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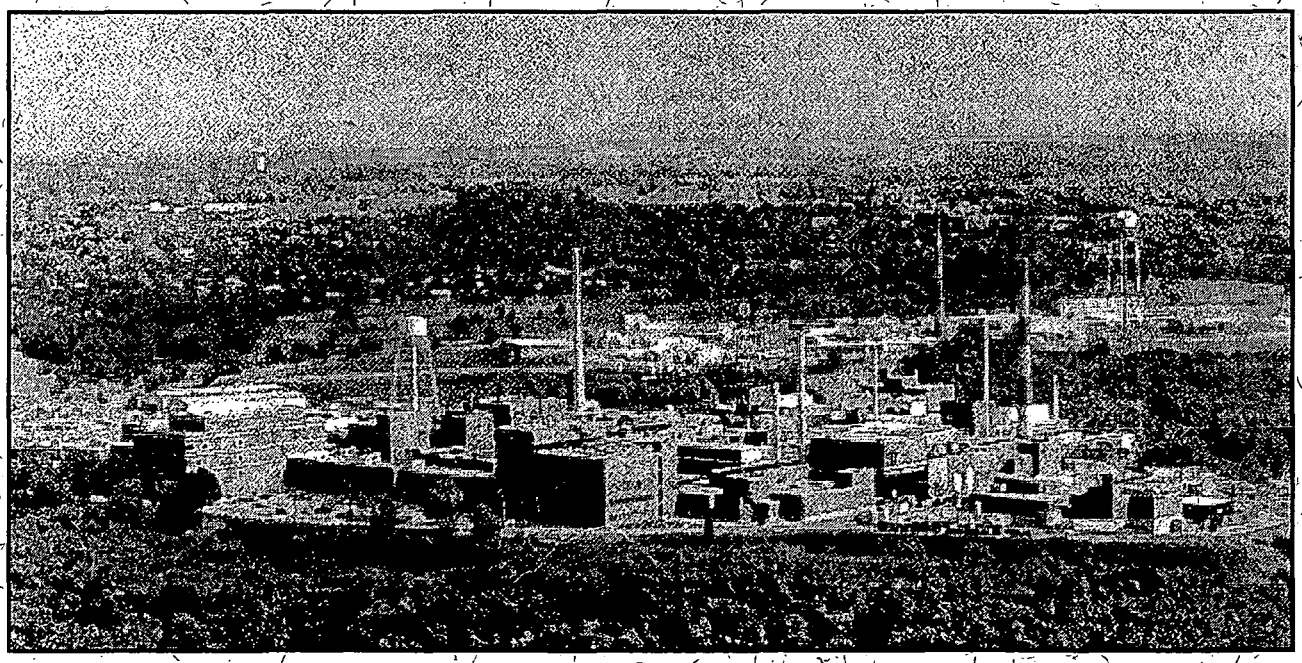
Environmental Restoration Program

Miamisburg Closure Project
Potential Release Site Package
PRS 397

Public Review Draft
February 2003



Environmental
Restoration
Program

MIAMISBURG CLOSURE PROJECT
POTENTIAL RELEASE SITE PACKAGE
Notice of Public Review Period

The following Potential Release Site (PRS) packages are available for public review in the CERCLA Public Reading Room, 305 E. Central Ave., Miamisburg, Ohio. Public comment on these documents will be accepted 26 February 2003 through 27 March 2003.

PRS 41: Area 3 Thorium Drum Storage/Redrum
PRS 64: Building 19 Historic Gasoline Tank
PRS 397: Soil Contamination

Questions can be referred to Paul Lucas at (937) 865-4578

PRS 397 Package Tracking Sheet

REVISION	DESCRIPTION	DATE
Working Draft (to DOE)		
Draft (to Core Team)		
Draft Proposed Final	Addendum 1 submitted to CT. No USEPA or OEPA comments. Added Addendum 1 to original package and submitted it as public review draft.	**January 2003**
Public Review Draft	Binned NFA on 19 February 2003. Public review period: 26 Feb to 27 Mar 03	**February 2003**
Final		

ADDENDUM 1

SUPPORTING NFA RECOMMENDATION

Environmental
Restoration
Program

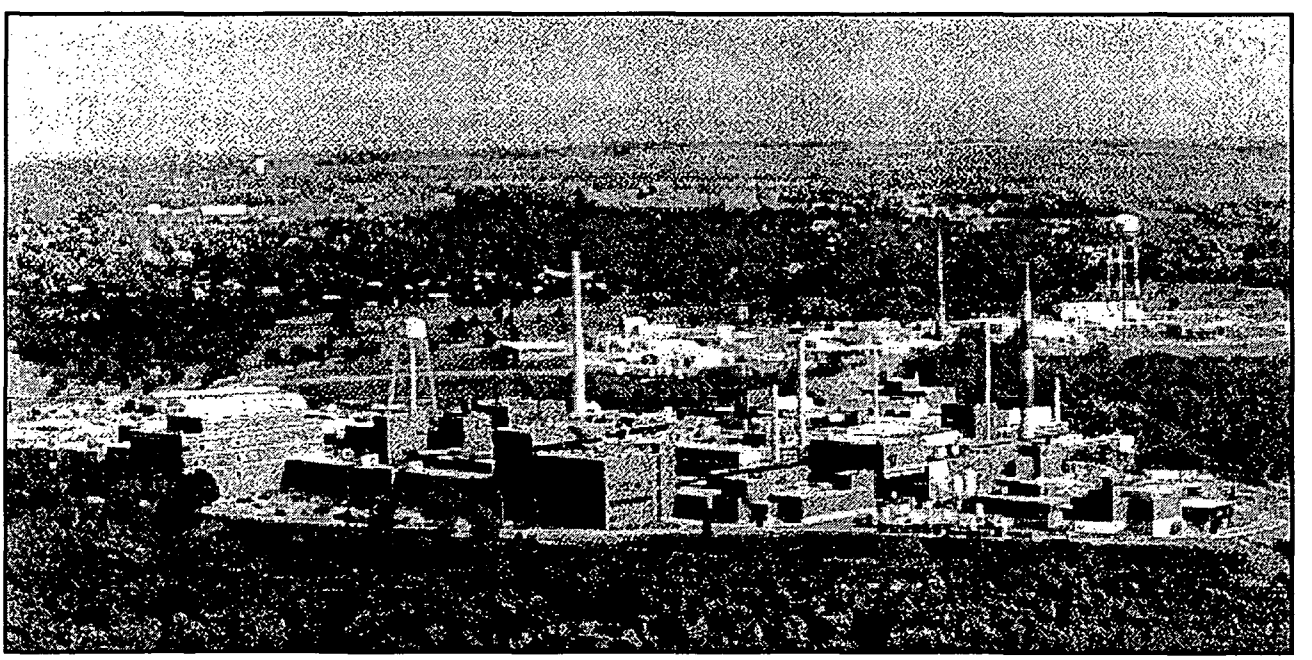
Miamisburg Closure Project

Potential Release Site Package

PRS 397

Addendum 1

Public Review Draft
February 2003



PRS HISTORY:

Potential Release Site (PRS) 397 is located south of the former fuel tanks (Figure 1) and was binned Further Assessment (FA) by the Core Team on 3 October 1996. PRS 398 (soil gas location near the fuel pumps) was binned jointly with PRS 397 but, due to its proximity to PRS 66, was subsequently included in the PRS 66 effort. This addendum addresses only PRS 397. PRS 397 was identified based on a soil sample (Sample ID SEPW) collected as part of the passive soil gas survey in 1994[1]. Further Assessment sampling was completed in December of 2002 per the Sampling and Analysis Plan (**SAP**)[2] approved by the Core Team.

FURTHER ASSESSMENT ACTIVITY:

The potential contaminants of concern (COCs) were benzene, toluene, ethylbenzene, and xylene (BTEX) and total petroleum hydrocarbon (TPH). Although not a COC, the Core Team agreed to add polyaromatic hydrocarbon (PAH) analyses based on two historic results in the PRS 397 vicinity that indicated benzo(a)pyrene at concentrations above the 10^{-6} Risk-Based Guideline Values (RBGVs).

One soil sample and and one duplicate sample were analyzed for the COCs and for PAH. The FA sample location is presented in Figure 2. The FA **Data Report**[3] presents a full account of soil sampling activities and sample results. All analyses were performed by an offsite laboratory (Severn Trent Laboratories, St. Louis).

There were no FA sample results above detection limits for any of the analytes. All detection limits were significantly below the more restrictive of the 10^{-6} RBGV or the Hazard Index of one value.

FIGURES:

Figure 1: Location of PRS 397
Figure 2: PRS 397 Sample Location

REFERENCES:

1) Operable Unit 5, Operational Area Phase I Investigation Non-AOC Field Report, Final (Revision 0) June 1995
2) PRS 397 Sampling & Analysis Plan, Final, September 2002
3) PRS 397 Data Report, Rev. 0, December 2002

PREPARED BY:

Gary Miller, CH2MHill, ER Technical Staff
Karen M. Arthur, CH2MHill, ER QA

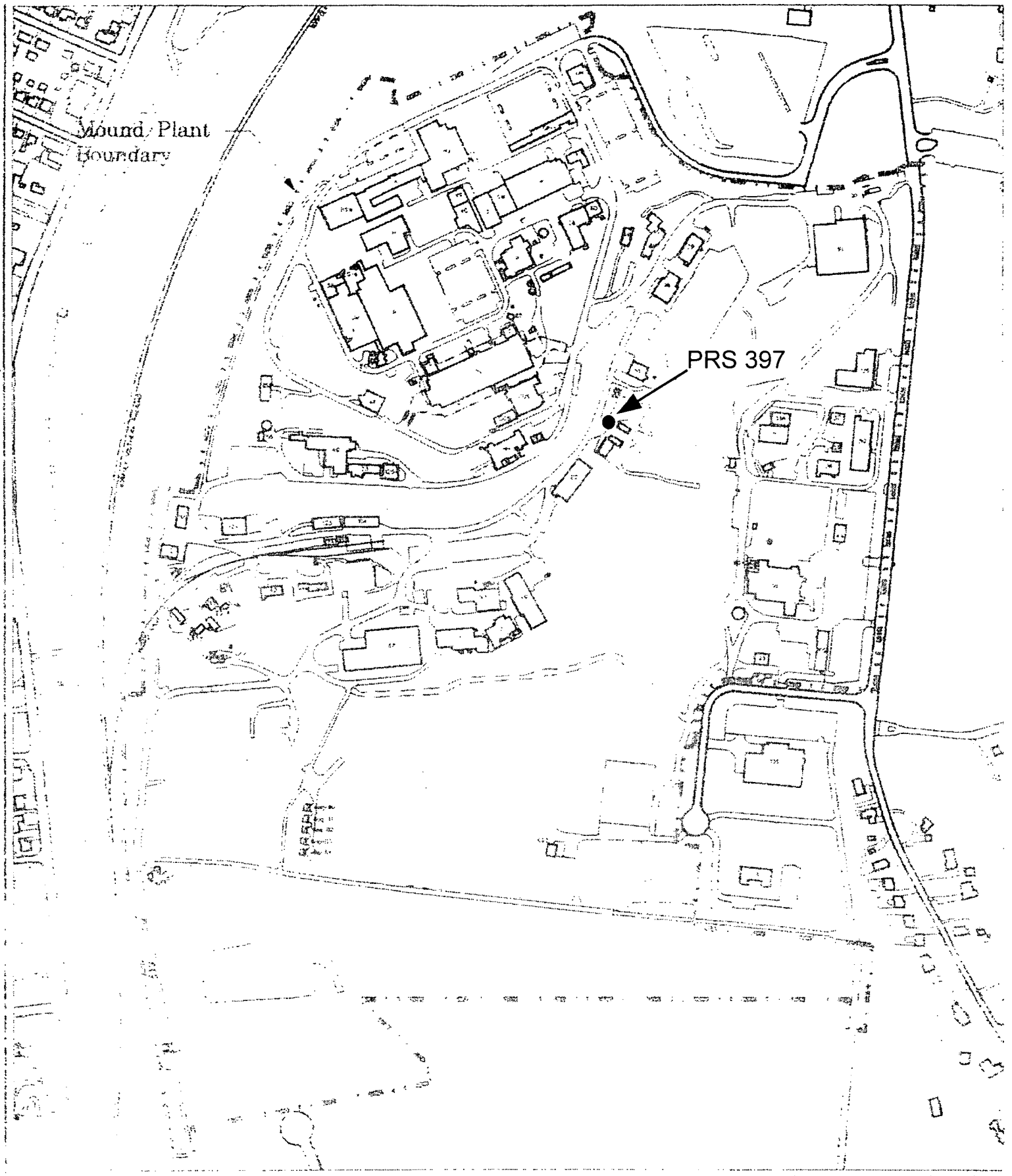


Figure 1: Location of PRS 397

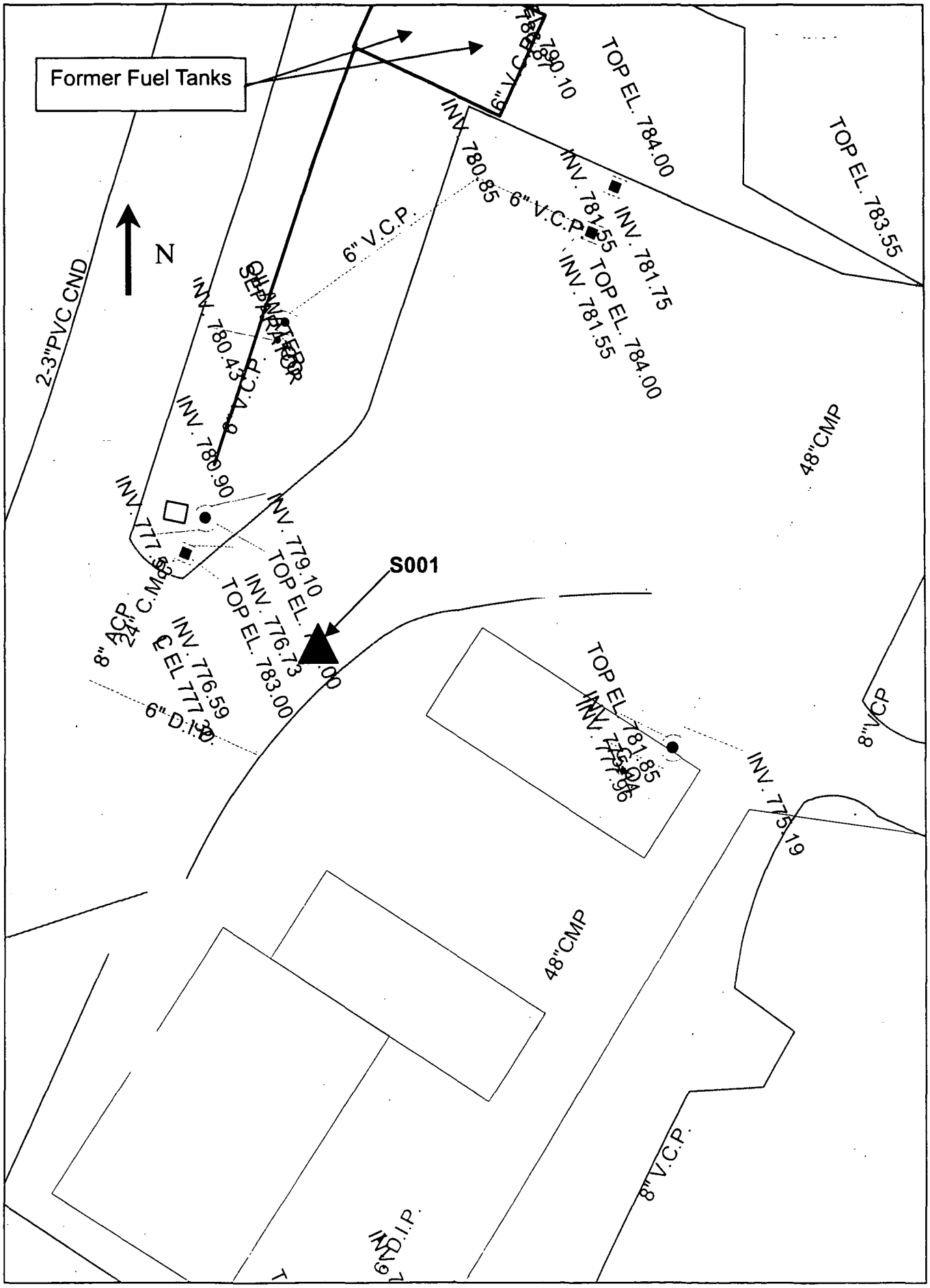


Figure 2: PRS 397 Sample Location

MIAMISBURG CLOSURE PROJECT
PRS 397

RECOMMENDATION:

Potential Release Site (PRS) 397 is located south of the former fuel tanks (Figure 1) and was binned Further Assessment (FA) by the Core Team on 3 October 1996. PRS 397 was identified based on a soil sample (Sample ID SEPW) collected as part of the passive soil gas survey in 1994.

Further Assessment was performed and confirmed that the levels of BTEX and PAH are acceptable when compared to the more stringent of the 10^{-6} RBGV or Hazard Index of one values. TPH was not detected in the sample.

Therefore, the Core Team recommends **No Further Assessment** for PRS 397.

A PRS Package with an NFA recommendation signed by the Core Team will be placed in the Public Reading Room for a 30-day review period. Upon closure of the public review comments, if any, the PRS Package will be issued as a final document and made available in the Public Reading Room.

CONCURRENCE:

DOE/MCP: _____ 2/19/03
Robert S. Rothman, Remedial Project Manager (date)

USEPA: _____ 2/19/03
David P. Seely, Remedial Project Manager (date)

OEPA: _____ 2/19/03
Brian K. Nickel, Project Manager (date)

ORIGINAL DOCUMENT

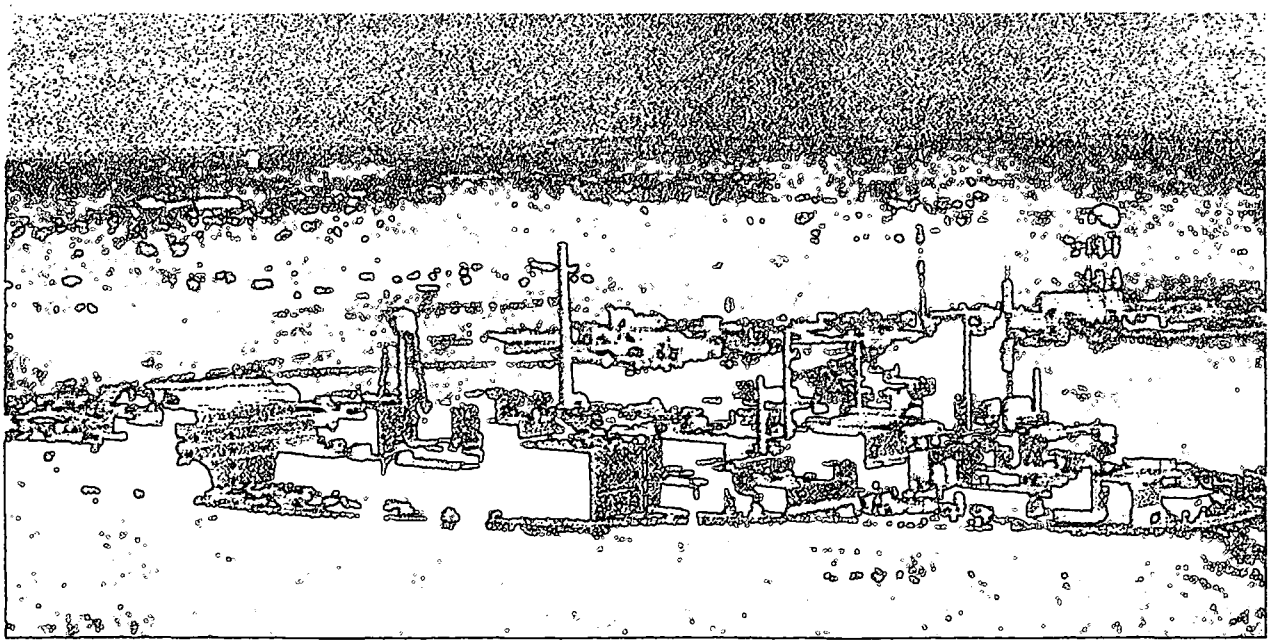
SUPPORTING FA RECOMMENDATION

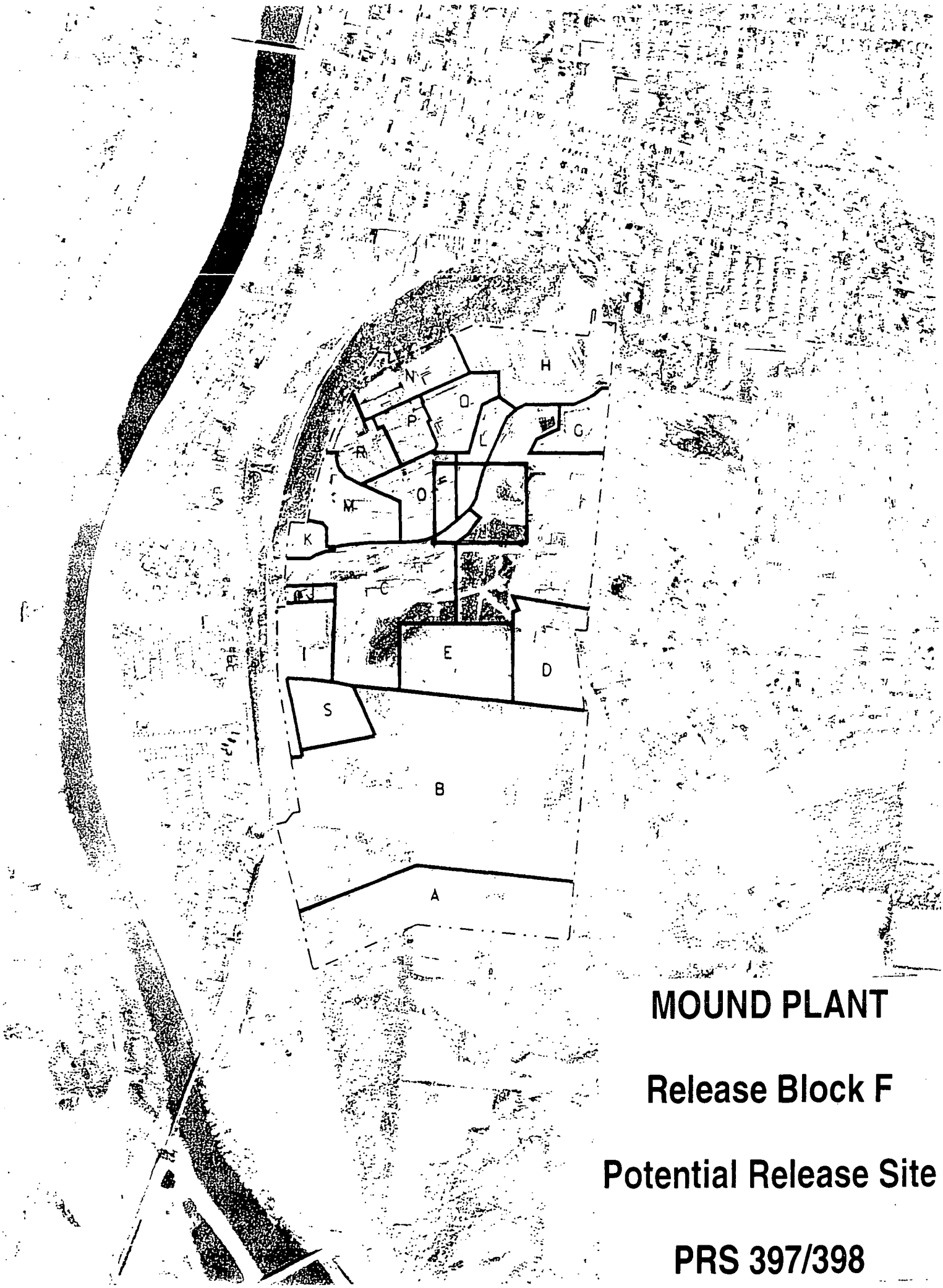
Environmental
Restoration
Program

MOUND PLANT

Potential Release Site Package

PRS #397/398





MOUND PLANT

Release Block F

Potential Release Site

PRS 397/398

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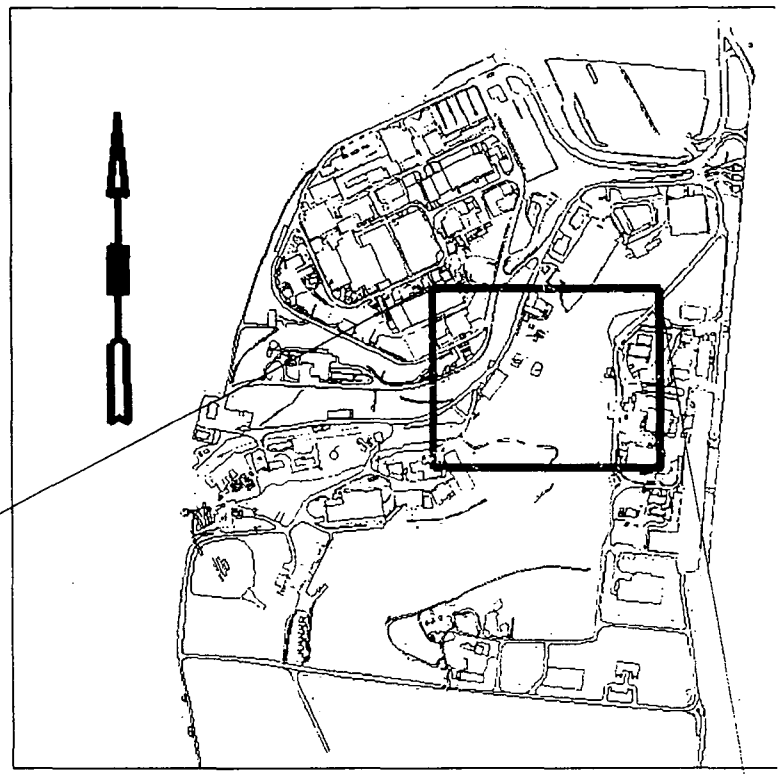
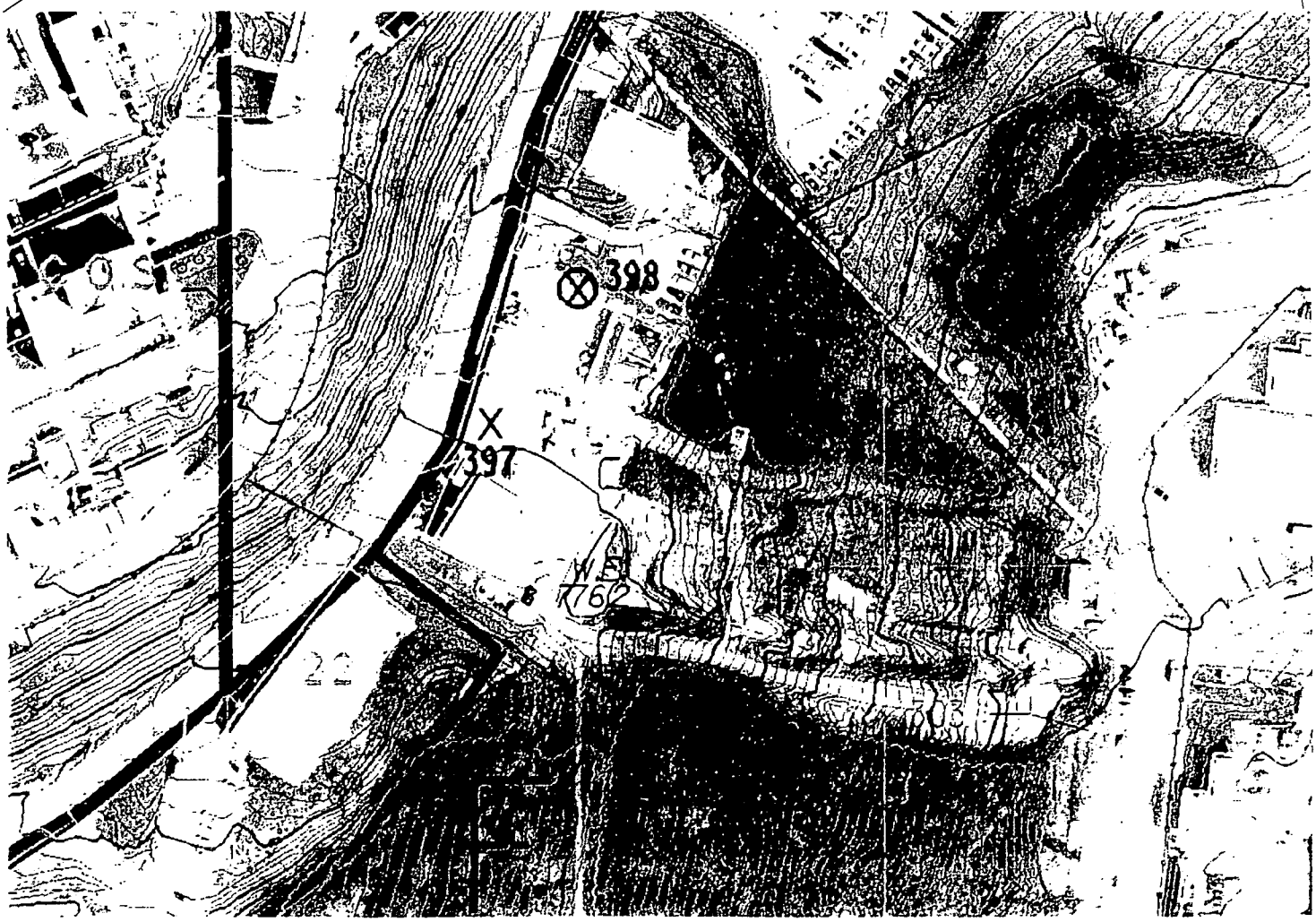
Mound Plant

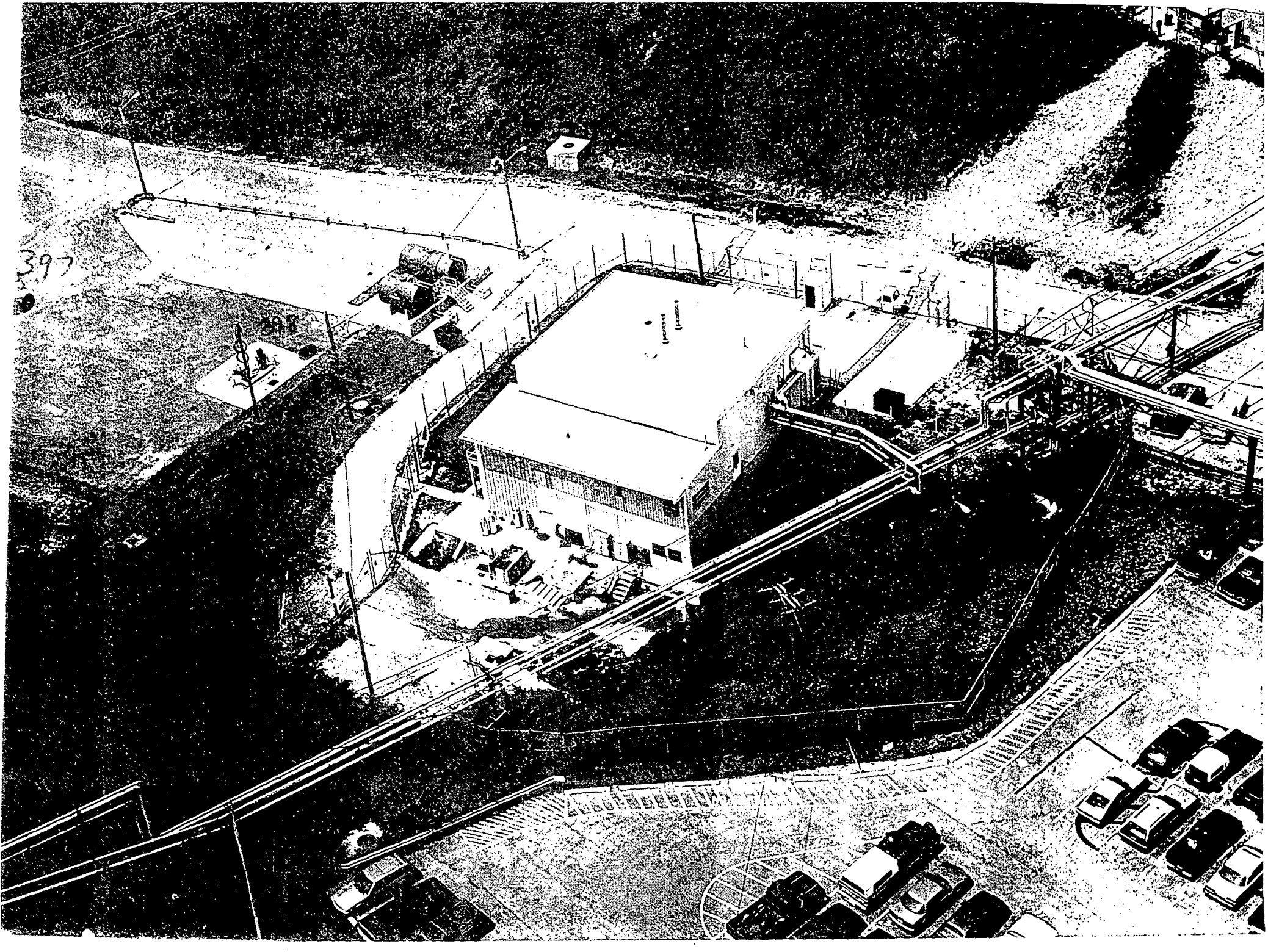
Release Block F

Potential Release Site

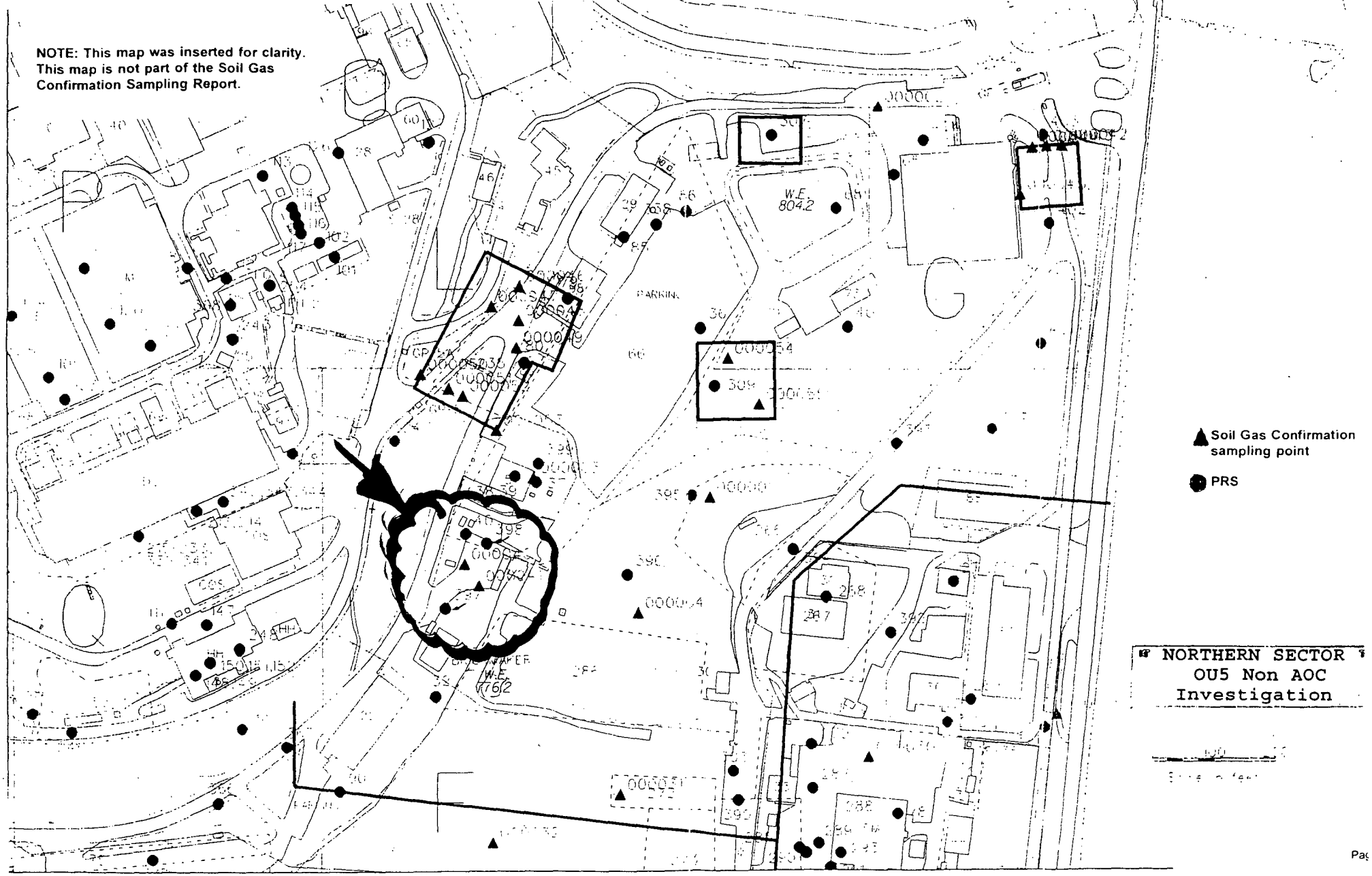
PRS 397/398






397
398

NOTE: This map was inserted for clarity. This map is not part of the Soil Gas Confirmation Sampling Report.



PRS 397/398

PRS HISTORY:

Potential Release Sites (PRS) 397 and 398 are located in the parking lot of the refueling facility, south of Building 51 and north of Building 22. PRSs 397 and 398 were identified in the Operable Unit 5, Operational Area Phase 1 Investigation Non-AOC Field Report.[1] The investigation of the non-areas of concern (non-AOC) generally included areas that were not known or suspected to be contaminated. As part of scoping for the study, areas of special interest with the possibility of the presence of hazardous substances were identified. One such area, the "Fuel Area" was included in the study and now encompasses PRS 397 and 398. For the remainder of this paper, PRSs 397 and 398 will be referred to as the Fuel Area.

The Fuel Area is built on fill materials. In the late 1960s and 1970s, the upper reach of the plant drainage ditch was filled to allow development, including construction of Building 51.[2] The area between buildings 22 and 51 lay largely undeveloped for many years. Building 66, a modular transportable building, was used in the area immediately south of Building 51 in the late 1970s and early 1980s, this designation is still apparent on many maps. The Fuel Area facilities were constructed in 1986 to replace the G Building facilities on the Main Hill. The Fuel Area facilities consist of 2 above ground fuel tanks, 2 gasoline pumps, and a water/oil separator.[1]

CONTAMINATION:

Two soil gas surveys have been conducted in the Fuel Area: a broad, passive soil gas survey, conducted in the Fuel Area in 1994, the results of which identify PRSs 397 and 398; and a reconnaissance soil gas survey, conducted in the Building 51 area in 1992.

1) The passive soil gas survey was conducted in 1994 as part of the *OU5, Operational Area Phase 1 Non-AOC* field investigation.[1] This investigation included a field instrument for detection of low energy radiation (FIDLER) survey; surface soil sampling and analysis using the Mound Plant soil screening facility; and a PETREX passive soil gas survey to detect volatile and semi-volatile hydrocarbons and total petroleum hydrocarbons. A single, relatively moderate detection of halogenated hydrocarbons was noted just north of PRS 398, to the east of the tanks. PRS 397 exhibits relatively low to moderate total aromatic hydrocarbons, total semi-volatile hydrocarbons and total petroleum hydrocarbons. Seven other sample locations in the Fuel Area, however, exhibit relatively low to moderate levels of all organic parameters. The PETREX soil gas methods generally indicate the relative presence of a substance, but do not yield a quantitative concentration of that substance. Review of the data files used to compile the distribution maps indicates that the analytical results were dominated by toluene, ethylbenzene, and xylene, as well as other compounds related to medium and heavy weight fuels.

Soil samples from each of the soil gas detector holes were submitted to the Mound soil screening facility. The results indicated that no plutonium-238 or thorium-232 occurred in concentrations above the Mound as low as reasonably achievable (ALARA) goal of 25 pCi/g for plutonium or the regulatory guideline of 5 pCi/g for thorium.[7]

2) As part of the *Reconnaissance Soil Gas Survey*[3], 8 locations were sampled and analyzed for volatile organic compounds near the Fuel Area. The study collected gas samples at 5-foot depths and analyzed them in an on-site mobile lab using a gas chromatograph (equivalent to U.S. EPA Method 8021). The results of the survey indicated that traces of halogenated and petroleum hydrocarbons are present[3] (see Table 1).

Table 1 Results for which concentration can be compared to Guideline Criteria:

Contaminant	Maximum Concentration Detected	Calculated Guideline Criteria
Cis-1,2 Dichloroethane (1,2 DCE)	18 ppb[3] (soil gas)	5,000 ppb[4] (soil gas)
1,1,1-Trichloroethane (1,1,1-TCA)	37 ppb[3] (soil gas)	173,400 ppb[4] (soil gas)
Tetrachloroethene (PCE)	44 ppb[3] (soil gas)	3,100 ppb[4] (soil gas)
Trichloroethene (TCE)	207 ppb[3] (soil gas)	2,400 ppb[4] (soil gas)
Toluene	37 ppb[3] (soil gas)	414,600 ppb[4] (soil gas)

3) In February 1996, the *Soil Gas Confirmation Investigation*[6] sampled the soil at 100 locations on the Mound plant site. Each sample was collected over a depth of 1 to 3 feet and analyzed for volatiles, semivolatiles, PCBs, pesticides, metals, radionuclides, and explosives. The investigation did not sample the location of PRS 397 or 398, however two *Soil Gas Confirmation* samples were taken in the Fuel Area (see map on page 44 for location of samples 41 and 40 in relation to PRS 397 and 398) within approximately 50 feet of the PRS locations.

Results showed that the samples in the vicinity of PRS 397 and 398 contained contaminant concentrations less than the applicable 10^{-6} Risk Based Guideline Value, regulatory guideline or ALARA guideline with the exception of:

Contaminant	Sample Locations in Excess of Guideline Criteria	Maximum Concentration Detected	Guideline Criteria
Benzo(a)pyrene	40, 41	570 ug/kg (in soil @ location 40)	410 ug/kg[7] (10^{-6} Risk Based limit in soil)

ug = micrograms, kg = kilograms

READING ROOM REFERENCES:

1) Operable Unit 5, Operable Area Phase 1 Investigation Non-AOC Field Report, June 1995. (pages 7-18)
2) Operable Unit 9, Site Scoping Report: Volume 6 - Photo History Report, February 1992. (pages 19-22)
3) Soil Gas Survey and Geophysical Investigations, Main Hill and SM/PP Hill Areas, Reconnaissance Sampling, February 1993. (pages 23-34)
5) Risk Based Guideline Values, Final, December 1995.

OTHER REFERENCES:

4) Comparison of Actual Soil Gas Values with Calculated Acceptable Soil Gas Values. (pages 35-37)
6) Soil Gas Confirmation Sampling, Revision 0, May 1996. (pages 38-49)
7) Code of Federal Regulations, 40 CFR 192.12 and 40 CFR 192.41.

PREPARED BY:

Alexander Bray, Member of EG&G Technical Staff
William Criswell, Member of EG&G Technical Support Staff

MOUND PLANT
PRS 397/398

RECOMMENDATION:

CONCURRENCE:

DOE/MB: _____
Arthur W. Kleinrath, Remedial Project Manager (date)

USEPA: _____
Timothy J. Fischer, Remedial Project Manager (date)

OEPA: _____
Brian K. Nickel, Project Manager (date)

SUMMARY OF COMMENTS AND RESPONSES:

Comment period from _____ to _____.

☐ No comments were received during the comment period.
☐ Comment responses can be found on page _____ of this package.

REFERENCE MATERIAL
PRS 397/398

Document Control No._____

Environmental Restoration Program

OPERABLE UNIT 5
OPERATIONAL AREA PHASE I INVESTIGATION
NON-AOC FIELD REPORT

MOUND PLANT
MIAMISBURG, OHIO

VOLUME II - APPENDICES A-G

June 1995

Final (Revision 0)

U.S. Department of Energy
Ohio Field Office

EG&G Mound Applied Technologies

APPENDIX E
SOIL GAS SURVEY REPORT

Final Report of the PETREX® Soil Gas Survey
Of The Non-Area of Concern, Operable Unit 5

U.S. Department of Energy Mound Facility
Miamisburg, Ohio

2.0 INTRODUCTION

With the aid of Northeast Research Institute LLC (NERI), Science Applications International Corporation (SAIC) recently completed a Petrex soil gas survey of the NonArea of Concern (NonAOC) of Operable Unit -5 (OU-5) of the U. S. Department of Energy's Mound Facility in Miamisburg, Ohio. The survey of the NonAOC was performed as part of a larger soil gas survey of the entire OU-5 area including seven defined Areas of Concern.

The NonAOC encompasses the majority of the facility within the boundaries of OU-5 excepting the smaller, embedded Areas of Concern (AOC-3, AOC-7, AOC-13, AOC-21, AOC-22, AOC-J, and Area-SDB). The NonAOC was divided-up into four geographical units, NonAOC-South, NonAOC-West, NonAOC-East, and NonAOC-North to accommodate practical limitations in field operations. Two subunits of NonAOC-North, Area-61 and the Fuel Area, were also recognized (see Plate 1). Samplers from individual geographical units were collected and analyzed as separate phases of the larger soil gas survey of OU-5.

Past and current land use within the NonAOC varies. Some portions of the NonAOC may consist of undisturbed ground while other areas may have been extensively regarded and used for storage of facility wastes. Some portions of the NonAOC currently house structures in which various chemical products are stored or processed. Due to this diverse history, subsurface contamination by numerous volatile and semivolatile organic compounds (VOC's and SVOC's) is suspected. These compounds include components of petroleum products (fuels, oils, and lubricants), coal tar products (such as creosote), halogenated and nonhalogenated solvents (such as xylenes, and PCE), and refrigerants (CFC's or Freons). The purpose of this Petrex soil gas survey was to locate areas within the NonAOC which exhibit potential subsurface contamination by VOC's and SVOC's. The information generated by this survey could then be used to 1) determine what compounds may impact soil or groundwater quality, 2) locate areas of greatest potential impact and areas where these compounds might have been buried or released, and 3) strategically plan quantitative testing of soil and groundwater to determine the regulatory significance of findings site-wide.

3.0 OBJECTIVES

The technical objectives of the Petrex soil gas survey of the NonAOC were to:

1. Collect and identify VOC's and SVOC's in the subsurface.

2. Report results for targeted VOC's and SVOC's and illustrate their areal distribution on-site through mapping of results.

3. Determine the location of possible sources of subsurface contamination and identify areas meriting quantitative investigation.

4.0 OVERVIEW OF THE PETREX TECHNIQUE

Each Petrex soil gas sampler consists of two or three activated charcoal adsorption elements (collectors) housed in a resealable glass container in an inert atmosphere.

Soil gas sample collection is performed by unsealing the sampler and exposing the collector to the soil gas of the subsurface environment at the base of a shallow bore hole. Sample collection proceeds via free vapor diffusion through the opening of the uncapped sampler container. Following a controlled period of time, the sampler is retrieved from the bore hole, resealed, and submitted for analysis.

One collector from each soil gas sampler is analyzed by Thermal Desorption - Mass Spectrometry (TD-MS). Selected second collectors may be analyzed by Thermal Desorption - Gas Chromatography/Mass Spectrometry (TD-GC/MS) for compound confirmation. At least ten percent of samplers used in any project contain three collectors. The third collector is used for setting instrument sensitivity prior to analysis.

Compounds are identified by comparison to standard reference spectra derived from the same instrument. The mass spectral ion count of the appropriate indicator peak(s) for each compound or group of compounds is then plotted as relative response on a map and contoured using a variety of standard geostatistical analyses.

For a more detailed and technical discussion of the method, please refer to Appendix A, Petrex Protocol.

5.0 SCOPE OF WORK

The scope of work of the soil gas survey of the NonAOC specified collection and analysis of soil gas samples from a total of three hundred and ninety-six (396) sample collection points. The majority of these sample collection points was arrayed in a uniform grid which overlaid the NonAOC. The distance between sample collection points within the sampling grid was one hundred feet. This sampling grid corresponds to a rectangular coordinate system that extends 2,800 feet to the north and 2,700 feet to the west from an origin in the southeast of the facility (see Plate 1 provided with this report). Approximately twenty sample collection points were strategically located outside of the uniform rectangular grid near suspected contaminant sources areas.

~~The NonAOC South encompasses approximately thirty acres or the southern one third of OU-5 (south of coordinate 7 North). A total of one hundred and thirty-one (131) Petrex soil gas sample collection points were distributed across this area. The terrain within the NonAOC-South is near level in the eastern half, but slopes downward to the west from the mid-point with an average grade of 15%.~~

the occurrence of the subsurface dispersion and migration of components of these products to other portions of the site.

Detections of elevated levels of halogenated hydrocarbons in the soil gas within the NonAOC-East were infrequent. Prominent occurrences of PCE were noted at the collection points of samples #915, #919, and #941. Prominent occurrences of TCE were detected in the soil gas at the collection points of samples #915 and #956. No other halogenated organics were detected at elevated levels in the soil gas within the NonAOC-East.

The pronounced levels of petroleum hydrocarbons in samples #923, #946, #948, and #953 has potentially masked response to halogenated hydrocarbons greater than 100,000 ion counts. To determine whether elevated levels of halogenated organics may be present in these four samples, sample duplicates have been submitted for TD-GC/MS analysis. TD-GC/MS analysis of these four samples is pending. Results will be reported as soon as they are available.

8.2.4 NonAOC-North

High relative levels of petroleum hydrocarbons were detected at many points within the NonAOC-North, particularly in the Fuel Area and in the eastern half of the site both along the border with the NonAOC-East and at several points surrounding Building No. 61.

The majority of the sampling points within the Fuel Area demonstrated highly elevated levels of aromatic petroleum hydrocarbons, specifically toluene and ethylbenzene/xylenes (see the mass spectra of samples #1075, and #1083). Sample #1074 however, also demonstrated high relative levels of heavier weight aromatics, and medium to heavy weight alkanes, cycloalkanes/alkenes, and cycloalkenes/dienes which are common to medium and heavy weight fuels (see the mass spectrum of sample #1074). The high levels of toluene and ethylbenzene/xylenes in the soil gas at points on the periphery of the Fuel Area (such as the collection points of samples #1079 through #1083) suggest that the toluene and ethylbenzene/xylenes detected in this and other portions of the NonAOC derive wholly from fuels and not from suspected potential purer sources of these aromatics such as solvents or thinners.

Soil gas at numerous points in the east of the NonAOC-North exhibited compositions similar to that detected in the Fuel Area to the far west. Specifically, samples #847, #856, #857, #888, #896, #897, and #973 demonstrated combinations of C_4 to C_{11} petroleum hydrocarbons typical of the composition of vapor derived from slightly weathered light to medium weight fuels. While samples #853, #855, #980, and #1014 demonstrated pronounced singular occurrences of the C_6 and C_7 aromatics toluene and ethylbenzene/xylenes. These findings suggest that the hydrocarbons in the subsurface in the eastern half of the NonAOC-North may have originated in a similar fashion as the hydrocarbons in the subsurface in the Fuel Area.

The most significant occurrences of semivolatile hydrocarbons, as determined by the number of contiguous samples exhibiting elevated response, were detected in the southern portion of NonAOC-East. The highest response levels detected in this area were detected northeast of Building No. 39, east of Building No. 102 and at the collection point of sample #953 (located south of the parking lot). Isolated occurrences of semivolatile hydrocarbons were identified east of Building No. 38, and along the property boundary located east of Building No. 36 in the NonAOC-East.

Potentially significant occurrences of semivolatile hydrocarbons were identified in the northeastern section of the NonAOC-North, which includes Area-61, and in the Fuel Area. In Area-61, elevated response levels were detected adjacent to the northeastern portion of Building No. 61 and extend east to the access road. The elevated response detected at the collection point of sample #974 (at grid coordinate 27N5W) reflects the occurrence of high levels of naphthalenics principally naphthalene and methylnaphthalene. Of all of the samples collected within the NonAOC, this one sample exhibits character most unlike vapor derived from fuels and most like vapor derived from a coal tar product.

In the Fuel area, a single sample, #1074, collected from a point adjacent to the fuel pumps exhibited a high level of semivolatile hydrocarbons. The semivolatile hydrocarbons in this sample co-occur with a broad mixture of other hydrocarbons typical of the composition of only partially weathered fuels. Isolated occurrences of semivolatile hydrocarbons were also detected west of Buildings No. 61 and No. 33, and northwest of the access road at the collection point of sample #904.

In the NonAOC-South, only one area exhibited a small zone of elevated levels of semivolatile hydrocarbons which may relate to potential subsurface contamination. This zone is was located west of Building No. 100 and extends north beyond the access road. An isolated occurrence of semivolatile hydrocarbons was also identified in the soil gas at the collection point of sample #86.

In NonAOC-West only a limited number of isolated occurrences of semivolatile hydrocarbons was identified. Most of these occurrences were detected along the access roads, however single samples exhibiting high relative levels were collected east of Buildings No. 19 and No. 94. The environmental significance of discrete detections is difficult to ascertain. They are most likely related to low level near surface soil contamination rather than potentially significant subsurface contamination. The occurrences identified in close proximity to the access roads may be related to road use and/or maintenance (i.e., oiling dirt roads to minimize dust).

As the mobility of organic compounds in the subsurface environment generally decreases with increasing molecular weight or complexity of molecular structure, high levels of C_9, C_{10}, and C_{11} semivolatile compounds in the soil gas likely correspond to points of release of these and other petroleum hydrocarbons. It is equally likely that the occurrence of semivolatile hydrocarbons in the soil gas across the greater NonAOC represents small scale contamination of near surface soils and not any widespread impact to subsurface media.

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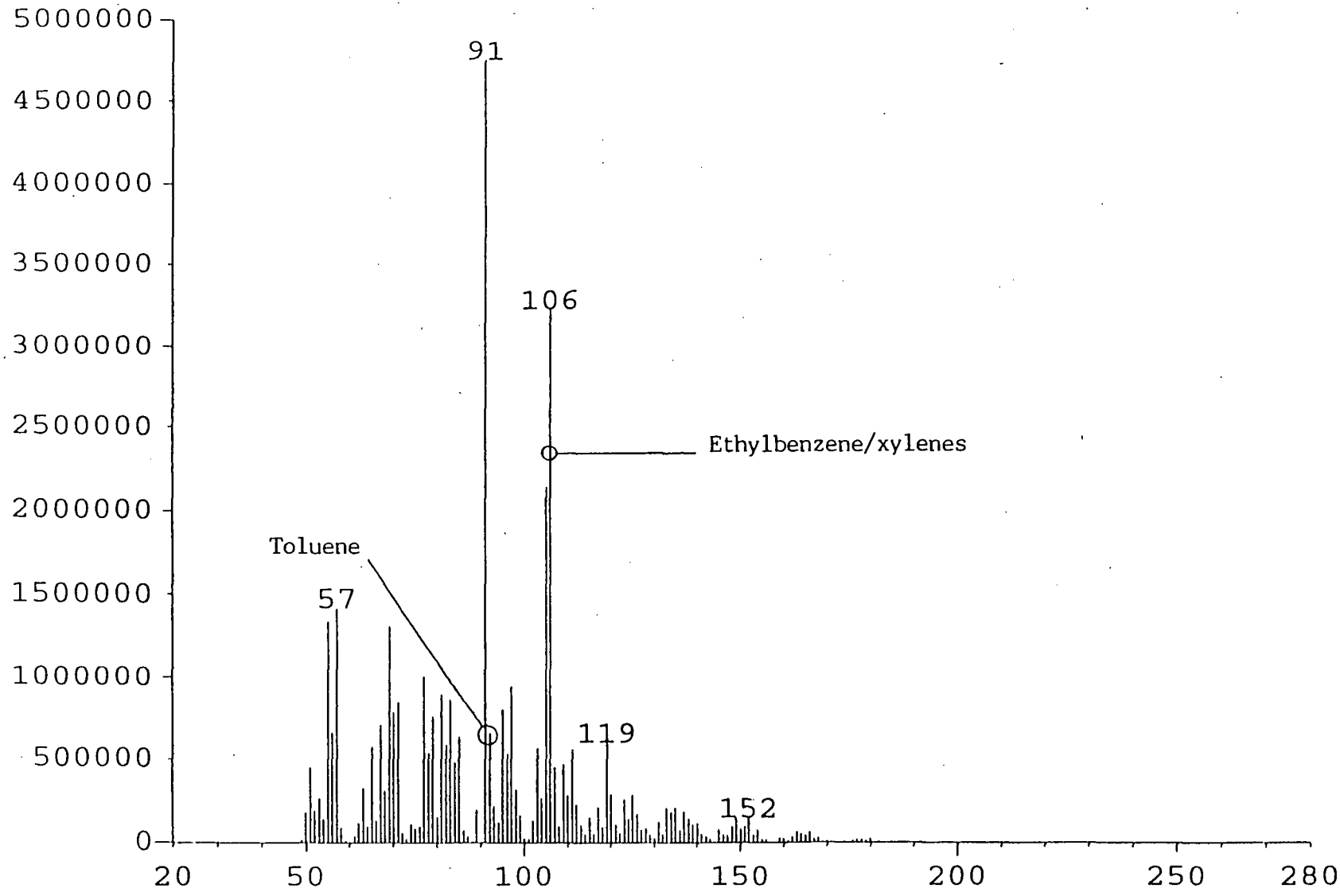

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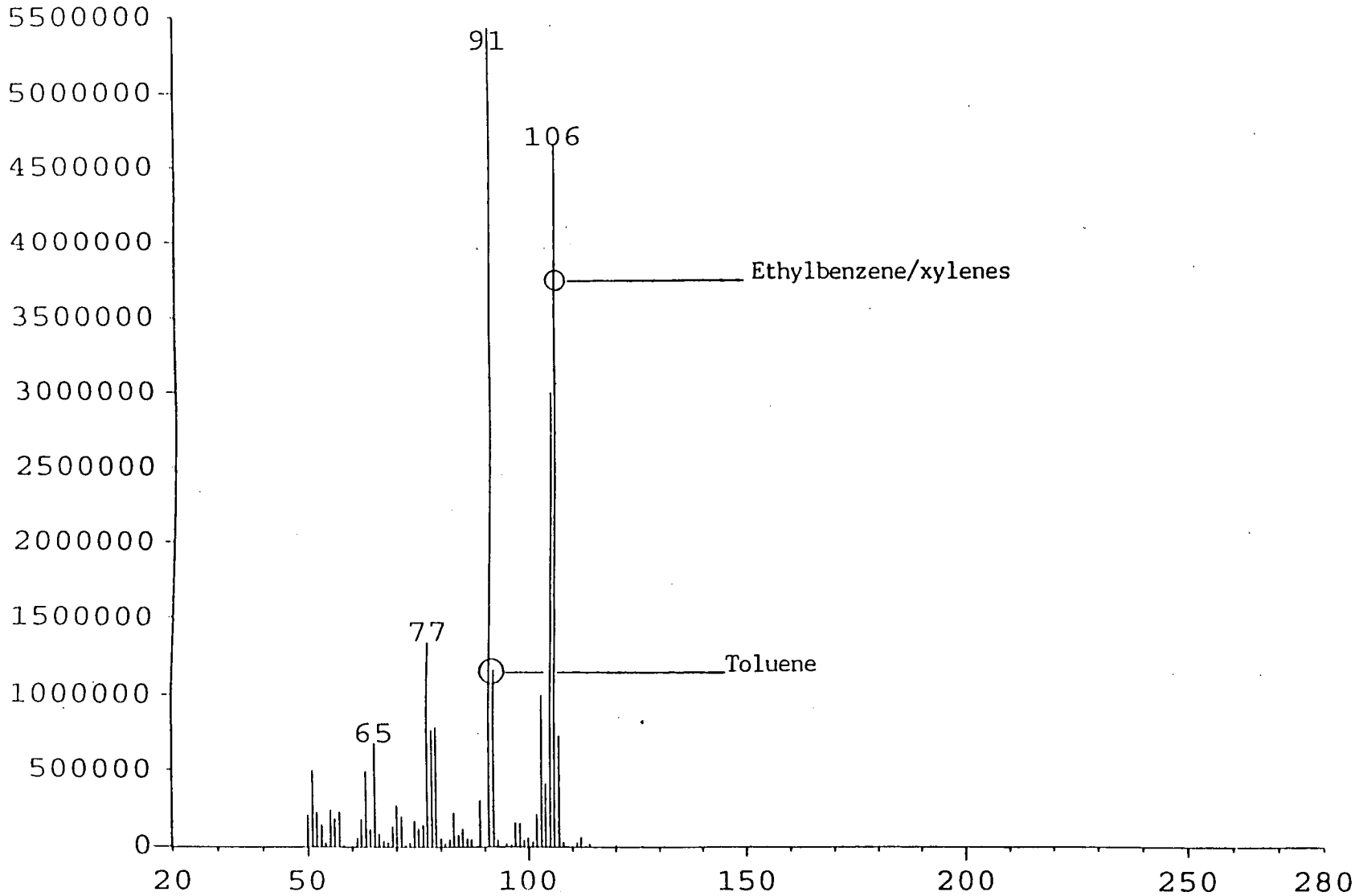


Features:

+ PETREX Sample Location

ND Not Detected

T Denotes interference by terpenes; see text.

Relative Response

Total Aromatic Hydrocarbons

Plate 2

Features:

+ PETREX Sample Location

ND Not Detected

Relative Response

Total Semivolatile Hydrocarbons

Plate 3

Features:

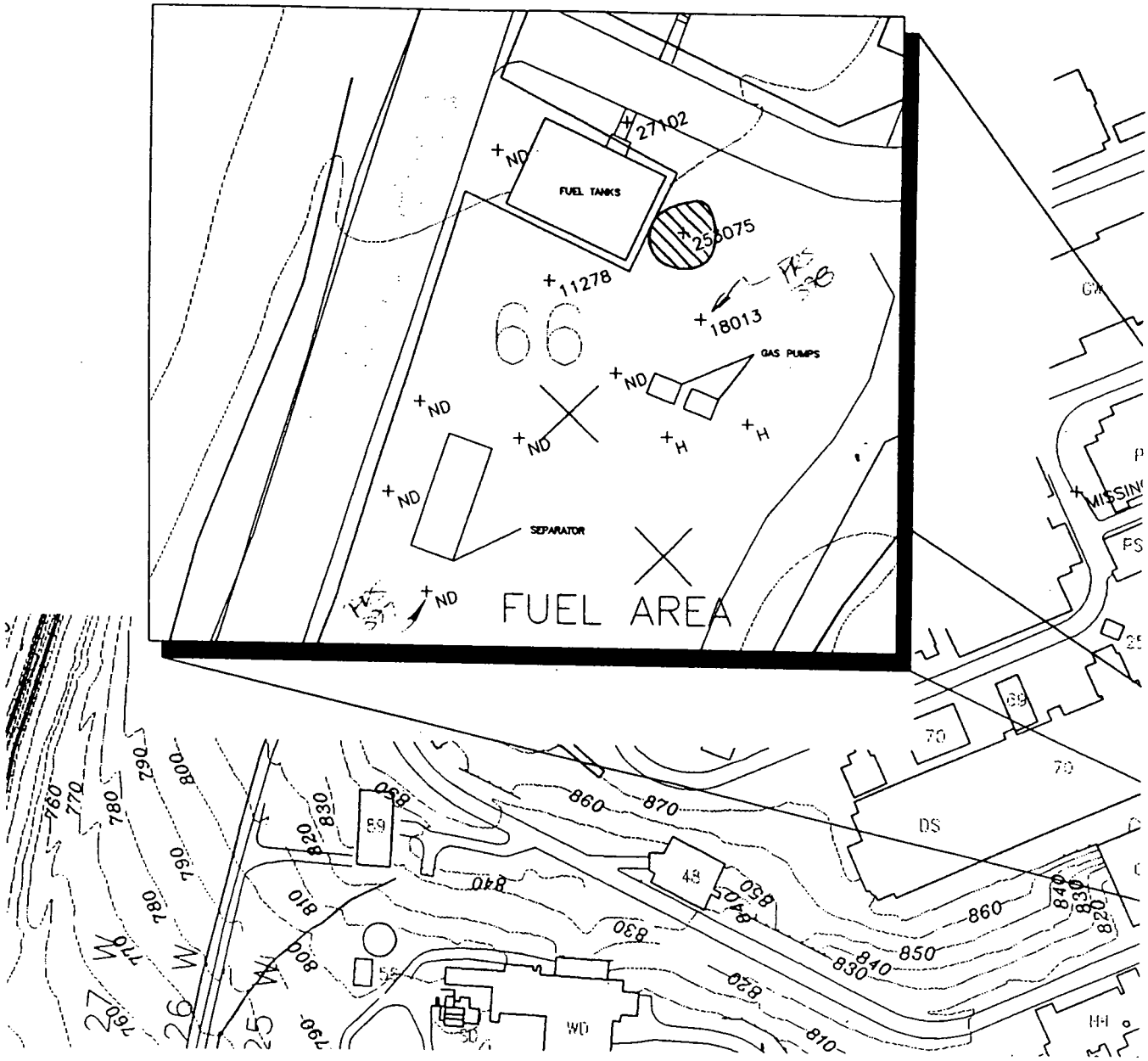
+ PETREX Sample Location

T Denotes interference by terpenes; see text.

Relative Response

Total C5-C11 Petroleum Hydrocarbons

Plate 4



Features:

+ PETREX Sample Location

ND Not Detected

H Denotes interference by petroleum hydrocarbons; see text.

Relative Response

Total Halogenated Hydrocarbons

Plate 5

ENVIRONMENTAL RESTORATION PROGRAM

OPERABLE UNIT 9,
SITE SCOPING REPORT
VOLUME 6 - PHOTO HISTORY REPORT

MOUND PLANT
MIAMISBURG, OHIO

February 1992

DEPARTMENT OF ENERGY
ALBUQUERQUE OPERATIONS OFFICE

ENVIRONMENTAL RESTORATION PROGRAM
TECHNICAL SUPPORT OFFICE
LOS ALAMOS NATIONAL LABORATORY

FINAL

Note: Although this document is an approved Final document, some text may be marked as "Draft" in the footer. This indicates that no changes have been necessary between submission of the Draft, revision, and regulatory agency approval.

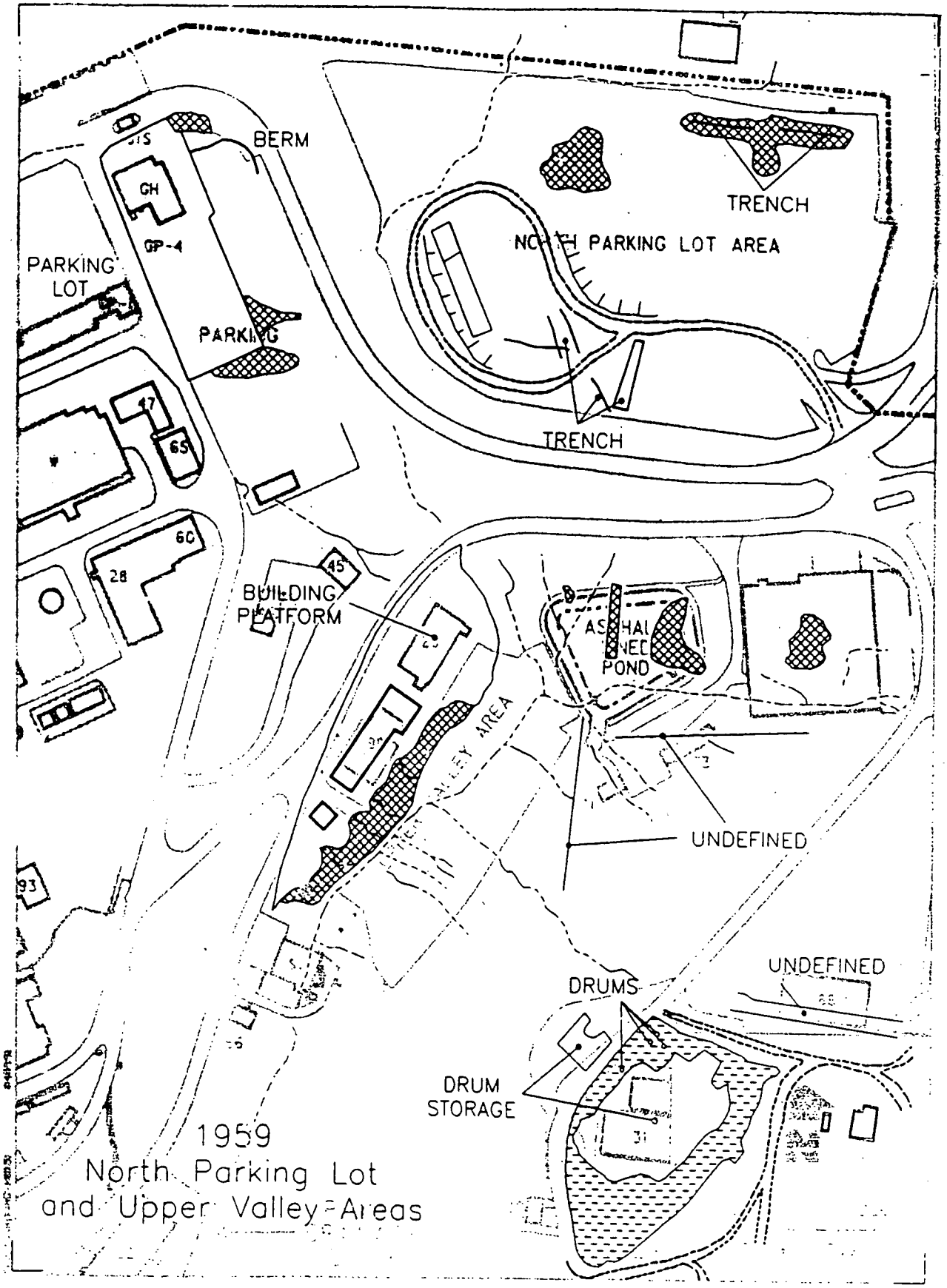


Figure 4.2. Interpretive map of Northern Study Area - 1959.

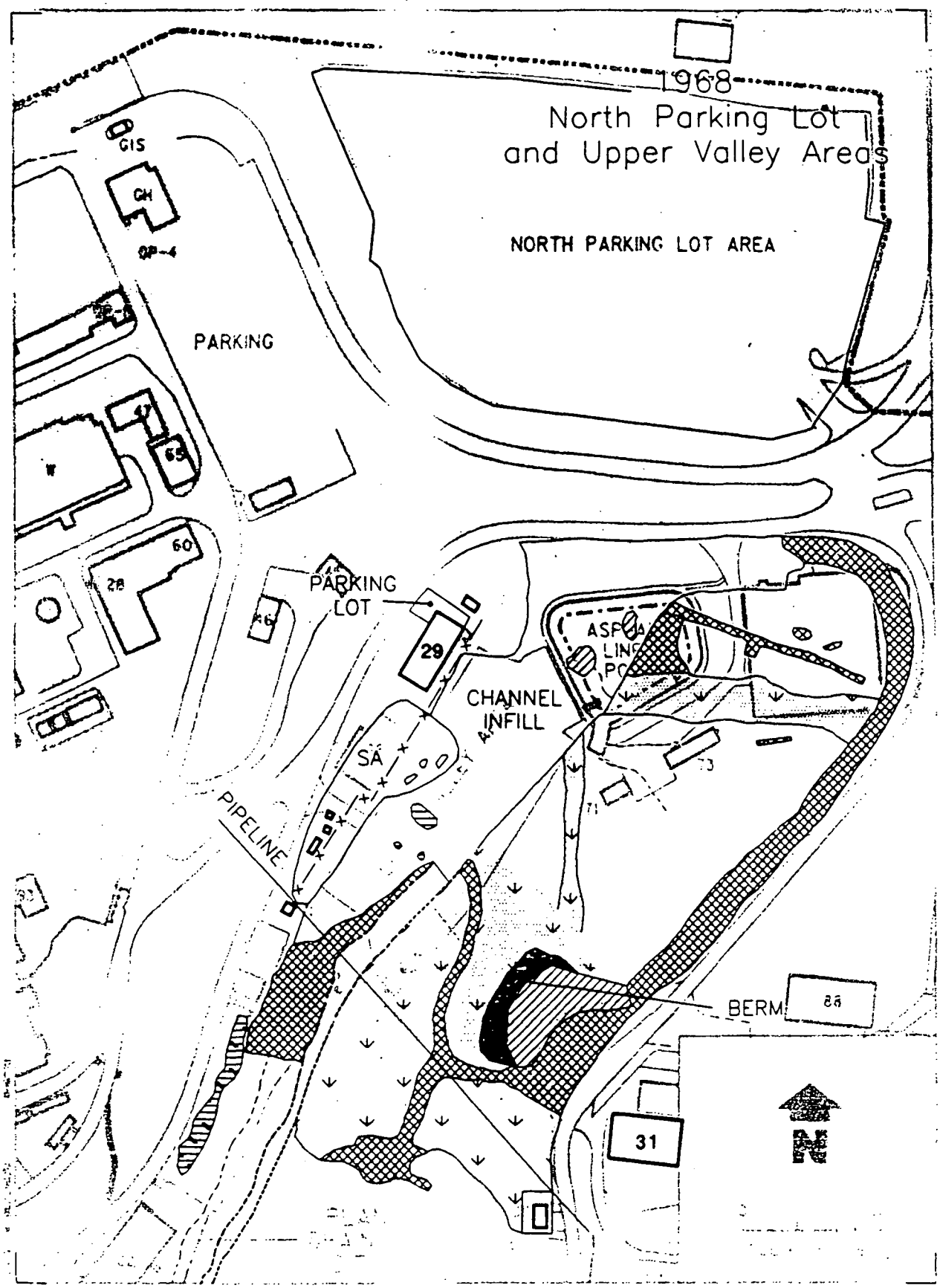


Figure 4.4. Interpretive map of Northern Study Area - 1968.

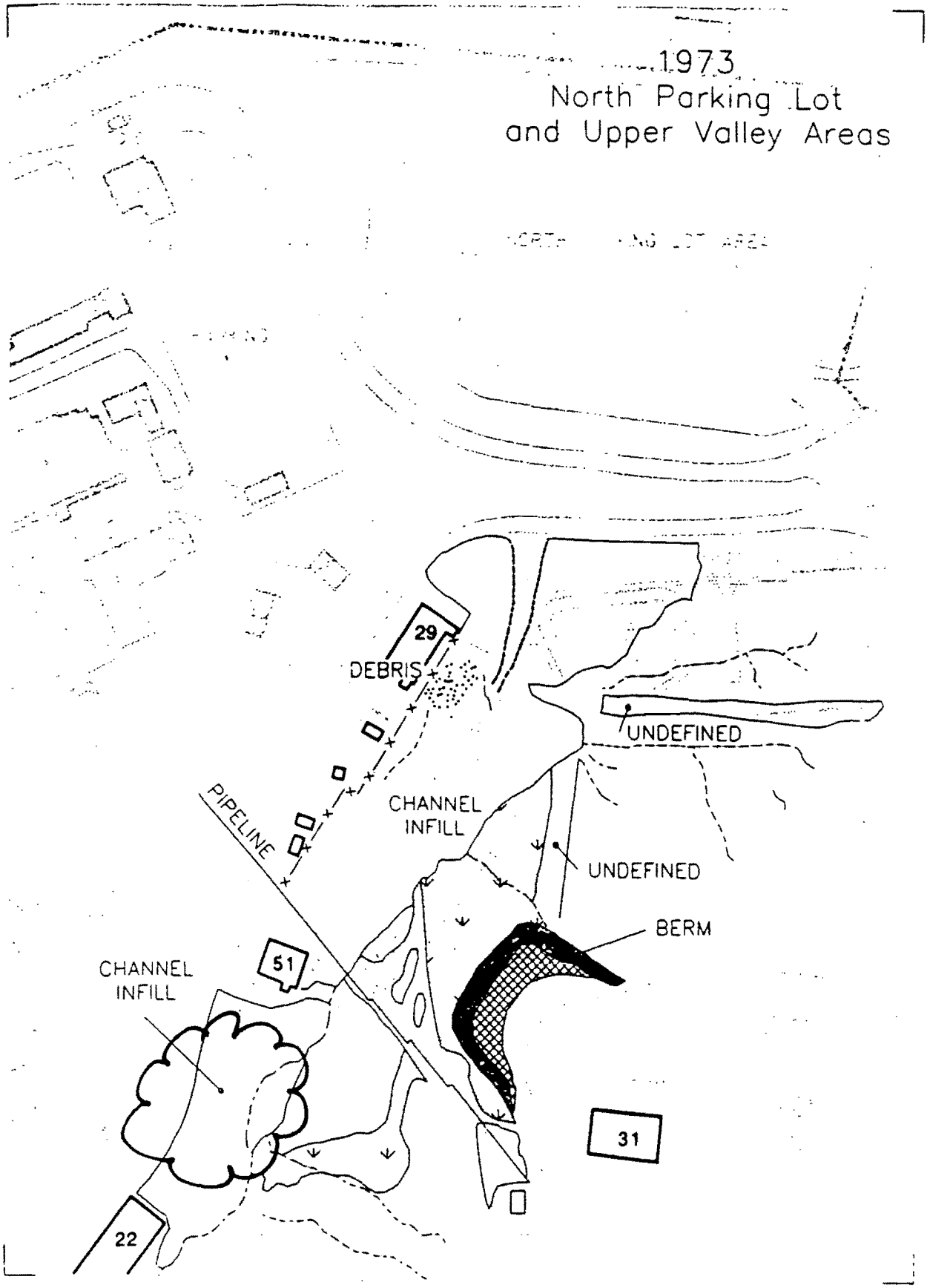


Figure 4.5. Interpretive map of Northern Study Area - 1973.

SOIL GAS SURVEY AND GEOPHYSICAL INVESTIGATIONS MAIN HILL AND SM/PP HILL AREAS RECONNAISSANCE SAMPLING

MOUND PLANT
MIAMISBURG, OHIO

February 1993

DEPARTMENT OF ENERGY
ALBUQUERQUE OFFICE

ENVIRONMENTAL RESTORATION PROGRAM
EG&G MOUND APPLIED TECHNOLOGIES

2.15 and 2.16). Trichloroethylene (TCE) was detected at 33 locations ranging from 2 to 34,780 ppb (Figures 2.17 and 2.18). Toluene was detected at 41 locations ranging from 3 to 23,142 ppb (Figures 2.19 and 2.20). Figures 2.21 and 2.22 illustrate the total VOCs detected at each location on the Main Hill.

Some of the trip blanks, ambient blanks, and field blanks collected during the Main Hill investigation contained minor amounts of some of the target compounds. Table II.5 presents the positive blank detections from the Main Hill sampling effort. Neither of the Main Hill groundwater samples contained measurable concentrations of the target compounds.

2.3.2 Old Firing Range Drum Storage Site/Area J

A total of 26 investigative samples were collected and analyzed from the grid at Area J at depths ranging from 5 to 20 feet. All samples initially were collected from a 5-foot depth (samples 3152-3188). Samples 3209 and 3210 were collected as discretionary locations following a review of the geophysical survey data, which showed potential for the burial of ferrous materials below a depth of 10 feet. These samples were collected at depths of 17 and 20 feet near the geophysical anomalies to determine the presence of VOCs at that greater depth. No groundwater was sampled nor encountered during the Area J field effort. Samples 3184 and 3186 could not be collected due to shallow obstructions encountered during probe placement.

Table II.6 summarizes the positive detections from the Area J sampling effort. Five of the eight target compounds were detected. Freon 11 was detected at three locations at concentrations ranging from 2 to 46 ppb (Figure 2.23). The compound 111TCA was detected at two locations ranging from 7 to 37 ppb (Figure 2.24). PCE was detected at one location at 15 ppb (Figure 2.25). TCE was detected at one location at 13 ppb (Figure 2.26). Toluene was detected at three locations ranging from 5 to 11 ppb (Figure 2.27). Figure 2.28 illustrates the total VOCs detected at each location in Area J.

There was one detection of PCE in an ambient blank sample during the Area J sampling effort at a concentration of 6 ppb. Table II.7 describes this blank detection.

2.3.3. Building 51

A total of 18 investigative samples were collected from 10 locations near Building 51. Sampling depths were planned to be 15 and 25 feet at each location, however, two locations were only sampled from 13 to 15 feet due to soil probe refusal. Of the eight locations having 25-foot samples, two were water samples (4159 and 4160).

Table II.8 summarizes the positive detections from the Building 51 area sampling effort. Seven of the eight target compounds were detected in the soil vapor samples. These detections are shown on Figures 2.29 through 2.36. These figures also show Area 7 results. Toluene was the only VOC detected in either of the two water samples. Freon 11 was detected at two locations and three depths at concentrations ranging from 5 to 89 ppb (Figure 2.29). Freon 113 was detected in the 15- and 25-foot samples at one location at 9 and 18 ppb, respectively (Figure 2.30). Cis-12DCE was detected in the 15-foot samples from two locations at concentrations of 8 and 18 ppb (Figures 2.31). 111TCA was detected at two locations and three depths at concentrations ranging from 4 to 37 ppb (Figure 2.32). PCE was detected at three locations and four depths at concentrations ranging from 7 to 44 ppb (Figure 2.33). TCE was detected in the 15- and 25-foot samples at three locations at concentrations ranging from 9 to 207 ppb (Figure 2.34). Toluene was detected at four locations and six depths at concentrations ranging from 0.2 to 37 ppb, however, all but the water sample collected from the 25-foot depth at location 4160 showed associated blank detections (Figure 2.35). Figure 2.36 shows the total VOCs detected at each location near Building 51 (excluding samples with associated blank interferences).

Table II.9 summarizes the blank detections from the Building 51 sampling effort. Two soil gas ambient blanks and one water trip blank contained toluene from 0.1 to 5 ppb.

2.3.4. Area 7

A total of 53 investigative samples were collected from Area 7. All locations were sampled at a 5-foot depth except samples 2211 and 2212, which were contingency samples collected from a 15-foot depth. One of the 5-foot samples was a water sample (2036). Table II.10 summarizes the positive detections from the Area 7 sampling effort. Area 7 detection figures are repeats of the Building 51 figures. Six of the eight target compounds were detected at Area 7. Freon 11 was detected at three locations at concentrations ranging from 7 to 32 ppb (Figure 2.29). Freon 113 was detected at four locations ranging from 4 to 33 ppb (Figure 2.30). CIS-12DCE was detected at two locations ranging from 3 to 10 ppb (Figure 2.31). 111TCA was detected at five locations ranging from 2 to 22 ppb (Figure 2.32). PCE was detected at two locations at 6 and 7 ppb (Figure 2.33). Toluene was detected at 24 locations within Area 7. Eight of the 24 locations had associated blank detections of toluene. Sample 2036 was a water sample, which also showed toluene in its associated field blank. Figure 2.35 illustrates the Area 7 toluene detections that do not have these associated blank detections. Figure 2.36 shows the total VOCs detected at each of the Area 7 sample locations.

TABLE II.8. SUMMARY OF POSITIVE DETECTIONS–BUILDING 51
(ppb)

SAMPLE ID	SAMPLE DATE	FREON 11	FREON 113	TRAN–12DCE	CIS–12DCE	111TCA	PCE	TCE	TOLUENE
~~MND–01–4157–0025w~~	~~[illegible]~~					---	---	---	0.2 *
MND–01–4160–0015	29 AUG 92	---	---	---	8	---	---		37 *
~~MND–01–4160–0025w~~	~~30 AUG 92~~	---	---	---	---	---	---	---	~~0.2 *~~
MND–01–4161–0015	29 AUG 92	---	---	---	---	---	---	9	8 *
MND–01–4161–1025	29 AUG 92	---	---	---	---	---	7	19	---
MND–01–4166–0015	31 AUG 92	5	9	---	---	---	44	75	---
MND–01–4166–0025	31 AUG 92	---	18	---	---	4	44	56	---
MND–01–4167–0015	31 AUG 92	89	---	---	18	37	44	207	8 *
MND–01–4167–0025	31 AUG 92	36	---	---	---	11	---	169	8 *

Notes:

Only sample locations having positive detections are shown.

*: Associated trip, ambient, equipment or field blank contained specified compound.

B: Indicates blank sample.

w: Indicates water sample.

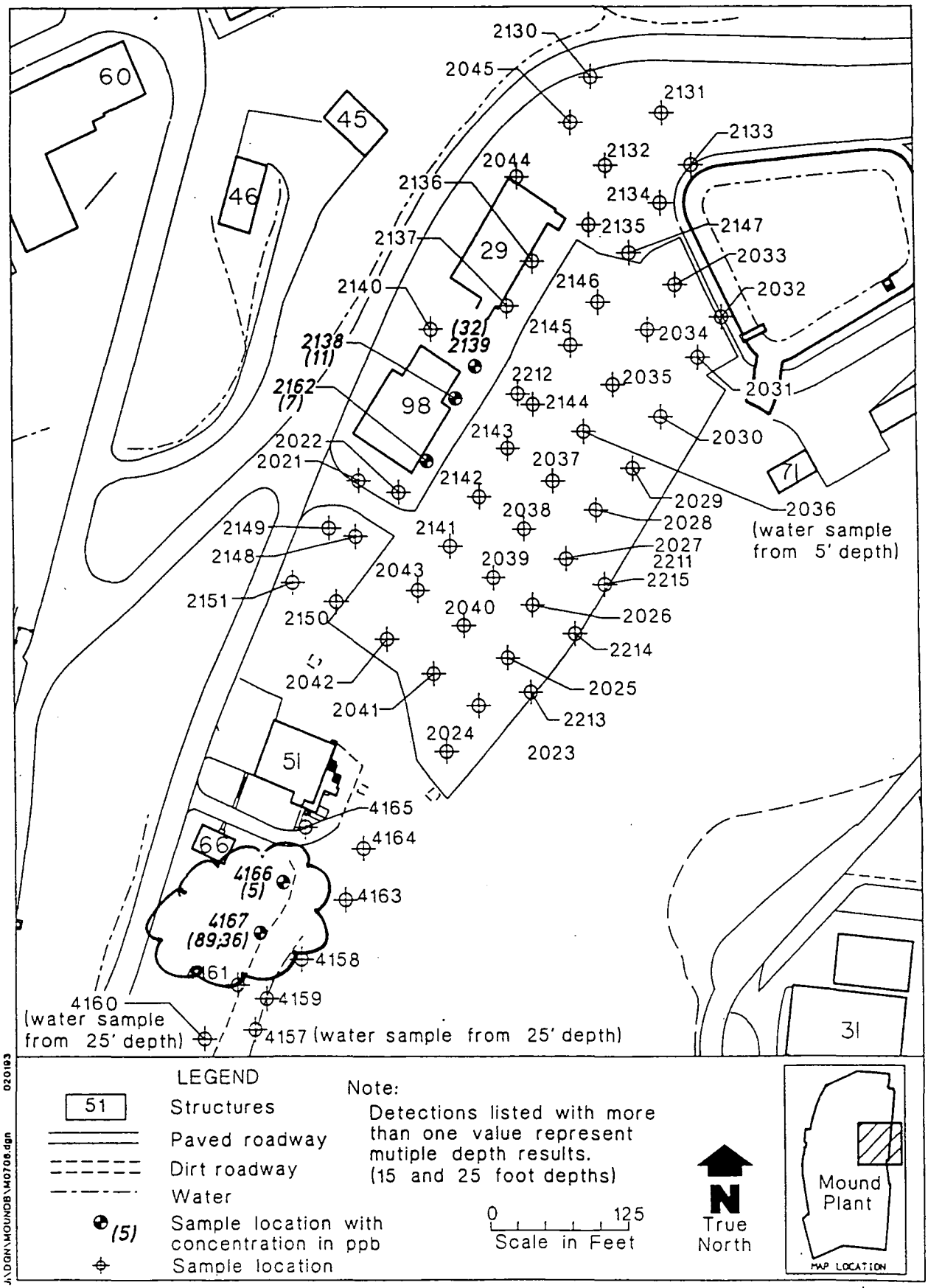


Figure 2.29. Freon II detection map for Area 7 and Building 51.

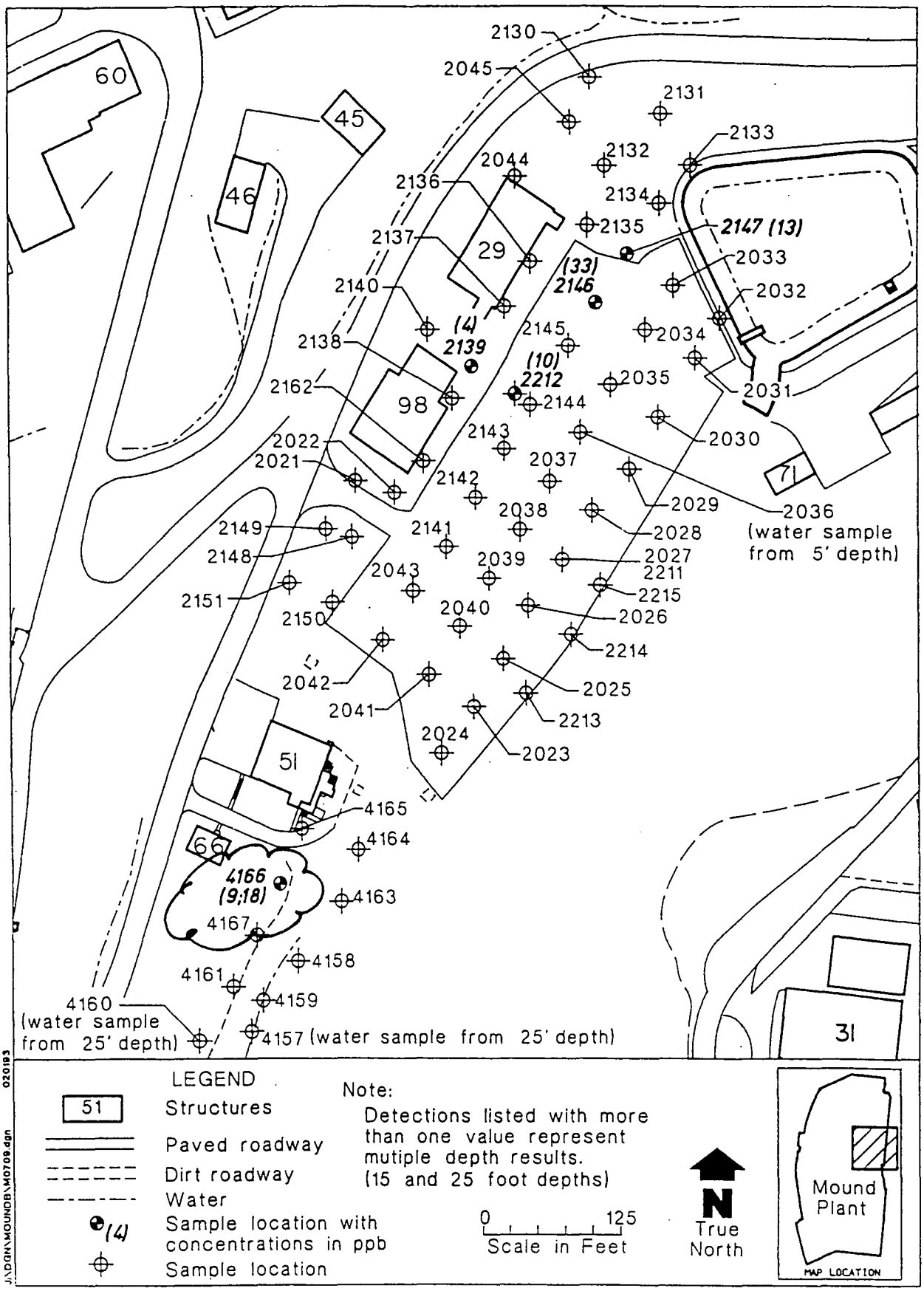


Figure 2.30. Freon 113 detection map Area 7 and Building 51.

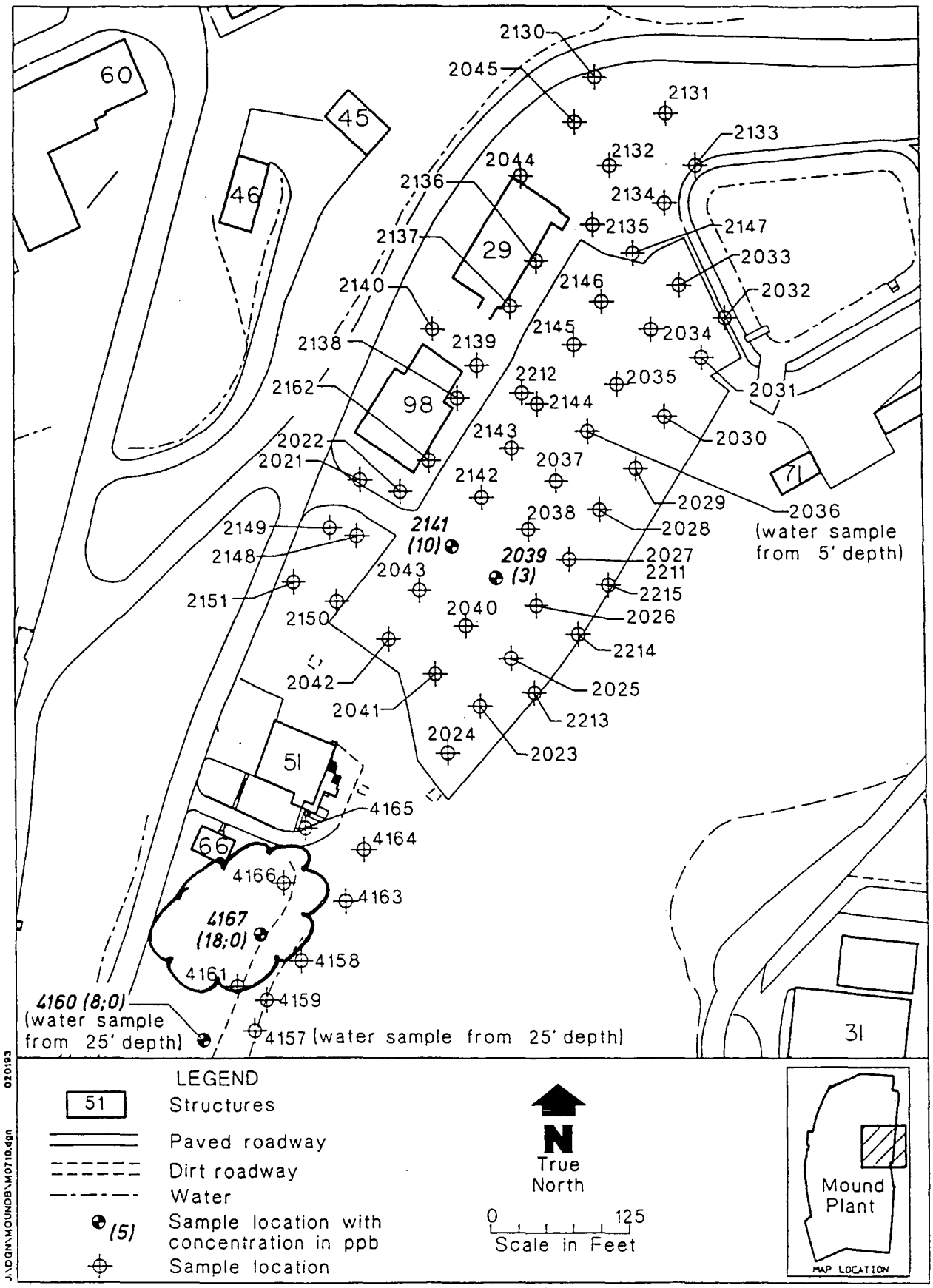


Figure 2.31. CIS-1,2-Dichloroethene detection map for Area 7 and Building 51.

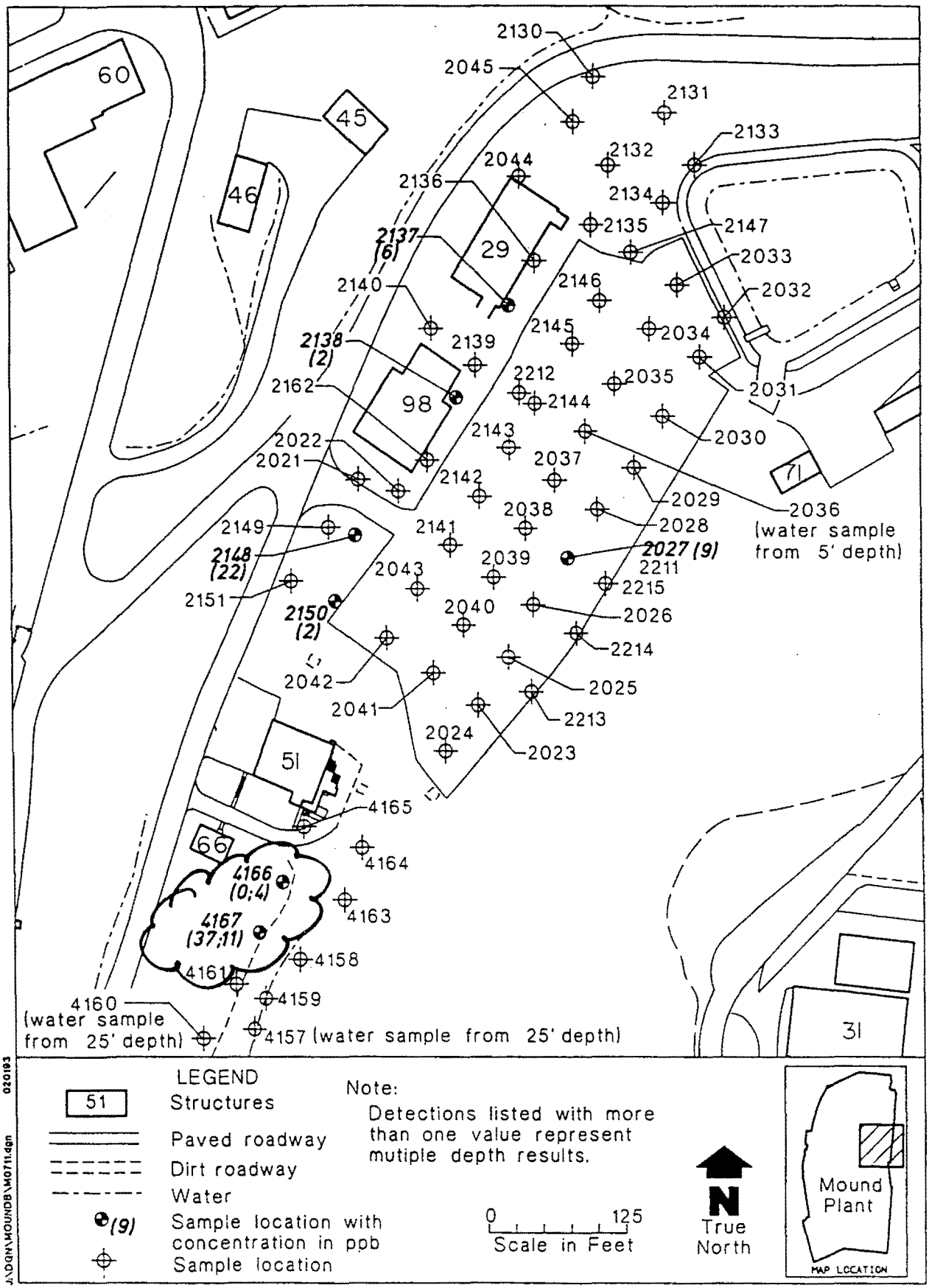


Figure 2.32. 1,1,1-Trichloroethane detection map for Area 7 and Building 51.

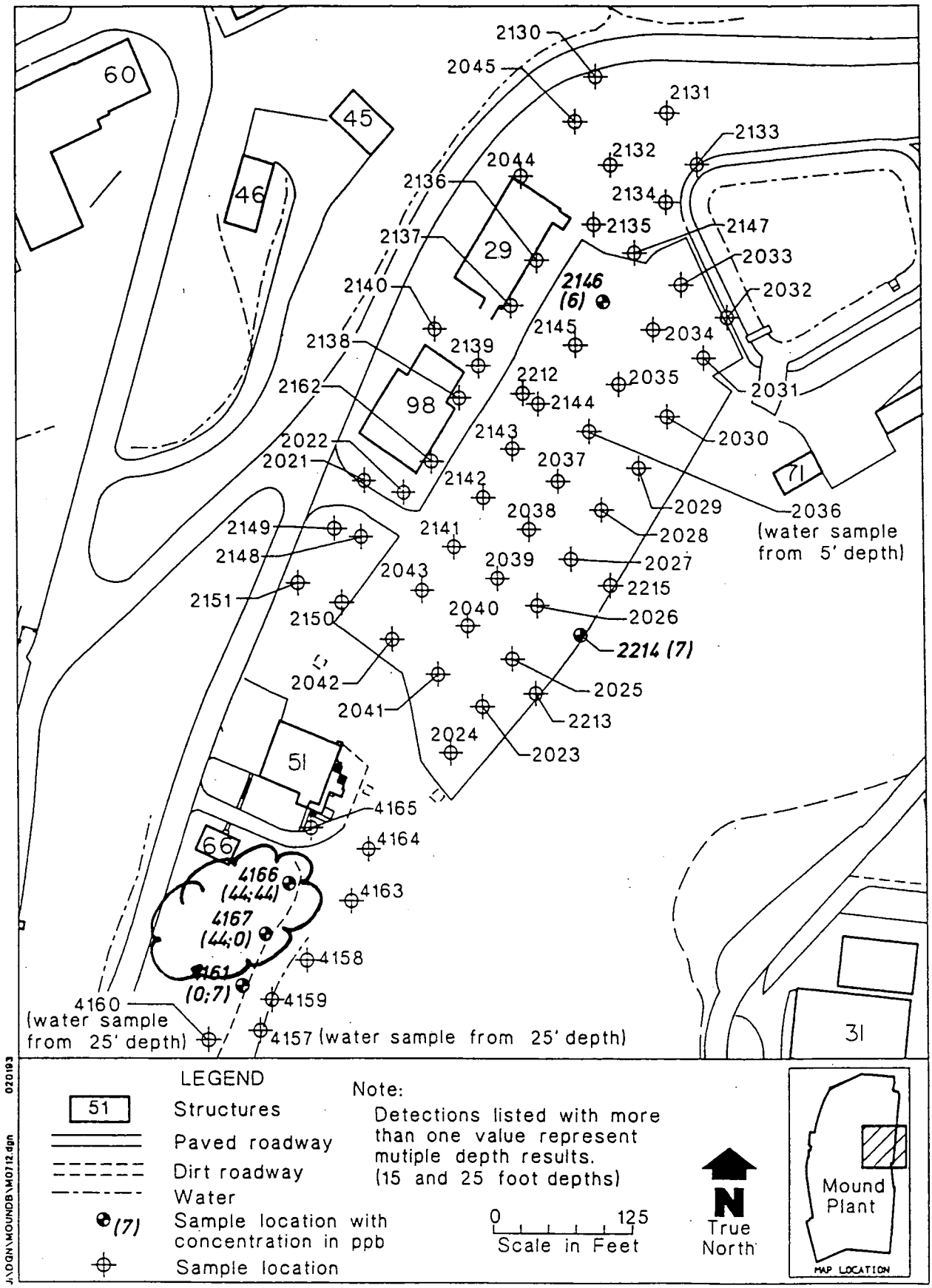


Figure 2.33. Tetrachloroethene detection map for Area 7 and Building 51.

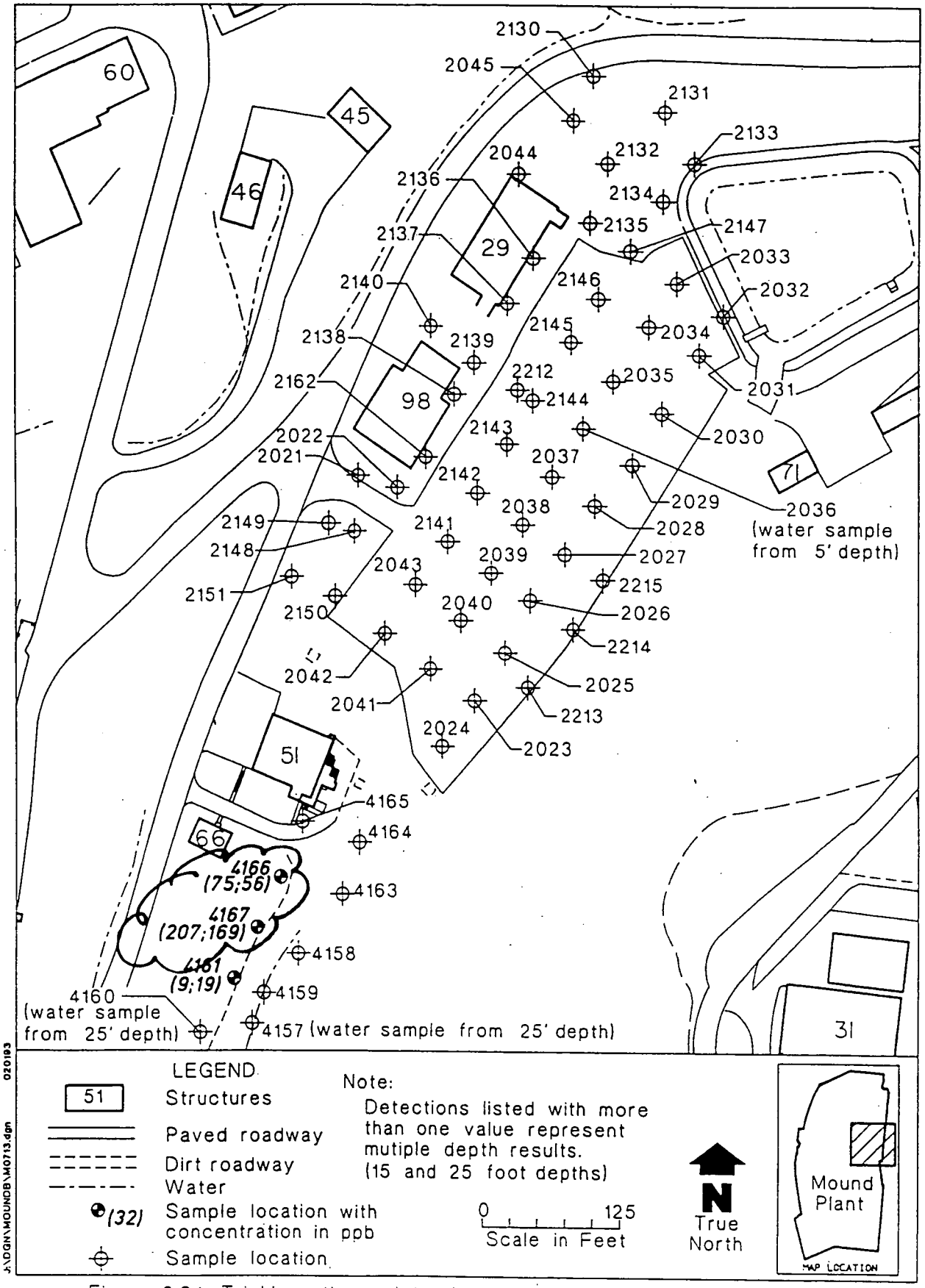


Figure 2.34. Trichloroethene detection map for Area 7 and Building 51.

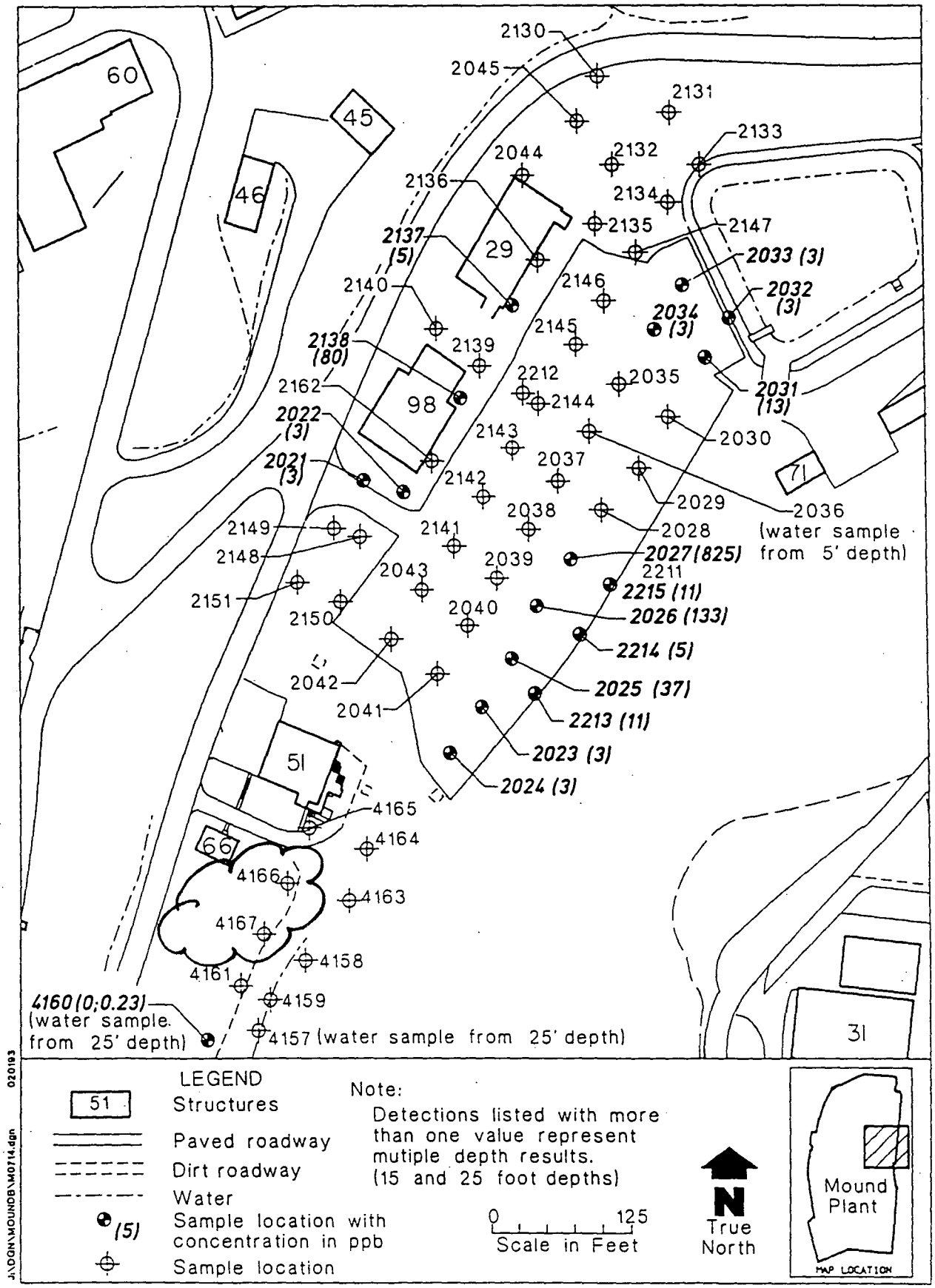


Figure 2.35. Toluene detection map for Area 7 and Building 51.

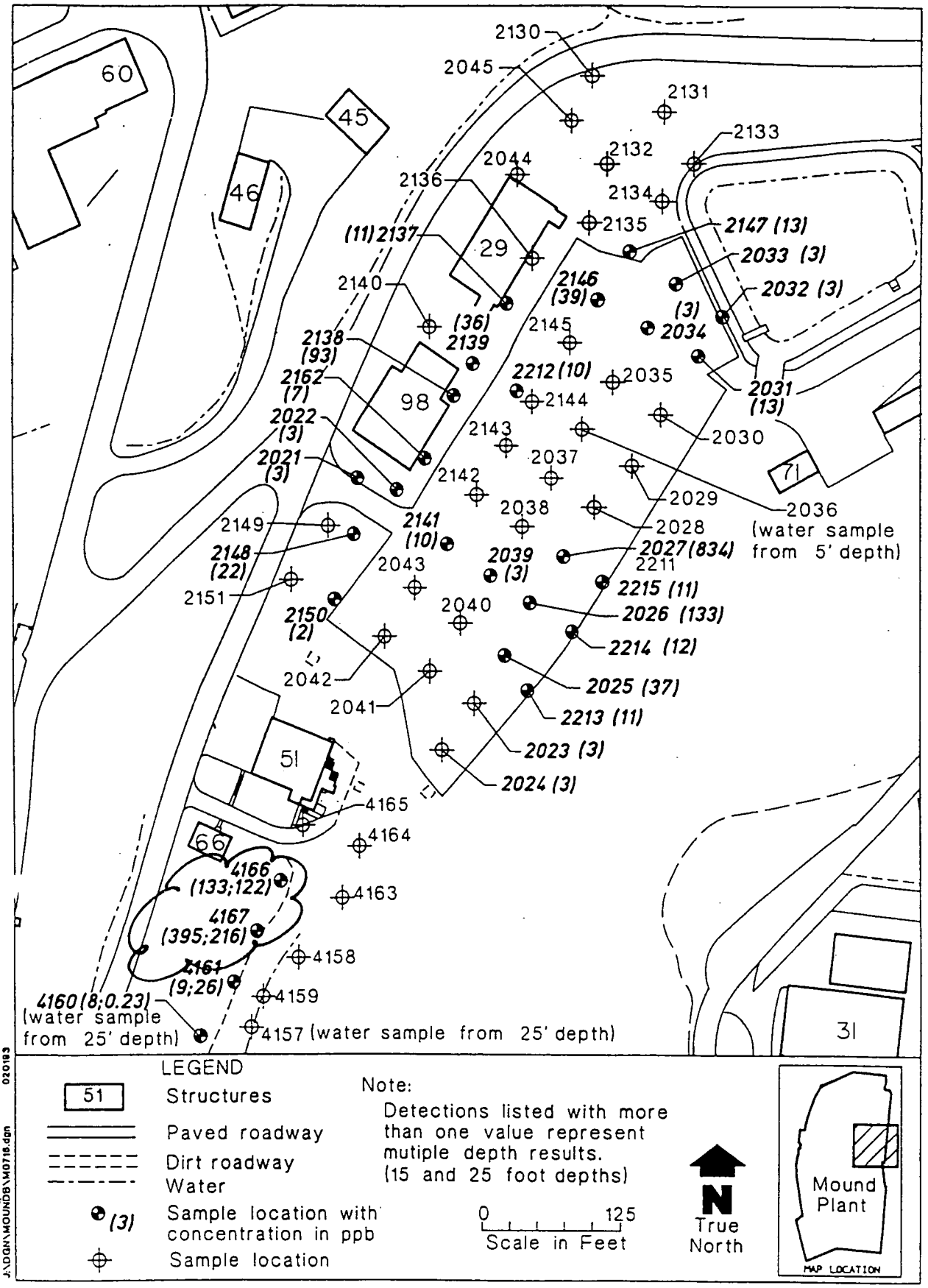


Figure 2.36. Total VOCs detection map for Area 7 and Building 51.

COMPARISON OF ACTUAL SOIL GAS VALUES WITH CALCULATED ACCEPTABLE SOIL GAS VALUES

SCREENING POTENTIAL RELEASE SITES BASED ON SOIL GAS READINGS

Soil gas readings can be utilized in the PRS screening process to identify potential release sites that may present a potential soil contamination problem for volatile organics. The soil gas survey that was conducted at Mound as part of the "Reconnaissance Sampling Report--Soil Gas Survey and Geophysical Investigations, Mound Plant Main Hill and SM/PP Hill" investigated 8 volatile compounds. The concentrations of these compounds in the in the vapor phase within the pore spaces of the soil can be correlated to the actual soil contaminant concentrations by utilizing a method developed by ICF Kaiser Engineers. This technique has been used with US EPA Region IX approval at a large Superfund site contaminated with many of the same chemicals found at relatively low levels in soils at the Mound Plant.

The soil concentration can be estimated from the soil gas values by the following equation:

$$Ct = (Cg/Pb)*[[Pb * Kd / H] + [pw / H] + [pt - pw]]$$

where

Cg	concentration of volatile chemical concentrations as soil vapor in ng/ml
Pb	Bulk density of the soil in g/ml
Kd	soil/water partition coefficient in ml/g
H	Dimensionless Henry's Law Constant
pw	water filled porosity
pt	total porosity
Ct	target soil concentration in ng/g or ug/kg (ppb)

The technique that Mound Plant will use for screening a PRS is to compare the soil gas values obtained at a PRS with soil gas concentrations that are known to be below any regulatory or health based level of concern. The risk based guideline values for the Mound Plant (DOE, December 1995) soils are based upon 10^{-6} risk levels or a hazard index of 1. These values correspond to direct soil exposure to persons who's activities place them at the highest risk, in particular inhalation and ingestion by a Mound Plant construction worker.

Another potential exposure path must be considered, however. The potential for some of the organic contaminants to leach into ground water must be considered in developing protective soil screening levels. A "Mound Plant Soil Screening Level" paper explains the calculation of soil screening levels. For all of the chemicals that the soil gas survey identified, the calculated soil screening level soil concentrations are below the standard guideline values, therefore they are more conservative and are appropriate to be used as the basis for the soil gas calculations.

By re-arranging the equation, and using either the soil guideline values or the soil screening levels as the target soil concentration, a soil gas concentration can be calculated; this calculated soil gas concentration can be compared to the actual observed soil gas values:

$$Cg = (Pb*Ct)/[[Pb*Kd/H] + [pw/H] + [pt-pw]]$$

The values of the soil specific and chemical parameters for this equation are summarized as follows:

Pb	1.6	Bulk density of the soil in g/ml
pw	0.15	water filled porosity
pt	0.43	total porosity
foc	0.02	fraction organic material in soil (used in developing the SSL values)

Typical chemicals that are detected with soil gas sampling are:					
NAME	H	Kd	Calculated Acceptable	Calculated Acceptable	Calculated Acceptable
			Soil Screening Level Value	Soil Gas Reading	Soil Gas Reading
		ml/g	mg/kg (ppm)	ng/ml	ppb
Toluene	2.52E-01	3.42	22.06	1.56E+03	414600
Trichloroethene (TCE)	4.35E-01	2.24	0.07	1.26E+01	2400
111 Trichloroethane (TCA)	7.63E-01	2.2	3.01	9.46E+02	173400
Trans-1,2 Dichloroethene (DCE)	2.29E-01	1	0.70	1.41E+02	35700
cis-1,2 Dichloroethene (DCE)	1.85E-01	2.78	0.31	1.97E+01	5000
Freon 11	NA	NA			
Freon 113	NA	NA			
Tetrachloroethene (PCE)	7.09E-01	2.78	0.09	2.13E+01	3100

na not available

IF THE SOIL GAS READING IS BELOW THE VALUES IN THE CALCULATED SOIL GAS READING COLUMN (SHADED), THEN THERE IS NO THREAT TO GROUNDWATER FROM THIS PRS.

The soil screening level values are calculated using the Soil Screening Methodology. The Potential Release Site is assumed to be more than 100 meters from a potential drinking water source with an aquifer thickness of 15 meters and a source size of 10 meters. The hydraulic gradient is assumed to be 0.01 which is conservative for most of the Mound Plant PRSs. In special instances where the PRS lies less than 100 meters from a potential drinking water source, or the hydraulic gradient is much less than 0.01, new SSL values and new acceptable soil gas values will be calculated for that particular PRS.

MOUND

Environmental
Restoration
Program

Further Assessment

Soil Gas Confirmation Sampling

Mound Plant
Miamisburg, Ohio

May 1996

Revision 0

Department of Energy

EG&G Mound Applied Technologies

Table I.1 Soil Analyte List

Volatile Organic Compounds

Acetone	Dibromochloromethane	4-Methyl-2-Pentanone
Benzene	1,1-Dichloroethane	Styrene
Bromodichloromethane	1,2-Dichloroethane	1,1,2,2-Tetrachloroethane
Bromoform	1,1-Dichloroethene	Tetrachloroethene
Bromomethane	1,2-Dichloroethene (total)	1,1,1-Trichloroethane
2-Butanone	1,2-Dichloropropane	1,1,2-Trichloroethane-
Carbon Disulfide	cis-1,3-Dichloropropene	Trichloroethene
Carbon Tetrachloride	trans-1,3-Dichloropropene	Toluene
Chlorobenzene	Ethylbenzene	Vinyl Acetate
Chloroethane	2-Hexanone	Vinyl Chloride
Chloroform	Methylene Chloride	Xylenes (total)
Chloromethane		

Semivolatile Organic Compounds

Acenaphthene	Chrysene	Hexachlorobenzene
Acenaphthylene	Dibenz(a,h)anthracene	Hexachlorobutadiene
Anthracene	Dibenzofuran	Hexachlorocyclopentadiene
Benzo(a)anthracene	1,2-Dichlorobenzene	Hexachloroethane
Benzo(a)pyrene	1,3-Dichlorobenzene	Indeno(1,2,3-cd)pyrene
Benzo(b)fluoranthene	1,4-Dichlorobenzene	Isophorone
Benzo(g,h,i)perylene	3,3-Dichlorobenzidine	2-Methylnaphthalene
Benzo(k)fluoranthene	2,4-Dichlorophenol	2-Methylphenol
bis(2-Chloroethoxy)methane	Diethylphthalate	4-Methylphenol
bis(2-Chloroethyl)ether	2,4-Dimethylphenol	Naphthalene
bis(2-Ethylhexyl)phthalate	Dimethyphthalate	2-Nitroaniline
4-Bromophenyl-phenylether	Di-n-butylphthalate	3-Nitroaniline
Butylbenzylphthalate	Di-n-octylphthalate	4-Nitroaniline
Carbazole	4,6-Dinitro-2-methylphenol	Nitrobenzene
4-Chloroaniline	2,4-Dinitrophenol	2-Nitrophenol
4-Chloro-3-methylphenol	2,4-Dinitrotoluene	4-Nitrophenol
2-Chloronaphthalene	2,6-Dinitrotoluene	N-Nitroso-di-n-propylamine
2-Chlorophenol	Fluoranthene	N-Nitroso-diphenylamine
4-Chlorophenyl-phenylether	Fluorene	2,2-oxybis(1-Chloropropane)
Pentachlorophenol	Pyrene	2,4,5-Trichlorobenzene
Phenanthrene	1,2,4-Trichlorobenzene	2,4,6-Trichlorobenzene
Phenol		

Table I.1 Soil Analyte List (Continued)

Pesticides/PCB's		
Aroclor-1016	Delta-BHC	Endosulfan II
Aroclor-1221	Gamma-BHC	Endosulfan sulfate
Aroclor-1232	alpha-Chlordane	Endrin
Aroclor-1242	gamma-Chlordane	Endrin aldehyde
Aroclor-1248	4,4'-DDD	Endrin ketone
Aroclor-1254	4,4'-DDE	Heptachlor
Aroclor-1260	4,4'-DDT	Heptachlor epoxide
Aldrin	Dieldrin	Methoxychlor
Alpha-BHC	Endosulfan I	Toxaphene
Beta-BHC		
Inorganics		
Aluminum	Copper	Potassium
Antimony	Cyanide	Selenium
Arsenic	Iron	Silver
Barium	Lead	Sodium
Beryllium	Lithium	Thallium
Bismuth	Magnesium	Tin
Cadmium	Manganese	Vanadium
Calcium	Mercury	Zinc
Chromium	Molybdenum	Nitrate/Nitrite
Cobalt	Nickel	Explosives (USATHAMA,PETN)
Radionuclides		
Americium-241	Plutonium-238	Thorium-230
Bismuth-207	Plutonium-239/240	Thorium-232
Bismuth-210	Potassium-40	Uranium-234
Cesium-137	Radium-226	Uranium-235
Cobalt-60	Thorium-228	Uranium-238

1.2. SAMPLE NUMBERING SCHEME

The sample identification numbers were assigned by Mound to each location in the following format: XXX-AAA-######. For each location, the first three characters were SGC, identifying the sample as part of the soil gas confirmation study. The next three characters represented the area from which each sample was taken:

A03 = Area 3
A07 = Area 7
A13 = Area 13
A21 = Area 21
A22 = Area 22
SDB = Area SDB
AOJ = Area AOJ
NAC = Non-AOC areas (Area of Concern)
SAN = Sanitary area

The final six digits were a sequential number beginning with 000001. The samples related to this study begin with 000001 and end with 000102. Due to an error in surveying, samples 000099 and 000100 were taken from the wrong locations. The sites were resurveyed and the samples were taken again, renamed as 000101 and 000102. No other problems arose with the sample identification.

1.3 SURVEYING

Prior to this sampling event, surveying relocated each of the 100 sites based on coordinates from a previous soil gas sampling event. Surveyors from Barge, Waggoner, Sumner and Cannon, of Miamisburg, Ohio, completed the task, using a benchmark map of approximately 50 locations with state plane coordinates provided by EG&G. Each point was relocated with an accuracy of ±6 inches and identified with either a 3-foot stake with orange flagging tape and the sample identification number or a pin driven into the ground through orange flagging with the sample identification number written on the flagging. The surveyed sampling locations are shown on Figure 1.1.

1.4 UTILITIES CLEARANCE/VARIANCES

After surveying, all sites were checked for the presence of underground utilities by EG&G personnel. The requirement states that sample sites must be located five feet or more from utilities. Situations in which the 5-foot rule was not met were handled in one of three ways: 1) **relocations** - sample sites were placed 5 feet or more from utility markings and normal sampling procedures were followed; 2) **hand-digging** - the VOC sample soil was collected using the core sampler, which was driven only to the depth necessary to collect the VOC sample, and the remaining soil was collected using a hand auger; or 3) **variances to the 5-foot clearance requirement** - some sites were located near visible utilities, so after safe clearance was established, normal sampling procedures were followed. Alternatively, some locations had underground utilities at relitivley deeper depths. At these locations, normal sampling procedures were followed except that digging/coring was limited to two feet instead of the established three feet. No utilities were damaged during the sampling event.

Some locations had no utility interference but still could not be sampled to three feet due to "refusal"--an inability to drive the sampler deeper. This usually indicates that bedrock or large gravel has been reached. In such cases, multiple shallow cores were taken.

A complete list of sites with variances to the original soil gas sampling location or depth can be found in Table I.2.

1.5 SOIL SAMPLING METHODOLOGY

Soil was collected at each location using either a van-mounted Geoprobe® rig equipped with a core sampler, an electric hammer equipped with a core sampler, or a hand auger. The device chosen depended upon the particulars of the location. Acetate liners were used in the Geoprobe® core barrel and the hand-held core sampler. The liners were cut open with utility knives, using a new blade at each site.

The first six inches of the core, designated for radionuclide analysis, were removed using a clean, stainless steel scoop and placed in a clean stainless steel bowl to be homogenized. Soil was cut from between the 6-inch and 1-1/2 foot depth and placed directly into jars appropriate for volatile organic compound (VOC) analysis, leaving as little headspace as possible. The remaining soil was then placed into another clean stainless steel bowl. If necessary to obtain sufficient sample volume, another core was taken, and the above process was repeated. When enough soil was collected to fill all the sample jars, the contents of both bowls were individually homogenized and used to fill their respective containers. The jars were labeled prior to being filled. Each sample was then secured with a custody seal, sealed in a plastic bag and stored in a refrigerator in Building 19. Radiological samples were delivered to the Mound Environmental Laboratory for screening. Several duplicate radiological samples were collected and set aside for later analysis by the Mound wet chemistry laboratory. After screening clearance was obtained from the Mound Environmental Laboratory, the samples were sealed in coolers and shipped to off-site contract laboratories for analysis. The contract laboratory for radionuclide analysis was Quanterra Environmental Services in Richland, Washington. All other analyses were completed by Roy F. Weston, Incorporated Laboratory in Lionville, Pennsylvania.

acc
ple

Table I.2. Variance From 3-Foot Sampling Depth Specification

Location	Description of Variance
SGC-NAC-000001	Core sampler hit refusal at 2 feet.
SGC-NAC-000002	Relocated due to utilities.
SGC-NAC-000003	Core sampler hit refusal at 2 feet.
SGC-NAC-000004	Core sampler hit refusal at 18 inches.
SGC-NAC-000005	Drilled to 1 foot, hand-augered rest due to utilities.
SGC-NAC-000006	Drilled to 1 foot, hand-augered rest due to utilities.
SGC-NAC-000007	Core sampler hit refusal at 18 inches.
SGC-NAC-000008	Drilled to 2 feet due to utilities.
SGC-NAC-000010	Drilled to 1 foot; hand-augered rest due to utilities; flag against building, so sample taken 6 feet from flag.
SGC-NAC-000012	Drilled to 2 feet due to utilities.
SGC-SAN-000018	Core sampler hit refusal at 2 feet; relocated from inside clarifier.
SGC-NAC-000029	Core sampler hit refusal at 18 inches.
SGC-A61-000043	Sampled 1 foot from flag.
SGC-A61-000047	Drilled to 2 feet due to utilities.
SGC-A61-000048	Drilled to 2 feet due to utilities.
SGC-A61-000049	Relocated due to utilities.
SGC-A61-000051	Core sampler hit refusal at 18 inches.
SGC-A61-000052	Relocated due to utilities; core sampler hit refusal at 18 inches.
SGC-A61-000053	Core sampler hit refusal at 2 feet.
SGC-A13-000056	Core sampler hit refusal at 18 inches
SGC-A13-000058	Drilled to 1 foot, hand-augered rest due to utilities.
SGC-A13-000060	Core sampler hit refusal at 1 foot.
SGC-AOJ-000064	Core sampler hit refusal at 2 - 3 inches.
SGC-AOJ-000066	Core sampler hit refusal at 4 inches.
SGC-AOJ-000067	Core sampler hit refusal at 6 inches.
SGC-AOJ-000069	Core sampler hit refusal at 2 feet.
SGC-A03-000080	Core sampler hit refusal at 20 inches
SGC-A03-000081	Drilled to 2 feet due to utilities.
SGC-A03-000082	Drilled to 1 foot, hand-augered rest due to utilities.
SGC-A03-000083	Sampled 25 feet from original location due to storm sewer; core sampler hit refusal at 18 inches.
SGC-A03-000087	Core sampler hit refusal at 2 feet.
SGC-A21-000088	Core sampler hit refusal at 18 inches.
SGC-A21-000090	Core sampler hit refusal at 20 inches.
SGC-SDB-000097	Relocated due to utilities.
SGC-SDB-000098	Relocated from inside a building.
SGC-SDB-000101	Relocation of SGC-SDB-000099; first location surveyed incorrectly.
SGC-SDB-000102	Relocation of SGC-SDB-000100; first location surveyed incorrectly.

The following tables contain the Soil Gas Confirmation Sampling results. Sampling was performed for the following categories of contaminants:

Volatiles
Semivolatiles
PCBs/pesticides
Metals
Radionuclides
Explosives

If no results are given for the contaminant categories listed above, then no detects were found for that category of contaminants.

This page was inserted for clarity. It is not part of the Soil Gas Confirmation Report.

Table A.1. Soil Gas Confirmation Detected Volatile Organic Compounds (cont.)

ANALYTE	SGC NAC 000036	SGC NAC 000037	SGC NAC 000038	SGC NAC 000039	SGC A66 000040	SGC A66 000041	Background	10^{-6} Construction Worker Guidelines
VOLATILES (μg/Kg)								
Acetone						88	NA	105000000
1,2-Dichloroethene (total)							NA	21500000
2-Butanone						7 J	NA	46500000
Benzene							NA	8900
Carbon Disulfide							NA	1400000
Chloroform							NA	NA
Chloromethane							NA	NA
Ethylbenzene							NA	480
Methylene Chloride	17	2	12		8	7	NA	NA
Tetrachloroethene							NA	10500000
Toluene		1		1			NA	1250000
Trichloroethene							NA	41000
Xylene (total)							NA	2150000000

Table A.2. Soil Gas Confirmation Detected Semivolatile Organic Compounds (cont.)

ANALYTE	SGC NA 00003	SGC A66 000040	SGC A66 000041	SGC A61 000042	SGC A61 000043	SGC A61 000044	Background	10^{-6} Construction Worker Guidelines
SEMIVOLATILES (μg/Kg)								
Acenaphthene		130 J	97 J				NA	NA
Acenaphthylene							NA	NA
Anthracene		150 J	110 J				NA	320000000
Benzo(a)anthracene		550	420				NA	4100
Benzo(a)pyrene		570	430				NA	410
Benzo(b)fluoranthene		540	380				NA	4100
Benzo(g,h,i)perylene		400	310 J				NA	NA
Benzo(k)fluoranthene		550	360 J				NA	41000
Bis(2-ethylhexyl)phthalate			4400 D				NA	215000
Butylbenzylphthalate							NA	215000000
Carbazole		180 J	97 J				NA	NA
Chrysene		680	490		23 J		NA	410000
Di-n-butyl phthalate	240					4 J	NA	105000000
Di-n-octyl phthalate							NA	21500000
Dibenz(a,h)anthracene		120 J	92 J				NA	410
Dibenzofuran		48 J	35 J				NA	NA
Diethyl phthalate							NA	NA
Fluoranthene		1500	1000	26 J	25 J		NA	42500000
Fluorene		74 J	60 J				NA	NA
Indeno(1,2,3-cd)pyrene		370 J	290 J				NA	4100
2-Methylnaphthalene							NA	NA
Naphthalene		26 J	26 J				NA	NA
Phenanthrene		1100	720		25 J		NA	NA
Phenol							NA	650000000
Pyrene		1200	880	21 J	30 J		NA	32000000

Table A.4. Soil Gas Confirmation Detected TAL Inorganics (cont.)

ANALYTE	SGC NAC 000037	SGC NAC 000038	SGC NAC 000039	SGC A66 000040	SGC A66 000041	SGC A66 000042	Background	10^{-6} Construction Worker Guidelines
INORGANICS (mg/kg)								
Aluminum	15700	7[illegible]	15400	5600	3030	4860	19000	NA
Antimony			0.27 B			[illegible]9 B	NA	425
Arsenic	4.5	8.3	3.1	7.3	3.2	6.4	8.6	320
Barium	97.[illegible]	58.4	122	71.1	19.1 B	37.3 BJ	180	75000
Beryllium	0.[illegible]	0.46	0.[illegible]	0.13 B		0.13 B	1.3	0.7
Bismuth	1.7 B	1.4 B					NA	NA
Cadmium							2.1	1050
Calcium	10100	8[illegible]00	3980	158000	189000	18900	310000	NA
Chromium	20.8	1[illegible]	19	7.7	6.7	8	20	1050000
Cobalt	13.2 B	7.7 B	13.5	4.9 B	3.3 B	6.1 B	19	NA
Copper	19.4	14.2	[illegible].8	9.7	22.1	13.[illegible] J	26	NA
Cyanide				0.59 B	0.56 B		ND	21400
Iron	309[illegible]	18100	26[illegible]	13800	8300	1450[illegible] J	35000	NA
Lead	11.1	11.2	12.8	23	11.3	9.2	48	NA
Lithium	24.6 B	14.2 B	15.8 B	12.3 B	11.7 B	14.3 B	26	NA
Magnesium	4430	29[illegible]	3790	81600	68600	23400 J	40000	NA
Manganese	1120	7[illegible]	1400	596	273	78 J	1400	135000
Mercury							NC	320
Molybdenum	0.7	1.1 B	[illegible] B	0.9 B	0.62 B	1.6 B	27	NA
Nickel	26.[illegible]	18.1	25.8	9.8	7.6 B	14.8	32	21500
Potassium	2650 B	1160 B	232[illegible]	536 B	562 B	600 B	1900	NA
Selenium						0.4[illegible] BJ	NA	NA
Silver					0.3 B		1700	5500000
Sodium	305 B	165[illegible] B	99.8 B	698 B	329 B	1540 J	240	NA
Thallium						0.67 BJ	460	NA
Tin			1.6			4.4 B	20	NA
Vanadium	25.9	17	25[illegible]	12.2	7.1 B	10.4 J	25	7500
Zinc	71.3	47.8	[illegible]1.8	34	46.8	[illegible].1 J	140	320000

Table A.6. Soil Gas Confirmation Detected Radionuclides (cont.)

ANALYTE	SGC NAC 000036	SGC NAC 000037	SGC NAC 000038	SGC NAC 000039	SGC A66 000040	SGC A66 000041	SGC A66 000042	Background	10^{-6} Construction Worker Guidelines
RADIONUCLIDES (pCi/g)									
Americium-241								ND	4.95
Bismuth-207								ND	0.175
Bismuth-210								ND	NA
Cesium-137		0.305	0.600				0.201	0.42	0.46
Cobalt-60								NC	0.1
Plutonium-238	0.19[illegible]	1.53	0.0[illegible]4	0.144	0.264	0.0496	0.937	0.13	5.5
Plutonium-239/240		0.00848	0.00898					0.18	5.5
Potassium-40	18.7	19.8	17.7	24[illegible]	9.55	18.2	[illegible]05	37	NA
Radium-226	1.26	1.2[illegible]	0.983	[illegible]6	0.432	0.834	0.635	2	0.14
Thorium-228	1.50	1.0[illegible]	1.05	0.987	0.319	0.755	1.01	1.5	0.85
Thorium-230	1.27	[illegible]12	1.23	1.24	0.416	1.10	0.578	1.9	44
Thorium-232	1.[illegible]	1.06	1.[illegible]1	1.08	0.380	0.873	1.[illegible]1	1.4	50
Uranium-234	1.02	1.02	0.[illegible]99	0.853	0.477	0.811	0.4[illegible]7	1.1	37.5
Uranium-235	0.0656	0.0504	0.0493	0.0[illegible]6				0.11	3.35
Uranium-238	1.05	1.15	1.13	1.02	0.444	0.918	0.602	1.2	11