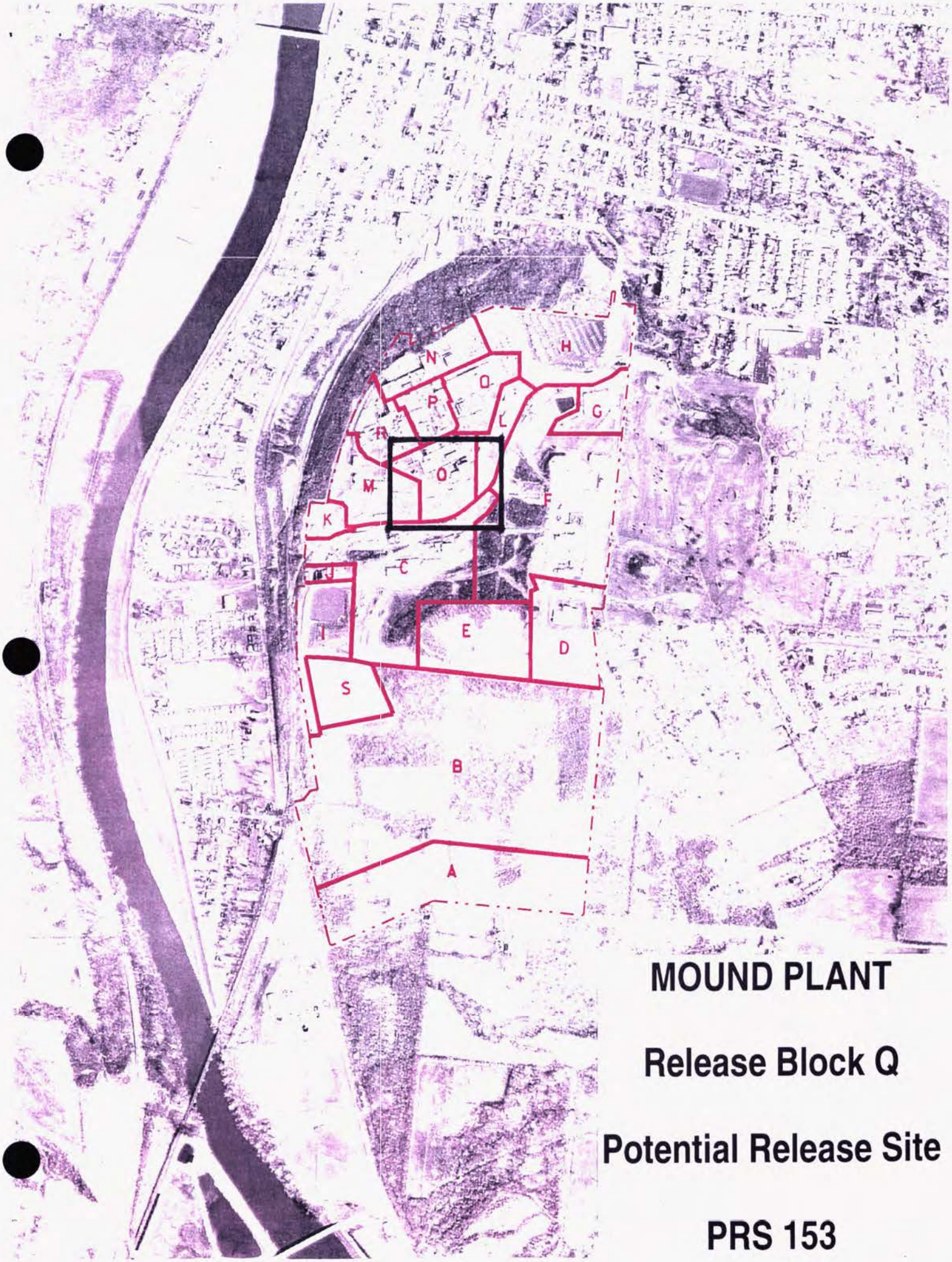
EG&G MOUND-30-03-03-02--9701300043

MOUND

Environmental
Restoration
Program

MOUND PLANT
Potential Release Site Package
PRS # 153

REV	DESCRIPTION	DATE
PUBLIC RELEASE 0	Available for comment.	Dec. 17, 1996
FINAL 1		



MOUND PLANT

Release Block Q

Potential Release Site

PRS 153

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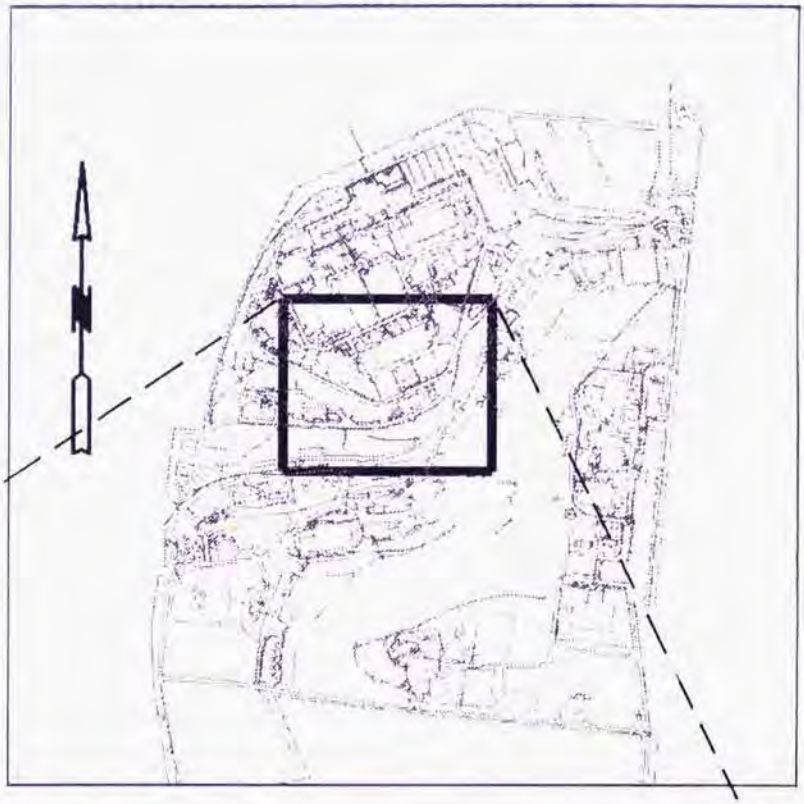
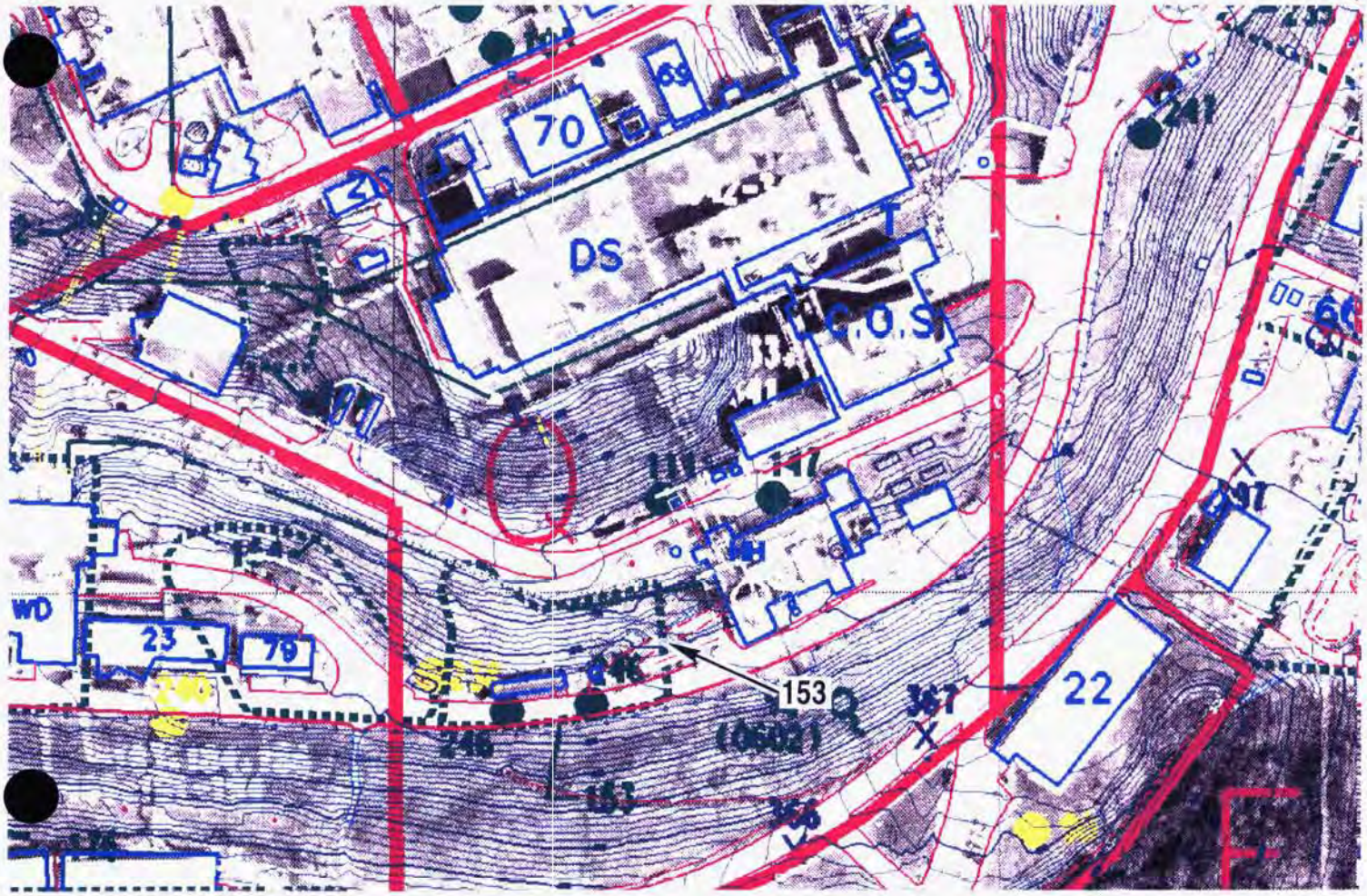
MOUND PLANT

Release Block Q

Potential Release Site

PRS 153





153

PRS 153

PRS HISTORY:

Potential Release Site (PRS) 153 is a soil area on the hillside west of the Hydrolysis House (HH) Building and bounded on the south by the roadway. This soil area, also known as Area 20,[1] was contaminated by leaks of wastewater from the 3-inch underground pipeline that transversed the northern boundary of this soil area.

Acidic aluminum chloride wastes from polonium production were processed in HH Building. The waste was treated to form a gelatinous sludge and a supernatant liquid. The sludge was stored for possible re-use. The supernatant liquid was transferred via the underground line to WD Building for additional waste treatment. HH to WD pipeline leaks of low level alpha wastewater were discovered and repaired in 1954 and 1958. This line was abandoned in place in 1959.[2]

The HH to WD underground line was removed in 1994 along with soil in the immediate area of the waste line. Near the completion of the line removal, an expanded area of contamination was discovered on the north side of the pipeline. The removal of contaminated soil from this small area was limited, because utility relocations and retaining wall construction would be necessary for the removal of additional soil. The excavation was marked and backfilled with clean soil. Excavated soils were placed in low-level waste boxes for off-site disposal.

CONTAMINATION:

1) In the mid 1980's, the Radiological Site Survey's study[3] of PRS 153 found:

Contaminant	Maximum Concentration Detected	Guideline Criteria
Plutonium-238	1.9 pCi/g[3] (in surface soil)	25 pCi/g (Mound ALARA in soil)
Cesium-137	1.0 pCi/g[3] (in surface soil)	0.46 pCi/g[ref 9] * (in soil)
Radium-226	0.9 pCi/g[3] (in subsurface soil)	15 pCi/g[ref. 8] (in subsurface soil)
Americium-241	less than 0.5 pCi/g[3] (in soil)	4.95 pCi/g[ref 9] (in soil)
Thorium-232	4.0 pCi/g[3] (in surface soil)	5 pCi/g[ref 8] (in surface soil)

NOTE: pCi = picocuries, g = grams, ALARA = As low as reasonably achievable
* 0.42 pCi/g is background value for cesium-137.[ref 11]

2) In 1985, during installation of a sanitary sewer line routine surface soil sampling found:

Contaminant	Maximum Concentration Detected	Guideline Criteria
Cobalt-60	800 pCi/g [ref 3, 10] (in surface soil)	0.1 pCi/g [ref 9] (in soil)
Bismuth-207	70 pCi/g [ref 3, 10] (in surface soil)	0.175 pCi/g [ref 9] (in soil)
Cesium-137	200 pCi/g [ref 3, 10] (in surface soil)	0.46 pCi/g [ref 9] (in soil)

The above contamination was reported removed from PRS 153.[ref 3]

3) In 1992, the Soil Gas Survey [4] of PRS 153 found:

Contaminant	Maximum Concentration Detected	Guideline Criteria
Toluene	213 ppb [ref 4] (soil gas)	414,600 ppb [ref 7] (soil gas)

ppb = parts per billion

4) In 1994, the HH to WD underground line (transverses PRS 153) was removed. At the completion of this removal, a contaminated soil area was discovered. Some of this area was excavated, but the remediation was discontinued because of utility interference and the depth of excavation. The excavation was marked and backfilled. The soil screening analyses [5] of the excavated soil found:

Contaminant	Maximum Concentration Detected	Guideline Criteria
Thorium-232	678 pCi/g [ref 5]	15 pCi/g [ref 8] (in subsurface soil)
Plutonium-238	7,694 pCi/g [ref 5]	25 pCi/g (Mound ALARA in soil)

The Field Engineer stated that field screening was detecting radioactive contaminants in the excavation before backfilling occurred.

5) Further assessment of the PRS 153 area was performed in 1995. This investigation, Other Soils Characterization,[6] divided up PRS 153 into 15 foot by 15 foot grids and analyzed soil samples for organics (by organic vapor analyzer and organic vapor meter), metals (by x-ray fluoroscope) and radionuclides (field analysis by FIDLER and lab analysis by the Mound Soil Screening Facility). Samples were collected every four feet until a depth of 12 feet or refusal was reached. However, the presence of utilities prevented sampling the extent of the contamination found during the HH to WD line removal (see #4 above). Sample results showed:

Contaminant	Maximum Concentration Detected	Guideline Criteria
Thorium-232	less than 5 pCi/g [ref 6] (in soil)	15 pCi/g [ref 8] (in subsurface soil)
Plutonium-238	38 pCi/g [ref 6] (in soil)	25 pCi/g (Mound ALARA in soil)

- All metal detections were below the 10^{-6} Risk Based Guideline Criteria for soils.
- Volatile organic compounds (VOCs) were detected in twenty-nine samples (no quantitative data is available).

READING ROOM REFERENCES:

1) OU9, Site Scoping Report: Volume 12 - Site Summary Report, December 1994. (pages 6-8)
2) OU9, Site Scoping Report: Volume 7 - Waste Management, February 1993. (pages 9-11)
3) OU9, Site Scoping Report: Volume 3 - Radiological Site Survey, June 1993. (pages 12-18)
4) Report, Soil Gas Survey & Geophysical Investigations, Mound Plant, Main Hill and SM/PP Hill Areas Reconnaissance Sampling, February 1993. (pages 19-22)
9) Risk Based Soil Guidelines, December 1995, Revision 0.

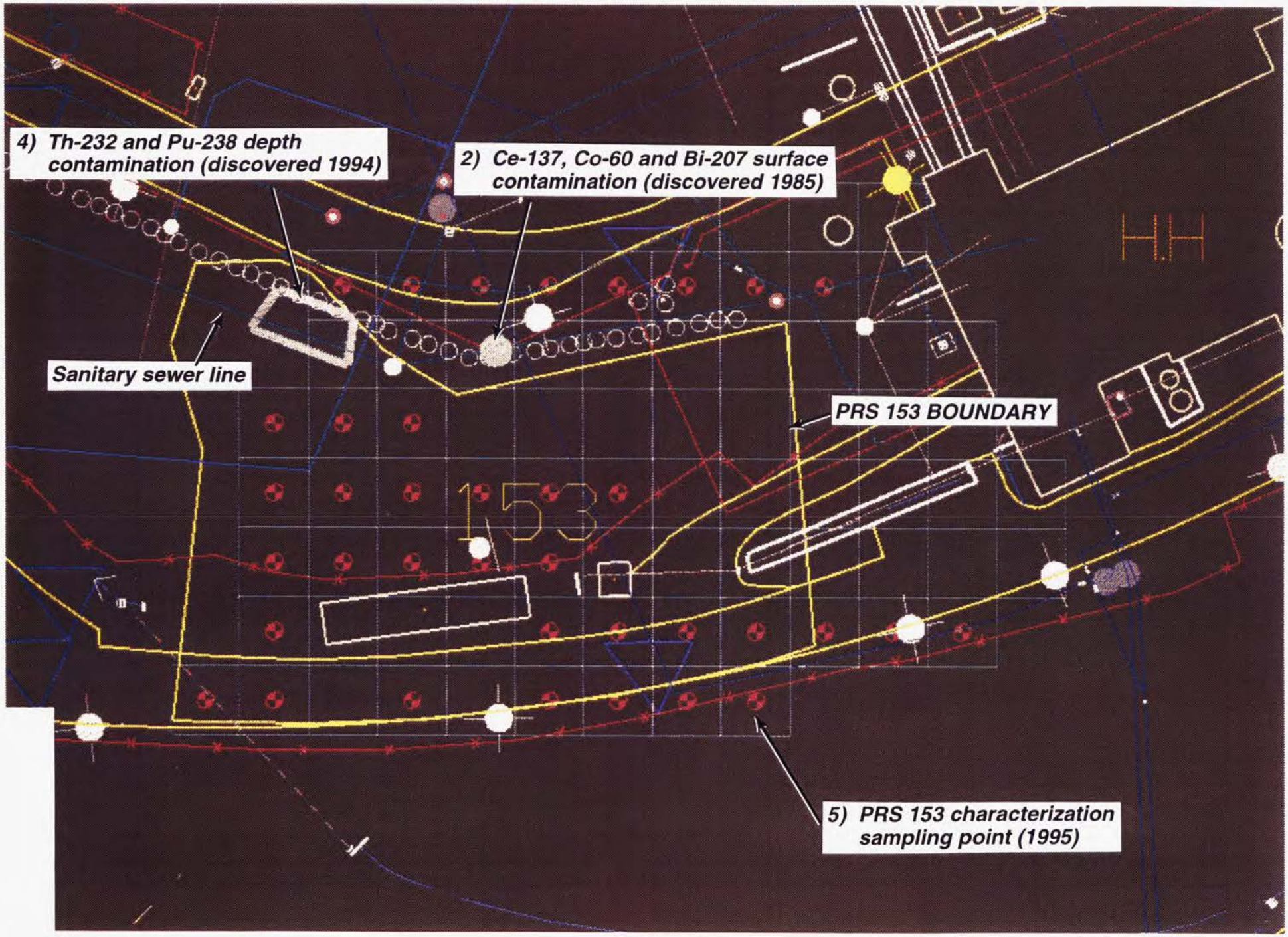
OTHER REFERENCES:

5) 1994, HH to WD Underground Line Removal, Contaminated Soil Area Chase, Soil Screening Analysis. (pages 23-29.1)
6) Other Soils Characterization Report, Draft, Mound Plant, January 1996. (pages 30-35)
7) Comparison of Actual Soil Gas Values with Calculated Acceptable Soil Gas Values, March 1996. (pages 36-38)
8) Code of Federal Regulations, 40 CFR 192.12 and 40 CFR 192.41
10) The Mound Site Survey Project for the Characterization of Radioactive Materials in Site Soils, May 16, 1988. (pages 42-44)
11) Radionuclide Background Values for Comparison to Mound Plant Soils. (pages 39-41)
12) Interview with Field Engineer (HH-WD UGL project), April 4, 1996.

PREPARED BY:

Richard Bauer, Member of EG&G Technical Staff

PRS 153


4) Th-232 and Pu-238 depth contamination (discovered 1994)
2) Ce-137, Co-60 and Bi-207 surface contamination (discovered 1985)
Sanitary sewer line
PRS 153 BOUNDARY
153
5) PRS 153 characterization sampling point (1995)

MOUND PLANT
PRS 153
RADIOACTIVE WASTEWATER SEWER PIPELINE BREAK
AREA 20

RECOMMENDATION:

Potential Release Site (PRS) 153 is a soil area on the hillside west of the Hydrolysis House (HH) Building and bounded on the south by a roadway. This soil area, also known as Area 20, was designated a PRS because of contamination by leaks of wastewater from the 3-inch underground pipeline that transversed the northern boundary of this soil area. During the removal of the underground pipeline and surrounding soils in 1994, a localized area of contamination in the northwest corner of PRS 153 was discovered. The remediated soil had maximum concentrations of 678 pCi/g Th-232 (5 pCi/g Th-232 guideline level) and 7,694 pCi/g Pu-238 (25 pCi/g Pu-238 guideline level).

Therefore, a RESPONSE ACTION is recommended for the remainder of the contamination.

CONCURRENCE:

DOE/MB: Arthur W Kleinrath 11/26/96
Arthur W. Kleinrath, Remedial Project Manager (date)

USEPA: Timothy J. Fischer 12/3/96
Timothy J. Fischer, Remedial Project Manager (date)

OEPA: Brian K. Nickel 12/17/96
Brian K. Nickel, Project Manager (date)

SUMMARY OF COMMENTS AND RESPONSES:

Comment period from 1/9/97 to 2/13/97

☐ No comments were received during the comment period.

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

REFERENCE MATERIAL
PRS 153

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

MOUND PLANT
MIAMISBURG, OHIO

December 1994

U.S. DEPARTMENT OF ENERGY
OHIO FIELD OFFICE

ENVIRONMENTAL RESTORATION PROGRAM
EG&G MOUND APPLIED TECHNOLOGIES

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Table A.1. Comprehensive Tabulation of Potential Release Sites

Description of History and Nature of Waste Handling						Hazardous Conditions and Incidents			Environmental Data		
No.	Site Name	Location	Status	Potential Hazardous Substances	Ref	Releases	Media	Ref	Analytes[a]	Results	Ref
147	HH Building Soils	F-7	Grounds	Polonium-210, cobalt-60, tritium	4, 18	Indicated by Soil Gas Survey	S	12	1	SGS[b] Table B.4 Locations 1114, 1119, 1206, 1207, 1230	12
148	HH Building Solidification Unit	F-7	Historical	Cobalt-60, Polonium-210	4	Unknown			No Data		
149	HH Building Pilot Incinerator	F-7	Historical	Polonium-210	4	Probable air releases in 1951	A		No Data		
150	Room HH-15 Beta Wastewater Sump (Tank 236)	F-7	Inactive	Beta wastewater from restrooms and process area floor drains - tritium	3	Unknown			No Data		
151	Room HH-6 Alpha Wastewater Sump (Tank 237)	F-7	Historical	Alpha wastewater from process area floor drains. Possible contaminants include polonium-210, cobalt-60, and bismuth.	3, 4	Unknown - filled with concrete			No Data		
152	HH Building Beta Wastewater Sump (Tank 24)	F-7	In service	Beta wastewater from process area sinks and floor drains	3, 4	Unknown			No Data		
153	Area 20, Radioactive Waste Line Break	G-7	Grounds	Sodium nitrate, Plutonium-238, Cesium-137, Thorium, Cobalt-60	4, 5, 18	Cobalt-60	S	6, 18	1 2, 14, 16	SGS[b] Table B.4 Locations 1119 and 1120 Table B.1 (Table III.8 in Ref. 6)	12 6
154	Area 23, Thorium Contaminated Soil	F-6 G-6	Grounds	Thorium-230	18	Thorium-230	S	6	1 2	SGS[b] Table B.4 Location 1122 Table B.1 RSS[c] Location S1092 (Appendix E in Ref. 6)	12 6
155	Old Sanitary Disposal (SD) Plant (AKA Old Sanitary Wastewater Treatment Plant)	F-6	Surplus	Chromic acid, Calcium cyanide, Nickel sulfate, Nickel chloride, Black oxide, Copper cyanide	4, 5, 18	Unknown			No Data		
156	Old SD plant Tank (Tank 205)	F-6	Surplus	Polonium-210, Cobalt-60	3, 5						

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

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

Reference List

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

ENVIRONMENTAL RESTORATION PROGRAM

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

MOUND PLANT
MIAMISBURG, OHIO

February 1993

DEPARTMENT OF ENERGY
ALBUQUERQUE FIELD OFFICE

ENVIRONMENTAL RESTORATION PROGRAM
EG&G MOUND APPLIED TECHNOLOGIES

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~~electroplating of the metal from a bismuth chloride solution. This process is described in subsection 2.1.2.2.~~

The acidic aluminum chloride waste from the decanning operation was sent to the hydrolysis building, HH Building, for processing. Bismuth chloride solutions from the polonium processing operation also went to the HH Building for processing. The individual bismuth and aluminum chloride solutions were adjusted to a pH of 12 by the addition of caustic, which produced a gelatinous sludge and a supernatant liquid. The sludge was considered to be a high-risk waste, as it contained high levels of radioactivity, including alpha radiation at 0.02 Ci per L (Ci/L), beta radiation at 0.002 Ci/L, and gamma radiation at 100 mrem at 1 ft (Lamberger 1991). The aluminum sludge from this waste processing operation was separated by filtration and was solidified, drummed, temporarily stored in the old bunkers, and shipped off-plant for burial. In 1959, all polonium wastewater precipitation processes were moved to T Building (Meyer 1959b), and polonium operations ceased in the HH Building.

Since the start-up of the polonium program at Mound, the bismuth sludge from the precipitation process was stored in the eventuality that a feasible bismuth recovery method could be developed. In January 1952, the accumulated sludge represented 30 tons of recoverable metal (McEwen 1952a). About 650 drums of sludge were stored at the Quonset hut and were not shipped off-plant as waste until April 1954 (Bradley 1954b).

The supernatant liquids were transferred from the HH Building through a 3-inch steel pipe to 30,000-gallon influent holding tanks in the WD Building for processing as a low-level alpha wastewater (Bixel et al. 1975). Leaks are known to have occurred along this pipe in the 1950s, although the number of leaks is unknown. One leak was reported in December 1955 (Meyer 1956a). The pipe remains today, abandoned in place after its discontinuance in 1959 (Meyer 1959b). * The contaminated soil along the pipeline from HH to WD buildings is now referred to as Area 20 (DOE 1992g). ~~The volumes of water and sludge generated by the polonium program and processed by the WD waste treatment facilities in selected months in 1952 and 1953 are shown in Table II.1-(~~ * **Removed in 1994** ~~53e). The activity of the waste in millicuries (mCi) for alpha and beta radiati~~ ~~II.1. The monthly volume of water discharged was on the order of one-half million gallons from WD to the Great Miami River. Treatment processes for polonium are described in detail in Section 4. Maximum permissible concentration levels of polonium in the wastewater effluents (7×10^{-7} μCi/mL) were guided by U.S. Department of Commerce, National Bureau of Standards Handbook 69. In 1965, AEC adopted these standards into the USAEC Manual, Chapter 0524, for Radioactivity Concentration Guides (RCGs).~~

~~In the early years of polonium processing, the low-level alpha was~~ ~~designed so that there were no restrictions on what was poured dow~~

~~In 1975, the low-level wastewater beta line from the SW Building was found to be leaking and was abandoned and replaced. The new above-ground pipeline consists of a continuous 1-1/2-inch polyethylene pipe encased in a 3-inch pipe of the same construction (MRC 1983). In 1982, an above-ground alpha wastewater pipe from the R Building to tl~~ * **Removed in 1994** ~~structed of a 2-inch polyethylene pipe encased within a 3-inch pipe of the s:~~

The 3-inch steel pipe from the HH Building to the WD Building has also been abandoned in place. * Leaks along this pipe during the period of polonium processing created some soil contamination now known as Area 20 (DOE 1992g, 1991c). One leak was discovered December 23, 1954, and was cleaned up and repaired by December 28 (Meyer 1956a). Another leak was discovered and repaired during the summer of 1958. An area of 40 to 50 ft^2 appeared to be contaminated and was sodded to confine the activity (Meyer 1958c). The polonium production byproduct precipitation processes were moved from the HH Building to the T Building in 1959 (Meyer 1959a), at which time the 3-inch * line was abandoned in place. One report (Biles 1973) suggests that the line was abandoned in 1954. No record could be found that the line may have been replaced.

~~In 1955, a leak was discovered in the 8-inch vitrified clay pipe from the south part of T Building to WD Building. This pipe was abandoned in place, and a new 5-inch steel pipe was laid directly on the concrete encasement (Biles 1973). In 1970, a leak was discovered in the 8-inch vitrified clay pipe from the north part of T Building to WD Building. This pipe was also abandoned in place, and a new 3-inch steel pipe was laid directly on the concrete encasement (Biles 1973).~~

~~3.11. GENERAL ALPHA WASTEWATER SOURCES~~

~~There are several potential sources of alpha wastewater at Mound, including the H, R, SW, SM, and WD buildings, Building 38, and the old alpha waste line. The SW and R buildings are addressed as the SW/R complex. Similarly, the SM Building and Building 38 now share the same system for the disposal of alpha wastewater and will be addressed as the SM/PP complex.~~

~~Floor drains in these buildings discharged materials to the alpha wastewater treatment system. Materials common to the building's floor drains include soapy shower water, mop and plutonium decontamination water, cleansers (Bowmans) and detergents, oils, paint, alcohol, and acetone. Approximately 200 pounds per year of acids (nitric, sulfuric, hydrochloric, and hydrofluoric) were discharged into drains from laboratory sinks (MRC 1985b). Sources from the individual buildings are discussed in the following subsections.~~

ENVIRONMENTAL RESTORATION PROGRAM

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

MOUND PLANT
MIAMISBURG, OHIO

June 1993

DEPARTMENT OF ENERGY
ALBUQUERQUE FIELD OFFICE

ENVIRONMENTAL RESTORATION PROGRAM
EG&G MOUND APPLIED TECHNOLOGIES

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~~is no longer present due to radioactive decay. The exact location of Area 13 is not exactly known. The locations depicted on Plate 1 indicate the general locations and display the different variations published in various documents. The map of Hot Waste Burial Sites, reproduced in the Site Scoping Report: Volume 7 - Waste Management (DOE 1992g) depicted Area 13 to the far east of Building 49. The Site Survey Project Report (Stought et al. 1988) depicted Area 13 slightly farther west and overlapping Building 49. Evaluation of the historic relationships of the Quonset hut and other historic buildings in the area indicate the actual location was even farther west as shown by the dashed square on Plate 1. The Quonset hut was also moved from the Dayton units to the lower part of the plant valley and is described in the companion reactor waste decontamination subsection 9.3 of this report.~~

~~Two surface samples were taken in or near the reported location of Area 13 during the Site Survey Project. These locations are S0670 and S0671 (Plate 1; Table III.7). Plutonium-238 was detected at 0.34 and 5.74 pCi/g, respectively (Table III.7). No thorium was detected above 2 pCi/g in these samples. Area 13, like Area 10, is in a position to receive surface water runoff from areas upgradient on the SM/PP Hill, including Area 12, which contains plutonium contamination (subsection 3.1.12). It is believed that the plutonium present in the samples taken in Area 13 may be the result of surface water runoff and not the result of the polonium-contaminated wood placed in the area. No analyses for gamma spectroscopy are known for Area 13.~~

* Removed in 1994

3.9. AREA 20

Area 20 is located on the southern slope of the Main Hill, just west of the HH Building (Plate 1). In the 1950s, an underground radioactive waste line in this area is reported to have ruptured, releasing polonium-210 and cobalt-60 to the soils in the area. At least two separate incidents are known (DOE 1992c). The aerial survey conducted in 1976 indicated gamma exposure levels of 4.5 to 7.5 μR/hr in Area 20 (EG&G 1978). During construction activities in 1985, radioactively contaminated soils from Area 20 were reportedly excavated and moved to Area 22. The old wasteline remains in place today. *

Table III.8 presents the results of the Site Survey Project sampling in Area 20. The sampling locations are shown in Plate 1. No plutonium-238 or thorium results were given for the core locations sampled. Cesium-137 was detected at 1 pCi/g in the surface sample collected from core location 0070 (C0070 on Table III.8). Radium-226 was the only other radionuclide detected in the samples collected from the other core locations.

The samples from the surface locations in Area 20 were analyzed for plutonium-238 and thorium. The maximum concentrations detected were 1.9 and 4.02 pCi/g for plutonium-238 and thorium, respectively. Both of these concentrations were detected in samples collected from surface location 0406 (S0406, Table III.8).

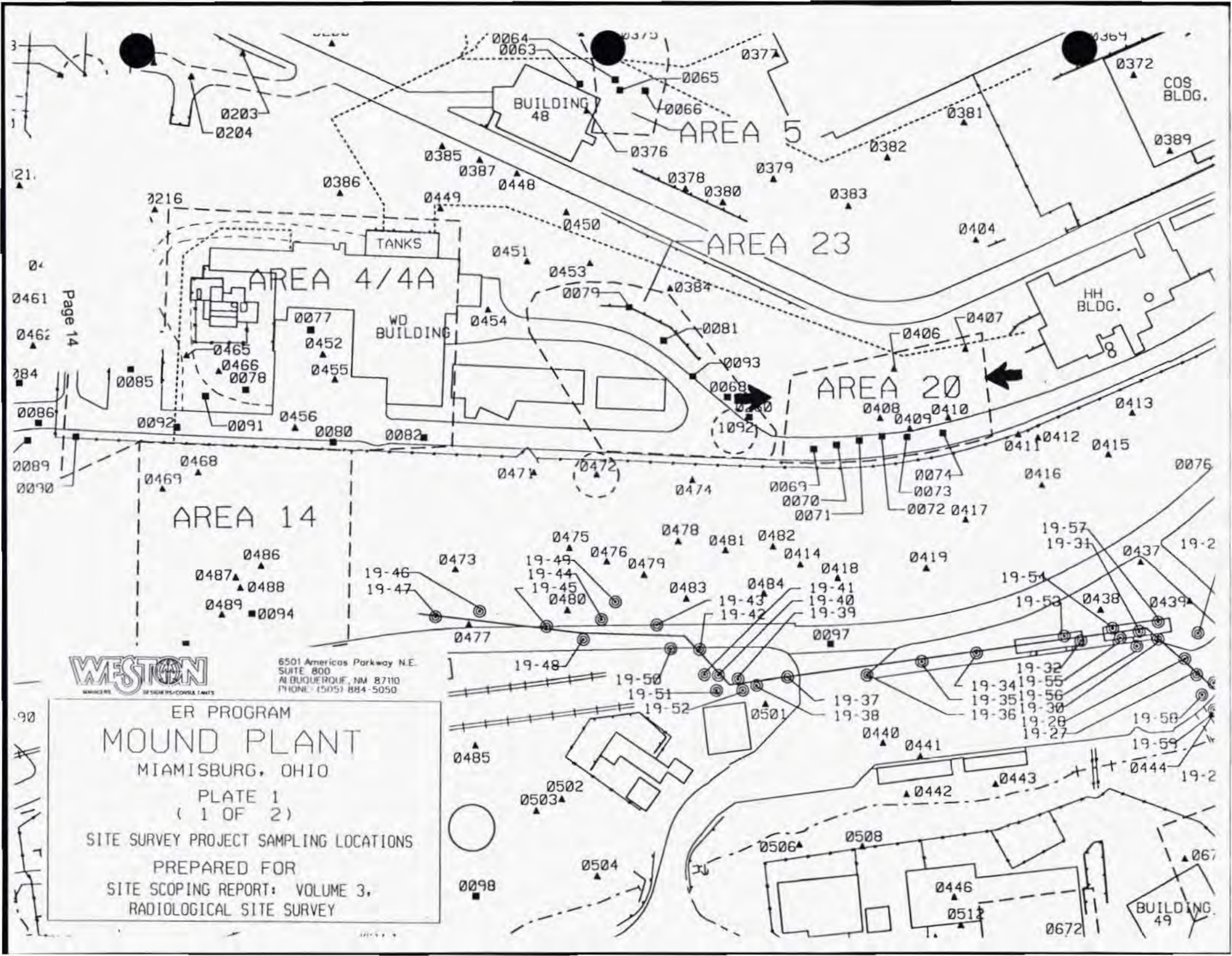

AREA 5
AREA 23
AREA 4/4A
AREA 20
AREA 14
BUILDING 48
TANKS
WD BUILDING
HH BLDG.
COS BLDG.
BUILDING 49
WESTON
6501 Americas Parkway N.E.
SUITE 800
ALBUQUERQUE, NM 87110
PHONE: (505) 884-5050
ER PROGRAM
MOUND PLANT
MIAMISBURG, OHIO
PLATE 1
(1 OF 2)
SITE SURVEY PROJECT SAMPLING LOCATIONS
PREPARED FOR
SITE SCOPING REPORT: VOLUME 3,
RADIOLOGICAL SITE SURVEY

Table III.8. Mound Site Survey Project - Area 20

Plate 1 Location[a]	Coordinates South	Coordinates West	MRC ID No.	Mo-Yr	Depth (inch)	Plutonium-238 (pCi/g)	Thorium[b] (pCi/g)	Cobalt-60 (pCi/g)	Cesium-137 (pCi/g)	Radium-226 (pCi/g)	Americium-241 (pCi/g)
C0069	2235	3320	10804	09-85	0	NR	NR	LDL	LDL	0.5	LDL
			10805	09-85	18	NR	NR	LDL	LDL	0.4	LDL
			10806	09-85	36	NR	NR	LDL	LDL	0.4	LDL
			10807	09-85	54	NR	NR	LDL	LDL	0.6	LDL
			10808	09-85	72	NR	NR	LDL	LDL	0.4	LDL
			10809	09-85	90	NR	NR	LDL	LDL	0.8	LDL
			10910	09-85	108	NR	NR	LDL	LDL	0.6	LDL
			10911	09-85	126	NR	NR	LDL	LDL	0.6	LDL
			10812	09-85	144	NR	NR	LDL	LDL	0.5	LDL
C0070	2240	3300	10792	09-85	0	NR	NR	LDL	1.0	0.7	LDL
			10794	09-85	36	NR	NR	LDL	LDL	0.2	LDL
			10796	09-85	72	NR	NR	LDL	LDL	0.9	LDL
			10798	09-85	108	NR	NR	LDL	LDL	0.5	LDL
			10799	09-85	126	NR	NR	LDL	LDL	0.7	LDL
			10800	09-85	144	NR	NR	LDL	LDL	0.6	LDL
			10801	09-85	162	NR	NR	LDL	LDL	0.5	LDL
			10802	09-85	180	NR	NR	LDL	LDL	0.2	LDL
C0071	2245	3280	10781	09-85	0	NR	NR	LDL	LDL	0.5	LDL
			10782	09-85	18	NR	NR	LDL	LDL	0.2	LDL
			10783	09-85	36	NR	NR	LDL	LDL	0.2	LDL
			10786	09-85	90	NR	NR	LDL	LDL	0.5	LDL
			10787	09-85	108	NR	NR	LDL	LDL	0.2	LDL
			10788	09-85	126	NR	NR	LDL	LDL	0.6	LDL
			10789	09-85	144	NR	NR	LDL	LDL	0.2	LDL
			10790	09-85	162	NR	NR	LDL	LDL	0.6	LDL
			10789	09-85	180	NR	NR	LDL	LDL	0.9	LDL
C0072	2250	3260	10675	09-85	18	NR	NR	LDL	LDL	0.4	LDL
			10676	09-85	36	NR	NR	LDL	LDL	0.5	LDL
			10677	09-85	54	NR	NR	LDL	NR	0.6	LDL
			10678	09-85	72	NR	NR	LDL	LDL	0.4	LDL
			10679	09-85	90	NR	NR	LDL	LDL	0.3	LDL
			10680	09-85	108	NR	NR	LDL	LDL	0.4	LDL
			10681	09-85	126	NR	NR	LDL	LDL	0.5	LDL
			10682	09-85	144	NR	NR	LDL	LDL	0.6	LDL
			10683	09-85	162	NR	NR	LDL	LDL	0.2	LDL
C0073	2260	3240	10770	09-85	0	NR	NR	LDL	LDL	0.5	LDL
			10772	09-85	36	NR	NR	LDL	LDL	0.2	LDL
			10775	09-85	90	NR	NR	LDL	LDL	0.7	LDL
			10777	09-85	126	NR	NR	LDL	LDL	0.6	LDL
			10778	09-85	144	NR	NR	LDL	LDL	0.6	LDL
			10779	09-85	162	NR	NR	LDL	LDL	0.2	LDL

Table III.8. (page 2 of 2)

Plate 1 Location[a]	Coordinates South	Coordinates West	MRC ID No.	Mo-Yr	Depth (inch)	Plutonium-238 (pCi/g)	Thorium[b] (pCi/g)	Cobalt-60 (pCi/g)	Cesium-137 (pCi/g)	Radium-226 (pCi/g)	Americium-241 (pCi/g)
C0074	2270	3210	10762	09-85	0	NR	NR	LDL	LDL	0.50	LDL
			10763	09-85	18	NR	NR	LDL	LDL	0.40	LDL
			10764	09-85	36	NR	NR	LDL	LDL	0.50	LDL
			10765	09-85	54	NR	NR	LDL	LDL	0.50	LDL
			10766	09-85	72	NR	NR	LDL	LDL	0.50	LDL
			10767	09-85	90	NR	NR	LDL	LDL	0.60	LDL
			10768	09-85	108	NR	NR	LDL	LDL	0.60	LDL
			10769	09-85	126	NR	NR	LDL	LDL	0.70	LDL
S0406	2200	3225	2873	10-83	0	1.90	4.02				
S0407	2210	3160	2872	10-83	0	0.13	b				
S0408	2235	3255	2913	10-83	0	NR	b				
S0409	2255	3235	2914	10-83	0	1.46	b				
S0410	2260	3200	5867	07-84	0	0.48	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 background level of 2.0 pCi/g, using FIDLER screening. Therefore, radiochemical analysis was not performed.

FIDLER - field instrument for the detection of low-energy radiation

LDL - The measured concentration was below the lower detection limit, estimated to be 0.5 pCi/g for cobalt-60, cesium-137, and americium-241; and 1 pCi/g for radium-226.

MRC ID - Monsanto Research Corporation identification

NR - No result given

pCi/g - picocuries per gram

pCi/mL - picocuries per milliliter

The presentation of the Site Survey Project data for Area 20 made in this report does not agree with the presentation of data in the original Site Survey Report. The differences lie mainly in the reporting of the cesium-137 and cobalt-60 results. In the original report, cesium concentrations less or equal to the LDL of 0.5 pCi/g were reported as between 0.1 and 1.0 pCi/g. Cobalt concentrations less than the LDL of 0.5 pCi/g were reported as between 0.01 and 0.1 pCi/g (Table III.8).

The depth to bedrock in Area 20 is approximately 324 inches (27 ft) (Mound Plant drawing #FSE16472) (DOE 1992f). The maximum depth of the Site Survey Project boreholes was 180 inches, or 15 ft. Because boring logs are not available, it is not known if bedrock was reached during sampling.

The original Site Survey Project noted that more recent construction data for Area 20 indicated the presence of significant contamination (Garner 1985), as follows:

- 800 pCi/g of cobalt-60,
- 200 pCi/g of cesium-137,
- 400 pCi/g of bismuth-210m, and
- 70 pCi/g of bismuth-207.

This contamination was discovered during routine health physics screening of soil being excavated for sewer work in Area 20. It was reportedly removed to Area 22 during the sewer work. Area 22 is described in the companion General Use Areas section of this report. Other than cobalt-60, the origin of these isotopes in Area 20 is not known for certain. Cesium-137 was probably associated with the processing of reactor wastes, as described in section 9 of this report. However, no connection between the HH Building and the reactor waste decontamination experiments was discovered during the research for this report.

Bismuth-210m and bismuth-207 were undoubtedly associated with the bismuth processing conducted to produce polonium-210, but up to that time were not recognized. Bismuth-210m is a long-lived metastable isotope with a half-life of nearly 3 million years. In addition to gamma radiation, it decays through alpha emission to thallium-206, which in turn decays over a very short half-life (4.3 minutes) to stable lead-206. Thallium-206 is generally known as a descendent in the uranium-238 decay chain. The origin of bismuth-207 is more speculative. It is, however, known to be produced by alpha particle bombardment of bismuth-209 to produce astatine-211, which decays over a very short half-life (7.2 hours) by alpha particle emission to bismuth-207. Bismuth-207 decays over a 30-year half-life by electron capture to lead-207 metastable (lead-207m). Lead-207m decays to stable lead-207 by

gamma radiation over a 0.8-second half-life. It is entirely conceivable, but speculative, that some of the bismuth-209 destined for neutron bombardment actually absorbed an alpha particle during irradiation in the nuclear reactor. Alpha particles could have been present from polonium-210, for instance. Based on their identification in Area 20, both bismuth-210m and bismuth-207 should be considered potential contaminants in areas affected by cobalt-60.

3.10. LOCATIONS WITH ELEVATED COBALT-60

Cobalt-60 is a radionuclide produced as a by-product of polonium production. In the production of polonium-210, bismuth metal was the prime target, but it was jacketed in an aluminum can because the bismuth was so brittle. The irradiation of trace quantities of nickel in the aluminum cans produced cobalt-60. Details of the process are described in the Site Scoping Report: Volume 7 - Waste Management (DOE 1992g).

Only one isolated occurrence of cobalt-60 was documented during the Site Survey Project. The sample taken at surface location S0175, located on the western edge of the Main Hill, contained 82 pCi/g of cobalt-60 (Plate 1; Table III.6). This sample also contained 10 pCi/g of cesium-137. Few samples were taken in this area, so it is not known if there are other locations of elevated cobalt-60. The source of the potential contamination at surface location S0175 is not currently known. Cobalt-60 may be present at other locations at Mound Plant associated with processing of polonium wastes, particularly the handling of the decanning solutions. The decanning solutions were handled in HH Building and moved to the old explosives bunker for storage before shipment offsite for disposal (DOE 1992g). The old explosives bunker, also known as the radium shack, is now known as Area 21 and is described in the companion radium/actinium section of this report. Bismuth-210m and bismuth-207 may be associated with cobalt-60, as noted above. These two isotopes were not formerly recognized as contaminants from the processing of polonium-210, but their occurrence within Area 20 suggests that they may be associated with cobalt-60. Cobalt-60, bismuth-210m, and bismuth-207 are typically analyzed by gamma spectroscopy and can be identified by that method.

SOIL GAS SURVEY AND GEOPHYSICAL INVESTIGATIONS MAIN HILL AND SM/PP HILL AREAS RECONNAISSANCE SAMPLING

MOUND PLANT
MIAMISBURG, OHIO

February 1993

DEPARTMENT OF ENERGY
ALBUQUERQUE OFFICE

ENVIRONMENTAL RESTORATION PROGRAM
EG&G MOUND APPLIED TECHNOLOGIES

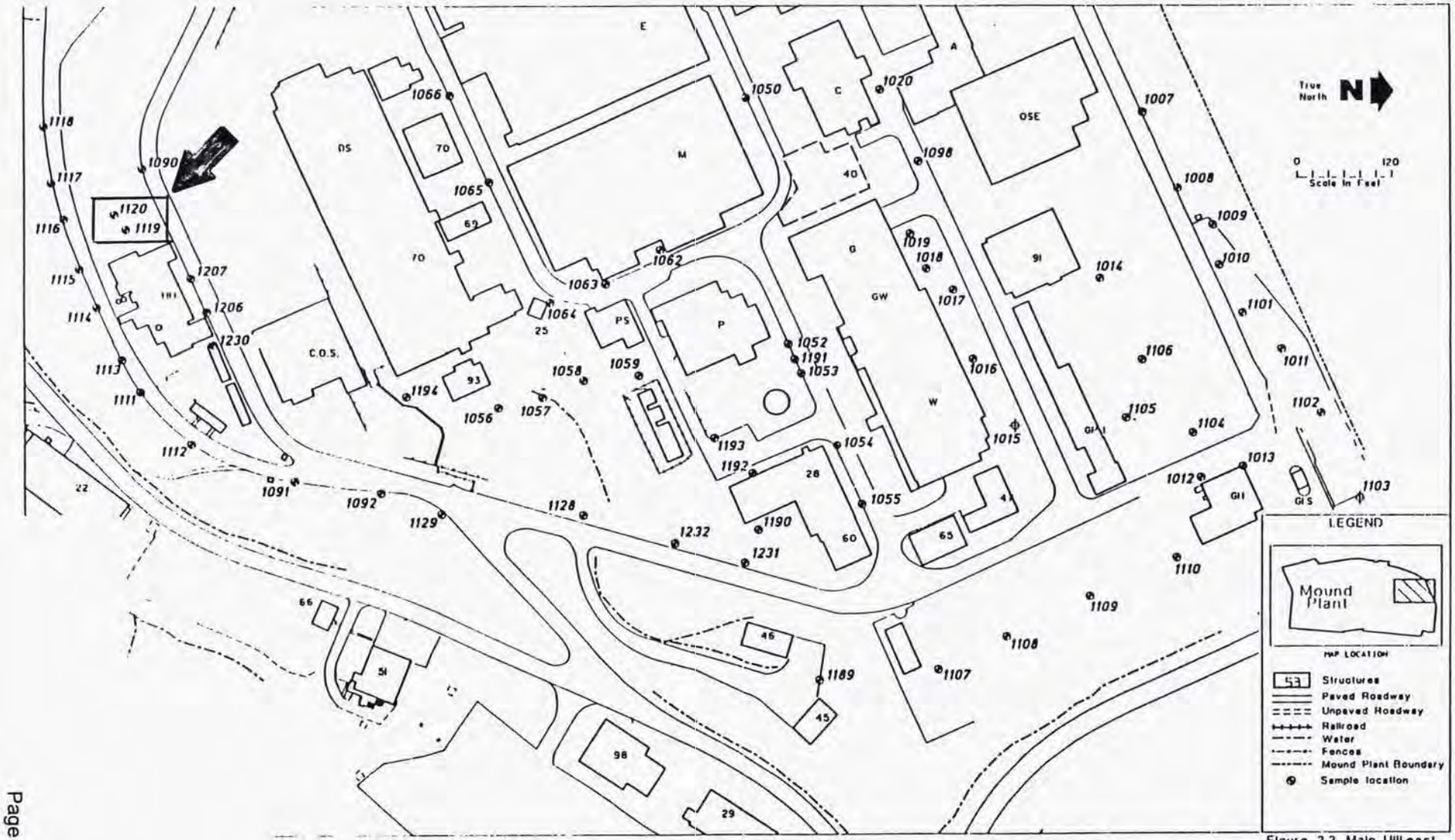


Figure 2.2. Main Hill east sample location map.

TABLE II.4. SUMMARY OF POSITIVE DETECTIONS – MAIN HILL
(ppb)

SAMPLE ID	SAMPLE DATE	FREON 11	FREON 113	TRAN-12DCE	CIS-12DCE	111TCA	PCE	TCE	TOLUENE
MND-01-1113-0005	17 AUG 92	---	---	---	---	---	---	11	---
MND-01-1114-0005	17 AUG 92	---	9	---	---	315	18	357	5 *
MND-01-1114-1005	17 AUG 92	---	---	---	---	259	9	263	3 *
MND-01-1115-0005	17 AUG 92	---	---	---	---	56	---	13	---
MND-01-1117-0005	18 AUG 92	---	---	---	---	---	12	8	---
MND-01-1117-1005	18 AUG 92	---	---	---	---	---	15	9	---
MND-01-1118-0005	18 AUG 92	---	---	---	---	---	3	---	---
MND-01-1119-0005	18 AUG 92	---	---	---	---	---	---	---	213
MND-01-1122-0005	18 AUG 92	801	13	---	---	---	---	---	---
MND-01-1123-0005	18 AUG 92	---	---	---	---	---	---	---	5 *
MND-01-1124-0005	18 AUG 92	---	---	---	---	---	---	---	8884 *
MND-01-1127-0005	18 AUG 92	---	---	---	---	---	4	---	27 *
MND-01-1129-0005	18 AUG 92	---	10	---	---	37	12	4	11 *
MND-01-1190-0005	24 SEP 92	240	477	---	---	---	---	---	3 *
MND-01-1190-1005	24 SEP 92	287	707	---	---	---	---	---	3 *
MND-01-1192-0005	24 SEP 92	---	---	---	---	---	---	---	5 *
MND-01-1193-0005	24 SEP 92	---	---	---	---	---	---	---	16 *
MND-01-1196-0005	25 SEP 92	---	---	---	---	---	---	4	64
MND-01-1197-0002	25 SEP 92	---	---	---	---	---	---	23	5
MND-01-1198-0006	25 SEP 92	---	24	13	518	33	---	474	5
MND-01-1199-0002	25 SEP 92	---	10218	---	120	---	---	479	---
MND-01-1201-0007	25 SEP 92	---	4716	13	811	---	---	130	48
MND-01-1201-1007	25 SEP 92	---	5895	---	612	---	---	117	43
MND-01-1202-0002	25 SEP 92	---	6419	66	2499	9	---	1921	3
MND-01-1202-1002	25 SEP 92	---	9301	41	1708	---	---	1737	---
MND-01-1203-0002	25 SEP 92	---	1475	---	334	---	---	45	192
MND-01-1204-0005	25 SEP 92	---	453	---	---	---	---	11	5
MND-01-1205-0005	25 SEP 92	---	---	---	---	---	---	---	21
MND-01-1206-0005	26 SEP 92	---	---	---	---	---	---	---	23142
MND-01-1207-0005	26 SEP 92	---	---	---	---	---	---	---	90
MND-01-1227-0005	28 SEP 92	---	10	---	---	---	---	---	4788
MND-01-1228-0005	28 SEP 92	---	---	---	---	---	---	---	11
MND-01-1230-0005	28 SEP 92	---	---	---	---	---	---	---	13
MND-01-1230-1005	28 SEP 92	---	---	---	---	---	---	---	5
MND-01-1231-0005	28 SEP 92	---	48	---	---	---	34	21	5
MND-01-1232-0005	28 SEP 92	---	4	---	---	---	13	8	24
MND-01-1233-0002	29 SEP 92	---	29	---	---	---	---	---	72
MND-01-1233-1002	29 SEP 92	---	29	---	---	---	---	---	64

Notes:

Only sample locations having positive detections are shown.

*: Associated trip, ambient, equipment or field blank contained specified compound.

B: Indicates blank sample.

w: Indicates water sample.

**: Freon 113 & TCE Off-Scale

TABLE II.15 UNQUANTIFIED SOIL VAPOR DETECTIONS

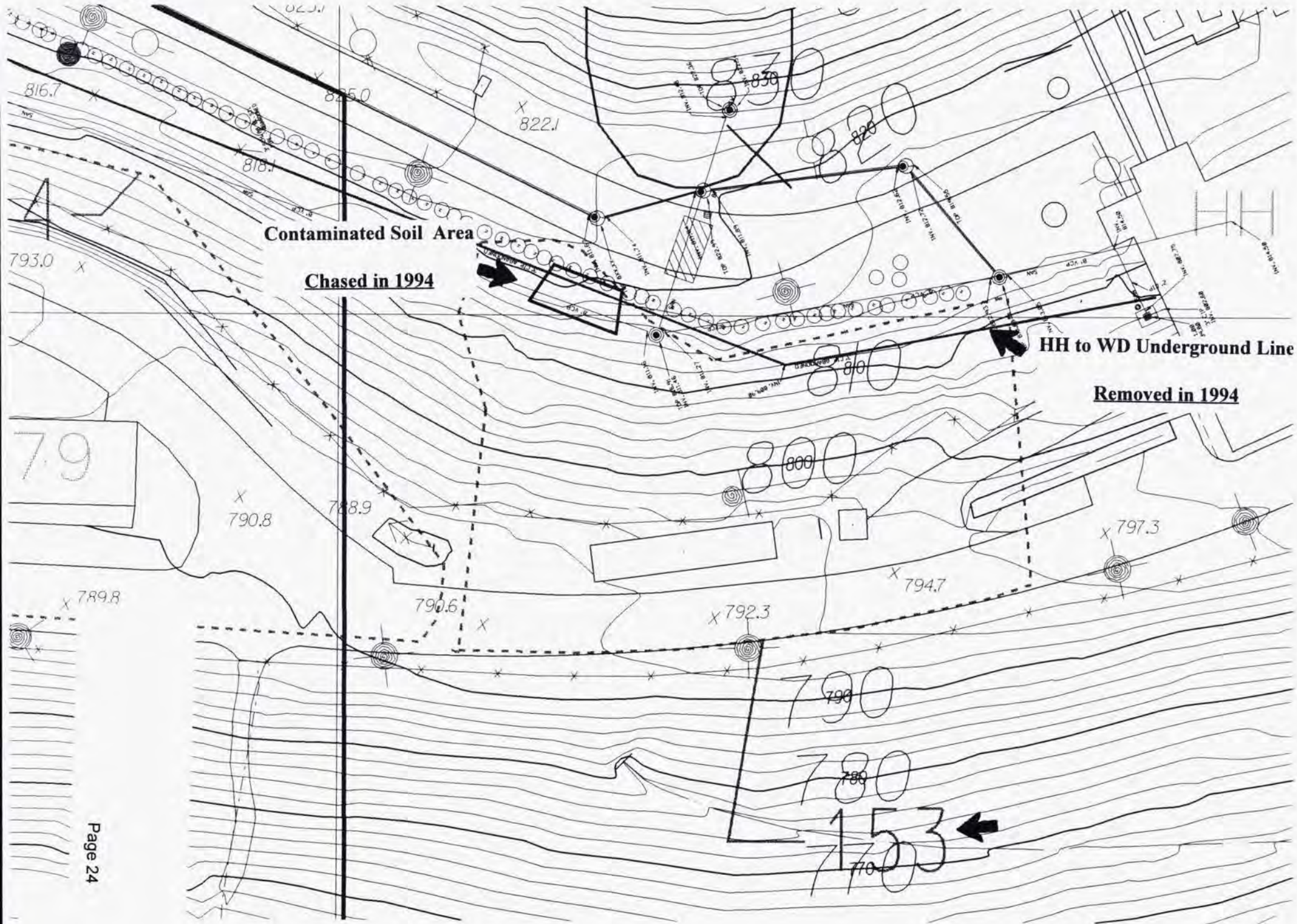
SAMPLE ID	DETECTED COMPOUND OR TYPE
MND-01-1007-0005	Freon 113
MND-01-1008-0005	Freon 113
MND-01-1009-0005	Freon 113
MND-01-1010-0005	Freon 113
MND-01-1011-0005	Freon 113
MND-01-1014-0002	Fuel Pattern
MND-01-1050-0003	Chlorinated Hydrocarbon
MND-01-1075-0005	Fuel Pattern
MND-01-1081-0005	Fuel Pattern
MND-01-1098-0004	Fuel Pattern
MND-01-1110-0005	Fuel Pattern
MND-01-1119-0005	Fuel Pattern
MND-01-1124-0005	Fuel Pattern
MND-01-1196-0005	Fuel Pattern
MND-01-1201-0007	Vinyl Chloride, Methane
MND-01-1203-0002	Fuel Pattern
MND-01-1206-0005	Diesel Fuel
MND-01-1207-0005	Fuel Pattern
MND-01-1227-0005	Diesel Fuel Pattern
MND-01-2023-0005	Peak on FID
MND-01-2027-0005	Fuel Pattern
MND-01-2034-0005	Peaks on FID
MND-01-2040-0005	Peaks on FID
MND-01-2135-0005	Peak @ 7 HECD
MND-01-2138-0005	Fuel Pattern
MND-01-2139-0005	Diesel Pattern
MND-01-2142-0005	Fuel Pattern
MND-01-2142-1005	Fuel Pattern
MND-01-2144-0005	Fuel Pattern
MND-01-2147-3002	Fuel Pattern
MND-01-2151-3002	Fuel Pattern
MND-01-2216-0005	Fuel Pattern
MND-01-2220-3002	Fuel Pattern
MND-01-4160-0015	Fuel Pattern
MND-01-5225-0005	Diesel Fuel Pattern

During the investigation, the laboratory chemist noted 35 samples which showed the presence of other volatile organic constituents which were not quantified in analysis. Most of these occurrences were hydrocarbon compounds associated with petroleum distillates. Table II.15 summarizes the locations and types of contaminants observed but unquantified during the sample analysis program.

1994 HH to WD Underground Line Removal

Contaminated Soil Area Chase

Soil Screening Analysis


Contaminated Soil Area
Chased in 1994
HH to WD Underground Line
Removed in 1994
816.7
825.0
822.1
818.1
793.0
790.8
788.9
790.6
789.8
792.3
794.7
797.3
830
820
810
800
790
780
770
153

TEST RESULTS - SODIUM IODIDE SOIL SCREEN
(MD-80030, OP. 1355)
400 SECOND COUNT
PREPARED BY BETTY PETERS -EXT. 4408

SAMPLE NO.	DATE COLLECTED	DATE SCREENED	SAMPLER	SAMP TYPE	88 KEV WINDOW	17 KEV WINDOW	MORE ISO-TOPES	GRID LOCATION	WELL
94063309	08/01/94	08/02/94	S. BRINKMEIER 5416	CONT	12.8	143	N	WD-HH BOX 3412 SAMPLE #1 J11-2	A
94063298	08/01/94	08/02/94	S. BRINKMEIER 5416	CONT	5.0	41	N	WD-HH BOX 3412 SAMPLE #2 J11-2	A
94063302	08/01/94	08/02/94	S. BRINKMEIER 5416	CONT	678.3	4725	Y	WD-HH BOX 3412 SAMPLE #3 J11-2	A
94063312	08/01/94	08/02/94	S. BRINKMEIER 5416	CONT	109.7	2064	Y	WD-HH BOX 3412 SAMPLE #4 J11-2	A
63314	08/01/94	08/02/94	S. BRINKMEIER 5416	CONT	0.9	23	N	WD-HH BOX 3453 SAMPLE #1 J11-2	A
3311	08/01/94	08/02/94	S. BRINKMEIER 5416	CONT	6.5	0	N	WD-HH BOX 3453 SAMPLE #2 J11-2	B
94063300	08/01/94	08/02/94	S. BRINKMEIER 5416	CONT	160.9	0	Y	WD-HH BOX 3453 SAMPLE #3 J11-2	A
94063307	08/01/94	08/02/94	S. BRINKMEIER 5416	CONT	6.5	68	N	WD-HH BOX 3453 SAMPLE #4 J11-2	A
94063299	08/01/94	08/02/94	S. BRINKMEIER 5416	CONT	15.0	24	Y	WD-HH BOX 3461 SAMPLE #2 J11-2	B
94063304	08/01/94	08/02/94	S. BRINKMEIER 5416	CONT	2.5	5	N	WD-HH BOX 3461 SAMPLE #3 J11-2	C
94063303	08/01/94	08/02/94	S. BRINKMEIER 5416	CONT	201.9	869	Y	WD-HH BOX 3461 SAMPLE #4 J11-2	B
94063295	08/01/94	08/02/94	S. BRINKMEIER 5416	CONT	7.1	57	N	WD-HH BOX 3461 SAMPLE #7 J11-2	A
94063317	08/01/94	08/02/94	S. BRINKMEIER 5416	CONT	374.1	3174	Y	WD-HH BOX 3480 SAMPLE #1 J11-2	B
94063318	08/01/94	08/02/94	S. BRINKMEIER 5416	CONT	9.9	68	N	WD-HH BOX 3480 SAMPLE #2 J11-2	C
94063315	08/01/94	08/02/94	S. BRINKMEIER 5416	CONT	3.2	34	N	WD-HH BOX 3480 SAMPLE #3 J11-2	C

No. 2
)8/02/94

TEST RESULTS - SODIUM IODIDE SOIL SCREEN
(MD-80030, OP. 1355)
400 SECOND COUNT
PREPARED BY BETTY PETERS -EXT. 4408

SAMPLE NO.	DATE COLLECTED	DATE SCREENED	SAMPLER	SAMP TYPE	88 KEV WINDOW	17 KEV WINDOW	MORE ISO-TOPES	GRID LOCATION	WELL
94063305	08/01/94	08/02/94	S. BRINKMEIER 5416	CONT	75.8	981	N	WD-HH BOX 3480 SAMPLE #4 J11-2	C
94063301	08/01/94	08/02/94	S. BRINKMEIER 5416	CONT	672.4	7694	Y	WD-HH BOX 3489 SAMPLE #1 J11-2	C
94063296	08/01/94	08/02/94	S. BRINKMEIER 5416	CONT	1.2	8	N	WD-HH BOX 3489 SAMPLE #2 J11-2	B
94063297	08/01/94	08/02/94	S. BRINKMEIER 5416	CONT	0.8	17	N	WD-HH BOX 3489 SAMPLE #3 J11-2	C
63308	08/01/94	08/02/94	S. BRINKMEIER 5416	CONT	28.3	468	N	WD-HH BOX 3489 SAMPLE #4 J11-2	C
306	08/01/94	08/02/94	S. BRINKMEIER 5416	CONT	158.8	1076	Y	WD-HH BOX 3565 SAMPLE #1 J11-2	B
94063316	08/01/94	08/02/94	S. BRINKMEIER 5416	CONT	3.4	15	N	WD-HH BOX 3565 SAMPLE #2 J11-2	B
94063310	08/01/94	08/02/94	S. BRINKMEIER 5416	CONT	14.8	57	N	WD-HH BOX 3565 SAMPLE #3 J11-2	B
94063313	08/01/94	08/02/94	S. BRINKMEIER 5416	CONT	12.6	70	N	WD-HH BOX 3565 SAMPLE #4 J11-2	C

TEST RESULTS - SODIUM IODIDE SOIL SCREEN
(MD-80030, OP. 1355)
400 SECOND COUNT
PREPARED BY BETTY PETERS -EXT. 4408

SAMPLE NO.	DATE COLLECTED	DATE SCREENED	SAMPLER	SAMP TYPE	88 KEV WINDOW	17 KEV WINDOW	MORE ISO-TOPES	GRID LOCATION	WELL
94062714	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	8.0	50	N	WD-HH BOX 3330 J11-9 #1 AREA 3	A
94062717	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	10.3	101	N	WD-HH BOX 3330 J11-9 #2 AREA 3	A
94062683	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	56.7	694	Y	WD-HH BOX 3330 J11-9 #3 AREA 2	B
94062725	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	7.3	75	N	WD-HH BOX 3330 J11-9 #4 AREA 2	A
62691	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	47.5	438	Y	WD-HH BOX 3389 J11-9 #1 AREA 2	A
94062690	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	26.4	52	Y	WD-HH BOX 3389 J11-9 #2 AREA 2	B
94062694	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	24.3	143	N	WD-HH BOX 3389 J11-9 #3 AREA 2	C
94062686	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	9.3	59	N	WD-HH BOX 3389 J11-9 #4 AREA 2	C
94062724	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	183.9	2794	Y	WD-HH BOX 3434 J11-9 #1 AREA 2	A
94062697	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	29.4	184	Y	WD-HH BOX 3434 J11-9 #2 AREA 2	A
94062719	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	80.4	417	N	WD-HH BOX 3434 J11-9 #3 AREA 3	C
94062721	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	13.2	55	N	WD-HH BOX 3434 J11-9 #4 AREA 2	B
94062700	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	33.2	62	N	WD-HH BOX 3442 J11-9 #1 AREA 2	C
94062692	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	24.4	1484	Y	WD-HH BOX 3442 J11-9 #2 AREA 2	A
94062704	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	6.4	27	N	WD-HH BOX 3442 J11-9 #3 AREA 3	C

TEST RESULTS - SODIUM IODIDE SOIL SCREEN
(MD-80030, OP. 1355)
400 SECOND COUNT
PREPARED BY BETTY PETERS -EXT. 4408

SAMPLE NO.	DATE COLLECTED	DATE SCREENED	SAMPLER	SAMP TYPE	88 KEV WINDOW	17 KEV WINDOW	MORE ISO-TOPES	GRID LOCATION	WELL
94062696	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	7.9	37	N	WD-HH BOX 3442 J11-9 #4 AREA 2	B
94062695	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	21.3	0	N	WD-HH BOX 3446 J11-9 #1 AREA 2	C
94062701	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	15.9	66	N	WD-HH BOX 3446 J11-9 #2 AREA 2	C
94062698	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	11.5	107	Y	WD-HH BOX 3446 J11-9 #3 AREA 2	A
062707	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	7.7	16	N	WD-HH BOX 3446 J11-9 #4 AREA 3	C
[illegible]720	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	83.3	635	N	WD-HH BOX 3447 J11-9 #1 AREA 3	A
94062688	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	111.8	457	Y	WD-HH BOX 3447 J11-9 #2 AREA 2	B
94062709	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	13.0	132	N	WD-HH BOX 3447 J11-9 #3 AREA 3	A
94062706	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	14.7	63	N	WD-HH BOX 3447 J11-9 #4 AREA 3	A
94062699	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	25.6	91	Y	WD-HH BOX 3449 J11-9 #1 AREA 2	B
94062710	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	6.9	91	N	WD-HH BOX 3449 J11-9 #2 AREA 3	A
94062693	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	21.5	201	Y	WD-HH BOX 3449 J11-9 #3 AREA 2	B
94062734	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	11.3	111	N	WD-HH BOX 3449 J11-9 #4 AREA 2	A
94062718	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	13.0	68	N	WD-HH BOX 3467 J11-9 #1 AREA 3	C
94062733	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	31.8	20	N	WD-HH BOX 3467 J11-9 #2 AREA 2	B

TEST RESULTS - SODIUM IODIDE SOIL SCREEN
(MD-80030, OP. 1355)
400 SECOND COUNT
PREPARED BY BETTY PETERS -EXT. 4408

SAMPLE NO.	DATE COLLECTED	DATE SCREENED	SAMPLER	SAMP TYPE	88 KEV WINDOW	17 KEV WINDOW	MORE ISO-TOPES	GRID LOCATION	WELL
94062689	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	20.6	0	N	WD-HH BOX 3467 J11-9 #3 AREA 2	C
94062732	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	60.6	1346	N	WD-HH BOX 3467 J11-9 #4 AREA 2	C
94062685	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	23.1	167	N	WD-HH BOX 3473 J11-9 #1 AREA 2	[illegible]
94062716	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	29.2	0	N	WD-HH BOX 3473 J11-9 #2 AREA 3	B
62715	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	28.2	0	Y	WD-HH BOX 3473 J11-9 #3 AREA 3	B
[illegible]727	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	13.6	32	N	WD-HH BOX 3473 J11-9 #4 AREA 2	C
94062687	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	52.2	544	Y	WD-HH BOX 3483 J11-9 #1 AREA 2	A
94062705	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	8.0	2039	Y	WD-HH BOX 3483 J11-9 #2 AREA 3	B
94062729	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	138.8	1973	Y	WD-HH BOX 3483 J11-9 #3 AREA 2	C
94062723	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	31.6	0	N	WD-HH BOX 3483 J11-9 #4 AREA 2	B
94062711	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	15.5	79	N	WD-HH BOX 3503 J11-9 #1 AREA 3	B
94062712	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	7.2	27	N	WD-HH BOX 3503 J11-9 #2 AREA 3	C
94062713	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	37.1	954	N	WD-HH BOX 3503 J11-9 #3 AREA 3	C
94062708	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	7.1	65	N	WD-HH BOX 3503 J11-9 #4 AREA 3	B
94062684	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	16.1	112	Y	WD-HH BOX 3517 J11-9 #1 AREA 2	A

No. 4
07/13/94

TEST RESULTS - SODIUM IODIDE SOIL SCREEN
(MD-80030, OP. 1355)
400 SECOND COUNT
PREPARED BY BETTY PETERS -EXT. 4408

SAMPLE NO.	DATE COLLECTED	DATE SCREENED	SAMPLER	SAMP TYPE	88 KEV WINDOW	17 KEV WINDOW	MORE ISO-TOPES	GRID LOCATION	WELL
94062728	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	30.5	0	N	WD-HH BOX 3517 J11-9 #2 AREA 2	B
94062703	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	28.9	0	Y	WD-HH BOX 3517 J11-9 #3 AREA 3	B
94062726	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	24.5	176	N	WD-HH BOX 3517 J11-9 #4 AREA 2	A
94062730	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	40.0	105	N	WD-HH BOX 3558 J11-9 #1 AREA 2	A
062731	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	26.0	0	N	WD-HH BOX 3558 J11-9 #2 AREA 2	B
9[illegible]702	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	35.7	319	Y	WD-HH BOX 3558 J11-9 #3 AREA 2	[illegible]
94062722	07/11/94	07/13/94	S. BRINKMEIER 5416	CONT	16.9	40	N	WD-HH BOX 3558 J11-9 #4 AREA 2	C

DRAFT
OTHER SOILS CHARACTERIZATION REPORT

MOUND PLANT
MIAMISBURG, OHIO

JANUARY 1996

U.S. DEPARTMENT OF ENERGY
OHIO FIELD OFFICE

DECONTAMINATION AND DECOMMISSIONING PROGRAM
EG&G MOUND APPLIED TECHNOLOGIES

Data exceeding the action levels are tabulated below. These tables identify samples from areas of potential contamination. Graphic representations of the Other Soils areas and Hot Spots with a data overlay have been included to facilitate interpretation, and aid in the computation of soil cleanup volumes.

Where Mound Rad Lab method detection limits exceed specified action levels, a symbol indicating the undetermined nature of the data ("U") accompanies the spreadsheet entry.

Table 5.2 shows the action levels used in the Other Soils Field Program to identify potentially contaminated soil.

Table 5.2 Field Action Levels

Field Instruments	Action Level
FIDLER	
Channel 1 (Pu)	1000 cpm Above Background
Channel 2 (Th)	5000 cpm Above Background
OVA	1 Meter Unit Above Background
OVM	1 Meter Unit Above Background
PXRF	
Arsenic	102.07 mg/Kg
Barium	1489 mg/Kg
Cadmium	NA
Chromium (High)	NA
Chromium (Low)	164.43 mg/Kg
Lead	172 mg/Kg
Mercury	NA
Selenium	NA
Silver	2559 mg/Kg
Mound Rad Lab	
Plutonium 238	25 pCi/g
Thorium 232	5 pCi/g
Radium 226	5 pCi/g
Cesium 137	15 pCi/g *
Americium 241	20 pCi/g

* NRC Limit

The action level for Cesium 137 was reduced for this report from the D&D action level of 80 pCi/g to the NRC action level of 15 pCi/g. The basis for adjusting this limit can be found in a communication with the Nuclear Regulatory Commission (NRC) which discusses decommissioning criteria and maximum acceptable isotope concentrations in soil. A copy of the communiqué may be found in Appendix H.

Area 5

Thirteen samples in Area 5 triggered field screening action levels:

Area 12

Seventy-six samples in Area 12 triggered field screening action levels:

- Twelve samples exceeded limits for hazardous compounds
- Sixty samples exceeded limits for radionuclides
- Four samples exhibited elevated levels of both radiological and hazardous compounds

Organic vapors from soil samples peaked at 30 meter units on the OVA. Elevated concentrations of chromium and lead were detected by the PXRF. Pu238, Th232 and Ra226 were found in excess of D&D limits in soil samples collected from the site. Maximum concentrations detected were 301,212, and 30 pCi/g respectively.

Table 5.8 shows Area 12 field results exceeding action levels. Figure 5.7 graphically represents Area 12 field sampling results.

Area 20

Thirty-three samples in Area 20 triggered field screening action levels:

- Twenty-nine samples exceeded limits for hazardous compounds
- Four samples exceeded limits for radionuclides

Organic vapors from soil samples peaked at over 500 meter units on the OVA. Elevated concentrations of Pu238 were found at up to 38 pCi/g in soil samples collected from the site.

Table 5.9 shows Area 20 field results exceeding action levels. Figure 5.8 graphically represents Area 20 field sampling results.

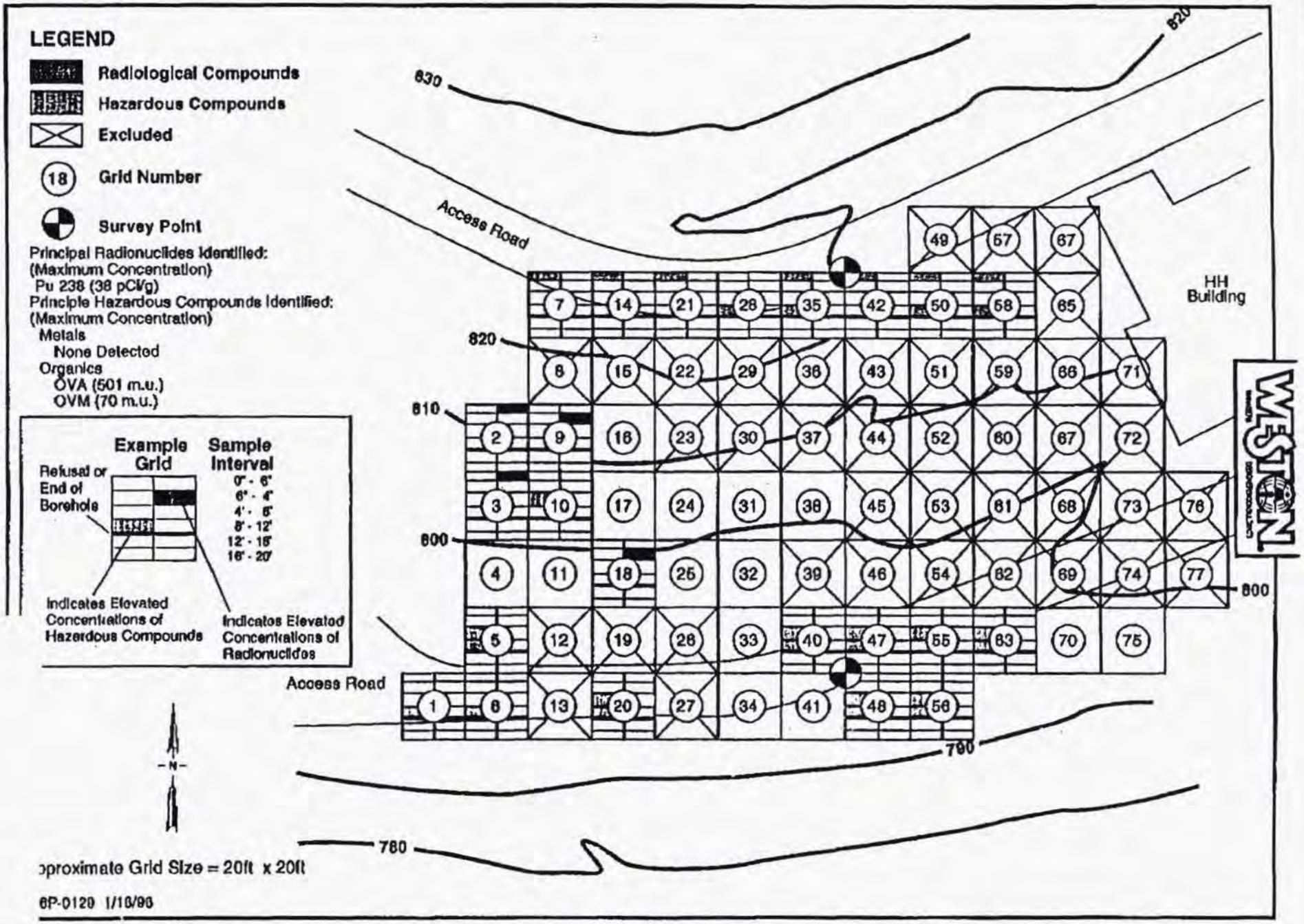


FIGURE 5.8 AREA 20

Table 5.9 Area 20 Field Sampling Results

	FIDLER		Organics				Rad Laboratory				
Sample ID	Channel 1 (1K)	Channel 2 (5K)	OVA		OVM		Pu 238 (25)		Th 232 (5)	Ra 226 (5)	Cs 137 (15)	Am 241(20)
2001-5012	<1000	<5000	10	•	10	•	<25		<5	NA	NA	NA
2002-5001	<1000	<5000	<1		<1		38	•	<5	NA	NA	NA
2003-5001	<1000	<5000	<1		<1		26	•	<5	NA	NA	NA
2005-5008	<1000	<5000	40	•	35	•	<25		<5	NA	NA	NA
2005-5012	<1000	<5000	30	•	35	•	<25		<5	NA	NA	NA
2006-5012	<1000	<5000	40	•	45	•						
2007-5001	NA	NA	20	•	<1							
2009-5004	<1000	<5000	NA		<1		25	•	<5	NA	NA	NA
2010-5008	<1000	<5000	501	•	<1		<25		<5	NA	NA	NA
2014-5001	NA	NA	1	•	<1							
2018-5004	<1000	<5000	NA		<1		30	•	<5	NA	NA	NA
2020-5008	<1000	<5000	60	•	65	•						
2020-5012	<1000	<5000	35	•	45	•						
2021-5001	NA	NA	2	•	4.2	•						
2028-5012	<1000	<5000	<1		1	•	<25		<5	NA	NA	NA
2035-5001	NA	NA	5	•	2	•						
2035-5012	<1000	<5000	20	•	40	•	<25		<5	NA	NA	NA
2040-5008	<1000	<5000	40	•	70	•	<25		<5	NA	NA	NA
2040-5012	<1000	<5000	30	•	40	•	<25		<5	NA	NA	NA
2042-5001	NA	NA	20	•	20	•						
2047-5004	<1000	<5000	40	•	35	•	<25		<5	NA	NA	NA
2047-5008	<1000	<5000	44	•	40	•	<25		<5	NA	NA	NA
2048-5004	<1000	<5000	10	•	<1		<25		<5	NA	NA	NA
2048-5008	<1000	<5000	15	•	25	•	<25		<5	NA	NA	NA
2050-5001	NA	NA	10	•	<1		<25		<5	NA	NA	NA
2050-5012	<1000	<5000	20	•	10	•	<25		<5	NA	NA	NA
2055-5008	<1000	<5000	30	•	35	•	<25		<5	NA	NA	NA
2058-5008	<1000	<5000	60	•	55	•	<25		<5	NA	NA	NA
2056-5012	<1000	<5000	10	•	15	•	<25		<5	NA	NA	NA
2058-5001	NA	NA	1	•	<1							
2058-5012	<1000	<5000	40	•	1.2	•						
2063-5008	<1000	<5000	40	•	38	•	<25		<5	NA	NA	NA
2063-5012	<1000	<5000	10	•	<1		<25		<5	NA	NA	NA

	PXRF Metals								
Sample ID	As (102.07)	Ba (1489)	Cd	Cr HI	Cr LO (164.43)	Pb (172)	Hg	Se	Ag (2559)
2001-5012	<34	279.29	<44.5	<347	<60.7	33.017	<37	<14	108.652
2002-5001	NA	NA	NA	NA	NA	NA	NA	NA	NA
2003-5001	NA	NA	NA	NA	NA	NA	NA	NA	NA
2005-5008	43.625	215.39	<44.5	<347	<60.7	<10	<37	16.984	45.7499
2005-5012	<34	191.33	<44.5	<347	<60.7	<10	<37	15.425	73.0481
2006-5012	<34	191.127	<44.5	<347	<60.7	25.2316	<37	<14	61.7865
2007-5001	NA	NA	NA	NA	NA	NA	NA	NA	NA
2009-5004	40.156	216.43	<44.5	<347	<60.7	14.307	<37	<14	42.2927
2010-5008	<34	201.63	<44.5	<347	<60.7	<10	<37	<14	<29
2014-5001	40.404	159.83	<44.5	<347	<60.7	<10	<37	<14	88.644
2018-5004	60.147	211.85	<44.5	<347	<60.7	<10	<37	<14	56.3426
2020-5008	<34	147.637	<44.5	<347	<60.7	<10	<37	<14	66.2435
2020-5012	<34	209.701	<44.5	<347	<60.7	<10	<37	15.4596	29.5182
2021-5001	NA	NA	NA	NA	NA	NA	NA	NA	NA
2028-5012	73.569	245.23	<44.5	<347	<60.7	<10	<37	<14	68.8976
2035-5001	NA	NA	NA	NA	NA	NA	NA	NA	NA
2035-5012	NA	NA	NA	NA	NA	NA	NA	NA	NA
2040-5008	57.311	252.51	<44.5	<347	<60.7	13.326	<37	<14	58.2956
2040-5012	<34	230.51	<44.5	<347	<60.7	19.348	<37	<14	50.1529
2042-5001	NA	NA	NA	NA	NA	NA	NA	NA	NA
2047-5004	<34	151.18	<44.5	<347	<60.7	24.018	<37	<14	57.3498
2047-5008	<34	240.55	<44.5	<347	<60.7	24.62	<37	<14	57.6291
2048-5004	48.349	157.05	<44.5	<347	<60.7	<10	<37	<14	<29
2048-5008	<34	243	<44.5	452.55	<60.7	23.468	<37	<14	46.2025
2050-5001	NA	NA	NA	NA	NA	NA	NA	NA	NA
2050-5012	NA	NA	NA	NA	NA	NA	NA	NA	NA
2055-5008	51.2176	179.854	<44.5	<347	<60.7	<10	<37	29.824	56.1021
2058-5008	39.251	226.01	<44.5	<347	<60.7	<1(			
2058-5012	<34	203.8	<44.5	476.94	<60.7	<1(			
2058-5001	NA	NA	NA	NA	NA	NA			
2058-5012	NA	NA	NA	NA	NA	NA			
2063-5008	40.731	198.25	<44.5	<347	<60.7	<1(			
2063-5012	69.455	257.1	<44.5	<347	<60.7	<1(			

~~soil concentration and PXRF results was not possible. Based on the data set produced by the PXRF, however, additional samples can now be selected and sent for analyses. A better correlation can be determined for the heavy metals concentrations found in the Other Soils areas, and in future work. Samples were retained as part of this study, and can be retrieved for this task at a fraction of the cost of resampling.~~

6.3.2 Additional Sampling

Areas 5, 20, 23

The Bicron method was employed by the Mound Radiological Laboratory until June 1995. Samples submitted before June received analyses for Pu238 and Th232 only. Samples submitted in June and later received analyses for a number of additional radionuclides by means of a gamma scan.

Areas 5, 20, 23 were sampled prior to June 1995. The primary nuclides of interest at these locations are Pu238, Co 60, Cs 137, and Ra226 . Resampling these locations using the gamma scan would help to define soil concentrations of these radionuclides.

Utilities

The potential presence of underground utilities thwarted sampling efforts in a number of areas. Most afflicted were areas 20 and 23, in which 40 to 50% of the projected sampling locations were excluded. Additional field sampling is recommended for these areas to further characterize the excluded locations. It may not be possible, however, to sample these areas until other means of utilities-detection are adopted.

~~6.3.3 Mound Radiological Laboratory~~

~~Gamma Scan~~

~~The gamma scan method presently used by the Mound Radiological Laboratory provides soil concentration information for a range of radioisotopes. However, detection limits for Pu238 may exceed D&D action levels unless scan time is extended.~~

6.3.4 Excavation

~~Professional Evaluation~~

~~Excavation volume calculations for removal of radiologically contaminated zones of soil assume lay-back of the excavation side walls to slopes between 1:1 and 1:2 (x:y). A professional evaluation is recommended to account for variations that may be needed because of local soil conditions and adjacent structures or~~

COMPARISON OF ACTUAL SOIL GAS VALUES WITH CALCULATED ACCEPTABLE SOIL GAS VALUES

SCREENING POTENTIAL RELEASE SITES BASED ON SOIL GAS READINGS

Soil gas readings can be utilized in the PRS screening process to identify potential release sites that may present a potential soil contamination problem for volatile organics. The soil gas survey that was conducted at Mound as part of the "Reconnaissance Sampling Report--Soil Gas Survey and Geophysical Investigations, Mound Plant Main Hill and SM/PP Hill" investigated 8 volatile compounds. The concentrations of these compounds in the in the vapor phase within the pore spaces of the soil can be correlated to the actual soil contaminant concentrations by utilizing a method developed by ICF Kaiser Engineers. This technique has been used with US EPA Region IX approval at a large Superfund site contaminated with many of the same chemicals found at relatively low levels in soils at the Mound Plant.

The soil concentration can be estimated from the soil gas values by the following equation:

$$Ct = (Cg/Pb)*[[Pb * Kd / H] + [pw / H] + [pt - pw]]$$

where

Cg	concentration of volatile chemical concentrations as soil vapor in ng/ml
Pb	Bulk density of the soil in g/ml
Kd	soil/water partition coefficient in ml/g
H	Dimensionless Henry's Law Constant
pw	water filled porosity
pt	total porosity
Ct	target soil concentration in ng/g or ug/kg (ppb)

The technique that Mound Plant will use for screening a PRS, is to compare the soil gas values obtained at a PRS with soil gas concentrations that are known to be below any regulatory or health based level of concern. The risk based guideline values for the Mound Plant (DOE, December 1995) soils are based upon 10^{-6} risk levels or a hazard index of 1. These values correspond to direct soil exposure to persons who's activities place them at the highest risk, in particular inhalation and ingestion by a Mound Plant construction worker.

Another potential exposure path must be considered, however. The potential for some of the organic contaminants to leach into ground water must be considered in developing protective soil screening levels. A "Mound Plant Soil Screening Level" paper explains the calculation of soil screening levels. For all of the chemicals that the soil gas survey identified, the calculated soil screening level soil concentrations are below the standard guideline values, therefore they are more conservative and are appropriate to be used as the basis for the soil gas calculations.

By re-arranging the equation, and using either the soil guideline values or the soil screening levels as the target soil concentration, a soil gas concentration can be calculated; this calculated soil gas concentration can be compared to the actual observed soil gas values:

$$Cg = (Pb*Ct)/[[Pb*Kd/H] + [pw/H] + [pt-pw]]$$

The values of the soil specific and chemical parameters for this equation are summarized as follows:

Pb	1.6	Bulk density of the soil in g/ml
pw	0.15	water filled porosity
pt	0.43	total porosity
foc	0.02	fraction organic material in soil (used in developing the SSL values)

Typical chemicals that are detected with soil gas sampling are:					
NAME	H	Kd	Calculated Acceptable Soil Screening Level Value	Calculated Acceptable Soil Gas Reading	Calculated Acceptable Soil Gas Reading
		ml/g	mg/kg (ppm)	ng/ml	ppb
Toluene	2.52E-01	3.42	22.06	1.56E+03	414600
Trichloroethene (TCE)	4.35E-01	2.24	0.07	1.26E+01	2400
111 Trichloroethane (TCA)	7.63E-01	2.2	3.01	9.46E+02	173400
Trans-1,2 Dichloroethene (DCE)	2.29E-01	1	0.70	1.41E+02	35700
cis-1,2 Dichloroethene (DCE)	1.85E-01	2.78	0.31	1.97E+01	5000
Freon 11	NA	NA			
Freon 113	NA	NA			
Tetrachloroethene (PCE)	7.09E-01	2.78	0.09	2.13E+01	3100

na not available

IF THE SOIL GAS READING IS BELOW THE VALUES IN THE CALCULATED SOIL GAS READING COLUMN (SHADED), THEN THERE IS NO THREAT TO GROUNDWATER FROM THIS PRS.

The soil screening level values are calculated using the Soil Screening Methodology. The Potential Release Site is assumed to be more than 100 meters from a potential drinking water source with an aquifer thickness of 15 meters and a source size of 10 meters. The hydraulic gradient is assumed to be 0.01 which is conservative for most of the Mound Plant PRSs. In special instances where the PRS lies less than 100 meters from a potential drinking water source, or the hydraulic gradient is much less than 0.01, new SSL values and new acceptable soil gas values will be calculated for that particular PRS.

Radionuclide Background Values for Comparison to Mound Plant Soils

EG&G MOUND APPLIED TECHNOLOGIES
P.O. BOX 3000 MIAMISBURG, OHIO 45343-3000 • TEL (513) 865-4020

July 27, 1995

Ms. Debra A. White
U.S. Department of Energy
Miamisburg Area Office
P.O. Box 66
Miamisburg, Ohio 45343

Dear Ms. White:

We are pleased to transmit the following tables which propose background concentrations for chemicals in soils. Mostly, these values were calculated from data collected in the OU9 Soils Investigation from locations designated for background samples. Please refer to Section 5, Appendix J, and Appendix K of the OU9 Background Soil Chemistry Report for a description of the calculations and the process used to develop these numbers.

In our review, Dan Carfagno, Alec Bray, and I determined that the thorium-230 value reported in the OU9 Background Soil Chemistry Report (3.0 pCi/g) did not seem scientifically correct. Its background value should be similar to the background value for its parent radionuclides uranium-238 and uranium-234. In the following tables, we have proposed the value 1.9 pCi/g for thorium-230. We computed this value from data collected in the OU9 Regional Soils Investigation.

If you have any questions regarding how the tables were prepared, or if you have further needs, please call me.

Sincerely,

Jim Rigano

cc:
Art Kleinrath (DOE/MB)

Radionuclide Background Values for Comparison to Mound Plant Soils

	Maximum Value (pCi/g)	Background* Value (pCi/g)
Americium-241	Not detected in any sample	Not detected in any sample
Bismuth-207	Not detected in any sample	Not detected in any sample
Bismuth-210	Not detected in any sample	Not detected in any sample
Cesium-137	0.73	0.42
Cobalt-60	1.01	Note 1
Plutonium-238	0.25	0.13
Plutonium-239/240	0.32	0.18
Potassium-40	37.9	37
Radium-226	2.95	2
Strontium-90	21.9	0.72
Thorium-228	2.13	1.5
Thorium-230**	2.44	1.9
Thorium-232	1.69	1.4
Tritium	8.28	1.6
Uranium-234	1.16	1.1
Uranium-235/236	0.12	0.11
Uranium-238	1.29	1.2

Note 1: The background value could not be computed due to the large number of non-detects in the sample set.

* Upper 95% Sample Tolerance Limit

** From Regional Soils Investigation

MLM-3517
UC-702

The Mound Site Survey Project for the Characterization of Radioactive Materials in Site Soils

Robert L. Stought, Don A. Edling, and
Douglas G. Draper

Issued: May 16, 1988

MOUND
Miamisburg, Ohio 45342

operated by
MONSANTO RESEARCH CORPORATION
a subsidiary of Monsanto Company

for the
U.S. DEPARTMENT OF ENERGY
Contract No. DE-AC04-76DP00053

Table 2.1 (continued)

Area	Isotopes	Description
		flanged at 10-ft intervals and were abandoned in September 1974 (higher level) and April 1976 (low level) because of leakage and were replaced by other systems. The lines were removed as part of the ongoing D&D effort. Additional contaminated soil will have to be removed in some locations as part of the D&D project.
20	^{210}Po Residuals ^{60}Co ^{137}Cs ^{207}Bi ^{210m}Bi	1969 - Radioactive waste line broke. (Po-210 contamination has decayed out.) Source of Cs-137 is not currently known. - More recent construction engineering data indicate soil samples in one location of: Cs-137 up to 200 pCi/g; Co-60 up to 800 pCi/g; Bi-210^{m} up to 400 pCi/g; and Bi-207 up to 70 pCi/g.
21	^{137}Cs	Presence of cesium has not been explained. This site is speculated to be the site of a bunker used to store radioactive material thought to have originated in SW-Building. However, Cs-137 was not a known constituent of these materials from SW.
22	^{60}Co ^{137}Cs ^{238}Pu	1985 - Transfer of contaminated soil from Area 20 and other areas to this location created this new area. Identified by construction engineering survey support, but included in the site survey because of the consistency with the overall site survey program objectives.

New data - No area number designated as yet -- Block 33, Figure 4.12. More recent construction engineering data (Pu-238 core samples) indicate Pu-238 contamination in the range of 7 nCi/g at a depth of 6 to 8 ft in one location.

New data - No area number designated as yet -- Block 19, Figure 4.12. More recent construction engineering data (Pu-238 soil sampling during digging operations) indicate levels of Pu-238 in the range of 32 and 23 nCi/g at one location.

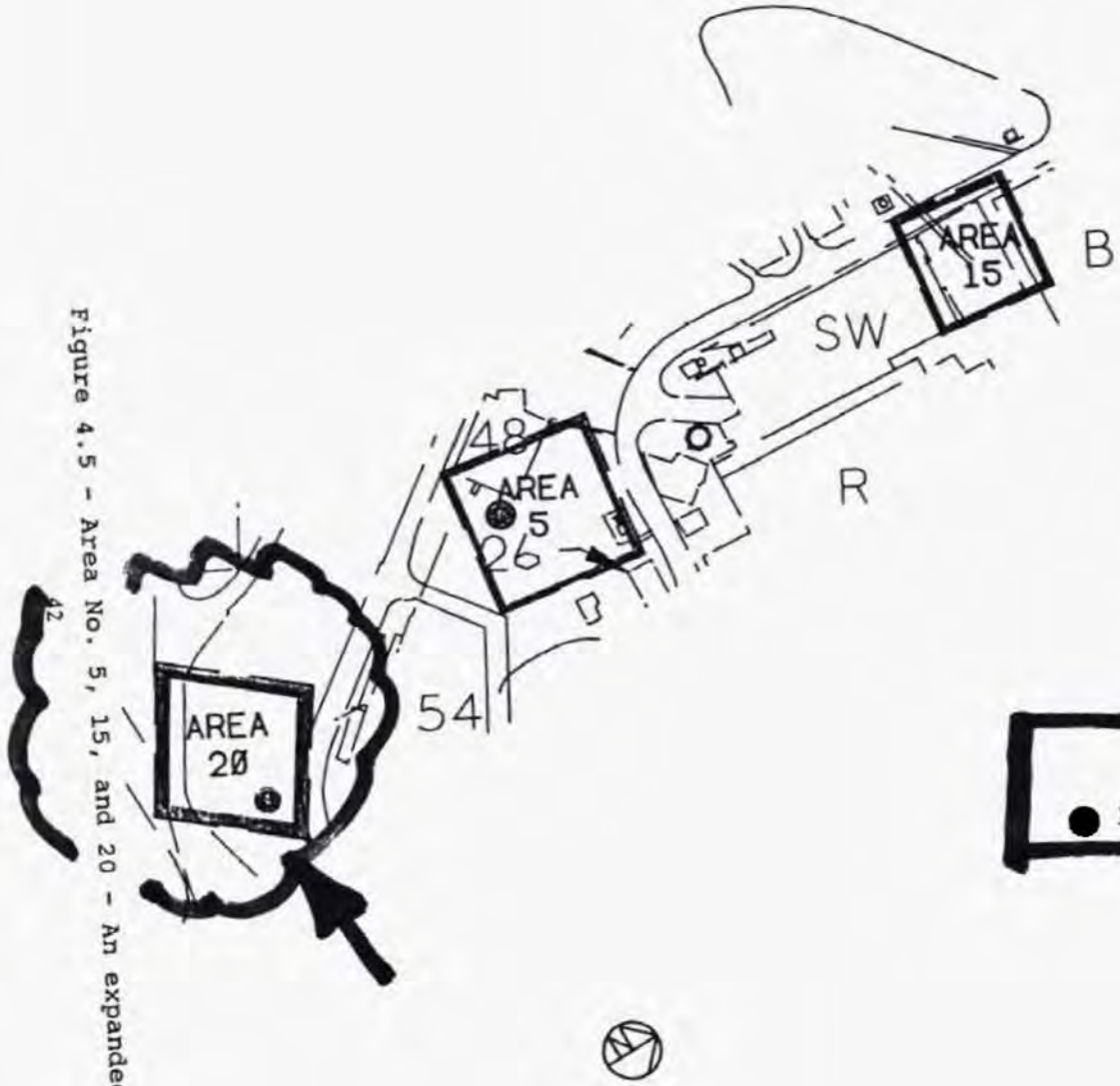


Figure 4.5 - Area No. 5, 15, and 20 - An expanded view.

AREA Nos. 5, 15 & 20

SUSPECTED ISOTOPES: Cobalt-60, Cesium-137, Actinium-227

VERIFIED ISOTOPES: Cobalt-60, Cesium-137, Actinium-227

AREA 5 - Co - 60 (blue)

● 1 core sample 100 - 999 pCi/g

AREA 15 - Ac - 227

There has not been any core or soil sampling in this area. Radon monitoring indicates substantial Ac - 227 beneath the concrete floors in this area.

AREA 20 - Co - 60, Cs -137

● 1 surface sample 100 - 999 pCi/g (green and blue)