			
8 9		S5	0.3	11 12 12 12	1.6 ppm/ 200 ppm			Separate phase hydrocarbons in the soil from 8' to 9.5', strong odor and black staining. Water at 9.5'.
10								Bottom of boring at 10'.



Vapor Probe Well Construction Details

2-inch diameter 0.020-inch machine-slotted PVC well screen from 7.5' to 2.5'.

2-inch diameter solid PVC riser from 2.5' to 2.5' above grade.

#4 sand from 10' to 2'.

Hydrated bentonite powder from 2' to 1'.

Concrete from 1' to 0.3' above grade.

Riser stick-up fitted with press-on PVC cap.

Note: OVA headspace readings were taken directly from soil sample jars within 6 hours of collection.

SURFACE ELEVATION ____

DATE STARTED 10/11/90

DATE COMPLETED 10/11/90

CLASSIFIED BY DLC

PROJECT Envirotek

PROJECT NO 580.01

NO B-2 (VP-3)

SHEET 1 OF 1

BLASLAND & BOUCK ENGINEERS, P.C.

SUBSURFACE LOG B-3

DEPTH (FT)	SAMPLES	SAMPLE NO	RECOVERY (FEET)	BLOWS (PER 0.5 FT)	OVA BACKGROUND/READING	GEOLOGIC COLUMN	WELL COLUMN	DESCRIPTION
0 1 2		S1	2.0	10 13 15 15	1.0 ppm/ 15 ppm			Brown to gray, medium to coarse sand, some medium angular gravel, trace silt and clay, moist, firm, slight odor, discontinuous film, FILL.
3 4		S2	1.3	15 12 10 7	1.0 ppm/ 80 ppm			
5 6		S3	0.7	6 6 6 6	1.0 ppm/ 75 ppm			
7 8		S4	0.5	5 5 5 6	1.0 ppm/ 100 ppm			Grades to brown-black, some staining at 7.5' to 10'.
9 10		S5	0.4	4 7 7 6	1.0 ppm/ 80 ppm			Water at 9'.
								Bottom of boring at 10.0'.

Notes:

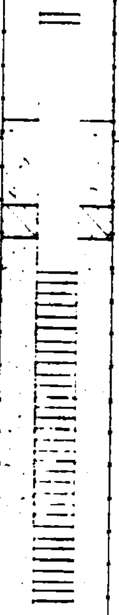
1. Borehole grouted with cement from 10' to 1.5', concrete from 1.5' to grade.
2. OVA headspace readings were taken directly from soil sample jars within 6 hours of collection.

SURFACE ELEVATION
DATE STARTED 10/12/90
DATE COMPLETED 10/12/90
CLASSIFIED BY DLG

PROJECT Envirotek
PROJECT NO 580.01
NO B-3
SHEET 1 OF 1

BLASLAND & BOUCK ENGINEERS, P.C.

SUBSURFACE LOG B-4 (VP-2)



DEPTH (FT)	SAMPLES	SAMPLE NO	RECOVERY (FEET)	BLOWS (PER 0.5 FT)	OVA BACKGROUND/READING	GEOLOGIC COLUMN	WELL COLUMN	DESCRIPTION
0 1		S1	.7	1 2 1 5	0.0 ppm/ 100 ppm			Brown to dark brown, coarse sand, some gravel and cinders, brick and wood fragments, mosit, loose, slight odor and film, FILL.
2 3		S2	.3	4 4 5 5	0.0 ppm/ 500 ppm			
4 5		S3	.4	2 3 3 4	0.0 ppm/ 500 ppm			Grading to black-gray, medium to coarse sand and gravel, some silt, trace clay, moist, loose to firm, strong odor, black staining.
6 7		S4	.3	8 4 7 10	0.0 ppm/ 100 ppm			Separate phase hydrocarbons in the soil from 7.5' to 9.'
8 9		S5	.7	20 22 17 8	0.0 ppm/ 10,000 ppm			Water at 9'.
10								Bottom of boring at 10'.

Vapor Probe Well Construction Details

2-inch diameter 0.020-inch machine-slotted PVC screen from 7' to 2'.

2-inch diameter solid PVC riser from 2' to 2' above grade.

#4 sand from 10' to 1.5'.

Hydrated bentonite powder from 1.5' to 1'.

Concrete from 1' to 0.3' above grade.

Riser stick-up fitted with press on PVC cap.

Note:

OVA headspace readings were taken directly from soil smple jars within 6 hours of collection.

SURFACE ELEVATION ________
DATE STARTED 10/12/90
DATE COMPLETED 10/12/90
CLASSIFIED BY DLC

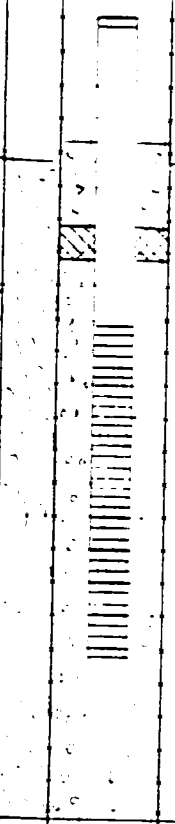
PROJECT Envirotek
PROJECT NO 580.01
NO. B-4 (VP-2)
SHEET 1 OF 1

BLASLAND & BOUCK ENGINEERS, P.C.

SUBSURFACE LOG B-5 (VP-1)

DEPTH (FT)	SAMPLES	SAMPLE NO	RECOVERY (FEET)	BLOWS (PER 05 FT)	OVA BACKGROUND/READING
0		S1	1.0	1 2 3 5	0.0 ppm/ 100 ppm
2		S2	0.7	4 4 5 5	0.0 ppm/ 100 ppm
4		S3	0.5	2 8 8 5	0.0 ppm/ 500 ppm
6		S4	0.3	7 6 8 6	0.0 pm/ 100 ppm
8		S5	0.3	10 12 12 14	0.0 ppm/ 10,000 ppm
10					

GEOLOGIC COLUMN / WELL COLUMN



DESCRIPTION

Dark brown to gray, medium to coarse sand, medium gravel, some wood and glass fragments, slight odor, film, moist, loose, FILL.

Grading to brown-black, coarse sand and some medium gravel, some silt and clay, strong odor, film, wet, firm. Separate phase hydrocarbon in soil from 8' to 9.5'.

Water at 9.5'.

Bottom of boring at 10'.

Vapor Probe Well Construction Details

2-inch diameter 0.020-inch machine-slotted PVC screen from 7.5' to 2.5'.

2-inch diameter solid PVC riser from 2.5' to 2' above grade.

#2 gravel (limestone) from 10' to 1.5'.

Hydrated bentonite powder from 1.5' to 1'.

Concrete from 1' to 0.3' above grade.

Riser stick-up fitted with press-on PVC cap.

Note:

OVA headspace readings were taken directly from soil sample jars within 6 hours of collection.

SURFACE ELEVATION ____
DATE STARTED 10/12/90
DATE COMPLETED 10/12/90
CLASSIFIED BY DLC

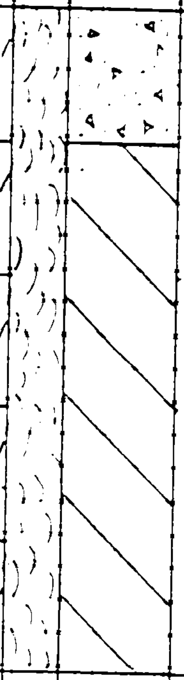
PROJECT Envirotek
PROJECT NO 580.01
NO. B-5 (VP-1)
SHEET 1 OF 1

BLASLAND & BOUCK ENGINEERS, P.C.

SUBSURFACE LOG B-6

DEPTH (FT)	SAMPLES	SAMPLE NO	RECOVERY (FEET)	BLOWS (PER 0.5 FT)	OVA BACKGROUND/READING
0–2	/	S1	1.3	8 21 13 13	1.0 ppm/ --
2–4	/	S2	1.3	3 4 3 3	1.0 ppm/ 400 ppm
4–6	/	S3	0.7	3 1 3 6	1.0 ppm/ 200 ppm
6–8	/	S4	0.3	6 8 7 9	1.0 ppm/ 10,000 ppm
8–10	/	S5	0.5	5 7 5 9	1.0 ppm/ 10,000 ppm

GEOLOGIC COLUMN | WELL COLUMN



DESCRIPTION

Dark brown to black, fine to coarse sand, some medium gravel and cinders, trace red clay, moist, firm, FILL.

Grading to black-brown, coarse sand and gravel, hydrocarbon odor and black staining, sheen on soil, wet, loose.

Water at 8'.

Bottom of boring at 10'.

Notes:

1. Borehole grouted with cement from 10' to 2', concrete from 2' to grade.
2. OVA headspace readings were taken directly from soil sample jars within 6 hours of collection.

SURFACE ELEVATION ________

DATE STARTED 10/11/90

DATE COMPLETED 10/11/90

CLASSIFIED BY DLC

PROJECT Envirotek

PROJECT NO 580.01

NO. B-6

SHEET 1 OF 1

BLASLAND & BOUCK ENGINEERS, P.C.

APPENDIX C

LABORATORY ANALYTICAL REPORTS

(Submitted Under Separate Cover)

BLASLAND, BOUCK & LEE, INC.

ENGINEERS & SCIENTISTS

Syracuse, NY • Rochester, NY • Islandia, NY • White Plains, NY • Middletown, NY • Cranbury, NJ • Pittsburgh, PA • Baltimore, MD
Durham, NC • Columbus, OH • Boca Raton, FL • Tampa, FL • Orlando, FL • Miami, FL • Irvine, CA • Novato, CA