EG&G MOUND-30-03-04-02--9611140002

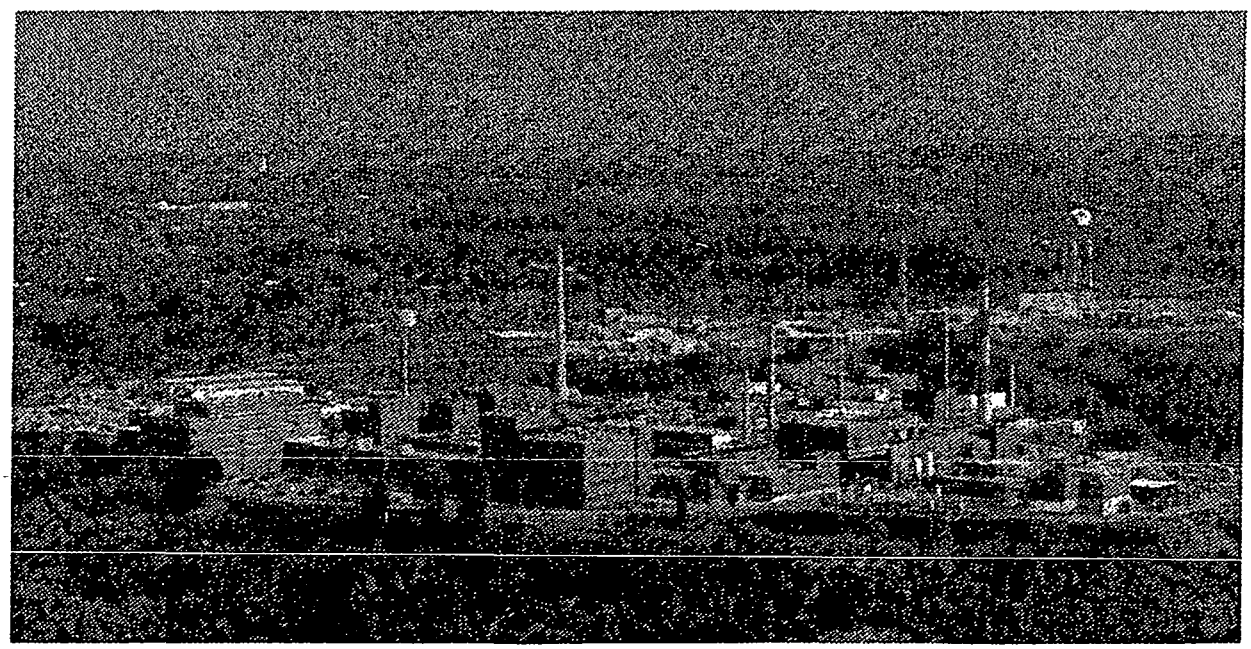
MOUND

Environmental Restoration Program

MOUND PLANT

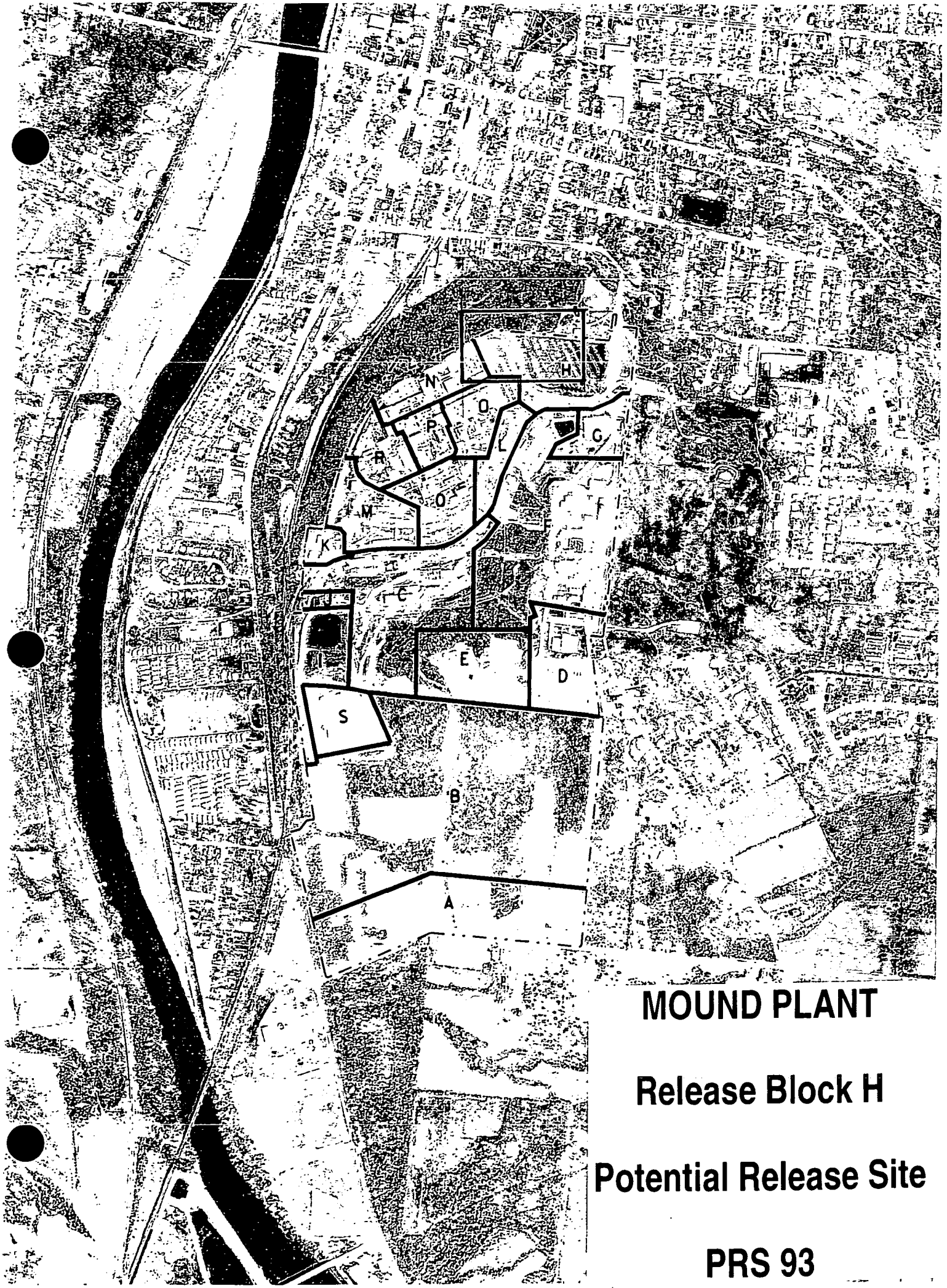
Potential Release Site Package

PRS # 93



PRS 93

REV	DESCRIPTION	DATE
PUBLIC RELEASE 0	Available for comments.	Mar. 4, 1996
FINAL 1	Comment period expired. No comments. Recommendation page annotated.	Oct. 10, 1996

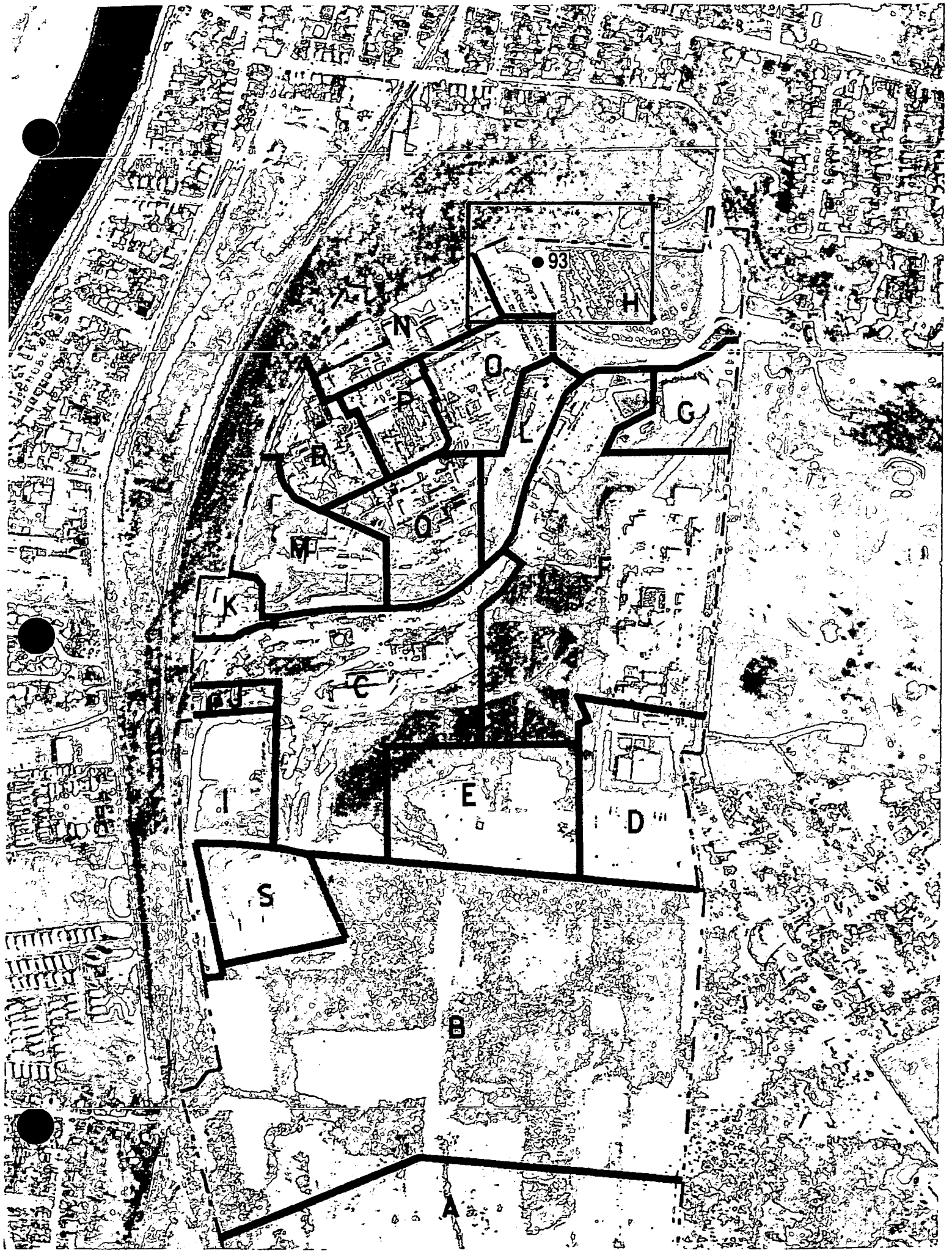


MOUND PLANT

Release Block H

Potential Release Site

PRS 93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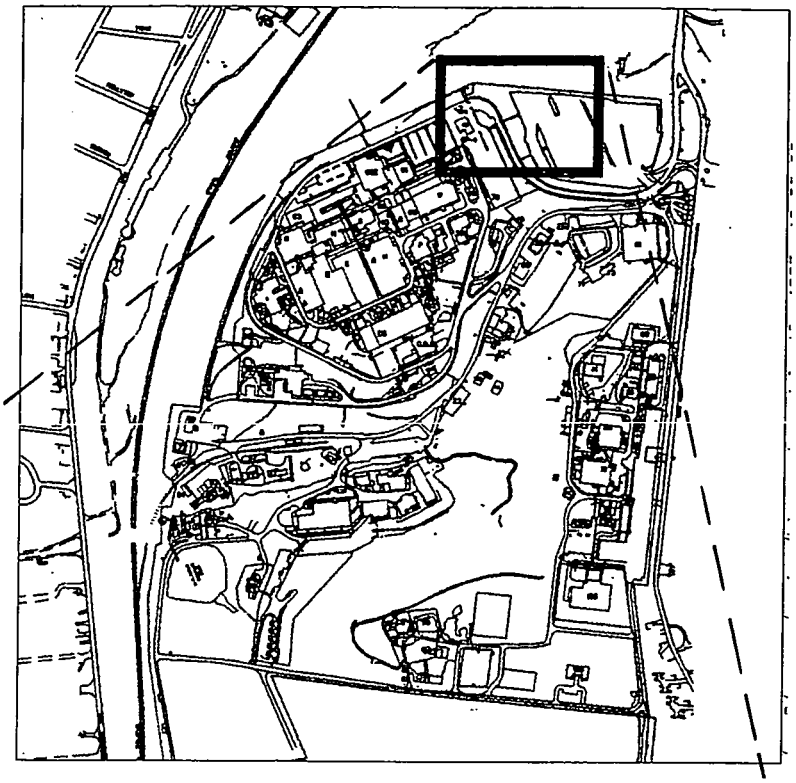
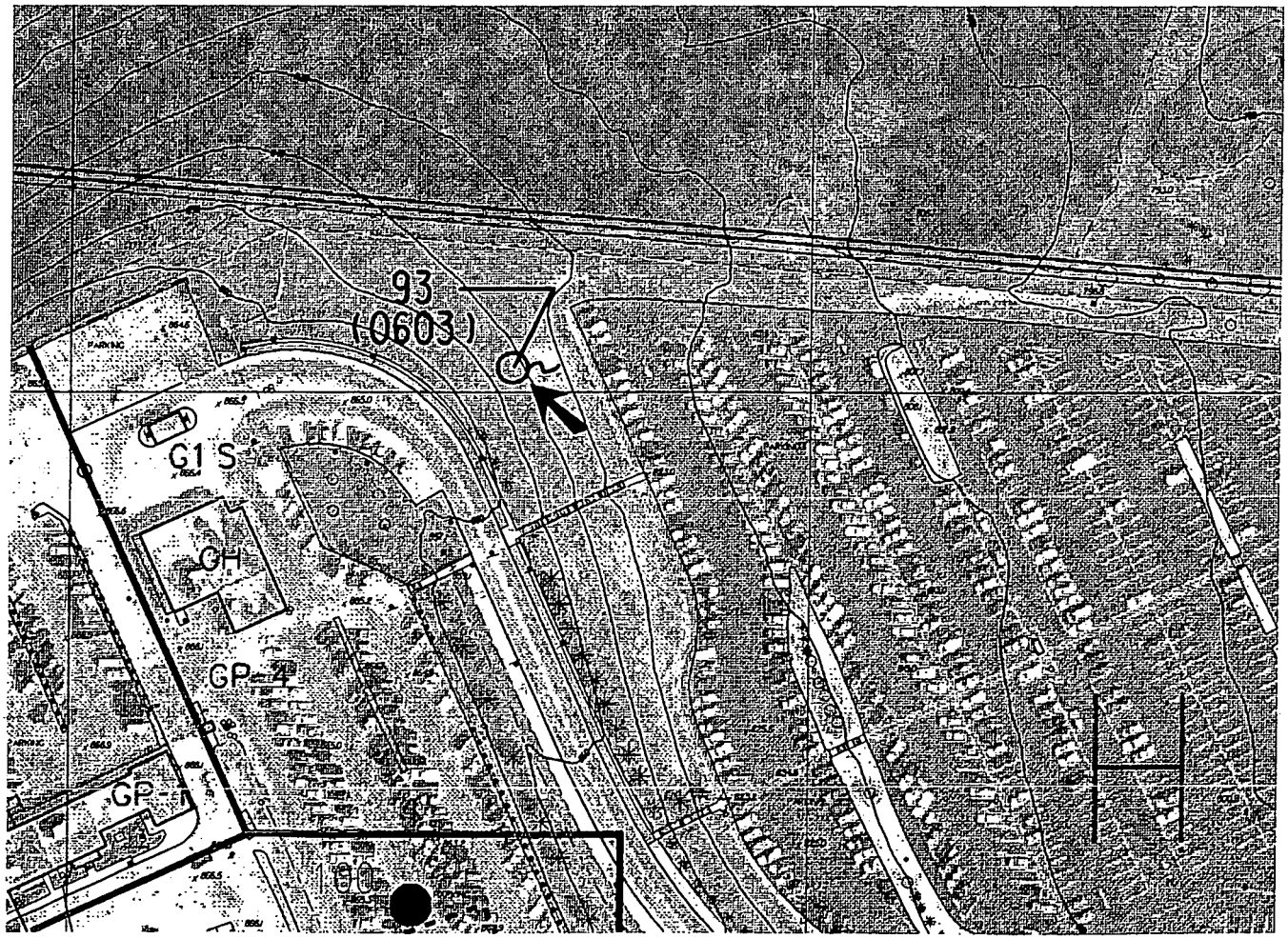
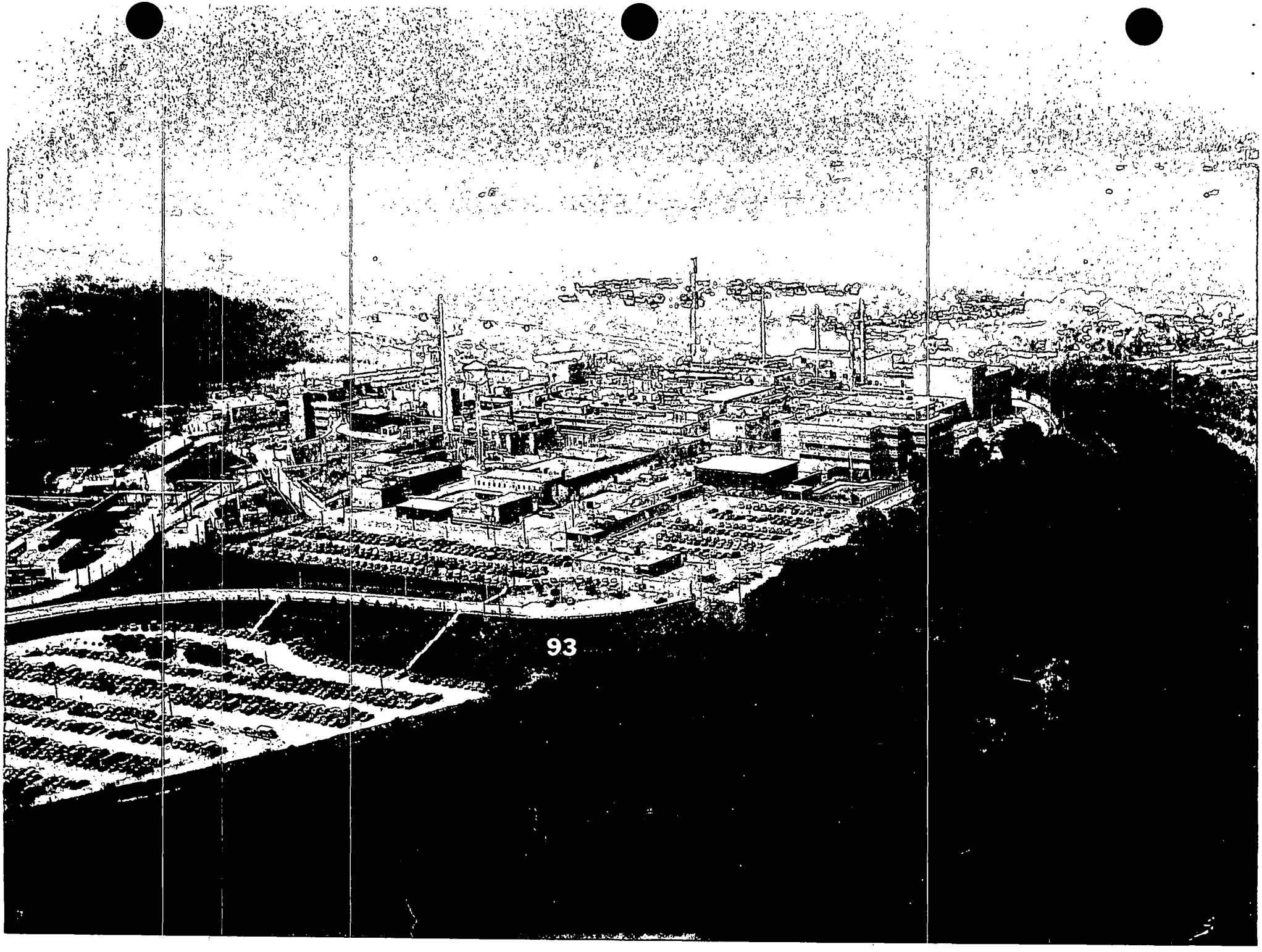
Release Block H

Potential Release Site

PRS 93







PRS 93

PRS HISTORY:

PRS 93 was historically identified as seep 603 and is located on-site, adjacent to the large parking lot.[1] The investigation for seeps on the Main Hill was initiated in the spring of 1986. The investigation stemmed from the discovery of a groundwater seep on the western hillside below SW Building. The seep was sampled and a laboratory analysis showed elevated concentrations of tritium. A thorough search and sampling program was initiated to find other seeps that may exhibit elevated tritium concentrations. Emphasis was placed on searching the off-site areas along the western and northern plant boundaries. Eight seeps were identified including three on-site and five off-site.

PROCESS DESCRIPTION:

No radioactive or hazardous waste generating processes are known to have occurred at the location of PRS 93.

CONTAMINATION:

Tritium was originally detected at low concentrations i.e. in the range of 1 to 3 nCi/L.[2, 3] Flow was intermittent in the past and continues to be even recently. The latest data seems to indicate an increase in tritium concentrations but is most likely related to much diminished flow.[3, 4]

Soil was sampled at seep 603 as part of OU9, Regional Soils Investigation.[5] All radionuclide concentrations for seep 603 were at background. All other contaminants at seep 603 are in the range of background. Radiological Site Survey data from the vicinity of seep 603 shows a maximum concentration of Pu-238 of 3.46 pCi/g which is less than Mound's ALARA guideline of 25 pCi/g. Thorium concentrations were all below the detection limit of 2 pCi/g.[6]

READING ROOM REFERENCES:

1) OU9, Site Scoping Report: Volume 12 - Site Summary Report, December 1994. (pages 5-7)
2) Remedial Investigation Plan: Task AL-MD-1, Stage 3, September 1989. (pages 8-9)
3) OU2, Technical Memorandum 1: Preinvestigation Evaluation of Remedial Action Technologies (PERAT), August 1991. (pages 10-13)
4) OU2, Technical Memorandum, Characterization of Main Hill Seeps & Foundation Drains, February 1995. (pages 14-18)
5) OU9, Regional Soils Investigation Report, May 1995. (pages 19-29)
6) OU9, Site Scoping Report: Volume 3 - Radiological Site Survey, June 1993. (pages 30-35)

PREPARED BY:

Keith McMahan, Member of EG&G Technical Staff
Dan Carfagno, Member of EG&G Technical Staff

MOUND PLANT
PRS 93
MAIN HILL SEEP - LOCATION 0603

RECOMMENDATION:

Potential Release Site (PRS) 93 is designated a PRS because it is the Main Hill Seep #0603, however, no processes occur at the offsite location of PRS 93. Minimal flow (0.07 gal/min) is observed only after major rainfall events and soil concentrations of high explosives, inorganics, organics, PAHs, pesticides/PCBs, and radionuclides (including tritium) are consistently within the range of background levels, therefore, NO FURTHER ASSESSMENT of PRS 93 is required. It should also be noted that the Department of Energy (DOE) will continue to monitor all seeps until the source of contamination has been addressed.

CONCURRENCE:

DOE/MB: Arthur W. Kleinrath, Remedial Project Manager — 2/29/96 (date)

USEPA: Timothy J. Fischer, Remedial Project Manager — 3/4/96 (date)

OEPA: Brian K. Nickel, Project Manager — 3/4/96 (date)

SUMMARY OF COMMENTS AND RESPONSES:

Comment period from 4/15/96 to 5/15/96.

☒ No comments were received during the comment period.

☐ Comment responses can be found on page_____ of this package.

REFERENCE MATERIAL
PRS 93

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
85	Building 29 Solvent Storage Shed	E-8	Inactive	Acetone	4	Suspected	S	4	1 14	SGS[b] Table B.3 Location 2137 Table B.9 RSS Location S0275	12 6
86	Building 29 Septic Tank (Tank 224)	E-9	Historical	Actinium-227, Radon-222, Thorium-228, Radium-226	3, 4, 6	Suspected	S	4, 6	2	Table B.9 (See discussion for Area 7 in Ref. 6)	6
87	Building 49 Solvent Storage Shed	G-7	Inactive	Organic solvents (including trichloroethene, isopropanol, ethanol, freon-TF, hexane)	4 9	Suspected	S	4	No Data		
88	Tritium in Buried Valley Aquifer	H-4	Historical	Tritium	1 18	Tritium, historically remediated	GW	18	16	Table B.9	11 18
89	Test Fire Residual Storage Area	H-7	In service	Unexploded detonation devices	4, 5, 18	None Suspected		5	No Data		
90	Site Survey Project Potential Hot Spot Location S0425	G-8	Grounds	Thorium	6	Unknown			14	Table B.9 (Appendix E in Ref. 6)	6
91	Main Hill Seep 0601	F-5	NA	Tritium, VOCs	5, 18	Tritium, VOCs	SW	13	3, 4, 5, 10, 11, 16	Tables B.6, B.7, B.8, and B.9	18
92	Main Hill Seep 0602	G-7	NA	Tritium, VOCs	5, 18	Tritium, VOCs	SW	13	3, 4, 5, 10, 11, 16	Tables B.6, B.7, B.8, and B.9	18
93	Main Hill Seep 0603	D-8	NA	Tritium, VOCs	5, 18	Tritium, VOCs	SW	13	No Data		
94	Main Hill Seep 0604	D-6	NA	Tritium, VOCs	5, 18	Tritium, VOCs	SW	13	No Data		
95	Main Hill Seep 0605	D-6	NA	Tritium, VOCs	5, 18	Tritium, VOCs	SW	13	3, 4, 5, 10, 11, 16	Tables B.6, B.7, B.8, and B.9	18
96	Main Hill Seep 0606	C-7	NA	Tritium, VOCs	5, 18	Tritium, VOCs	SW	13	No Data		
	Main Hill Seep 0607	C-7	NA	Tritium, VOCs	5, 18	Tritium, VOCs	SW	13	3, 4, 5, 10, 11, 16	Tables B.6, B.7, B.8, and B.9	18
	Main Hill Seep 0608	D-6	NA	Tritium, VOCs	5, 18	Tritium, VOCs	SW	13	3, 4, 5, 10, 11, 16	Tables B.6, B.7, B.8, and B.9	18

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
2. DOE 1992a
3. DOE 1992c
4. DOE 1993a
5. EPA 1988a
6. DOE 1993d
7. DOE 1993c
8. DOE 1992d
9. Fentiman 1990
10. DOE 1992f
11. Styron and Meyer 1981
12. DOE 1993b
13. DOE 1993d
14. DOE 1991b
15. Halford 1990
16. DOE 1993e
17. DOE 1990
18. DOE 1992a
19. Rogers 1975
20. DOE 1992h
21. Dames and Moore 1976a, b
22. DOE 1992i
23. DOE 1992j
24. DOE 1994
25. EG&G 1994

ENVIRONMENTAL RESTORATION PROGRAM

REMEDIAL INVESTIGATION PLAN

TASK AL-MD-1, STAGE 3 INVESTIGATION
MOUND PLANT
AREA B AND THE MAIN HILL SEEPS:
INSTALLATION GROUNDWATER

SAMPLING PLAN

September 1989

DEPARTMENT OF ENERGY

ALBUQUERQUE OPERATIONS OFFICE

ENVIRONMENT AND HEALTH DIVISION

ER PROGRAM PROJECT GROUP

DRAFT (REVISION 2)

Table VIII. Tritium Values from June 1987 to January 1988

Station	Maximum	Minimum	Average
B001	11	2	8
P012	6	3	5
P013	2318	10	1074
P014	1034	20	489
MND01-0601	1396	228	764
MND01-0602	33	10	16
MND01-0603	4	1.27	3
MND01-0605	174	29	77
MND01-0606	76	34	59
MND01-0607	139	29	85
MND01-0608	46	31	41
MND01-0609	0.7	0	0.4
W001	96	4	70
W002	57	26	42
W003	79	39	68
W004	9	5	7
W005	7	0.00	5
W006	843	8	188
W007	2528	5	1020

Environmental Restoration Program

Operable Unit 2, Technical Memorandum 1: Preinvestigation Evaluation of Remedial Action Technologies (PERAT)

Mound Plant
Miamisburg, Ohio

August 1991

Draft

(Revision 0)

Department of Energy
Albuquerque Operations Office

Environmental Restoration Program
Technical Support Office
Los Alamos National Laboratory

maximum values measured in January 1988 were under 800 nCi/L. The further decline in tritium concentrations at seeps 0601 and 0607 is illustrated by Table II.4, which presents monthly averages for tritium concentrations over the period from January 1989 through July 1990 (WESTON 1991).

The impact of rainfall on flow at seeps 0601 and 0607 is illustrated by the data presented in Figures 2.12 through 2.17, presenting rainfall and flow rates for the months of December 1987 and January 1988 (WESTON 1991). Flow rates at seep 0601 are presented in gallons per minute and flow rates at seep 0607 are presented as voltage and are not converted to gallons per minute. The numerous minor rain events in December 1987 resulted in variations in flow at the two seeps. For example, rainfall recorded over December 1 and 2, 1987, resulted in increased flow measured at the seeps on December 2 and 3, 1987 (Figures 2.13 and 2.14). The extreme variation in flow measured at seep 0601 throughout the month of December 1987 (Figure 2.13) is not clearly understood and may be due to a daily release of water from a buried pipe or a malfunction of the monitoring equipment. Measured flows decline at both seeps over the dry period of January 1, 1988, through January 18, 1988 (Figures 2.16 and 2.17). The rainfall event of January 19, 1988, resulted in an increase of flow at both seeps. The rapid response of the seeps to rainfall events indicates that the seeps are part of local shallow groundwater flow systems that are open to receive recharge from rainfall.

Table II.4 presents monthly averages of tritium concentrations measured in groundwater samples from the Main Hill seeps, the monitoring pits, the SW Building groundwater capture system, and the 0712 groundwater intercepter trench over the period January 1989 through July 1990. Sample locations are shown on Figure 2.6. Table II.5 presents tritium concentrations measured in samples collected from monitoring wells on the Main Hill for the period January to July 1990. Monitoring well locations are shown on Figure 2.6. Construction information on the monitoring wells is presented in Table II.6.

In 1990, the highest tritium concentrations were measured in groundwater samples collected at sample locations for the SW Building groundwater capture system (0713, 0714, and 0727). Tritium concentrations measured at seep 0601 are greater than 100 nCi/L, but concentrations have declined over one order of magnitude compared to measured values before the groundwater capture system was placed in operation. The data in Table II.4 indicate that tritium concentrations in groundwater samples collected at seep 0603 are increasing. The seep has a very low flow and is often dry. The cause for the concentrations measured on May 1989 (39 nCi/L) and January 1990 (109 nCi/L) is not known. Tritium concentrations also exhibit a general trend to higher values over time for samples collected at seep 0602.

Tritium concentrations measured in groundwater samples from seeps 0605 and 0607, located off Mound Plant property, have declined since the SW Building capture syste
Tritium concentrations in seeps 0605, 0606, and 0607 are much hig
groundwater collected in the 0712 intercepter trench that is located ups

Table II.4. Monthly Averages of Tritium (nCi/L) from January 1989 through July 1990[a]

Date	Sample Location								
	712	713	714	601	602	603	605	606	607
1/89	3.7	20	383	227	[illegible]	2.2	88	25	32
2/89	3.9	19	393	258	13	1.7	[illegible]	16	[illegible]
3/89	3.7	1607	424	395	11	1.7	[illegible]	16	[illegible]
4/89	3.3	565	410	[illegible]	11	1.5	67	15	25
5/89	[illegible]	427	476	205	10	39	59	16	26
6/89	2.8	233	309	170	13	[illegible]	73	27	31
7/89	3.5	443	496	196	18	[illegible]	69	–	36
8/89	3.1	[illegible]	[illegible]	220	–	[illegible]	87	–	36
9/89	3.2	507	447	190	29	[illegible]	87	–	37
10/89	2.9	280	464	152	–	[illegible]	66	–	41
11/89	3.6	[illegible]	[illegible]	159	24	[illegible]	92	–	35
12/89	–	418	481	103	–	[illegible]	110	–	33
01/90	3.6	60	280	136	19	109	92	–	24
02/90	[illegible]	315	222	[illegible]	21	[illegible]	87	15	21
03/90	3.3	335	261	106	26	[illegible]	72	12	26
04/90	3.5	468	330	119	–	–	75	18	[illegible]
05/90	3.4	530	229	111	33	–	[illegible]	25	[illegible]
06/90	4.4	302	291	132	–	[illegible]	53	–	22
07/90	3.6	335	307	128	28	–	63	–	24

Date	Sample Location								
	608	721	722	723	724	725	726	727	
1/89	37	14	19	17	6.8	4.5	10	638	
2/89	36	11	20	17	6.9	4.6	8.9	[illegible]	
3/89	30	24	16	16	11	5.4	7.8	693	
4/89	29	15	18	12	5.4	5.3	[illegible]	636	
5/89	30	39	20	18	5.5	[illegible]	8.2	439	
6/89	27	39	30	15	5.5	4.0	7.6	461	
7/89	26	48	32	19	[illegible]	5.8	9.7	526	
8/89	30	44	28	15	7.0	5.3	11	545	
9/89	30	25	26	[illegible]	5.7	5.5	9.4	444	
10/89	28	12	35	18	5.2	5.0	13	512	
11/89	32	10	[illegible]	16	[illegible]	6.2	8.8	396	
12/89	–	6.5	39	20	6.0	5.8	80	439	
01/90	–	[illegible]	35	–	5.5	[illegible]	72	363	
02/90	–	12	28	–	5.1	5.3	8.9	301	
03/90	–	12	26	–	4.8	6.1	10	380	
04/90	–	20	28	–	4.7	5.9	9.3	[illegible]	
05/90	–	22	25	–	4.9	5.2	8.0	450	
06/90	–	29	80	–	5.1	5.1	7.2	574	
07/90	–	28	253	–	4.6	4.9	7.4	449	

[a] Analyses by Mound Plant personnel

Table II.7. Uranium and Tritium Concentrations in Groundwater From Seeps and 0700 Series Locations[a]

Sample Date	Location	U-233 + U-234 (pCi/L)	U-238 (pCi/L)	U-233 + U-234 / U-238 (pCi/L)	H^3 (nCi/L)	H^3 (range)[b] (nCi/L)
Main Hill Seeps						
03/20/88	0601	18.77	0.24	78.2	497	172-700
01/23/88	0601	15.75	0.15	105	700	172-700
02/02/88	0601	5.14	0.28	18.4	172	172-700
03/07/88	0602	1.17	1.19	0.98	11	7-17
02/05/88	0603	0.78	0.26	3.0	2	1-3
04/11/88	0605	0.56	0.20	2.8	74	39-119
03/07/88	0606	0.17	0.04	4.3	14	7-35
01/27/88	0607	0.81	0.29	2.8	62	15-76
02/01/88	0607	0.22	0.09	2.4	15	15-76
02/12/88	0607	0.33	0.17	1.9	76	15-76
04/14/88	0607	0.48	0.2	2.4	56	15-76
04/15/88	0607	0.68	0.05	13.6	56	15-76
01/21/88	0608	1.52	0.34	4.5	38	24-43
Building SW Groundwater Capture System						
03/23/88	0713	105.2	2.6	40.4	51	33-949
02/01/88	0714	7.68	0.41	18.7	249	134-523
03/17/88	0727	2.13	0.17	12.5	1,095	9-1,095
Groundwater Intercepter Trench						
03/02/88	0712	1.69	0.21	8.0	5	3-7
01/27/88	0712	1.19	0.55	2.2	4	3-7
03/16/88	0712	1.15	0.74	1.6	5	3-7
Groundwater Monitoring Pits						
03/04/88	0721	1.37	0.42	3.3	10	4-64
02/03/88	0722	1.01	0.21	4.8	21	15-44
03/07/88	0724	0.85	0.35	2.4	8	5-8
03/28/88	0725	0.76	0.39	2.5	3	2-7
03/22/88	0726	1.51	0.46	3.3	9	6-682
01/21/88	0726	0.47	0.28	1.7	526	6-682

[a] Analyses by Mound Plant.
[b] The range in concentations for all samples collected from January 1988 to May 1988 at the listed location.

Environmental Restoration Program

CHARACTERIZATION OF MAIN HILL SEEPS AND FOUNDATION DRAINS OPERABLE UNIT 2, MAIN HILL OU-2 PHASE I TECHNICAL MEMORANDUM

MOUND PLANT
MIAMISBURG, OHIO

February 1995

FINAL

(Revision 0)

Department of Energy
Ohio Field Office

Environmental Restoration Program
EG&G Mound Applied Technologies

Table V.1. Seep Monitoring Results

Seep No.	Date	pH	Conductivity (µmhos/cm)	Temperature (°F)	Flow (gpm)
0601	6/6/94	7.45	1710	58.5	1.08
	6/7/94	7.43	1570	58.9	1.50
	6/9/94	7.30	1610	58.5	0.39
	6/14/94	7.20	1776	60.5	0.98
	6/22/94	7.10	1810	60.2	1.80
	6/27/94	7.30	1560	61.1	3.60
	6/28/94	7.19	1780	60.8	2.16
	6/30/94	7.20	1780	60.5	1.80
0602	6/6/94	8.08	1227	61.9	1.80
	6/7/94	7.77	1283	61.2	2.0
	6/9/94	7.65	1270	59.8	1.80
	6/14/94	7.81	6420	62.3	1.80
	6/22/94	7.40	2140	64.8	0.30
	6/27/94	7.49	2390	64.0	0.42
	6/28/94	7.30	2340	64.6	0.32
	6/30/94	7.32	2110	65.2	0.25
0603	6/6/94	Dry	N/A	N/A	N/A
	6/7/94	Dry	N/A	N/A	N/A
	6/9/94	Dry	N/A	N/A	N/A
	6/14/94	Dry	N/A	N/A	N/A
	6/22/94	Dry	N/A	N/A	N/A
	6/27/94	7.55	5910	63.6	0.07
	6/28/94	Dry	N/A	N/A	N/A
	6/30/94	Dry	N/A	N/A	N/A
0604/0605	6/6/94	N/A	N/A	N/A	N/A
	6/7/94	7.5	3390	60.5	0.012
	6/9/94	7.30	3410	59.5	0.004
	6/14/94	Dry	N/A	N/A	N/A
	6/22/94	7.97	3170	66.0	0.003
	6/27/94	7.69	2900	60.6	0.018
	6/28/94	7.90	3010	63.5	0.007
	6/30/94	7.92	3000	63.6	0.006

time to fill a graduated vessel with the water seeping from the outfall pipe. Temperature, specific conductance, and pH were measured using a Hydac combination meter. The outfall water was allowed to flow directly into the sampling cup on the meter. Temperature was checked first, followed by specific conductance, and then pH. The results were recorded in the log book along with the time of sampling, type of vessel used, and any other observations of seep conditions. The Hydac instrument was calibrated daily.

Daily rainfall was collected from the Mound Plant rain gauge located on the Main Hill. The rain gauge is automatic with daily readings recorded at twelve midnight for the previous 24 hours. When no precipitation falls for a given day the gauge records this as zero, and when a rain event does occur the gauge records the amount in inches (Appendix B).

5.1.2. Foundation Drain Investigation

When information about foundation drain sampling was obtained during the Mound Plant personnel interviews, a meeting was set up with a representative of EG&G who conducts the sampling program. The monitoring point for Building 48 is at the bottom of a catch basin on the northwest corner of the building. The monitoring point for T Building is in an unlined open drainage ditch southwest of the building. The collected samples are a composite of the water flowing into the sampling location. Mound Plant personnel indicated that in the past the foundation drain on the east side of T Building may have been sampled but the information is not available. However, the hillside where the east drain is shown to discharge was thoroughly investigated without locating the drain. Temperature, conductivity, pH, and flow were not measured because the sample would not have been representative of only the foundation drain. The tritium results from these locations are summarized in Table V.2 and graphed versus rainfall on Figure 5.2.

5.2. RESULTS

5.2.1. Seep Monitoring

Of the eight seeps, 0601 and 0607 flow at consistent rates of approximately one to three gallons per minute, with fluctuations after rainfall events (Figure 5.3). The other seeps flow at rates well below half a gallon per minute (gpm), with seep 0603 dry except after a rainfall event of over one inch (Figure 5.4). Seep 0601 located on the western hillside is equipped with an automatic sampling station that was recently upgraded. This seep flows at rates above 1.0 gpm with pH averaging 7.27, conductivity averaging 1700 micromhos (µmhos), and temperature average at 59.9° F (Table V.3).

Table V.3. Summary of Seep Sampling Results

Seep No.	Average pH	pH Range	Average Conductivity (µmhos/cm)	Conductivity Range (µmhos/cm)	Average Temp (°F)	Temp Range (°F)	Average Flow (gpm)	Flow Range (gpm)
0601	7.27	7.10-7.45	1700	1560-1810	59.9	58.5-61.1	1.66	0.39-3.60
0602	7.60	7.30-8.08	2398	1227-6420	63.0	59.8-65.2	1.08	0.25-2.0
0603	7.55	7.55-7.55	5910	5910-5910	63.6	63.6-63.6	0.07	0.07/
0604/ 0605	7.71	7.30-7.97	3147	2900-3410	62.3	59.5-66.0	0.008	0.003-0.018
0606	7.39	7.10-7.64	3872	3530-4120	64.1	61.5-65.6	0.007	0.0006-0.013
0607	7.46	7.35-7.64	3895	3580-4140	55.0	53.6-56.1	1.6	0.450-2.70
0608	7.35	6.79-7.63	2068	2000-2240	59.5	57.1-62.3	0.06	0.054-0.070
0625	7.70	7.56-7.75	1235	1190-1270	62.7	62.3-63.5	0.096	0.09-0.102

Seep 0602 consists of numerous discrete seeps and is located on the southern hillside below HH Building. The reservoir and outfall pipe was installed in the seep with the highest flow. Because of the numerous discrete seeps, the flow value is only an estimate and will need to be refined in future phases. Specific conductivity, pH, and temperature averaged 2398 µmhos, 7.6, and 63.0°F, respectively (Table V.3). The estimated flow was 2.0 gpm in the beginning of the month, but slowed to below 0.5 gpm near the end of the month. This could be attributed to the numerous seep locations within the seep, with increased flow at another location.

Flow from seep 0603, located on the eastern hillside above the lower parking lot, was observed only once during the field reconnaissance. A length of pipe was already installed at this seep from a previous monitoring effort. The flow was observed after an rainfall event of 1.37 inches and for only the one site reconnaissance; the measured flow was 0.07 gpm. Specific conductivity, pH, and temperature averaged 5,910 µmhos, 7.55 and 63.6°F, respectively (Table V.3).

Seep 0604/0605, located on the northern hillside, was considered two separate seeps until disturbed during vegetation removal along the Mound Plant fence. As a result of the fencing activities, the seep did not flow for several months and when seepage did reappear it was only at a single location. The seep flows at an average rate of 0.008 gpm, and was dry during one monitoring event. Specific conductivity, pH, and temperature averaged 3145 µmhos, 7.71, and 62.3°F, respectively (Table V.3).

Seep 0606 is located on the northern hillside between seeps 0604/0605 and 0607, on the uphill side of an old roadway cut. The seep was fitted with a length of pipe after a small reservoir was dug into the roadway cut. This seep also flows at an average rate of 0.008 gpm. Specific conductivity, pH, and temperature averaged 3872 µmhos, 7.39, and 64.1°F, respectively (Table V.3).

Seep 0607, also located on the northern hillside, is fitted with a recently upgraded automatic sampling station. When monitoring first began, water from the seep was leaking around the weir outlet, therefore, a length of pipe was installed downgradient of the seep to capture the full amount of flow. After a few monitoring events the leak was repaired and monitoring was conducted at the weir outfall. This may explain the increase in the flow from the beginning to the end of the month with an average flow of 1.6 gpm. Specific conductivity, pH, and temperature averaged 3,895 µmhos, 7.46, and 55.0°F, respectively (Table V.3).

The flow from seep 0608 is from a few discrete locations at the far eastern end of the railroad cut along the northern hillside. The reservoir was located in the area with the highest visible flow of all the discrete seeps. The flow averaged 0.06 gpm, with specific conductance, pH, and temperature averaging 2068 µmhos, 7.38, and 59.5°F, respectively (Table V.3).

Document Control No.

Environmental Restoration Program

OPERABLE UNIT 9
REGIONAL SOILS INVESTIGATION REPORT

MOUND PLANT
MIAMISBURG, OHIO

May 1995

Revision 1

U.S. Department of Energy
Oh. Field Office

EG&G Mound Applied Technologies

Sampling was conducted in accordance with the OU9 FSP, with the following exceptions. The FSP indicated that six sampling locations with the possibility of a seventh, located near manhole #4, would be investigated. The FSP also indicated that the exact locations will be determined in the field. Eight sampling locations were identified and samples taken from all eight locations. Sampling locations were near manholes #1, #2, #3, #4, #5, and #6, as well as between #7 and #8 and between #8 and #9. The additional location was sampled to insure all pipe size change areas would be assessed for leakage.

The FSP indicated that a minimum of two samples per stratigraphic unit (excluding bedrock) should be obtained for geotechnical analysis. Geotechnical samples were collected from five of the borings. Three strata types were discernable: a silt and clay layer, a sand and gravel layer, and bedrock. Due to the physical properties of the sand and gravel layer, only one geotechnical sample was obtained for analysis. Four samples of the silt and clay layer were also collected.

2.3.3. Soil and Water Sampling at the Main Hill Seeps

The Main Hill Seep assessment consisted of sampling the soil (surface and subsurface) at and near the seeps, and sampling the water discharged at the surface. At a minimum, three surface soil samples were taken: at all selected locations, at approximately 10 feet downgradient from each selected location, and at approximately 20 feet downgradient from each selected location. Additional soil samples taken at a depth of two feet were taken at four of the selected locations. Surface water samples were also taken at four of the selected locations. Water samples could not be taken at locations 603, 605, and 606 because the flow was insufficient. Sampling took place on and off the Mound Plant property. Figure 2.6 presents the Main Hill Seep Sample Locations. Table II.1 describes the sample location descriptors used.

Sampling was conducted in accordance with the FSP, with one exception. The FSP indicated that eight sampling locations (601, 602, 603, 604, 605, 606, 607, 608) should be sampled. Upon inspection of the seeps, only seven seeps were identified. One seep was found near the historically represented locations of seeps 604 and 605. Due to the relatively short distance between seeps 604 and 605 on the historical map (Figure 2.6), the field crew arbitrarily identified this "combined" seep as 605.

The soil and water samples were analyzed for the full suite of analytes listed in Section 2.1.3, plus geotechnical parameters as described above.

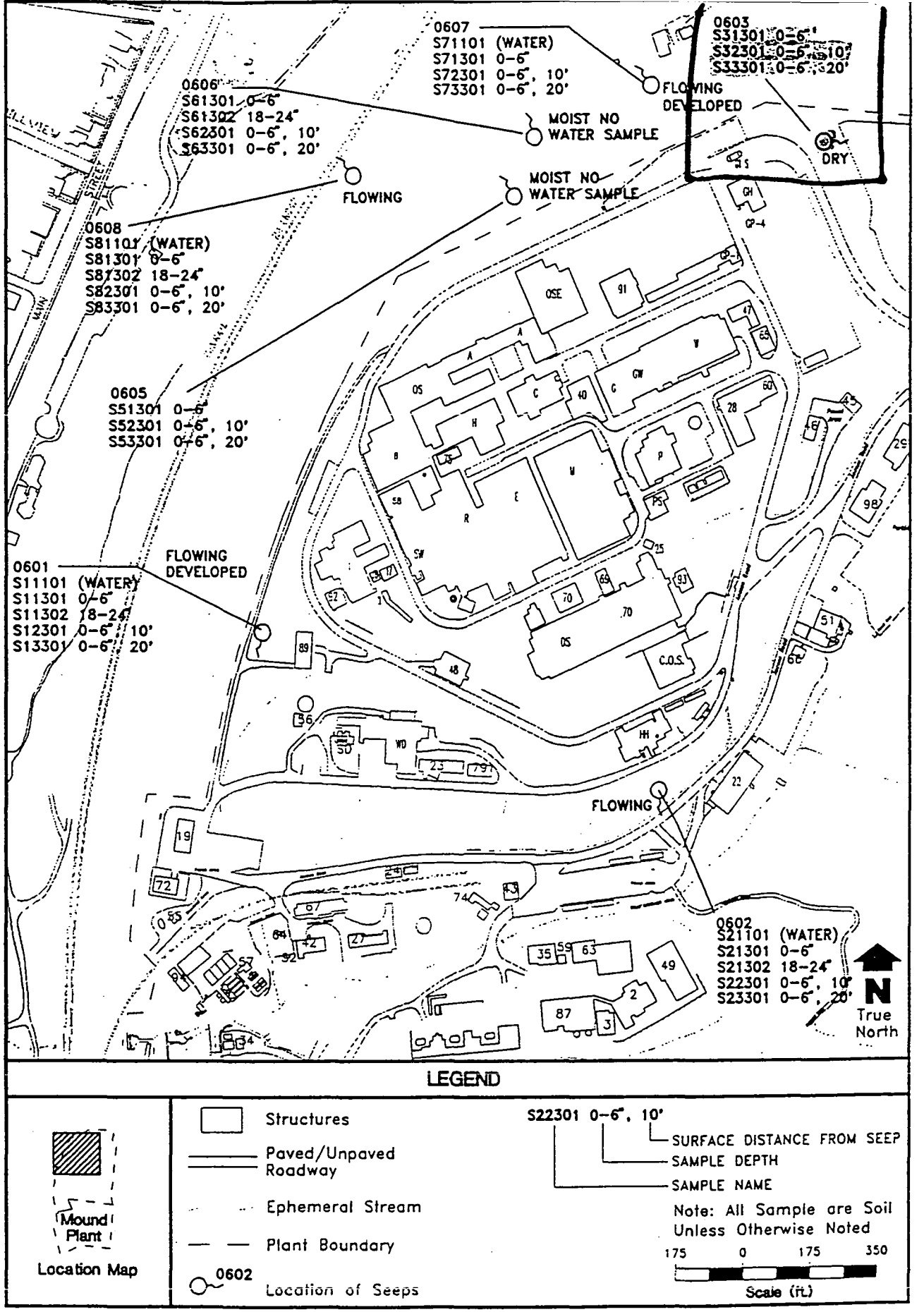


Figure 2.6. Main Hill Seep Sample Locations

APPENDIX E.3 MAIN HILL SEEPS SOIL INVESTIGATION (SOIL)

MAIN HILL SEEP 603							
		S31301		S32301		S33301	
		902-S31301		902-S32301		902-S33301	
		H4483.D REG		H4484.D REG		H4485.D REG	
		6/21/94		6/21/94		6/21/94	
		Result	Val	Result	Val	Result	Val
Volatile Organics	Units						
Acetone	UG/KG	13	U	13	U	12	U
Acetonitrile	UG/KG	126	U	133	U	120	U
Acrylonitrile	UG/KG	126	U	133	U	120	U
Benzene	UG/KG	13	U	13	U	12	U
Bromodichloromethane	UG/KG	13	U	13	U	12	U
Bromoform	UG/KG	13	U	13	U	12	U
Bromomethane	UG/KG	13	UJ	13	UJ	12	UJ
2-Butanone	UG/KG	13	U	13	U	12	U
Carbon Disulfide	UG/KG	13	U	13	U	12	U
Carbon Tetrachloride	UG/KG	13	U	13	U	12	U
Chlorobenzene	UG/KG	13	U	13	U	12	U
Chlorodibromomethane	UG/KG	13	U	13	U	12	U
Chloroethane	UG/KG	13	U	13	U	12	U
Chloroform	UG/KG	13	U	13	U	12	U
Chloromethane	UG/KG	13	U	13	U	12	U
1,1-Dichloroethane	UG/KG	13	U	13	U	12	U
1,2-Dichloroethane	UG/KG	13	U	13	U	12	U
1,1-Dichloroethene	UG/KG	13	U	13	U	12	U
1,2-Dichloroethene	UG/KG	25	U	27	U	24	U
1,2-Dichloropropane	UG/KG	13	U	13	U	12	U
cis-1,3-Dichloropropene	UG/KG	13	U	13	U	12	U
trans-1,3-Dichloropropene	UG/KG	13	U	13	U	12	U
1,2-Diethylbenzene	UG/KG	25	U	27	U	24	U
Ethylbenzene	UG/KG	13	U	13	U	12	U
Hexane	UG/KG	13	U	13	U	12	U
2-Hexanone	UG/KG	13	U	13	U	12	U
Iodomethane	UG/KG	13	U	13	U	12	U
4-Methyl-2-pentanone	UG/KG	13	U	13	U	12	U
Methylene Chloride	UG/KG	3	J	13	U	12	U
Styrene	UG/KG	13	U	13	U	12	U
1,1,2,2-Tetrachloroethane	UG/KG	13	U	13	U	12	U
Tetrachloroethene	UG/KG	13	U	13	U	12	U
Toluene	UG/KG	13	U	13	U	12	U
1,1,1-Trichloroethane	UG/KG	13	U	13	U	12	U
1,1,2-Trichloroethane	UG/KG	13	U	13	U	12	U
Trichloroethene	UG/KG	13	U	13	U	12	U
Trichlorotrifluoroethane	UG/KG	13	U	13	U	12	U
Vinyl Acetate	UG/KG	13	U	13	U	12	U
Vinyl Chloride	UG/KG	13	U	13	U	12	U
Xylene, Total	UG/KG	25	U	27	U	24	U
Tentatively Identified Compounds		1					

APPENDIX E.3 MAIN HILL SEEPS SOIL INVESTIGATION (SOIL)

MAIN HILL SEEP 603							
		S31301		S32301		S33301	
		902-S31301		902-S32301		902-S33301	
		A0501136.D REG		A0601137.D REG		A0701138.D REG	
		6/21/94		6/21/94		6/21/94	
		Result	Val	Result	Val	Result	Val
Semi-volatile Organics	Units						
Acenaphthene	UG/KG	420	U	440	U	400	U
Acenaphthylene	UG/KG	420	U	440	U	400	U
Anthracene	UG/KG	420	U	440	U	400	U
Benzo(a)anthracene	UG/KG	420	U	440	U	51	J
Benzo(a)pyrene	UG/KG	420	U	440	U	61	J
Benzo(b)fluoranthene	UG/KG	420	U	440	U	64	J
Benzo(g,h,i)perylene	UG/KG	420	U	440	U	400	U
Benzo(k)fluoranthene	UG/KG	420	U	440	U	76	J
Benzoic Acid	UG/KG	2100	U	2200	U	2000	U
Benzyl Alcohol	UG/KG	420	U	440	U	400	U
2-Benzyl-4-Chlorophenol	UG/KG	420	U	440	U	400	U
bis(2-Chloroethoxy)methane	UG/KG	420	U	440	U	400	U
bis(2-Chloroethyl)ether	UG/KG	420	U	440	U	400	U
bis(2-Ethylhexyl)phthalate	UG/KG	420	UJ	440	UJ	400	UJ
4-Bromophenyl-phenylether	UG/KG	420	U	440	U	400	U
Butylbenzylphthalate	UG/KG	420	U	440	U	400	U
Carbazole	UG/KG	420	U	440	U	400	U
4-Chloro-3-methylphenol	UG/KG	420	U	440	U	400	U
4-Chloroaniline	UG/KG	420	U	440	U	400	U
2-Chloronaphthalene	UG/KG	420	U	440	U	400	U
2-Chlorophenol	UG/KG	420	U	440	U	400	U
4-Chlorophenyl-phenylether	UG/KG	420	U	440	U	400	U
Chrysene	UG/KG	420	U	440	U	94	J
Di-n-butylphthalate	UG/KG	420	U	440	U	400	U
Di-n-octylphthalate	UG/KG	420	U	440	U	400	U
Dibenzo(a,h)anthracene	UG/KG	420	U	440	U	400	U
Dibenzofuran	UG/KG	420	U	440	U	400	U
1,2-Dichlorobenzene	UG/KG	420	U	440	U	400	U
1,3-Dichlorobenzene	UG/KG	420	U	440	U	400	U
1,4-Dichlorobenzene	UG/KG	420	U	440	U	400	U
3,3'-Dichlorobenzidine	UG/KG	420	U	440	U	400	U
2,4-Dichlorophenol	UG/KG	420	U	440	U	400	U
Diethylphthalate	UG/KG	420	U	440	U	400	U
2,4-Dimethylphenol	UG/KG	420	U	440	U	400	U
Dimethylphthalate	UG/KG	420	U	440	U	400	U
4,6-Dinitro-2-methylphenol	UG/KG	1000	U	1100	U	960	U
2,4-Dinitrophenol	UG/KG	1000	U	1100	U	960	U
2,4-Dinitrotoluene	UG/KG	420	U	440	U	400	U
2,6-Dinitrotoluene	UG/KG	420	U	440	U	400	U
Fluoranthene	UG/KG	49	J	64	J	140	J
Fluorene	UG/KG	420	U	440	U	400	U
Hexachlorobenzene	UG/KG	420	U	440	U	400	U
Hexachlorobutadiene	UG/KG	420	U	440	U	400	U
Hexachlorocyclopentadiene	UG/KG	420	U	440	U	400	U
Hexachloroethane	UG/KG	420	U	440	U	400	U
Indeno(1,2,3-c,d)pyrene	UG/KG	420	U	440	U	43	J

APPENDIX E.3 MAIN HILL SEEPS SOIL INVESTIGATION (SOIL)

MAIN HILL SEEP 603							
		S31301		S32301		S33301	
		902-S31301		902-S32301		902-S33301	
		A0501136.D REG		A0601137.D REG		A0701138.D REG	
		6/21/94		6/21/94		6/21/94	
		Result	Val	Result	Val	Result	Val
Semi-volatile Organics	Units						
Isophorone	UG/KG	420	U	440	U	400	U
2-Methylnaphthalene	UG/KG	420	U	440	U	400	U
2-Methylphenol	UG/KG	420	U	440	U	400	U
4-Methylphenol	UG/KG	420	U	440	U	400	U
N-Nitroso-di-n-propylamine	UG/KG	420	U	440	U	400	U
N-Nitrosodiphenylamine	UG/KG	420	U	440	U	400	U
Naphthalene	UG/KG	420	U	440	U	400	U
2-Nitroaniline	UG/KG	1000	U	1100	U	960	U
3-Nitroaniline	UG/KG	1000	U	1100	U	960	U
4-Nitroaniline	UG/KG	1000	U	1100	U	960	U
Nitrobenzene	UG/KG	420	U	440	U	400	U
2-Nitrophenol	UG/KG	420	U	440	U	400	U
4-Nitrophenol	UG/KG	1000	U	1100	U	960	U
2,2'-oxybis(1-Chloropropane)	UG/KG	420	U	440	U	400	U
Pentachlorophenol	UG/KG	1000	U	1100	U	960	U
Phenanthrene	UG/KG	420	U	440	U	43	J
Phenol	UG/KG	420	U	440	U	400	U
Pyrene	UG/KG	420	U	51	J	110	J
1,2,4-Trichlorobenzene	UG/KG	420	U	440	U	400	U
2,4,5-Trichlorophenol	UG/KG	1000	U	1100	U	960	U
2,4,6-Trichlorophenol	UG/KG	420	U	440	U	400	U
Tentatively Identified Compounds		29		27		28	

APPENDIX E.3 MAIN HILL SEEPS SOIL INVESTIGATION (SOIL)

MAIN HILL SEEP 603											
		S31301		S32301		S32301		S33301		S33301	
		902-S31301		902-S32301		902-S32301		902-S33301		902-S33301	
		36433-01 REG		36433-02DL DIL		36433-02 REG		36433-03DL DIL		36433-03 REG	
		6/21/94		6/21/94		6/21/94		6/21/94		6/21/94	
		Result	Val	Result	Val	Result	Val	Result	Val	Result	Val
Pesticides and PCBs	Units										
Aldrin	UG/KG	0.43	U	9	UJ	3.1	J	1.6	UJ	0.52	J
alpha-BHC	UG/KG	0.43	U	9	UJ	1.8	U	1.6	UJ	0.41	U
alpha-Chlordane	UG/KG	0.54	J	10	J	10		1.6	J	1.2	J
Aroclor 1232	UG/KG	8.3	U	180	UJ	35	U	32	UJ	8	U
Aroclor-1016	UG/KG	8.3	U	180	UJ	35	U	32	UJ	8	U
Aroclor-1221	UG/KG	17	U	360	UJ	71	U	64	UJ	16	U
Aroclor-1242	UG/KG	8.3	U	180	UJ	35	U	32	UJ	8	U
Aroclor-1248	UG/KG	8.3	U	180	UJ	35	U	32	UJ	8	U
Aroclor-1254	UG/KG	3.7	J	180	UJ	35	U	32	UJ	8	U
Aroclor-1260	UG/KG	8.3	U	180	UJ	35	U	32	UJ	8	U
beta-BHC	UG/KG	0.43	U	9	UJ	1.8	U	1.6	UJ	0.41	U
4,4'-DDD	UG/KG	0.83	U	18	UJ	3.5	U	3.2	UJ	0.8	U
4,4'-DDE	UG/KG	0.83	U	18	UJ	3.5	U	3.2	UJ	0.8	U
4,4'-DDT	UG/KG	0.83	U	18	UJ	3.5	U	3.2	UJ	0.8	U
delta-BHC	UG/KG	0.43	U	9	UJ	1.8	U	1.6	UJ	0.41	U
Dieldrin	UG/KG	10		150	J	140		46	J	29	
Endosulfan I	UG/KG	0.43	U	9	UJ	1.8	U	1.6	UJ	0.41	U
Endosulfan II	UG/KG	0.83	UJ	18	UJ	3.5	UJ	3.2	UJ	0.8	UJ
Endosulfan Sulfate	UG/KG	0.83	U	18	UJ	3.5	U	3.2	UJ	0.8	U
Endrin	UG/KG	0.83	U	18	UJ	3.5	U	3.2	UJ	0.8	U
Endrin Aldehyde	UG/KG	0.83	U	18	UJ	3.5	U	3.2	UJ	0.8	U
Endrin Ketone	UG/KG	0.83	U	18	UJ	3.5	U	3.2	UJ	0.8	U
gamma-BHC (Lindane)	UG/KG	0.43	U	9	UJ	1.8	U	1.6	UJ	0.41	U
gamma-Chlordane	UG/KG	0.42	J	7.4	J	7.4		1.3	J	1	
Heptachlor	UG/KG	0.43	U	9	UJ	1.8	U	1.6	UJ	0.41	U
Heptachlor Epoxide	UG/KG	0.43	U	9	UJ	2.2	J	1.6	UJ	0.53	J
p,p'-Methoxychlor	UG/KG	4.3	UJ	90	UJ	18	UJ	16	UJ	4.1	UJ
Toxaphene	UG/KG	43	U	900	UJ	180	U	160	UJ	41	U

APPENDIX E.3 MAIN HILL SEEPS SOIL INVESTIGATION (SOIL)

MAIN HILL SEEP 603							
		S31301		S32301		S33301	
		902-S31301		902-S32301		902-S33301	
		3643501 REG		3643502 REG		3643503 REG	
		6/21/94		6/21/94		6/21/94	
		Result	Val	Result	Val	Result	Val
Inorganics	Units						
Aluminum	MG/KG	13100		13500		11700	
Antimony	MG/KG	0.78	R	0.83	R	0.74	R
Arsenic	MG/KG	8.9		10.9		10.3	
Barium	MG/KG	105		249		142	
Beryllium	MG/KG	0.75		0.89		0.67	
Bismuth	MG/KG	58.6		48.9		52.1	
Cadmium	MG/KG	0.58	U	0.61	U	0.55	U
Calcium	MG/KG	28200	J	18800	J	63500	J
Chromium	MG/KG	19.8		18.6		14.7	
Cobalt	MG/KG	12.3		9.8		9.7	
Copper	MG/KG	21.6		21.8		22.1	
Cyanide	MG/KG	1.7		0.79		0.6	U
Iron	MG/KG	30600		34700		25100	
Lead	MG/KG	16.6		19.7		19.7	
Magnesium	MG/KG	7810		7160		18700	
Manganese	MG/KG	668		1200		743	
Mercury	MG/KG	0.13	U	0.13	U	0.12	U
Nickel	MG/KG	22.8		20.3		23.4	
Potassium	MG/KG	1680		956		1360	
Selenium	MG/KG	0.51	UJ	0.53	UJ	0.48	UJ
Silver	MG/KG	1.2	U	1.3	U	1.2	U
Sodium	MG/KG	2240	J	2670	J	1420	J
Thallium	MG/KG	0.91	U	0.96	U	0.86	U
Vanadium	MG/KG	21.7		27.9		20.8	
Zinc	MG/KG	66.6		75.8		66.3	

APPENDIX E.3 MAIN HILL SEEPS SOIL INVESTIGATION (SOIL)

MAIN HILL SEEP 603							
		S31301		S32301		S33301	
		902-S31301		902-S32301		902-S33301	
		036434-0001-SA		0364340002SA REG		0364340003SA REG	
		6/21/94		6/21/94		6/21/94	
		Result	Val	Result	Val	Result	Val
Anions	Units						
Chloride	MG/KG	1150		1300		372	
Fluoride	MG/KG	1.5		2.1		1.9	
Nitrate/Nitrite (NO3/NO2-N)	MG/KG	9		2.4		0.76	
Sulfate	MG/KG	322		81.3		107	
		S31301		S32301		S33301	
		902-S31301		902-S32301		902-S33301	
		REG		0364340002SA REG		0364340003SA REG	
		6/21/94		6/21/94		6/21/94	
		Result	Val	Result	Val	Result	Val
Miscellaneous	Units						
Cation Exchange Capacity as Na	MEQ/100	12.5					
PH	UNITS	7.8		7.9		8.4	
Total Organic Carbon	%	1.05		2.1667		1.3	

APPENDIX E.3 MAIN HILL SEEPS SOIL INVESTIGATION (SOIL)

MAIN HILL SEEP 603			
		S31301	
		902-S31301	
		0364340001SA REG	
		6/21/94	
		Result	Val
EXPLOSIVES	Units		
2-Amino-4,6-dinitrotoluene	UG/G	0.32	U
1,3-Dinitrobenzene	UG/G	0.32	U
2,4-Dinitrotoluene	UG/G	0.32	U
2,6-Dinitrotoluene	UG/G	0.33	U
HMX	UG/G	2.8	U
Nitrobenzene	UG/G	0.33	U
PETN	UG/G	1.3	U
RDX	UG/G	1.3	U
TETRYL	UG/G	0.82	U
1,3,5-Trinitrobenzene	UG/G	0.32	U
2,4,6-Trinitrotoluene	UG/G	0.32	U

APPENDIX E.3 MAIN HILL SEEPS SOIL INVESTIGATION (SOIL)

MAIN HILL SEEP 603										
		S31301			S32301			S33301		
		902-S31301			902-S32301			902-S33301		
		3228673 REG			3228674 REG			3228672 REG		
		34506			34506			34506		
		Result	UNC	Val	Result	UNC	Val	Result	UNC	Val
Radiological	Units									
Am-241	PCI/G	0.108	NA	U	0.0854	NA	U	0.0854	NA	U
Bi-207	PCI/G	0.0257	NA	U	0.0191	NA	U	0.0242	NA	U
Bi-210m	PCI/G	0.0293	NA	U	0.0221	NA	U	0.0279	NA	U
Co-60	PCI/G	0.0305	NA	U	0.0247	NA	U	0.0316	NA	U
Cs-137	PCI/G	0.202	0.0344		0.238	0.0323		0.299	0.0451	
K-40	PCI/G	21	2.24		14.3	1.51		16.9	1.87	
Pu-238	PCI/G	0.259	0.0517	J	0.0461	0.0251	J	0.359	0.0672	J
Pu-239/240	PCI/G	0.0328	0.0161	J	0.00629	0.00731	J	0.0215	NA	UJ
Pu-242	PCI/G	0.0125	0.00895	J	0.0154	NA	UJ	0.0143	0.0114	J
Ra-226	PCI/G	2.29	0.636		3.15	0.575		2.24	0.7	
Sr-90	PCI/G	0.492	NA	U	0.537	NA	U	0.384	0.233	J
Th-228	PCI/G	0.828	0.135		0.818	0.132		0.847	0.134	
Th-230	PCI/G	1.08	0.166		1.6	0.228		1.24	0.181	
Th-232	PCI/G	0.718	0.121		0.75	0.123		0.74	0.12	
Tritium	PCI/G	0.175	0.0601	R	0.17	0.0868	R	0.127	0.617	R
U-234	PCI/G	0.809	0.159		0.772	0.138		0.851	0.16	
U-235	PCI/G	0.0399	ND	U	0.042	0.0238		0.0659	0.034	
U-238	PCI/G	0.95	0.179		0.84	0.147		0.962	0.175	

RADIOCHEMICAL ANALYSIS

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W.P. DAVIS

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

The drilling and sampling were performed using an auger drill rig and a 2-ft, split-barrel sampler. As the split-barrel sampler was removed from the borehole, it was monitored for radioactivity contamination by Mound Plant health physics personnel using a FIDLER to detect radioactivity contamination that would pose a hazard to the workers present. After the soil was removed from the sampler and placed in sample containers, field team members wearing gloves brushed the remaining soil out of the sampler. The gloves were then monitored with an alpha scintillometer before the split-barrel sampler was used again. However, no standard decontamination was performed.

The core locations are shown in Plate 1. The core locations were surveyed by a licensed surveyor after drilling was completed. The available reports submitted to Mound Plant by the drilling subcontractors are presented in Appendix B.

2.1.4. Sample Analyses

2.1.4.1. FIDLER Screening

In order to identify samples with concentrations of plutonium-238 exceeding 25 pCi/g and total thorium exceeding 2 pCi/g, all of the soil samples collected were pulverized and then screened using a Bicron® FIDLER at the Mound Plant Soil Screening Facility, known as trailer 15 at the time of the Site Survey Project. The Soil Screening Facility is now located in the H Building at Mound Plant (Plate 1). The minimum detectable activity at which plutonium-238 can be reliably detected at the Mound Plant screening facility is estimated to be 25 pCi/g (Draper 1986b). The detection of plutonium-238 at lesser concentrations (12-25 pCi/g) was unreliable and had an estimated error of ±75 percent. The estimated error decreased with increasing sample activity; for samples with 25 to 100 pCi/g of plutonium-238, the estimated error was ±35 percent, and for samples with >100 pCi/g, the estimated error was ±30 percent (Casella and Bishop 1984). The minimum detectable activity for thorium from FIDLER screening was estimated to be about 2 pCi/g (Stought et al. 1988). The Mound Plant procedure for screening soil samples is provided in Appendix A.

2.1.4.2. Radiochemical Analysis for Plutonium-238

Because of the high error (±75 percent) involved in the FIDLER screening of samples containing less than 25 pCi/g of plutonium-238, all soil samples were radiochemically analyzed by Mound Plant for plutonium-238. The lower detection limit (LDL) for plutonium-238 by this method was estimated to be 0.01 pCi/g, with a relative precision (two standard deviations) of 25 percent. The overall precision of the plutonium-238 measurements was reported to be about 18 percent (DOE 1991b). The Mound

Plant procedure for the radiochemical analysis of soil samples for plutonium-238 is provided in Appendix A.

2.1.4.3. Radiochemical Analysis for Thorium

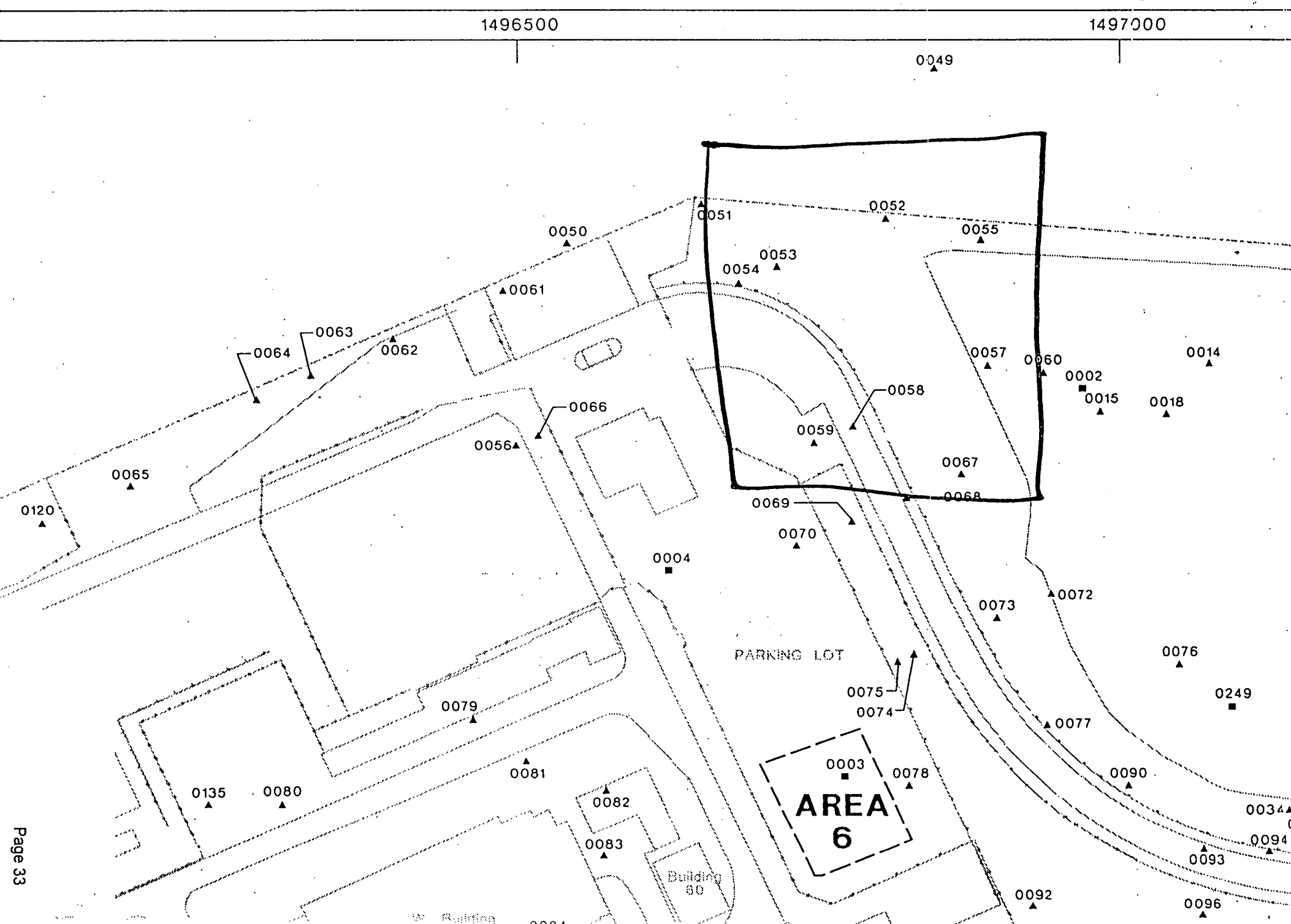
Samples with thorium concentrations in excess of 2 pCi/g by FIDLER screening were also radiochemically analyzed for thorium, resulting in the radiochemical analysis of about 12 percent of the samples. The LDLs for the thorium isotopes using radiochemical procedures were estimated to be

- 0.3 pCi/g for thorium-228, with a relative precision of 60 percent;
- 0.3 pCi/g for thorium-230, with a relative precision of 30 percent; and
- 0.1 pCi/g for thorium-232, with a relative precision of 70 percent.

The overall precision for the thorium measurement was reported to be about 25 percent. The thorium results were reported in pCi of total thorium per gram of soil, isotopes were not identified. The Mound Plant procedure for the radiochemical analysis of soil samples for thorium is provided in Appendix A.

2.1.4.4. Gamma Spectroscopy

Gamma spectroscopy was performed by Mound Plant on approximately 350 (18 percent) of the soil samples in order to verify the identity of the radionuclides present when screening indicated the presence of gamma-emitting radionuclides, but little excess plutonium or thorium was identified by radiochemical analysis. Gamma spectroscopy is capable of detecting a variety of gamma-emitting radionuclides; the radionuclides detected in samples collected during the Site Survey Project included cobalt-60, cesium-137, radium-226, actinium-227, and americium-241. No other gamma-emitting radionuclides with gamma energies below 1.5 millielectron volts (MeV) were detected, although the project report stated that subsequent sampling and analysis in some areas indicated bismuth-207 and bismuth 210m. No polonium-210 peaks were detected in the Site Survey Project samples, confirming that polonium-210, which was used at Mound Plant in the 1950s, is no longer present due to radioactive decay (half-life of 138.4 days). The LDLs for cesium-137, cobalt-60, and americium-241 were given with the original data, and were estimated to be 0.5 pCi/g for each. The LDLs for radium-226 and actinium-227 were estimated to be 1.0 pCi/g for both (Stought 1990). The Mound Plant procedure for gamma spectroscopy is provided in Appendix A.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Map Location[a]	Coordinates South	Coordinates West	MRC ID No.	Mo-Yr	Depth (inch)	Pu-238 (pCi/g)	Thorium[b] (pCi/g)	Tritium (pCi/mL)	Co-60 (pCi/g)	Cs-137 (pCi/g)	Ra-226 (pCi/g)	Am-241 (pCi/g)
S0037	1675	1730	6738	08-84	0	1.09	b					
S0038	1700	1630	6735	08-84	0	0.18	b					
S0039	1700	1680	2970	10-83	0	0.22	b	0.76				
S0040	1700	1705	6737	08-84	0	1.52	b					
S0041	1725	1605	6734	08-84	0	0.91	b					
S0042	1725	1655	6736	08-84	0	0.33	b					
S0043	1725	1755	6741	08-84	0	0.48	b					
S0044	1775	1505	2969	10-83	0	0.45[c]	b	0.72				
S0045	1775	1555	6733	08-84	0	1.49	b					
S0046	1775	1680	2972	10-83	0	0.86	b	1.06				
S0047	1785	1490	6732	08-84	0	0.44	b					
S0048	1785	1855	2973	10-83	0	0.28	b					
S0049	0900	1860	No MRC results given.									
S0050	0910	2200	6762	08-84	0	0.36	b					
S0051	0925	2085	4058	10-83	0	0.19	b					
S0052	1000	1950	6764	08-84	0	0.89	b					
S0053	1000	2050	6763	08-84	0	3.46	b		LDL	LDL	1	LDL
S0054	1000	2085	4057	10-83	0	0.19[c]	b					
S0055	1050	1885	4059	10-83	0	0.62	b					

Map Location[a]	Coordinates South	Coordinates West	MRC ID No.	Mo-Yr	Depth (inch)	Pu-238 (pCi/g)	Thorium[b] (pCi/g)	Tritium (pCi/mL)	Co-60 (pCi/g)	Cs-137 (pCi/g)	Ra-226 (pCi/g)	Am-241 (pCi/g)
S0056	1050	2310	4056	10-83	0	0.19	b					
S0057	1150	1925	6765	08-84	0	0.55	b					
S0058	1150	2050	6761	08-84	0	0.57	b					
S0059	1150	2085	4061	10-83	0	1.68	b					
S0060	1175	1885	4060	10-83	0	0.28	b					
S0061	0925	2265	4064	10-83	0	1.50	b					
S0062	0925	2365	4065	10-83	0	1.50	b					
S0063	0925	2440	6766	08-84	0	17.60	b					
S0064	0925	2490	4066	10-83	0	0.25	b					
S0065	0950	2615	4067	10-83	0	0.02	b					
S0066	1050	2290	4063	10-83	0	1.07[c]	b					
C0002	1200	1860	8340	11-84	36	0.10	4.47					
			8341	11-84	72	0.01	2.49					
S0067	1225	1985	6433	08-84	0	0.24	b					
S0068	1225	2035	6434	08-84	0	0.45	b					
S0069	1225	2085	6435	08-84	0	0.10	b					
S0070	1225	2135	6436	08-84	0	0.60	b					
S0071	1250	1385	3030	10-83	0	0.17	b	1.92				
S0072	1350	1960	6439	08-84	0	0.24	b					

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