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Environmental Restoration Program

OPERABLE UNIT 5
OPERATIONAL AREA PHASE I INVESTIGATION
AREA 3 FIELD REPORT

MOUND PLANT
MIAMISBURG, OHIO

VOLUME I - TEXT

June 1995

Final (Revision 1)

U.S. Department of Energy
Ohio Field Office

EG&G Mound Applied Technologies

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ACRONYMS

AOC	Area of Concern
CC	contamination criterion
cpm	counts per minute
CTC	carbon tetrachloride
DCA	1,2,-dichloroethane
DCB	dichlorobenzene
DCE	1,2-*trans*-dichloroethene
DCM	dichloromethane
DOE	U.S. Department of Energy
DQO	data quality objective
ER	Environmental Restoration
FIDLER	field instrument for the detection of low-energy radiation
Freon-11	trichlorofluoromethane
Freon-113	trichlorotrifluoroethane
FSP	Field Sampling Plan
kcpm	counts per minute X 1000
NERI	Northeast Research Institute LLC
OU	Operable Unit
PCE	tetrachloroethene
pCi/g	picocuries per gram
Pu-238	Plutonium-238
QAPjP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
SDB	Sewage Disposal Building
SM/PP	Special Metallurgical/Plutonium Processing
SOP	Standard Operating Procedures
TCA	trichloroethane
TCE	trichloroethene
Th-232	Thorium-232

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1. INTRODUCTION

Area 3 has been identified as an area of concern within the Operational Area of Operable Unit (OU) 5 (see Figure 1.1). The purpose of the Area 3 Field Report is to (1) present the results of the radiological and soil gas reconnaissance surveys conducted in Area 3 as part of a larger OU5 Phase 1 Investigation and (2) identify potential areas of radiological and chemical contamination within Area 3.

The data gathered during the Phase 1 Investigation is not Remedial Investigation (RI) quality. However, as summarized in this report, the data provide a qualitative screen that can be used to determine a strategy for directing Phase 2 and possible Phase 3 investigations. A Phase 2 investigation will be conducted to gather RI quality data from locations with probable contamination, as found during the Phase 1 reconnaissance investigation. This information will be used to refine the data quality objectives (DQOs) to determine if an additional round of sampling (Phase 3) is necessary. The phased approach to data gathering is part of an overall strategy to conduct a remedial investigation/feasibility study (RI/FS) for OU5.

The following sections briefly describe the scope of the Area 3 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 scope of the Area 3 Field Report is to describe the field work performed and to present the data collected at Area 3 during the Phase 1 investigation conducted from July through September 1994. This work was conducted according to the OU5, South Property, Remedial Investigation/Feasibility Study Work Plan (DOE 1993a) and associated OU5 Field Sampling Plan (FSP) (DOE 1993d). In addition, relevant data available from previous studies are integrated into this report.

1.2. SITE DESCRIPTION

Area 3, approximately 340 feet by 450 feet (153,000 ft^2), is in the lower valley, southwest of the Main Hill (see Figure 1.2). It includes buildings 19, 42, 55, 57, 72, and 94. These buildings serve a variety

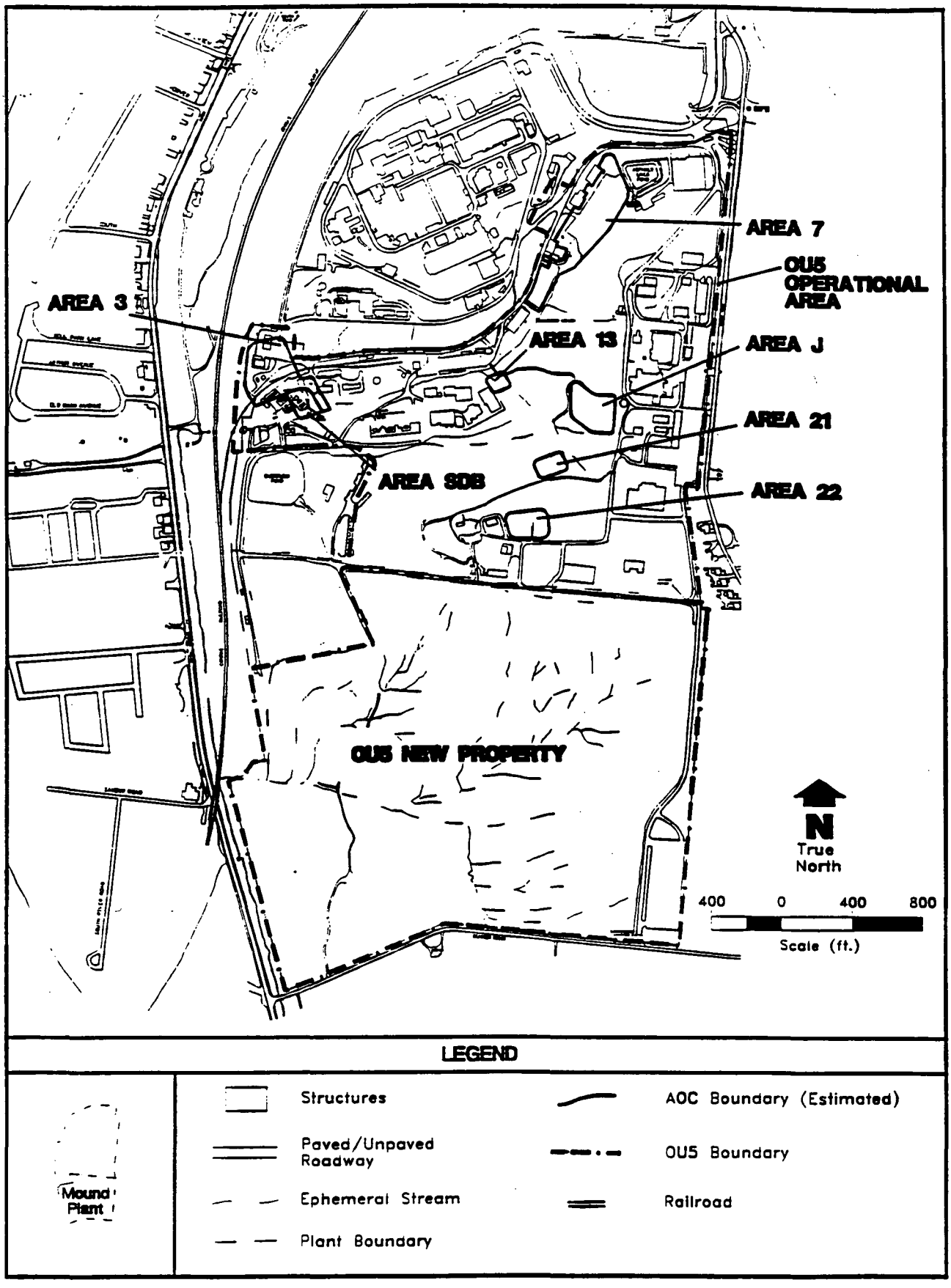

Figure 1.1. Site Map of OU5 Areas of Concern

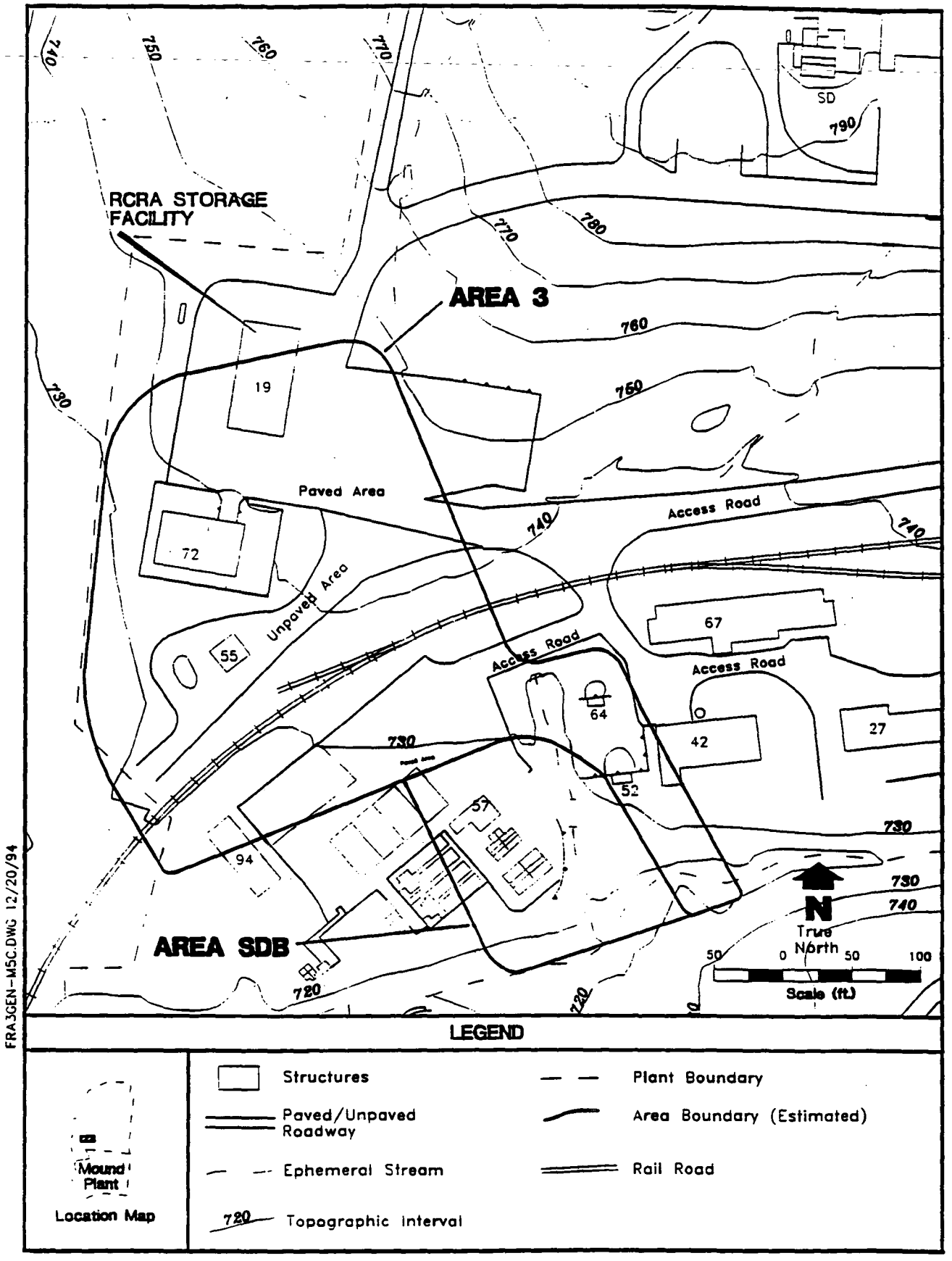

Figure 1.2. Site Map of Area 3

of purposes including salvage operations, effluent monitoring, and sewage treatment. Building 72 is currently used to store empty drums and waste materials including combustible and flammable liquids, waste oils, solvents, plating wastes, polymer wastes, and photo-processing wastes (DOE 1993b). Buildings 72 and 19 are regulated Resource Conservation and Recovery Act (RCRA) Storage Facilities, and are not addressed in this report. The assessment of Buildings 72 and 19 and the immediate surrounding areas will be conducted under separate Mound programs. The area not covered by buildings is approximately 40,000 ft^2 (DOE 1993a). A railroad spur runs through the middle of Area 3. Previous investigations (DOE 1992a) show that bedrock is greater than 25 feet below ground surface.

1.3. SITE HISTORY

Area 3 was used for the storage and redrumming of 55-gallon drums containing thorium wastes in the late 1950s and early 1960s (MRC 1973). In 1954 and 1955, approximately 6,000 55-gallon drums containing thorium sludge were delivered by rail to the Mound Plant (MRC 1973; Meyer 1979). Some of these drums were stored in Area 3 for prolonged periods of time. Weathering and internal corrosion made it necessary to frequently redrum the thorium sludge (MRC 1973). Thorium was released into the soil due to leakage during storage and the redrumming operation. In 1965, the thorium-contaminated soil was reportedly excavated and the area backfilled with clean soil (MRC 1985; Stought et al. 1988). It is not known how much fill was placed in this area.

A small section of Area 3, near Building 19, may have been contaminated by a plutonium-238 waste line break in 1969 or during the cleanup operations following that event (Rogers 1975).

Building 72 stored (in and near the building) drums containing RCRA wastes from processing facilities at Mound Plant prior to off-site disposal. These waste materials may have included organic solvents (acetone, trichloroethane, freons, isopropyl alcohol, methyl alcohol, and paint thinners), waste oils, paints, spent plating solutions (chromic acid, cadmium cyanide, nickel sulfate, nickel chloride, and copper cyanide), photoprocessing wastes (fixers, developers, bleaches, and rinses), polymer wastes, and other hazardous waste materials (DOE 1993c).

Area 3 historically includes the Sewage Disposal Building (SDB) (see Figure 1.2). Area SDB was investigated and the results reported separately to focus on the Mound Plant drainage ditch located

partially within its boundaries. This information can be found in the OU5 Operational Area Phase 1 Investigation Area SDB Field Report.

1.4. REPORT ORGANIZATION

The remainder of this report present the results of the Area 3 Phase 1 investigation. Section 2 summarizes field activities performed and data collected during the radiological survey and the soil gas survey. It also compares significant data from previous investigations with Phase 1 investigation data. Section 3 summarizes the results of the radiological and chemical reconnaissance surveys. References are provided in Section 4. Field logbooks, survey maps, radiological data, and the soil gas data are included in Appendices A, B, C, and D, respectively, in Volume II.

2. FIELD ACTIVITIES AND DATA SUMMARY

The Area 3 Phase 1 field activities were conducted to screen this area of concern (AOC) for potential areas of contamination. Reconnaissance activities in Area 3 consisted of:

- a field instrument for the detection of low-energy radiation (FIDLER) survey and surface soil sample analyses at the Mound Plant Soil Screening Facility to detect possible surface radiological contamination; and
- a soil gas survey to detect subsurface volatile and semi-volatile organic chemical contamination.

As specified in the FSP (DOE 1993d), the radiological screening was conducted to detect the presence of plutonium-238 (Pu-238) and thorium-232 (Th-232) in Area 3. These two radionuclides are the most prevalent radiological contaminants at Mound Plant. The soil gas survey was conducted to detect total aromatic hydrocarbons, total semi-volatile compounds, total C_5 to C_{11} petroleum hydrocarbons, and total halogenated compounds.

The data collection points for the FIDLER survey, the soil screening activities, and the soil gas survey were established over a 25 foot grid system within the estimated Area 3 boundary (see Figure 2.1 or Plate 1, Appendix A). The survey map of Area 3 (Appendix B) shows those points on the grid system located by a registered land surveyor. Before sampling, all transverses of the grid system were cleared of small trees and underbrush and the remaining sample locations were marked with wooden stakes or paint.

Portions of the "estimated" Area 3 location were not included in this Phase 1 program. These included the immediate areas surrounding and under Buildings 72 and 19 due to both being RCRA facilities. Also, the asphalt parking lot (in the northwest region of Area 3) was not surveyed due to the extent of the paving material. Should Phase II activities be required, cores in this area will be assessed for those sample requirements.

The following sections describe the field activities, the analyses performed, report the results of the Phase 1 investigation, and compare these results with the historical data.

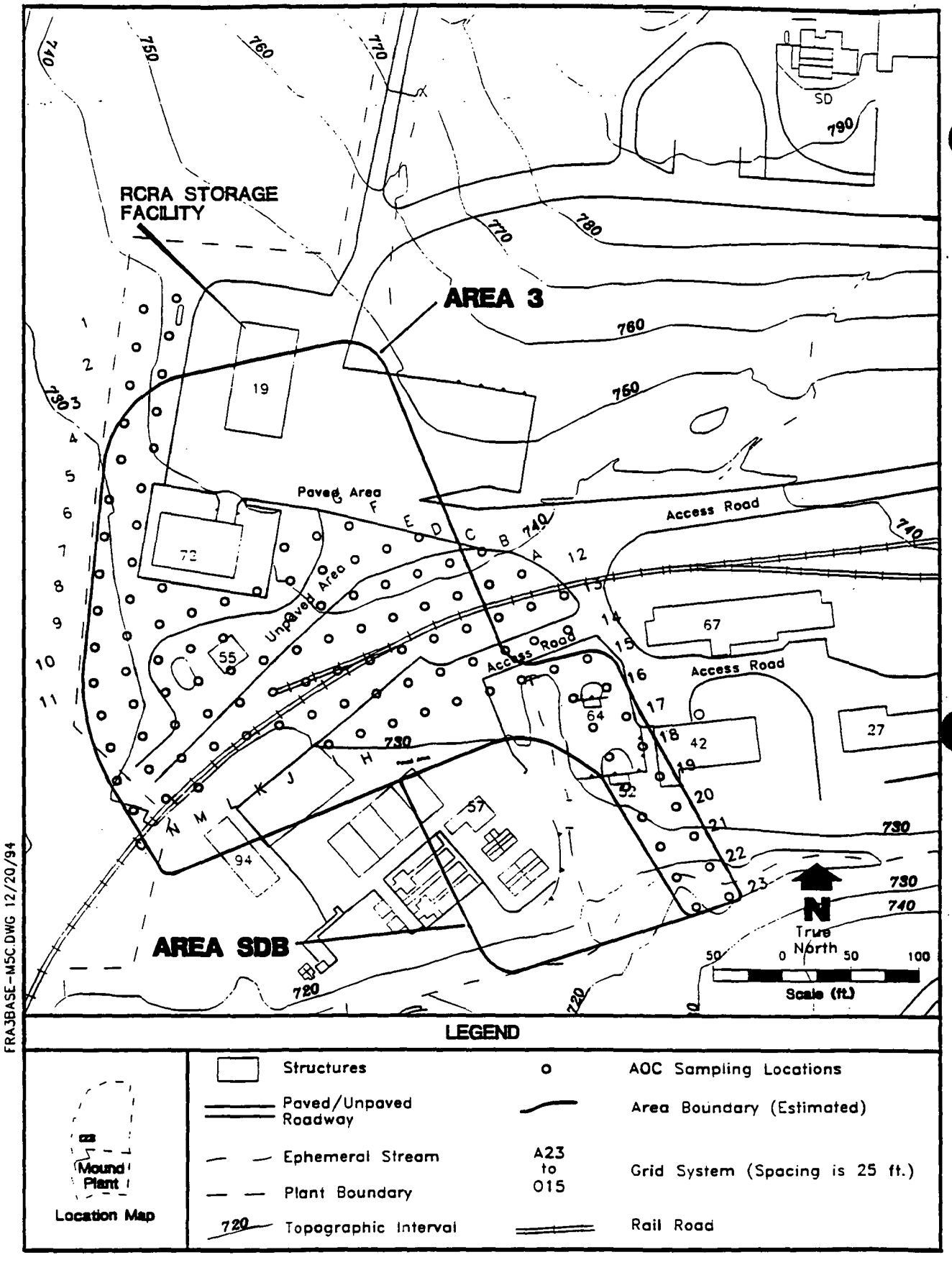

Figure 2.1. The Estimated Boundary and Established Grid System of Area 3

2.1. RADIOLOGICAL (FIDLER) SURVEY

A FIDLER survey was performed at Area 3 on July 20, 26, 27, and 28, and on August 1 and 2, 1994, per the Mound Standard Operating Procedure (SOP) 6.7, Near Surface and Soil Screening for Low-Energy Gamma Radiation Using the FIDLER.

2.1.1. Field Work Performed and Procedures

Prior to beginning the survey, a Bicron FIDLER was calibrated and a background station was established each day as listed in Table II.1.

Table II.1. FIDLER and Background Station Information for Area 3

Date	FIDLER #	Instrument #	Probe #	Background Station
7/20/94	#1	#3712	#3713	Stake A22
7/26/94	#1	#3712	#3713	Stake N01
7/27/94	#1	#3712	#3713	Stake A12
7/28/94	#3	#3228	#3432	Stake I12
8/01/94	#3	#3228	#3432	Stake C16
8/02/94	#3	#3228	#3432	Area A15

Background and standard source checks for Pu-238 and Th-232 were performed daily and readings were recorded on the card attached to the FIDLER and in the FIDLER logbook (Appendix A.2). Channel 1 readings were recorded in counts per minute (cpm). Channel 2 and the Out Channel readings were recorded in counts per minute x 1000 (kcpm). The standard deviations and the contamination criteria (CC) were calculated for the Out Channel, Channel 1, and Channel 2.

Due to its ability to detect a wide range of isotopes, the Out Channel was selected for screening surface radiological contamination within Area 3. The Out Channel responds to low-energy gamma rays and x-rays, while Channel 1 primarily responds to Pu-238 and Channel 2 primarily responds to Th-232.

In cleared areas, each 25 foot by 25 foot grid block was subdivided into 25 five foot by five foot sections (see Appendix C, Generic Sampling Identification Scheme figure). These sections were surveyed in a

serpentine fashion at a rate of 20 feet per minute. An Out Channel reading was taken in each section and recorded in the FIDLER logbook. If the readings exceeded the CC for the Out Channel, the section was divided into quadrants (northwest, northeast, southwest, and southeast). The FIDLER crew then located the point of highest activity in the area of elevated activity by identifying where the highest readings were detected in one of these quadrants. After one minute stabilization periods, Channel 1, Channel 2, and Out Channel readings were taken at the point of highest activity and recorded in the FIDLER logbook. The FIDLER was then slowly moved radially around the point of highest activity until the Out Channel reading dropped below the CC, thereby defining the area of elevated activity. The size of the area was recorded by distance and direction from the highest activity in the FIDLER logbook (Appendix A.2).

Where grid blocks could not be surveyed in a serpentine fashion due to thick vegetation, Out Channel readings were taken at each stake after a one minute stabilization period. The FIDLER operator then walked between stakes perpendicular to Row A, (i.e. A13 to A23, B12 to B23, etc. as depicted in Figure 2.2) at a rate of 20 feet per minute with the FIDLER in the Out Channel mode. In these particular grid blocks of Area 3, no Out Channel readings exceeded the CC between stakes.

2.1.2. Quality Assurance Summary Report

The field and data analysis variances are summarized in the following subsections.

2.1.2.1. Field Variance Report

The FIDLER survey was completed with no variances from the OU5 Quality Assurance Project Plan (QAPjP) (DOE 1993d). Two minor variances from the SOP 6.7 involved source checks and scanning techniques.

The first minor variance was the use of Pu-238 and Th-232 sources for the daily source check as opposed to the americium-241 source specified in SOP 6.7. Plutonium and thorium sources were provided by the Mound plant for the required daily check. The second variance from SOP 6.7, the inability to screen the entire area in a serpentine fashion, occurred due to portions of Area 3 being thickly wooded and very steep. In grid blocks where it was not possible to screen in a serpentine fashion, screening was conducted at and between grid points as described in Section 2.1.1. For Area 3, 64 percent was screened in a

serpentine fashion, 11 percent was partially screened in a serpentine fashion, and 25 percent was screened at grid points only.

2.1.2.2. Data Analysis Variance Report

FIDLER survey data were not formally validated. However, all logbook entries were checked for accuracy, completeness, and format. An error was found in the calculations used to determine the FIDLER contamination criteria (CC). These values were recalculated and compared to the FIDLER survey data. After reviewing the data, several additional locations in Area 3 were identified as having elevated radiological activity when compared to the recalculated Out Channel CC. Because the corrections were made following the completion of the survey, no Channel 1 or Channel 2 readings were taken at these locations identified as having elevated Out Channel readings.

2.1.3. Health and Safety Summary Report

The FIDLER survey was conducted according to the OU5 South Property RI/FS Health and Safety Plan (DOE 1993e), and the Environmental Restoration Program Site-Specific Health and Safety Plan for OU5 Operational Area - Area 3 and Sewage Disposal Building Area. Health and safety issues were discussed and resolved during daily tailgate safety briefings conducted by the Site Health and Safety Officer and documented in the Site Manager Logbook (Appendix A.1).

On July 27, 1994 a minor accident occurred when a member of the FIDLER field team slipped on a steep gravel incline and fell into a thistle bush. Thistles were imbedded in her hand, arm, leg, and back. First aid was administered at the site. Serpentining was discontinued in this steep portion of Area 3 to prevent a recurrence of this type of accident.

No safety violations occurred during the FIDLER survey at Area 3. On August 23, a health and safety surveillance was conducted; no deviations were found.

2.1.4. Presentation of Radiological 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 from the Mound Soil Screening Facility.

The FIDLER survey of Area 3 located several areas of elevated surface activity shown in Figure 2.2 and summarized in Table II.2. A majority of these locations were found near Building 55 and Building 72. The activity was found near of on the surface of a gravel road constructed on fill dirt and a grassy area to the west of Building 72. Two other locations of elevated activity (3B15-15 and 3B15-25) were found on the edge of a drainage ditch that runs between Building 42 and Building 57, through the woods, and empties into the plant drainage ditch running through Area SDB.

Surface soil samples, collected as part of the soil gas survey (see Section 2.2.1.1), were analyzed for Pu-238 and Th-232 at the Mound Plant Soil Screening Facility. Concentrations of Th-232 at or exceeding the Mound Plant Soil Screening Facility detection limit of 2.0 pCi/g were detected at four of the 102 sample locations (G10, I13, J10, and N15) (see Table II.3). Concentrations of Pu-238 at or exceeding the Mound Plant Soil Screening Facility detection limit of 25 pCi/g were detected at 22 of the 102 sample locations. Figure 2.3 shows (1) the locations where concentrations of Pu-238 equal or exceed 25 pCi/g; (2) the concentration contours where Pu-238 exists at concentrations from 25-50 pCi/g; and 3) the concentration contours where Pu-238 exists at concentrations greater than 50 pCi/g. This information is summarized in Table II.3. The concentration of Pu-238 at the soil surface does not appear to exceed 100 pCi/g within the estimated boundary of Area 3. Additionally, surface soil sample results indicate that Pu-238 might be present outside the estimated Area 3 boundary on the northwest "arm" and the southeast "arm" of the area at concentrations above 25 pCi/g.

2.1.5. Comparison with Historical Radiological Data

Surface and subsurface soil samples were collected within the boundary of Area 3 from 1983 to 1985 during the Site Survey Project (Stought et al. 1988). Eighteen core locations (drilled to a maximum depth of 15 feet) and 20 surface soil sample locations were analyzed for Pu-238 and isotopic thorium. A summary of the results of the soil sampling conducted under the Site Survey Project is presented in Table II.4 of this report (DOE 1992b). The corresponding core and surface soil sampling locations are shown in Figure 2.4.

During the Site Survey Project, Pu-238 was detected in six samples at concentrations greater than 25 pCi/g. Elevated Pu-238 activity was found near Building 19 (C0099, C0100, and S0540), near Building 72 (C0103 and C0104), and in surface samples S0547, S0557, and S0540. The maximum concentration

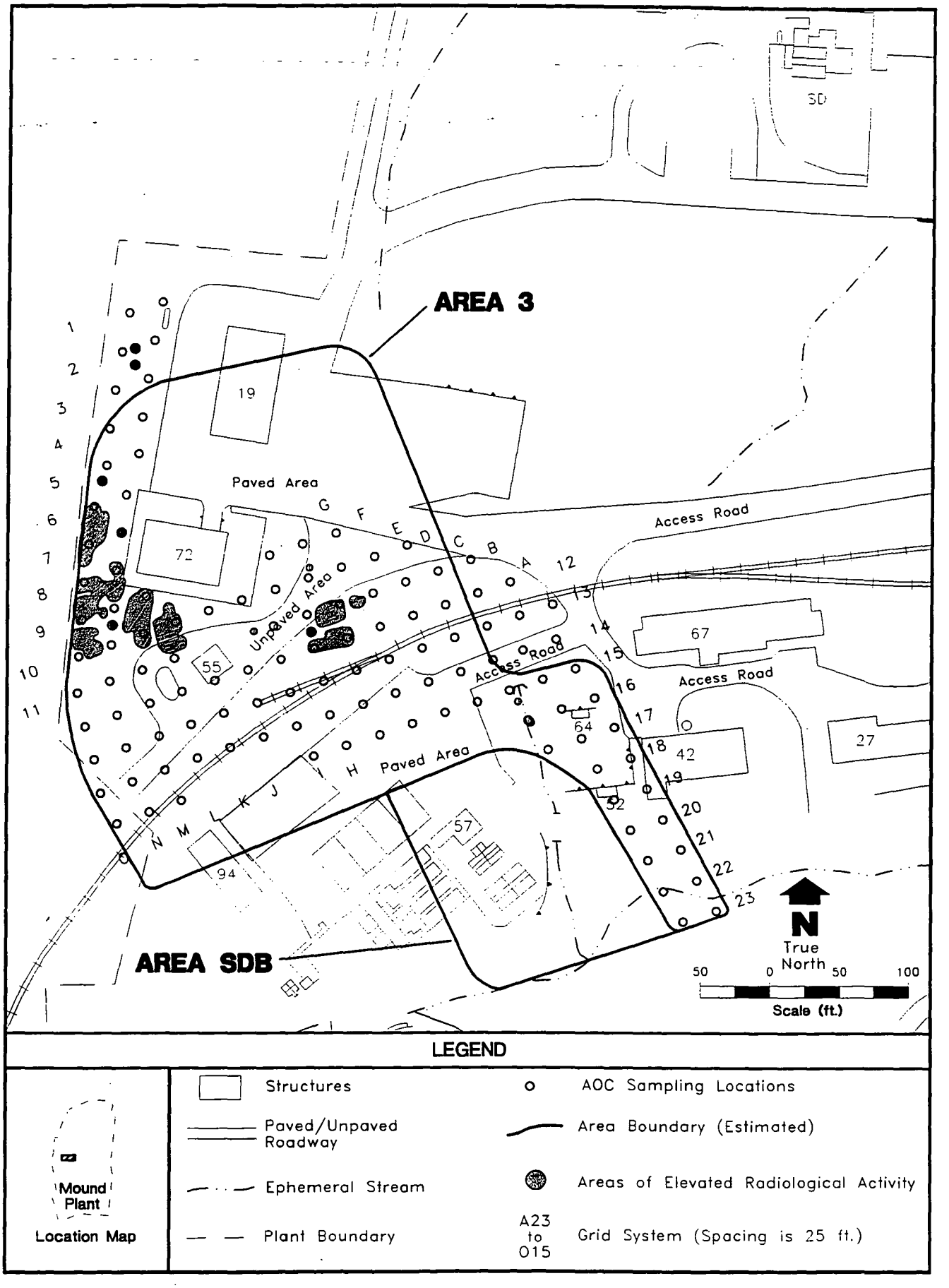

Figure 2.2. Areas of Elevated Surface Radiological Activity (FIDLER Survey)

Table II.2. Summary of Elevated Surface Radiological Activity in Area 3 (FIDLER Survey)
Page 1 of 2

Grid Location	Out Channel Reading (kcpm)	Out Channel CC (kcpm)
3N01-24	8.0	7.5
3N02-07	8.0	
3N05-06	8.0	
3N06-05 to 3N06-07, 3N06-14 to 3N06-17, 3N06-21, 3N06-22, 3N06-24, 3N06-25	8.0 - 8.5	
3N07-05, 3N07-06	8.0	
3N08, 3N08-04, 3N08-05, 3N08-08 to 3N08-10, 3N08-14 to 3N08-17, 3N08-20, 3N08-24, 3N08-25	8.0 - 9.5	
3L09-19	12.5	11.5
3M09-01 to 3M09-03, 3M09-08 to 3M09-12, 3M09-19 to 3M09-21	8.0 - 9.5	7.5
3N09-02, 3N09-11, 3N09-14 to 3N09-16, 3N09-23, 3N09-24	8.0 - 8.5	
3F10-02, 3F10-03, 3F10-05	12.0 - 19.0	11.5
3G10-01 to 3G10-03, 3G10-08 to 3G10-10, 3G10-15, 3G10-18 to 3G10-25	8.0 - 9.5	7.5
3I10-23	22.0	11.5
3L10-01 to 3L10-03, 3L10-05, 3L10-08, 3L10-09, 3L10-11, 3L10-12	12.0 - 27.0	11.5
3M10-02, 3M10-09, 3M10-10, 3M10-14 to 3M10-18, 3M10-23 TO 3M10-25	8.0 - 13.5	7.5
3N10-08, 3N10-09, 3N10-11 to 3N10-25	8.0 - 13.0	7.5
3K11-04	19.0	11.5
3M11-03 to 3M11-07, 3M11-12 to 3M11-18, 3M11-21 to 3M11-25	8.0 - 8.5	7.5
3N11-01 to 3N11-25	8.0 - 10.0	7.5
3E12-03	13.0	11.5
3F12-04, 3F12-05, 3F12-08, 3F12-11, 3F12-12	12.0 - 12.5	11.5

Table II.2. Summary of Elevated Surface Radiological Activity in Area 3 (FIDLER Survey)

Grid Location	Out Channel Reading (kcpm)	Out Channel CC (kcpm)
3G12-06 to 3G12-12, 3G12-20	12.5 - 13.0	11.5
3H12-01, 3H12-03, 3H12-07 to 3H12-10, 3H12-12 to 3H12-14	12.0 - 14.0	11.5
3I13	15.0	12.1
3K13-22	13.0	12.1
3L13-20	13.0	12.1
3A15-01 to 3A15-03	9.5 - 10.0	9.3
3B15-13, 3B15-15, 3B15-25	11.0 - 29.0	9.9
3A16-24	9.5	9.3
3B16-05	21.0	9.9
3A17-07	9.5	9.3
3A18-24, 3A18-25	10.0	9.3

CC contamination criteria
kcpm counts per minute x 1000

Table II.3. Summary of Elevated Surface Soil Radiological Activity (Soil Screening)

Grid Location[a]	Mound Soil Screening Facility Data	
	Plutonium-238 (pCi/g)	Thorium-232 (pCi/g)
A20	31	ND
A21	37	ND
A22	84	ND
B15	39	ND
B16	25	ND
B17	29	ND
B18	25	ND
B22	35	ND
B23	25	ND
E12	25	ND
G10	ND	3.6
I13	38	2.3
J10	ND	2.1
M12	25	ND
N6	48	ND
N7	31	ND
N10	32	ND
N11	26	ND
N15	ND	2.2
O2	25	ND
O5	27	ND
O6	53	ND
O7	40	ND
O8	32	ND
O9	52	ND
O12	27	ND

a - See Figure 2.3 for grid location
ND - Radiological activity not detected above detection limit

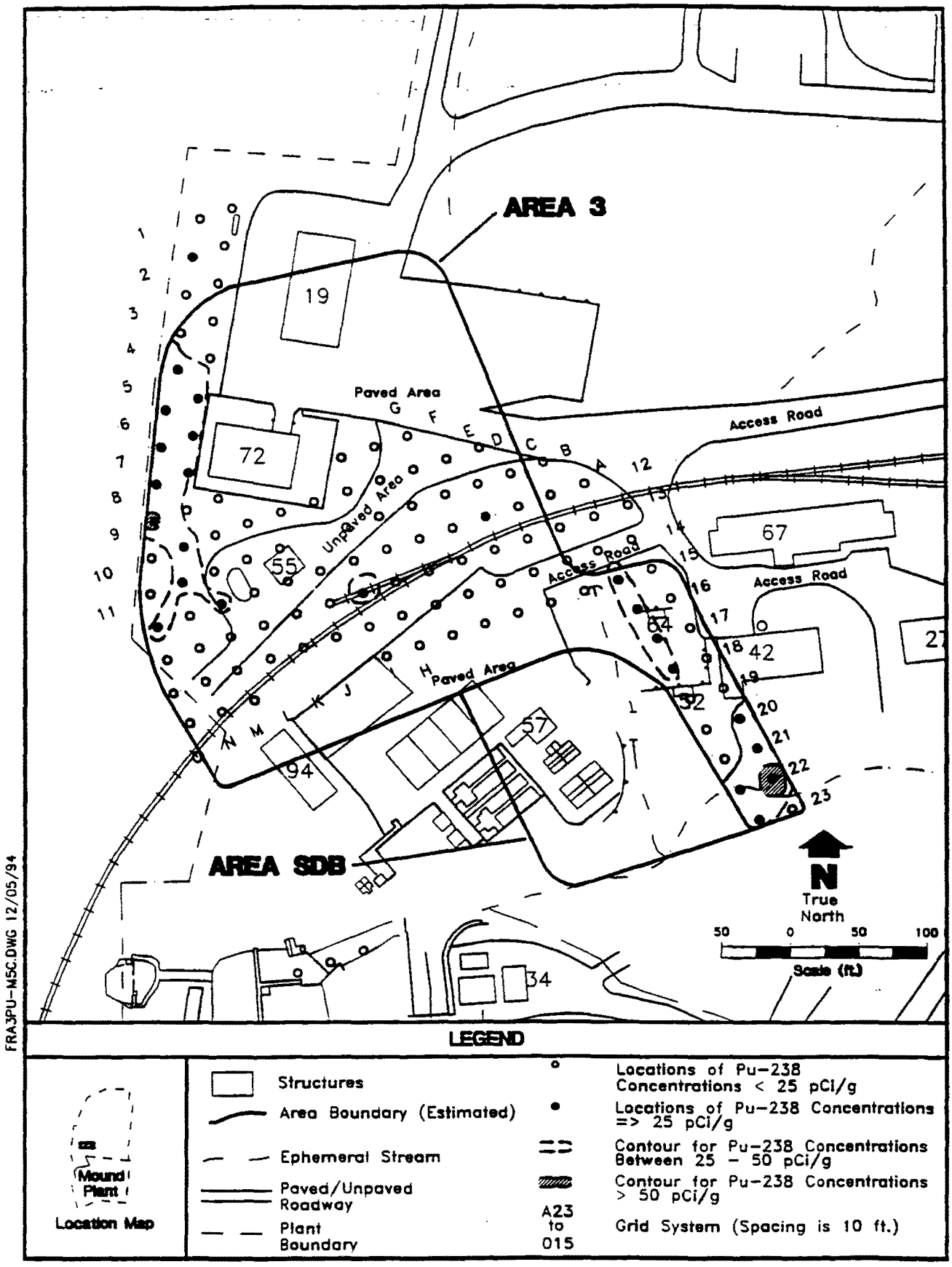

Figure 2.3. Locations of Elevated Surface Soil Radiological Activity (Pu-238)

Table II.4. Summary of Historical Radiological Data Collected in Area 3 (Mound Site Survey Project, 1983-1985)

Location[a]	Coordinates South	Coordinates West	MRC ID No.	Mo.Yr.	Depth (inch)	Plutonium-238 (pCi/g)	Thorium[b] (pCi/g)
C0099	1965	4265	10419	08-85	18	31.4	b
C0100	1975	4275	10421	08-85	18	32.4	b
C0103	2060	4300	1624	04-83	18	0.26	3.95
			1625	04-83	36	0.50	b
C0104	2085	4365	1622	04-83	18	50.60	b
			1623	04-83	36	5.28	b
C0107	2170	4375	1620	04-83	18	0.69	b
			1621	04-83	36	0.07	2.56
C0115	2275	4395	1644	04-83	18	1.46	3.56
			1646	04-83	36	0.31	b
S0540	2050	4165	2685	10-83	0	36.94	b
S0547	2365	4375	10485	08-85	0	11.0	5.30
S0551	2375	4390	6878	08-84	0	27.10	b
S0552	2380	4370	10486	08-85	0	41.70	b

[a]Map locations are given using a "C" to designate core locations and an "S" to designate surface locations.
[b]A "b" indicates that the total thorium concentration was less than the Mound Plant Soil Screening Facility level of 2.0 pCi/g. Therefore, radiochemical analysis was not performed.
MRC ID - Monsanto Research Corporation identification.
pCi/g - picocuries per gram.

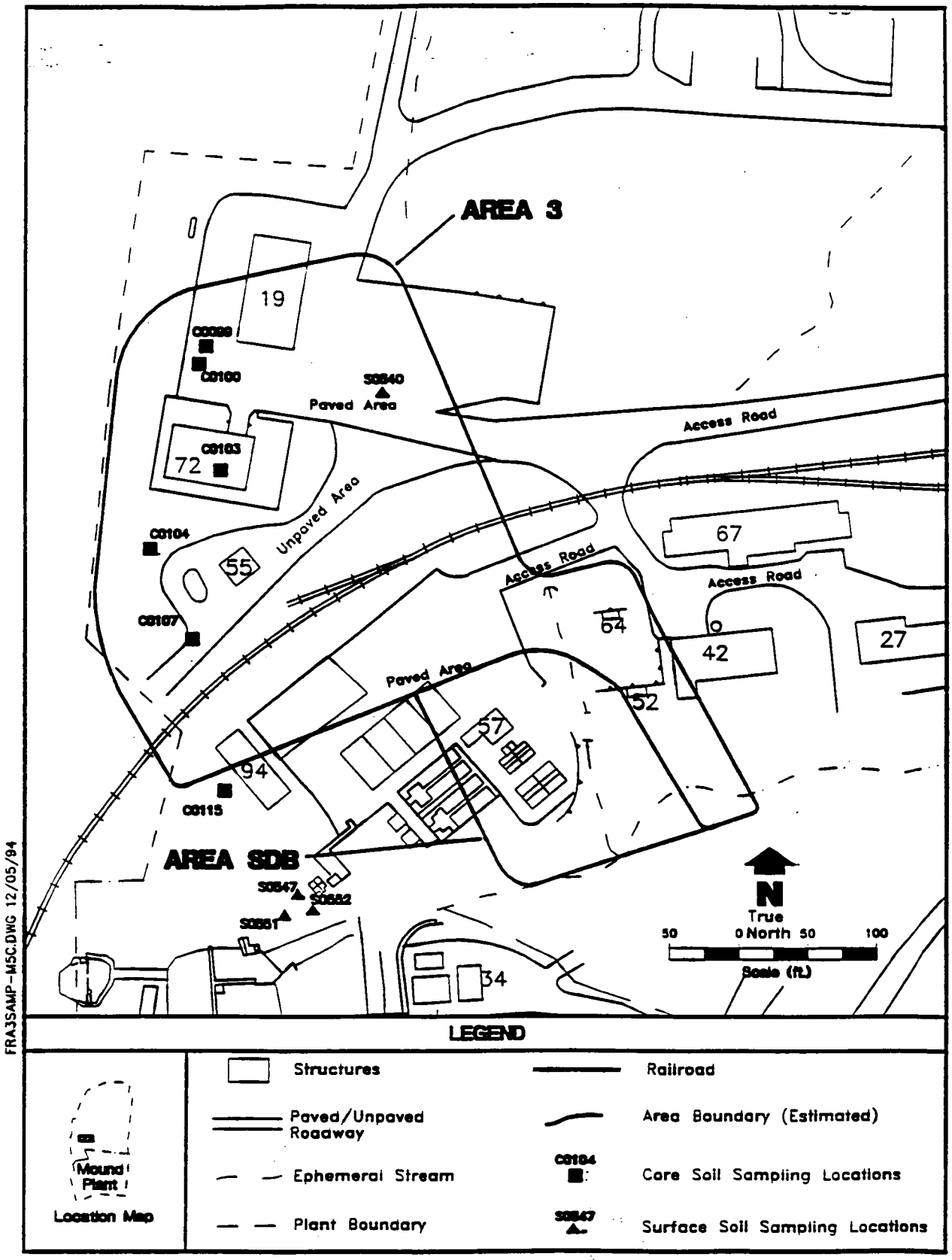

Figure 2.4. Sampling Locations for Historical Radiological Data Collected in Area 3 (Mound Site Survey Project, 1983-1985)

of 50.6 pCi/g was measured in the sample taken at a depth of 18 inches at core location 0104. Thorium was detected in four samples at concentrations greater than 2.0 pCi/g, with a maximum concentration of 5.30 pCi/g at surface location 0547 in the southern portion of Area 3.

The results from the soil sample screening of Area 3 during the 1994 Phase I investigation clearly indicate the presence of Pu-238 in the surface soil around buildings 19 and 72. Pu-238 was also found in this area during the Mound Site Survey Project. In both investigations, four isolated locations of elevated thorium activity were detected. However, the locations of elevated activity for thorium are not consistent between the two investigations (see Figures 2.3 and 2.4).

2.2. SOIL GAS SURVEY

2.2.1. Field Work Performed and Procedures

A soil gas survey was performed in Area 3 from July 18 to September 1, 1994, per the OU5 QAPjP, SOP for Petrex Environmental Surveys [Attachment 1] (DOE 1993d). The survey was completed over the grid system established for Area 3 (see Figure 2.1 or Plate 1, Appendix A).

2.2.1.1. Soil Gas Sampler Installation

Two sets of time calibration samplers (timers) and 114 data samplers were installed on six days between July 18 and August 18, 1994. Locations of the timers and data samplers are shown in Appendix D, Plate 1. The samplers and timers were installed at depths between 7-18 inches using an electric hammer drill and a 18 x 1.5 inch steel/tungsten carbide-tipped drill bit.

After each use, the drill bit was washed in a phosphate free detergent solution with a synthetic scrub brush, rinsed with deionized water, and allowed to air dry.

A FIDLER was used to monitor placement of all samplers and timers. Soil samples were collected from each of the locations for analysis of radiological contamination at the Mound Plant Soil Screening Facility. Results of the soil screening analyses are summarized in Section 2.1.4 and presented in their entirety in Appendix C.

2.2.1.2. Soil Gas Sampler Retrieval

On July 25, 1994, one timer from each of the two timer sets was retrieved, wiped (checked for radiological contamination), and sent to Northeast Research Institute LLC (NERI) for analysis. The analysis of timers at grid coordinates B12 and N12 indicated low to moderate relative response to C_4 to C_9 petroleum hydrocarbons and very low relative response to the chlorinated organic compound tetrachloroethene. Based on these low relative responses and slow loading rates, NERI requested that the second set of timers be retrieved on July 28, 1994. After analyses of the second set of timers, NERI recommended an exposure time of approximately 21 days per sampler.

Samplers were extracted on four days between August 10 and September 1, 1994. Six of the samplers O10, I11, C13, G14, J14, and H15 could not be retrieved due to broken tubes and the placement of construction materials and debris over the emplacement site. The remaining samplers were wiped and prepared for shipment. On September 1, 1994, the samplers were sent to NERI for analysis.

Upon receipt of the samplers, NERI noted that the collector wires in samplers B13 and H09 had been scraped and that the cap liner in sampler G11 was missing. As these conditions compromise sample integrity, these three samplers were withheld from analysis. Thus, 105 samplers were analyzed by NERI (108 samplers retrieved less three samplers withheld from analyses).

2.2.2. Quality Assurance Summary Report

The field and laboratory analysis variances are summarized in the following subsections.

2.2.2.1. Field Variance Report

The soil gas survey was completed with minor variances from the OU5 QAPjP, SOP for Petrex Environmental Surveys [Attachment 1] and the FSP (DOE 1993d). These variances included decontamination procedures, the number of samplers installed, timers, and travel blanks.

One minor variance from the SOP, per instruction from NERI, was the elimination of the methanol rinse step from the decontamination process used for cleaning drill bits.

Three minor variances from the FSP affected the total number of samplers and timers installed, and the use of travel blanks. The first variance was a decrease of nine samplers installed in Area 3 (123 proposed, 114 installed). Eight of these sampling points were located under freshly laid asphalt. These points were deleted from the survey area because of the uncertain effect of the new asphalt on the integrity of the soil gas samples. The remaining sample point (grid coordinate J11) was located under a building.

The second variance was a decrease in the number of timers installed in Area 3. The FSP requires five timers for an area this size, whereas NERI suggested that three timers were sufficient.

A third variance from the FSP was the use of the travel blanks. The FSP requires that travel blanks be returned with the timers and samples, whereas NERI instructed that travel blanks be returned with the samplers only.

2.2.2.2. Laboratory Data Variance Report

Petrex analytical data were not formally validated. However, logbook entries were checked for accuracy, completeness and format. A final report for Area 3 was received from NERI on October 20, 1994. Sample locations shown on Plate 1 of the NERI report (Appendix D) were checked against the field map to confirm that all sampling locations were correctly plotted; no errors were found. A ten percent quality assurance check of ion count values (Table 1, Appendix D) versus plot accuracy (Plates 2 through 5, Appendix D) yielded no errors.

2.2.3. Health and Safety Summary Report

The soil gas survey was conducted according to the OU5 South Property RI/FS Health and Safety Plan (DOE 1993e), and the Environmental Restoration Program Site-Specific Health and Safety Plan for OU5 Operational Area - Area 3 and Sewage Disposal Building Area.

All soil gas locations were screened using a FIDLER to avoid digging in radiologically contaminated soil. All sampling locations were checked for underground utilities to avoid damaging or severing utility lines while digging. Health and safety issues were discussed and resolved during daily tailgate safety briefings conducted by the Site Health and Safety Officer and documented in the Site Manager Logbook (Appendix A.1).

No accidents or safety violations occurred during the soil gas survey. On August 23, 1994, a health and safety surveillance was conducted; no deviations were found.

2.2.4. Presentation of Chemical 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, quality assurance/quality control methods, 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 qualitative in that multiple sources in soil and/or groundwater cannot be differentiated. Based on a review of historical information for Area 3 and the immediate vicinity, NERI provided analytical data for the following four general classes of compounds in order to assess the potential for the presence of these compounds below the surface:

- total aromatic hydrocarbons;
- total semi-volatile hydrocarbons;
- total C_5 to C_{11} petroleum hydrocarbons; and
- total halogenated hydrocarbons.

The following subsections describe the distribution of these compounds.

2.2.4.1. Distribution of Total Aromatic Hydrocarbons

Total aromatic hydrocarbons are reported as the combined levels 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 smaller (C_6 through C_9) aromatics. Very few samples were observed to contain C_{10} and larger aromatic hydrocarbons. This combination of compounds is typical of vapor derived from the weathered residue of medium and heavy weight fuels.

Elevated relative levels of total aromatic hydrocarbons are present along the periphery of Area 3 in several zones to the east, west, and north and in one larger zone centered in the middle of the area (see Appendix D, Plate 2). This larger zone surrounds the railroad spur and Building 55 and extends south toward the

border of Area SDB. The highest relative level of aromatics detected occurs at sample G13, located near the bed of the railroad spur.

2.2.4.2. Distribution of Total Semi-Volatile Hydrocarbons

Total semi-volatile hydrocarbons are reported as the combined response to naphthalene, C_{11} through C_{15} alkyl naphthalenes, and C_{12}, C_{14}, and C_{16} polycyclic hydrocarbons (including acenapthene, anthracene, and pyrene). 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 naphthalene are also found in medium to heavy weight fuels and heating oils. Soil gas data indicate that very few semi-volatile compounds over C_{12} molecular weight may be present in the soil gas, and that the majority of the relative responses derive from the presence of naphthalene compounds.

Elevated relative responses of semi-volatile hydrocarbons are found in scattered zones along the northern edge of Area 3, in a zone bordering Building 55, and in a central zone which extends to the south toward Area SDB (see Appendix D, Plate 3). These relative responses are principally naphthalene and alkyl naphthalenes and generally coincide with elevated relative levels of a broad assortment of other petroleum hydrocarbons which are typical of the vapor of various weathered fuels. Only the soil gas at sample locations B23, F14, and G15 showed relative levels of napthalene compounds atypical of fuels.

2.2.4.3. Distribution of Total C_5 to C_{11} Petroleum Hydrocarbons

Total C_5 to C_{11} petroleum hydrocarbons reported include alkanes, cycloalkanes, alkenes, cycloalkenes, dienes (collectively referred to as aliphatics), aromatics, naphthalene, and alkyl naphthalenes. These compounds together make up the bulk of most petroleum fuels, oils, and lubricants.

The areal distribution of total C_5 to C_{11} petroleum hydrocarbons is shown in Appendix D, Plate 4. The distribution of these petroleum hydrocarbons is similar to that of total aromatics, except that several zones in which heavier aliphatic compounds are more abundant appear better defined. Several small zones of elevated relative responses of total petroleum hydrocarbons are scattered throughout the central portion of Area 3. The highest relative levels were found near Building 55 and at a point near the northeast border at grid coordinate F10. The soil gas from locations in these areas contained elevated relative levels

of aliphatic compounds and alkyl styrenes which is typical of vapor from weathered, heavy fuel, oil-like products.

Also, there is a larger zone in the central portion of the site which trends along the railroad spur and extends to the south. The composition of the soil gas in this zone and in most of the other zones scattered along the northern and eastern border is more characteristic of weathered, medium weight fuels.

2.2.4.4. Distribution of Total Halogenated Hydrocarbons

Total halogenated hydrocarbons are reported as the combined levels of tetrachloroethene (PCE), trichloroethene (TCE), trichlorofluoromethane (Freon-11), trichlorotrifluoroethane (Freon-113), trichloroethane (TCA), and dichlorobenzene (DCB). PCE, TCE, and TCA are volatile liquids commonly used as solvents and cleaning agents for petroleum based products. Freon-11 and Freon-113 are highly volatile liquids used as refrigerants or solvents in vapor degreasers. DCB, as a liquid, is used in solvents and cleaning agents (1,3- and 1,4- isomers). DCB, as a solid, is used as a fumigant (1,2- isomer).

PCE and TCE were detected more frequently in the soil gas than the other halogenated hydrocarbons. Thus, most of the relative responses to total halogenated hydrocarbons principally reflect the presence of PCE and TCE in the soil gas.

Elevated relative levels of halogenated hydrocarbons occur in several zones throughout the western half of the site. The two largest zones are found near Buildings 19 and 72. A smaller zone borders Building 42 to the east (see Appendix D, Plate 5).

2.2.5. Comparison with Historical Chemical Data

Previous sampling investigations indicate the presence of subsurface organic chemical contamination in and around Area 3. The following subsections describe the sampling events, present the data from these events, and compare this data with data from the Phase 1 soil gas survey.

2.2.5.1. Historical Groundwater Data

Laboratory analyses of groundwater samples from five monitoring wells in or around Area 3 have indicated chemical contamination. The locations of Wells 0122, 0125, 0137, 0312, and 0315 are shown in Figure 2.5; Well 0122 is the only well located in Area 3. These wells were sampled from February 1984 to December 1991 (DOE 1992c), and in March 1993 (DOE 1993f).

Though no comprehensive interpretive report has been produced, certain organic contaminants were found (DOE 1992d). These contaminants included 1,2-*trans*-dichloroethene (DCE), TCA, PCE, and TCE. In addition, dichloromethane (DCM), 2-butanone, carbon tetrachloride (CTC), 1,2-dichloroethane (DCA), and styrene were also found. Table II.5 shows the sampled wells and the contaminants found.

Table II.5. Chemical Contaminants Detected in Monitoring Wells in the Vicinity of Area 3

CONTAMINANT	WELL ID #
DCM	0122
2-butanone	0122, 0137
TCE	0122, 0137, 0312, 0315
TCA	0125, 0137, 0312, 0315
DCE	0137, 0312, 0315
PCE	0137, 0315
CTC	0137
DCA	0137
Styrene	0137

As Table II.5 shows, TCE, TCA, and DCE were the most commonly occurring organic contaminants. Well 0137, located south of Area 3 shows the most contaminants. Well 0122, the only well within the boundary of Area 3, shows contamination by DCM, 2-butanone, and TCE.

Data from the soil gas survey as reported in the NERI report (Appendix D) is somewhat consistent with the groundwater sample analyses, shown in Table II.5. PCE and TCE are common parameters to both the groundwater samples and the NERI soil gas survey. TCA was found in groundwater samples from

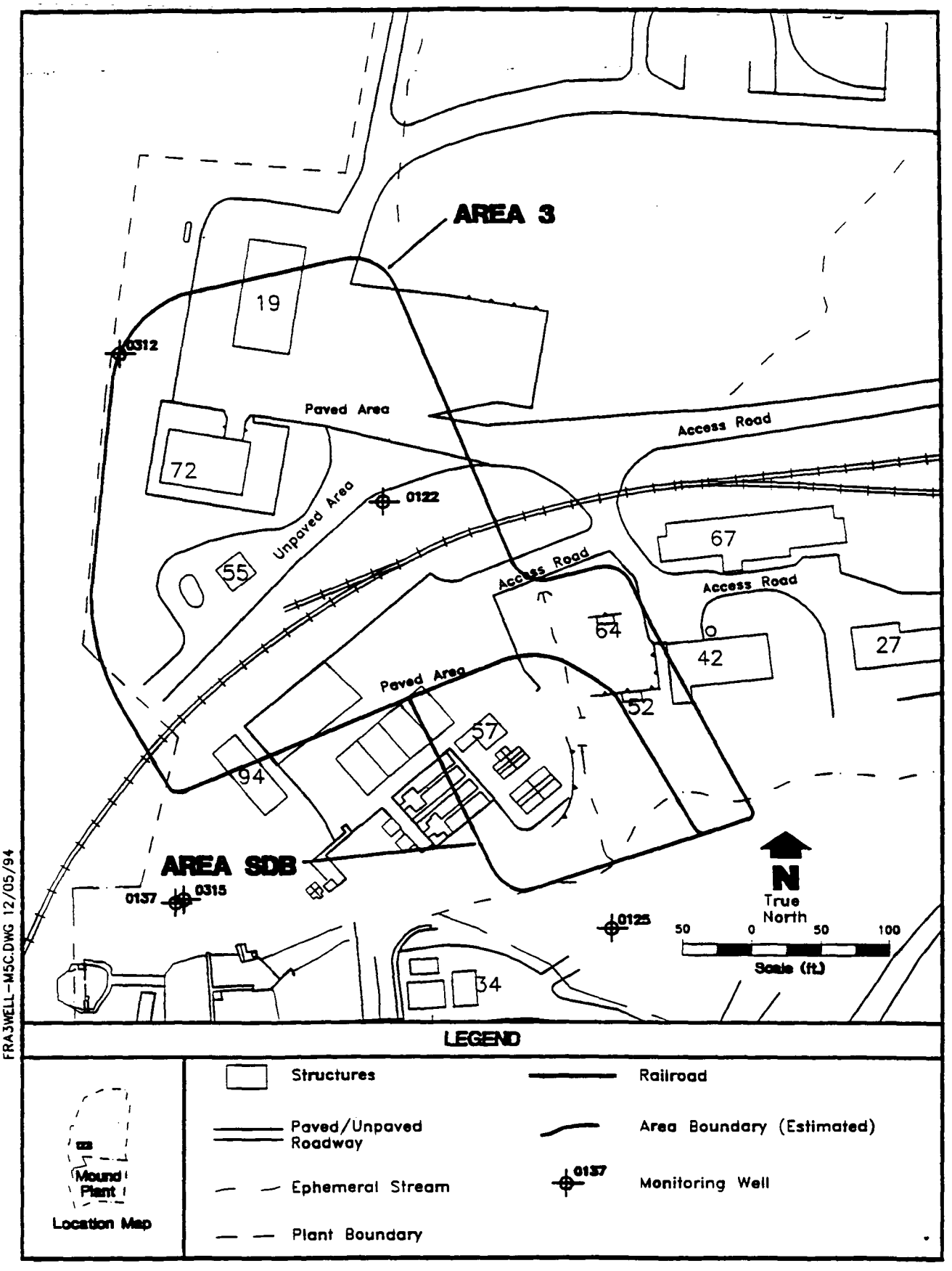

Figure 2.5. Monitoring Wells Located in the Vicinity of Area 3

four of the wells but was only found sporadically by NERI. DCA and styrene were found in Well 0137 but was not detected by NERI. DCE, DCM, and CTC were not reported as constituents of total halogenated hydrocarbons by NERI so no comparison is possible. The compound, 2-butanone, was found in two of the wells (0122 and 0137), however, due to it's solubility in water, it does not disperse as a gas and was not detected by NERI.

2.2.5.2. Historical Soil Gas Data

During the 1992 reconnaissance soil gas survey, four soil gas samples were collected in or around Area 3 (1992e). Sample 5221, collected at the edge of Building 19, indicated the presence of Freon-11, Freon-113, TCE, and possibly toluene. Sample 5222, collected a few feet northwest of Building 72, indicated the possible presence of toluene.

These data are fairly consistent with data from the NERI report, especially with respect to Freon-11, Freon-113, and TCE. These compounds were found consistently by both NERI and the 1992 soil gas survey around Buildings 19 and 72. Toluene was possibly detected during the 1992 soil gas survey in this same area, but was not reported by NERI.

3. SUMMARY

The results of the reconnaissance (radiological and chemical) surveys conducted in Area 3 are summarized in this section.

The radiological surveys (FIDLER and soil screening) performed in Area 3 indicate elevated levels of surface radiological activity mainly in the western and central portions of Area 3 near Buildings 72 and 55. The soil screening analysis also indicates the presence of Pu-238 in the southeastern arm of Area 3 near Area SDB and close to the ditch which drains into Area SDB.

The soil gas survey conducted in Area 3 indicates the presence of chemical contaminants as summarized below:

- Elevated relative levels of total aromatic hydrocarbons (primarily C_6 - C_9) occurred along the periphery of Area 3 in several zones to the east, west, and north and in one larger zone located in the center of the area. This larger zone encompasses the railroad spur and Building 55 and extends south toward the border of Area SDB.

- Elevated relative levels of semi-volatile hydrocarbons (primarily naphthalene and C_{11} - C_{12} alkyl napthalenes) occurred along the northern edge of Area 3, in a zone bordering Building 55, and in a central zone which extends to the south toward Area SDB.

- Elevated relative levels of petroleum hydrocarbons ocurred in several small zones scattered throughout the central portion of Area 3 (the highest relative levels were found near Building 55) and a larger area in the central portion which runs along the railroad spur and extends to the south.

- Elevated relative levels of total halogenated hydrocarbons (primarily PCE and TCE) occurred in several zones throughout the western half of Area 3. The two largest zones were found near buildings 19 and 72. A smaller zone borders Building 42 to the east.

These results will be used to plan a Phase 2 investigation of Area 3 in accordance with the Operable Unit 5, Work Plan (DOE 1993a).

4. REFERENCES

DOE 1992a. "Operable Unit 9 Site Scoping Report: Volume 4, Engineering Map Series, [FINAL]," U.S. Department of Energy, Albuquerque Operations Office, Albuquerque, New Mexico. February 1992.

DOE 1992b. "Operable Unit 9 Site Scoping Report: Volume 3, Radiological Site Summary, [Revision 1]," U.S. Department of Energy, Albuquerque Operations Office, Albuquerque, New Mexico. December 1992.

DOE 1992c. "Groundwater Water and Seep Water Quality Data Report Through First Quarter, FY92," U.S. Department of Energy, Albuquerque Field Office, Albuquerque, New Mexico. November 1992.

DOE 1992d. "Operable Unit 9 Site Scoping Report: Volume 1, Groundwater Data: February 1987 - July 1990 and Addendum [FINAL]," U.S. Department of Energy, Albuquerque Operations Office, Albuquerque, New Mexico. February 1992.

DOE 1992e. "Reconnaissance Sampling Report, Soil Gas Survey and Geophysical Investigation, Mound Pant, Main Hill and SM/PP Hill," U.S. Department of Energy, Albuquerque Operations Office, Albuquerque, New Mexico. February 1992.

DOE 1993a. "Operable Unit 5 South Property Remedial Investigation/Feasibility Study Work Plan, [FINAL, Revision 0]," U.S. Department of Energy, Albuquerque Operations Office, Albuquerque, New Mexico. December 1993.

DOE 1993b. "Operable Unit 9 Site Scoping Report: Volume 12, Site Summary Report, [DRAFT Revision 0]," U.S. Department of Energy, Albuquerque Operations Office, Albuquerque, New Mexico. October 1993.

DOE 1993c. "Operable Unit 9 Site Scoping Report: Volume 7, Waste Management, [FINAL Revision 0]," U.S. Department of Energy, Albuquerque Operations Office, Albuquerque, New Mexico. February 1993.

DOE 1993d. "Operable Unit 5 South Property Remedial Investigation/Feasibility Study, Sampling and Analysis Plan, [FINAL, Revision 0]," U.S. Department of Energy, Albuquerque Operations Office, Albuquerque, New Mexico. December 1993.

DOE 1993e. "Operable Unit 5 South Property Remedial Investigation/Feasibility Study, Health and Safety Plan, [FINAL, Revision 0]," U.S. Department of Energy, Albuquerque Operations Office, Albuquerque, New Mexico. December 1993.

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Meyer, H. E. 1979. "Thorium-232 Program, Mound Facility." Monsanto Chemical Company, Mound Plant, Miamisburg, Ohio. October 3, 1979.

MRC 1973. "Options for Disposal of Thorium Ore Residues Stored at Monsanto Research Corporation, Mound Laboratory, Miamisburg, Ohio." Report prepared by Monsanto Research Corporation, Mound Laboratory, Miamisburg, Ohio. April 9, 1973.

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SPECIFIC COMMENTS:

Comment #1: Section 1.3, Page 1-4, Paragraph 4:
This paragraph states that the issues concerning the Mound Plant Drainage Ditch were reported seperately in the Area SDB Field. These issues were raised by Ohio EPA during review of the Area SDB Field Report because they were not covered in the report. Due to the contamination levels found at the southern edge of the sample grid in Area SDB, the Mound Plant Drainage Ditch issue still merits discussion. Will the drainage ditch be covered as a separate Area of Concern, as a part of Operable Unit 9, in a separate field report?

Response #1: The Mound Plant Ditch was not investigated during the OU5 Operational Area Phase I investigation as a separate Area of Concern. Contamination levels found in or near the Mound Plant Drainage Ditch during the Area 3 and Area SDB investigations indicate that further investigation of this ditch is warranted.

The findings reported in the Area 3 and Area SDB Field Reports relating to the Mound Plant Drainage Ditch will be used as the basis for issuance of an addendum to the OU5 Work Plan for Ohio EPA and USEPA approval. The addendum will specify the Phase II activities required to conduct the collection of RI quality data from adjacent areas in the drainage ditch.

The Mound Plant Drainage Ditch has been sampled as part of an OU9 investigation. The report for this investigation is currently being prepared.

Comment #2: Section 2, Page 2-1, Paragraph 4:
Asphalt surfaces surrounding Buildings 19 and 72 prevented core sampling. If a Phase II investigation is not performed (and therefore no core samples taken from the paved area), will it be possible to obtain screening (e.g., FIDLER) data for the areas just north and east of the paved area? This would help determine if the paved area may be a problem.

Response #2: A Phase 2 investigation will be performed in accordance with the OU5 Work Plan addendum. Additional screening data for the areas north and east of the paved area will be obtained.

Comment #3: Section 2.1.4, Page 2-7, Last Sentence, and Figure 2.3:
Elevated radiological activity greater than 50 piC/g exists at or near the southeast and northwest boundaries of the sampling grid (e.g., at O9 and A22 in Figure 2.3). We agree with the statement that results may indicate that contamination exists outside the boundaries of the sampling grid, and therefore believe that it should be expanded.

Response #3: Comment noted. The findings reported in the Area 3 Field Report will be used as a basis for issuance of an addendum to the OU5 Work Plan for Ohio EPA and USEPA approval. The addendum will specify the expansion of the study area as part of the Phase II activities.

SPECIFIC COMMENTS:

Comment #1: Section 1.3 Site History
Page 1-4, Paragraph 2
The report indicates that an excavation of thorium-contaminated soil took place in 1965 in Area 3, and that the excavation site was then backfilled with clean soil. Was any verification sampling performed after this excavation took place? To what area were the drums which were stored in this area moved?

Response #1: It is not known whether verification sampling was performed after the excavation of thorium-contaminated soil in 1965 in Area 3. As stated in the OU9 Site Scoping Report: Volume 3 - Radiological Site Survey (DOE 1993), "no documentation of the excavation activity was found during research for the scoping reports."

As summarized in the OU9 Site Scoping Report: Volume 3 (DOE 1993), the drums stored in Area 3 were moved to Building 21, a permanent bulk thorium sludge storage facility, in Area 1.

Comment #2: Section 2.1.1 Field Work Performed and Procedures
Page 2-3, Table II.1
U.S. EPA is concerned about the use of points within the area of concern as background points. The possibility exists that contaminated areas may be "zeroed out" and not found if the background reference is also within an area of contamination. It would be more appropriate to use a point outside the area of concern which is in an area where contamination would not be expected. Also, it is not clear why a different background station is being used for each day of sampling. At a minimum, it would seem appropriate to use one reference point for comparison of the sampling points within Area 3.

Response #2: When establishing a "background" station, a location was chosen daily that was assumed to be uncontaminated and similar to the terrain to be surveyed based on SOP 6.7 *Surface and Soil Sample Screening for Low Energy Gamma Radiation Using the FIDLER.* While it is stated that "background" stations were established at stakes located in Area 3, the readings were actually taken 20-25 feet away from the stakes and essentially outside the area of potential contamination (except for I12 "background" station taken within Area 3 in order to match the terrain to be surveyed). Therefore, the "background" locations should not contain sufficient contamination to bias the background.

Comment #3: Section 2.2.4.2 Distribution of Total Semi-Volatile Hydrocarbons
Page 2-17, Paragraph 1
The paragraph states that the elevated relative responses in sampling for semi-volatile hydrocarbons are principally naphthalene and alkyl naphthalenes and generally coincide with elevated levels of other petroleum hydrocarbons which are typical of the vapor of various weathered fuels. The paragraph then states that only three samples within the grid exhibit levels of naphthalene which are atypical of fuels. To what are these levels attributed?

Response #3: As explained in the PETREX® Soil Gas Survey Report in Appendix D, the relative levels of naphthalene compounds at sample locations B23, F14, and G15 were anomalously high for fuels. This finding may indicate that petroleum products particularly high in napthalenes (e.g., tar, creosote, etc.) may have been released at these three sampling points. No definitive explanation can be given until a Phase II program is completed. Further identification of the possible contaminants, and therefore its source(s), could then be possible.