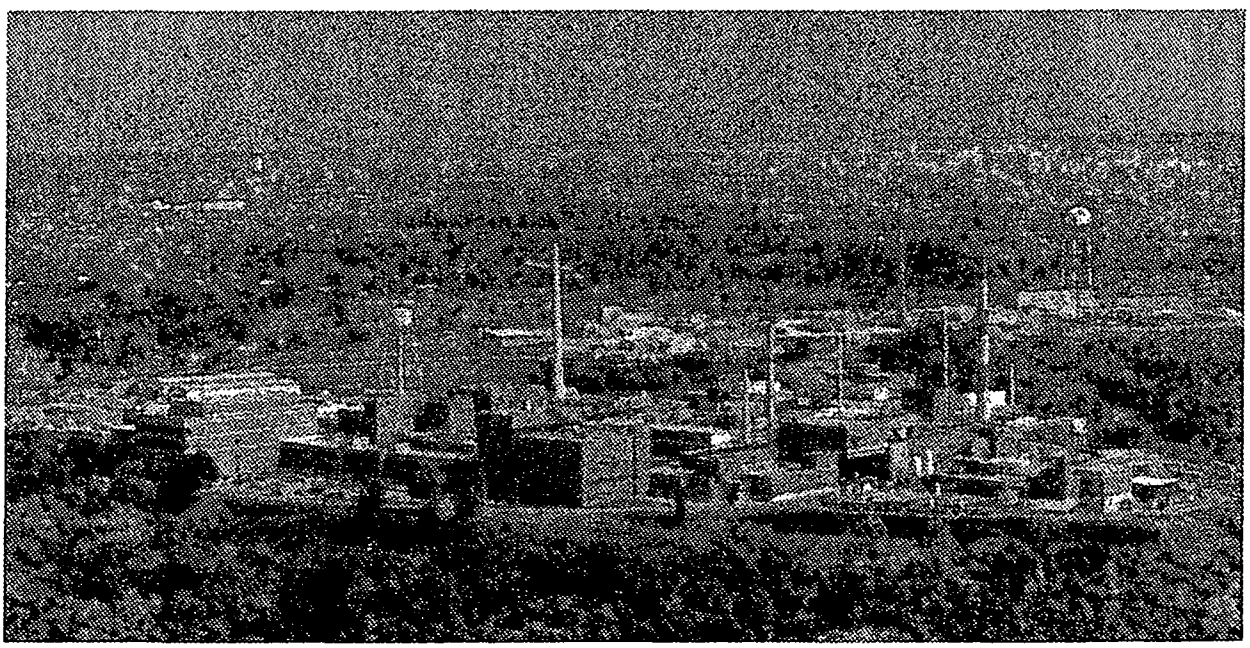
EG&G MOUND-30-03-03-03--9612230061

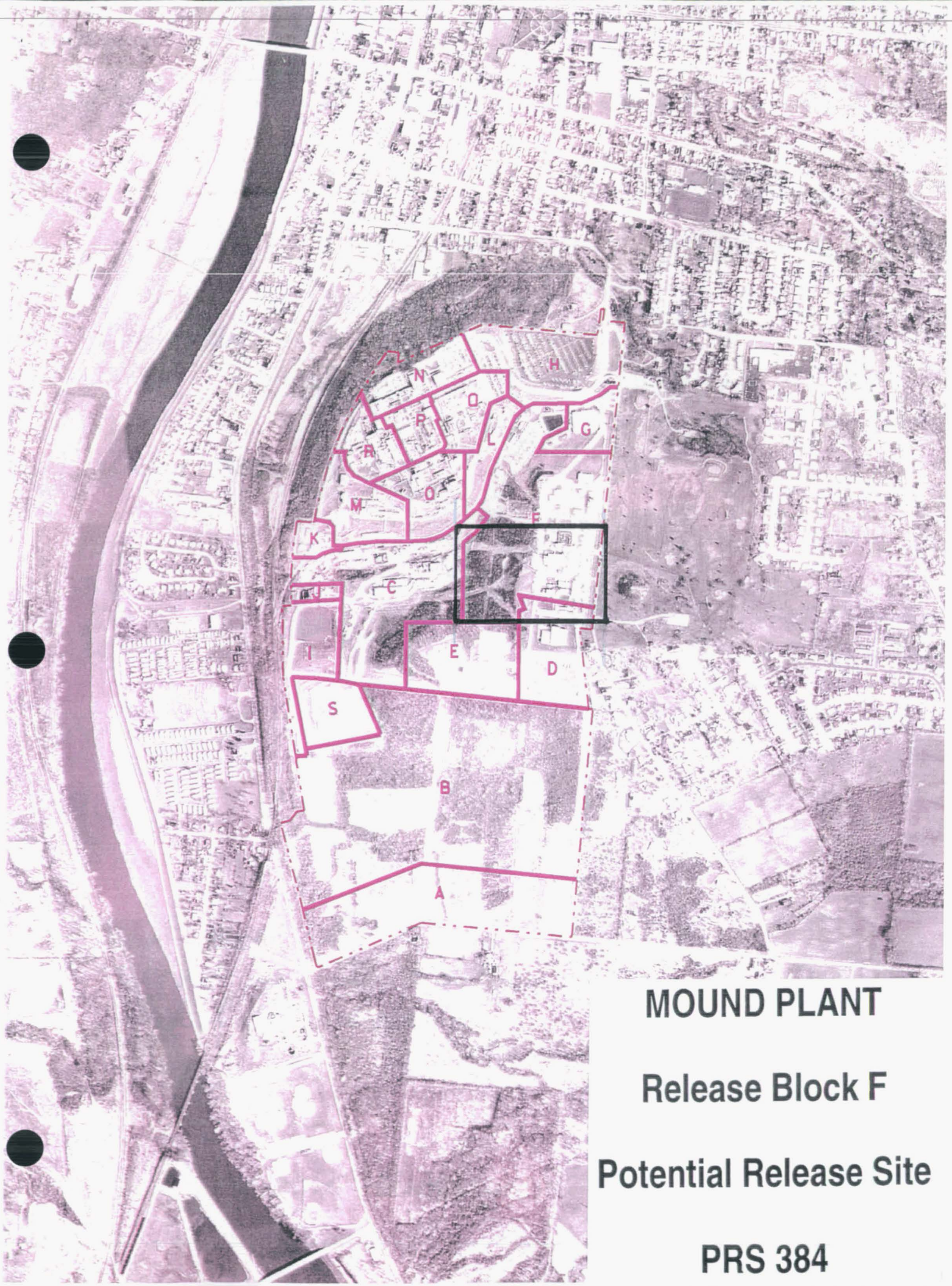
MOUND

Environmental
Restoration
Program

# MOUND PLANT
## Potential Release Site Package
## PRS # 384



| REV | DESCRIPTION | DATE |
|---|---|---|
| PUBLIC RELEASE<br>0 | Available for comment. | Dec. 19, 1996 |
| FINAL<br>1 | | |

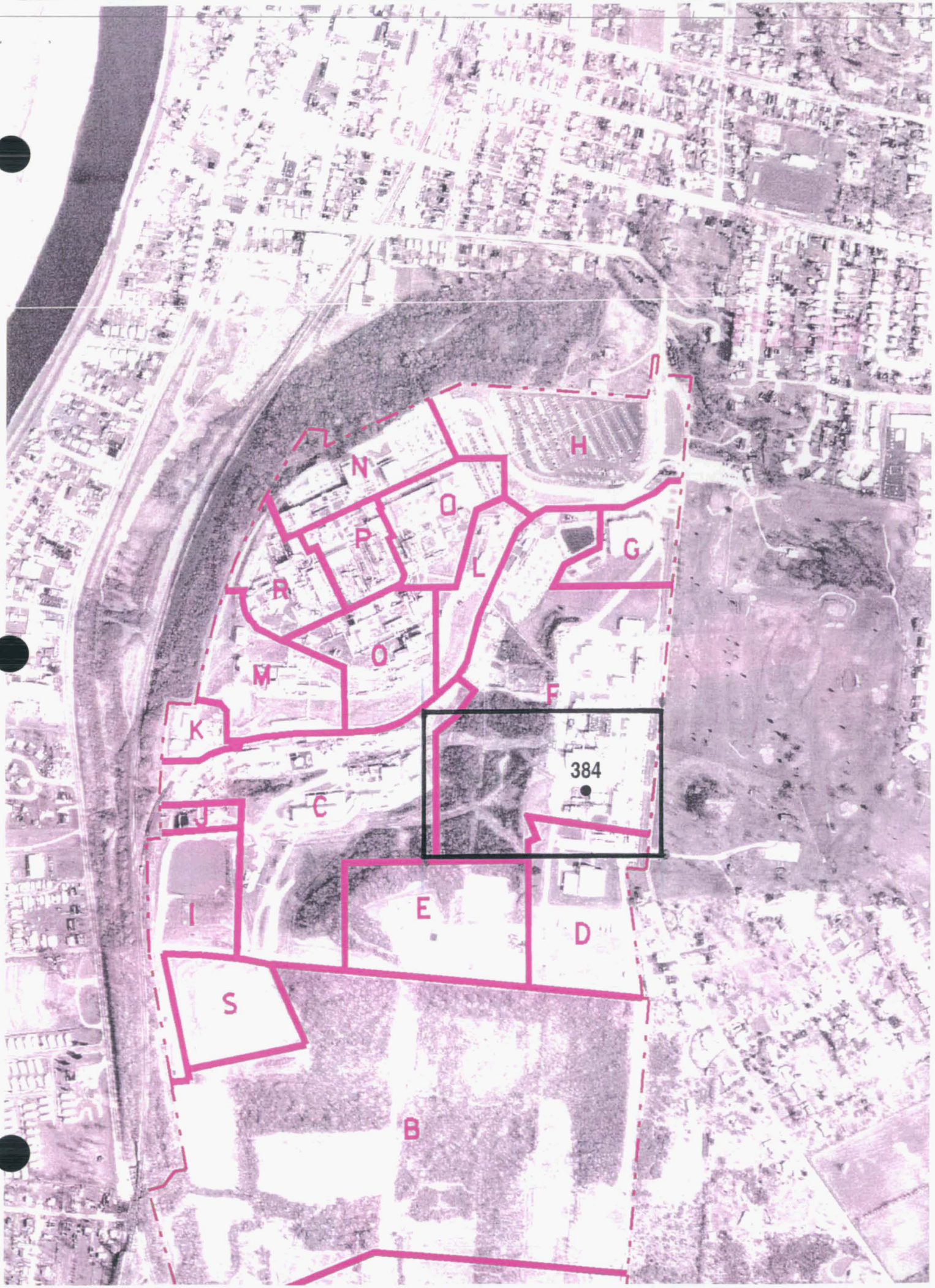



# MOUND PLANT

## Release Block F

## Potential Release Site

## PRS 384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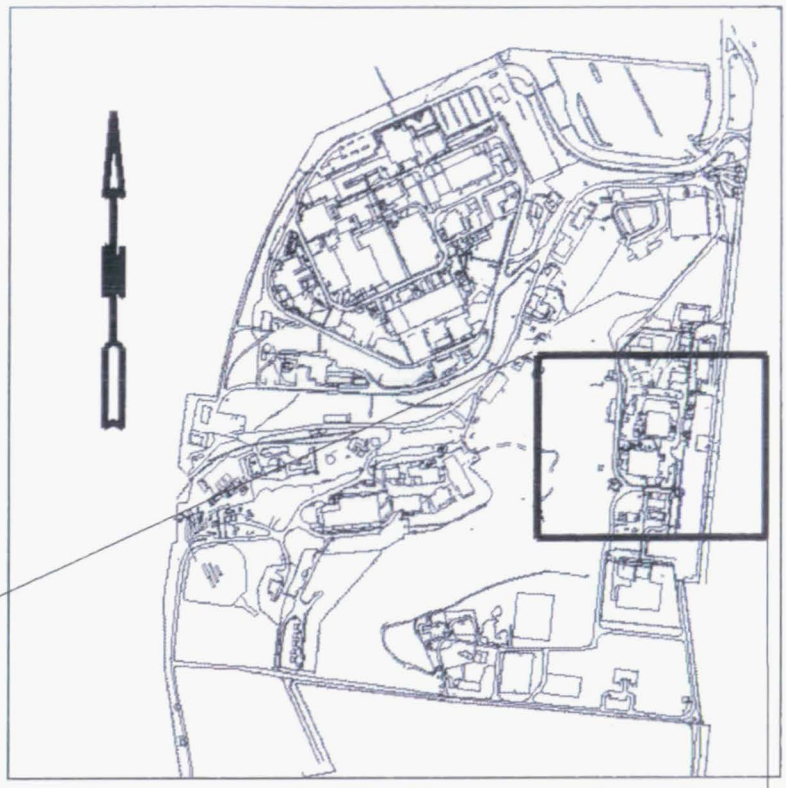
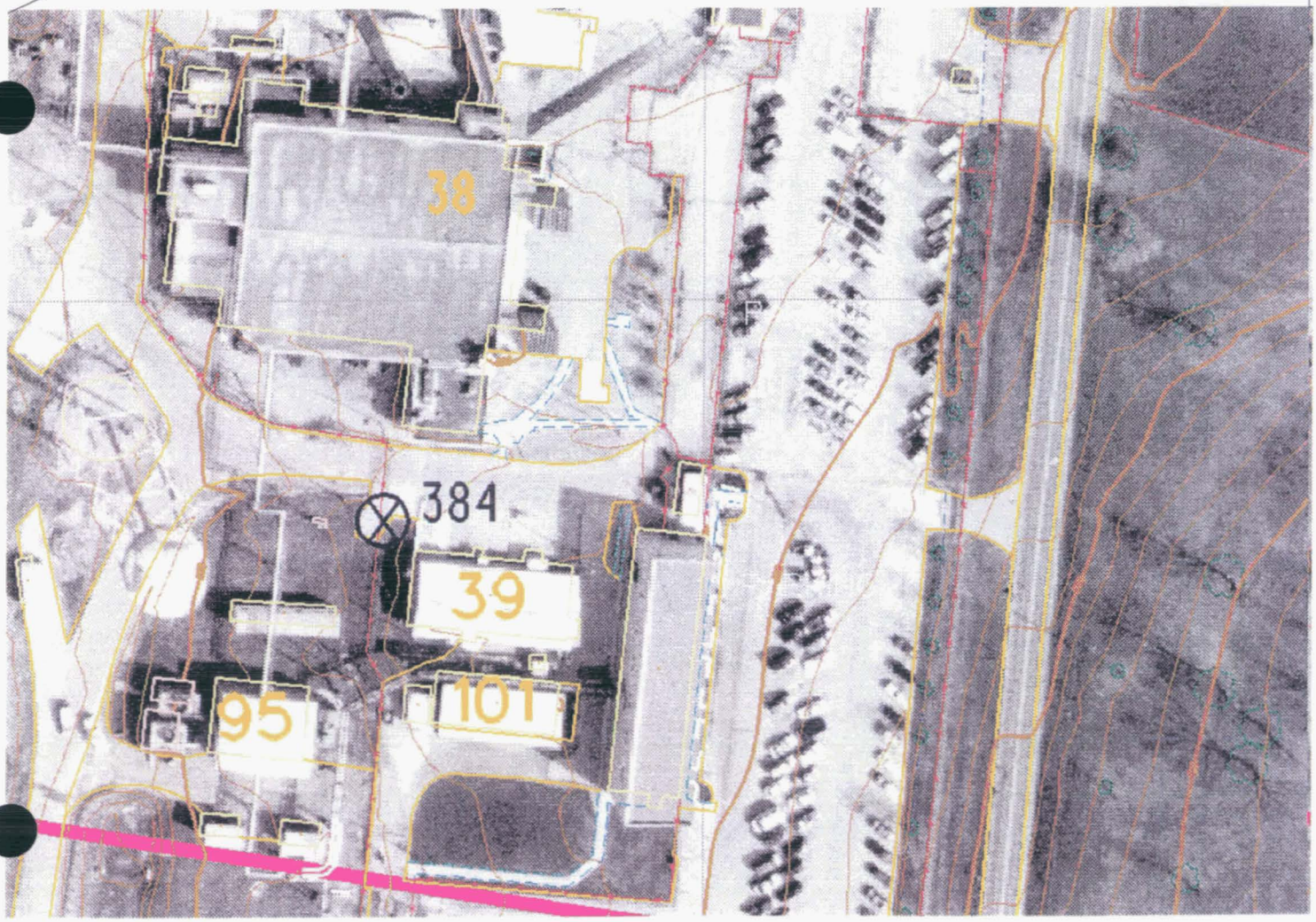
# Mound Plant

# Release Block F

## Potential Release Site

## PRS 384





384

# PRS 384

## PRS HISTORY:

PRS 384 is located on the Special Metallurgical/Plutonium Processing (SM/PP) Hill, east of the water tank, and south of the road opposite Building 38, near Building 39. This soils location became a PRS due to relatively high organic detections found during a PETREX soil gas investigation.[2] There is no history of any known radioactive waste generating processes at this location.[3] The site is adjacent to Building 39 where equipment is maintained and repaired (e.g. air conditioner, vacuum pumps), and general fabrications are done. Prior to 1990, fiber glass applications required adhesives and solvents.[3]

## CONTAMINATION:

In 1983, the ***Radiological Site Survey*** [1] analyzed one surface soil sample in the vicinity of PRS 384. The sample was analyzed for radioactivity via Mound Soil Screening, radiochemistry, and gamma spectroscopy. Results of the analysis showed that the plutonium-238 concentration was 1.64 pCi/g (compared to Mound ALARA for plutonium of 25 pCi/g), and the thorium concentration was below 2 pCi/g (regulatory guideline criteria 5 pCi/g).[4] No other radionuclides were detected.

In 1994, the ***OU5 Operational Area Phase I Investigation*** [2] performed a PETREX qualitative soil gas survey that detected relatively high amounts of aromatic and petroleum hydrocarbons at PRS 384. The OU5 Operational Area Phase I investigation also performed a radionuclide study. One surface soil sample was taken at PRS 384 and analyzed for plutonium-238 and thorium-232. Sample results failed to find any plutonium and thorium was detected at 0.5 pCi/g (compared to a guideline criteria of 5 pCi/g).[4]

In 1996, the ***Soil Gas Confirmation Investigation*** [5] sampled within 25 feet of PRS 384 (see map on page 29). Sample number 000010 was taken over a depth of 1 to 3 feet and analyzed for volatiles, semivolatiles, PCBs, pesticides, metals, radionuclides and explosives. Results of the investigation showed:

> All concentrations of volatiles, semivolatiles, PCBs, pesticides, metals, radionuclides and explosives in the soils were below their respective ALARA, regulatory, or $10^{-6}$ Risk Based Guideline Criteria.[4,5,6]

## READING ROOM REFERENCES:


1) Operable Unit 9, Site Scoping Report: Volume 3 - Radiological Site Survey, 1993. (pages 6- 8)
2) Operable Unit 5, Operational Area Phase I Investigation Non-AOC Field Report, June 1995. (pages 9-22)

**OTHER REFERENCES:**

3) Private Communication with John V. Adams (Area Supervisor).
4) Code of Federal Regulations 40CFR 192.41 and 40 CFR 192.12.
5) Further Assessment, Soil Gas Confirmation Sampling, Rev 0, May 1996. (pages 23-35)
6) Risk-Based Soil Guideline Values, December 1995, Final, Revision 0.

**PREPARED BY:**

Dean A. Buckner, Member of EG&G Technical Staff

# MOUND PLANT
# PRS 384
# SOIL CONTAMINATION

**RECOMMENDATION:**

Potential Release Site (PRS ) 384 was identified due to elevated qualitative PETREX hydrocarbon levels. During the 1996 soil gas confirmation investigation all concentrations of volatile, semivolatile, PCBs, pesticides, metals, radionuclides, and explosives, in the soils, were below their respective ALARA, regulatory, $10^{-6}$ Risk Based Guideline Criteria, or background levels. Therefore, NO FURTHER ASSESSMENT is recommended.

**CONCURRENCE:**

DOE/MB: Arthur Kleinrath 11/20/96
Arthur W. Kleinrath, Remedial Project Manager (date)

USEPA: Timothy J. Fischer 11/20/96
Timothy J. Fischer, Remedial Project Manager (date)

OEPA: Brian K. Nickel 11/20/96
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 384

ENVIRONMENTAL RESTORATION PROGRAM

# OPERABLE UNIT 9, SITE SCOPING REPORT: VOLUME 3 - RADIOLOGICAL SITE SURVEY

## MOUND PLANT
## MIAMISBURG, OHIO

June 1993

DEPARTMENT OF ENERGY
ALBUQUERQUE FIELD OFFICE

ENVIRONMENTAL RESTORATION PROGRAM
EG&G MOUND APPLIED TECHNOLOGIES

FINAL

| Map Location[a] | Coordinates South | Coordinates West | MRC ID No. | Mo-Yr | Depth (inch) | Pu-238 (pCi/g) | Thorium[b] (pCi/g) | Tritium (pCi/mL) | Co-60 (pCi/g) | Cs-137 (pCi/g) | Ra-226 (pCi/g) | Am-241 (pCi/g) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S0626 | 3200 | 2375 | 2393 | 08-83 | 0 | NR | NR | | LDL | LDL | 1.1 | LDL |
| S0627 | 3225 | 2365 | 4122 | 10-83 | 0 | 1.64 | b | | | | | |
| S0628 | 3225 | 2575 | 4124 | 10-83 | 0 | 1.14 | b | | LDL | 0.5 | 1.2 | LDL |
| S0629 | 3275 | 2265 | [illegible] | 10-83 | 0 | [illegible] | b | | | | | |
| S[illegible]0 | 3275 | 2415 | 6557 | 08-84 | 0 | 2.29 | b | | | | | |
| S0631 | 3275 | 249[illegible] | 4123 | [illegible]0-83 | 0 | 3.15[c] | b | | | | | |
| S0632 | 32[illegible] | [illegible]565 | 4125 | 10-8[illegible] | 0 | 2.18 | | | | | | |
| C0158 | 3000 | 2620 | 8285 | 10-84 | [illegible]36 | 1.95 | b | | | | | |
| | | | 8286 | 10-[illegible] | [illegible] | 25.00[c] | b | | | | | |
| S0633 | 3025 | 264[illegible] | 2923 | 10-83 | 0 | 47.45[c] | b | [illegible]6.84 | | | | |
| S0634 | 3050 | 2845 | [illegible]667 | 12-84 | 0 | [illegible]31 | b | | | | | |
| S0635 | 3075 | 2870 | [illegible] | 12-84 | 0 | [illegible]0.34 | b | | | | | |
| C01[illegible]9 | 3100 | 2620 | 8283 | 10-84 | 108 | 18.90 | b | | | | | |
| | | | 8284 | [illegible]0-84 | 19[illegible] | 6.91 | b | | | | | |
| S0636 | [illegible]00 | 2820 | 8666 | 12-8[illegible] | 0 | 1.84 | b | | | | | |
| S0637 | 312[illegible] | 2670 | 6791 | 0[illegible] | 0 | 1.45 | b | | | | | |

[a]C denotes core location and S denotes surface sample location on Plate 1.

[b]Thorium results of ≤ 2 pCi/g are listed as "b".

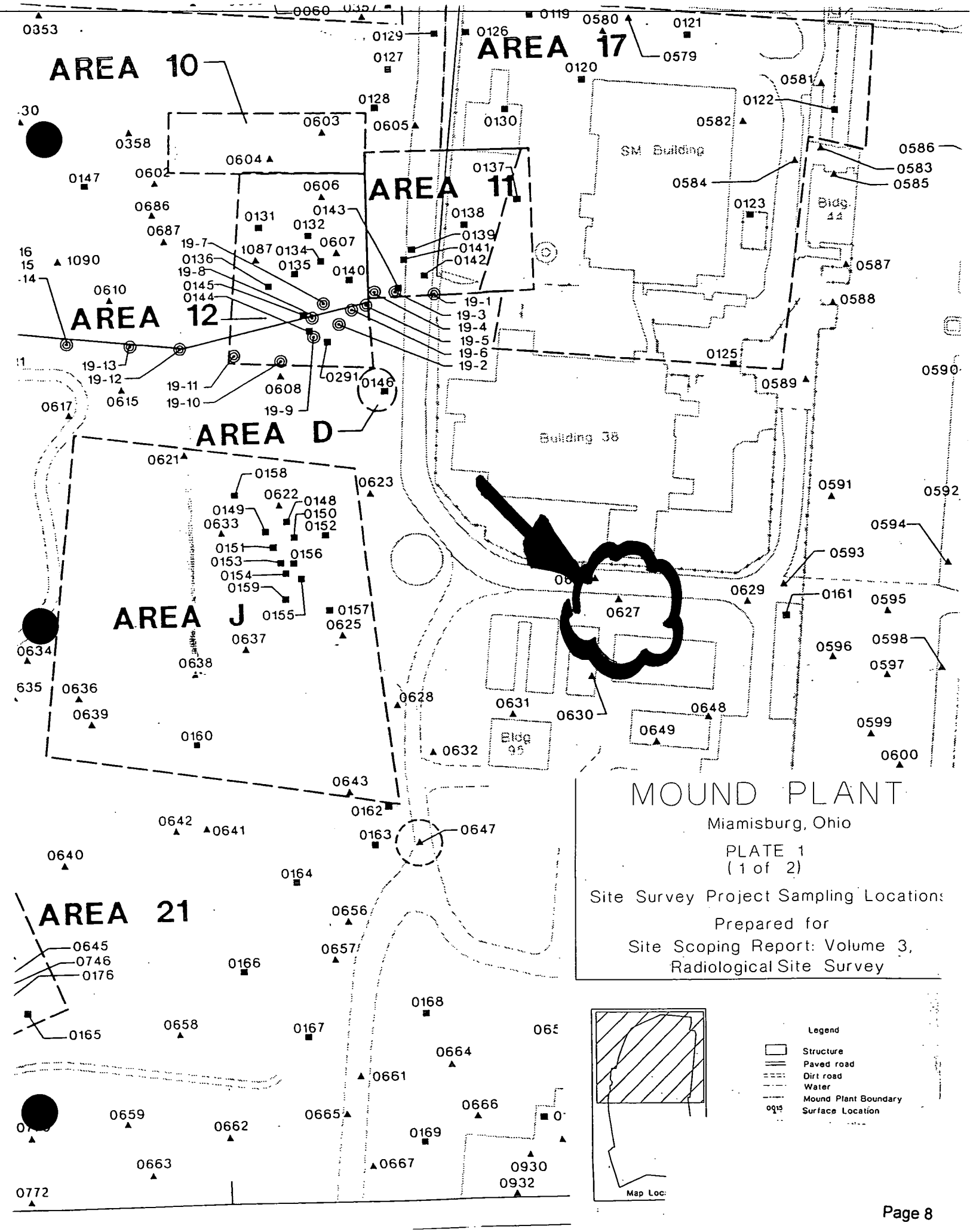
[c]Verification sample analyzed for QA/QC.

[d]No MRC ID assigned because *in situ* gamma spectrometry was performed for thorium-232.

[e]Gamma results could not be confirmed using the gamma spectroscopy printout given in this appendix.

[f]The depth for this sample was given as "SS". For mapping purposes (Plates 1 and 5), this is assumed to be a surface sample.

[g]Sample results were given isotopically for this sample and included 0.99 pCi/g thorium-228; 321 pCi/g thorium-230; and 1.5 pCi/g thorium-232, for a total of 323.5 pCi/g.


AREA 10
AREA 11
AREA 12
AREA 17
AREA D
AREA J
AREA 21
SM Building
Building 38
Bldg. 44
Bldg 95
MOUND PLANT
Miamisburg, Ohio
PLATE 1
(1 of 2)
Site Survey Project Sampling Locations
Prepared for
Site Scoping Report: Volume 3,
Radiological Site Survey
Legend
Structure
Paved road
Dirt road
Water
Mound Plant Boundary
Surface Location
Map Loc

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.

The majority of the soil gas samples from the NonAOC-West demonstrated only mildly elevated levels of light weight aromatics, alkanes, cycloalkanes/alkenes, and cycloalkenes/dienes. All of these compounds are components of fuels or oils and, thus, may have originated through dispersion and migration, over time, from the same occurrences of weathered fuels or oils indicated by the samples named above. The collection points of samples containing the highest levels of petroleum hydrocarbons may correspond to source areas or former points of release of petroleum products.

Prominent levels of halogenated hydrocarbons were detected rarely within the NonAOC-West. The highest levels of PCE were detected in samples #1024, and #1028. The highest levels of TCE were detected in samples #1010, #1058, #1066, and #1076. A mildly elevated level of dichlorobenzene was detected in sample #963. Trace levels of trichloroethane (TCA) were detected in samples #964, #1001, and #1021. Low levels of trichlorofluoromethane (Freon-11) were detected in samples #964, #969, #997, #1004, #1007, #1028, #1034, #1060, and #1092 (see the mass spectrum of sample #1004).

Five samples from the NonAOC-West yielded a high response to ions derived from petroleum hydrocarbons which have the same atomic mass as the principal ions derived from the halogenated hydrocarbons also targeted by this survey (see response to total halogenated hydrocarbons in Table 2 and Plate 5). This high response and coincidence of atomic masses has masked response to halogenated hydrocarbons of similar or lesser magnitude in these samples. Of these five, only samples #1022 and #1071 contain levels of hydrocarbons capable of masking levels of halogenated hydrocarbons greater than 100,000 ion counts. To determine whether elevated levels of halogenated organics may also be present in these two samples, sample duplicates have been submitted for TD-GC/MS analysis. Chromatographic separation of individual compounds in each sample afforded by this analytical process should resolve between elevated levels of any halogenated compounds and petroleum hydrocarbons. TD-GC/MS analysis of these five samples is pending. Results will be reported as a separate document as soon as they are available.

8.2.3 NonAOC-East

LOCATION 11 NORTH 5 WEST (SEE PG 22)

Numerous soil gas samples from the NonAOC-East showed similar combinations of petroleum hydrocarbons. Samples #909, #911, #919, and #1067 demonstrated the most elevated levels of a combination of compounds typical of the vapor of weathered light to medium weight fuels. Furthermore, samples #912, #928, and #929 exhibited singularly high levels of toluene and ethylbenzene/xylenes which could indicate the presence in the subsurface of the components of solvents or thinners. Samples #923, #925, #926, #948, #955, #993, and #994 contained elevated levels of a combination of $C_4$ to $C_{14}$ hydrocarbons typical of the composition of vapor from weathered medium to heavy weight fuels or oils. Soil gas samples representative of the balance of the NonAOC-East principally demonstrated only low relative levels of a combination of light weight aromatics, alkanes, and cycloalkanes/alkenes which are common to most petroleum products. Similar to the findings for the NonAOC-West, results of the survey of the NonAOC-East suggest the presence of source areas or points of release of various petroleum products and

Elevated levels of the halogenated organic compound PCE were also detected at several points with Area-61. The most pronounced occurrence of PCE was detected in the soil gas at the collection point of sample #775.

Due to high levels of petroleum hydrocarbons it is unclear whether levels of the halogenated organics PCE and TCE (on the order of 100,000 ion counts) may also be present in samples #770, #771, #772, #777, and #778. To determine whether elevated levels of halogenated organics are present in these samples, the duplicates of these samples have been submitted for TD-GC/MS analysis. TD-GC/MS sample analysis is pending. Results will be reported as soon as they are available.

The areal distribution of the targeted compounds within the NonAOC are discussed in greater detail in section 9.0, below.

The high sensitivity to organic compounds inherent in the Petrex Technique must be considered in the evaluation of these findings. Elevated relative levels of VOC's and SVOC's in the soil gas detected in this Petrex survey may derive from concentrations of these VOC's and SVOC's in subsurface media which are below the threshold of detection of most quantitative analyses.

## 9.0 DISCUSSION

### 9.1 Distribution of Total Aromatic Hydrocarbons

Total Aromatic Hydrocarbons are reported as the combined level of $C_6$ to $C_{15}$ aromatic (benzene based) hydrocarbon compounds detected in the soil gas samples. The majority of the samples contained only the lighter weight ($C_6$ through $C_9$) aromatics. Very few samples were observed to contain $C_{10}$ and heavier aromatic hydrocarbons.

The areal distribution of Total Aromatic Hydrocarbons in the soil gas across the NonAOC is displayed by Plate 2. The areas demonstrating the greatest potential impact by aromatics are the northern and southern reaches of the NonAOC-East and large portions of the Fuel Area and Area-61.

As discussed in section 8.2.4, aromatics in the soil gas across much of the NonAOC-East occur with combinations of other hydrocarbons in mixtures which are characteristic of weathered fuels. The near isolated occurrence of $C_7$ and $C_8$ aromatics toluene and ethylbenzene/xylenes in several samples may also indicate the presence of components of solvents or thinners in the subsurface.

Note that the zone of high response to aromatics in the central western portion of the NonAOC-East is continuous to the border of the NonAOC-East where it approaches AOC-J and the large aboveground tank. This finding may indicate that the elevated levels of hydrocarbons detected in both of these survey areas are related.

As observed in the Fuel Area, the highest levels of aromatics occur in the soil gas in the vicinity of the pumps and of the separator. These findings are likely due to one or more surface or near surface releases of fuels handled in this area.

Elevated levels of aromatics occur within Area-61 principally as components of mixtures of $C_4$ to $C_{13}$ hydrocarbons common to medium to heavy weight fuels. The zone of elevated levels of aromatics with Area-61 extends the full length of the border of the survey area where it adjoins Building No. 61. This distribution may indicate that high levels of aromatics (and petroleum hydrocarbons in general) exist beneath Building No. 61 beyond survey Area-61 boundaries and may originate from sources associated with Building No. 61. Note that elevated levels of aromatics also occur in zones extending to the north and west of Building No. 61.

Spot occurrences of aromatic hydrocarbons in the soil gas across the rest of the NonAOC likely derive from various small scale releases of common petroleum products, especially fuels. It is important to note that numerous structures with the NonAOC such as paved roads, railroad spurs, and other structures to which petroleum products may be applied in building or maintenance may be sources of hydrocarbons in the near surface soil gas yet not be significant contaminants of subsurface media. The potential for this condition is exemplified by the detection of high levels of aromatics in the soil gas at the collection points of samples #229, #855, #1008, #1015, and #1022 (at grid coordinates 7N26W, 25N5W, 11N18W, 13N26W, 12N21W). This condition should be considered when evaluating results of sampling within or very near such structures.

At some locations within the NonAOC, particularly within the NonAOC-West and the NonAOC-North, elevated levels of aromatics (and other petroleum hydrocarbons) occur at points that are seemingly distant and isolated from structures which could be sources of these compounds. The detection of elevated levels of aromatics at the collection points of samples #10, #25, #889 #963,, and #1001 (from grid coordinates 6N3W, 2N18W, 19N8W, 9N1[illegible]W, and 11[illegible]11W) are examples of this. These findings may indicate the occurrences of VOC's and SVOC's derive from past land use.

9.2 The Distribution of Total Semivolatile Hydrocarbons

Total semivolatile hydrocarbons are reported as the combined response to naphthalene, $C_1$ through $C_{15}$ alkyl naphthalenes, and $C_{12}$, $C_{14}$, and $C_{16}$ polycyclic hydrocarbons. These compounds are constituents of creosote, coal tar, and other heavy, high boiling point fraction petroleum products. Naphthalene and $C_{11}$ and $C_{12}$ alkyl naphthalenes (e.g., methylnaphthalene and ethyl- or dimethylnaphthalene) are also often found in medium to heavy weight fuels and fuel oils. A review of the mass spectra of all samples which yielded an elevated response to semivolatiles indicated that very few semivolatile compounds over $C_{11}$ in molecular weight may be present in the soil gas and that the majority of the responses derive from the presence of naphthalenes.

The distribution of semivolatile hydrocarbons in the soil gas across the NonAOC is displayed by Plate 3.

## 9.3 The Distribution of Total $C_5$ to $C_{11}$ Petroleum Hydrocarbons

Total $C_5$ to $C_{11}$ petroleum hydrocarbons reported here include alkanes, cycloalkanes, alkenes, cycloalkenes, dienes (referred to collectively as aliphatics), plus aromatic and naphthalenic compounds. In various combinations, these compounds, together, make up the bulk of most petroleum fuels, oils, and lubricants. Total $C_5$ to $C_{11}$ petroleum hydrocarbons are reported to best illustrate the occurrence in the soil gas of petroleum product vapor of which aromatic and semivolatile compounds may not be prominent components. Although $C_4$ hydrocarbons were also detected in most samples, the levels of $C_4$ compounds are excluded from reporting as they (and lighter weight species) are commonly found in most environments.

The areal distribution of total $C_5$ to $C_{11}$ petroleum hydrocarbons in the soil gas on-site is displayed in Plate 4. Zones of elevated levels of total petroleum hydrocarbons coincide, in most instances, with zones of elevated levels of aromatic hydrocarbons. This finding supports earlier observations that the majority of the hydrocarbons in the soil gas likely derive from fuels which contain abundant levels of both aromatics and a broad assortment of aliphatic compounds. Differences between the distribution of total petroleum hydrocarbons and aromatic hydrocarbons in the soil gas apparent in a comparison of Plates 4 and 2 indicate some variation in soil gas composition from one portion of the NonAOC to another. Namely, aromatics alone occur more widely across the NonAOC-East, and may be of greater impact to the subsurface within both the Fuel Area and Area-61.

Throughout the NonAOC-South and the NonAOC-West the distribution of elevated levels of total petroleum hydrocarbons is nearly identical to that of aromatics and accentuates several large areas which may be impacted by releases of petroleum. Elevated levels of aromatic and aliphatic hydrocarbons occur in several zones surrounding AOC-3 and Area-SDB (at grid coordinates 9N25W, 9½N25½W, 12N24W, and 13N26W). These zones likely relate to elevated levels of hydrocarbons detected at numerous points within the margins of AOC-3 and Area-SDB (see report of findings of the Petrex soil gas surveys of AOC-3 and Area-SDB, dated 10/[illegible]/94 and 10/10/94, respectively). Another zone of elevated response to total petroleum hydrocarbons occurs in the northwest of the site, northwest of the access road which parallels the northwest border of OU-5 (at grid coordinates 14N15W, 15N1[illegible]W, and 16N1[illegible]W). The location of this zone suggests that it may derive from a source of petroleum which resides outside of OU-5 to the northwest. Similarly, the occurrence of elevated levels of petroleum hydrocarbons on the northern border of the NonAOC-North (at grid coordinates 2[illegible]N[illegible]W and 27N5W) may derive in part from sources of petroleum located further to the north.

## 9.4 The Distribution of Total Halogenated Hydrocarbons

Total Halogenated Hydrocarbons are reported as the combined levels in the soil gas of tetrachloroethene (PCE), trichloroethene (TCE), trichloroethane (TCA), tetrachloromethane (Freon-[illegible]), trichlorotrifluoroethane (Freon-113), dichlorobenzene (DCB), and chloroform. The majority of these compounds are used most often as solvents and cleaning agents. The Freons detected here may also have been used as refrigerants.

The areal distribution of halogenated hydrocarbons in the soil gas is displayed in Plate 5. PCE was detected much more frequently in the soil gas than were the other halogenated organics. Thus, the majority of the elevated responses to Total Halogenated Hydrocarbons shown in Tables 1 through 5 and on Plate 5 principally reflects the presence of PCE in the soil gas. Significant exceptions to this rule were the occurrence of pronounced levels of TCE at the collection points of samples #239, #956, #[illegible], #1010, #1058, 1066, #1069, #1077, and #1096 (grid coordinates 4N14W, 9N6W, 20N10W, 9N21W, 10N14W, 10N13W, 3½N1[illegible], 19N10¾W, and 8N25W, respectively); dichlorobenzene at the collection point of sample #25 (grid coordinate 2N18W); and chloroform at the collection point of samples #887 and #890 (from grid coordinates 20N7W and 18N8W). The highest levels of PCE were detected in the soil gas at the collection points of samples #94[illegible], #775, #941, #1024, and #107[illegible] (at grid coordinates 7N13W, 2[illegible]N2¼W, 13N1W, 12N18W, and 19N10¾W).

The occurrence of elevated levels of TCE and dichlorobenzene in the soil gas at sampling points #25 and #239 is the most salient feature of the distribution of halogenated compounds within the NonAOC-South. Although the structure nearest the collection point of sample #239 may relate to a source of halogenated compounds, the collection point of sample #25 appears to be isolated from any potential source and thus may show impact due to past land use.

The occurrence of high levels of halogenated compounds in the center of the NonAOC-West may relates to nearby operations within neighboring Buildings No. 49 and No. [illegible]. Similarly, the zone of elevated halogenated hydrocarbons located immediately to the northwest of nearby Buildings No. 36, No. 59, and No. 63 may also relate to local operations. The distribution of halogenated organics in the soil gas throughout the NonAOC is limited and suggests that any occurrence of halogenated organics in the in the subsurface is the result of localized small scale releases.

Prominent occurrences of halogenated hydrocarbons in the soil gas at points in the south of the NonAOC-East and the NonAOC-North generally appear distant from existing structures from which they may originate. Thus, these occurrences may derive from past land use.

## 10.0 CONCLUSIONS

From the findings of this Petrex soil gas survey the following conclusions may be drawn:

1. Elevated levels of petroleum hydrocarbons occur in the subsurface in many areas of the NonAOC and are likely the result of the release of any of various grades of fuels. However, the potential exists for some occurrences of aromatics to derive from releases of solvents or thinners.

2. The Fuel Area, Area-61, and large portions of the NonAOC-East demonstrate the greatest potential impact to the subsurface by hydrocarbons. Aromatic hydrocarbons which are components of most fuels show the greatest areal distribution within the NonAOC and may pose the greatest risk to subsurface media quality. Principal source areas of petroleum hydrocarbons within the NonAOC include the fuel pumps, separator, and abovegroud fuel

storage tank within the Fuel Area, Building No. 61 or operations within Building No. 61, and operations throughout the central portion of the NonAOC-East. Potential sources of petroleum hydrocarbons from outside the NonAOC may exist to the north of the NonAOC-West and to the north of the NonAOC-North.

3. Elevated levels of hydrocarbons detected in the soil gas in the southwestern portion of the NonAOC-East may relate to anomalous levels of these same compounds detected in the earlier survey of AOC-J. Elevated levels of hydrocarbons at numerous locations in the far western sector of the NonAOC-West may relate to the occurrence of hydrocarbons in the soil gas detected in the surveys of AOC-3 and Area-SDB.

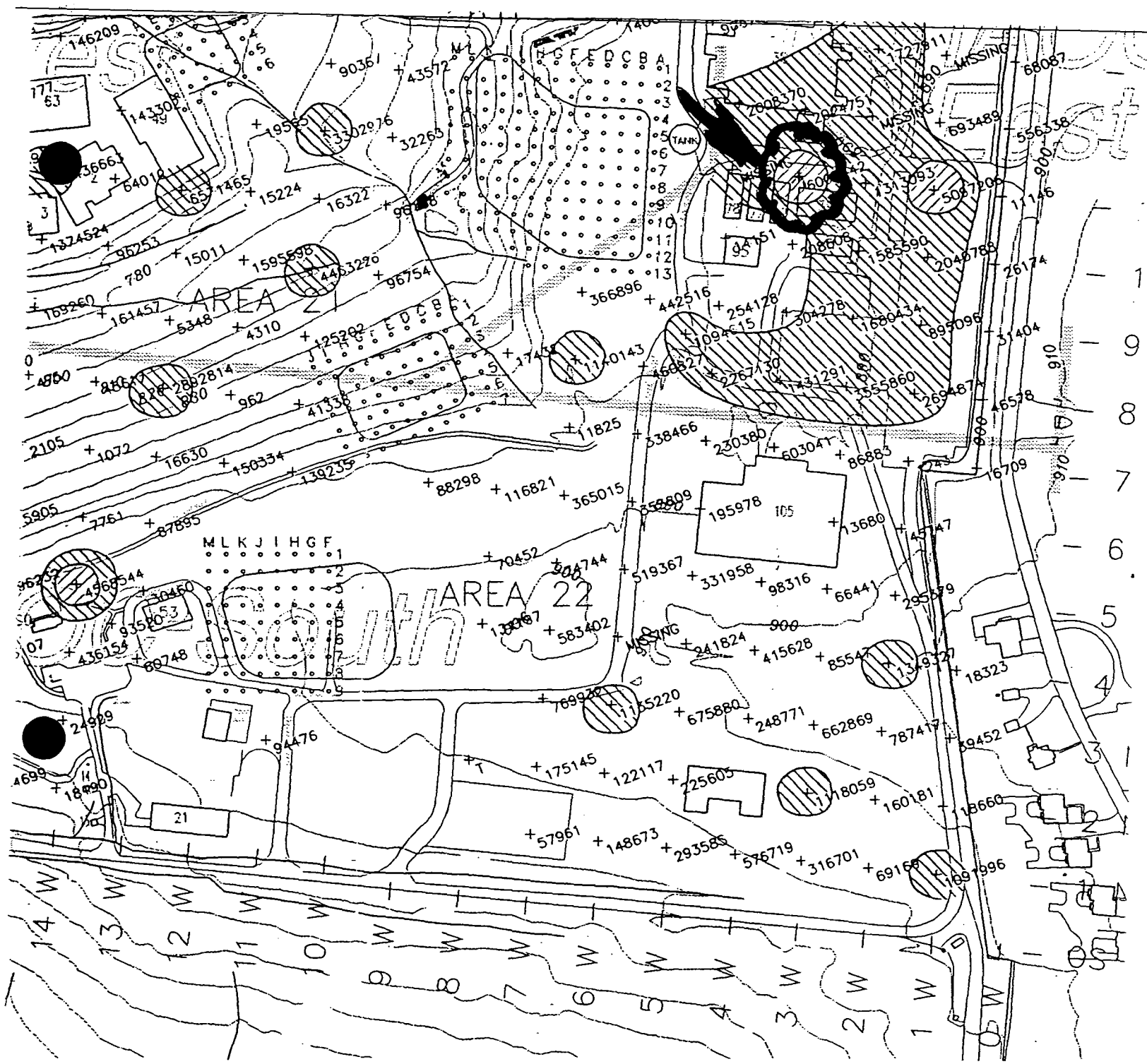
4. Elevated levels of halogenated hydrocarbon compounds occur in the subsurface within the NonAOC, but mostly only in numerous small zones which suggest only very limited subsurface impact. The locations of specific source areas of most of the halogenated compounds detected within the NonAOC are unclear. Sources of the majority of the occurrences of halogenated hydrocarbons detected in this survey likely relate to past land use.

5. The areal distribution of halogenated hydrocarbons in the soil gas survey wide suggests that these compounds, where they occur in the subsurface, are not subject to widespread subsurface dispersion or migration.

6. Any verification of soil gas results for petroleum hydrocarbons should include quantitative testing of soil and groundwater from the collection points of samples #94 (at 7N15W) and #239 (at 4N14W) within the NonAOC-South; samples #1015 (at 13N26W), #1022 (at 12N21W), #1056 (at 10N15W), #1085 (at 14N15W), and #1[illegible] (at 9N24½W) within the NonAOC-West; samples #9[illegible] (at 11N2W), #928 (at 11N4W), and #946 (at 11N2W) within the NonAOC-East; and samples #853 (at 26N4W), #974 (at 27N5W), and #1014 (at 16N13W) within the NonAOC-North. Within Area-61 and the Fuel Area, quantitative testing should include soil and groundwater from the collection points of samples #771, #786, #1072, #1074, and #1075.

7. Any verification of soil gas results for halogenated hydrocarbons should include quantitative testing of soil and groundwater from the collection points of samples #25 (at 2N[illegible]W) and #239 (at 4[illegible]4W) from within the NonAOC-South; samples #956 (at 9N6W), #1028 (at 12N17W) and #1066 (at 10N13W) within the NonAOC-West; sample #9[illegible] (at 13N1W) from the NonAOC-East; and samples #[illegible]90 (at 18N8W), #[illegible]01 (at 15N12W), and #976 (at 20N10W) from within the NonAOC-North. Within Area-61 and the Fuel Area, quantitative testing should include soil and groundwater from the collection points of samples #778 and #1077.

8. The environmental significance of the existence of petroleum hydrocarbons and halogenated hydrocarbons in the subsurface can only be evaluated through quantitative testing of soil and groundwater.




Unit-5

Facility

| NonAOC--South | NonAOC--Wes |
|---|---|
| ≥ 4,200,000 | ≥ 20,000,000 |
| 850,000–4,199,999 | 2,600,000–19,9 |

Relative Response

Total Aromatic Hydrocarbons

Plate 2

nit-5

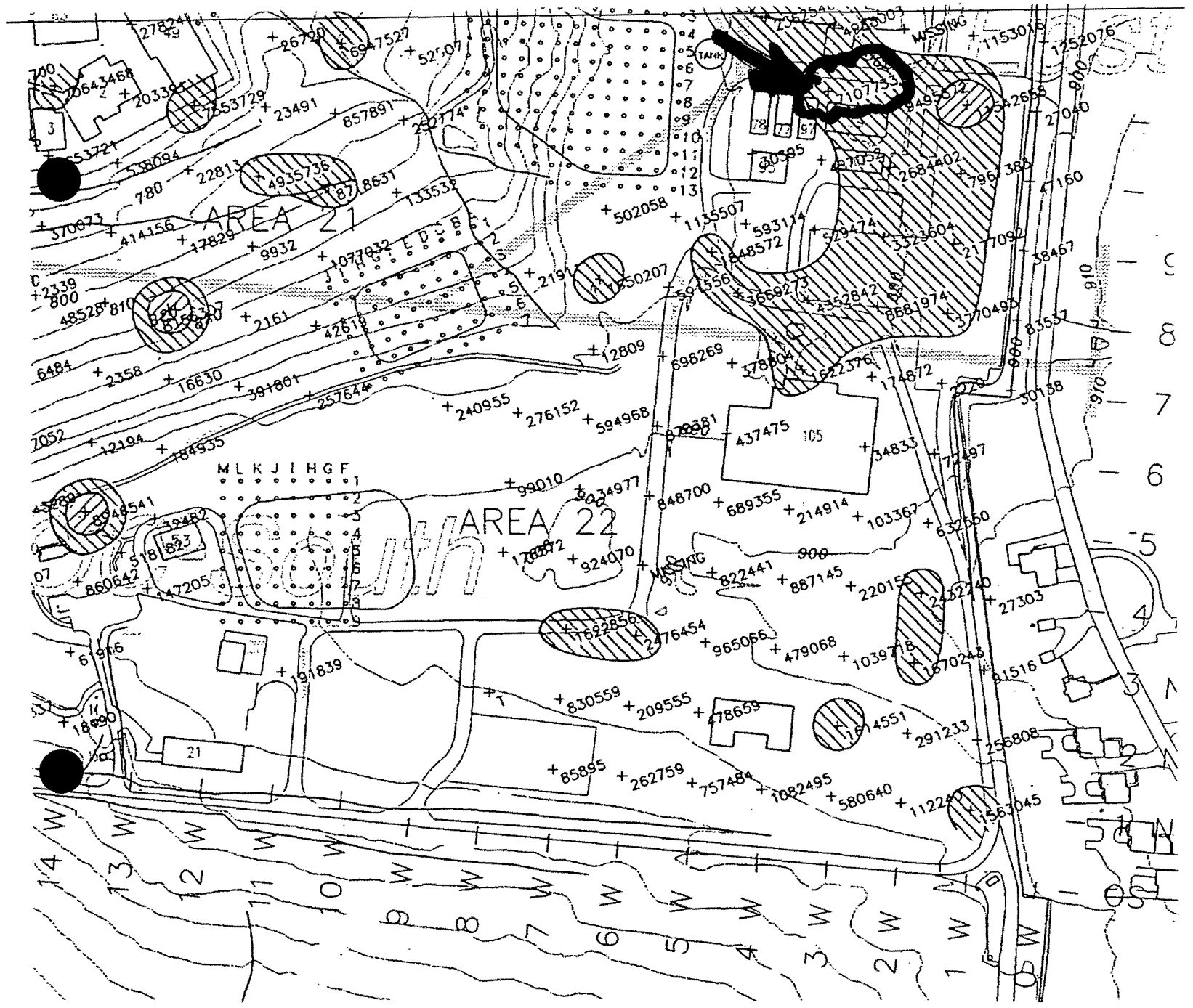
cility

| NonAOC-South | NonAOC-West |
|---|---|
| ≥ 70,000 | ≥ 1,000,000 |
| 7,000-69,999 | 100,000-999,999 |

Relative Response

Total Semivolatile Hydrocarbons

Plate 3




nit-5

cility

LE

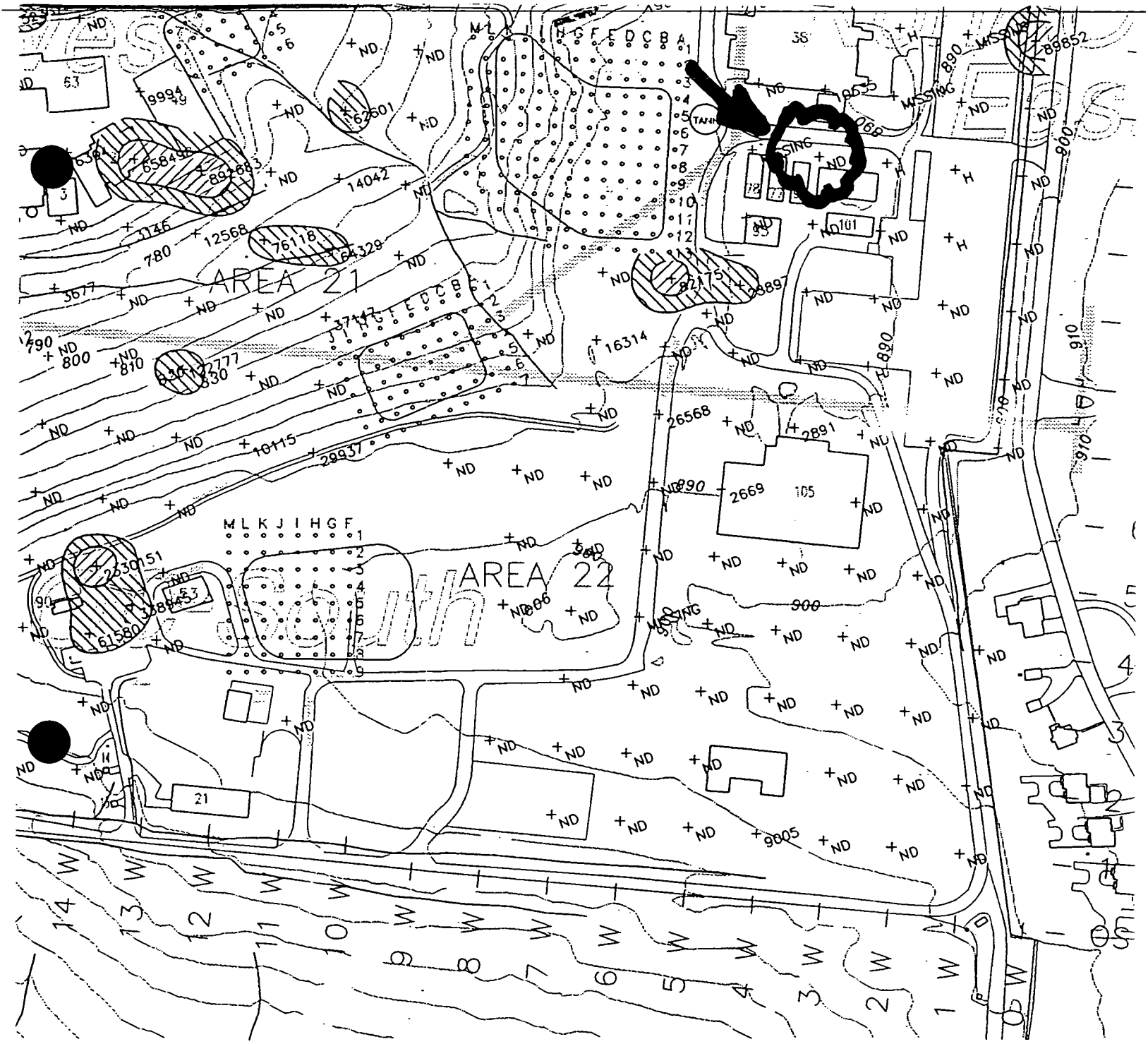
Relative Response Values (in ion counts):

| NonAOC-South | NonAOC-West |
|---|---|
| ≥ 8,000,000 | ≥ 29,000,000 |
| 1,500,000-7,999,999 | 3,000,000-28,999,99 |

Relative Response

Total C5-C11
Petroleum Hydrocarbons

Plate 4




Unit-5

Facility

NonAOC-South

≥ 500,000

50,000-499,999

NonAOC-Wes

≥ 500,000

50,000-499,999

Relative Response

Total Halogenated Hydrocarbons

Plate 5

# APPENDIX D

## RADIOLOGICAL DATA (FIDLER SURVEY MOUND SOIL SCREENING FACILITY DATA) FOR NON-AOC POINTS

| | FIDLER SURVEY DATA | | | | | MOUND SOIL SCREENING FACILITY DATA | | | |
|---|---|---|---|---|---|---|---|---|---|
| SMPID | Contamination Criteria CH1 | FIDLER Readings CH1 | Contamination Criteria CH2 | FIDLER Readings CH2 | FIDLER Readings Out Channel | Plutonium - 238 | | Thorium - 232 | |
| | Units: CPM | Units: CPM | Units: KCPM | Units: KCPM | Units: KCPM | Units: pCi/g | | Units: pCi/g | |
| | RESULTS | RESULTS | RESULTS | RESULTS | RESULTS | RESULTS | Note: | RESULTS | Note: |
| 10N18 | 130 | 65 | 6.5 | 4.0 | NC | 21 | a | 0.7 | a |
| 10N19 | 130 | 80 | 6.5 | 8.0 | NC | WIPE | c | WIPE | c |
| 10N20 | 152.1 | 110 | 8.45 | 6.5 | NC | 0 | a | 1 | a |
| 10N21 | 152.1 | 70 | 8.45 | 5.0 | NC | NC | | NC | |
| 10N22 | 152.1 | 85 | 8.45 | 4.0 | NC | NC | | NC | |
| 11N01 | 253.5 | 150 | 12.48 | 9.5 | NC | 4 | a | 1 | a |
| 11N02 | 122.2 | 80 | 5.59 | 4.0 | NC | WIPE | c | WIPE | c |
| [redacted] | | | | | | | | | |
| 11N04 | 130 | 90 | 6.5 | 4.5 | NC | 0 | a | 0.5 | a |
| [redacted] | | | | | | | | | |
| 11N10 | 213.2 | 140 | 13.13 | 10.5 | NC | 18 | a | 1 | a |
| 11N11 | 213.2 | 130 | 13.13 | 11.0 | NC | 25 | b | 0.5 | a |
| 11N12 | 213.2 | 85 | 13.13 | 7.0 | NC | 7 | a | 1.1 | a |
| 11N14 | 130 | 90 | 6.5 | 5.0 | NC | WIPE | c | WIPE | c |
| 11N16 | 183.3 | 110 | 11.05 | 7.5 | NC | 19 | a | 0.5 | a |
| 11N17 | 130 | 50 | 6.5 | 4.0 | NC | 5 | a | 0.8 | a |
| 11N18 | 157.3 | 60 | 8.45 | 4.0 | NC | WIPE | c | WIPE | c |
| 11N19 | 157.3 | 85 | 8.45 | 7.5 | NC | 18 | a | 0.3 | a |
| 11N20 | 157.3 | 100 | 8.45 | 4.5 | NC | WIPE | c | WIPE | c |
| 11N21 | 87.1 | 75 | 5.85 | 4.5 | NC | NC | | NC | |
| 11N22 | 87.1 | 75 | 5.85 | 4.5 | NC | NC | | NC | |
| 11N23 | 157.3 | 55 | 8.45 | 5.5 | NC | NC | | NC | |
| 12N01 | 253.5 | 160 | 12.48 | 9.0 | NC | 14 | a | 0.9 | a |
| 12N02 | 122.2 | 100 | 5.59 | 5.0 | NC | WIPE | c | WIPE | c |
| 12N03 | 130 | 90 | 6.5 | 5.0 | NC | 5 | a | 0.7 | a |
| 12N04 | 130 | 75 | 6.5 | 4.5 | NC | 0 | a | 0.3 | a |
| 12N05 | 130 | 110 | 6.5 | 5.0 | NC | 13 | a | 0.8 | a |

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

Semivolatile Organic Compounds

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

**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.

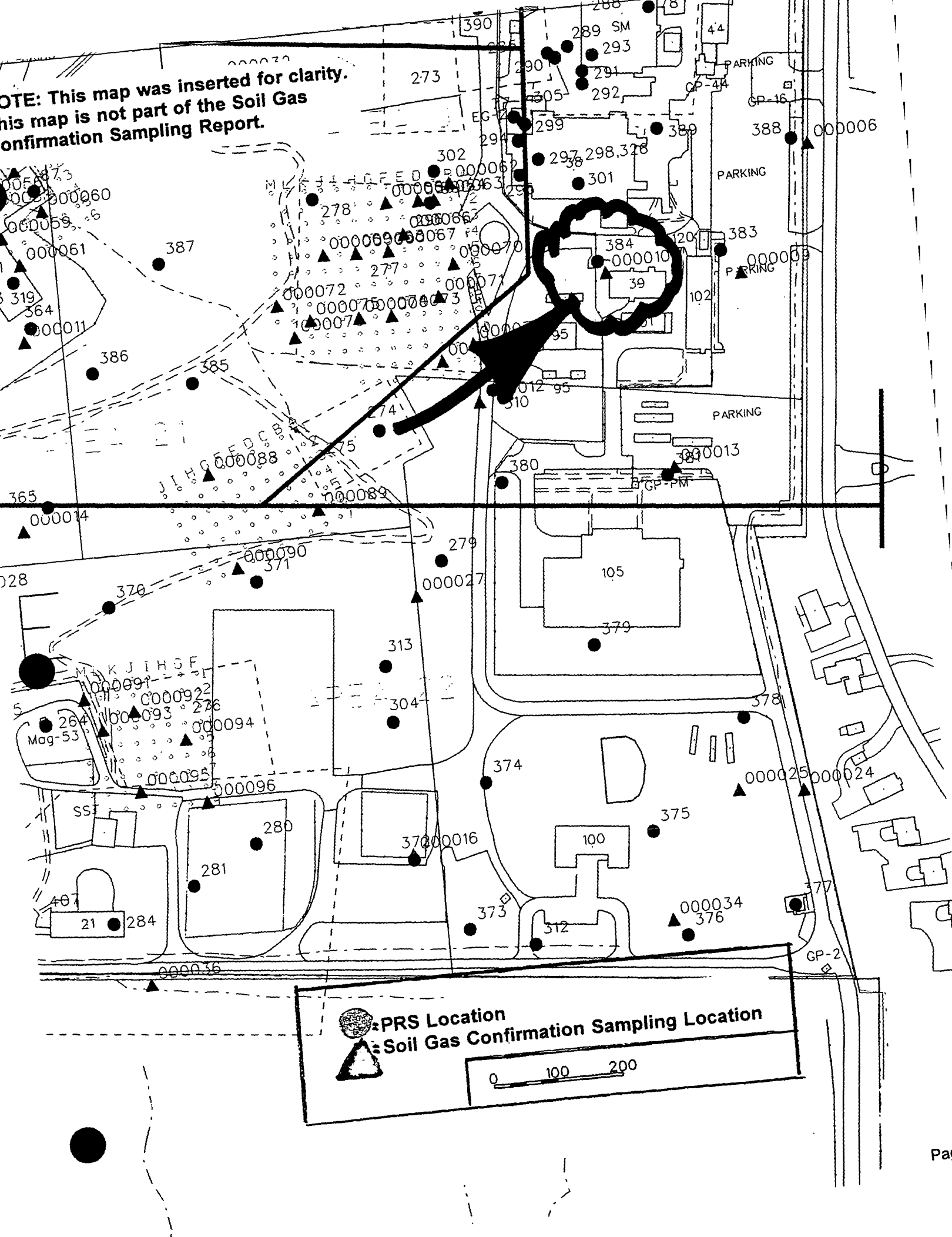
## 1.5 SOIL SAMPLING METHODOLOGY

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.

**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. |


OTE: This map was inserted for clarity.
his map is not part of the Soil Gas
onfirmation Sampling Report.
PARKING
PARKING
PARKING
PARKING
GP-44
GP-16
GP-PM
GP-2
Mag-53
SS
PRS Location
Soil Gas Confirmation Sampling Location
0
100
200

*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 000010 | SGC NAC 000011 | SGC NAC 000012 | SGC NAC 000013 | SGC NAC 000014 | SGC NAC 000015 | Background | $10^{-6}$ Construction Worker Guidelines |
|---|---|---|---|---|---|---|---|---|
| VOLATILES (μg/Kg) | | | | | | | | |
| Acetone | | | | | | | NA | 105000000 |
| 1,2-Dichloroethene (total) | | | | | | 96 | NA | 21500000 |
| 2-Butanone | | | 8 J | 10 J | | | NA | 46500000 |
| Benzene | | | | | | J | NA | 8900 |
| Carbon Disulfide | | | | 4 J | | | NA | 1400000 |
| Chloroform | | | | | | | NA | NA |
| Chloromethane | 4 J | | | | | | NA | NA |
| Ethylbenzene | | | | | | 1 J | NA | 480 |
| Methylene Chloride | 8 | | | | | | NA | NA |
| Tetrachloroethene | | | | | | | NA | 10500000 |
| Toluene | | 2 J | | | | 28 | NA | 1250000 |
| Trichloroethene | | | | 7 | | 3 | NA | 41000 |
| Xylene (total) | | | | | 1 J | J | NA | 2150000000 |

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

| ANALYTE | SGC NAC 000[illegible] | SGC NAC 000009 | SGC NAC 000010 | SGC NAC 000011 | SGC NAC 00[illegible]12 | SGC NAC 000[illegible] | Background | $10^{-6}$ Construction Worker Guidelines |
|---|---|---|---|---|---|---|---|---|
| SEMIVOLATILES (μg/Kg) | | | | | | | | |
| Acenaphthene | | | | | | | NA | NA |
| Acenaphthylene | | | | | | | NA | NA |
| Anthracene | | | | | | | NA | 320000000 |
| Benzo(a)anthracene | 5[illegible] J | | | | [illegible]8 J | | NA | 4100 |
| Benzo(a)pyrene | 65 | | | | 21 J | | NA | 410 |
| Benzo(b)fluoranthene | 67 J | | | | 22 J | | NA | 4100 |
| Benzo(g,h,i)perylene | 26 J | | | | | | NA | NA |
| Benzo(k)fluoranthene | 58 J | | | | [illegible]7 J | | NA | 41000 |
| Bis(2-ethylhexyl)phthalate | | 71 J | | 36 J | 35 J | | NA | 215000 |
| Butylbenzylphthalate | | | | | | | NA | 215000000 |
| Carbazole | | | | | | | NA | NA |
| Chrysene | 68 J | | 20 J | | 22 J | | NA | 410000 |
| Di-n-butyl phthalate | | | | | | | NA | 105000000 |
| Di-n-octyl phthalate | | | | | | | NA | 21500000 |
| Dibenz(a,h)anthracene | | | | | | | NA | 410 |
| Dibenzofuran | | | | | | | NA | NA |
| Diethyl phthalate | | | | | | | NA | NA |
| Fluoranthene | 11[illegible] J | | 31 J | | 38 J | | NA | 42500000 |
| Fluorene | | | | | | | NA | NA |
| Indeno(1,2,3-cd)pyrene | 36 J | | | | | | NA | 4100 |
| 2-Methylnaphthalene | | | | | | | NA | NA |
| Naphthalene | | | | | | 61 J | NA | NA |
| Phenanthrene | 5[illegible] J | | | | | | NA | NA |
| Phenol | | | | | | | NA | 650000000 |
| Pyrene | 120 J | | 31 J | 20 J | 37 J | | NA | 32000000 |

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

| ANALYTE | SGC NAC 000007 | SGC NAC 000008 | SGC NAC 000009 | SGC NAC 000010 | SGC NAC 000011 | SGC NAC 000012 | Background | $10^{-6}$ Construction Worker Guidelines |
|---|---|---|---|---|---|---|---|---|
| INORGANICS (mg/kg) | | | | | | | | |
| Aluminum | 10200 | 2820 | [illegible] | 7300 | 1030[illegible] | 13100 | 19000 | NA |
| Antimony | | 0.27 B | 0.91 B | 0.21 B | 1.2 B | | NA | 425 |
| Arsenic | 1.9 B | [illegible] | 11.1 | 7.2 | 2.2 B | 1.[illegible] BJ | 8.6 | 320 |
| Barium | 26.2 B | 23[illegible] B | 163 | 64.7 | 13.5 B | 78.4 | 180 | 75000 |
| Beryllium | 0.28 | | 0.9 B | 0.34 | 0.36 B | 0.44 | 1.3 | 0.7 |
| Bismuth | | | [illegible]85 B | | 0.99 B | | NA | NA |
| Cadmium | 0.33 B | 0.22 B | 6 | 0.62 B | 5.2 | 6.0 | 2.1 | 1050 |
| Calcium | 839[illegible] | 113000 | 59[illegible] | 41500 | 90800 | [illegible]000 J | 310000 | NA |
| Chromium | 14.3 | 5.7 | [illegible]0.3 | 12 | 11.9 | [illegible] | 20 | 1050000 |
| Cobalt | 11 B | [illegible] B | 13 | 7.9 B | 13.7 | 12.7 J | 19 | NA |
| Copper | 16.2 | 13.9 | 19.2 | 17.4 | 16.6 | 21.3 | 26 | NA |
| Cyanide | | | | | | | ND | 21400 |
| Iron | 23000 | [illegible]660 | [illegible]400 | 17300 | 25600 | 27900 | 35000 | NA |
| Lead | 7.2 | 5.9 | 22.2 | 16.5 | 5.7 | 9.3 J | 48 | NA |
| Lithium | 3.2 B | 8.2 B | 14.7 B | 9.2 B | 27.3 | [illegible] | 26 | NA |
| Magnesium | 21[illegible]00 | 47900 | 4500 | 16700 | 12300 | [illegible] J | 40000 | NA |
| Manganese | 493 | [illegible]6 | 728 | 604 | 908 | 658 | 1400 | 135000 |
| Mercury | | | | | | | NC | 320 |
| Molybdenum | 0.63 B | 1.4 B | 1.8 B | 2.3 B | 0.58 B | 1.3 B | 27 | NA |
| Nickel | 22.6 | 8.1 B | [illegible] | 16.5 | 21.6 | 26.4 | 32 | 21500 |
| Potassium | 1590 | 463[illegible] B | 1420 | 794 B | 2210 B | 1630 | 1900 | NA |
| Selenium | | | | | 0.31 B | | NA | NA |
| Silver | | | | | | | 1700 | 5500000 |
| Sodium | 246 | [illegible] B | 1010 B | 82 B | 288 B | 2490 | 240 | NA |
| Thallium | | | | | | | 460 | NA |
| Tin | | 4.5 B | [illegible]5 B | | | 1.6 B | 20 | NA |
| Vanadium | 14.[illegible] | 7.4 | 42.[illegible] | 19.2 | 15.8 | 22.4 | 25 | 7500 |
| Zinc | 53.8 | 36.6 | 71.8 | 299 | 59.9 | 68.5 | 140 | 320000 |

## Table A.3. Soil Gas Confirmation Detected Pesticides/PCB's

| ANALYTE | SGC NAC 000008 | SGC NAC 000010 | SGC NAC 000031 | SGC A66 000041 | SGC A61 000044 | SGC 13 000[illegible]0 | Background | $10^{-6}$ Construction Worker Guidelines |
|---|---|---|---|---|---|---|---|---|
| PESTICIDES/PCB (µg/kg) | | | | | | | | |
| Aroclor-1248 | 48 | | | 110 | 98 | | ND | 380 |
| Aroclor-1254 | 4[illegible] | | | | 55 | | ND | 21500 |
| Alpha-Chlordane | | | | | | | ND | NA |
| Gamma-Chlordane | | | | | | 3.7 | ND | NA |
| 4,4'-DDT | | | | | | | 13000 | 9000 |
| Dieldrin | | 4.4 | 5* | | | | ND | 185 |
| Endosulfan I | | | | [illegible]4 | 2.4* | | ND | NA |
| Endosulfan II | | | | | | | NA | NA |
| Endrin | | | 11[illegible] | | | | ND | NA |
| Heptachlor | | | | | | 2 | ND | NA |

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

| ANALYTE | SGC NAC 00[illegible]08 | SGC NAC [illegible]00009 | SGC NAC 000010 | SGC NAC 0[illegible] | SGC NAC 000012 | SGC NAC [illegible]00013 | SGC [illegible]C 0000[illegible] | Background | $10^{-6}$ Construction Worker Guidelines |
|---|---|---|---|---|---|---|---|---|---|
| RADIONUCLIDES (pCi/g) | | | | | | | | | |
| Americium-241 | | | | | -0.23[illegible] | [illegible].0694 | | ND | 4.95 |
| Bismuth-207 | | | | | 0.0292 | -0.0304 | | ND | 0.175 |
| Bismuth-210 | | | | | 0.[illegible]55 | 0.0297 | | ND | NA |
| Cesium-137 | | | | | 0.0371 | 0.[illegible]175 | 0.[illegible] | 0.42 | 0.46 |
| Cobalt-60 | | | | | 0.0547 | -0.02[illegible] | | NC | 0.1 |
| Plutonium-238 | 0.0826 | 0.0233 | 0.107 | 0.0718 | 0.[illegible]01 | 0.0[illegible] | 0.671 | 0.13 | 5.5 |
| Plutonium-239/240 | | | | | 0.0015[illegible] | [illegible].000127 | [illegible].0206 | 0.18 | 5.5 |
| Potassium-40 | 7.72 | [illegible].9 | 15.0 | [illegible]7.8 | 15.5 | 4.65 | 2[illegible]5 | 37 | NA |
| Radium-226 | 0.571 | 0.764 | 0.917 | 0.7[illegible] | [illegible].592 | 0.263 | 1.10 | 2 | 0.14 |
| Thorium-228 | 0.678 | 0.779 | 0.914 | 0.913 | 0.697 | 0.[illegible]47 | 1.18 | 1.5 | 0.85 |
| Thorium-230 | 0.541 | 1.09 | 1.27 | 0.902 | 0.803 | 0.3[illegible] | 1.09 | 1.9 | 44 |
| Thorium-232 | 0.554 | 0.82[illegible] | 0.708 | 0.830 | [illegible].769 | [illegible].210 | 1.08 | 1.4 | 50 |
| Uranium-234 | 0.361 | [illegible]12 | 0.897 | 0.88[illegible] | 0.69[illegible] | 0.378 | 0.866 | 1.1 | 37.5 |
| Uranium-235 | | | 0.0459 | | 0.0[illegible]1 | 0.0183 | 0.[illegible] | 0.11 | 3.35 |
| Uranium-238 | 0.414 | 0.774 | 1.06 | 0.871 | 0.681 | 0.424 | 1.01 | 1.2 | 11 |