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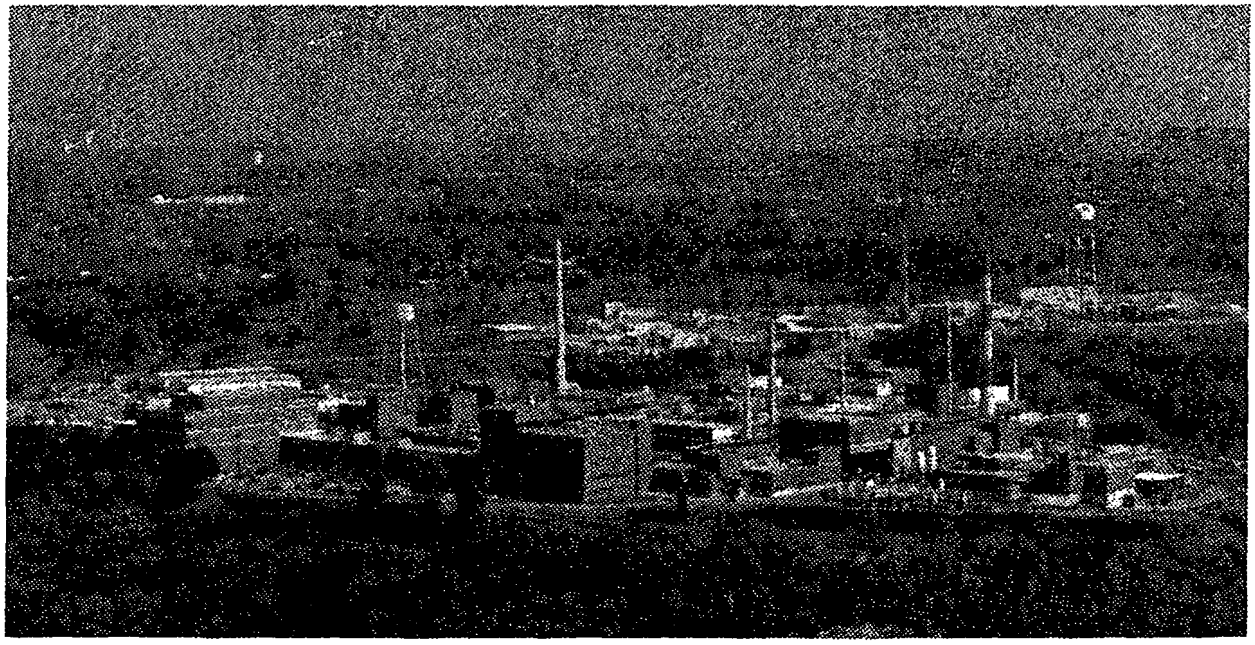
MOUND

Environmental
Restoration
Program

MOUND PLANT
Potential Release Site Package
PRS # 75



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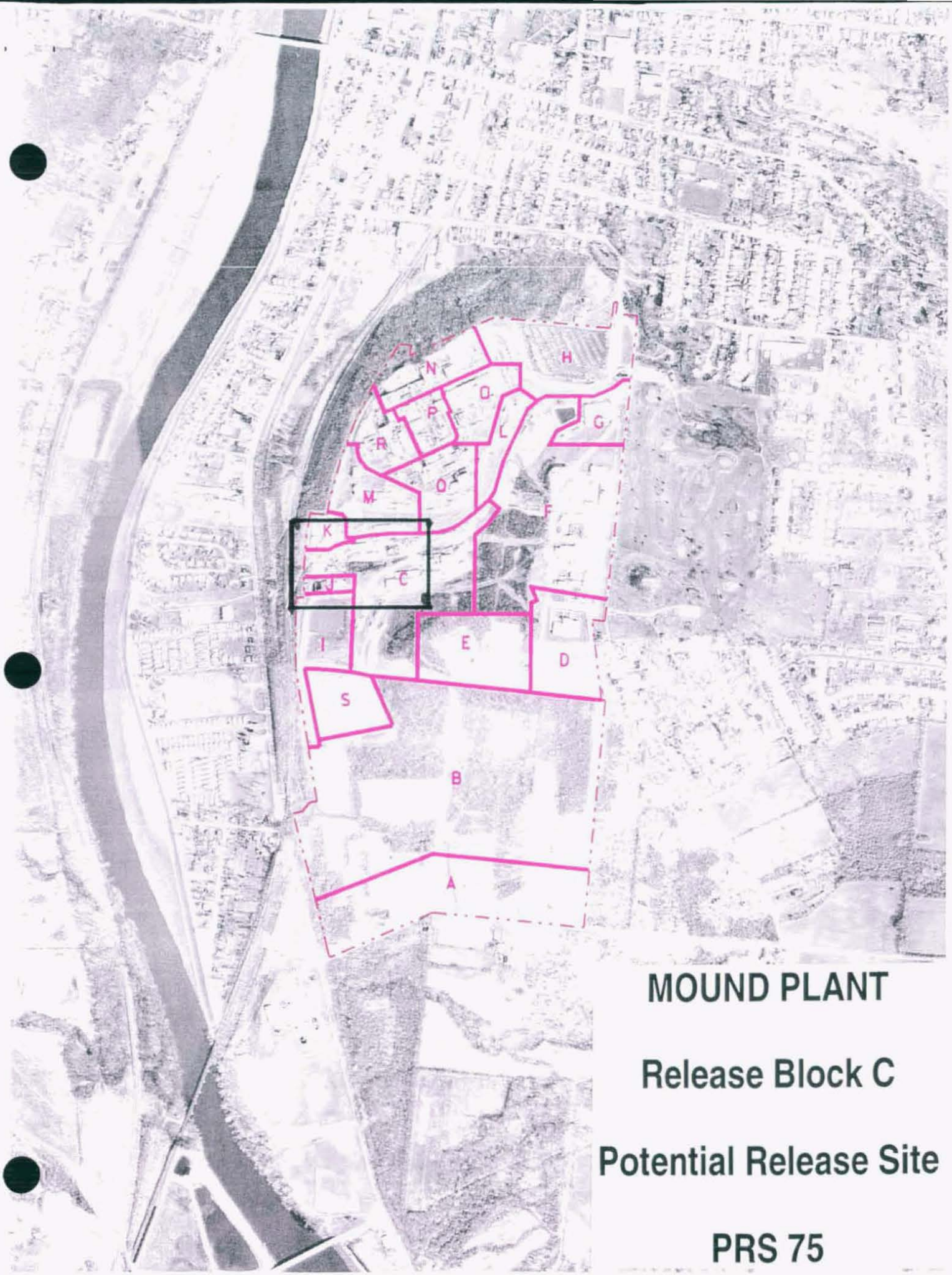

MOUND PLANT

Release Block C

Potential Release Site

PRS 75

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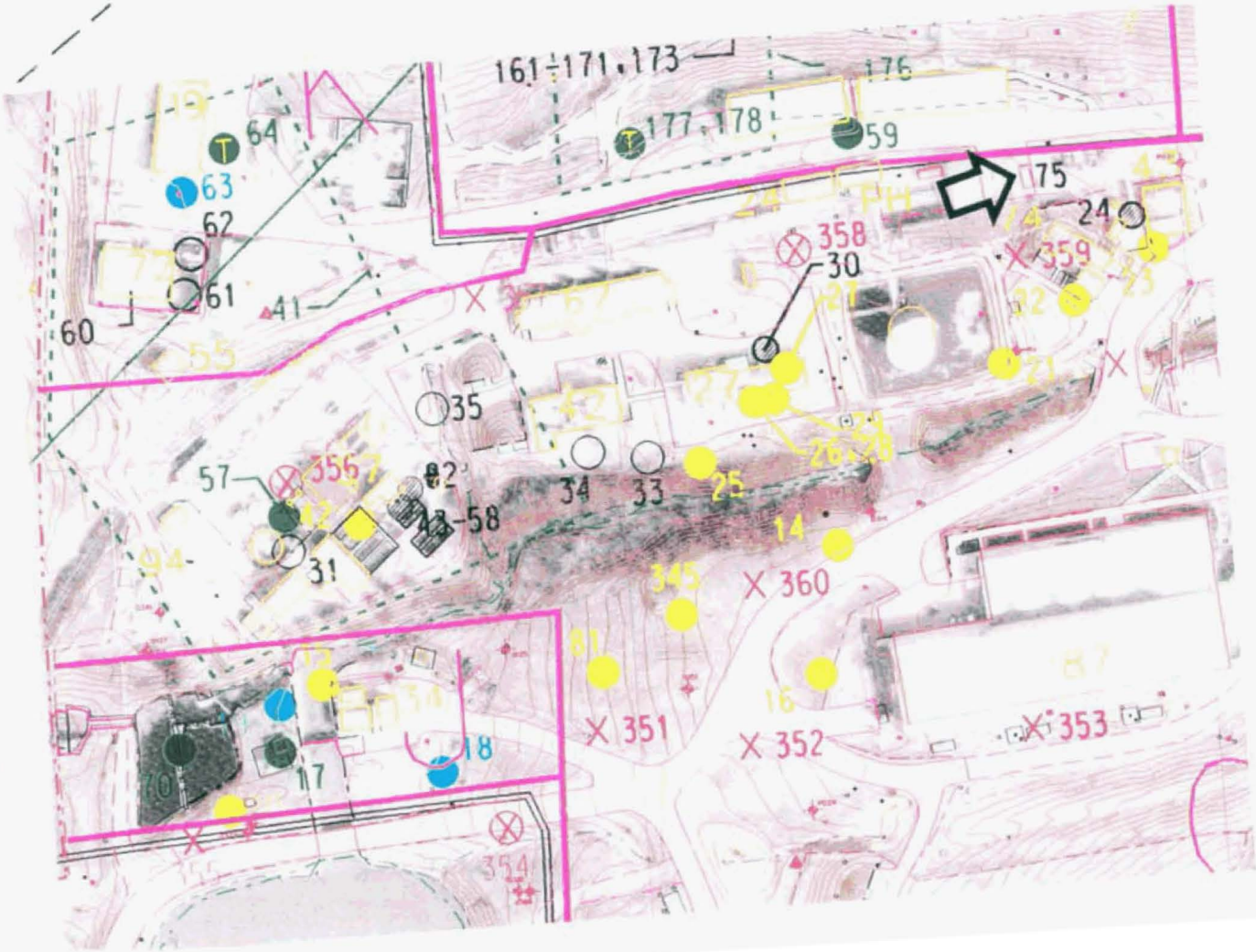
MOUND PLANT

Release Block C

Potential Release Site

PRS 75



75

PRS 75

PRS HISTORY:

Potential Release Site (PRS) 75 is a soils area located in the vicinity of the railroad siding near PH Building, in the lower valley area of the plant. The siding has been used for loading and unloading materials and wastes for the polonium, thorium, and plutonium projects in the 1950's, 60's and 70's.[2, 3]

In 1955, approximately 1,650 tons of thorium sludge, packaged in over 6,000 55-gallon drums were shipped to Mound, many in deteriorated conditions. The drums were unloaded at the siding or at historic Warehouse 9.[2, 3] Many of the railroad cars required decontamination to remove residual sludge materials and were washed at the siding.

From the early 1970's to the late 1980's, Mound used the railroad siding to ship packaged plutonium wastes via special railcars to out of state disposal facilities.[3] No record of spill or contamination at the siding is known from these activities.

Between 1982 and 1986, approximately 5,000 feet of track leading up to Warehouse 9, were removed as part of the Waste Transfer Line Removal (reference PRS 300).[4]

The rail siding is scheduled to become an active site as part as CERCLA's OU4 removal program where contaminated soil from the Miami-Erie Canal will be shipped out by rail.

CONTAMINATION:

I. RADIOLOGICAL

A) In June 1987, two soil samples were taken (depth unknown) near the end of the railroad track (exact location unknown) and analyzed by the Mound soil screening facility.[2, 4, 7] Results showed:

Contamination	Maximum Concentration Detected	Guideline Criteria
Thorium-232	107 pCi/g [2, 4] (in soil at unknown depth)	5 pCi/g (in soil surface) [5] 15 pCi/g (in soil subsurface) [5]
Plutonium-238	573 pCi/g [2, 4] (in soil at unknown depth)	25 pCi/g (Mound ALARA in soil)

B) In 1994, the OU5, Phase I RI/FS Operational Area Sampling[4] took 8 subsurface soil samples from the soils surrounding Building 24 and 3 surface samples in the vicinity of the south fork of the train track. The samples were analyzed for plutonium and thorium by the Mound Soil Screening Lab. Results showed:

Contaminant	Maximum Concentration Detected	Guideline Criteria
Thorium-232	6.7 pCi/g (in soil)[6]	5 pCi/g (in surface soil)[5] 15 pCi/g (in subsurface soil)[5]
Plutonium-238	38 pCi/g (in soil)[6]	25 pCi/g (Mound ALARA in soil)

NOTE: pCi/g = picocurries/gram, ALARA = As Low As Reasonably Achievable

C) In February 1996, a FIDLER scan was performed over an area of soil at the end of the railroad track (see map in attached reference section).[6, 7] Five surface soil samples were taken. Three of the five samples were taken from the locations with the highest FIDLER reading. The samples were analyzed for radionuclides by the Mound soil screening facility.[6, 7] Results showed:

Contamination	Maximum Concentration Detected	Guideline Criteria
Thorium-232	79 pCi/g (in soil surface)[6]	5 pCi/g (in soil surface)[5]
Radium-226	14 pCi/g (in soil surface)[6]	5 pCi/g (in soil surface)[5]
Uranium-238	13.5 pCi/g (in soil surface)[6]	5 pCi/g (in soil)[8]

II. OTHER

In 1994, a PETREX soil gas study of the PRS 75 area found elevated aromatic and petroleum hydrocarbon ion counts near the end of the southern fork of the railroad track.[4]

READING ROOM REFERENCES:

1) OU9, Site Scoping Report: Volume 12 - Site Summary Report, December 1994. (pages 6-7.1)
2) OU9, Site Scoping Report: Volume 3 - Radiological Site Survey, June 1993. (pages 8-15)
3) OU9, Site Scoping Report: Volume 7 - Waste Management, Final, February 1993. (pages 16-20)
4) OU5, Operational Area Phase I Investigation, Non-AOC Field Report, Final, June 1995. (pages 21-25)
8) Risk Based Guideline Values, December 1995, Revision 0. (pages 36-37)

OTHER REFERENCES:

5) Code of Federal Regulations, 40 CFR 192.12 and 40 CFR 192.41.
6) EG&G Interdepartment Correspondence, "Railroad Spur Work Stoppage", February 1996. (pages 26-35)
7) Phone interview with EG&G Health Physics supervisor Roy Mowen, February 1996.

PREPARED BY:

George W. Wooten, Member of EG&G Technical Staff
George Liebson, Member of EG&G Technical Staff

MOUND PLANT
PRS 75
SOIL CONTAMINATION
HISTORICAL RAILROAD SPUR AREA

RECOMMENDATION:

Potential Release Site (PRS) 75 is a soils area in the vicinity of the railway siding. This PRS was created due to its use as a radioactive drum storage, loading, unloading, and repackaging area. Plans call for the rail siding to be considered an active site, instrumental in the shipment of contaminated soils from the Mound plant.

Mutiple soil samples taken from the PRS 75 area have recorded concentrations of thorium-232 and plutonium-238 in excess of guideline criteria. Radium-226 and uranium-238 has also been found in excess of guideline in at least one sample. Plutonium-238 has been reported as high as 573 pCi/g (Mound ALARA guideline criteria is 25 pCi/g). Thorium-232, radium-226, and uranium-238 have been reported as high as 107 pCi/g, 14 pCi/g, and 13.5 pCi/g, respectively (regulatory guideline criteria for thorium-232, radium-226, and uranium-238 is 5 pCi/g).

Therefore, due to soil radiological concentrations which present an unacceptable risk to potential future construction activities at PRS 75, a <u>RESPONSE ACTION</u> is recommended.

CONCURRENCE:

DOE/MB: Arthur W. Kleinrath — 11/21/96
Arthur W. Kleinrath, Remedial Project Manager (date)

USEPA: Timothy J. Fischer — 11/21/96
Timothy J. Fischer, Remedial Project Manager (date)

OEPA: Brian K. Nickel — 11/21/96
Brian K. Nickel, Project Manager (date)

SUMMARY OF COMMENTS AND RESPONSES:

Comment period from _____ to _____

No comments were received during the comment period.

Comment responses can be found on page _____ of this package.

Page R

REFERENCE MATERIAL
PRS 75

Document Control No. _____

Environmental Restoration Program

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

MOUND PLANT
MIAMISBURG, OHIO

December 1994

Final

U.S. Department of Energy
Ohio Field Office

EG&G Mound Applied Technologies

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	Ref
72	Area 13, Polonium-Contaminated Wood from Dayton Unit IV	H-7	Historical	Polonium-210	1, 4, 5	None Suspected	S	6	14	Tables B.1 and B.9	6
73	Evaporator Storage Area (AKA Lower storage area)	H-7	Historical	Actinium-227, Cesium-137, Radium-226	4				14, 15, 16	Table B.9 RSS[c] Locations S0692 and S0697 (Appendix E in Ref. 6)	6
74	Quonset Hut (former)	H-7	Historical	Polonium-210, cobalt-60, bismuth					14	Table B.9 RSS[c] Locations S0684, S0685, and S0689 (Appendix E in Ref. 6)	6
75	Railroad Siding	G-6 G-7	Inactive	Thorium and daughters	4	Suspected thorium	S	4	14	Table B.1	6
76	Warehouse 9	G-7	Historical	Thorium-232	4	Suspected thorium	S	4	No Data		
77	Warehouse 10	G-9	Historical	Polonium-210	4	None suspected			No Data		
78	Warehouse 13	G-9	Historical	Reactor waste including Strontium-90, Cesium-137, and Nickel-63	4	Cesium 137	S	4	No Data		
79	Warehouse 15	E-8	Historical	Radioactive waste Plutonium-238 wastes and sludge Thorium sludge constituents (c)	4	Suspected	S	4	See Area 7 (No. 66)	Table B.9	6
	Warehouse 15A	F-8	Historical	Plutonium-238, thorium	4						
	ng Mud Drum Storage Areas (3 locations)	H-5 I-4	Historical	Barium	4, 5, 18	None Suspected			No Data		
	ilding 57 Diesel Fuel rage Tank (Tank 118)	H-5	In service	Diesel fuel	3				No Data		
	ling 2 Propane Storage Tank (Tank 122)	H-7	Inactive	Propane	3				No Data		
	ilding 56 Diesel Fuel rage Tank (Tank 223)	F-5	Historical	Diesel fuel	3	Tank Removed			No Data		

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 1992i "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: DGC

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

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	--	288	--	--	--	--	--	--	--	--
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	0.6	LDL	--	--	--
Plutonium-238 Hot Spots	61.0	<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 (Daines 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

surrounding the storage areas produced soil contamination. Some wash water produced during repackaging activities were diluted and discharged via the storm sewer to the Great Miami River.

Storage areas for the thorium feed material included Area 3, Area 9, Warehouse 9, Warehouse 15, and Building 21 located in Area 1. Old Warehouse 9, along the railroad spur, received drums directly from the boxcars and served as an interim storage facility. Boxcars were washed and decontaminated as they sat on the spur. Warehouse 9 was razed and the walls sold as scrap, except the contaminated wooden floor of the building, which was burned in place. Much of the railroad spur is no longer visible. The upper portion that was adjacent to Warehouse 9 is now largely covered over with new soil and asphalt. Some of the track was removed during the excavations for the Area 19 D&D of the waste transfer lines in 1986.

Initially, drums were moved from Warehouse 9 to Warehouse 15 (previously located in the area now known as Area 7) where the sludges were repackaged into new 55-gallon drums. When radiation reached unsafe levels as a result of the repackaging, this activity was transferred to Areas 3 and 9, where the work was performed in the open air. The drums were also stored in these areas.

Repackaging continued almost annually until July 1964 when a permanent bulk thorium sludge storage facility, Building 21, was constructed (MRC, 1973). Fugitive dust was generated by dumping the material into the bulk storage bins through the roof. This dust contaminated soil north of the building. This area is now known as Area 1.

Storage and repackaging areas investigated in the Site Survey Project include Areas 1, 3, 7, and 9. Descriptions of these areas are in the subsections that follow. Warehouse 9 and the railroad spur was not investigated as part of the Site Survey Project, except the area where the waste transfer line crossed the old tracks (Plate 1).

No thorium sludge or ores are known to have been buried or disposed of on the site. Most of the surficial soil contaminated with thorium is due to material spills and fugitive dust emissions associated with the repackaging and storage efforts. The major isotope of concern from the thorium sludge is thorium-232. [Note - Soils on Mound Plant are known to be locally contaminated with thorium-230, but this would not be from the thorium sludge materials. Thorium-230 is largely a decay product of uranium and is discussed in this report with the uranium ore processes in section 6.] Corroded drums from the repackaging of thorium sludges were collapsed and buried in Areas 2 and 7, in the lower and upper valley areas, respectively. Soils with low-level thorium contamination do exist in many areas and these areas generally have a complex history of surficial contamination from the redrumming activities and shallow excavation. It is known that soils from Areas 1 and 9 were s

SOIL SCREENING FACILITY BUILDING 30
MRC MOUND
WELL A & B

SAMPLE TYPE CONT
SAMPLE CONDITION WET
DATE SCREENED 06/30/87
DATE COLLECTED 06/30/87
SAMPLER NAME & HP C. SMITH 3810

WELL: ID.	SAMPLE NUMBER	GRAMS	WEIGHT FACTOR	GROSS CTS TH-232	GROSS CTS PU-238	TH 232 pCi/g	PU 238 pCi/g	GRID & SAMPLE LOCATION
A	15705	300	0.167	7797	1654	13.0	16	PLD 55 WEST
A	15706	300	0.167	62461	14067	107.3	573	RAILROAD LOADING BY TR 15

Doug -
these are the two samples Chet
& I told you about
Roy Mowen

PREPARED BY : TROY J. FEARSON III
ALL SOIL SAMPLE ARE RAN FOR 400 SEC UNLESS SPECIFIED IN THIS REPORT .

TAKEN FROM OU3 VOL 3 APPENDICES

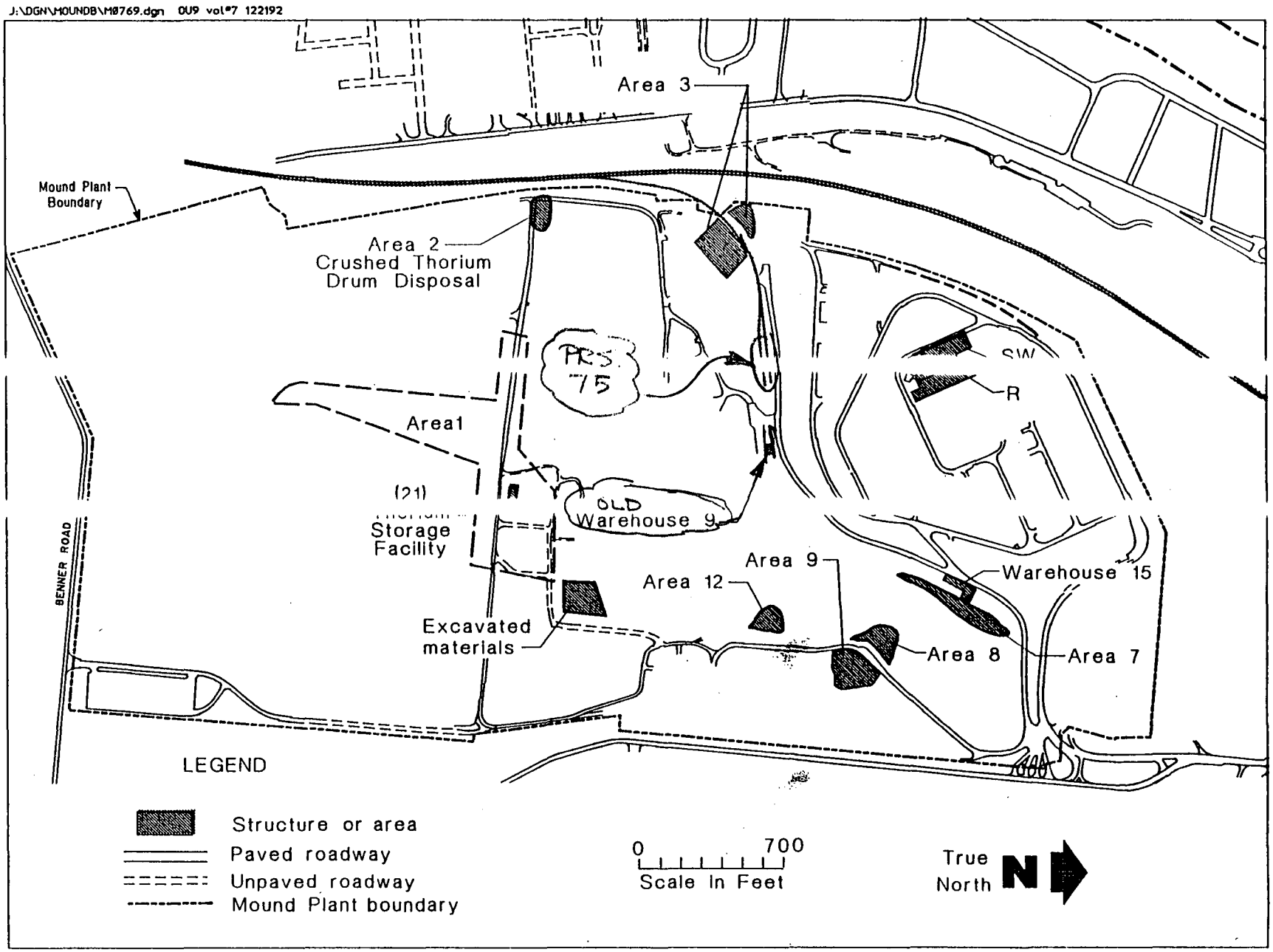
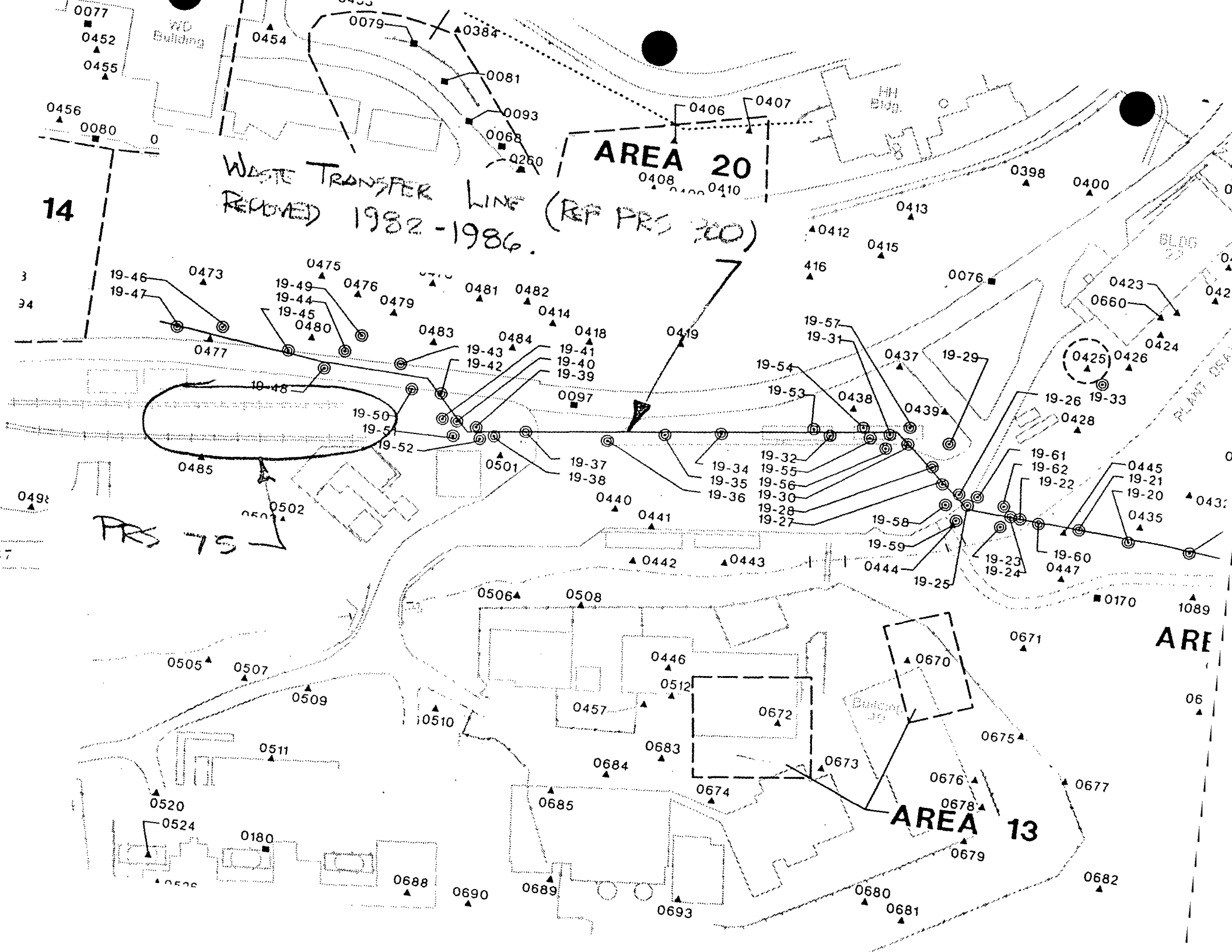


Figure 5.1. Thorium ore processing areas.



WASTE TRANSFER LINE (REF PRS 300)
REMOVED 1982-1986.
PRS 75
AREA 20
AREA 13
14
WD Building
HH Bldg.
BLDG 22
PLANT DEA
0077
0452
0455
0456
0080
0454
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19-60
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0442
0443
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0670
0446
0512
0457
0672
0505
0507
0509
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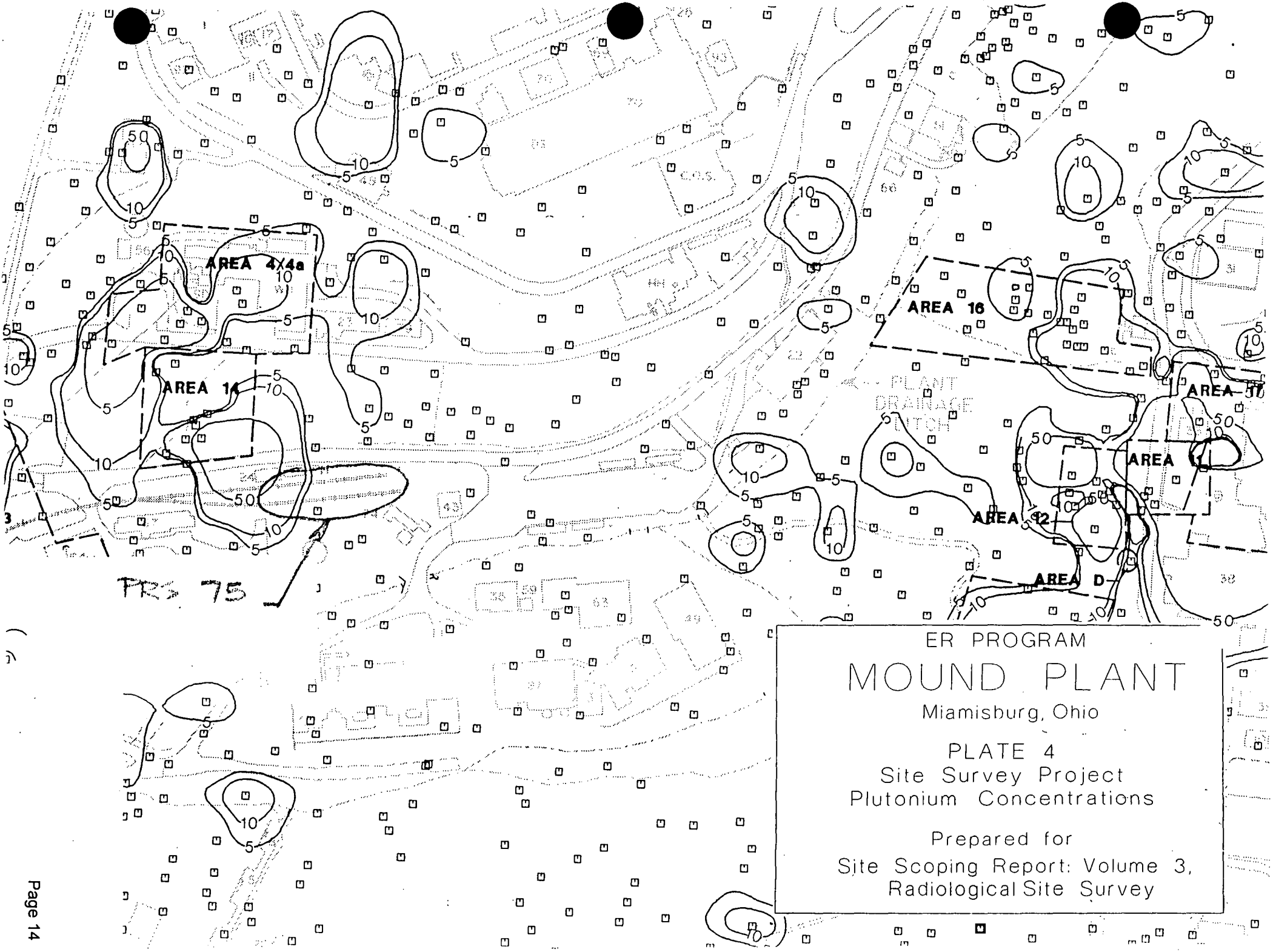


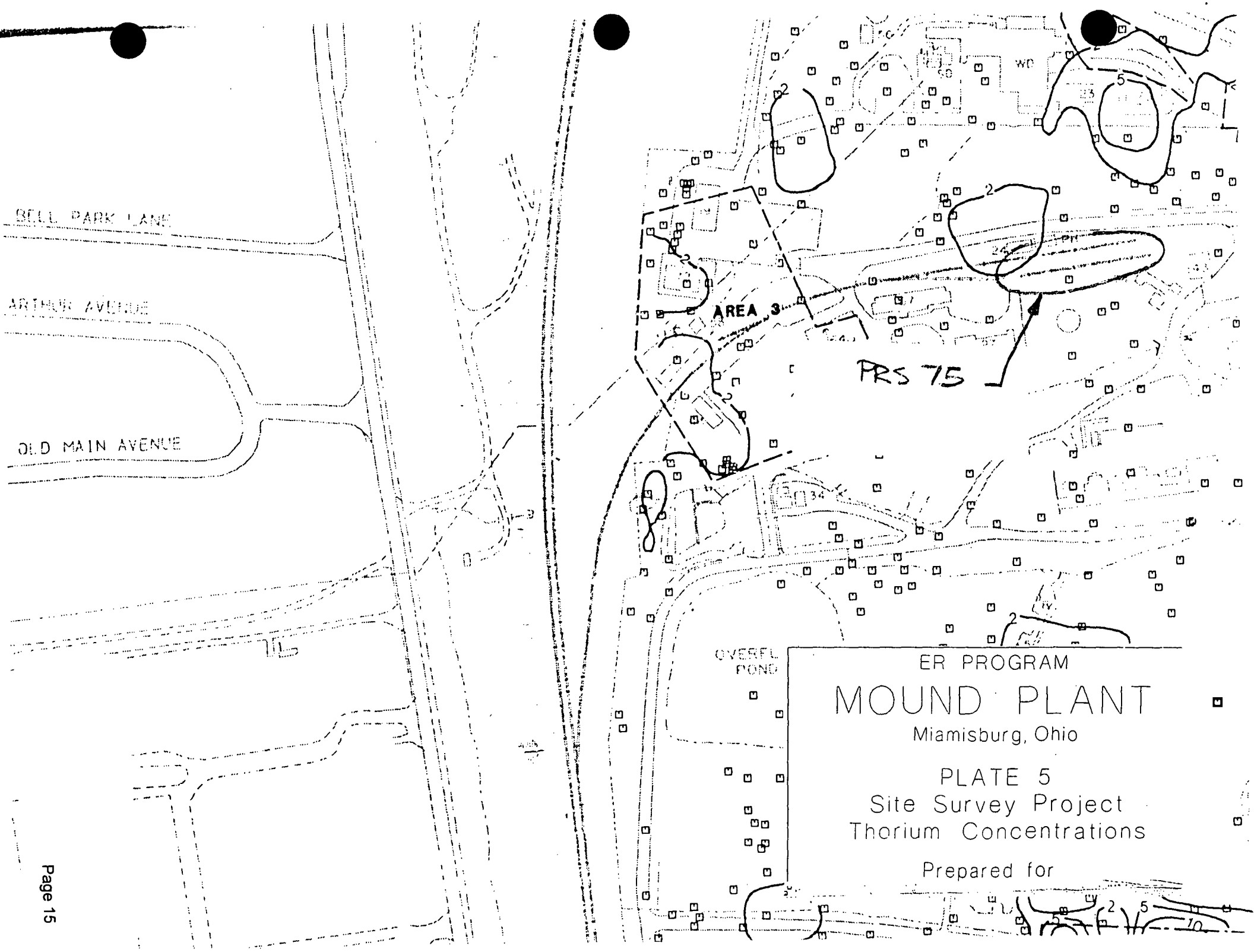
ER PROGRAM

MOUND PLANT

Miamisburg, Ohio

PLATE 4
Site Survey Project
Plutonium Concentrations

Prepared for
Site Scoping Report: Volume 3,
Radiological Site Survey



ER PROGRAM

MOUND PLANT

Miamisburg, Ohio

PLATE 5

Site Survey Project

Thorium Concentrations

Prepared for

Document Control No. DGe

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

in quantities required by the AEC. The refinery was to provide a thorium salt suitable for the preparation of metallic thorium of high purity for the thorium fuel cycle planned for the breeder reactor. Pilot-scale studies in preparation for a large-scale thorium refinery were conducted at Mound to refine the techniques that had been developed elsewhere. The process developmental work done at Mound is known as the Monex process (MRC 1973a). The Monex pilot plant was assembled in room 1B of the SW Building in the spring of 1955. At the same time, construction began on the thorium refinery that was to be built in the west side of the SW Building. Extensive remodeling of the WD Building was also planned, but never implemented. Wastewater processing was to be focused on reduction of trace radium contaminants (Huddleston 1955). The project hardly got started before it was cancelled. The actual directive to construct the facility was issued March 11, 1955 (Wende 1955), but construction was canceled May 9, 1955 (MCC 1955d). The roof that had been removed for construction was replaced and sealed. All the foundations, footings, and piers had been poured inside the building. A construction drawing of the refinery, as it was to have been built on the west side of the SW Building, is supplied in Appendix A. All the extensive interior excavations were backfilled with gravel and soil. Research work on the pilot plant was continued after the construction was halted and was completed by July 1955 (McCarthy 1955).

In anticipation of the completion of the thorium refinery, Mound received at least 1,650 tons of thorium-containing sludge from United Lead Company between December 1954 and June 1955 (McCarthey 1955). These shipments included Brazilian Monazite sludge, thorium oxalate, and sulfate sludge residues (Weisler 1955). The Brazilian Monazite sands are treated with caustic to recover the phosphates as sodium phosphate. The residual Monazite sand is then treated with hydrochloric acid to dissolve the rare earths. These are removed in the supernate. The remaining residue was known as Brazilian Monazite sludge (Mead et al. 1955). The sludge was extremely corrosive, being basic or acidic depending on the pretreatment it received, and contained approximately 55% water. The analysis of this sludge showed a wide range of thorium and rare earth components. Estimates of the original quantities of sludge materials are given in Table II.8. Table II.9 provides a typical elemental analysis of Brazilian Monazite sludge (Mead et al. 1955). These results are based on the sample being dried at 110°C. This drying results in the removal of water. When the sample is heated to elevated temperatures, metal hydroxides and chlorides are converted to the oxides. The typical sludge lost additional weight amounting to 14% due to an oxidation at an elevated temperature referred to as ignition. These materials were contained in over 6,000 55-gallon drums and were delivered to Mound by railcar. Many of the drums were in deteriorated condition. One shipment was received by truck in April 1955 in particularly poor condition, indicating that significant spillage had occurred enroute (Scott 1955b). Some thorium metal scrap, machine turnings, and oxide were also received from Nuclear Metals, Inc. The thorium metal scrap consisted of thorium metal chips, a variety of alloys, and aluminum-clad thorium metal. Thorium alloys also contained uranium, aluminum, and iron. Thorium

Table II.8. Quantities of Thorium Sludges and Thorium-Bearing Materials Stored at Mound as Feedstocks for the Monex Process

Monex Feedstocks	Material Weight (lbs)	Thorium Content (kg)	Thorium Content (% dry weight)
Brazilian hydroxide sludge	2,700,000	270,013	>40
Brazilian oxalate sludge	286,000	36,876	~30
Domestic oxalate sludge	309,000	22,291	~20
Other material, miscellaneous	33,000		
Metal scrap	24,000		
Oxides and grinder sludge	78,000		
Indian nitrate	72,000		
Thorium, aluminum, and copper alloys	1543	656	43

Data from Nuclear Metals, Inc. 1955; MCC 1955b; McCarthy 1955.

Table II.9. Typical Elemental Analyses of Brazilian Sludge

Element	Concentration (Weight %)	Element	Concentration (Weight %)
Aluminum	0.01 - 0.1	Lead	0.01 - 1.0
Calcium	0.1 - 1.0	Praseodymium	1.0 - 10.0
Cerium	<10.0	Selenium	Not Detected
Copper	0.001 - 0.01	Silicon	1.0 - 10.0
Erbium	Not Detected	Samarium	1.0 - 10.0
Gadolinium	1. - 10.	Terbium	Not Detected
Holmium	Not Detected	Titanium	7.0
Lanthanum	<10.	Thulium	0.1 - 1.0
Lutetium	Not Detected	Yttrium	1.0 - 10.0
Magnesium	0.01 - 0.1	Ytterbium	0.1 - 1.0
Neodymium	1.0 - 10.0	Radium-228	Not Analyzed
Thorium oxide[a]	45	Radium-224	Not Analyzed
Rare earth oxide[a]	15	Zirconium oxide[a]	1.4
Silicon dioxide[a]	4.4	Phosphorous oxide[a]	5.3
Titanium oxide[a]	7.0	Uranium oxide[a]	
Iron oxide[a]	4.3	Chloride[a]	1.0
Loss on ignition[a]	14		1.4

Data from Mead et al. 1955
[a]Percentages on dry basis at 110°C; MRC 1973a,d.

barium chloride followed by a pH adjustment to 6. This step resulted in the precipitation of the radium isotopes. No analytical data were found to indicate the concentrations of radium-228 and -224 present in the raffinate or wastewater. This aqueous waste went to the 30,000-gallon influent tanks in the WD Building. It is not known whether it was treated or simply diluted and released to the Great Miami River. The tributyl phosphate and nitric acid wastes were probably drummed for shipment and burial offsite, but this has not been confirmed. The equipment used in the pilot plant, including the columns, glassware, pumps, and other equipment, was cleaned and subsequently used for the protactinium-231 separations (Meyer 1956c).

The production-scale thorium refinery facility that was planned for construction at Mound required extensive construction in the SW Building. Construction of the foundations for the refinery equipment was nearly complete in the west side of the SW Building when excavations for the refinery exposed a section of contaminated soil and gravel that had resulted from leakage of radium-actinium process wastes from the sump located on the west side of room SW-1-A. The sump served the "hot" side of the old cave in which the radium and actinium was processed. About 200 ft^3 of contaminated soil and gravel were excavated and dumped into an old septic tank. The septic tank was a remnant from the plant construction in the late-1940s and is currently included in Area 7 (DOE 1992g).

The majority of the waste generated by the thorium refinery project at Mound was associated with the storage of the 1,650 tons of thorium-containing sludges. Some of the drums in which the thorium was shipped were in poor condition when they arrived; many of the drums were apparently frozen when they were shipped and had thawed in transit, resulting in contamination of the interiors of the boxcars. These boxcars underwent decontamination procedures before being allowed to leave the facility. In some cases, the interior flooring and other contaminated material was removed, and some of the flooring was replaced.

Equipment necessary to conduct the redrumming was initially installed in Warehouse 15 (Figure 2.9), but the high levels of radon caused the operation to be moved outdoors (Thomas 1991). One report indicates that some redrumming took place by an AEC contractor other than MCC. The drums were washed, and the resulting "thorium decantate," amounting to 630 drums of wastewater, was diluted and released to the river in early January 1956 (Meyer 1956a). This release probably took place either to the storm sewer or the NPDES Outfall 001 pipeline to the Great Miami River.

The highly corrosive nature of the sludges resulted in drum leakage and subsequent soil contamination. The repacking of leaking drums became an ongoing activity. Somewhere between 15,000 and 20,000 steel drums had to be disposed of before the sludge was put into storage in Building 21 (Meyer 1979a). Corroded drums were collapsed and buried at Mound in the areas now known

Document Control No.

Environmental Restoration Program

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

MOUND PLANT
MIAMISBURG, OHIO

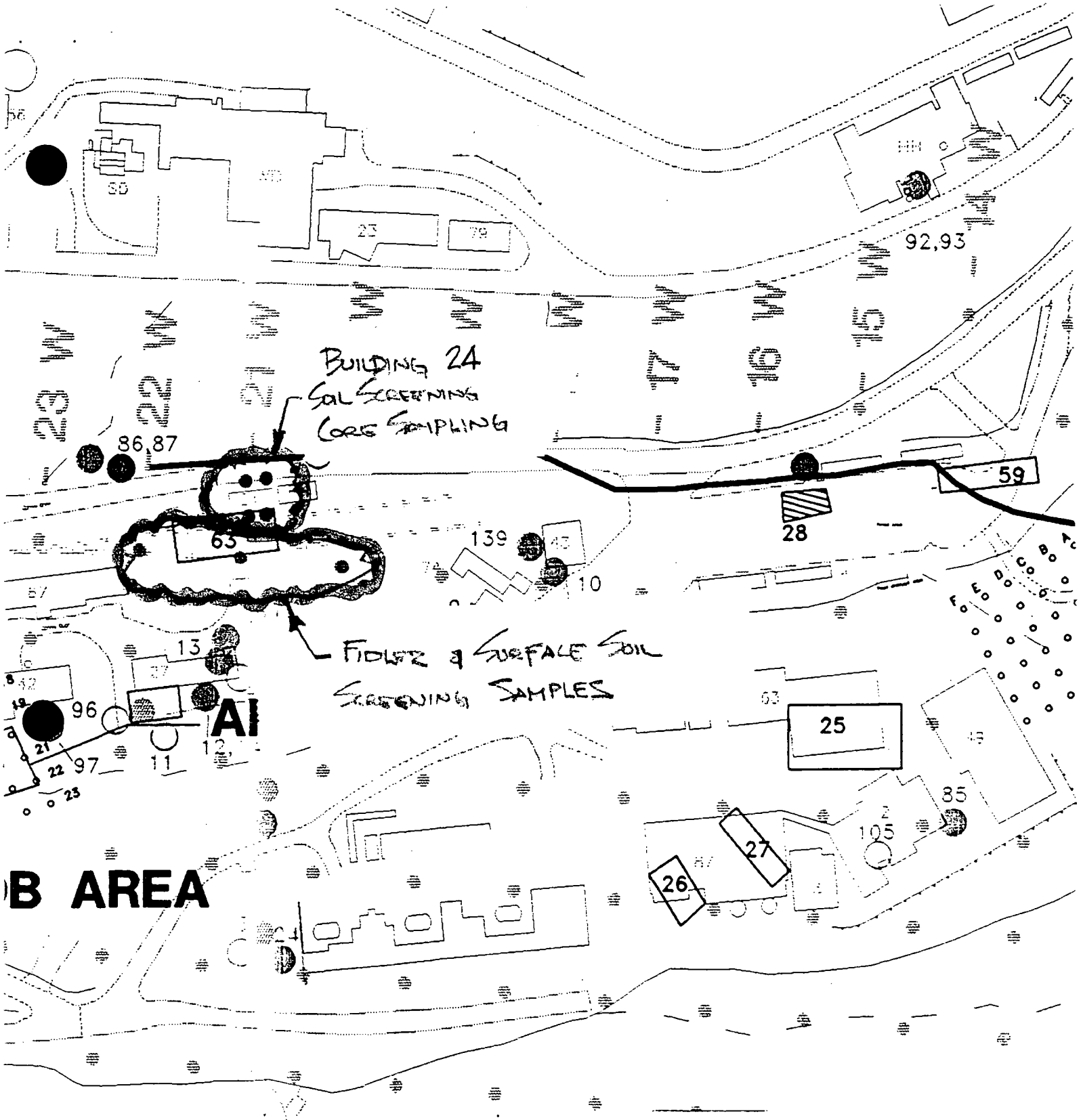
VOLUME II - APPENDICES A-G

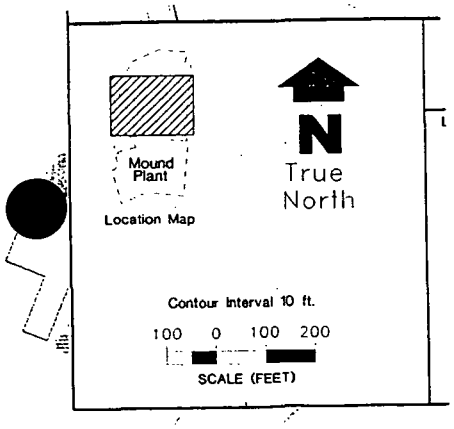
June 1995

Final (Revision 0)

U.S. Department of Energy
Ohio Field Office

EG&G Mound Applied Technologies





MOUND PLANT OPERABLE UNIT 5

PHASE 1 RI/FS OPERATIONAL AREA SAMPLING AND LOCATION OF POTENTIAL SITES OF CONTAMINATION

- Structures
- Plant Boundary
- Paved/Unpaved Roadway
- Ephemeral Stream
- Site Locations
- Tank Locations
- Non-AOC Operational Area Sampling and Survey Locations: Soil Gas Samples, Mound Soil Screening Facility Radiological Samples, and FIDLER Survey (Proposed)
- AOC Sampling and Survey Locations: Soil Gas Samples, Mound Soil Screening Facility Radiological Samples, and FIDLER Survey (Proposed)
- 1 N - 1 W - Grid Lines
- Contaminated Areas
- Warehouses
- Proposed Locations for Soil Gas Samples Mound Soil Screening Facility Radiological
- Proposed Building Walls for Soil Gas Sam Mound Soil Screening Facility Radiological
- Proposed Locations of Mound Soil Screen Radiological Samples
- Proposed Loca Metals Soil Sa
- Proposed Loca
- Surface and Subsurface Soil Sample Loca (Building 24)

APPENDIX D

RADIOLOGICAL DATA (FIDLER SURVEY MOUND SOIL SCREENING FACILITY DA

NON-AOC POINTS

	MOUND SOIL SCREENING FACILITY DATA			
SMPID	Plutonium - 238		Thorium - 232	
	Units: pCi/g		Units: pCi/g	
	RESULTS	Note:	RESULTS	Note:
	SOIL SCREENING SAMPLES			
	ADDITIONAL LOCATIONS IN NON-AOC			
13.25N06	2	a	0.4	a
13.5N15	20	a	0.8	a
13N22.5	12	a	0.3	a
14.3N13	14	a	0.8	a
2.5N18	13	a	1.3	a
21.5N2.5	25	b	1	a
OS5W	16	a	0.7	a
4.5N7.5	2	a	1	a
	SOIL SAMPLES			
BB1001	8	a	0.4	a
BB2001	6	a	0.6	a
BB3001	5	a	0.7	a
BB4001	3	a	0.5	a
BB5001	7	a	0.1	a
BB6001	4	a	0.5	a
BB7001	8	a	0.4	a
	BUILDING 24			
17001	9	a	1.2	a
17002	15	a	1.1	a
18001	38	b	6.7	b
18002	18	a	1.3	a
19001	6	a	0.4	a
19002	0	a	0.3	a
20001	2	a	0.3	a
20002	11	a	0.5	a
	WELL W410			
341001	17	a	0.7	a
341002	0	a	0.8	a

a - Mound Soil Screening Facility detection level not exceeded.

b - Concentration at or above the Mound Soil Screening Facility detection level.

c - Results of the wipe sample were less than 20 disintegrations per minute.

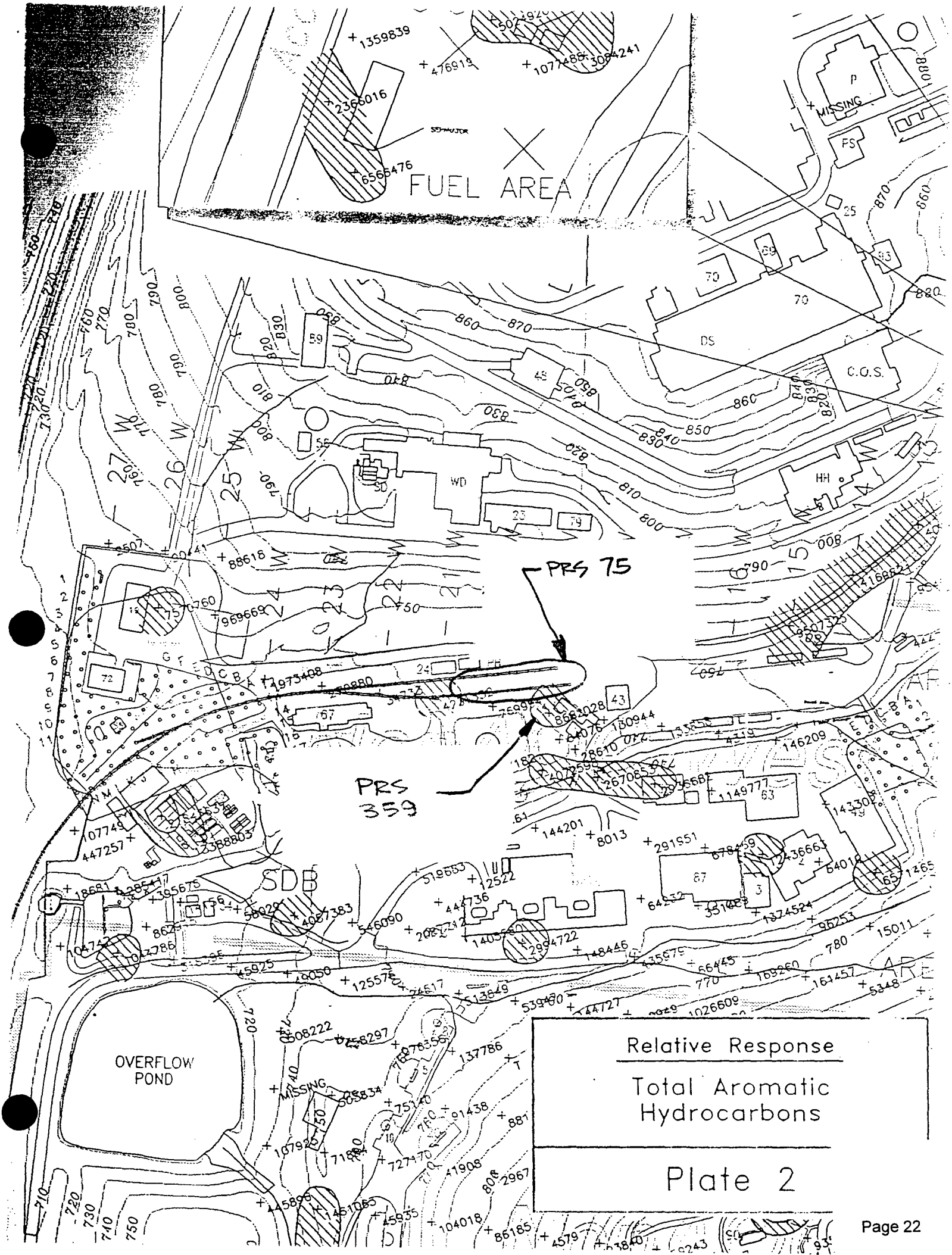
CPM - Counts per minute

KCPM - Counts per minute x 1000

pCi/g - Picocuires per gram

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

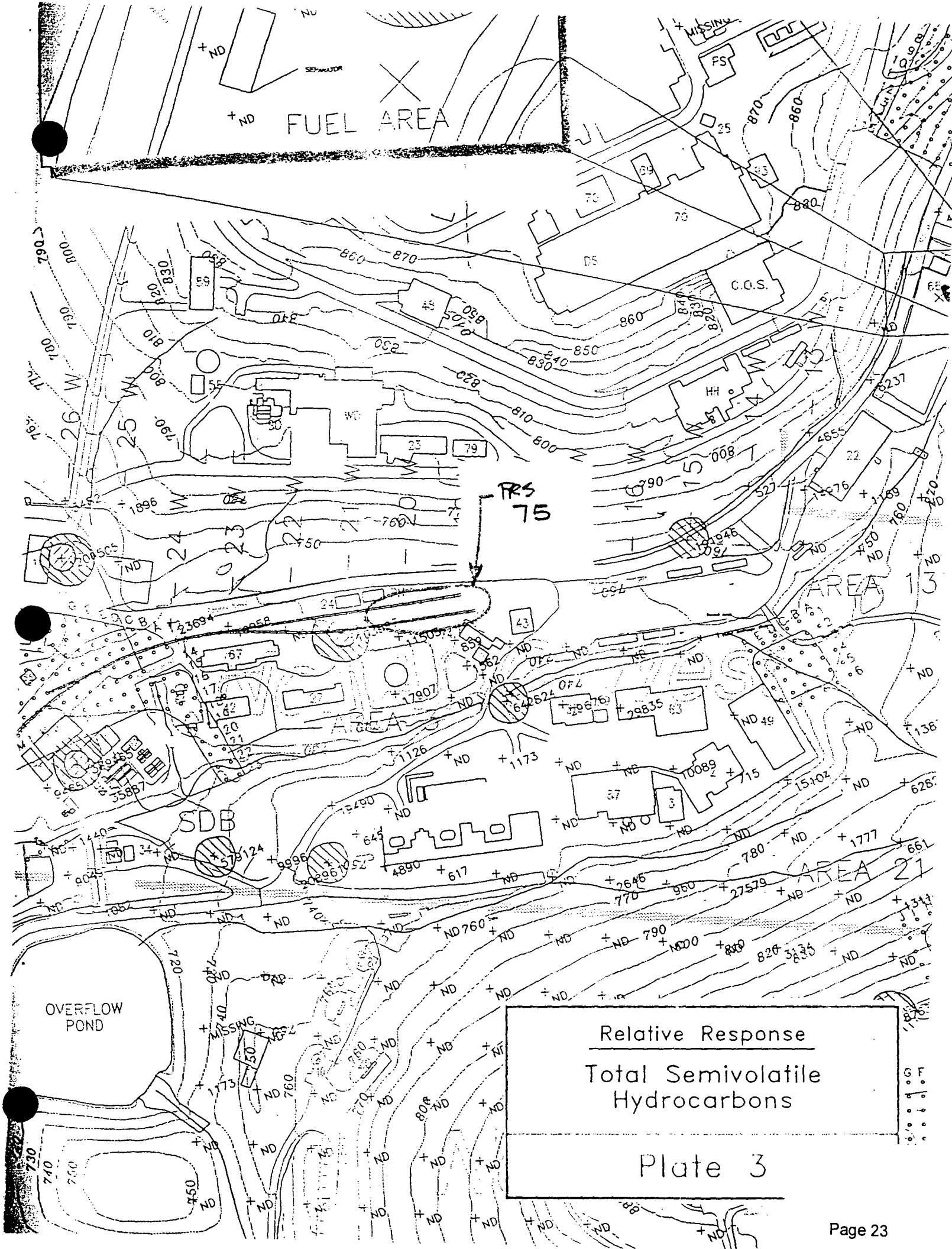
	FIDLER SURVEY DATA					MOUND SOIL SCREENING FACILITY DATA			
SMPID	Contamination Criteria CH1	FIDLER Readings CH1	Contamination Criteria CH2	FIDLER Readings CH2	FIDLER Readings Out Channel	Plutonium - 238		Thorium - 232	
	Units: CPM	Units: CPM	Units: KCPM	Units: KCPM	Units: KCPM	Units: pCi/g		Units: pCi/g	
	RESULTS	RESULTS	RESULTS	RESULTS	RESULTS	RESULTS	Note:	RESULTS	Note:
12N15	157.3	65	8.45	4.0	NC	85	b	0.9	a
12N16	157.3	110	8.45	5.5	NC	9	a	0.7	a
12N17	157.3	60	8.45	3.5	NC	WIPE	c	WIPE	c
12N18	157.3	60	8.45	4.5	NC	WIPE	c	WIPE	c
12N19	157.3	55	8.45	4.5	NC	19	a	0.5	a
12N20	157.3	65	8.45	4.5	NC	WIPE	c	WIPE	c
12N21	157.3	50	8.45	3.5	NC	WIPE	c	WIPE	c
12N22	157.3	85	8.45	5.5	NC	16	a	1	a
12N23	157.3	75	8.45	5.0	NC	WIPE	c	WIPE	c
12N24	157.3	40	8.45	3.5	NC	WIPE	c	WIPE	c
13N01	253.5	180	12.48	10.0	NC	15	a	1.1	a
13N02	253.5	95	12.48	4.5	NC	WIPE	c	WIPE	c
13N03	130	110	6.5	4.5	NC	WIPE	c	WIPE	c
13N25	157.3	40	8.45	4.0	NC	WIPE	c	WIPE	c
13N26	157.3	60	8.45	4.0	NC	WIPE	c	WIPE	c
14N01	253.5	100	12.48	7.0	NC	WIPE	c	WIPE	c
14N02	122.2	80	5.59	4.5	NC	WIPE	c	WIPE	c
14N03	130	75	6.5	5.0	NC	WIPE	c	WIPE	c
14N07	170.3	100	9.72	7.0	NC	NR		NR	
14N08	170.3	150	9.72	10.0	NC	NR		NR	
14N09	170.3	145	9.72	10.0	NC	NR		NR	
14N10	170.3	85	9.72	8.0	NC	NR		NR	
14N11	170.3	115	9.72	10.0	NC	NR		NR	
14N12	170.3	130	9.72	8.0	NC	NR		NR	
14N13	157.3	100	8.45	5.5	NC	NR		NR	
14N15	157.3	70	8.45	4.0	NC	WIPE	c	WIPE	c
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NC	9	a	0.6	a



Relative Response

Total Aromatic Hydrocarbons

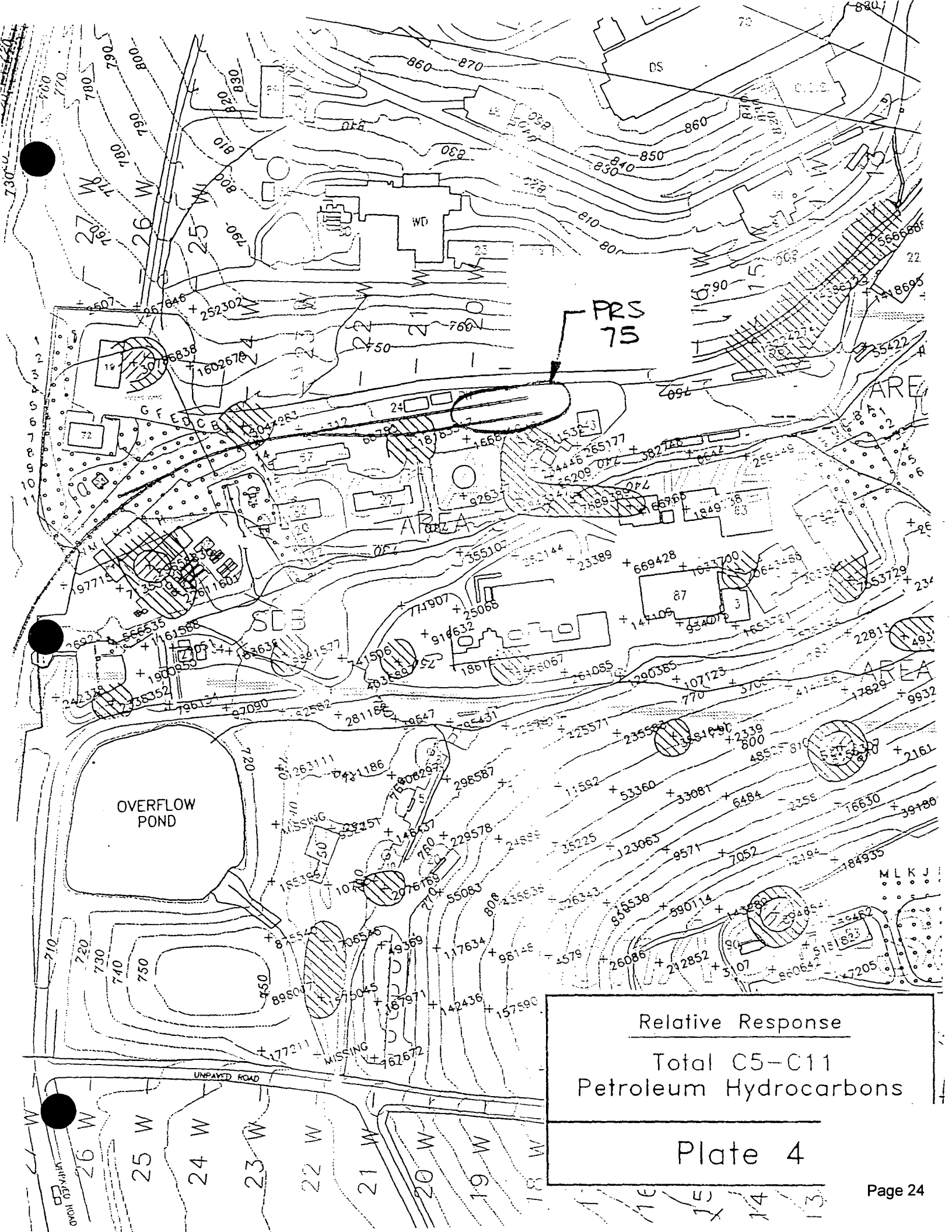
Plate 2

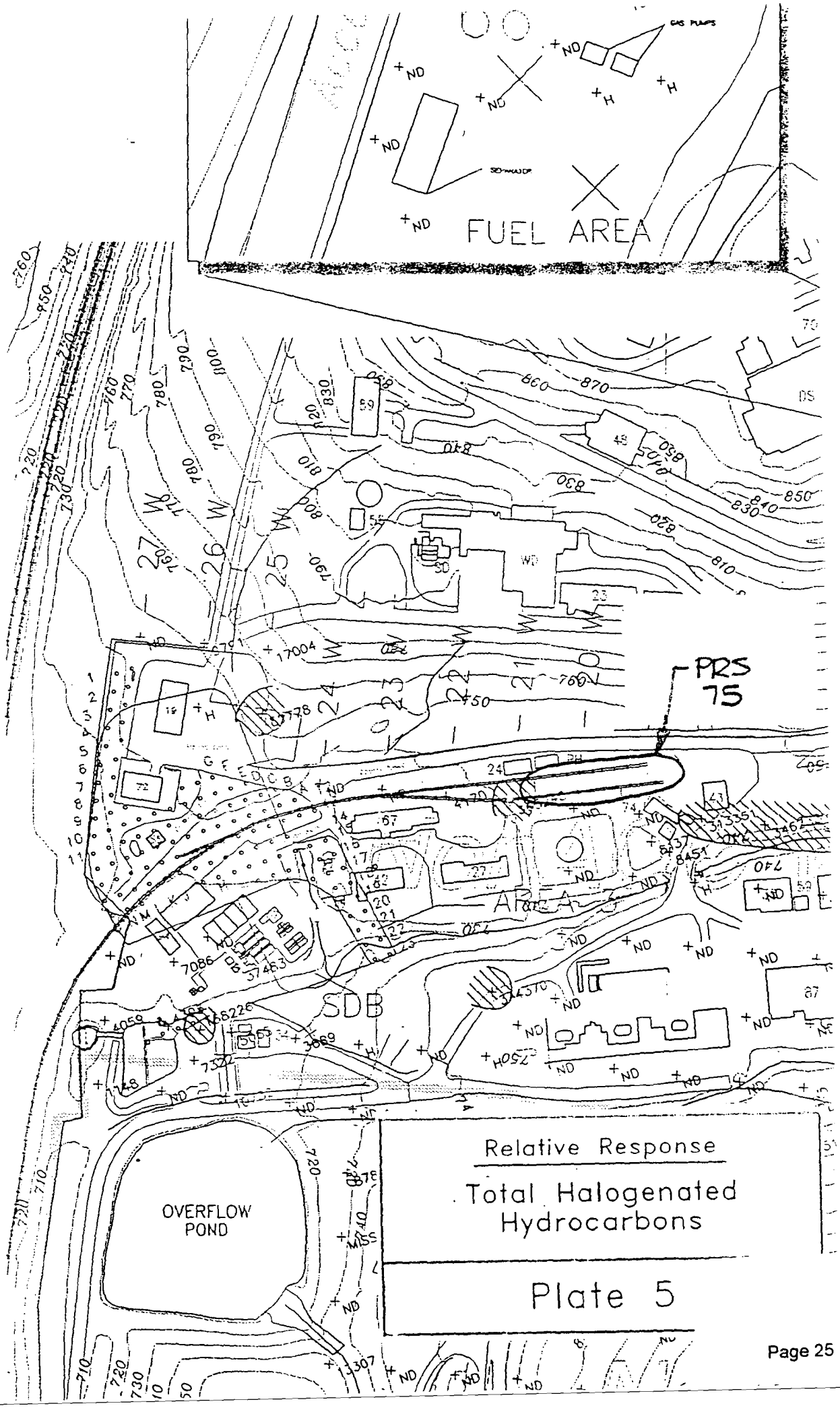


Relative Response

Total Semivolatile Hydrocarbons

Plate 3


PRS
75
OVERFLOW
POND
UNPAVED ROAD
Relative Response
Total C5-C11
Petroleum Hydrocarbons
Plate 4



Relative Response

Total Halogenated Hydrocarbons

Plate 5

EG&G INTERDEPARTMENTAL CORRESPONDENCE

"RAILROAD SPUR WORK STOPPAGE"

FEB, 96

M o u n d Electronic Message/AOS

From :Roy Mowen
MOWERL
Dept. :ES&H, HEALTH PHYSICS OPERATIONS
Tel. No :3937
Date :27-Feb-1996 06:56am EST
Subject :RailRoad Spur work stopage

TO :EDWARD M. SPANGLER (SPANEM)
TO :ROBERT L. STANLEY (STANRL)
TO :Steven Young (YOUNST)
TO :Craig Ferguson (FERGCR)

CC :ROBERT C. MAINE (MAINRC)

The East end of the Rail Road Spur upgrade is in a SOIL CONTAMINATION AREA due to the Thorium contamination that is above release levels. Highest soil sample was 65.3 pci/gram with the general area sample being 6 pci/gram. An RWP is required to work in this area and a requirenment on the RWP is to frisk personnel and equipment coming out of the area. This requires dry conditions for the frisks to be done.

Monday 2-26-96 we started working in the SOIL CONTAMINATION AREA under RWP # 88-017-96 (Requested by B. Keith McMahan). We were able to start work in the morning at 8:30 but around 11:00 we scanned out because it was starting to rain. The equipment was left in the area. During lunch it continued to rain and the ground became saturated. At 1300 hrs it was still raining and I told them it would not be dry enough to restart operations.

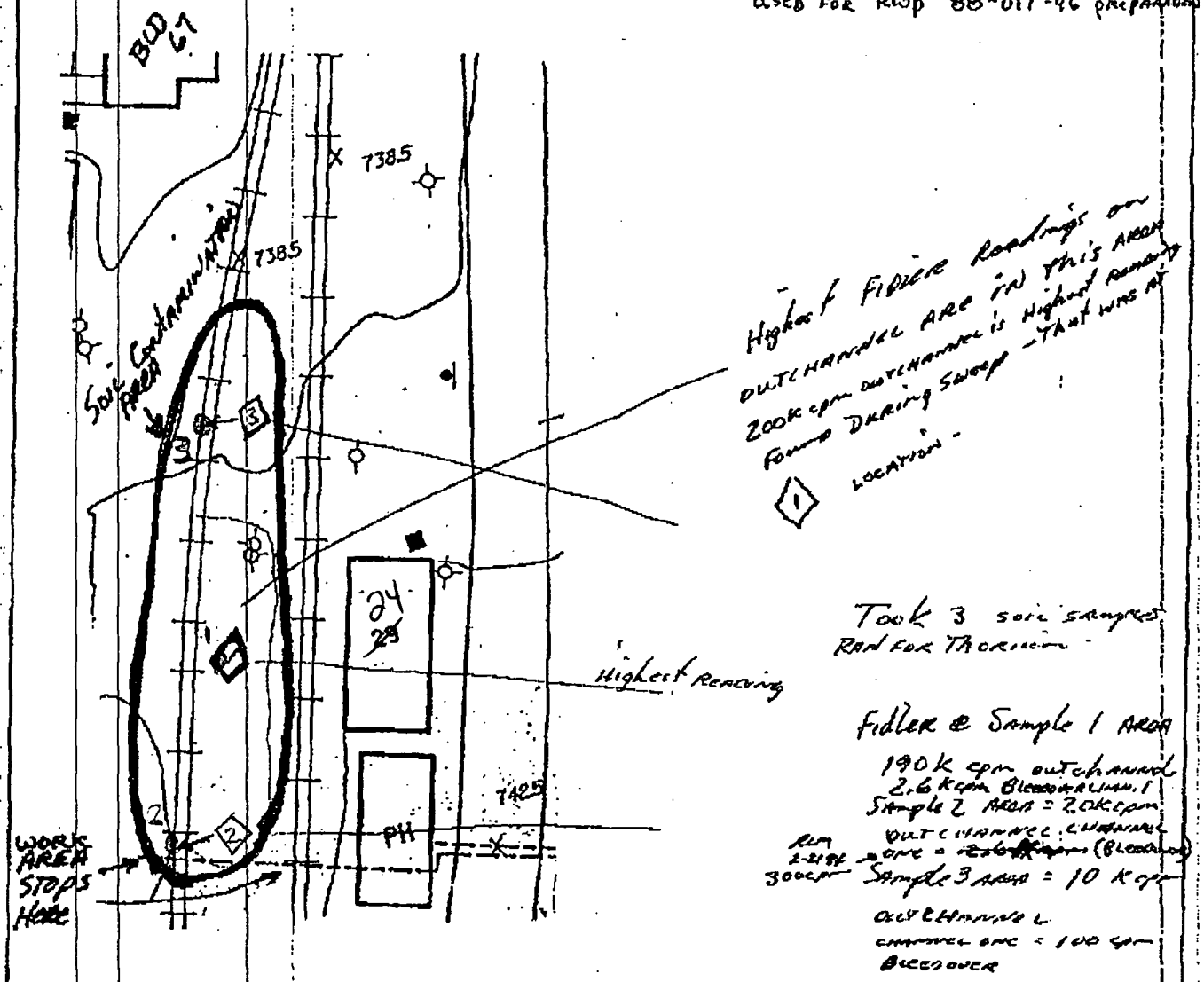
Roy Mowen

RADIOLOGICAL SURVEY DATA SHEET

Page 1 of 2

LOCATION: (BLDG./AREA/ROOM) RR Spur Area -	SURVEY NO. 96-GA-206
PURPOSE: Pre-check areas for work replacing the RR ties	RWP NO. N/A
	DATE: 2-19-96
	TIME: 15:45

MAP/DRAWING * This information and soil samples used for RWP 88-017-96 preparation



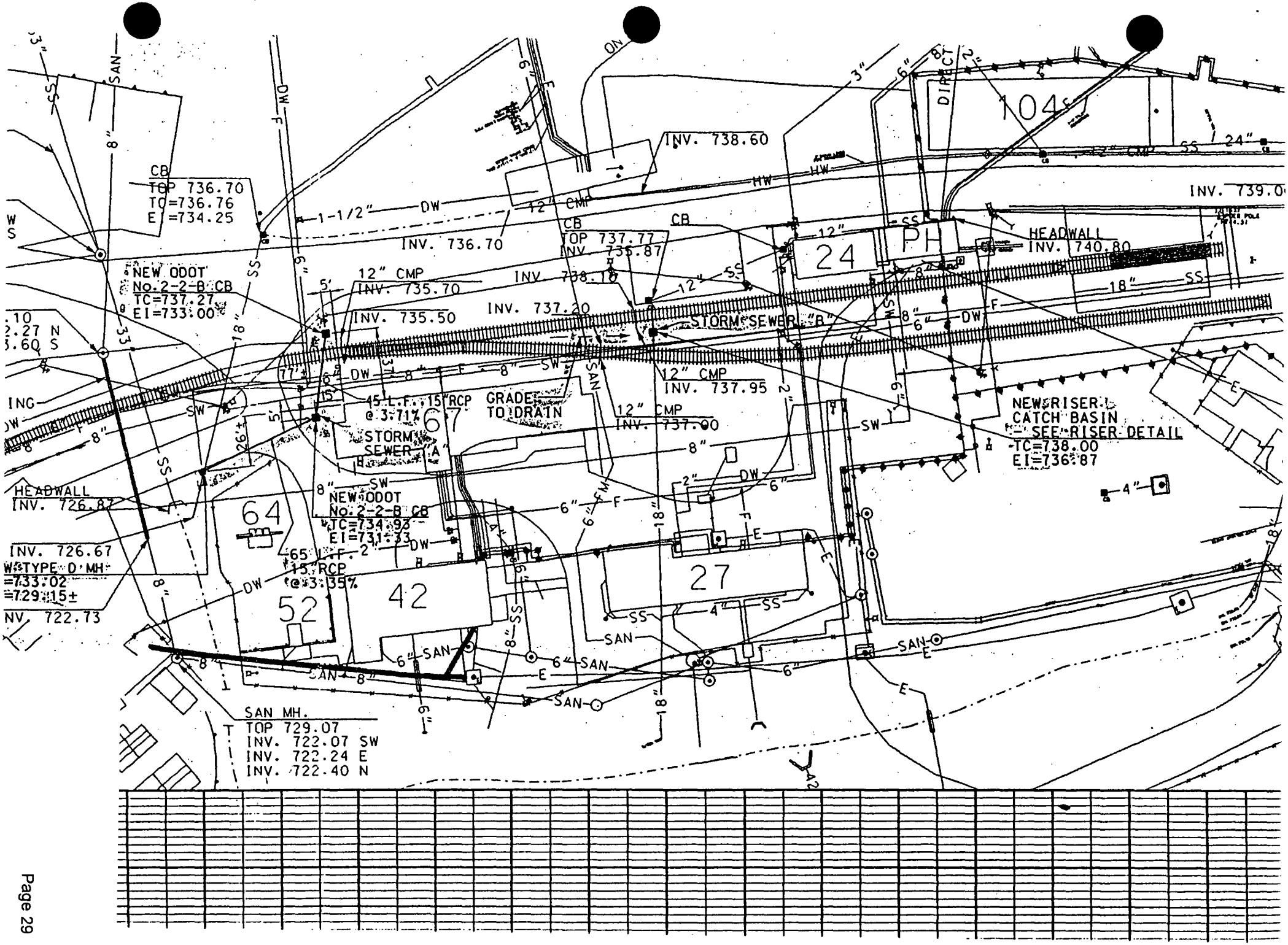
LEGEND: # = mrem/hr (γ) whole body
E = mrem/hr (β+η+γ) extremity on contact
△# = mrem/hr neutron
[#] = air sample number
(#) = swipe number
(#/α) or /β = direct cont. measurement in dpm/100cm²

INSTRUMENTS USED

Instrument	Serial Number	Cal. Due Date
Fidler	3714 / 3541	4-22-96
	NFE	

Completed by: (Signature/HP#) Ray L Mason [redacted]	Date: 2-19-96
Counted by: (Signature/HP#) N/A	Date:
Reviewed/Approved by: (Signature/HP#)	Date:

ML-9620 (10-95)


CB
TOP 736.70
TC=736.76
E =734.25
INV. 736.70
INV. 738.60
CB
TOP 737.77
INV. 735.87
INV. 739.0
HEADWALL
INV. 740.80
NEW ODOT
No.2-2-B CB
TC=737.27
EI=733.00
12" CMP
INV. 735.70
INV. 738.10
INV. 735.50
INV. 737.20
STORM SEWER "B"
12" CMP
INV. 737.95
12" CMP
INV. 737.00
45 L.F. 15" RCP
@ 3.71%
GRADE TO DRAIN
STORM SEWER "A"
NEW RISER
CATCH BASIN
SEE RISER DETAIL
TC=738.00
EI=736.87
HEADWALL
INV. 726.87
NEW ODOT
No.2-2-B CB
TC=734.93
EI=731.33
65 L.F. 15" RCP
@ 3.35%
INV. 726.67
TYPE D MH
=733.02
=729.15±
INV. 722.73
SAN MH.
TOP 729.07
INV. 722.07 SW
INV. 722.24 E
INV. 722.40 N
104
24
PH
67
64
42
52
27

See Survey
96-GA-206

SOIL ANALYSIS REPORT

SAMPLE ID: SS600014
FILE ID: SSB0015LS0

30 minute Test

Isotope		Activity (pCi/g)	Resp. Limit (pCi/g)
Co-60	<	0.1	1,390,000
Cs-137		0.3	6,500,000
Pb-210	<	3	1,300,000
Ra-226		8.6	26,300
Ac-227 (D)	<	1.6	31
Th-228	<	80.3	671
Th-229	<	3	104
Th-230	<	42.5	650
Actual Th-232 (D)		65.3	130
Pa-231	<	7.2	160
U-235	<	2.6	1,730
U-238 (D)	<	17.7	1,730
Pu-238	<	310.7	452
Am-241	<	0.5	400

Other Nuclides:

Isotope	Activity (pCi/g)	Resp. Limit (pCi/g)

Σ DOT 0.5434 nCi/g Σ Respirator 1.51352640 Σ

Description:
RAIL ROAD SPARS #1 (Highest Fiddler)

Collector: R. Moss, [redacted]

Date Collected: 2/20/96

Comments:

Σ Respirator <1 indicates soil levels below limits. Values > or = 1 indicate the soil levels exceed alarm limits for that operation. Respirator limits provided by Health

Σ DOT 2 nCi/g limit, total activity.

(D) denotes identification by daughter emissions. Sample is assumed to be in secular equilibrium.

< by activity means it is less than the MDA. MDA value is used in calculation of respirator, spoils, and DOT

Date: 2/20/96 Counted By: 5801 Report By: 5882

P.03 5138654455 G-HPO

See Survey
96-GA-206

SOIL ANALYSIS REPORT

SAMPLE ID: SS600015
FILE ID: SSB00152

30 min. test

Isotope		Activity (pCi/g)	Resp. Limit (pCi/g)
Co-60	<	0.06	1,390,000
Cs-137		0.3	6,500,000
Pb-210		2.1	1,300,000
Ra-226		3.6	26,300
Ac-227 (D)	<	0.5	31
Th-228	<	16.6	671
Th-229	<	1	104
Th-230	<	14.3	650
Actual Th-232 (D)		6	130
Pa-231	<	2.9	160
U-235	<	0.9	1,730
U-238 (D)	<	8.5	1,730
Pu-238	<	105.1	452
Am-241	<	0.2	400

Other Nuclides:

Isotope	Activity (pCi/g)	Resp. Limit (pCi/g)

Σ DOT 0.16206 nCi/g Σ Respirator 0.37535669 Σ

Description: RAIL ROAD SPARS #2 (Avg of Fiddler)

Collector: R. Moss, [redacted]

Date Collected: 2/20/96

Comments:

Σ Respirator <) indicates soil levels below limits. Values > or = 1 indicate the soil levels exceed alarm limits for that operation. Respirator limits provided by Health

Σ DOT 2 nCi/g limit, total activity

(D) denotes identification by daughter emissions. Sample is assumed to be in secular equilibrium.

< by activity means it is less than the MDA. MDA value is used in calculation of respirator, spoils, and DOT

Date: 2/20/96 Counted By: 5801 Report By: 5882

P.01 5138654455 G-HPO

See Survey
96-GA-206

SOIL ANALYSIS REPORT

SAMPLE ID: SSG00016
FILE ID: SSC00151.S0

30 min test

Isotope		Activity (pCi/g)	Resp. Limit (pCi/g)
Co-60	<	0.04	1,390,000
Cs-137		0.1	6,500,000
Pb-210		2.2	1,300,000
Ra-226		2.3	26,300
Ac-227 (D)	<	0.3	31
Th-228	<	8.6	671
Th-229	<	0.6	104
Th-230	<	8.2	650
Actual Th-232 (D)		0.8	130
Pa-231	<	1.6	160
U-235	<	0.5	1,730
U-238 (D)	<	5.6	1,730
Pu-238	<	77.8	452
Am-241	<	0.08	400

Other Nuclides:

Isotope	Activity (pCi/g)	Resp. Limit (pCi/g)

Σ DOT 0.10872 nCi/g Σ Respirator 0.23297166 Σ

Description:
RAIL ROAD SPARS #3 (Background - typical)

Collector: R. Moss, [redacted]

Date Collected: 2/20/96

Comments:

Σ Respirator <1 indicates soil levels below limits. Values > or = 1 indicate the soil levels exceed alarm limits for that operation. Respirator limits provided by Health

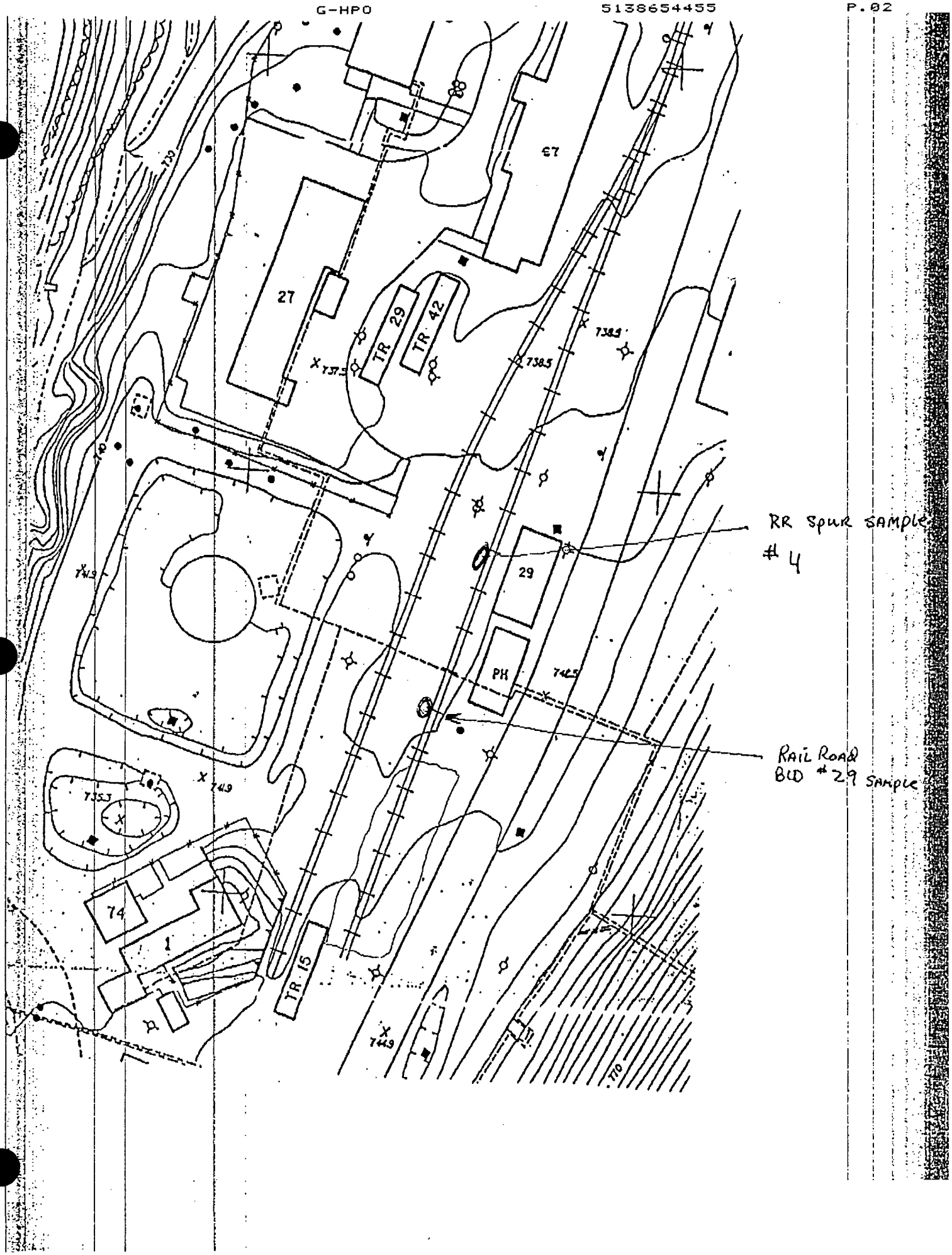
Σ DOT 2 nCi/g limit, total activity.

(D) denotes identification by daughter emissions. Sample is assumed to be in secular equilibrium.

< by activity means it is less than the MDA. MDA value is used in calculation of respirator, spoils, and DOT

Date: 2/20/96 Counted By: 5801 Report By: 5882

P.02 5138654455 G-HPO


27
TR 29
TR 42
29
PH
74
1
TR 15
RR SPUR SAMPLE #4
RAIL ROAD BLD #29 SAMPLE

COPY 10 hr count

Gamma Spectroscopy Report

Requested By: Roy Mowen

HP#: [redacted]

Description:
RAIL ROAD SPURS FROM NORTH #4

Sample ID# HPG00697 MK 3-4-96

Project ID#

Filename: SSC00167.S0

Detector: Ge-C

Geometry: GAMA-533N

Mass (g) 1159

Count Time: 36000 sec.

Priority:

Isotope	Concentration		pCi/g	MDA	pCi/g
Cs-137	0.3	±	0.06	0.05	
Ra-226	13.5	±	2.8	0.9	
Th-232D	78.5	±	15.7	0.1	
U-238D	12.5	±	3.7	4.3	

Comments
The daughters of Th-232 were also present. No Pu-238 above the MDA of 84.6 pCi/g was detected.

* Due to the Th bleed over the MDA was higher than normal
RLM - 3-4-96

Σ DOT 0.1 nCi/g

Energy Calibration File EC022896

Efficiency Calibration File C533N_16.s0

Resolution Calibration File C533N_16.s0

Library File soilscrn.lib

(D) denotes the isotope was identified by its daughter products

Sample Received 2/28/96

Sample Counted: 2/28/96

Sample Analyzed: 2/29/96

Product Cycle Time: 1 Days

Analyst: [signature] HP #: [redacted] Date: 2-29-96

COPY

10 hr. count

Gamma Spectroscopy Report

Requested By: HP 2768

HP#: 2768

Description:
Rail Road BLDG #29

Sample ID# HPG0069

Project ID#

Filename: ssc00169.s0

Detector: Ge-C

Geometry: GAMA-533N

Mass (g) 873

Count Time: 36000 sec.

Priority:

Isotope	*Concentration*		pCi/g	*MDA*	pCi/g
Cs-137	0.12	±	0.03	0.02	
Pb-210	1.2	±	0.3	0.3	
Ra-226	3.4	±	0.8	0.5	
Th-228	16	±	4.6	5	
Th-232	13	±	2.9	1.9	

Comments
Pu-238 was less than MDA of 33.9 pCi/g.

$\sum^{DOT}$ 0.0 nCi/g

Energy Calibration File
ECAL_GEC.S0

Efficiency Calibration File
c533n_12.S0

Resolution Calibration File
c533n_12.S0

Library File
soilscm.lib

(D) denotes the isotope was identified by its daughter products

Sample Received 2/29/96

Sample Counted: 2/29/96

Sample Analyzed: 3/4/96

Product Cycle Time: 4 Days

Analyst: [signature] HP #: [redacted] Date: 3-4-96

RISK-BASED GUIDELINE VALUES

MOUND PLANT
MIAMISBURG, OHIO

December 1995

Submitted to the
Office of Southwestern Area Programs (EM-453)
Environmental Restoration
and the
Miamisburg Area Office
U.S. DEPARTMENT OF ENERGY

Prepared by
HAZARDOUS WASTE REMEDIAL ACTIONS PROGRAM
Environmental Management and Enrichment Facilities
Managed by
LOCKHEED MARTIN ENERGY SYSTEMS, INC.
for the
U.S. DEPARTMENT OF ENERGY
under contract DE-AC05-84OR21400

FINAL
(REVISION 0)

TABLE 4B Construction/Mound Employee - Soil/Sediment Guideline Values: Radionuclides (Units = pCi/g)

RADIONUCLIDE	Ingestion			External			Inhalation			Ingestion + External + Inhalation		
	GV for TR=10-4	GV for TR=10-5	GV for TR=10-6	GV for TR=10-4	GV for TR=10-5	GV for TR=10-6	GV for TR=10-4	GV for TR=10-5	GV for TR=10-6	GV for TR=10-4	GV for TR=10-5	GV for TR=10-6
Uranium-233	3.70e+03	3.70e+02	3.70 e+01	2.75e+06	2.75 e+05	2.75 e+04	1.20e+06	1.20 e+05	1.20 e+04	3.70e+03	3.70 e+02	3.70 e+01
Uranium-234	3.75e+03	3.75 e+02	3.75 e+01	4.55e+06	4.55 e+05	4.55 e+04	1.20e+06	1.20 e+05	1.20 e+04	3.75 e+03	3.75 e+02	3.75 e+01
Uranium-235+D	3.55e+03	3.55 e+02	3.55 e+01	3.65e+02	3.65 e+01	3.65e+00	1.30e+06	1.30 e+05	1.30 e+04	3.35e+02	3.35 e+01	3.35 e+00
Uranium-238+D	2.70e+03	2.70 e+02	2.70 e+01	1.85e+03	1.85 e+02	1.85 e+01	1.40e+06	1.40 e+05	1.40 e+04	1.10e+03	1.10 e+02	1.10 e+01