

CHANGE PAGE INSTRUCTIONS
Issued June 1995

for the

Operational Area Phase 1 Investigation
Area 21 Field Report
Final (Revision 1)

Volume I

1. Remove and discard the cover, spine, title page, and text.
2. Insert the new cover, spine, title page, and text [Final (Revision 1)].

Volume II

1. Remove and discard the cover, spine, and title page. Replace with the new cover, spine, and title page [Final (Revision 1)].
2. In Appendix B, locate the "FIDLER logbook" and remove and discard pages 237, 263, and 279-281. Replace with pages 237, 263, and 279-281 (Revision 1) included in this package.



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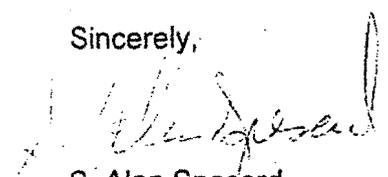
Mr. Arthur W. Kleinrath
Project Engineer,
Team Leader, MB
U. S. Department of Energy
Miamisburg Area Office
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Dear Mr. Kleinrath:

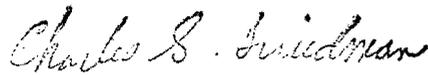
Attached for your use are two copies of the OU5 Area 21 Phase I Field Report (Final). The Draft issue comments with responses are also attached. With your concurrence, copies have been forwarded to Mr. Tim Fischer (U.S. EPA), Ms. Regina Bayer (Ch2M Hill), Mr. Brian Nickel (Ohio EPA), Ms. Jenifer Kwasniewski (Ohio EPA), Mr. John Sands (DOE/EM-40), Mr. George Rael (DOE/AL) and Mr. Doug Draper (MMES/HAZWRAP).

If you require additional information, please contact me at (513) 865-3859.

Sincerely,


S. Alan Spesard
OU-5 Manager

Approved:



Charles S. Friedman
Vice President
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John Sands	(DOE/EM-40)
George Rael	(DOE/AL)
Doug Draper	(MMES/HAZWRAP)

Environmental Restoration Program

**OPERABLE UNIT 5
OPERATIONAL AREA PHASE I INVESTIGATION
AREA 21 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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DATA)
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ACRONYMS

CC	contamination criterion
cpm	counts per minute
DCB	dichlorobenzene
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
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/FS	Remedial Investigation/Feasibility Study
SM/PP	Special Metallurgical/Plutonium Processing
SOP	Standard Operating Procedures
TCE	trichloroethene
Th-232	Thorium-232
TRPC	Technical Record of Project Change

ACKNOWLEDGEMENTS

This field report was prepared under the direction of the U.S. Department of Energy (DOE) by EG&G Mound Applied Technologies, supported by Science Applications International Corporation (SAIC) in Dayton, Ohio under contract DE-AC04-88DP43495 pursuant to Basic Ordering Agreement Number 52264. The contributors to this document include the following: DOE On-Scene Coordinator, Art Kleinrath; DOE Technical Reviewer, Richard Neff (Rust-Geotech); EG&G Mound Applied Technologies Operable Unit 5 Manager, Gary Coons; EG&G Mound Technical Reviewers, Alec Bray and Dan Carfagno; EG&G Mound Field Coordinator, Keith McMahan; and SAIC personnel as follows: Project Manager, Michael D. Giordano; Operable Unit Manager, Tom Tank; and Field Task Leader, John Davis with team members including Juan Alvarado, Sally Brown, Joletta Humpert, Cindy McIver, Laura Morrison, and Craig Patterson.

1. INTRODUCTION

Area 21 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 21 Field Report is to present the results of the radiological and soil gas surveys conducted in Area 21 as part of a larger OU5 Phase 1 Investigation and to identify potential areas of radiological and chemical contamination within Area 21. The data gathered during the Phase 1 Investigation is not remedial investigation (RI) quality. No conclusions were drawn from the results presented in this field report.

The Phase 1 reconnaissance investigation (radiological and soil gas surveys), as summarized in this report, provides a qualitative screen that can be used to determine a strategy for directing possible Phase 2 and 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) of OU5.

The following sections briefly describe the scope of the Area 21 Field Report, provide a site description, review the site land use history, and present the organization of the remainder of the report.

1.1. SCOPE

The scope of the Area 21 Field Report is to present the field work performed and the data collected at Area 21 during the Phase 1 investigation conducted in June, July, and August 1994. This work was conducted according to the OU5, South Property, Remedial Investigation/Feasibility Study Work Plan (DOE 1993a). In addition, relevant data available from previous studies are integrated into this report.

1.2. SITE DESCRIPTION

Area 21, approximately 150 feet by 175 feet (26,250 ft²), is located on the south central slope of the Special Metallurgical/Plutonium Processing (SM/PP) hill south of Area J (see Figure 1.1). There are no buildings in Area 21 and it is covered with thick stands of small trees, underbrush, and grasses which limit accessibility. Partially buried, steel cables of the old explosives bunker located in Area 21 are still visible.

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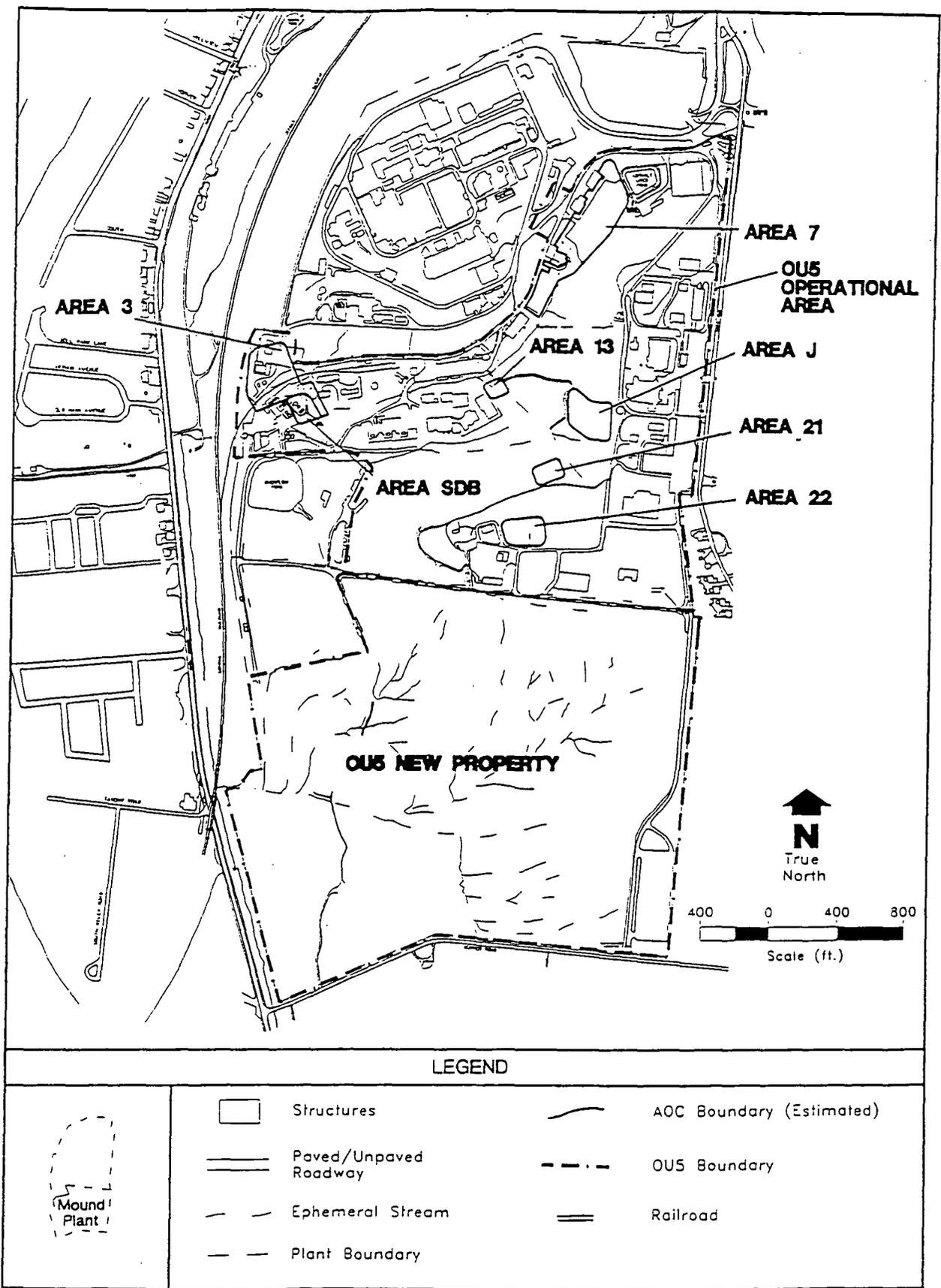


Figure 1.1. Site Map of OU5 Areas of Concern

The area slopes uniformly downhill from the southeast to the northwest, though there are several artificial slope breaks. Topographic elevations range from 840 feet to 870 feet above mean sea level. Mound Plant drawings (DOE 1992a) show that bedrock ranges from three to five feet below ground surface.

1.3. SITE HISTORY

The Mound Site Survey Project (Stought et al., 1988) reportedly located Area 21 by gamma survey and found significant levels of radium-226 activity. No indication of radium-226 was found during the evaluation of the data included in the Stought report for the OU9 Site Scoping Report, Volume 3: Radiological Site Survey. Cesium-137 was also found in the area. It is speculated that wastes from the reactor waste pilot plant were stored at the explosives bunker site in Area 21, but limited data indicates that the incoming casks were stored at the Quonset hut (Bradley 1952). The boundaries of Area 21 have not been fully determined.

According to historical data (DOE 1992b), there were two bunkers located in Area 21 during plant construction in 1947 and 1948: a large one for explosives storage and a smaller one for detonator storage. These bunkers were also known as the dynamite caves (Bradley 1953) and the dynamite shacks (MCC 1053-1957). The larger explosives bunker, also known as shack #2, is the one that was probably used the most by Mound Plant. The smaller detonator bunker is also known as shack #1. The bunkers were constructed of heavy timbers tied together with steel cables. The floors are believed to have been packed earth.

During the 1940s and 1950s, the old explosives bunker was used extensively for the storage of wastes that contained high gamma radiation. During the era of polonium processing, 20- and 30-gallon drums containing residual sludge from the bismuth decanting processes in HH Building were moved by truck to the bunkers. The sludge contained high levels of short-lived, gamma emitting radionuclides (Garner 1991).

In the early 1950s, the K-65 residues used in the radium-actinium project were stored in the explosives bunker in lead casks. Plant workers would remove small quantities of the residue for processing. At the conclusion of the radium-actinium project, the ion exchange resins containing approximately 10 grams of radium were stored at the bunker (Schauer 1953). High risk wastes from the radium-actinium project were probably also stored here (MCC 1951-1956).

In August 1953, radiation surveys of surface and air contamination levels on and around drums of waste storage indicated drum leakage. Residual thorium from the purification and separation processes of the radium-actinium program was the suspected cause. The drums were moved for shipment off-site (MCC 1953-1957).

No other historical data or references to these bunkers could be found during the research for this report. The only visible signs of the explosives bunker are partially buried, steel cables. No sign of the detonator shack is apparent.

1.4. REPORT ORGANIZATION

The remainder of this report presents the results of the Area 21 Phase 1 field investigation. Section 2 summarizes field activities performed and data collected during the radiological and the soil gas surveys. It also compares relevant data from previous investigations with Phase 1 investigation data. Section 3 summarizes the results of the radiological and chemical reconnaissance surveys. Section 4 lists the references used to prepare this report. Survey maps, field logbooks, radiological data, and soil gas data are included in Appendices A, B, C, and D respectively, contained in Volume II.

2. FIELD ACTIVITIES AND DATA SUMMARY

The Area 21 Phase 1 field activities were conducted to qualitatively screen this area of concern. In Area 21, Phase 1 reconnaissance activities 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 OU5 Field Sampling Plan (FSP) (DOE 1993b), the radiological screening was conducted to detect the presence of plutonium-238 (Pu-238) and thorium-232 (Th-232) in Area 21. 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 petroleum hydrocarbons, 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 21 boundary on a 25-foot grid system (see Figure 2.1 or Plate 1, Appendix B). The survey map of Area 21 (Appendix A) shows those points within the area located by a registered land surveyor. Before sampling, all transverses of the grid system were cleared of trees and underbrush and the remaining sample locations were marked with wooden stakes.

The following sections describe the field activities and the analyses performed, present the results of the Phase 1 investigation, and compare these results with historical data. No conclusions are presented.

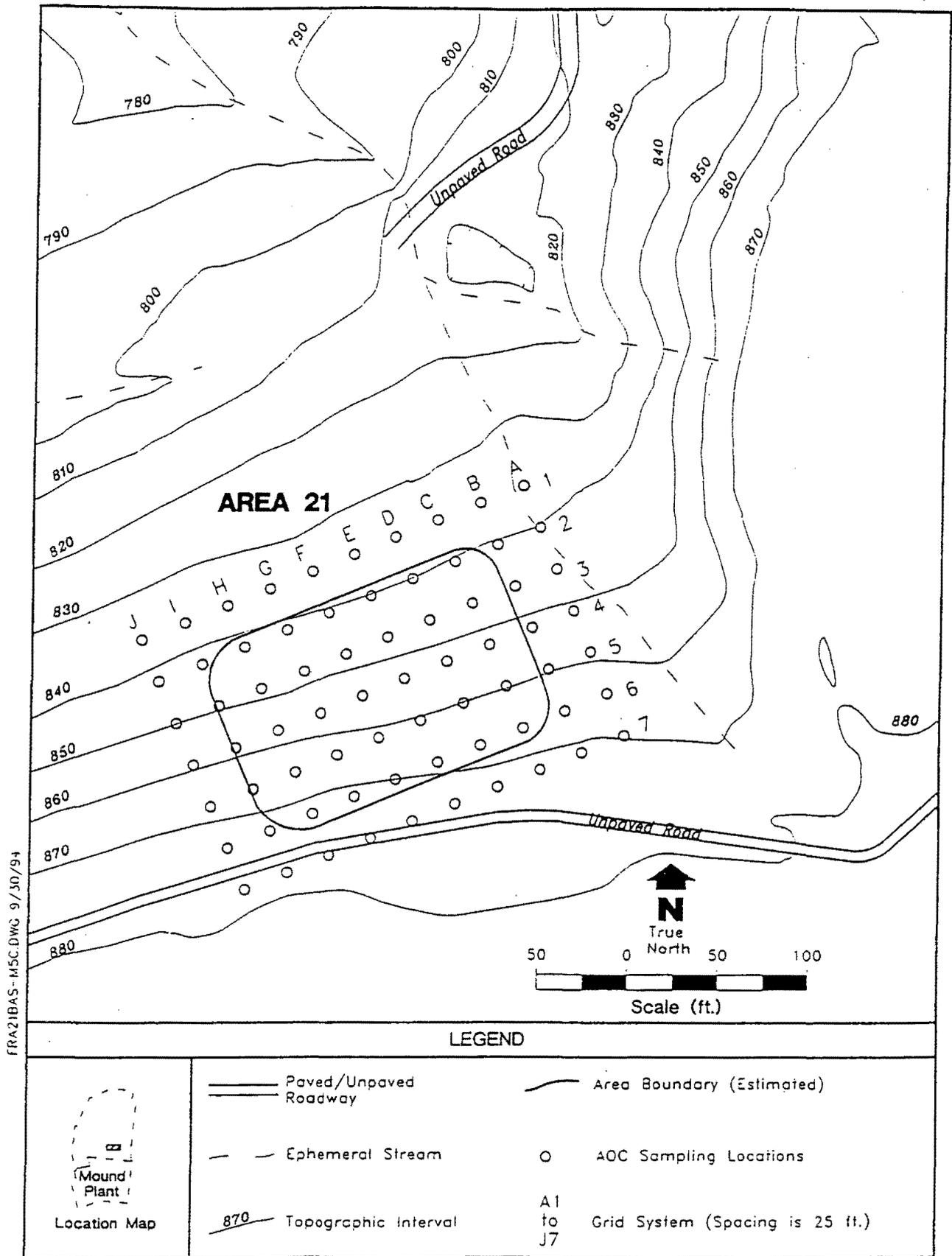


Figure 2.1. The Estimated Boundary and Established Grid System of Area 21

2.1. RADIOLOGICAL (FIDLER) SURVEY

2.1.1. Field Work Performed and Procedures

A FIDLER survey was performed at Area 21 on August 2, 1994, per the Mound Standard Operating Procedure (SOP) 6.7, Near Surface and Soil Screening for Low-Energy Gamma Radiation Using the FIDLER.

Before beginning the survey, Bicron FIDLER #3 (instrument #3228, probe #3432) was calibrated and the grid location J7 was established as the background station. 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 B). The standard deviations and the contamination criteria 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 21. The Out Channel detects low energy gamma rays and x-rays while Channel 1 primarily detects Pu-238 and Channel 2 primarily detects Th-232.

None of the 25 square foot grid blocks in Area 21 could be surveyed in a serpentine fashion due to the thick vegetation and heavy undergrowth. Therefore, Channel 1, Channel 2, and Out Channel readings were recorded at each stake after a one minute stabilization period. The FIDLER operator then walked between stakes perpendicular to Row 1, (i.e., F1 to F7, G1 to G7, etc. as shown in Figure 2.1) at a rate of 20 feet per minute in the Out Channel mode. No readings were recorded for the sweep, unless the contamination criterion (CC) for the Out Channel was exceeded. When this occurred, the FIDLER crew located the point of highest concentration in that area by identifying where the highest Out Channel reading was detected. Channel 1 and Channel 2 readings were taken at the point of highest concentration after a one minute stabilization period and recorded in the FIDLER Logbook. The FIDLER was then slowly moved radially around the point of highest concentration until the Out Channel reading dropped below the CC, thereby defining the area of elevated activity. The size of the that area was recorded by distance and direction from the point of highest concentration in the FIDLER Logbook (see Appendix B).

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 1993b). Two minor variances from SOP 6.7 involved check sources and scanning techniques.

The first 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 in a serpentine fashion, occurred due to the thick vegetation and heavy undergrowth covering Area 21. Instead, the screening was conducted at and between grid points, as described in Section 2.1.1.

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. One error was found in the calculations used to determine the FIDLER contamination criteria. These values were recalculated and compared to the collected data. After reviewing the data, several additional points in Area 21 were identified as having elevated radiological activity based on 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 1993c), and the Environmental Restoration Program Site-Specific Health and Safety Plan for OU5 Operational Area - Area 21. 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 B).

No accidents or safety violations occurred during the FIDLER survey at Area 21. On August 23, a health and safety surveillance was conducted; no deviations were reported.

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 the analytical results of soil samples from the Mound Plant Soil Screening Facility.

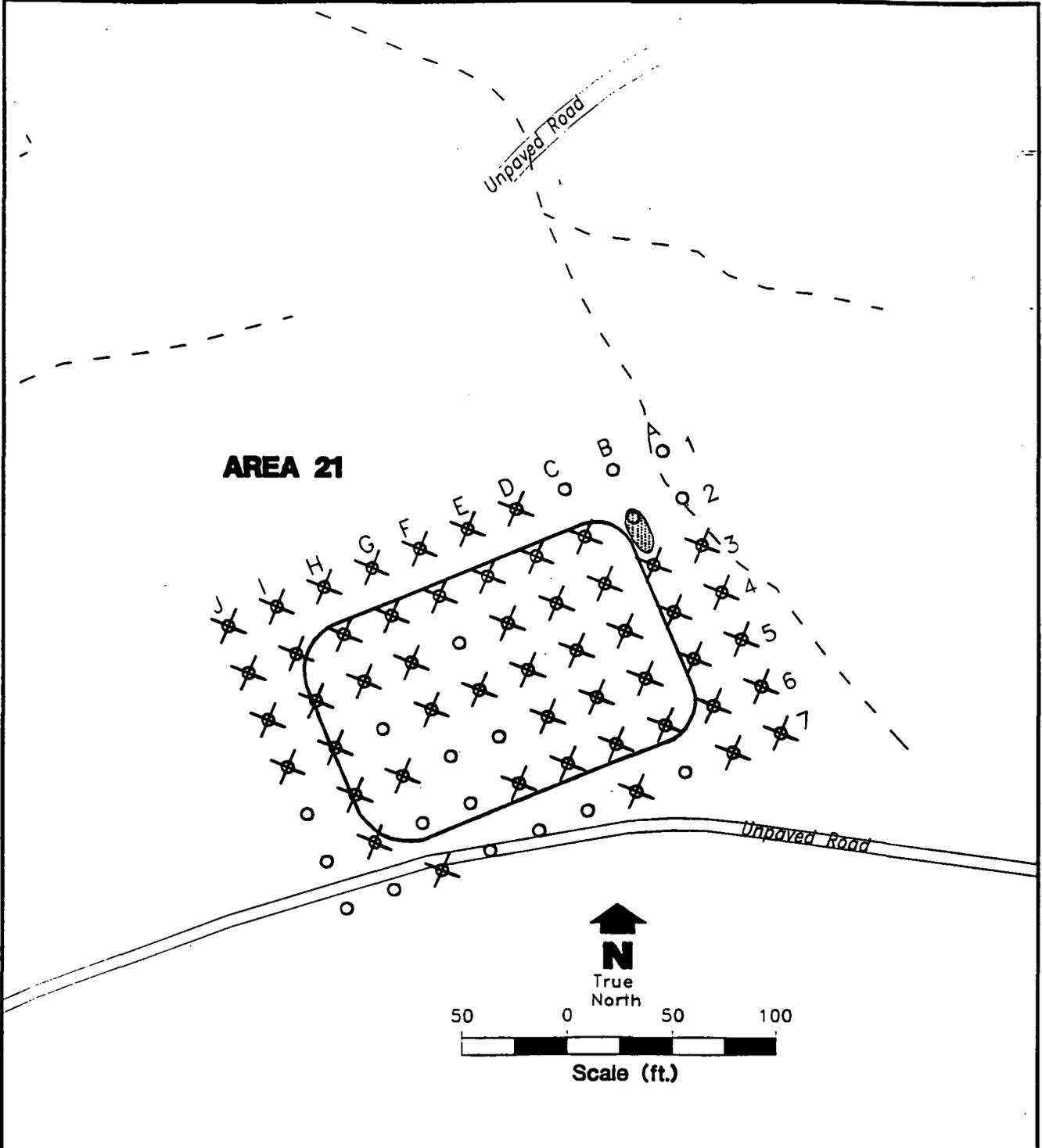
The FIDLER survey located several points and one area of elevated radiological surface activity as shown in Figure 2.2 and summarized in Table II.1. A total of 52 of the 70 survey points displayed elevated radiological activity. At location B2.5, an eight ft. by 15 ft. area of elevated radiological activity was found. Pu-238 was detected on Channel 1 at 215 counts per minute (cpm) and Th-232 was detected on Channel 2 at 22 counts per minute x 1000 (kcpm) in this area.

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. The data are summarized in Table II.2. Concentrations of Th-232 at or exceeding the Mound Plant detection limit of 2.0 pCi/g were not detected at any of the sample locations. Concentrations of Pu-238 at or exceeding the Mound Plant detection limit of 25 pCi/g were detected at 32 of the 70 sample locations. Figure 2.3 shows the locations where concentrations of Pu-238 equal or exceed 25 pCi/g and the concentration contours where Pu-238 exists at concentrations from 25-50 pCi/g. This information is summarized in Table II.2. The concentration of Pu-238 does not exceed 50 pCi/g in the estimated boundary of Area 21. Additionally, surface soil sample results indicate that Pu-238 might be present outside the estimated Area 21 boundary on the east side 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 estimated boundary of Area 21 from 1983 to 1985 during the Site Survey Project (Stought et al., 1988). Four core locations (drilled to a maximum depth of 60 inches) and 11 surface soil sample locations were analyzed for Pu-238 and isotopic thorium. Selected samples were also analyzed for tritium, cobalt-60, cesium-137, radium-226, and americium-241.

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LEGEND

<p>Mound Plant</p> <p>Location Map</p>	<p>Paved/Unpaved Roadway</p>	<p>Points of Elevated Radiological Activity</p>
	<p>Ephemeral Stream</p>	<p>Areas of Elevated Radiological Activity</p>
<p>Area Boundary (Estimated)</p>	<p>A1 to J7 Grid System (Spacing is 25 ft.)</p>	
<p>AOC Sampling Locations</p>		

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

Table II.1. Summary of Elevated Radiological Activity (FIDLER Survey)

Page 1 of 2

Location	Out Channel Reading (kcpm)	Out Channel CC (kcpm)
D1	12.0	11.6
E1	13.0	11.6
F1	12.5	11.6
G1	12.5	11.6
H1	12.0	11.6
I1	13.5	11.6
J1	13.5	11.6
B2	18.0	11.6
B2.5	26.0	11.6
C2	12.5	11.6
D2	12.0	11.6
E2	12.5	11.6
F2	12.5	11.6
G2	12.5	11.6
H2	12.0	11.6
I2	13.0	11.6
J2	13.5	11.6
A3	12.0	11.6
B3	12.0	11.6
C3	13.0	11.6
D3	12.5	11.6
E3	13.5	11.6
G3	12.0	11.6
H3	13.0	11.6
I3	13.5	11.6
J3	13.0	11.6
A4	13.0	11.6
B4	12.0	11.6
C4	13.0	11.6
D4	13.0	11.6

Table II.1. Summary of Elevated Radiological Activity (FIDLER Survey)
Page 2 of 2

Location	Out Channel Reading (kcpm)	Out Channel CC (kcpm)
E4	13.5	11.6
F4	12.0	11.6
G4	12.5	11.6
I4	12.0	11.6
J4	12.5	11.6
A5	12.5	11.6
B5	12.5	11.6
C5	12.0	11.6
D5	12.5	11.6
E5	12.0	11.6
H5	12.0	11.6
I5	12.5	11.6
A6	12.0	11.6
B6	12.5	11.6
C6	12.5	11.6
D6	12.5	11.6
E6	13.0	11.6
F6	12.0	11.6
I6	12.0	11.6
A7	12.0	11.6
B7	12.5	11.6
D7	12.0	11.6
H7	12.0	11.6

CC contamination criteria
kcpm counts per minute X 1000

**Table II.2. Summary of Elevated Surface Soil Radiological Activity
(Soil Screening)
Page 1 of 2**

Grid Location*	Mound Soil Screening Facility Data	
	Plutonium-238 (pCi/g)	Thorium-232 (pCi/g)
A3	29	ND
A4	40	ND
A5	25	ND
A6	33	ND
B1	25	ND
B4	30	ND
C2	25	ND
C3	28	ND
C4	43	ND
C5	28	ND
C6	50	ND
D1	27	ND
D2	30	ND
D5	32	ND
D6	31	ND
E4	28	ND
E5	34	ND
F2	26	ND
F4	26	ND
F6	43	ND
H1	37	ND
H2	40	ND
H3	27	ND
H6	33	ND

**Table II.2. Summary of Elevated Surface Soil Radiological Activity
(Soil Screening)
Page 2 of 2**

Grid Location ^a	Mound Soil Screening Facility Data	
	Plutonium-238 (pCi/g)	Thorium-232 (pCi/g)
I2	25	ND
I3	37	ND
I4	34	ND
I5	31	ND
I7	35	ND
J1	36	ND
J2	34	ND
J6	37	ND

a - See Figure 2.2 for grid location.

ND - Radiological contamination not detected above detection limit.

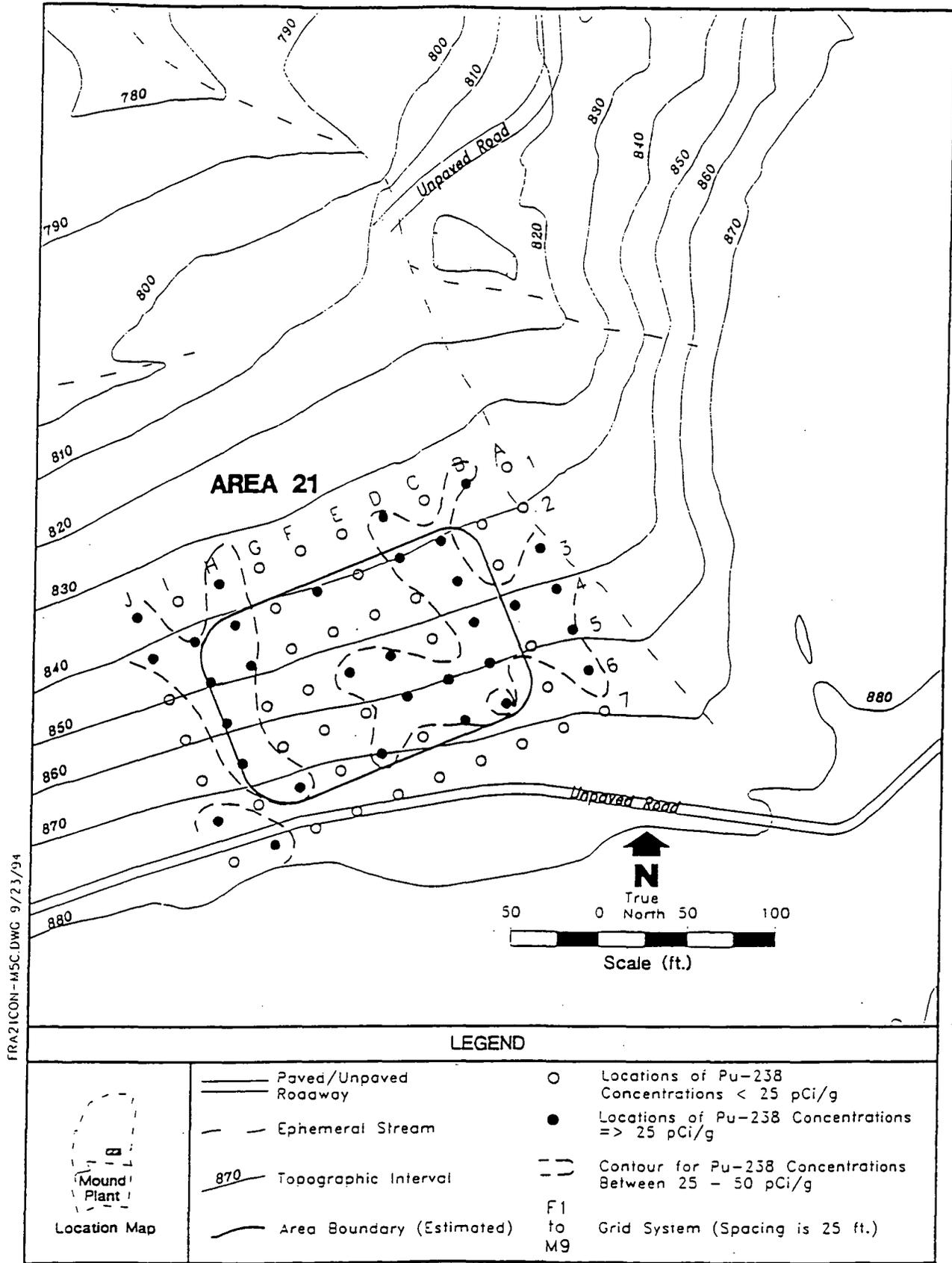


Figure 2.3. Locations of Elevated Surface Soil Radiological Activity (Pu-238)

The results of the surface soil sampling conducted under the Site Survey Project are presented in Table II.3 of this report (DOE 1992b). The corresponding core and surface soil sampling locations are shown in Figure 2.4.

During the Site Survey Project, cesium-137 was detected in several Area 21 soil samples, with a maximum concentration of 31 pCi/g measured in the sample taken at 60 inches at core location C0165. Pu-238, tritium, and radium-226 were also detected in several soil samples at low levels (1.12, 0.77, and 1.2 pCi/g respectively). Thorium and americium-241 were not detected in any of the soil samples collected. No indication of radium-226 was found during the evaluation of the data included in the Stought report for the OU9 Site Scoping Report, Volume 3: Radiological Site Survey (DOE 1992b).

The results from the soil sample screening of Area 21 during the 1994 Phase I investigation clearly indicate the presence of Pu-238 in the surface soil. Pu-238 was detected at levels higher than 25 pCi/g at 32 of the 70 sample locations (see Figure 2.3). The results are not consistent with the results for Pu-238 reported in the Mound Site Survey Project which were very low (see Table II.3). Th-232 was not detected at levels above 2.0 pCi/g in either survey.

The radiological survey of the Phase 1 investigation does not clearly indicate the areal extent of Area 21. The estimated area of Area 21 should be expanded for future phase activities.

2.2. SOIL GAS SURVEY

2.2.1. Field Work Performed and Procedures

A soil gas survey was performed at Area 21 from June 23 to August 2, 1994 per the OU5 QAPjP, SOP for Petrex Environmental Surveys [Attachment 1] (DOE 1993b). The survey was completed over the grid system established for Area 21 (see Figure 2.1 or Plate 1, Appendix B).

2.2.1.1. Soil Gas Sampler Installation

Two sets of time calibration samplers (timers) and 25 data samplers were installed on June 23, 1994. The remaining 45 samplers were installed on June 27, 1994. Locations of samplers and timers are shown in Appendix D, Plate 1. Samplers and timers were installed at depths between eight and 12 inches using an

**Table II.3. Summary of Historical Radiological Data Collected in Area 21
(Mound Site Survey Project, 1983-1985)
Page 1 of 2**

Sample Location ^a	Coordinates		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)
	South	West										
S0740	3250	3100	2997	10-83	0	0.54	b	0.77	LDL	29	1.2	LDL
S0745	3285	3010	2999	10-83	0	1.12	b	0.64				
S0747	3295	3010	9794	06-85	0	NR	NR			5.0 ^c		
S0644	3275	2970	6558	08-84	0	NR	NR		LDL ^c	29 ^c	1.2 ^c	LDL ^c
S0645	3290	2990	9789	06-85	0	NR	NR			28 ^c		
C0173	3250	3000	10436	08-85	18	NR	NR		LDL	6.7	0.8	LDL
			10437	08-85	36	NR	NR		LDL	5.6	0.8	LDL
			10438	08-85	54	NR	NR		LDL	1.9	0.9	LDL
			10439	08-85	60	NR	NR		LDL	9.7	0.9	LDL
C0176	3310	3010	10433	08-85	18	NR	NR		LDL	2.2	0.8	LDL
			10434	08-85	36	NR	NR		LDL	3.1	0.7	LDL
			10435	08-85	54	NR	NR		LDL	1.2	0.7	LDL
C0177	3310	3090	10444	08-85	18	NR	NR		LDL	2.3	0.9	LDL
			10445	08-85	36	NR	NR		LDL	5.3	0.9	LDL
			10446	08-85	54	NR	NR		LDL	4.5	0.9	LDL

**Table II.3. Summary of Historical Radiological Data Collected in Area 21
(Mound Site Survey Project, 1983-1985)
Page 2 of 2**

Sample Location ^a	Coordinates		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)
	South	West										
C0165	3325	2980	10440	08-85	18	NR	NR		LDL	3.0	0.9	LDL
			10441	08-85	36	NR	NR		LDL	LDL	1.0	LDL
			10442	08-85	54	NR	NR		LDL	2.5	1.0	LDL
			10443	08-85	60	NR	NR		LDL	31	0.7	LDL

a-A "C" designates core locations and an "S" designates surface locations. 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.

c-These results could not be confirmed because they were not listed in the gamma spec results included at the end of Appendix F.

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

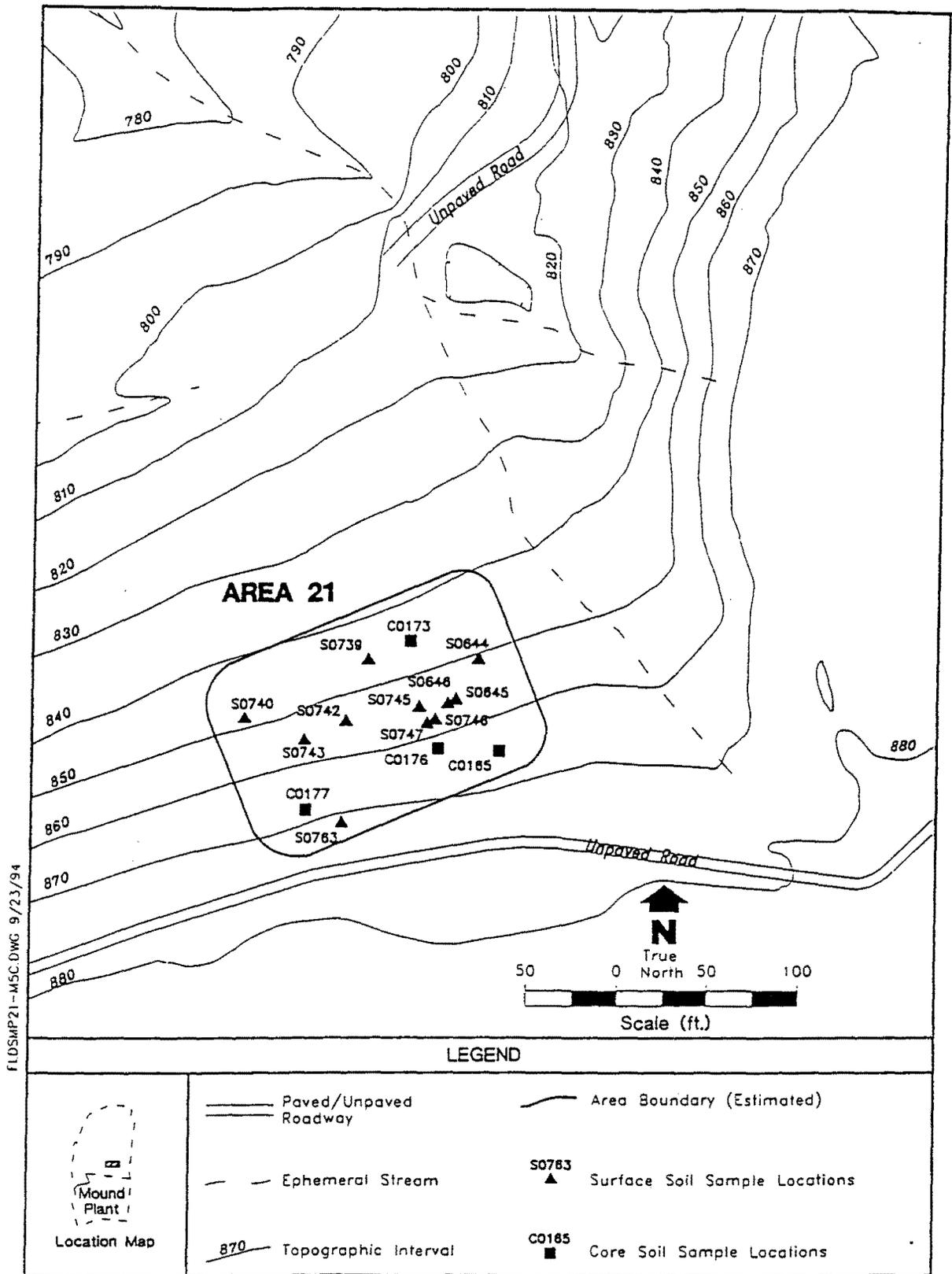


Figure 2.4. Sampling Locations for Historical Radiological Data Collected in Area 21 (Mound Site Survey Project, 1983-1985)

electric hammer drill and an 18 x 1.5 inch steel/tungsten carbide tipped drill bit. After each insertion, 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 the placement of all samplers and timers. Surface soil samples were collected from each location 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 June 30, 1994, one timer from each of the two sets of timers was extracted, checked for radiological contamination, and sent to Northeast Research Institute LLC (NERI) for analysis. The timer analyses indicated low levels of petroleum hydrocarbons. On July 7, 1994, a second timer from each of the two sets of timers was extracted, checked for radiological contamination, and sent to NERI for analysis. Based on the analyses of the second set of timers, NERI recommended an exposure time of three and 1/2 to four weeks for the samplers. On July 28, 1994 all but one of the samplers were extracted. Due to soil conditions one sampler (E7) broke and the sample wires were not recovered. The samplers were wiped and prepared for shipment. On August 2, 1994, the samplers were sent to NERI for analysis.

2.2.2. Quality Assurance Summary Report

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] (DOE 1993b) and the FSP (DOE 1993b). These variances included decontamination procedures, 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. Two minor variances from the FSP affected timers and travel blanks. The first variance was a decrease in the number of timers installed in

Area 21. The FSP requires five timers for an area this size, whereas NERI stated that two timers were sufficient.

The second variance from the FSP was the use of the travel blanks. The FSP requires that travel blanks be returned with the timers and samplers, 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 21 was received from NERI on September 16, 1994. Sample locations shown on Plate 1 (Appendix D) of the NERI report were checked against the field map to confirm that all sampling locations were correctly plotted; no errors were found. Ion count values for aromatic hydrocarbons, volatile halogenated compounds, semi-volatile hydrocarbons, and petroleum hydrocarbons, listed in Table 1 of Appendix D were checked for plot accuracy on Plates 2 through 5, (also in Appendix D); no errors were found.

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 1993b), and the Environmental Restoration Program Site-Specific Health and Safety Plan for OU5 Operational Area - Area 21. All soil gas locations were screened using a FIDLER to avoid digging in radioactively 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 B).

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 21 and the immediate vicinity, NERI was instructed to provide analytical data for four general classes of compounds to assess the potential for the presence of these compounds below the surface:

- total aromatic hydrocarbons;
- total semi-volatile hydrocarbons;
- total petroleum hydrocarbons; and
- total halogenated compounds.

2.2.4.1. Distribution of Total Aromatic Hydrocarbons

Total aromatic hydrocarbons are reported as the combined levels of C₆ to C₁₅ aromatic (benzene based) hydrocarbon compounds detected in the soil gas samples. These aromatics are common constituents of petroleum fuels, heating oils, some light lubricating oils, and many other petroleum based products.

The soil gas samplers for Area 21 were analyzed after a four-week field exposure. When compared to the qualitative detection capability of the analysis method, the levels of aromatic hydrocarbons in the soil gas samples for Area 21 were low. Elevated levels of aromatics are present principally in the southern half of Area 21 (see Appendix D, Plate 2). The majority of the samples contained only light weight aromatics benzene (C₆) and toluene (C₇). Very few samples contained C₉ and heavier aromatics. This mixture of aromatics is typical of the composition of vapor that may be released from dilute levels of the residue of highly weathered and degraded fuel-like petroleum products. Along with elevated levels of aromatics, samples #104 and #122 (grid coordinates H7 and I6, respectively) included elevated levels of light weight alkanes and cycloalkanes/alkenes.

2.2.4.2. Distribution of Total Semi-volatile Hydrocarbons

Total semi-volatile hydrocarbons are reported as the combined response to naphthalene, C₁₁ through C₁₅ alkyl naphthalenes, and C₁₂, C₁₄, and C₁₆ polycyclic hydrocarbons (including acenaphthene, anthracene, and pyrene). These compounds are constituents of creosote, coal, tar, and other heavy, high boiling point fraction petroleum products.

The only semi-volatile hydrocarbons identified in the samples collected at Area 21 were naphthalene and C₁₁ through C₁₃ alkyl naphthalenes (see Appendix D, Plate 3). Elevated levels of these compounds were detected primarily at sampling points #104 and #152 (grid coordinates H7 and G3, respectively) in the western half of Area 21. Lower levels of naphthalenes were detected in soil gas at sampling points nearby.

2.2.4.3. Distribution of Total C₅ to C₁₁ Petroleum Hydrocarbons

Total C₅ and C₁₁ petroleum hydrocarbons reported include alkanes, cycloalkanes, alkenes, cycloalkenes, dienes, aromatics, and naphthalene and alkyl naphthalenes. These compounds together make up the bulk of most petroleum fuels, oils, and lubricants.

Elevated levels of C₅ to C₁₁ petroleum hydrocarbons occurred in soil gas principally in the southern and southwestern portion of Area 21. The distribution of total C₅ to C₁₁ petroleum hydrocarbons, see Plate 4 (Appendix D), was similar to that of aromatics alone (discussed in subsection 2.2.4.1. above). This indicates that most of the soil gas samples were nearly uniform in composition; only minor differences were recorded. Specifically, soil gas samples #122, #130, and #153 (grid coordinates B6, D2, and G2, respectively) contained more prominent levels of alkanes, cycloalkanes, and alkenes.

Given the high sensitivity of the sampling method, and the extended exposure time, it is apparent that total C₅ to C₁₁ petroleum hydrocarbons in the soil gas are present at very low levels.

2.2.4.4. Distribution of Total Halogenated Hydrocarbons

Total halogenated hydrocarbons are reported as the combined levels of trichlorofluoromethane (Freon-11), trichloroethene (TCE), tetrachloroethene (PCE), and dichlorobenzene(s) (DCB) in soil gas. TCE, PCE, and the 1,3- and 1,4-isomers of DCB are liquids commonly used as solvents and cleaning agents for petroleum based products.

The majority of elevated responses to total halogenated hydrocarbons shown on Plate 5 (Appendix D) principally reflect the presence of PCE in the soil gas. However, three of the four sampling points (highlighted on Plate 5) did not solely exhibit the occurrence of PCE. Samples #122 and #130 (grid coordinates I6 and A1, respectively) contained Freon-11, TCE, and PCE. Sample #154 (grid coordinate G1) contained DCB and PCE. Each of the four points that exhibited the highest levels of halogenated hydrocarbons occurred in isolated locations on the periphery of Area 21.

2.2.5. Comparison with Historical Chemical Data

No historical data is available on possible Resource Conservation and Recovery Act (RCRA) hazardous constituents (chemical contamination) in Area 21 (DOE 1993d). Therefore, no comparison with the Phase 1 investigation results can be made.

3. SUMMARY

The results of the reconnaissance (radiological and chemical) surveys conducted in Area 21 are summarized in this section.

The results of the radiological surveys (FIDLER and soil screening) are summarized below:

- The FIDLER survey located 52 points and one area of elevated radiological activity in Area 21.
- Soil screening analysis of surface samples indicates that Pu-238 might be present outside the estimated Area 21 boundary on the east side. These results are not consistent with the results reported for Pu-238 in the Mound Site Survey Project. Th-232 was not detected in either survey.

The FIDLER survey located several points of elevated radiological activity where neither Pu-238 nor Th-232 were found during the soil screening analysis. This suggests the presence of other gamma emitting radionuclides at these locations. Radium, actinium, and cesium-137 are also suspected contaminants which were not part of the Phase 1 sampling scheme. Gammaspectroscopy can be utilized to determine if these and other suspected radiological contaminants are present in Area 21 during the sampling conducted under the Phase 2 investigation.

The soil gas survey conducted in Area 21 indicates the presence of chemical contaminants as summarized below:

- Elevated levels of total aromatic hydrocarbons (primarily C₆ and C₇) were detected in the southern half of Area 21.
- Elevated levels of semi-volatile hydrocarbons (primarily naphthalene and C₁₁ - C₁₂ alkyl naphthalenes) were detected at grid coordinates H7 and G3 in the western half of Area 21.
- Elevated levels of petroleum hydrocarbons (primarily C₅ to C₁₁) were detected in the south and southwestern portions of Area 21.

- Elevated levels of halogenated hydrocarbons (PCE, TCE, Freon-11, and DCB) were detected in isolated locations along the periphery of Area 21.

While specific conclusions cannot be made from these findings, the results may be used to direct a Phase 2 investigation of Area 21.

4. REFERENCES

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