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(937) 865-4020

ESC-026/00
February 29, 2000

00-TC/02-29

Mr. Richard B. Provencher, Director
Miamisburg Environmental Management Project
U. S. Department of Energy
P. O. Box 66
Miamisburg, OH 45343-0066

ATTENTION: Dewain Eckman

SUBJECT: Contract No. DE-AC24-97OH20044
PRS 276 DELIVERY OF FINAL POTENTIAL RELEASE SITE DATA PACKAGE

REFERENCE: Statement of Work Requirements C.7.1e -- Regulator Reports

Dear Mr. Provencher:

The attached Potential Release Site Data Package for PRS 276 has been authorized for release to USEPA, OEPA, ODH, MMCIC, and the public reading room by Art Kleinrath of MEMP. This revision of the PRS package includes responses to MMCIC comments to the "Public Review Draft" version. Delivery of this document completes the development of this PRS package.

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Please advise if additional copies are required. If you require further information, please contact Dave Rakel at extension 4203.

Sincerely,

JSStapleton

Jeffrey S. Stapleton
Acting Manager, Environmental Safeguards & Compliance

JSS/jdg

Enclosures as stated

cc: Tim Fischer, USEPA, (1) w/attachments
Dave Meredith, Techlaw, Inc. (1), w/attachments
Brian Nickel, OEPA, (1) w/attachments
Ruth Vandergrift, ODH, (1) w/attachments
Art Kleinrath, MEMP, (2) w/attachments
Terrence Tracy, DOE/HQ, (1) w/attachments
Dan Bird, MMCIC, (1) w/attachments
Evans Reynolds, BWO, (2) w/attachments
Public Reading Room, (5) w/attachments
Administrative Record, (2) w/attachments
DCC

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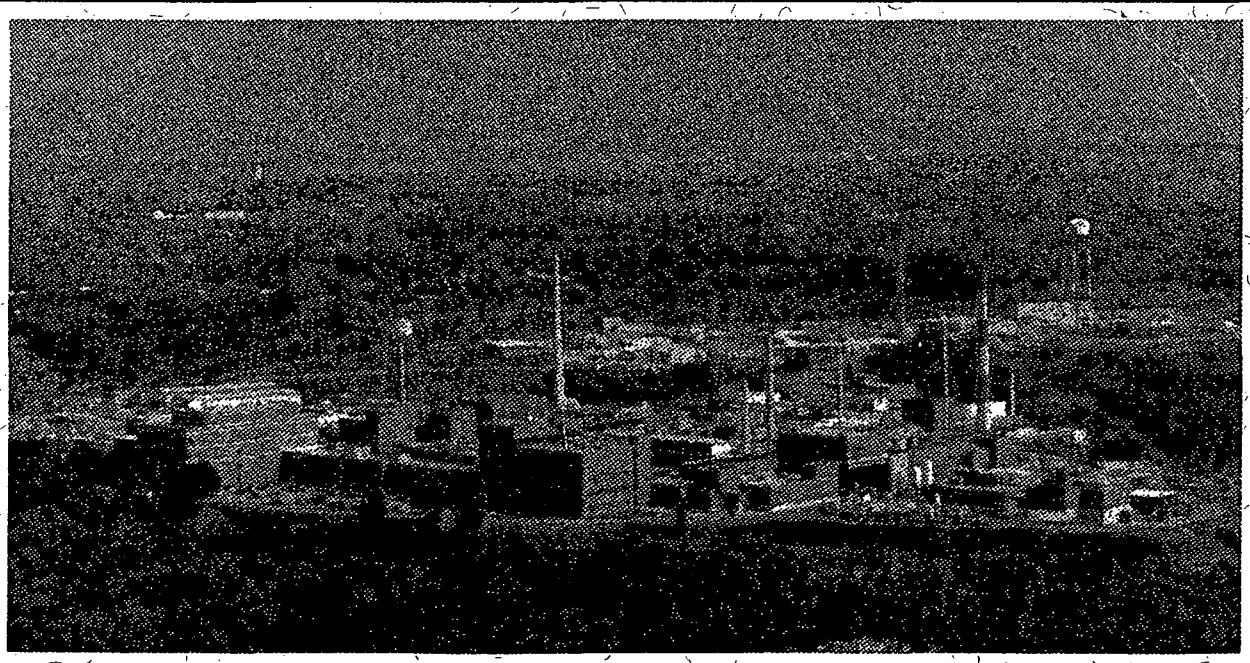
MOUND

Environmental
Restoration
Program

MOUND PLANT

Potential Release Site Package

PRS # 276



PRS 276

REV	DESCRIPTION	DATE
WORKING DRAFT		
Draft	Binned FA, 05/15/96	**March 28, 1999**
Draft Proposed Final	Assessment versus removal "cost comparison" accomplished. Core Team recommends a Response Action as more cost effective. Public Review: October 13, 1999 - November 13, 1999	**July 29, 1999**
Public Review Draft	MMCIC comments received. Comments and responses inserted in PRS 276 document. PRS 276 Action Memorandum required. PRS 276 On Scene Coordinator Report required.	**October 7, 1999**
Final		**February 21, 2000**

MOUND

Environmental Restoration Program

MOUND PLANT POTENTIAL RELEASE SITE PACKAGE

Notice of Public Review Period

The Potential Release Site (PRS) 276 Data Package is available for public review in the CERCLA Public Reading Room, 305 E. Central Ave., Miamisburg, Ohio. Public comment on this document will be accepted October 13, 1999 through November 13, 1999.

Potential Release Site 276:
Contaminated Soil

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

The Mound Core Team
P.O. Box 66
Miamisburg, Ohio 45343-0066

Mr. Daniel Bird, AICP
Planning Manager
Miamisburg Mound Community Improvement Corporation
720 Mound Road
COS Bldg. 4221
Miamisburg, Ohio 45342-6714

Dear Mr. Bird:

The Core Team, consisting of the U.S. Department of Energy Miamisburg Environmental Management Project (DOE-MEMP), U.S. Environmental Protection Agency (USEPA), and the Ohio Environmental Protection Agency (OEPA), appreciates your comments on the PRS 276 Data Package. Attached are our responses.

Should the responses to comments require additional detail, please contact Art Kleinrath at (937) 865-3597, and we will gladly arrange a meeting or telephone conference.

Sincerely,

DOE/MEMP: Art Kleinrath
Art Kleinrath, Remedial Project Manager

USEPA: Timothy J. Fischer
Timothy J. Fischer, Remedial Project Manager

OEPA: Brian K. Nickel
Brian K. Nickel, Project Manager

MMCIC Comments

PRS 276 Data Package

Public Review Draft

Substantive Comments:

1. PRS 276 is a small area of radiological soil contamination located 300 feet northeast of Building 21 (since demolished). The Core Team recommendation for this PRS is a response action. MMCIC concurs with this recommendation and recognizes that a response action at this time is more timely and cost-effective than further assessment. However, if further assessment of the extent of contamination is eliminated, DOE runs the risk of failing to remediate the full extent of contamination at this PRS location. We assume and/or recommend that DOE will perform verification soil sampling in the PRS 276 location following completion of the PRS 276 response action to confirm that the identified contaminants have been removed to levels below the cleanup criteria stated in the forthcoming work plan.

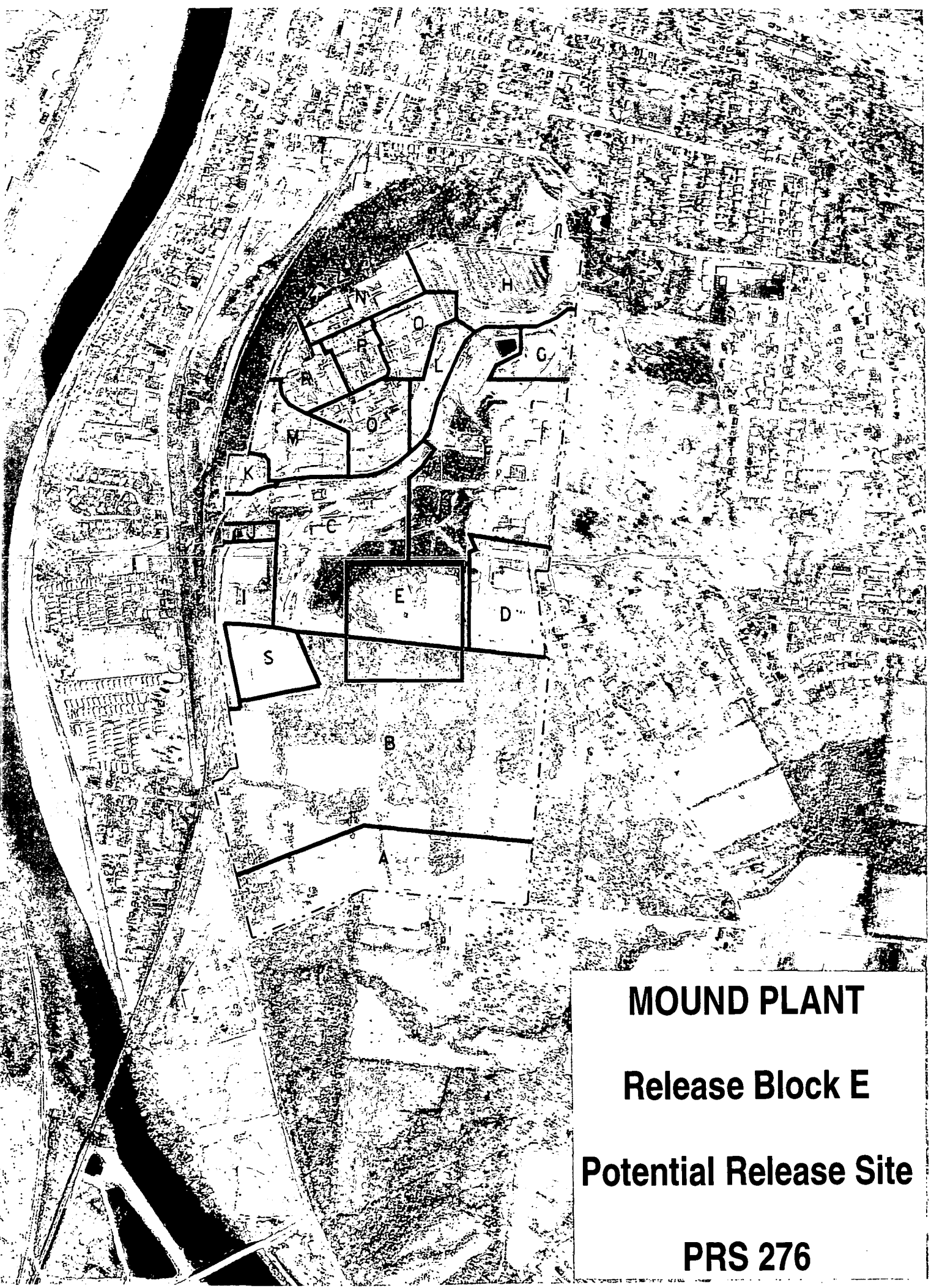
Response:

The verification plan, which will be subject to the approval of the Core Team, will be designed to ensure the removal is complete. This plan will also be available for public review. The removal will be designed to ensure that all contamination that threatens human health is removed.

2. Although radionuclides (principally cobalt-60, cesium-137, plutonium-238, and thorium-232) are the identified contaminants of concern at PRS 276, elevated PETREX readings of various hydrocarbons were detected in the PRS 276 area during the September 1994 *Operable Unit 5, Operational Area Phase I Investigation, Area 22 Field Report.* Although these detections may not have been environmentally significant given the sensitivity of the PETREX method to volatile and semi-volatile organic compounds, the possibility exists that some organic compound contamination has also occurred at PRS 276. We recommend that the work plan for this PRS include a percentage of the total sample analyses to be for typical Mound constituents other than radionuclides (i.e., volatile and semi-volatile compounds).

Response:

Similar Petrex readings have been found in other locations and have been shown to not indicate environmentally significant concentrations. This work is documented in the Further Assessment Soil Gas Confirmation Sampling report, Mound Plant, Miamisburg, Ohio, May 1996. However, because of the possibility of disposal in this open area and the diverse origin of these soils, the Core Team will include analysis for organic compounds in the Sampling Plan.



MOUND PLANT

Release Block E

Potential Release Site

PRS 276

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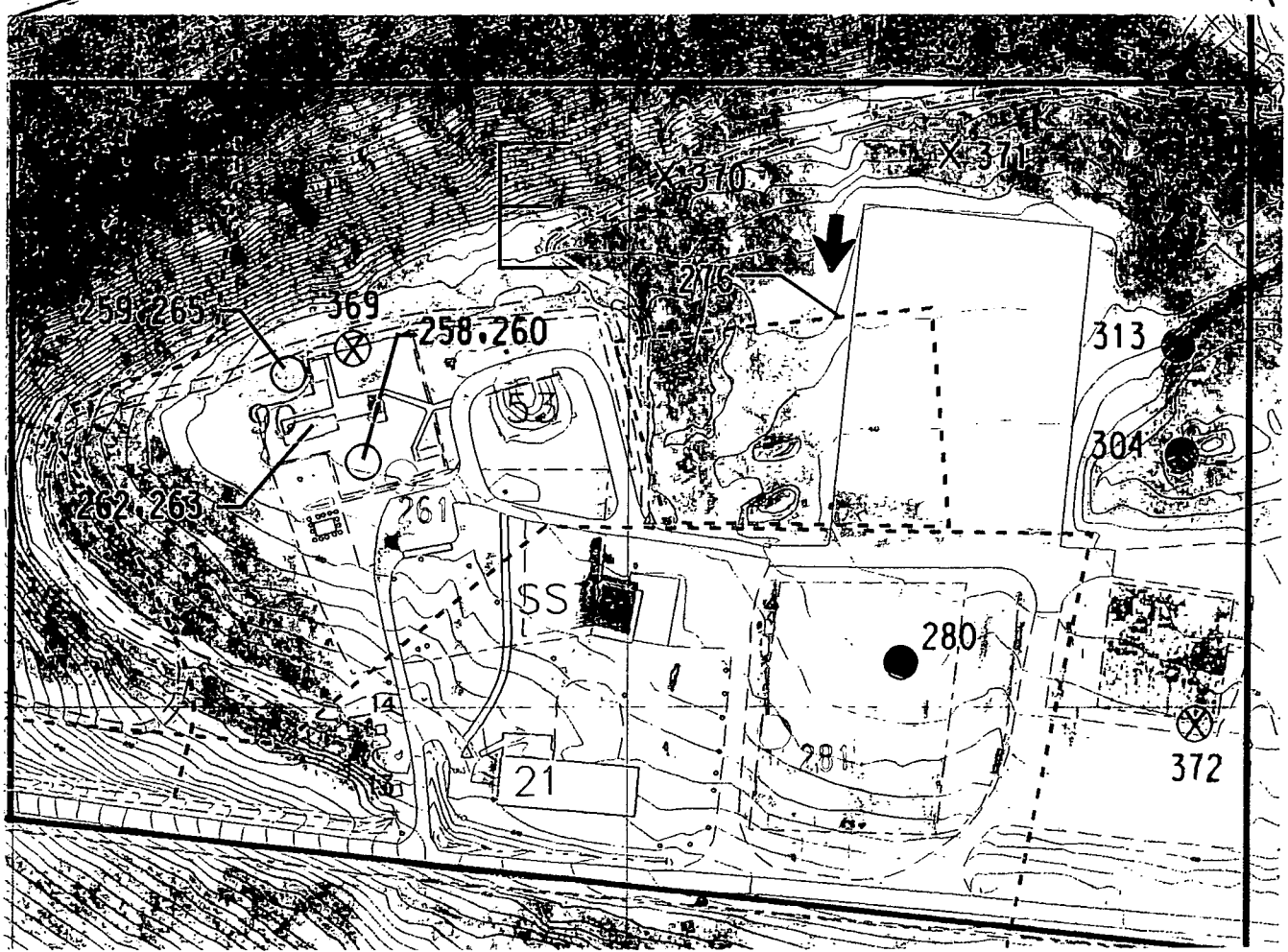
MOUND PLANT

Release Block E

Potential Release Site

PRS 276



276

PRS 276

PRS HISTORY:

PRS 276 is a soils location approximately 300 feet northeast of Building 21 and is also known as Area 22. Area 22 is located on the south part of the SM/PP Hill and has the approximate dimensions of 75 ft by 150 ft. This area consists of many piles of soil excavated from other areas at Mound Plant, including Area 20 (PRS 153). It is also called the "orphan soils" area because it was created when construction projects did not have funding for disposal of unexpected contaminated soil. The soil was placed at Area 22 while waiting for funding. Area 22 was not part of the original compilation of radioactively contaminated areas but was identified by the initial gamma surveys conducted when the Site Survey Project began.[2]

CONTAMINATION:

I. 1988 Radiological Site Survey:[2]

A) 1988 Radiological Site Survey investigated nine locations in and around Area 22 for both surface and subsurface radiological contamination.[2]
   1. Four surface locations within Area 22 exhibited positive detections of cobalt-60, cesium-137, radium-226, and tritium.
   2. Surface and two subsurface locations just south and west of Area 22 exhibited positive detections of thorium and tritium.

B) Results of the 1988 Radiological Site Survey Investigation for which Contaminant Concentrations can be compared to Guideline Criteria:

Contaminant	Maximum Concentration Detected	Guideline Criteria Listed or Calculated
Cobalt-60 (Co-60)	143 pCi/g	0.1 pCi/g
Cesium-137 (Cs-137)	7 pCi/g	0.46 pCi/g
Radium-226 (Ra-226)	0.7 pCi/g	2 pCi/g (background)
Americium-241 (Am-241)	Not detected	4.95 pCi/g
Plutonium-238 (Pu-238)	8.33 pCi/g	25 pCi/g
Thorium-232 (Th-232)	7.73 pCi/g	5 pCi/g
Tritium	990 pCi/l (soil distillate)	20,000 pCi/l

C) Other results:
Neither bismuth-207 nor bismuth-210m were analyzed for even though they may be expected in association with cobalt-60 due to the manner in which these materials were processed. Similarly, since cesium-137 was identified, it is possible that strontium-90 may also be present. Strontium-90 was not included in the analysis conducted.

II. 1994 screening investigation at Area 22:[3]

A) Seventy-two soil samples in Area 22 were analyzed at the Mound Soil Screening Facility for plutonium (Pu-238) and thorium (Th-232). Soil screening detected Pu-238 above the Mound Plant ALARA goal of 25 pCi/g in 21 samples. Thorium-232 was detected in one sample.

B) Results of the 1994 screening investigation at Area 22:[3]

Contaminant	Maximum Concentration Detected	Guideline Criteria Listed or Calculated
Plutonium-238 (Pu-238)	81 pCi/g	25 pCi/g
Thorium-232 (Th-232)	3.1 pCi/g	5 pCi/g

C) Field Instruments for the Detection of Low Energy Radiation (FIDLER) surveys within Area 22 determined 5 locations where radionuclides other than Pu-238 and Th-232 are suspected.

READING ROOM REFERENCES:

1) OU9, Site Scoping Report: Volume 12 - Site Summary Report, December 1994. (pages 6-12)
2) OU9, Site Scoping Report: Volume 3 - Radiological Site Survey, June 1993. (pages 13-24)
3) OU5, Operational Area Phase I Investigation Area 22 Field Report, Volume I, September 1994. (pages 25-43)

PREPARED BY:

James N. Rigano, Member of EG&G Technical Staff
Alexander Bray, Member of EG&G Technical Staff

PRS 276
(SUPPLEMENTAL DATA)

HISTORY:

In March 1996, the **Soil Gas Confirmation Investigation**[4] was performed to further assess PRS 276. Six core samples were taken to a depth of three feet, and analyzed for volatiles, semi-volatiles, PCBs, pesticides, metals, explosives, and radionuclides. The results showed that all concentrations of volatiles, semi-volatiles, PCBs, pesticides, metals, explosives, and radionuclides in the soils were below their respective ALARA, regulatory or 10^{-6} Risk Based Guideline Criteria.[4, 5, 6]

Note that Co-60 and Cs-137 were both included in the analyses. However, Sr-90 was not.

REFERENCES:

4) Further Assessment, Soil Gas Confirmation Sampling, May 1996. (pages 44-53)
5) Risk Based Soil Guidelines, Final, Rev. 3, December 1995.
6) Code of Federal Regulations, 40 CFR 192.41 and 40 CFR 192.12.

PREPARED BY:

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

MOUND PLANT
PRS 276
Contaminated Soil

RECOMMENDATION:

PRS 276 is a soils location approximately 300 feet northeast of Building 21 (since demolished) and is also known as Area 22. PRS 276 is located on the south part of the SM/PP Hill and has the approximate dimensions of 75 ft by 150 ft. This area consists of many piles of soil excavated from other areas at Mound Plant, including Area 20 (PRS 153). It is also called the "orphan soils" area because it was created when construction projects did not have funding for disposal of unexpected contaminated soil. The soil was placed at PRS 276 while waiting for funding. PRS 276 was not part of the original compilation of radioactively contaminated areas but was identified by the initial gamma surveys conducted when the Site Survey Project began.

The Core Team originally recommended Further Assessment for PRS 276. Subsequently, the cost of further investigation versus the cost of removing the potentially contaminated soils was evaluated. Cost estimates indicate that the cost of removal is not significantly greater than the cost of further assessment at PRS 276. Additionally Further Assessment findings may indicate the need for a Response (removal) Action, resulting in costs associated with both Further Assessment and Response Action. Therefore, the Core Team recommends a RESPONSE ACTION as a more cost-effective course of action for PRS 276.

CONCURRENCE:

DOE/MEMP: Arthur W. Kleinrath 7/28/1999
Arthur W. Kleinrath, Remedial Project Manager (date)

USEPA: Timothy J. Fischer 7/28/99
Timothy J. Fischer, Remedial Project Manager (date)

OEPA: Brian K. Nickel 7/28/99
Brian K. Nickel, Project Manager (date)

SUMMARY OF COMMENTS AND RESPONSES:

Comment period from 10/13/99 to 11/13/99

☐ No comments were received during the comment period.

☒ Comment responses can be found ~~on page~~ at front of this package.

REFERENCE MATERIAL
PRS 276

ENVIRONMENTAL RESTORATION PROGRAM

OPERABLE UNIT 9
SITE SCOPING REPORT:
VOLUME 12 - SITE SUMMARY REPORT

MOUND PLANT
MIAMISBURG, OHIO

December 1994

U.S. DEPARTMENT OF ENERGY
OHIO FIELD OFFICE

ENVIRONMENTAL RESTORATION PROGRAM
EG&G MOUND APPLIED TECHNOLOGIES

FINAL

Table A.1. Comprehensive Tabulation of Potential Release Sites

Description of History and Nature of Waste Handling						Hazardous Conditions and Incidents			Environmental Data		
No.	Site Name	Location	Status	Potential Hazardous Substances	Ref	Releases	Media	Ref	Analytes[a]	Results	
272	Area 10, Concrete Debris	G-8 G-9	Grounds	Polonium-210, Cobalt-60, Plutonium-238 (from runoff)	1, 4, 5, 18	Suspected	S	4, 6	14	Table B.1 (Table III.6 in Ref. 6)	
273	Area 12, Thorium-Contaminated Soil from Area 1	G-9	Grounds	Thorium, Plutonium-238 (from runoff)	1, 4, 5, 18	Suspected thorium	S	4, 6	14, 15	Table B.1 (Table V.5 in Ref. 6)	
274	Area 21, Old Bunker	H-9	Grounds	Cesium-137, Strontium-90, Actinium-227, Radium-226	4, 5, 18	Suspected thorium	S	4, 6	14, 15, 16	Table B.1 (Table VII.2 in Ref. 6)	
275	Area 21, Detonator Shack	H-8	Grounds	Cesium-137, Strontium-90, Actinium-227, Radium-226	4, 5, 18	Suspected thorium	S	4, 6	14, 15, 16	Table B.1 (Table VII.2 in Ref. 6)	
276	Area 22, Orphan Soil from other Areas	I-8	Inactive	Polonium-210, Radium-226, Cobalt-60, Plutonium-238, Cesium-237	4, 5, 18	Suspected	S	6	14, 15, 16	Table B.1 (Table X.1 in Ref. 6)	
277	Area J, Hillside Disposal Area (AKA Dredged Material Disposal Area 11a)	H-8 H-9	Historical	Construction/building debris, Paints, Thinners, Chemical contaminants, Asbestos, Thorium, Plutonium-238	1, 4, 18	Suspected VOCs	S	4	1 14, 15, 16	SGS[b] Table B.2 Table B.1 (Table X.2 in Ref. 6)	
278	Area J, Hillside catch basin	H-8	In service	Plutonium-238 (from runoff)	1, 4, 18	Suspected	SW	18	No Data		
279	Old Firing Range Drum Storage Area	H-9	Historical	Liquid chemical wastes	5, 18	Confirmed VOCs	S	4	1 2, 3, 4, 5, 6 14, 15	SGS[b] Table B.2 Locations 3152, 3153, and 3187 Tables B.6, B.7, B.8, and B.9 RSS[c] Locations S0162, S0163, and S0647 (Appendix E in Ref. 6)	

[a]Analyte List Codes
[b]SGS, Soil Gas Survey
[c]RSS, Radiological Site Survey

1 - Soil Gas Survey - Freon 11, Freon 113, Trans-1,2-Dichloroethylene, Cis-1,2-Dichloroethylene, 1,1,1-Trichloroethane, Perchloroethylene, Trichloroethylene, Toluene
2 - Gamma Spectroscopy - Thorium-228, -230, Cobalt-60, Cesium-137, Radium-224, -226, -228, Americium-241, Actinium-227, Bismuth-207, Bismuth-210m, Potassium-40
3 - Target Analyte List
4 - Target Compound List (VOC)
5 - Target Compound List (SVOC)
6 - Target Compound List (Pesticides/Polychlorinated Biphenyl)
7 - Dioxins/Furans
8 - Extractable Petroleum Hydrocarbons (EPH)/Total Petroleum Hydrocarbons (TPH)
9 - Lithium
10 - Nitrate/Nitrite
11 - Chloride
12 - Explosives
13 - Plutonium-238
14 - Plutonium-238, Thorium-232
15 - Cobalt-60, Cesium-137, Radium-226, Americium-241
16 - Tritium

Reference List

1. DOE 1986 "Phase I: Installation Assessment Mound [DRAFT]."
2. DOE 1992a "Remedial Investigation/Feasibility Study, Operable Unit 9, Site-Wide Work Plan (Final)."
3. DOE 1992c "Mound Plant Underground Storage Tank Program Plan & Regulatory Status Review (Final)."
4. DOE 1993a "Site Scoping Report: Vol. 7 - Waste Management (FINAL)."
5. EPA 1988a "Preliminary Review/Visual Site Inspection for RCRA Facility Assessment of Mound Plant"
6. DOE 1993d "Operable Unit 9, Site Scping Report: Vol. 3 - Radiological Site Survey (FINAL)."
7. DOE 1993c "Operable Unit 3, Misc. Sites Limited Field Investigation Report."
8. DOE 1992d "Reconnaissance Sampling Report Decontamination & Decommissioning Areas, OU6, (FINAL)."
9. Fentiman 1990 "Characterization of Mound's Hazardous, Radioactive and Mixed Wastes."
10. DOE 1992f "Operable Unit 9, Site Scpoing Report: Vol. 9 - Spills and Response Actions (FINAL)."
11. Styron and Meyer 1981"Potable Water Standards Project: Final Report."
12. DOE 1993b "Reconnaissance Sampling Report - Soil Gas Survey & Geophysical Investigations, Mound Plant Main Hill and SM/PP Hill (FINAL)."
13. DOE 1993d "Operable Unit 9, Site Scoping Report: Vol. 3 - Radiological Site Survey (FINAL)."
14. DOE 1991b "Main Hill Seeps, Operable Unit 2, On-Scene Coordinator Report for CERCLA Section 104 Remedial Action, West Powerhouse PCB Site."
15. Halford 1990 "Results of South Pond Sampling."
16. DOE 1993e "Operable Unit 4, Special Canal Sampling Report, Miami Erie Canal."
17. DOE 1990 "Preliminary Results of Reconnaissance Magnetic Survey of Mound Plant Areas 2, 6, 7, and C."
18. DOE 1992a "Remedial Investigation/Feasibility Study, Operable Unit 9, Site-Wide Work Plan (FINAL)."
19. Rogers 1975 "Mound Laboratory Environmental Plutonium Study, 1974."
20. DOE 1992h "Ground Water and Seep Water Quality Data Report Through First Quarter, FY92."
21. Dames and Moore 1976a, b "Potable Water Standards Project Mound Laboratory" and "Evaluation of the Buried Valley Aquifer Adjacent to Mound Laboratory."
22. DOE 1992l "Closure Report, Building 34 - Aviation Fuel Storage Tank."
23. DOE 1992j "Closure Report, Building 51 - Waste Storage Tank."
24. DOE 1994 "Operable Unit 1, Remedial Investigation Report."
25. EG&G 1994 "Active Underground Storage Tank Plan."

Document Control No. D6 c

Environmental Restoration Program

OPERABLE UNIT 9, SITE SCOPING REPORT: VOLUME 7 - WASTE MANAGEMENT

MOUND PLANT
MIAMISBURG, OHIO

July 1992

DRAFT FINAL

(Revision 0)

Department of Energy
Albuquerque Field Office

Environmental Restoration Program
Technical Support Office
Los Alamos National Laboratory

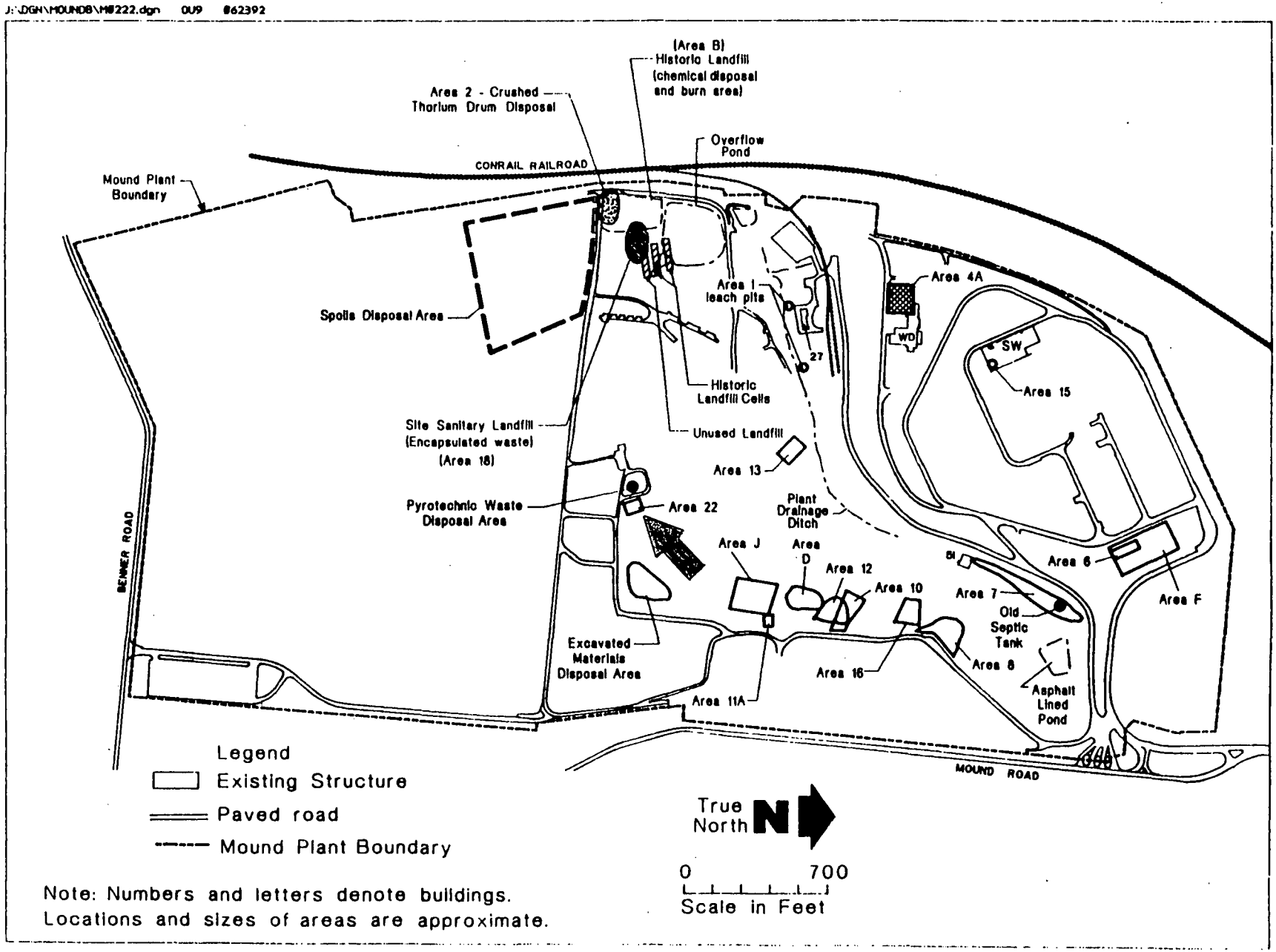


Figure 6.1 On-plant waste disposal areas.

~~system. The septic tank and leach field were connected to the toilets within the building. Process wastewater, floor drains, and sink drains were treated by a wastewater treatment system within room 1 of the SM Building. In 1967, the process wastewater was disconnected from the SM treatment system and was piped to WDA Building for treatment. The leach field may have received contamination from mop and wash water during decontamination operations. The septic may have been removed in the late 1970s, but no data are available. The leach field was undergoing excavation in 1991 by the Mound D&D Program.~~

~~The Mound Radiological Site Survey (DOE 1991c) showed the maximum plutonium-238 concentration to be 144 pCi/g at a sample depth of 36 inches and a maximum thorium concentration of 3.46 pCi/g at a sample depth of 36 inches. The contamination may have originated from surface water runoff from the storm sewer outfall or from contaminated floor mop water that was disposed of by pouring down the SM Building toilets (WESTON 1990). An area at the lower part of the slope may also be contaminated as a result of receiving drainage from this storm sewer or Area 16 (DOE 1992g). Recent sampling found this lower area to have contaminant concentrations (plutonium and thorium) of 6 to 8 nCi/g. The total size of the area could potentially be as high as 125,000 ft^2 (Geichman 1991). The septic tank and leach basin are currently undergoing excavation as part of the D&D Program.~~

~~6.1.1.9. Area D, Acid Leach Field~~

~~The Area D acid leach field is west of Building 38 on the upper slope of the SM/PP area, in the eastern portion of the plant (Figure 6.1). The leach field was installed to catch spills from the plutonium processing facility. Tanks inside Building 38, which contained nitric acid or caustic solutions, were surrounded by a metal tray to catch leaks or spills. In the event of a leak or spill, the liquid was collected by the tray and routed through a pipe to the acid leach field. The leach field, which was placed in service in 1967, was approximately 10 ft by 10 ft and filled with limestone to neutralize any acid routed to it. In 1987, the acid and caustic tanks routed to the leach field were taken out of service and the pipeline was capped (Davis 1991). Discussions with Mound personnel indicated that no significant spills or releases were ever discharged to the leach field. A single core sample taken from the area during the 1982 to 1985 Radiological Site Survey (DOE 1991c) found no significant thorium or plutonium contamination (0.98 pCi/g of plutonium-238 and less than 2 pCi/g of thorium).~~

6.1.1.10. Area 22, Orphan Soil from Other Areas

Area 22 is just east of Building 53, in the southern portion of Mound (Figure 6.1). It consists of many piles of excavated soil. Soil contaminated with polonium-210 from a waste line break west of the HH Building and from other sites was deposited there in 1985 (DOE 1991c). A 75-ft by 150-ft area has

been roped off. The 1982 to 1985 Radiological Site Survey (DOE 1991c) found soils contaminated with low levels of plutonium-238 (1.67 pCi/g), cesium-137 (7.0 pCi/g), and radium-226 (0.7 pCi/g), and an elevated concentration of cobalt-60 (143 pCi/g).

~~6.1.1.11. Spoils Disposal Area~~

~~The spoils disposal area is southeast of the overflow pond, in the west-central portion of Mound (Figure 6.1). It was put into operation in 1985 and is still in service. The area is used to dispose of uncontaminated soil and concrete removed during plant construction operations. Soil is dumped onto the ground and graded slightly to the west. All soils removed during construction are screened for plutonium-238 and thorium-232 by the soil screening facility prior to transfer to the area. Maximum activities must not exceed 25 or 5 pCi/g, respectively. In late 1986 or early 1987, soil removed from the Building G garage area was deposited in the spoils disposal area. The soil was contaminated with gasoline and was stockpiled for volatilization of the gasoline prior to transfer to the spoils area (Burdg 1991). The area is 300 ft by 300 ft by 10 ft and is divided into three cells with a total capacity of 350,000 yd^3. It is surrounded by a ditch to prevent rainfall run-on. The 1982 to 1985 Mound Site Survey (DOE 1991c) found surface soils to be contaminated with low levels of plutonium-238 at a maximum concentration of 8.30 pCi/g measured in a surface sample. No thorium activity greater than 2 pCi/g was measured.~~

~~6.1.1.12. Excavated Materials Disposal Area~~

~~The excavated materials disposal area is south of the water tower at the bend in the road, in the southeastern portion of the plant (Figure 6.1). The area is also known as Rader's Hill. The area partially overlaps the area formerly occupied by the old firing range and is south of the area used for storage of waste chemicals, known as the old firing range drum storage area. The area contains the overburden soil excavated to expose the WTS pipeline in the mid-1980s. The excavation on the western slopes of the SM/PP Hill penetrated the southern margin of what is known as Area 12, where thorium-contaminated soil was disposed of in the mid-1960s. The soil in Rader's Hill is probably contaminated with thorium. The volume of soil is probably on the order of several hundred cubic yards. Analytical data indicate thorium levels about 2 pCi/g.~~

~~6.1.2. Off-Plant Radioactive Waste Disposal~~

~~Off-plant shipment of wastes from the production, research, and development activities at Mound has dominated the radioactive waste management programs. Because Mound has not had the capacity nor the inclination to dispose of radioactive waste on-plant, it has been in~~

Document Control No. _____

Environmental Restoration Program

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

MOUND PLANT
MIAMISBURG, OHIO

June 1993

FINAL

Department of Energy
Albuquerque Field Office

Environmental Restoration Program
EG&G Mound Applied Technologies

10. GENERAL USE AREAS

~~Several areas of the Mound Plant were included in the investigations of the Site Survey Project or are known to contain low levels of radioactivity, but are not associated with a specific program or project. These areas include the Orphan Soils Area 22, the Hillside Disposal Area J, and the spoils disposal area. These areas and any results reported in the Site Survey Project report are described in the subsections that follow.~~

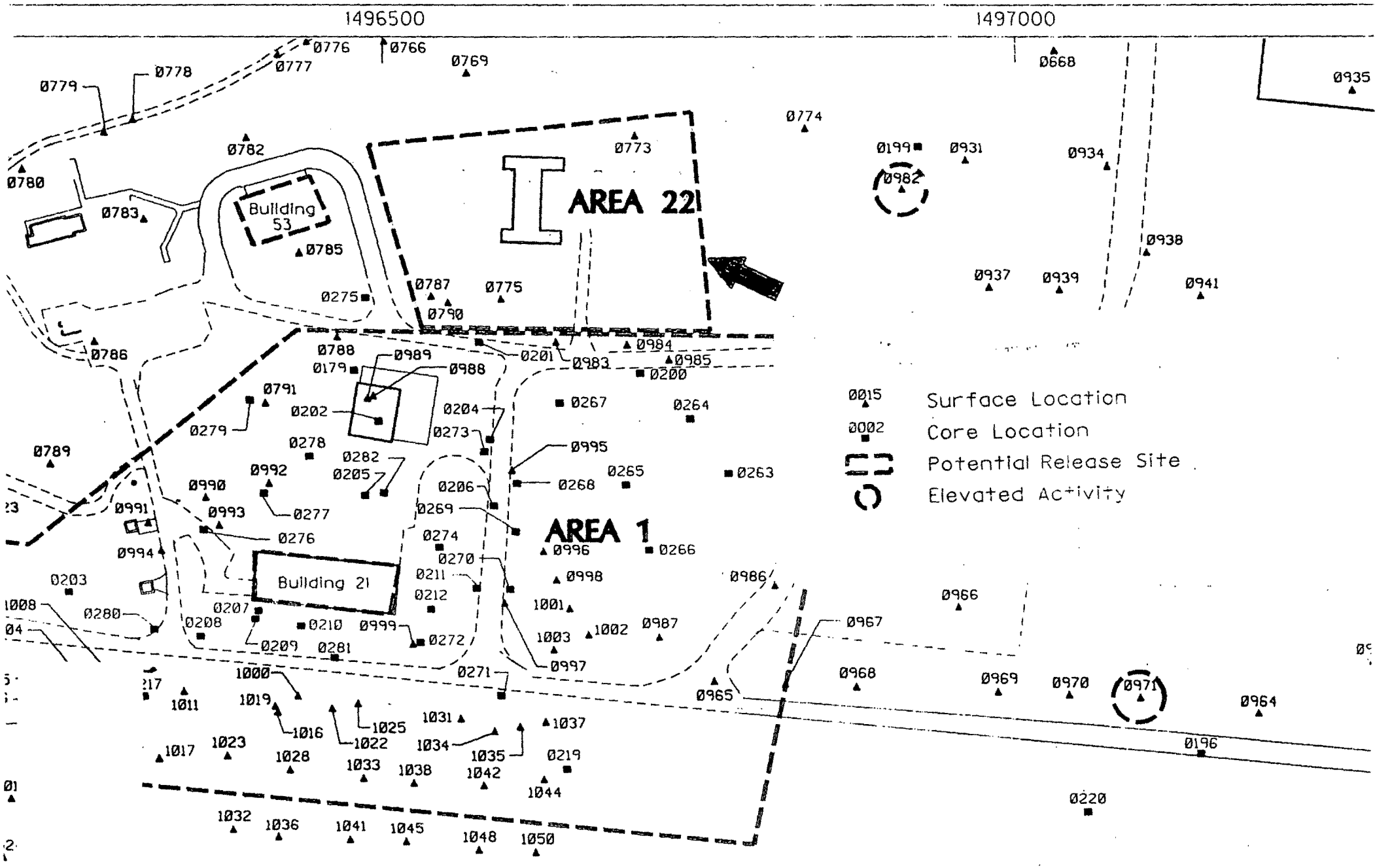
10.1. AREA 22

Area 22 is located on the south part of the SM/PP Hill adjacent to Building 53 (Plate 1). This area consists of many piles of soil excavated from other areas at Mound Plant, including Area 20 (subsection 3.9). It is also called the "orphan soils" area because it was created when construction projects did not have funding for disposal of unexpected contaminated soil, which was then staged at Area 22 while waiting for funding. Area 22 was not part of the original compilation of radioactively contaminated areas when the Site Survey Project began, but was identified by the initial gamma surveys (Stought et al. 1988).

The Area 22 sampling results are given in Table X.1 and the sampling locations are shown on Plate 1. Only surface locations were sampled. Cobalt-60 was detected in two of the samples, at levels of 143 and 54 pCi/g. The same samples showed radium-226 present in concentrations of 0.4 and 0.7 pCi/g, respectively. The sample from location S0787 also contained 7.0 pCi/g of cesium-137. The remaining two samples contained relatively low levels of plutonium-238, with a maximum level of 1.67 pCi/g, but these samples were not analyzed by gamma spectroscopy. No results were indicated for bismuth-207 or bismuth-210m, which may be expected to occur with cobalt-60 from speculation of process (see subsection 3.3.6 for discussion). Since cesium-137 was identified, it is possible that strontium-90 may also be present, but was not included in the analyses conducted by the Site Survey Project.

~~10.2. AREA J~~

~~Area J, known as the hillside disposal area, is located on the west slope of the SM/PP Hill, south of Areas D and 12 (Plate 1). This area was used from the early 1970s to the early 1980s for the disposal~~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AREA 22
AREA 1
Building 53
Building 21
Surface Location
Core Location
Potential Release Site
Elevated Activity

PLATE 1

~~- Area 21, a historic storage area used formerly used for storage of high-risk wastes from the SW Building (cesium-137 and radium-226).~~

~~Area 21 was not known at the beginning of the project, but was identified during the initial gamma surveys. Area 15 a historic radium-226/actinium-227 process area entombed in concrete inside the SW Building was not sampled during the investigation. It is known to give off 1 Ci of radon gas per year from the radioactive decay of radium-226. Results of analysis by gamma spectroscopy of samples from 288 locations were reported for radium-226. The distribution of sample locations is shown in Figure 11.2. The highest radium value (3.3 pCi/g) appears to be associated with the thorium areas, except for an isolated location on the far south part of the plant property. Most of the samples results were less than 1 pCi/g, only 65 samples were greater than 1 pCi/g. No samples were collected in the area around the entombed equipment in the SW Building (Area 15).~~

The experimental processing of reactor wastes from the Hanford and Oak Ridge nuclear reactors was a relatively unknown project conducted at Mound Plant in the early 1950s. Until the research for this report, the source of cesium-137 contamination at Mound Plant was highly speculative. Although no proof exists, the wastes generated in experimental processes probably serve as the principal source of the contaminant. An associated fission product of strontium-90 probably accompanied the cesium-137, but has not heretofore been an analyte of concern at Mound Plant. No data on the latter have been found. During or subsequent to the Site Survey Project (Stought et al. 1988), four principal areas of cesium-137 contamination have been described:

- Area 20, the location of a waste line break between the WD and the HH Buildings (cobalt-60, cesium-137, bismuth-210m, and bismuth-207);
- Area 21, a historic storage area used for storage of high-risk wastes from the SW Building (cesium-137 and radium-226);
- Area 22, with cesium-137 concentrations up to 7 pCi/g (believed to be contaminated soil excavated soil from Area 20);
- Hot spot 0175 on the west side of the Main Hill; and
- Hot Spot 0647 on the south end of the SM/PP Hill.

Results of analysis by gamma spectroscopy of samples from 292 locations were reported for cesium-137 The distribution of the sampling locations is shown in Figure 11.3. The highest value reported (270 pCi/g) was at a hot spot (0647) on the south part of the SM/PP Hill. Subsequent sampling indicated that values as high as 4 nCi/g were present. No apparent explanations exist for either of the hot spots. Hot spot 0647 was cleaned up to less than 2 pCi/g soon after it was discovered. No records have been found for the area at location 0175. Subsequent samples taken in Area 20 also indicated much higher values than those reported by the Site Survey Project, but were discovered during a construction excavation. ~~Area 21, an old bunker used for waste storage indicated values up to 31 pCi/g. Most reported values of cesium-137 were less than 1 pCi/g;~~

Table XI.1. Maximum Radioactivity Concentrations in Soil Samples from Major Areas

Site	Plutonium-238 (pCi/g)	Thorium (pCi/g)	Tritium (pCi/mL)	Cobalt-60 (pCi/g)	Cesium-137 (pCi/g)	Radium-226 (pCi/g)	Americium-241 (pCi/g)	Actinium-227 (pCi/g)	Bismuth-207 (pCi/g)	Bismuth-210m (pCi/g)
Area 1	34,000	924.2	1.67	LDL	0.8	1.1	LDL	--	--	--
Area 2	17.10	3.21	--	--	--	--	--	--	--	--
Area 3	1,235	83	--	--	--	--	--	--	--	--
Area 4/4a	355.00	<2	--	LDL	LDL	1.2	1.0	--	--	--
Area 5	0.35[b]	<2[b]	--	250	1.6	0.8	LDL	--	--	--
Area 6	--	--	--	LDL	LDL	0.9	LDL	--	--	--
Area 7	7.40[i]	20.53	5.23	LDL	1.2	2.0	LDL	1,400	--	--
Area 8	24.40	254.30	1.12	LDL	LDL	3.3	LDL	--	--	--
Area 9	8.15	150	--	--	--	--	--	--	--	--
Area 10	99	<2	--	--	--	--	--	--	--	--
Area 11	100,000	69	--	--	--	--	--	--	--	--
Area 12	313.00	189.90	--	LDL	LDL	1.1	LDL	--	--	--
Area 13	5.74	<2	--	--	--	--	--	--	--	--
Area 14	29[l]	2.24	--	LDL	LDL	1.2	LDL	--	--	--
Area 15[e]	--	--	--	--	--	--	--	--	--	--
Area 16	8,000	3.46	0.35	LDL	LDL	1.2	LDL	--	--	--
Area 17	3,300	1,000	--	LDL	LDL	0.9	LDL	--	--	--
Area 18	3.71	<2	--	--	--	--	--	--	--	--
Area 19[d]	185[m]	1.2	--	--	--	--	--	--	--	--
Area 20	1.90[b]	4.02[b]	--	800	200	0.9	LDL	--	70	400
Area 21	1.12	<2	0.77	LDL	31	1.2	LDL	--	--	--
Area 22	1.67	<2	0.99	143	7.0	0.7	LDL	--	--	--
Area 23	--	6,000[k]	--	--	--	--	--	--	--	--
Area D	0.98	<2	--	--	--	--	--	--	--	--
Area J	147	30.42	6.84	3.0	LDL	1.0	LDL	--	--	--
Spoils Disposal	8.30	<2	1.00	LDL	LDL	0.94	LDL	--	--	--

Table XI.1. (page 2 of 2)

Site	Plutonium-238 (pCi/g)	Thorium (pCi/g)	Tritium (pCi/mL)	Cobalt-60 (pCi/g)	Cesium-137 (pCi/g)	Radium-226 (pCi/g)	Americium-241 (pCi/g)	Actinium-227 (pCi/g)	Bismuth-207 (pCi/g)	Bismuth-210m (pCi/g)
~~Possible Elevated Thorium~~	~~8.97~~	~~37.69~~	~~--~~	~~LDL~~	~~LDL~~	~~1.5~~	~~LDL~~	~~--~~	~~--~~	~~--~~
~~Drainage Ditch~~	~~535.00~~	~~--~~	~~--~~	~~--~~	~~--~~	~~--~~	~~--~~	~~--~~	~~--~~	~~--~~
~~Railroad Siding~~	~~573~~	~~107~~	~~--~~	~~--~~	~~--~~	~~--~~	~~--~~	~~--~~	~~--~~	~~--~~
~~Overflow Pond~~		~~268~~	~~--~~	~~--~~	~~--~~	~~--~~	~~--~~	~~--~~	~~--~~	~~--~~
~~SW Building[e] Soils~~			~~3.83×10^{6}~~	~~--~~	~~--~~	~~--~~	~~--~~	~~--~~	~~--~~	~~--~~
~~Building 48 Hillside~~	~~32,000~~	~~--~~	~~--~~	~~--~~	~~--~~	~~--~~	~~--~~	~~--~~	~~--~~	~~--~~
~~Building 66 Lot~~	~~7,000~~	~~--~~	~~--~~	~~--~~	~~--~~	~~--~~	~~--~~	~~--~~	~~--~~	~~--~~
~~Cobalt-60 Hot Spots~~	~~NR~~	~~NR~~	~~--~~	~~82~~	~~10~~	~~0.8~~	~~LDL~~	~~--~~	~~--~~	~~--~~
~~Plutonium-238 Hot Spots~~	~~81.0~~	~~<2~~	~~--~~	~~--~~	~~--~~	~~--~~	~~--~~	~~--~~	~~--~~	~~--~~
Remedial Action Guidelines[f]	100/25[g]	5 surface[h] 15 subsurface	5,200[i]	NE	80[j]	5 surface[h] 15 subsurface	20[j]	NE	NE	NE

[a]The total thorium concentration was less than the background level of 2 pCi/g, using FIDLER screening; therefore, radiochemical analysis was not performed.
[b]Most of the results for this radionuclide for this area are reported as NR. See the area-specific tabulated results.
[c]Area 15 emits 1 Ci per year of radon, indicating the presence of radium-226.
[d]Sampling of Area 19 was verification sampling conducted after remedial action.
[e]SW Building soils were sampled in 1977 (Dames and Moore 1977).
[f]Current remedial action guidelines are subject to change, pending additional pathways analysis and risk assessment.
[g]Current D&D cleanup level is 100 pCi/g (DOE 1983); 25 pCi/g, if feasible (as low as reasonably achievable [ALARA]).
[h]remedial action guideline (CFR 1990)
[i]remedial action guideline (DOE 1983)
[j]value for Area 7 does not include value at Building 66
[k]value indicated is thorium-230 isotope
[l]value is mean during verification sampling after cleanup
[m]highest residual level after verification cleanup
-- Dashes indicate that no data are available for the given area and given radionuclide.
FIDLER - field instrument for the detection of low-energy radiation
LDL - The measured concentration was below the lower detection limit, estimated to be 0.5 pCi/g for cobalt-60, cesium-137, and americium-241; and 1 pCi/g for radium-226 and actinium-227.
NE - Not established
NR - No result
pCi/g - picocuries per gram
pCi/mL - picocuries per milliliter
Ci - curie

APPENDIX E
ANALYTICAL DATA

This appendix provides a tabulated set of the Site Survey Project analytical data because the project report (Stought et al. 1988) provided only data summaries. The data are presented in basically the same format as they were received from Mound Plant. Because the original report stated that all samples were radiochemically analyzed for plutonium-238 and FIDLER screened for thorium (at a minimum), when these data were absent it is assumed that the results were not recorded, so an "NR" for no result is entered in the tabulated results. Additionally, because only selected samples collected were analyzed for tritium, or by gamma spectroscopy for radionuclides such as cobalt-60, cesium-137, radium-226, and americium-241, when these data were absent, it is assumed that the analyses were not performed, so the table entries were left blank.

The data presented in Appendix E give the sample locations in terms of south and west coordinates because this is the system used by Mound Plant. Since the data are reported here in exactly the format received, these coordinates are reported as such. Since the Mound Plant ER Program currently uses the Ohio State Plane coordinate system, which includes north (y) and east coordinates (x), as in Plate 1, a conversion system is required. Therefore, to correlate the data in Appendix E with the Plate 1 locations and future ER Program documents, conversion tables are given in Appendix F that list the coordinates for the sampling locations given in Plate 1 (surface and core) in both the south/west and north/east systems.

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)
~~S0781~~	~~3350~~	~~3755~~	~~7236~~	~~09-84~~	~~0~~	~~0.50~~	~~b~~		~~LDL~~	~~LDL~~	~~1.3~~	~~LDL~~
~~S0782~~	~~3375~~	~~3480~~	~~7233~~	~~09-84~~	~~0~~	~~1.45~~	~~b~~					
~~S0783~~	~~3400~~	~~3580~~	~~7202~~	~~09-84~~	~~0~~	~~0.81~~	~~b~~					
~~S0784~~	~~3400~~	~~3730~~	~~7201~~	~~09-84~~	~~0~~	~~0.23~~	~~b~~					
~~S0785~~	~~3475~~	~~3480~~	~~7235~~	~~09-84~~	~~0~~	~~1.23~~	~~b~~					
~~S0786~~	~~3475~~	~~3655~~	~~7237~~	~~09-84~~	~~0~~	~~0.08~~	~~b~~					
S0787	3550	3400	9807	06-85	0	NR	NR		143	7.0	0.4	LDL
~~S0788~~	~~3550~~	~~3480~~	~~7234~~	~~09-84~~	~~0~~	~~234.09~~	~~b~~					
~~S0789~~	~~3550~~	~~3730~~	~~7200~~	~~09-84~~	~~0~~	~~0.25~~	~~b~~					
S0790	3560	3390	9810	06-85	0	NR	NR		54	LDL	0.7	LDL
~~S0791~~	~~3575~~	~~3555~~	~~4146~~	~~11-83~~	~~0~~	~~0.40[c]~~	~~b~~	~~0.49~~				

[a]C denotes core location and S denotes surface sample location on Plate 1.
[b]Thorium results of $\leq$ 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.

LDL - The sample result was below the Lower Detection Limit, which was estimated to be 0.5 pCi/g for cesium-137, cobalt-60, and americium-241. The LDL for radium-226 or actinium-227 was estimated to be 1 pCi/g.
NR - No result provided. (Note: no samples were taken for plutonium-238 when *in situ* gamma spectrometry was performed.)

~~S0794~~	~~2800~~	~~4085~~	~~4041~~	~~10-83~~	~~0~~	~~0.50~~	~~b~~	
~~S0795~~	~~2825~~	~~3910~~	~~4120~~	~~10-83~~	~~0~~	~~0.97~~	~~b~~	~~0.55~~

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)
~~S0764~~	~~3325~~	~~3350~~	~~2884~~	~~10-83~~	~~0~~	~~0.32~~	~~b~~					
~~S0765~~	~~3350~~	~~3225~~	~~7339~~	~~09-84~~	~~0~~	~~0.55~~	~~b~~					
~~S0766~~	~~3350~~	~~3350~~	~~7340~~	~~09-84~~	~~0~~	~~1.13~~	~~b~~					
~~S0767~~	~~3400~~	~~3075~~	~~7344~~	~~09-84~~	~~0~~	~~0.43~~	~~b~~					
~~S0768~~	~~3400~~	~~3225~~	~~2888~~	~~10-83~~	~~0~~	~~0.61~~	~~b~~					
~~S0769~~	~~3400~~	~~3300~~	~~7347~~	~~09-84~~	~~0~~	~~0.61~~	~~b~~					
~~S0770~~	~~3425~~	~~3025~~	~~7346~~	~~09-84~~	~~0~~	~~0.54~~	~~b~~					
~~S0771~~	~~3425~~	~~3075~~	~~7342~~	~~09-84~~	~~0~~	~~0.45~~	~~b~~					
~~S0772~~	~~3475~~	~~3050~~	~~7343~~	~~09-84~~	~~0~~	~~0.23~~	~~b~~					
S0773	3500	3200	2887	10-83	0	1.67[c]	b	0.15				
~~S0774~~	~~3550~~	~~3075~~	~~2886~~	~~10-83~~	~~0~~	~~0.54~~	~~b~~					
S0775	3575	3350	2883	10-83	0	1.61	b	0.99				

[a]C denotes core location and S denotes surface sample location on Plate 1.
[b]Thorium results of $\leq$ 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.

LDL - The sample result was below the Lower Detection Limit, which was estimated to be 0.5 pCi/g for cesium-137, cobalt-60, and americium-241. The LDL for radium-226 or actinium-227 was estimated to be 1 pCi/g.

NR - No result provided. (Note: no samples were taken for plutonium-238 when *in situ* gamma spectrometry was performed.)

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)
~~S0969~~	~~4025~~	~~3125~~	~~5959~~	~~07-84~~	~~0~~	~~0.12~~	~~b~~					
S0970	4050	3075	2941	10-83	0	0.52	b					
S0971	4075	3025	5958	07-84	0	0.15	5.02					
C0198	4135	2620	8512	12-84	30	0.19	b					
S0972	4225	2730	2623	09-83	0	0.02	b					
S0973	4225	2855	2622	09-83	0	0.02	b					
S0974	4250	2830	5969	07-84	0	0.59	b					
S0975	4275	2580	5964	07-84	0	0.75	b		LDL	LDL	1.1	LDL
S0976	4275	2780	5968	07-84	0	0.30	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.

LDL - The sample result was below the Lower Detection Limit, which was estimated to be 0.5 pCi/g for cesium-137, cobalt-60, and americium-241. The LDL for radium-226 or actinium-227 was estimated to be 1 pCi/g.

NR - No result provided. (Note: no samples were taken for plutonium-238 when *in situ* gamma spectrometry was performed.)

			8269	10-84	108	0.02	b					
~~S0982~~	~~3625~~	~~3025~~	~~5944~~	~~07-84~~	~~0~~	~~0.43~~	~~14.94~~					
S0983	3625	3325	4517	01-84	0	0.28	b	0.28				
S0984	3650	3275	5939	07-84	0	2.95	b					

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)
S0985	3675	3250	5940	07-84	0	8.53	7.73					
~~C0200~~	~~3675~~	~~3275~~	~~1279~~	~~12-82~~	~~18~~	~~0.25~~	~~b~~					
S0986	3875	3250	2943	10-83	0	~~1.54~~	~~7.13~~					
~~S0987~~	~~3875~~	~~3350~~	~~5942~~	~~07-84~~	~~0~~	~~1.38~~	~~b~~					
C0201	3600	3380	8279	10-84	42	1.57	b					
			8280	10-84	108	1.88	b					
~~S0988~~	~~3685~~	~~3475~~	~~4531~~	~~01-84~~	~~0~~	~~0.40~~	~~b~~	~~1.67~~				

[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.

LDL - The sample result was below the Lower Detection Limit, which was estimated to be 0.5 pCi/g for cesium-137, cobalt-60, and americium-241. The LDL for radium-226 or actinium-227 was estimated to be 1 pCi/g.

NR - No result provided. (Note: no samples were taken for plutonium-238 when *in situ* gamma spectrometry was performed.)

S0993	3650	3630	4526	01-84	0	6.73	b	0.17				
S0994	3650	3680	7206	09-84	0	5.67	18.99					
C0203	3650	3760	7810	10-84	90	0.39	b					
			7811	10-84	180	0.04	b					
C0204	3675	3405	1281	12-82	18	1.21	b					
			1282	12-82	36	0.09	b					
C0205	3675	3515	1285	12-82	18	478.00	2.38					
			~~1286~~	~~12-82~~	~~36~~	~~124.00~~	~~2.98~~					

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)
~~C0273~~	~~3682.1~~	~~3413.3~~	~~None[d]~~	~~04-84~~	~~0~~	~~NR~~	~~0.5~~					
			None[d]	04-84	12	NR	0.9					
			None[d]	04-84	24	NR	0.6					
			None[d]	04-84	36	NR	0.4					
			None[d]	04-84	48	NR	0.4					
			None[d]	04-84	60	NR	0.3					
C0274	3737.9	3478.5	None[d]	~~04-84~~	0	NR	0.5					
			None[d]	04-84	12	NR	0.6					
			None[d]	04-84	24	NR	0.3					
			~~None[d]~~	~~04-84~~	~~36~~	~~NR~~	~~0.4~~					
C0275	3529.9	3447.0	None[d]	04-84	0	NR	0.3					
			None[d]	04-84	12	NR	0.6					
			None[d]	04-84	24	NR	0.7					
			None[d]	04-84	36	NR	0.4					
~~C0276~~	~~3648.1~~	~~3642.8~~	~~None[d]~~	~~04-84~~	~~0~~	~~NR~~	~~0.8~~					
			None[d]	04-84	12	NR	0.9					
			None[d]	04-84	24	NR	0.3					

[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.

LDL - The sample result was below the Lower Detection Limit, which was estimated to be 0.5 pCi/g for cesium-137, cobalt-60, and americium-241. The LDL for radium-226 or actinium-227 was estimated to be 1 pCi/g.

NR - No result provided. (Note: no samples were taken for plutonium-238 when *in situ* gamma spectrometry was performed.)

C0279	3567.8	3565.3	None[d]	04-84	0	NR	0.2
			None[d]	04-84	12	NR	0.3
			None[d]	04-84	24	NR	0.5
C0280	3705.2	3710.7	None[d]	04-84	0	NR	0.8
			None[d]	04-84	12	NR	0.9
			~~None[d]~~	~~04-84~~	~~24~~	~~NR~~	~~1.0~~

Environmental Restoration Program

OPERABLE UNIT 5
OPERATIONAL AREA PHASE I INVESTIGATION
AREA 22 FIELD REPORT

MOUND PLANT
MIAMISBURG, OHIO

VOLUME I - TEXT

September 1994

U.S. Department of Energy
Albuquerque Operations Office

EG&G Mound Applied Technologies

1. INTRODUCTION

Area 22 has been identified as an area of concern (AOC) within the Operational Area of Operable Unit (OU) 5. The Phase 1 reconnaissance Investigation Area 22 Field Report (Area 22 Field Report) is the first in a series of reports that support the effort to conduct a remedial investigation/feasibility study (RI/FS) of OU5. The RI/FS will characterize Area 22 for all chemical and radiological substances that potentially pose a threat to human health and the environment. RI data gathering will be conducted in a phased approach; Phase 1 investigations will provide a qualitative screen to select a strategy for potential Phase 2 and Phase 3 investigations as required. Phase 2 investigations may be conducted to provide detailed data on Area 22 contaminants are detected followed by a possible Phase 3 investigations as needed.

The following sections briefly describe the scope of the Area 22 Field Report, provide a site description, and review the site land use history. The final section presents the organization of the remainder of the report.

1.1. SCOPE

The purpose of the Area 22 Field Report is to present the field work performed and data collected at Area 22 during the Phase 1 investigation conducted in June and July, 1994. Relevant data available from previous studies is also integrated into this report. This work was conducted according to the Operable Unit 5, South Property, Remedial Investigation/Feasibility Study Work Plan (DOE 1993a).

1.2. SITE DESCRIPTION

Area 22, approximately 175 feet by 200 feet (35,000 ft^2), is located on the southwest part of the Special Metallurgical/Plutonium Processing (SM/PP) hill near Building 53 (see Plate 1). Along the eastern edge of the Area is a large concrete pad used to store rolloff boxes. Area 22 contains many small piles of excavated soil from past construction activities at the Mound Plant. The Area is topographically flat and vegetation consists of grasses, shrubs, and small trees with concrete rubble and other construction debris exposed at the surface. A major portion of the Area is roped off and designated as a radiological area. Previous investigations (DOE 1992a) show that bedrock ranges from two to seven feet below ground surface.

1.3. SITE HISTORY

Area 22, also referred to as the "orphan soils" area, was historically used to store contaminated soil and debris excavated from other areas at the Mound Plant. Soil contaminated with polonium-210 from a waste linebreak west of the HH building was deposited in Area 22 in 1985 (DOE 1992b). The Area was first identified during the gamma survey conducted under the Site Survey Project (Stought et. al 1988).

1.4. REPORT ORGANIZATION

The remainder of this report presents the results of the Phase 1 investigation for Area 22. Section 2 summarizes field activities performed and data collected during the radiological and the soil gas surveys. It also compares significant data from previous investigations with Phase 1 investigation data. References are provided in Section 3. Survey maps, field logbooks, radiological data, and the soil gas data are included in the appendices.

2. FIELD ACTIVITIES AND DATA SUMMARY

Phase 1 field activities were conducted to characterize areas of contamination, if any, that may require further sampling under Phase 2 and Phase 3 investigative programs. In Area 22, Phase 1 reconnaissance activities consisted of:

- a field instrument for the detection of low-energy radiation (FIDLER) survey to detect surface radiological contamination, and surface soil samples sent to the Mound Soil Screening Facility to further detect possible surface radiological contaminates; and
- a soil gas survey to detect subsurface volatile and semi-volatile organic chemical contamination.

The radiological screening was conducted to detect the presence of plutonium-238 (Pu-238) and thorium-232 (Th-232) in Area 22. The soil gas survey was conducted to detect total aromatic hydrocarbons, total semi-volatile compounds (SVOCs), lubricants such as light oil and greases, and total volatile halogenated compounds.

The data collection points for the FIDLER survey, the soil screening activities, and the soil gas survey were established over the estimated Area 22 boundary on a 25 foot grid system (see Plate 1). The land survey map of Area 22 (Appendix A) shows those points within the area located by a registered surveyor. Prior to sampling, all transverse lines of the grid system were cleared of trees and underbrush and the remaining sample locations were marked with survey stakes.

The following sections describe the field activities and analyses performed, and the results of the Phase 1 investigation.

2.1. RADIOLOGICAL (FIDLER) SURVEY

2.1.1. Field Work Performed and Procedures

A FIDLER survey was performed over Area 22 on July 12 and 13, 1994, following the Mound Standard Operating Procedure (SOP) 6.7, Near Surface and Soil Screening for Low-Energy Gamma Radiation Using the FIDLER.

2.1.4. Presentation of Data

Appendix C contains all radiological data collected during the Phase 1 investigation. It includes data from the FIDLER survey and analytical results of soil samples sent to the Mound Soil Screening Facility.

The FIDLER survey located two areas of elevated surface contamination as summarized in Table II.1 shown in Figure 2.1. Pu-238 was detected at location I7.5 at 130 cpm and Th-232 was detected at locations G7 and I7.5 at 15 kcpm and 29 kcpm, respectively. Additionally, the Out Channel detected five serpentined locations (see Appendix C) where the contamination criteria was exceeded by 300 cpm. The potential for minor levels of radiological contamination may exist in these isolated areas.

Table II.1. Summary of Elevated Surface Radiological Activity in Area 22 (FIDLER Survey)

EPICENTER LOCATION	CHANNEL 1 (cpm)		CHANNEL 2 (kcpm)		OUT CHANNEL (kcpm)		SIZE	DESCRIPTION
	CC	RDG	CC	RDG	CC	RDG		
G7	205.4	150.0	9.64	15.0	10.79	17.0	1 ft diam	piles of rubble in heavy brush
I7.5	67.6	130.0	9.75	29.0	11.7	34.0	14 ft diam	piles of rubble in heavy brush

cpm - counts per minute
kcpm - counts per minute x 1000
diam - diameter
CC - contamination criteria
RDG - FIDLER reading

Surface soil samples, collected as part of the soil gas survey (see Section 2.2.1), were analyzed for Pu-238 and Th-232. The action level of 2.0 pCi/g established by the Mound Plant for Th-232, was exceeded at 1 of the 72 sample locations (see Table II.2). Concentrations of Pu-238 at or exceeding the Mound Plant action level of 25 pCi/g were detected at 21 of the 72 sample locations (see Table II.2). Figure 2.2 displays (1) the grid locations where concentrations of Pu-238 equal or exceed 25 pCi/g and (2) the concentration contours where Pu-238 exists at concentration from 25-50 pCi/g and at concentrations greater than 50 pCi/g. As displayed in Figure 2.2, there are four areas where the Pu-238 concentration exceeds 50 pCi/g. Additionally, surface soil sample results indicate that Pu-238 contamination exceeds the estimated Area 22 boundary on the northwest side.

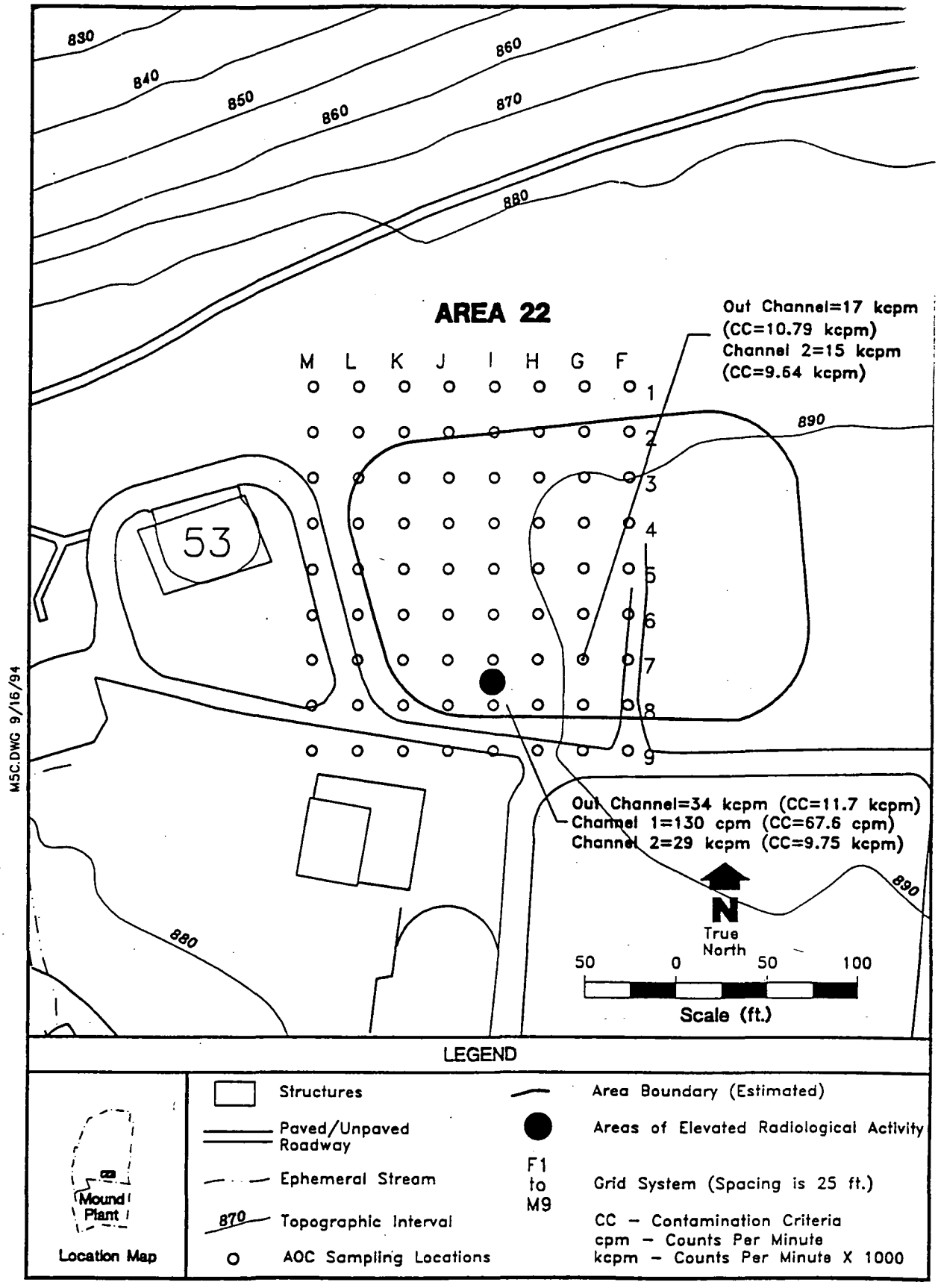


Figure 2.1. Areas of Elevated Surface Radiological Activity in Area 22 (FIDLER Survey)

Table II.2. Summary of Elevated Surface Radiological Activity in Area 22 (Mound Soil Screening Facility Data)

Grid Location[a]	Mound Soil Screening Facility Data	
	Plutonium-238 (pCi/g)	Thorium-232 (pCi/g)
G3	28	ND
G7	37	ND
H2	33	ND
H4	34	ND
H5	26	ND
H7	31	ND
I4	25	ND
I5	27	ND
I7	27	ND
J1	25	ND
J2	31	ND
J3	39	ND
J4	29	3.10
J5	56	ND
J6	81	ND
J7	34	ND
K3	40	ND
K4	67	ND
L1	25	ND
L3	27	ND
M3	51	ND

a - See Figure 2.2 for grid location point.

ND = Radiological contamination not detected above action level.

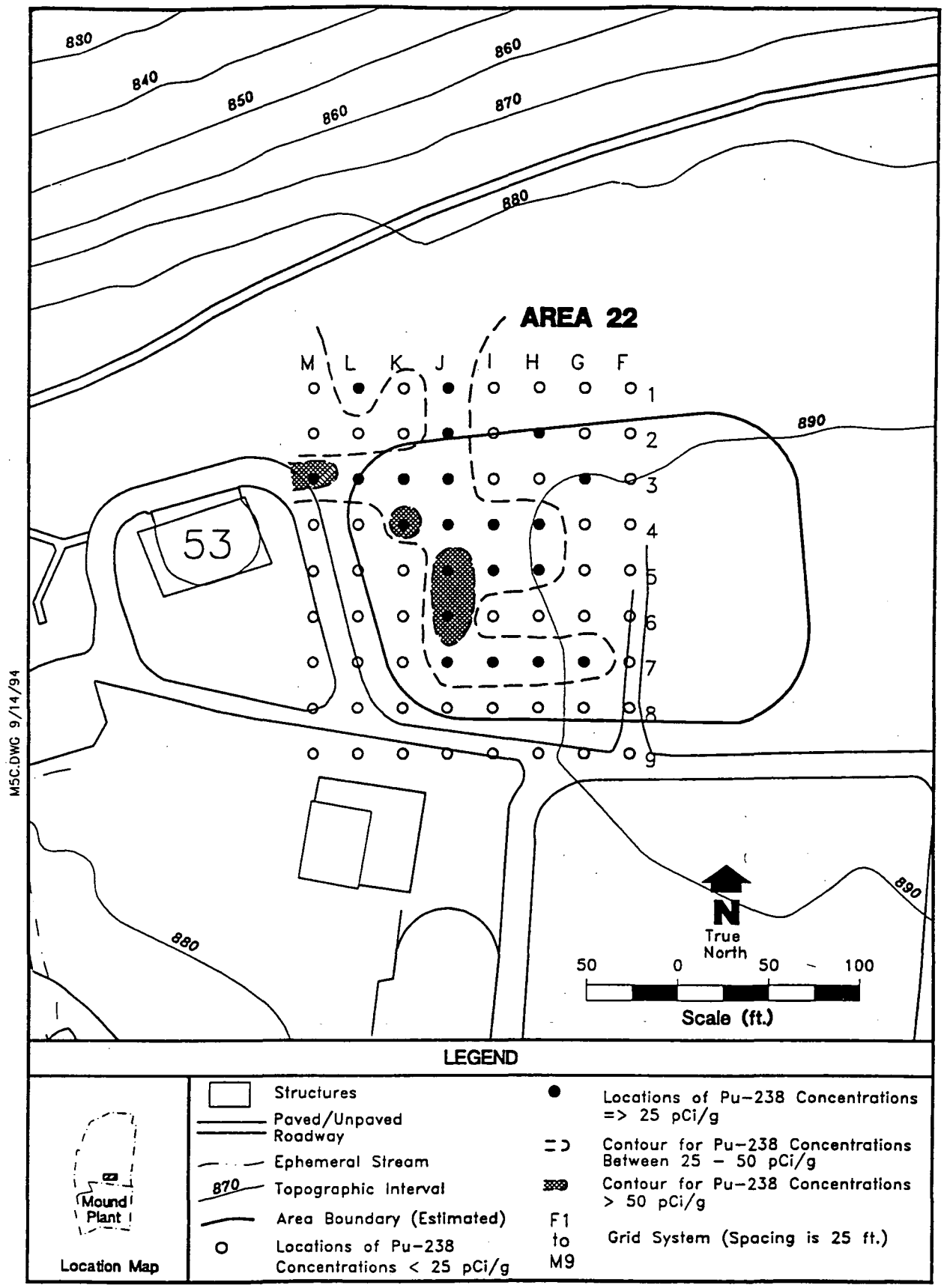


Figure 2.2. Locations of Elevated Surface Soil Radiological Activity (Pu-238)

2.1.5. Comparison with Historical Radiological Data

Surface soil samples collected in Area 22 during the Site Survey Project (Stought et. al 1988) were analyzed for Pu-238 and screened for Th-232 using a FIDLER. Additionally, some samples were further analyzed for tritium, cobalt-60, cesium-137, radium-226, and americium-241 (DOE 1992b). The results of the surface soil sampling conducted under the Site Survey Project (DOE 1992b) are presented in Table II.3 (DOE 1992b). The corresponding sampling locations are shown in Figure 2.3.

As shown in Table II.3, the concentrations of Pu-238 and Th-232 from historical data are well below Mound action levels. However, cobalt-60 was detected in samples S0787 and S0790 at 143 and 54 pCi/g, respectively. The same samples showed radium-226 present in concentrations of 0.4 and 0.7 pCi/g. Sample S0787 also contained 7.0 pCi/g of cesium-137.

In contrast to the 1988 Site Survey Project, the results from the soil sample screening for Area 22 during the Phase 1 investigation indicate the presence of Pu-238 in the surface soil. Pu-238 was detected at levels greater than 25 pCi/g at 21 of the 72 sample locations (see Figure 2.2). Th-232 was detected at levels greater than 2.0 pCi/g at 1 of the 72 sample locations.

2.2. SOIL GAS SURVEY

2.2.1. Field Work Performed and Procedures

A soil gas survey was performed over Area 22 from June 22, 1994 to July 13, 1994, per the OU5 QAPjP, Attachment 1, SOP for Petrex Environmental Surveys (DOE 1993b). The survey was completed over the grid system established for Area 22 (see Plate 1).

2.2.1.1. Installation

Two sets of time calibration samplers (timers) and 32 data samplers were installed on June 22, 1994. The remaining 40 data samplers were installed on June 28 and June 29, 1994. Locations of the timers and the data samplers are shown in Appendix D, Plate 1. The samplers and timers were installed at depths between 12-18 inches using an electric hammer drill and a 18 x 1.5 inch steel/tungsten carbide-tipped drill bit.

Table II.3. Summary of Historical Radiological Data Collected in Area 22 (Mound Site Survey Project, 1983-1985)

Surface Location[a]	Plant Coordinates South	Plant Coordinates West	MRC ID No.	Mo-Yr	Depth (inch)	Plutonium-238 (pCi/g)	Thorium[b] (pCi/g)	Tritium (pCi/mL)	Cobalt-60 (pCi/g)	Cesium-137 (pCi/g)	Radium-226 (pCi/g)	Americium-241 (pCi/g)
S0787	3550	3400	9807	06-85	0	NR	NR	NA	143	7.0	0.4	LDL
S0775	3575	3350	2883	10-83	0	1.61	b	0.99				
S0773	3500	3200	2887	10-83	0	1.67	b	0.15				
S0790	3560	3390	9810	06-85	0	NR	NR	NA	54	LDL	0.7	LDL

[a]Surface locations are shown in Figure 2.3.
[b]A "b" indicates that the total thorium concentration was less than the background level of 2.0 pCi/g, using FIDLER screening. Therefore, radiochemical analysis was not performed.
FIDLER - field instrument for the detection of low-energy radiation
LDL - The measured concentration was below the lower detection limit, estimated to be 0.5 pCi/g for cobalt-60, cesium-137, and americium-241; and 1 pCi/g for radium-226.
MRC ID - Monsanto Research Corporation identification
NR - No result given
pCi/g - picocuries per gram
pCi/mL - picocuries per milliliter

Source: DOE, 1992b

No accidents or safety violations were reported during the soil gas survey. A health and safety surveillance was conducted on August 23, 1994; no variances were reported.

2.2.4. Presentation of Data

The Report of Findings of the Petrex soil gas survey is presented in Appendix D. The report discusses the Petrex method, the scope of work, method quality assurance/quality control (QA/QC), and results. Appendix D, Plates 1 through 5, show sample locations and significant ion counts of targeted compounds. Ion count values are the unit of measure assigned by the mass spectrometer to the relative intensities associated with each compound. These intensity levels do not represent actual concentrations. Soil gas data are considered semiquantitative in that multiple sources in soil and/or groundwater cannot be differentiated.

NERI was instructed to provide analytical data for four general classes of compounds in order to assess the potential for the presence of subsurface contamination:

- total aromatic hydrocarbons;
- SVOCs;
- total oil and grease range hydrocarbons (lubricants); and
- total halogenated compounds.

2.2.4.1. Distribution of Total Aromatic Hydrocarbons

Total aromatic hydrocarbons are reported as the combined level of C_6 to C_{15} aromatic, or benzene based hydrocarbon compounds. These aromatics are common components of gasoline, diesel fuel, heating oil, kerosene, and solvents.

Elevated levels of aromatics are present in the soil gas principally in the southern portion of Area 22 (Appendix C, Plate 2). Only three sampling points outside this Area, to the northwest, also showed elevated levels of aromatics. With the exceptions of samples #62 and #64, it is the C_7 and C_8 aromatics that are most prevalent in these areas.

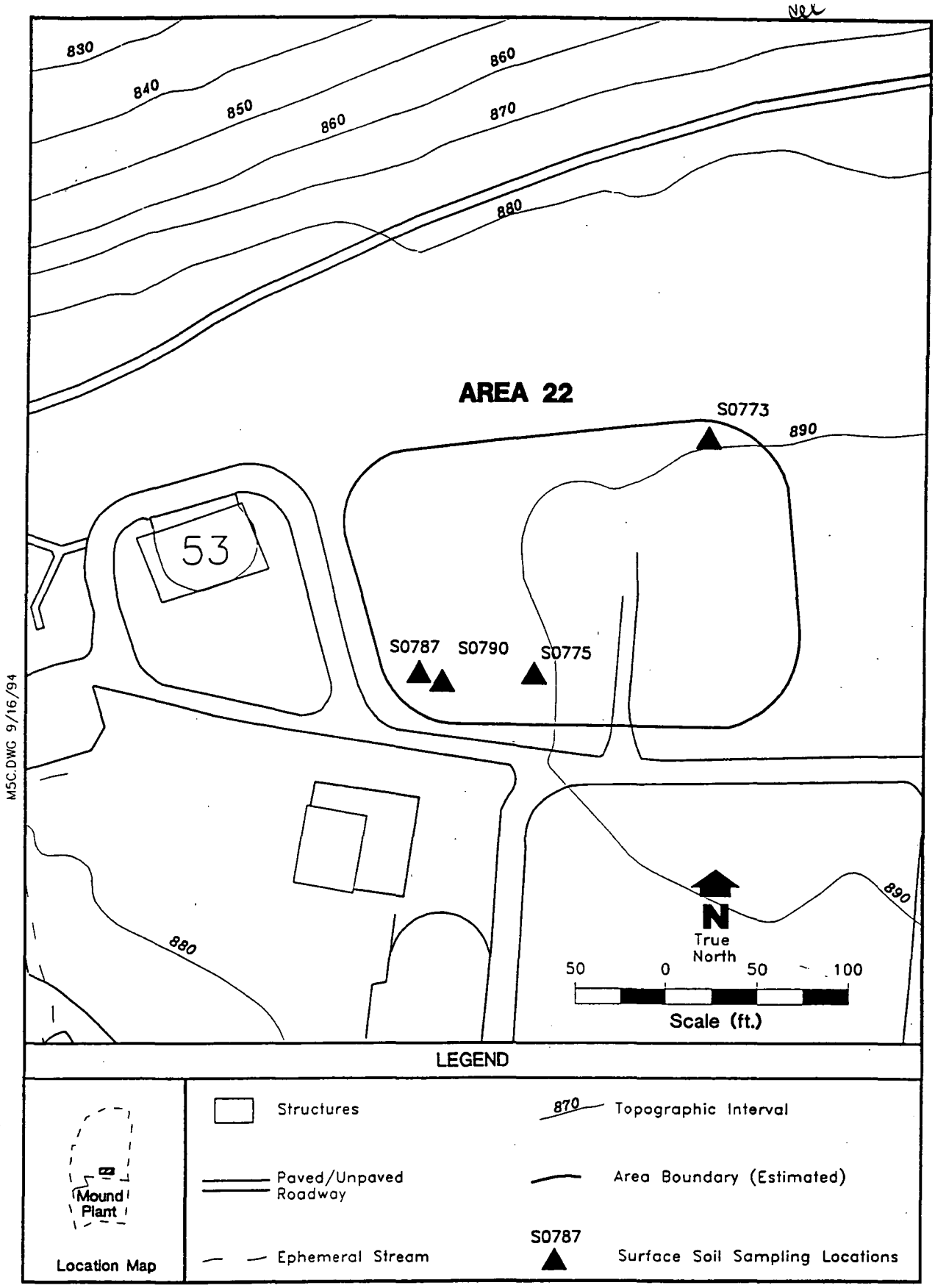


Figure 2.3. Surface Sampling Locations for Historical Radiological Data (Mound Site Survey Project, 1983-1985)

2.2.4.2. Distribution of Total Semivolatile Hydrocarbons

Naphthalene, C_{11} through C_{15} alkyl naphthalenes, and C_{12}, C_{14}, and C_{16} polycyclic hydrocarbons are reported as total semi-volatile hydrocarbons. These compounds are constituents of creosote, coal tar, and other heavy, high boiling point fraction petroleum products.

The highest relative levels of SVOCs detected in soil gas were from samples #62 and #64, located in the southcentral portion of Area 22. Anomalous though less elevated levels of SVOCs were detected at two other points to the north and northeast (Appendix D, Plate 3).

2.2.4.3. Distribution of Total Oil and Grease Range Hydrocarbons

Total oil and grease range hydrocarbons detected are C_{13}, C_{14}, and C_{15} alkanes, cycloalkanes, alkenes, cycloalkenes, dienes, and alkynes. These hydrocarbons are common constituents of oils and greases but are also found in heavy fuels and heating oils.

Only soil gas from samples #62 and #64 contained elevated levels of oil and grease range hydrocarbons. These sample points are in the southcentral portion of Area 22 and are displayed in Appendix D, Plate 4.

2.2.4.4. Distribution of Total Halogenated Hydrocarbons

Total halogenated hydrocarbons are reported as the combined levels of trichlorethene (TCE) and tetrachloroethene (PCE). TCE and PCE are most often used as solvents in degreasing, stripping, or dry cleaning operations.

As shown in Appendix D, Plate 5, total halogenated hydrocarbons were found in soil gas from the central, northern, and eastern portions of Area 22. The highest relative level came from sample #179 (grid point G5), located along the eastern edge of the area. PCE was detected much more frequently than was TCE. However, given the length of sampler exposure, halogenated hydrocarbons levels are low.

In summary, data from the Area 22 soil gas survey suggest that:

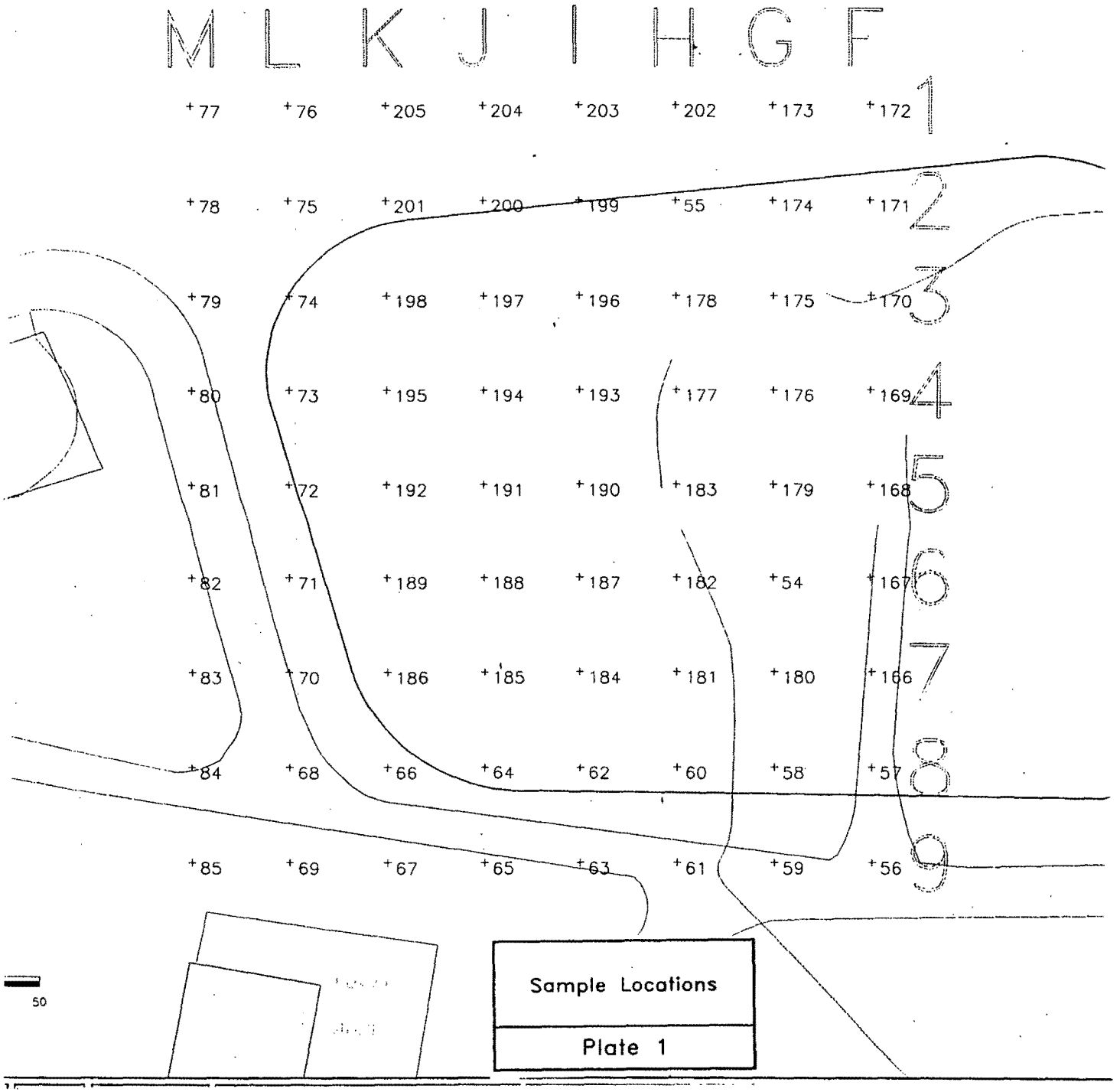
1. Petroleum hydrocarbons exist in the subsurface soil along the southern boundary and at limited isolated points to the northwest. Because the Petrex method is very sensitive to volatile organic and SVOCs, even the highest levels of hydrocarbons detected may represent concentrations that are not environmentally significant.

2. PCE is the principal halogenated hydrocarbon detected and was found at grid point G5 in the east central portion of the area. Given the sensitivity of the Petrex method to halogenated volatile organic compounds, even the level of PCE found may represent a concentration that is not environmentally significant.

2.2.5. Comparison with Historical Chemical Data

No historical data is available concerning the lateral and vertical distribution of the chemical contamination in Area 22 (DOE 1993d). Therefore, no comparison with the Phase 1 investigation results can be made.

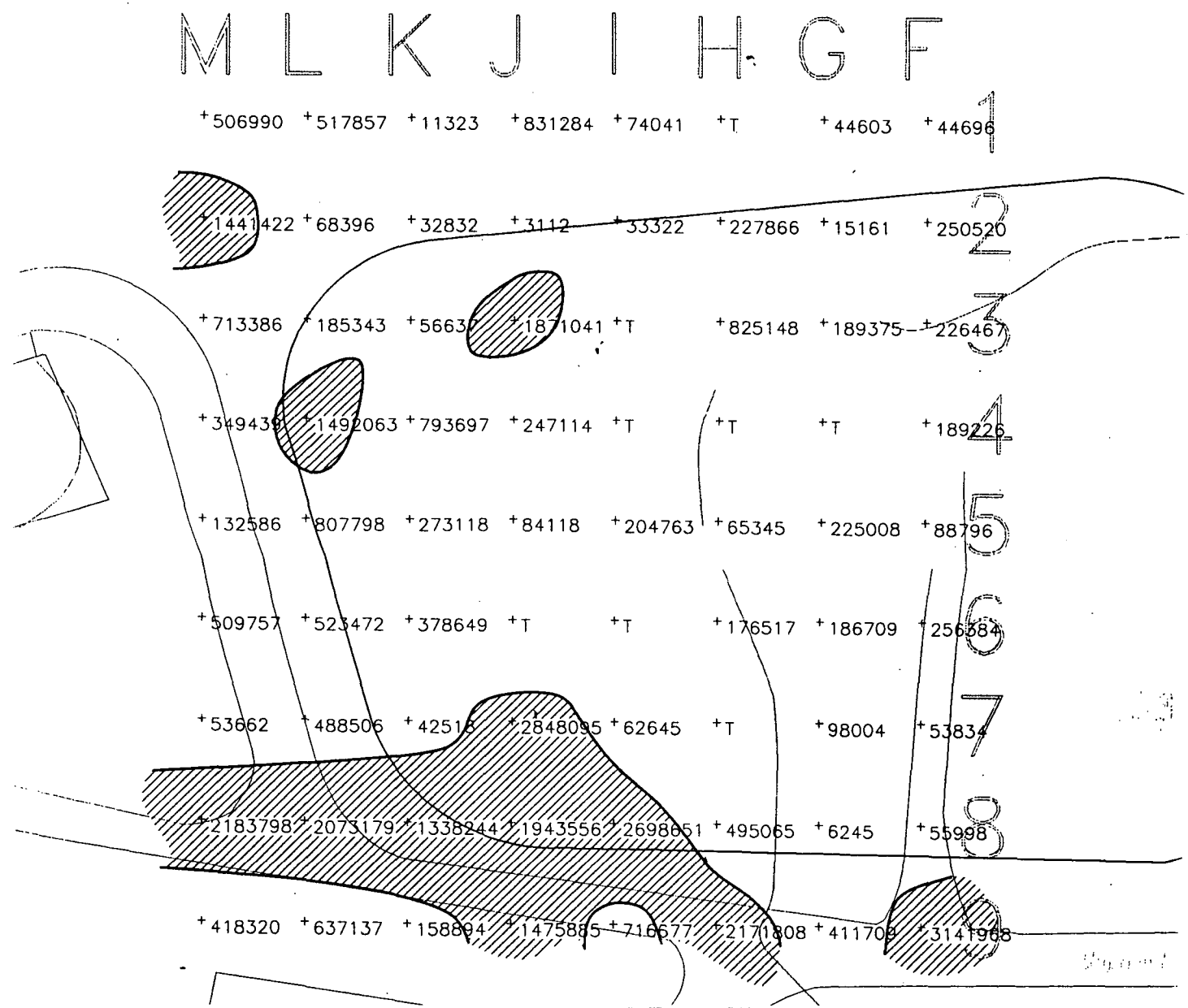
AREA 22



Sample Locations

Plate 1

AREA 22



50

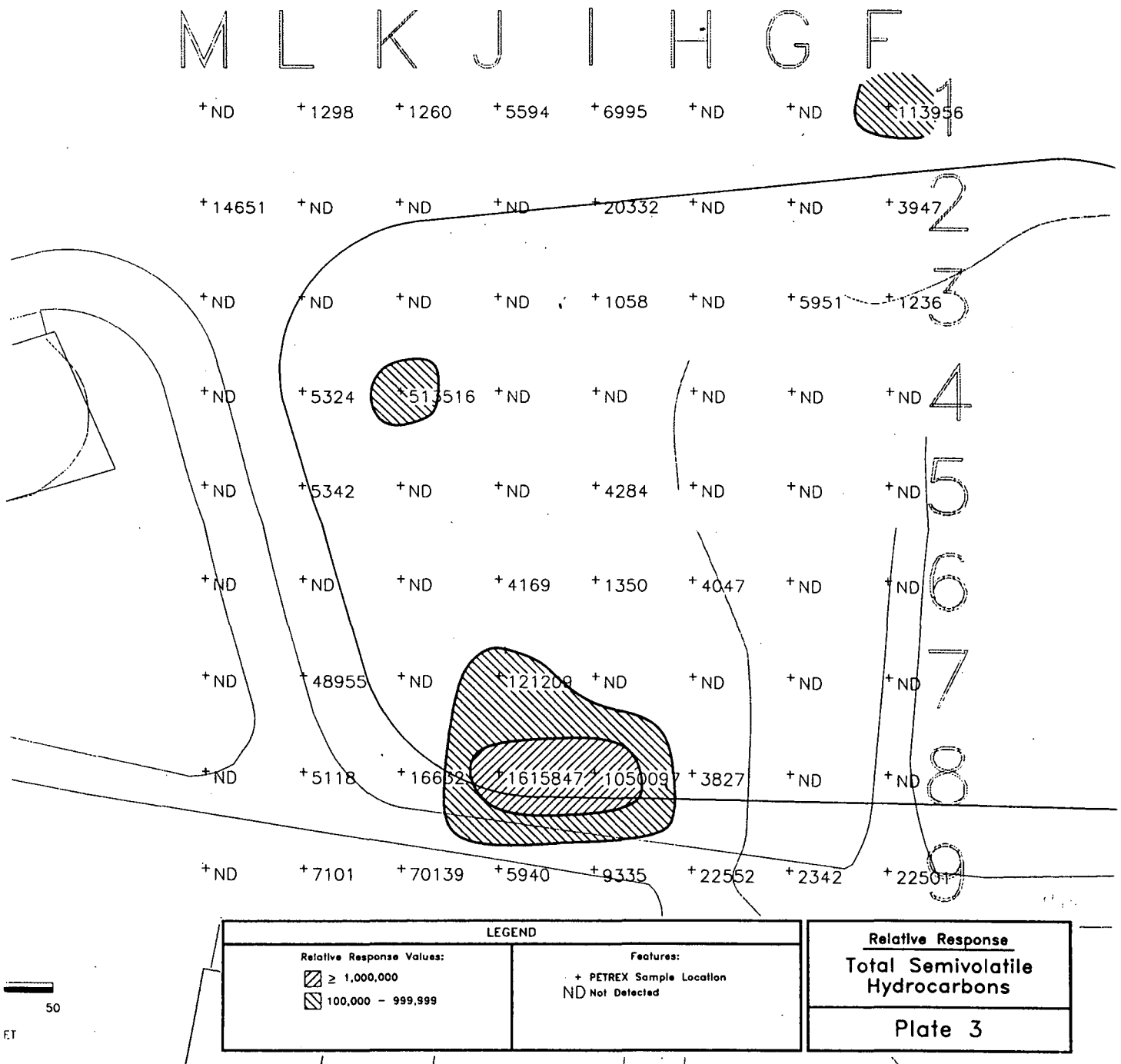
LEGEND	
Relative Response Values:	Features:
≥ 1,000,000	+ PETREX Sample Location
	T Denotes interference by terpenes; see text.

Relative Response

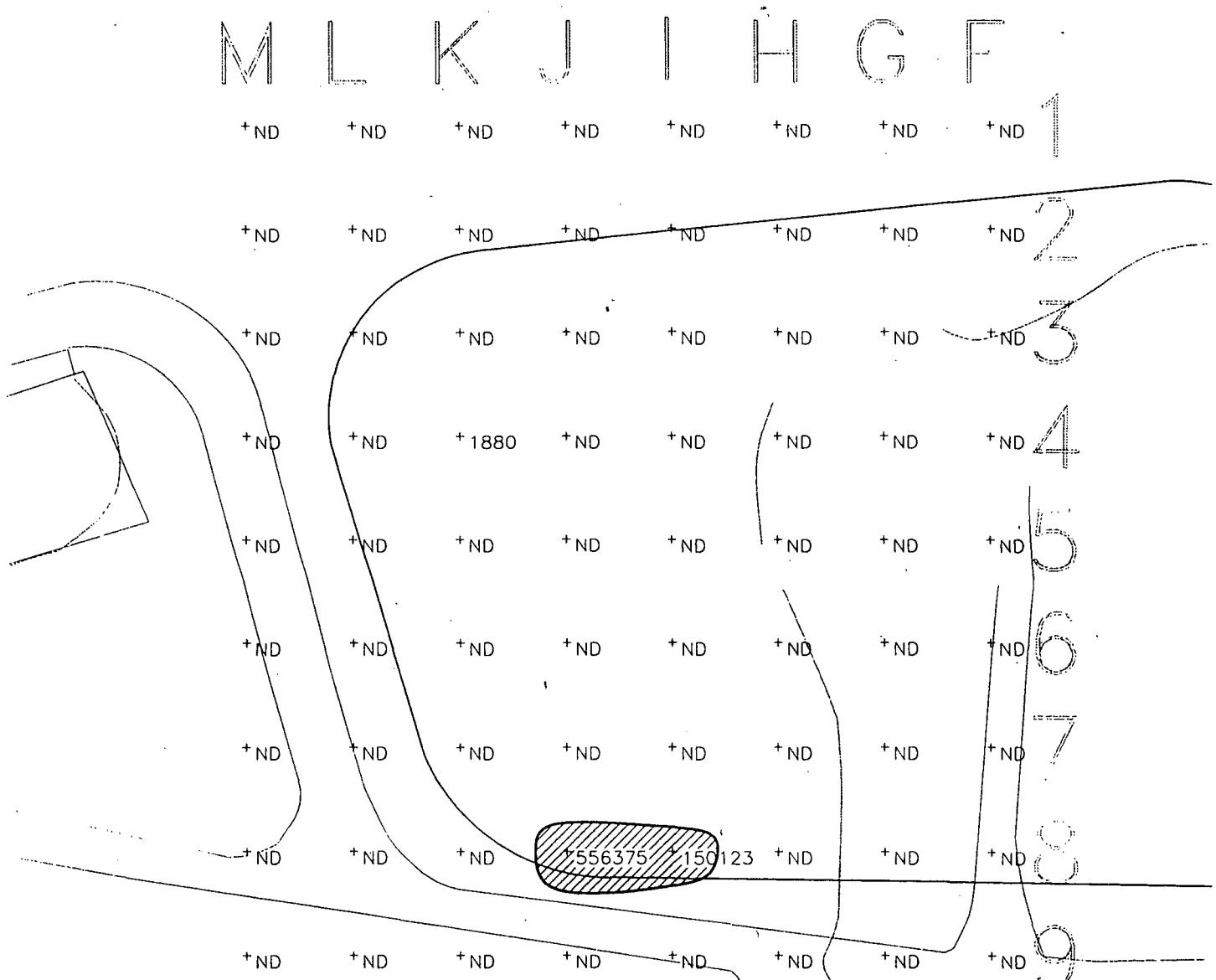
Total Aromatic Hydrocarbons

Plate 2

AREA 22


M L K J I H G F
1
2
3
4
5
6
7
8
9
+ND +1298 +1260 +5594 +6995 +ND +ND +113956
+14651 +ND +ND +ND +20332 +ND +ND +3947
+ND +ND +ND +ND +1058 +ND +5951 +1236
+ND +5324 +513516 +ND +ND +ND +ND +ND
+ND +5342 +ND +ND +4284 +ND +ND +ND
+ND +ND +ND +4169 +1350 +4047 +ND +ND
+ND +48955 +ND +121208 +ND +ND +ND +ND
+ND +5118 +166525 +1615847 +1050097 +3827 +ND +ND
+ND +7101 +70139 +5940 +9335 +22552 +2342 +22501
50
FT
LEGEND
Relative Response Values:
≥ 1,000,000
100,000 - 999,999
Features:
+ PETREX Sample Location
ND Not Detected
Relative Response
Total Semivolatile Hydrocarbons
Plate 3

AREA 22



LEGEND	
Relative Response Values:	Features:
≥ 100,000	+ PETREX Sample Location
	ND Not Detected

Relative Response

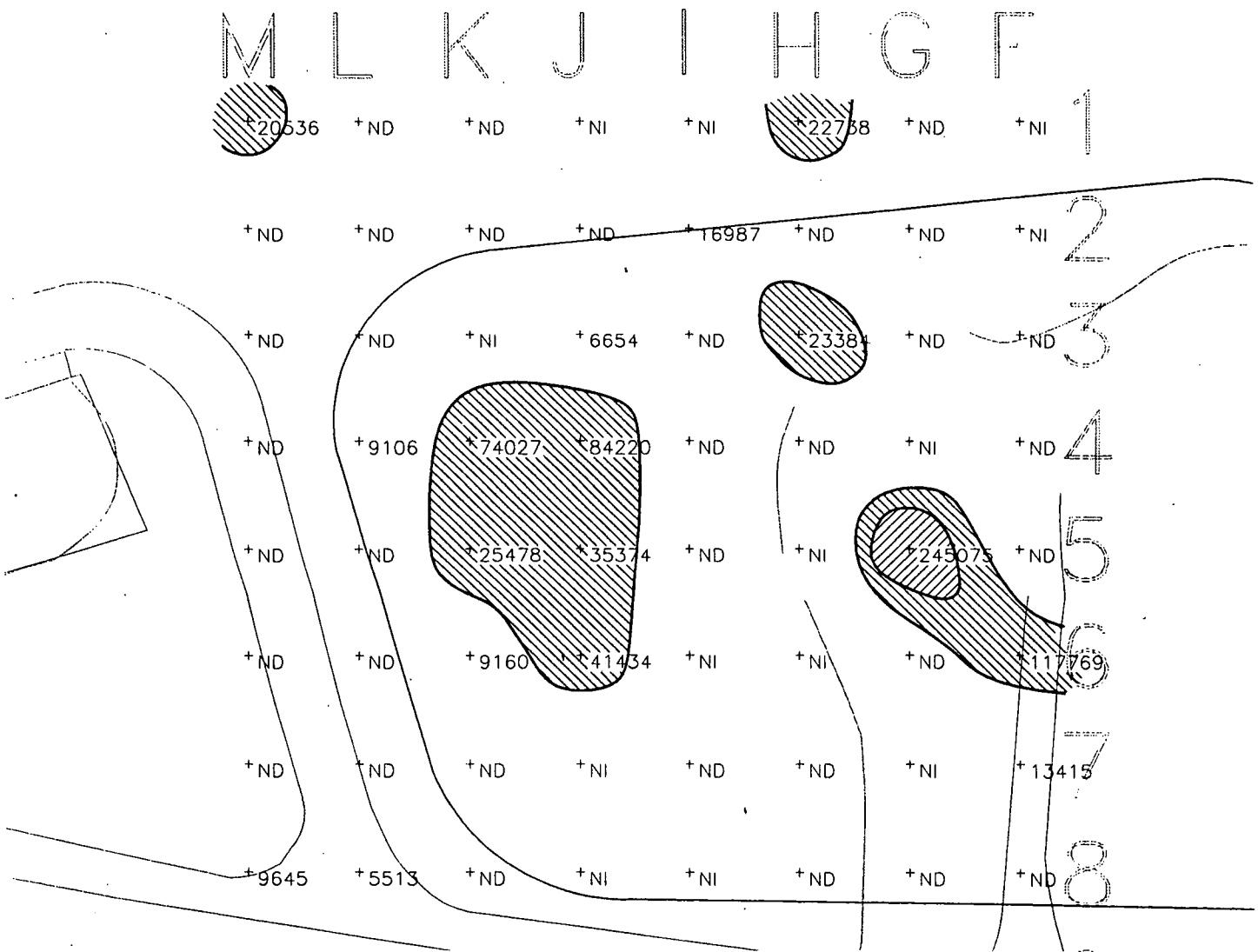
Total Oil & Grease Range Hydrocarbons

Plate 4

50

FEET

AREA 22



LEGEND	
Relative Response Values:	**Features:**
≥ 200,000	+ PETREX Sample Location
20,000 – 199,999	ND Not Detected
	NI Not Identified

Relative Response

Total Halogenated Hydrocarbons

Plate 5

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

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

ANALYTE	SGC AO3 000086	SGC AO3 000087	SGC A21 000088	SGC A22 000093	SGC SDB 000097	SGC SDB 000098	Background	10^{-6} Construction Worker Guidelines
VOLATILES (µg/Kg)								
Acetone		13				11	NA	105000000
1,2-Dichloroethene (total)							NA	21500000
2-Butanone		4 J					NA	46500000
Benzene							NA	8900
Carbon Disulfide							NA	1400000
Chloroform							NA	NA
Chloromethane							NA	NA
Ethylbenzene							NA	480
Methylene Chloride	9	11			12	21	NA	NA
Tetrachloroethene						70	NA	10500000
Toluene			2 J	1 J			NA	1250000
Trichloroethene		26					NA	41000
Xylene (total)				1 J			NA	2150000000

J - Numerical value is an estimated quantity
NA - Value not available
D - Sample was diluted
C - Estimated due to error in calibration
µg/kg - micrograms per kilogram

NC - background value not computed
B - detected below required level of detection, but above instrument level of detection.

Samples 91, 92, 94, 95, and 96 were not recorded. Therefore, no volatiles were detected.

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

ANALYTE	SGC A21 000088	SGC A22 000092	SGC A22 000093	SGC A22 000094	SGC SDB 000097	SGC SDB 000098	Background	10^{-6} Construction Worker Guidelines
SEMIVOLATILES (µg/Kg)								
Acenaphthene						19 J	NA	NA
Acenaphthylene					40 J		NA	NA
Anthracene					33 J	39 J	NA	320000000
Benzo(a)anthracene		23 J		51 J	160 J	100 J	NA	4100
Benzo(a)pyrene		23 J		65 J	180 J	92 J	NA	410
Benzo(b)fluoranthene		28 J		62 J	170 J	96 J	NA	4100
Benzo(g,h,i)perylene				48 J	65 J	46 J	NA	NA
Benzo(k)fluoranthene		21 J		69 J	160 J	95 J	NA	41000
Bis(2-ethylhexyl)phthalate	26 J		19 J				NA	215000
Butylbenzylphthalate							NA	215000000
Carbazole						50 J	NA	NA
Chrysene		25 J		76 J	170 J	130 J	NA	410000
Di-n-butyl phthalate							NA	105000000
Di-n-octyl phthalate							NA	21500000
Dibenz(a,h)anthracene					35 J	22 J	NA	410
Dibenzofuran						28 J	NA	NA
Diethyl phthalate					20 J		NA	NA
Fluoranthene		59 J		140 J	330 J	350 J	NA	42500000
Fluorene						27 J	NA	NA
Indeno(1,2,3-cd)pyrene				42 J	110 J	62 J	NA	4100
2-Methylnaphthalene							NA	NA
Naphthalene							NA	NA
Phenanthrene		42 J		96 J	150 J	340 J	NA	NA
Phenol							NA	650000000
Pyrene		48 J		120 J	280 J	240 J	NA	32000000

Samples 91, 95, and 96 were not recorded. Therefore, no semivolatiles were detected.

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

ANALYTE	SGC A22 000091		SGC A22 000092		SGC A22 000093		SGC A22 000094		SGC A22 000095		SGC A22 000096		Background	10^{-6} Construction Worker Guidelines
INORGANICS (mg/kg)														
Aluminum	5800		13700		8520		8970		13100		16400		19000	NA
Antimony			0.48	BJ					0.52	BJ			NA	425
Arsenic	0.80	B	5.4		1.0	B	4.2		5.5	J	1.1	B	8.6	320
Barium	35.3	B	102		64.2		55.0		75.1		86.0		180	75000
Beryllium	0.05	B	0.40		0.20	B	0.09	B	0.90		0.48		1.3	0.7
Bismuth							0.98	B					NA	NA
Cadmium	3.1		6.1		3.8		3.6				5.2		2.1	1050
Calcium	217000		188000		160000		124000		4190	J	137000		310000	NA
Chromium	7.1		16.8		10.5		13.8		20.2		17.2		20	1050000
Cobalt	5.6	B	11.0	B	6.0	B	6.7	B	13.0		9.6	B	19	NA
Copper	8.6		20.1		10.8		17.8		22.4		16.8		26	NA
Cyanide													ND	21400
Iron	14500		27100		16900		15900		32000		29400		35000	NA
Lead	7.6		10.4		5.5		20.4		17.6	J	8.5		48	NA
Lithium	18.0	B	19.5	B	14.4	B	13.0	B	8.7	B	22.8	B	26	NA
Magnesium	13600		33000		24700		72600		2940		5320		40000	NA
Manganese	347		788		402		503		600	J	553		1400	135000
Mercury							0.08	B	0.08	BJ			NC	320
Molybdenum	0.22	B	1.7	B	0.91	B	2.0	B	2.4	B	1.3	B	27	NA
Nickel	12.6		27.9		15.4		12.0		26.0		22.6		32	21500
Potassium	831	B	1190	B	873	B	852	B	820	B	1510		1900	NA
Selenium													NA	NA
Silver													1700	5500000
Sodium	163	B	319	B	212	B	276	B	1760	J	667	B	240	NA
Thallium													460	NA
Tin			1.4	B	0.67	B	1.7	B	1.2	B	1.2	B	20	NA
Vanadium	6.7		25.7		16.9		21.1		34.8		23.7		25	7500
Zinc	63.5		69.6		61.7		58.7		74.8		53.7		140	320000

Table A.5. Soil Gas Confirmation Detected Nitrate-Nitrite (cont.)

ANALYTE	SGC AOJ 000073	SGC AOJ 000074	SGC AOJ 000075	SGC AOJ 000076	SGC AOJ 000077	SGC AOJ 000078	Background	10^{-6} Construction Worker Guidelines
GENERAL ANALYTES								
% Solids (%)	94.0	88.5	85.3	86.8	85.8	89.4	NA	NA
Nitrate/Nitrite (MG-N/KG)	2.3	1.8	3.5	2.2	0.64	2.9	26	NA

ANALYTE	SGC AO3 000079	SGC AO3 000080	SGC AO3 000081	SGC AO3 000082	SGC AO3 000083	SGC AO3 000084	Background	10^{-6} Construction Worker Guidelines
GENERAL ANALYTES								
% Solids (%)	88.1	86.6	90.2	92.3	82.0	84.9	NA	NA
Nitrate/Nitrite (MG-N/KG)	2.2	3.7	2.2	1.4	1.6	13.1	26	NA

ANALYTE	SGC AO3 000085	SGC AO3 000086	SGC AO3 000087	SGC A21 000088	SGC A21 000089	SGC A21 000090	Background	10^{-6} Construction Worker Guidelines
GENERAL ANALYTES								
% Solids (%)	88.8	86.0	87.9	79.9	83.2	78.5	NA	NA
Nitrate/Nitrite (MG-N/KG)	6.8	8.6	0.93	3.4	1.9	5.2	26	NA

ANALYTE	SGC A22 000091	SGC A22 000092	SGC A22 000093	SGC A22 000094	SGC A22 000095	SGC A22 000096	Background	10^{-6} Construction Worker Guidelines
GENERAL ANALYTES								
% Solids (%)	90.3	83.3	89.3	85.7	80.0	84.7	NA	NA
Nitrate/Nitrite (MG-N/KG)	2.0	2.8	4.4	3.1	3.3	4.0	26	NA

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

ANALYTE	SGC AO3 000085	SGC AO3 000086	SGC AO3 000087	SGC A21 000088	SGC A21 000089	SGC A212 000090	SGC A22 000091	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			0.333	0.691	0.589	0.563		0.42	0.46
Cobalt-60								NC	0.1
Plutonium-238	0.118	3.11	0.914	0.508	0.444	0.284	0.449	0.13	5.5
Plutonium-239/240		0.00943	0.0111	0.0216	0.0132	0.00901	0.00434	0.18	5.5
Potassium-40	8.21	15.9	6.28	23.3	17.5	26.6	21.2	37	NA
Radium-226	0.552	1.02	0.478	1.26	1.03	1.14	1.31	2	0.14
Thorium-228	1.18	0.773	0.350	0.954	0.855	1.27	1.13	1.5	0.85
Thorium-230	0.575	1.07	0.653	1.30	1.20	1.16	1.50	1.9	44
Thorium-232	0.890	0.806	0.455	1.01	0.826	1.07	1.10	1.4	50
Uranium-234	0.536	0.799	0.572	0.860	0.767	0.790	1.19	1.1	37.5
Uranium-235	0.0371	0.0617			0.0591		0.0472	0.11	3.35
Uranium-238	0.666	0.966	0.596	0.897	0.803	1.16	1.22	1.2	11

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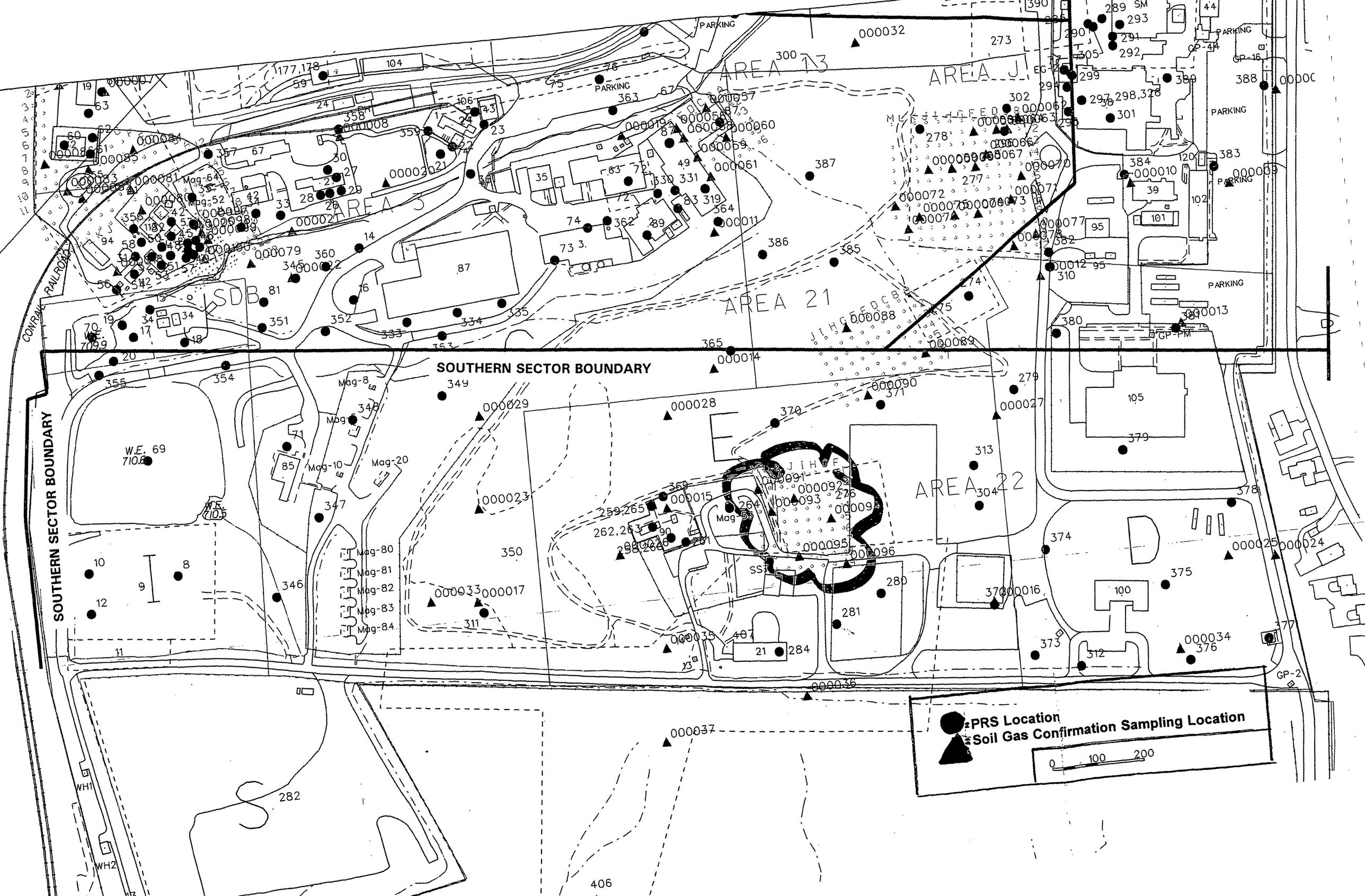
SOUTHERN SECTOR BOUNDARY
SOUTHERN SECTOR BOUNDARY
AREA 13
AREA J
AREA 3
AREA 21
AREA 22
SDB
CONRAIL RAILROAD
PARKING
PRS Location
Soil Gas Confirmation Sampling Location
0 100 200