300502-0605150006

CH2M HILL Mound, Inc.
1075 Mound Road
P.O. Box 750
Miamisburg, OH 45343-0750

SMO-120/06
February 16, 2006

Mr. Don Pfister, Director
Miamisburg Closure Project
U. S. Department of Energy
175 Tri-County Parkway
Springdale, OH 45246

ATTENTION: Paul Lucas

SUBJECT: **Contract No. DE-AC24-03OH20152:** Deliverable #39 Potential release site and removal action documentation; Section C.2.3.1.2 Further Assessments; PRSs 91-92 and 94-98 PRS Package Addendum 1, Public Review Draft

Dear Mr. Pfister:

Paul Lucas of your office has authorized the release of the following document for public review:

- PRSs 91-92 and 94-98 PRS Package Addendum 1, Public Review Draft

Public comment will be accepted through March 19, 2006.

If you or members of your staff have any questions regarding the document, or if additional support is needed, please contact Dave Rakel at 937-865-4203.

Sincerely,

Michael D. Ebben
Site Manager

JL/jg

Enclosures

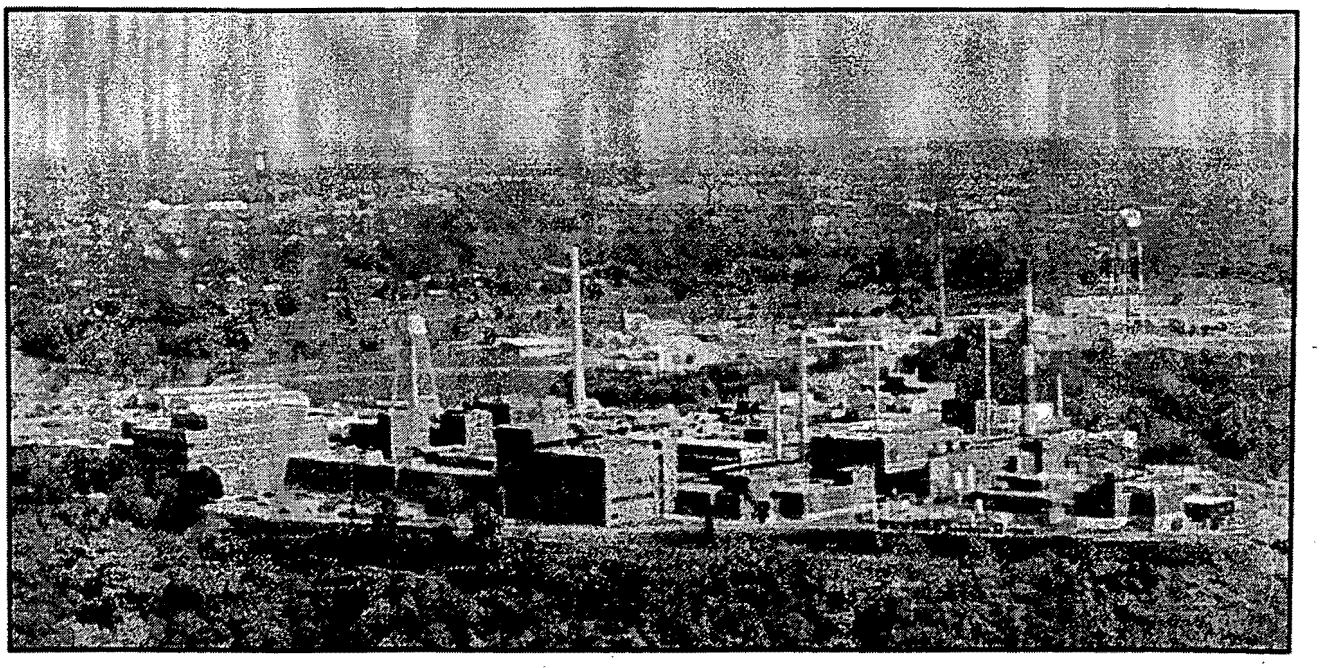
cc: T. Fischer, USEPA, (1) w/attachments
B. Nickel, OEPA, (4) w/attachments
R. Vandegrift, ODH, (1) w/attachments
J. Webb, ODH (1) w/attachments
M. Wojciechowski, Tetra Tech, (1) w/attach
G. Gorsuch, DOE/MCP, (1) w/attachments
R. Tormey, DOE/OH, (1) w/attachments
F. Bullock, MMCIC, (3) w/attachments
Public Reading Room, (1) w/attachments
C. Kline, CH2M Hill, (1) w/attachments
M. Gilliat, CH2M Hill, (1) w/attachmemts
ER Records, CH2M Hill, (1) w/attachs
DCC (1) w/attachments
M. Ebben, CH2M Hill, w/o attachments
D. Rakel, CH2M Hill, w/o attachments
K. Armstrong, CH2M Hill, w/o attachments
D. Kramer, CH2M Hill, w/o attachments
MOAT Coordinator
S. Barr, w/o attachments
M. McDougal, w/o attachments
file

300502-0605150006

Environmental
Restoration
Program

Miamisburg Closure Project
Potential Release Site Package
PRSs 91-92 and 94-98
Addendum 1

Public Review Draft
February 2006



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Appendix C PRS Package, PRS #91/92/94/95/96/97/98

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MIAMISBURG CLOSURE PROJECT
PRS 91, 92, 94, 95, 96, 97, and 98

RECOMMENDATION:

In the Spring of 1986, a groundwater seep was discovered on the western hillside of the Main Hill 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. PRS 91, 92, 94, 95, 96, 97, and 98 have historically been identified as seeps 601, 602, 604, 605, 606, 607, and 608. PRS 93, which was Main Hill Seep 0603, was previously binned NFA in September 1995.

No radioactive or hazardous waste generating processes are known to have occurred at the location of PRS 91, 92, 94, 95, 96, 97, and 98. Upon review of historical sampling, the Core Team has concluded that contamination in the seeps comes from migration from upgradient sources (R/SW Building footprint). The R/SW Building was demolished and the soil beneath has been removed to shale.

Therefore, the Core Team recommends that monitoring at Seeps 601, 602, 604, 605, 6067, 607, 608 be part of the remedy identified in the Parcel 6,7,8 Proposed Plan and Record of Decision. Details of the monitoring will be established in a monitoring plan that will be required by the Parcel 6,7,8 Proposed Plan and Record of Decision.

Therefore, the Core Team is proposing to retire PRS numbers 91, 92, 94, 95, 96, 97, 98 since the Seeps will be addressed in the Parcel 6,7, 8 Proposed Plan and Record of Decision.

This PRS Package signed by the Core Team will be placed in the Public Reading Room for a 30-day review period. Upon closure of the public review comments, if any, the PRS Package will be issued as a final document and made available in the Public Reading Room.

CONCURRENCE:

DOE/MCP: _____ 2/1/06
Paul Lucas, Remedial Project Manager (date)

USEPA: _____ 2/1/06
Timothy J. Fischer, Remedial Project Manager (date)

OEPA: _____ 2/1/06
Brian K. Nickel, Project Manager (date)

PRS HISTORY

PRSs 91, 92, located on DOE property (Parcel 8) and , 94/95, 96, 97, and 98, located just north of DOE owned property, are seeps 0601, 0602, 0604/0605, 0606, 0607, and 0608 respectively. Contaminants identified in the seeps include tritium and low levels of volatile organic compounds (VOCs). Seep monitoring was initiated in the Spring of 1986. The Core Team binned PRS 91, 92, 94/95, 96, 97 and 98 Further Assessment (FA) on February 1, 1996. This Addendum provides the data collected from December 1996 through the Fall of 2005. Figure 1 of this Addendum shows the location of the Seeps associated with this PRS package

FURTHER ASSESSMENT ACTIVITY

The seeps of PRS 91, 92, 94/95, 96, 97, and 98 have been monitored for various constituents with varying frequency throughout the FA time period. Tritium and VOCs are the only contaminants identified in the February 1, 1996 PRS 91/92/94/95/96/97/98 Potential Release Site Package and were therefore the primary contaminants that have been analyzed for during the FA sampling. Appendix A provides the results of the FA sampling. Appendix B provides various time series plots showing long-term trends at those seeps that have contaminant concentrations above the threshold of interest (e.g. maximum contaminant level [MCL]). Data reported are available in the Mound Environmental Information Management System (MEIMS) and include data collected through Fall 2005. Quarterly collection of data continues.

DISCUSSION OF ANALYTICAL RESULTS

The results discussion is limited to those Contaminants of Concern (COCs) that have, at some time, been detected above the applicable MCL.

VOC Results

Seep 0601 VOC concentrations in Seep 0601 show detections of both tetrachloroethene (PCE) and trichloroethene (TCE). Concentrations of PCE had hovered consistently in the 5 to 15 ppb (compared with an MCL of 5 ppb) range since Winter 1996. Following the initiation of the SW-R demolition project, a noticeable increase was observed with results just above 50 ppb. TCE concentrations have been just above or just below the MCL of 5 ppb for many years. Following the start of the SW-R demolition project no noticeable change in TCE concentration was observed.

Seep 0602 Seep 0602 has shown detections of TCE for many years with concentrations typically below the MCL of 5 ppb.

Seep 0605 TCE concentration in Seep 0605 has stayed between 2 and 8 ppb, with the exception of an uptick into the 12 – 14 ppb range in 2002-2003 time frame. Following the start of the SW-R demolition project, a noticeable increase

was observed with results approaching 100 ppb. Fall 2005 sampling shows TCE at a concentration of 33 ppb.

Seep 0606 Seep 0606 had shown declining levels of TCE throughout its monitoring. However, following the start of the SW-R demolition, TCE concentration rose above the MCL with recent concentrations at 24 ppb.

Seep 0607 TCE concentrations in Seep 0607 have historically been below the MCL of 5 ppb. However, following the start of SW-R demolition, TCE concentrations have risen above the MCL with recent concentrations at 8.7 ppb.

Seep 0608 VOCs have not been detected in excess of any MCL levels in Seep 0608.

Radionuclide Results

Seep 0601 Seep 0601 has shown elevated tritium levels throughout its monitoring history. Levels have historically been above the drinking water MCL of 20,000 pCi/L. Following the start of the SW-R demolition project, tritium levels increased significantly with peak concentrations in excess of 1 E+06 pCi/L. Results from Fall 2005 sampling show a tritium concentration at approximately 463,100 pCi/L. Elevated levels of radium 228 were also detected in fall 2005 samples with a concentration of 5.8 pCi/L, (The MCL for Ra-226/228 combined = 5 pCi/L). Additionally, Sr-90 was detected in fall 2005 at a concentration of 11.7 pCi/L (The E 10-6 Risk Based Guideline value for Sr-90 plus daughters for a site employee is 28.6 pCi/L).

Seep 0602 Tritium concentrations in Seep 0602 have been below the MCL throughout most of its monitoring history. Results from summer 2005 sampling show a tritium concentration at approximately 20,000 pCi/L.

Seep 0605 Seep 0605 has shown elevated tritium levels throughout its monitoring history. Levels have historically been above the drinking water MCL of 20,000 pCi/L. Following the initiation of the SW-R demolition project, tritium levels increased significantly with peak concentrations in excess of 300,000 pCi/L. Results from Fall 2005 sampling show a tritium concentration at approximately 158,300 pCi/L. Elevated levels of radium 228 were also detected in fall 2005 samples with a concentration of 23.6 pCi/L. Sr-90 was detected at a concentration of 1.16 pCi/L during the fall of 2005.

Seep 0606 Tritium concentrations in Seep 0606 have been below the MCL throughout most of its monitoring history. Immediately following the start of the SW-R project, tritium levels rose to just above 45,000 pCi/L; Results from fall 2005 sampling show a tritium concentration at approximately 76,640 pCi/L.

Seep 0607 Tritium concentrations in Seep 0607 have been below the MCL throughout most of its monitoring history. Following initiation of the SW-R demolition project tritium concentrations increased with fall 2005 concentrations at approximately 71,410 pCi/L.

Seep 0608 Tritium levels in Seep 0608 have been below the MCL of 20,000 pCi/L since mid 1997. Fall 2005 concentrations are at approximately 21,410 pCi/L

DISCUSSION OF IMPACTS TO SOILS FROM VOCs ADJACENT TO SEEPS

The following analysis provides a calculation to determine the potential contamination to local soils adjacent to a seep discharge.

Calculation to Determine Solvent Loading to Soils from a Typical Seep

ASSUME: **trichloroethene as contaminant with density = 1.46 g/ml**

10 μg/l concentration at seep

2 liters per minute flow rate

(10 μg/l) * (2 l/min) * (60 min/hr) * (24hours/day) * 365 days/year)

⇒ **10.5 grams per year deposited on the surface**

With trichloroethene density @ 1.46 g/ml this equates to approximately 6.8 milliliters of trichloroethene deposited on the soil surface.

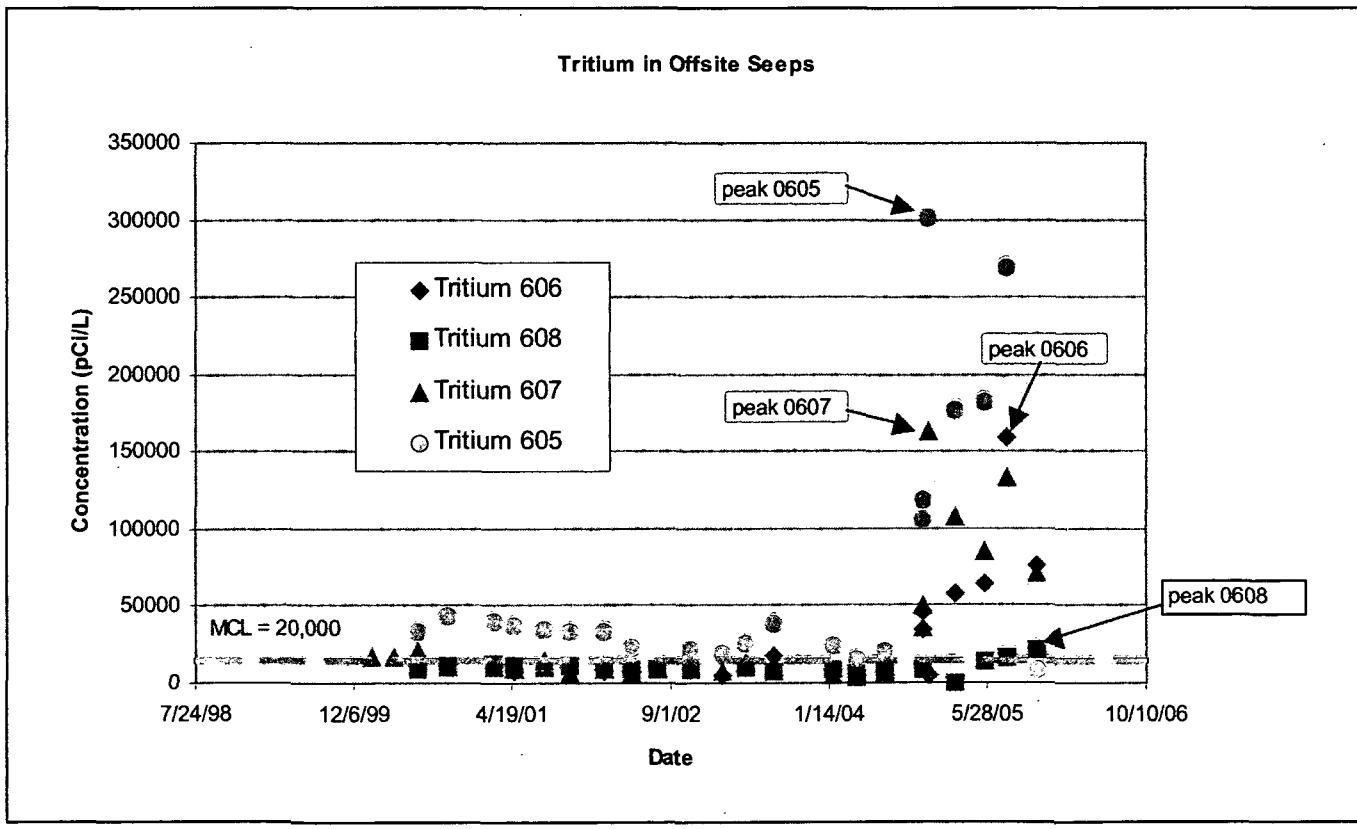
This calculation does not include the effects of vaporization which would reduce the actual loading to the soil.

The calculation demonstrates that given an average seep condition, the VOC loading to adjacent soils is minimal.

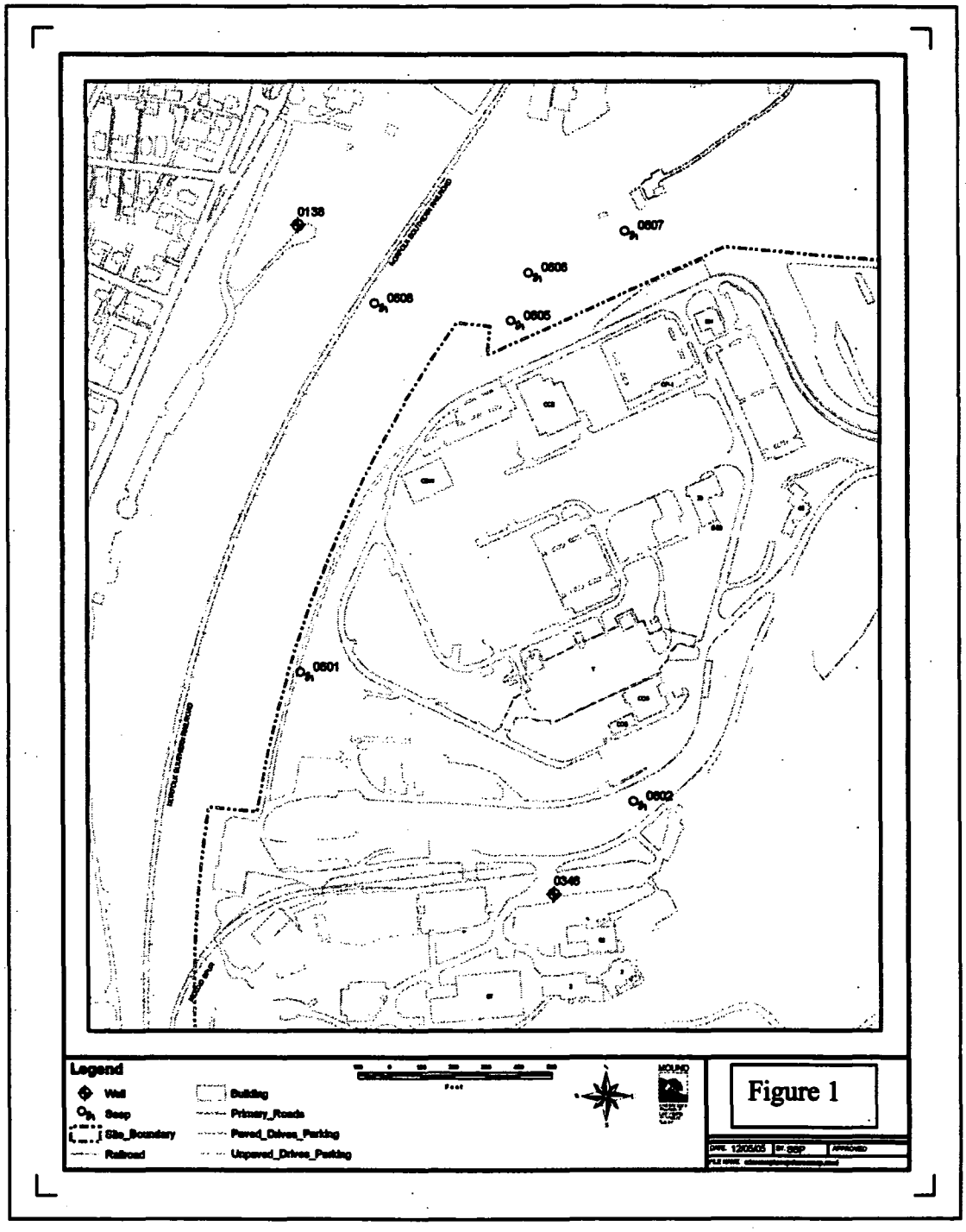
DISCUSSION OF IMPACTS FROM SOURCE REMOVAL

Tritium concentrations in onsite seep 0601 (just southwest of the SW-R demo project) have remained relatively stable over the last month and a half (October 2005 through mid-November 2005) with concentrations ranging between 400 – 500 nCi/L. Prior to October, concentrations had been in the 700 – 1,200 nCi/L range. The change in concentration observed at 0601 is likely due the recent excavation and removal of significant amounts of tritium contaminated soil from the SW-R footprint. Seep 0601 serves as a rapid response indicator of tritium levels entering the fractured bedrock system in the SW-R area.

Samples collected the week of November 1, 2005 from offsite seeps 0605, 0606, 0607 and 0608 support the tritium concentration trends observed in indicator seep 0601. The chart below shows tritium levels as a function of time for the offsite seeps. The chart shows the time period before and during the SW-R demolition project, (SW-R Demolition initiated in late summer 2004). The last sampling round, (data collected the week of 11/1/2005), suggests that peak tritium concentrations at the seeps may have passed, (this conclusion is supported by the trend observed at seep 0601). Tritium data collected the week of 11/1/2005 from monitoring wells 0346, (tributary valley well south of SW-R with max tritium concentrations last winter @ 15 nCi/L) and 0138 (BVA well west of SW-R with max tritium concentrations this summer @ 14 nCi/L), now show concentrations of 4.5 and 9 nCi/L respectively. See Figure 1 for well locations. This also supports the data trend observed at the seeps.



It therefore appears that, based on recent tritium data from wells and seeps, that the excavation activities at SW-R have removed some if not a majority of the tritium contaminated soil. In fact, a large majority of the soils have been removed from the area and what remains is the weathered upper portion of the fractured bedrock surface. As time progresses, tritium concentrations in the seeps should begin moving back down towards pre-SW-R demolition levels and then continue moving downward past the MCL level of 20 nCi/L.



VOC levels in the seeps are somewhat more difficult to analyze due to the fate and transport characteristics of chlorinated solvents. As these solvents move through the soil and groundwater system they interact with the matrix material through sorption/de-sorption reactions. This in turn creates a delay effect in term of arrival time between peak tritium (which does not effectively interact with the matrix material through which it flows) concentrations and peak VOC concentrations. Recent VOC data from the seeps indicate that VOC concentration rose rapidly during the latest sampling round (samples collected summer 2005). The data suggest that the peak concentrations for VOC are just beginning to move outward through the system. The rise in VOC concentrations is likely attributable to slab removal followed by focused infiltration of misting water in the VOC impacted area. Again, as a significant amount of the existing soils in the suspected source area were removed during the summer and fall of 2005, it is reasonable to assume that VOC levels should begin to drop at the seeps. Due to the differences in fate and transport between tritium and VOCs in groundwater it is also reasonable to assume that the rate at which VOC levels decline relative to tritium levels will be less.

REFERENCES

PRS 91/92/94/95/96/97/98 Potential Release Site Package, February 1, 1996

PREPARED BY

Mark Gilliat, CH2M Hill, ER/WM Technical Staff

APPENDIX A

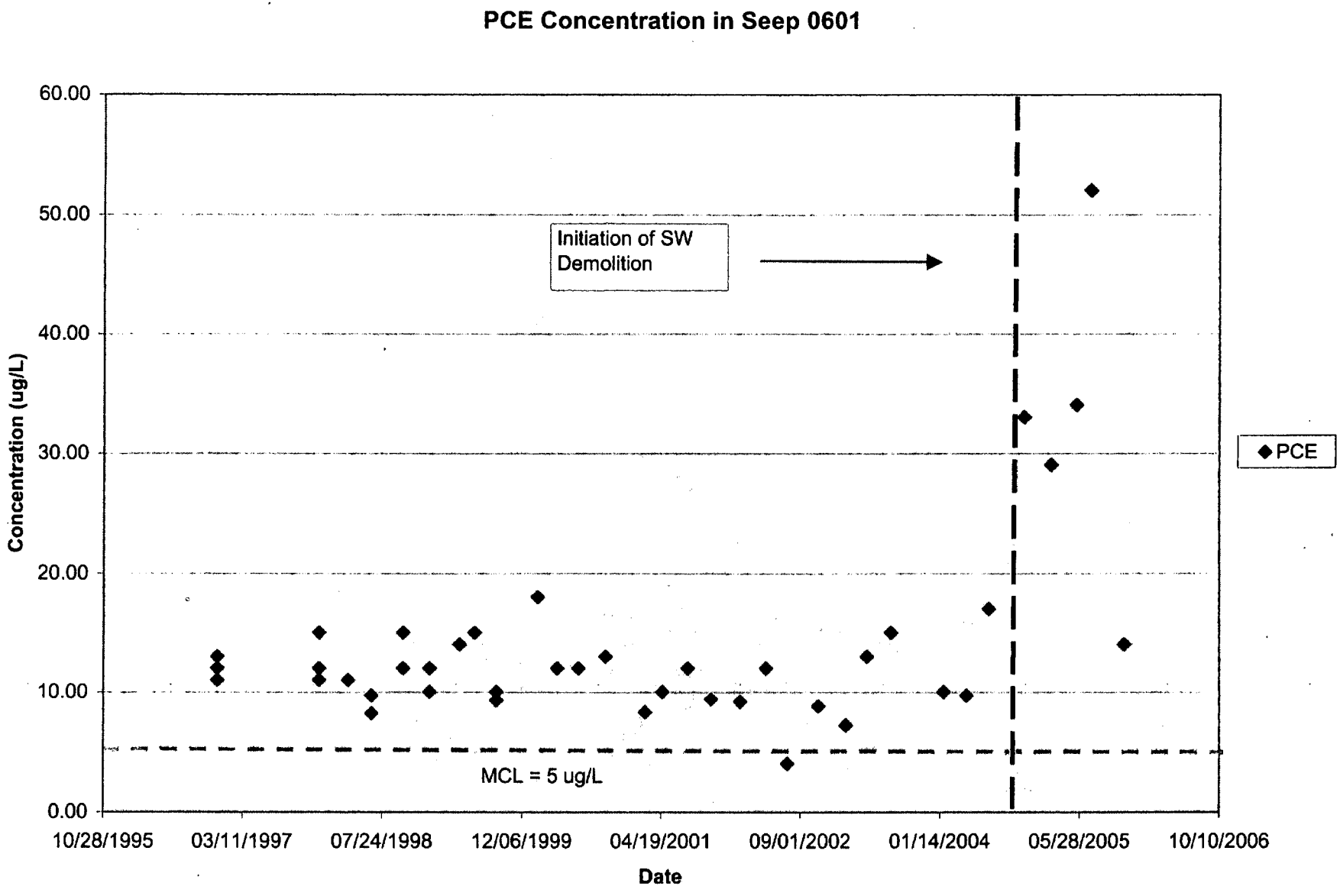
FURTHER ASSESSMENT DATA

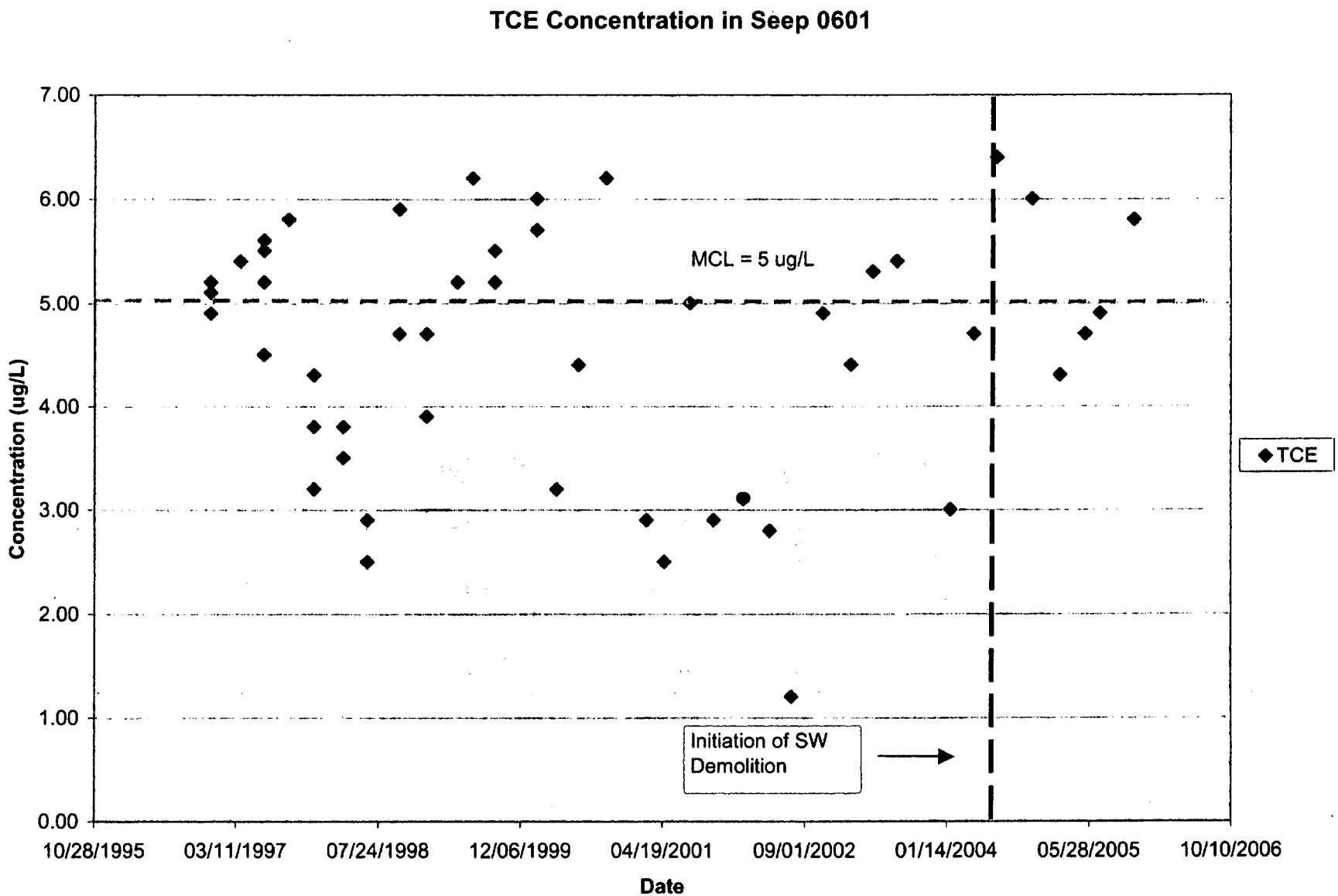
CD of PRSs 91-92 and 94-98 Data

ima
92 & 94-98 Data
CD-R

APPENDIX B

FURTHER ASSESSMENT TIME SERIES PLOTS FOR TRITIUM AND VOLATILE ORGANIC COMPOUNDS WITH MCL EXCEEDANCES


PCE Concentration in Seep 0601
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Concentration (ug/L)
Initiation of SW Demolition
MCL = 5 ug/L
PCE
10/28/1995
03/11/1997
07/24/1998
12/06/1999
04/19/2001
09/01/2002
01/14/2004
05/28/2005
10/10/2006
Date


TCE Concentration in Seep 0601
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Concentration (ug/L)
MCL = 5 ug/L
Initiation of SW Demolition
TCE
10/28/1995
03/11/1997
07/24/1998
12/06/1999
04/19/2001
09/01/2002
01/14/2004
05/28/2005
10/10/2006
Date

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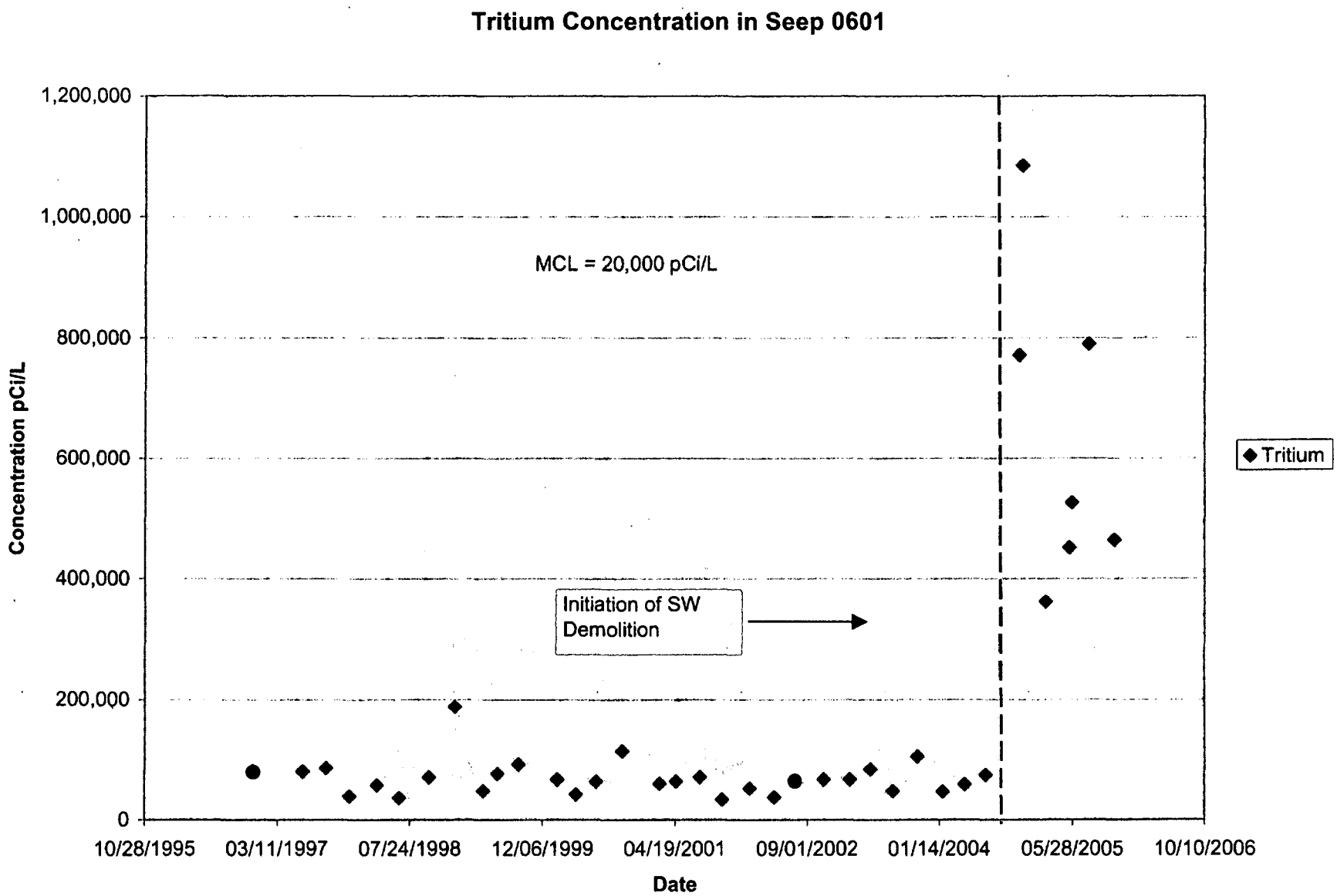
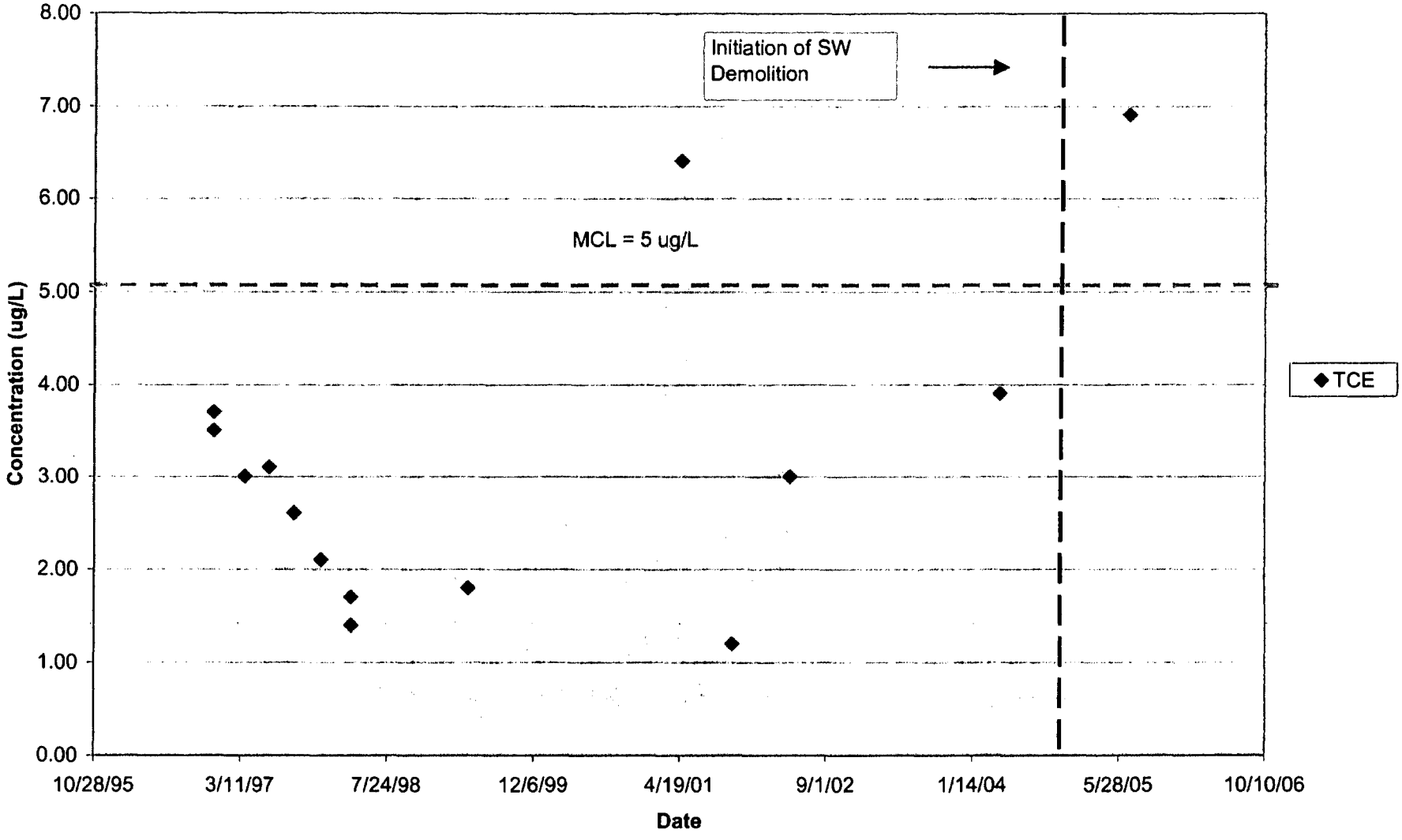

Tritium Concentration in Seep 0601
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
Concentration pCi/L
MCL = 20,000 pCi/L
Initiation of SW Demolition
Tritium
10/28/1995
03/11/1997
07/24/1998
12/06/1999
04/19/2001
09/01/2002
01/14/2004
05/28/2005
10/10/2006
Date

B 3/12

TCE Concentration in Seep 0602



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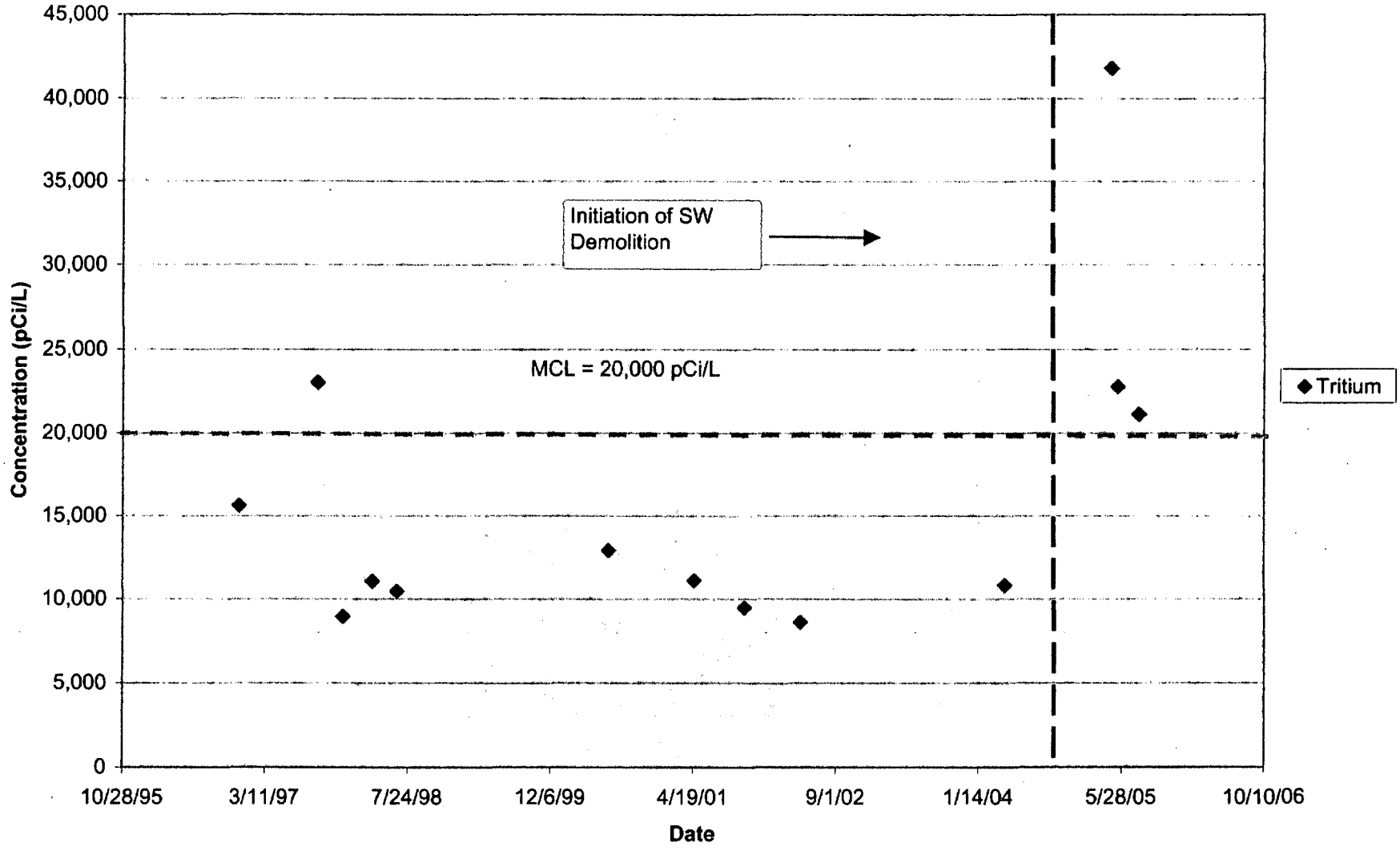
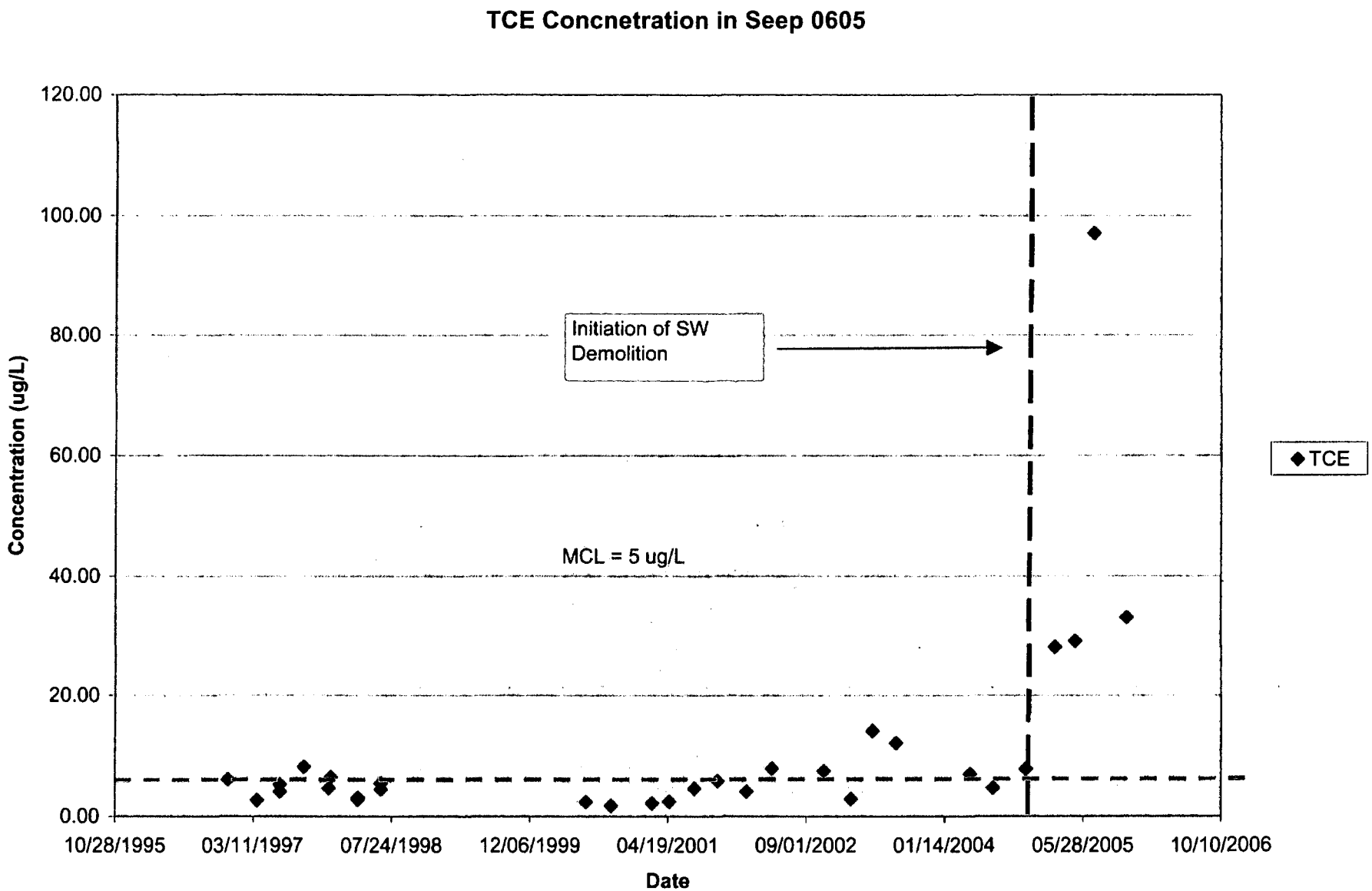
Tritium Concentration in Seep 0602




TCE Concnetration in Seep 0605
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Concentration (ug/L)
Initiation of SW Demolition
MCL = 5 ug/L
TCE
10/28/1995
03/11/1997
07/24/1998
12/06/1999
04/19/2001
09/01/2002
01/14/2004
05/28/2005
10/10/2006
Date

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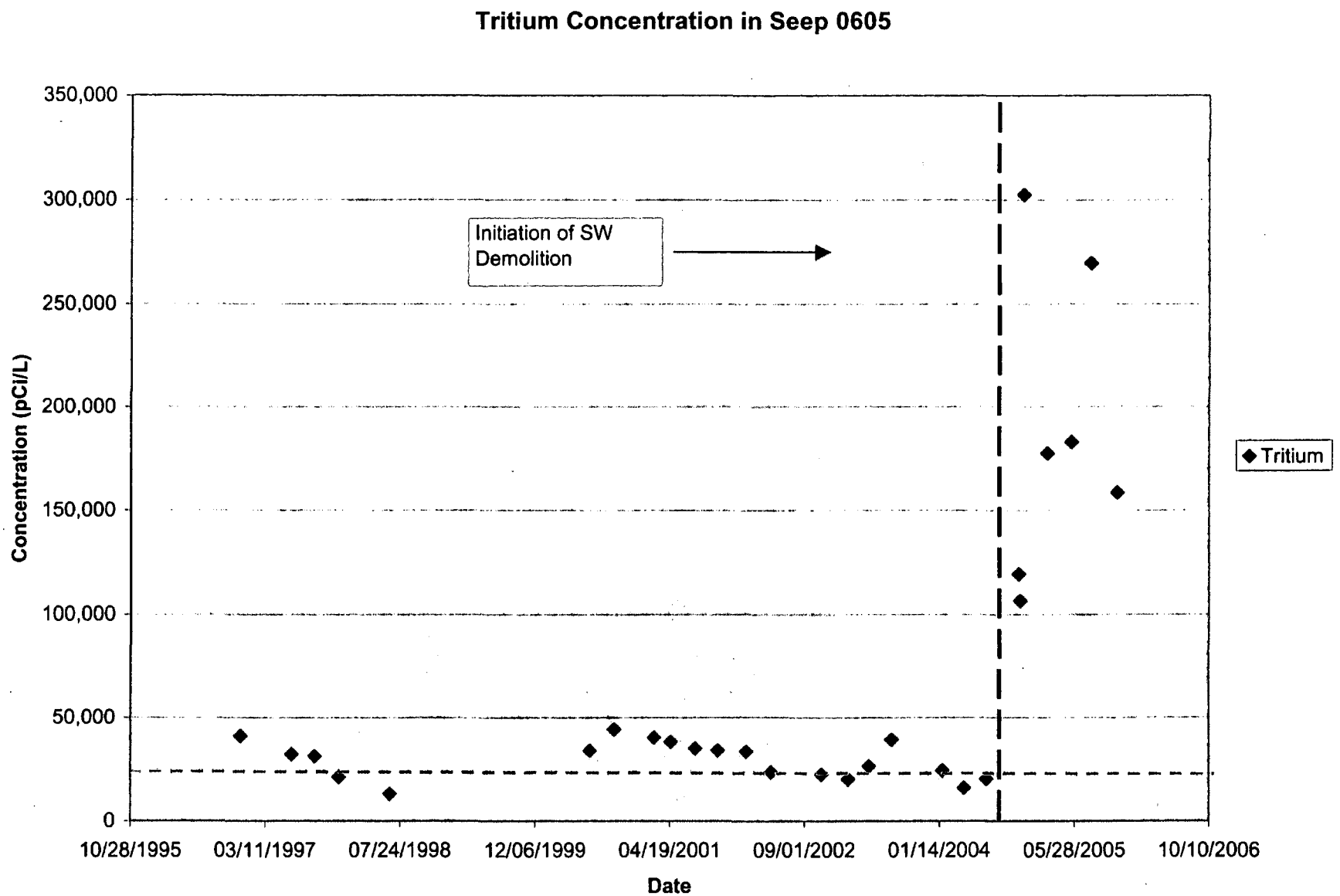
Tritium Concentration in Seep 0605
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
Concentration (pCi/L)
Initiation of SW Demolition
Tritium
10/28/1995
03/11/1997
07/24/1998
12/06/1999
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05/28/2005
10/10/2006
Date

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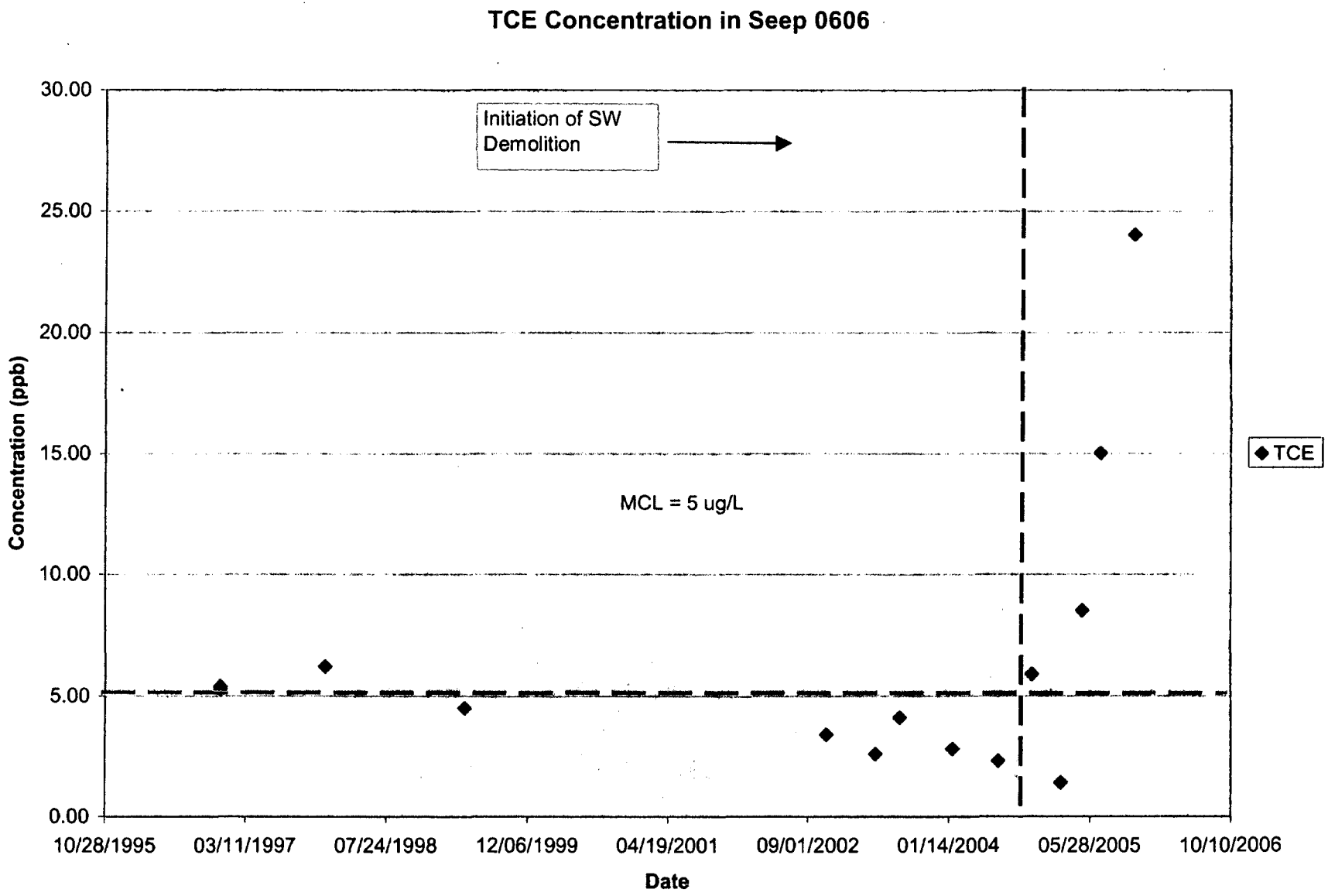
TCE Concentration in Seep 0606
Initiation of SW Demolition
MCL = 5 ug/L
TCE
Concentration (ppb)
30.00
25.00
20.00
15.00
10.00
5.00
0.00
10/28/1995
03/11/1997
07/24/1998
12/06/1999
04/19/2001
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05/28/2005
10/10/2006
Date

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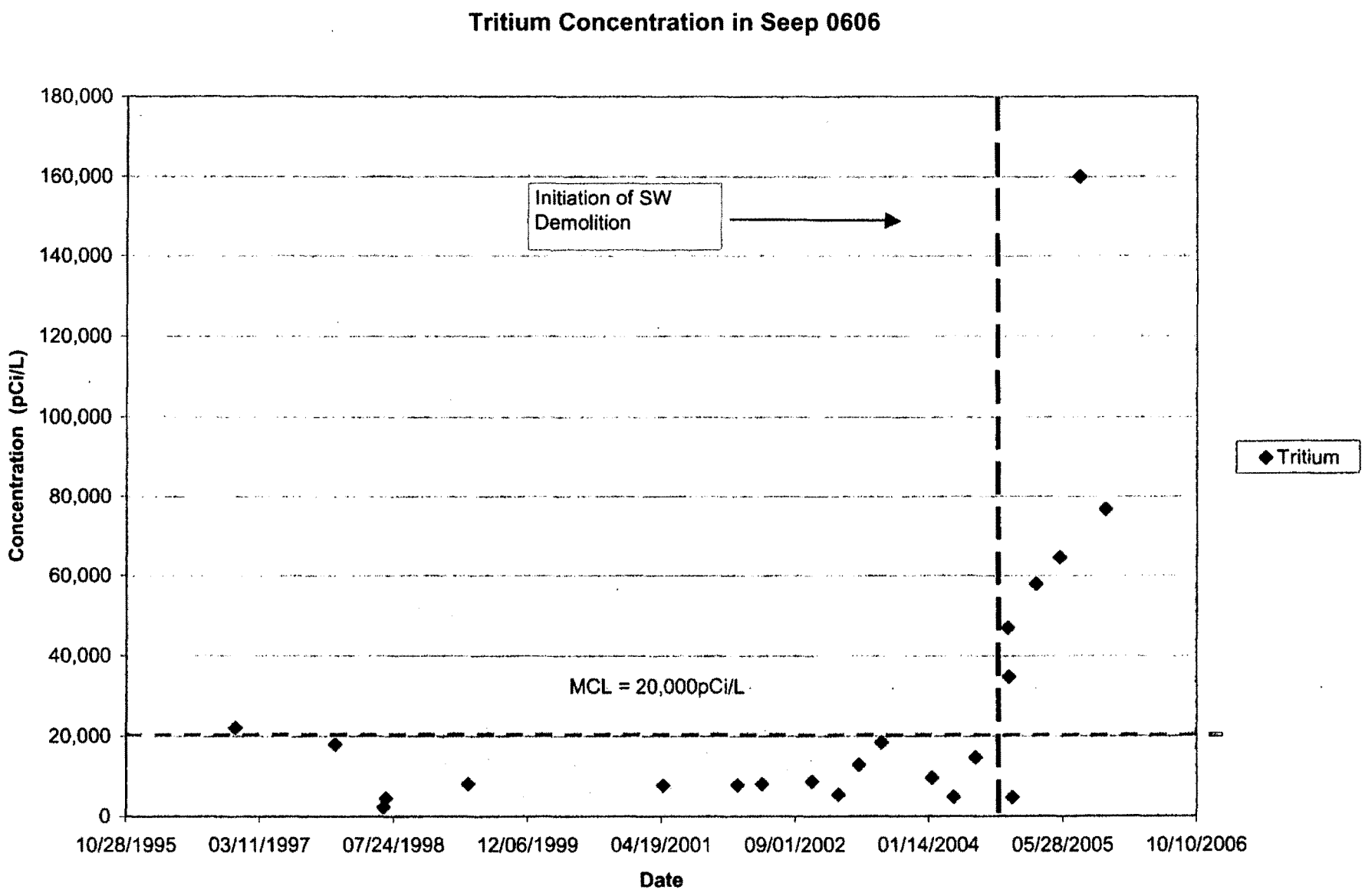
Tritium Concentration in Seep 0606
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
Concentration (pCi/L)
Initiation of SW Demolition
MCL = 20,000pCi/L
Tritium
10/28/1995
03/11/1997
07/24/1998
12/06/1999
04/19/2001
09/01/2002
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05/28/2005
10/10/2006
Date

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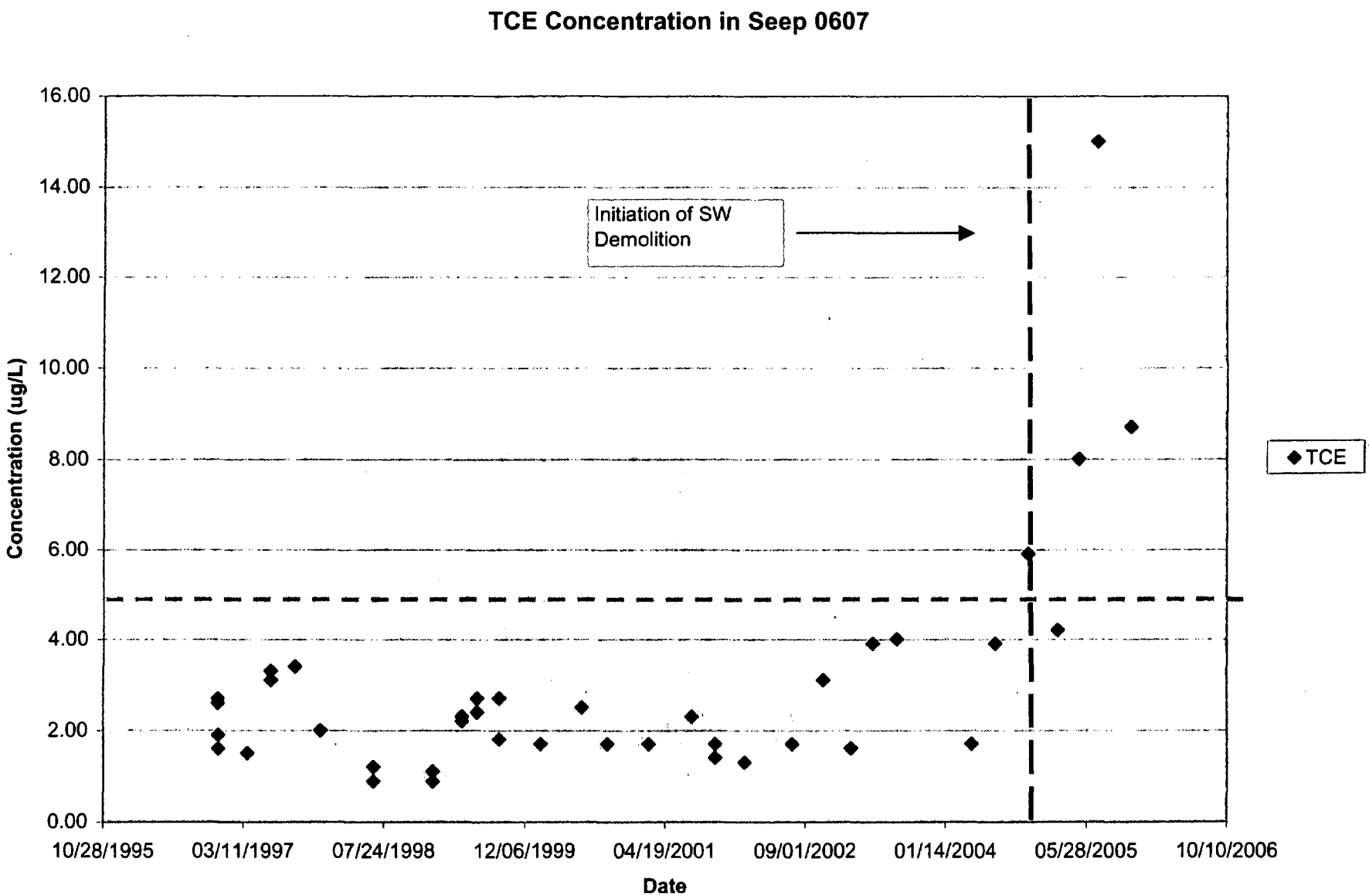
TCE Concentration in Seep 0607
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Concentration (ug/L)
Initiation of SW Demolition
TCE
10/28/1995
03/11/1997
07/24/1998
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05/28/2005
10/10/2006
Date

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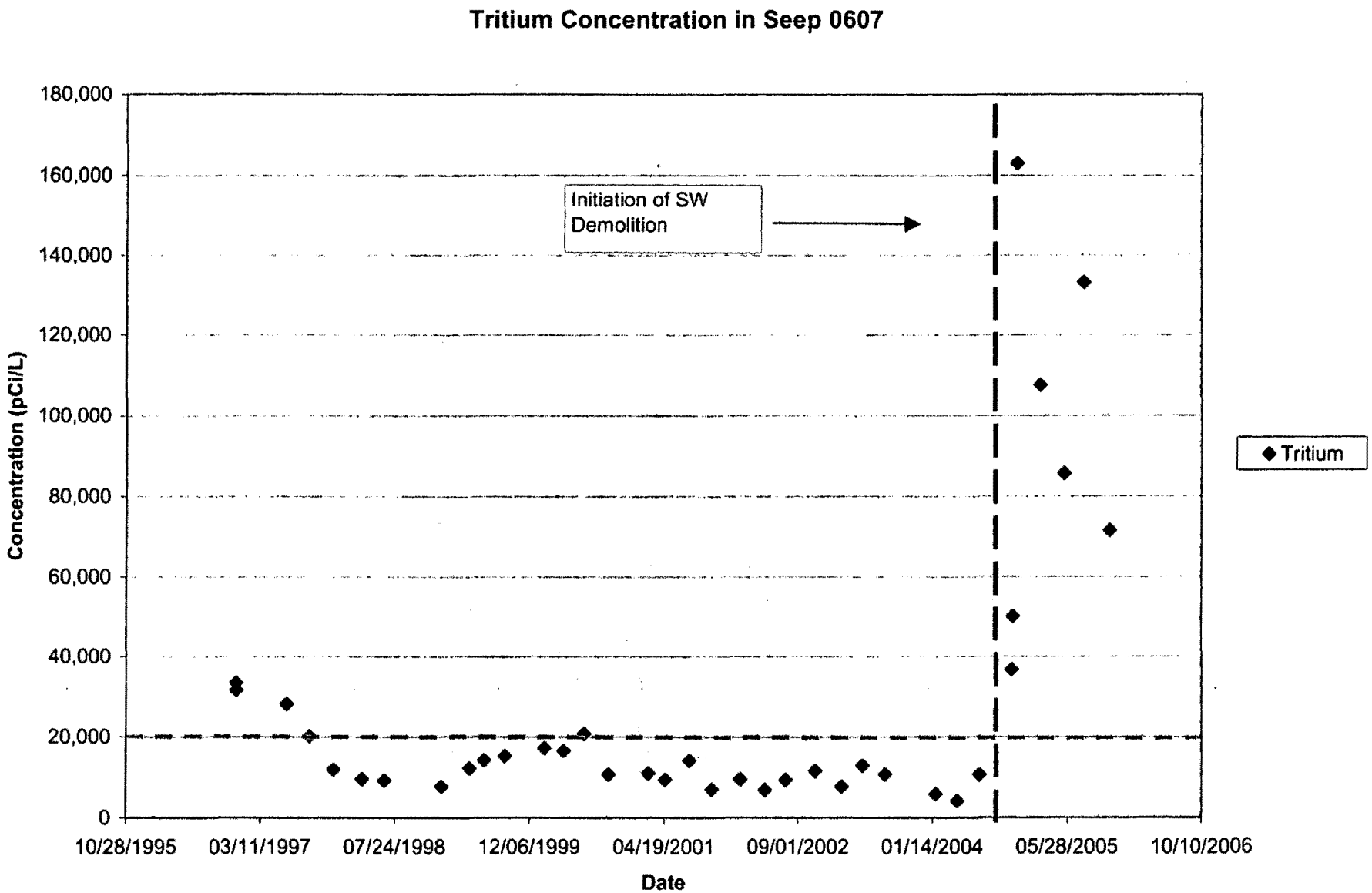
Tritium Concentration in Seep 0607
Concentration (pCi/L)
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160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
Initiation of SW Demolition
Tritium
10/28/1995
03/11/1997
07/24/1998
12/06/1999
04/19/2001
09/01/2002
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05/28/2005
10/10/2006
Date

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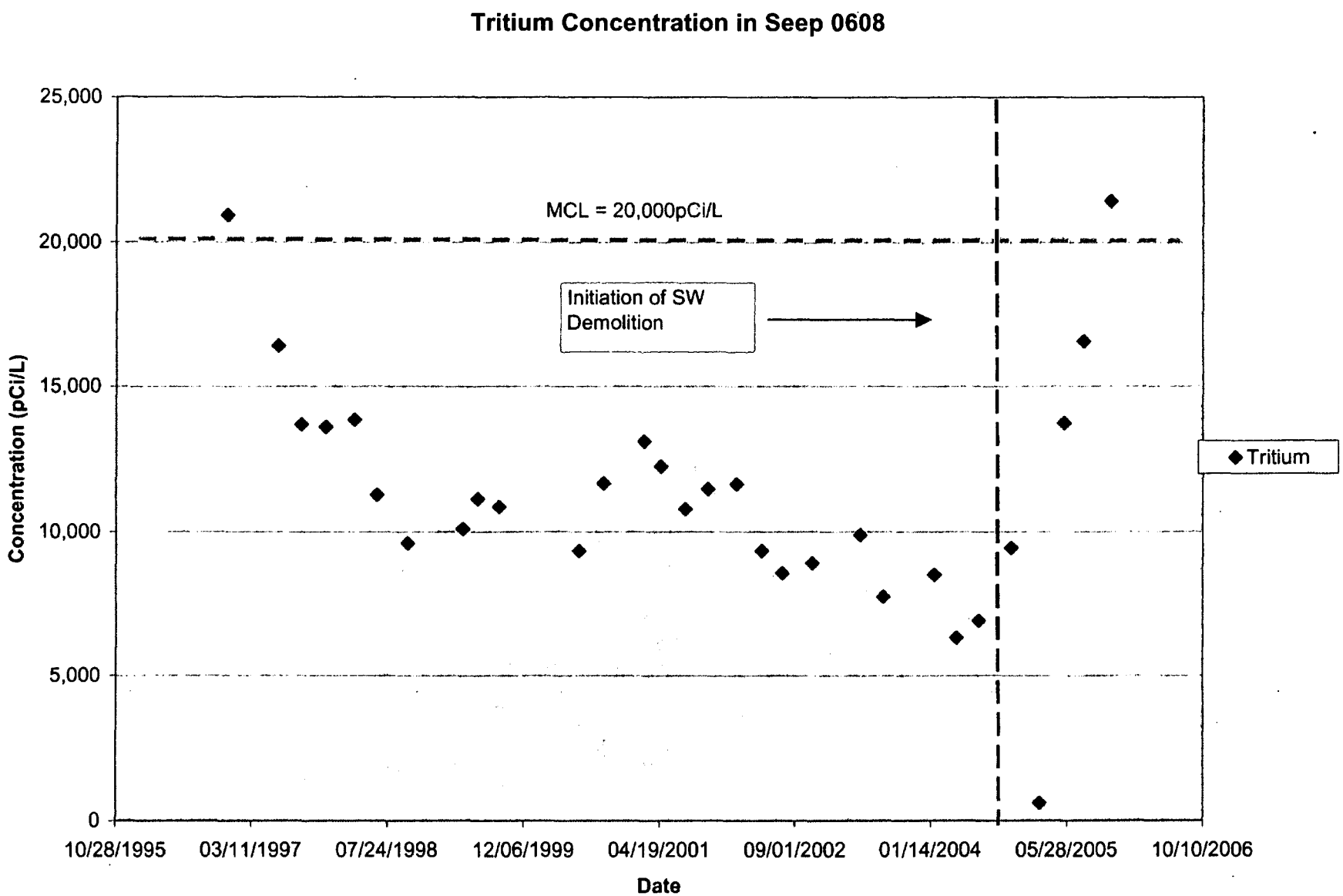
Tritium Concentration in Seep 0608
25,000
20,000
15,000
10,000
5,000
0
Concentration (pCi/L)
MCL = 20,000pCi/L
Initiation of SW Demolition
Tritium
10/28/1995
03/11/1997
07/24/1998
12/06/1999
04/19/2001
09/01/2002
01/14/2004
05/28/2005
10/10/2006
Date

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APPENDIX C

PRS Package
PRS # 91/92/94/95/96/97/98

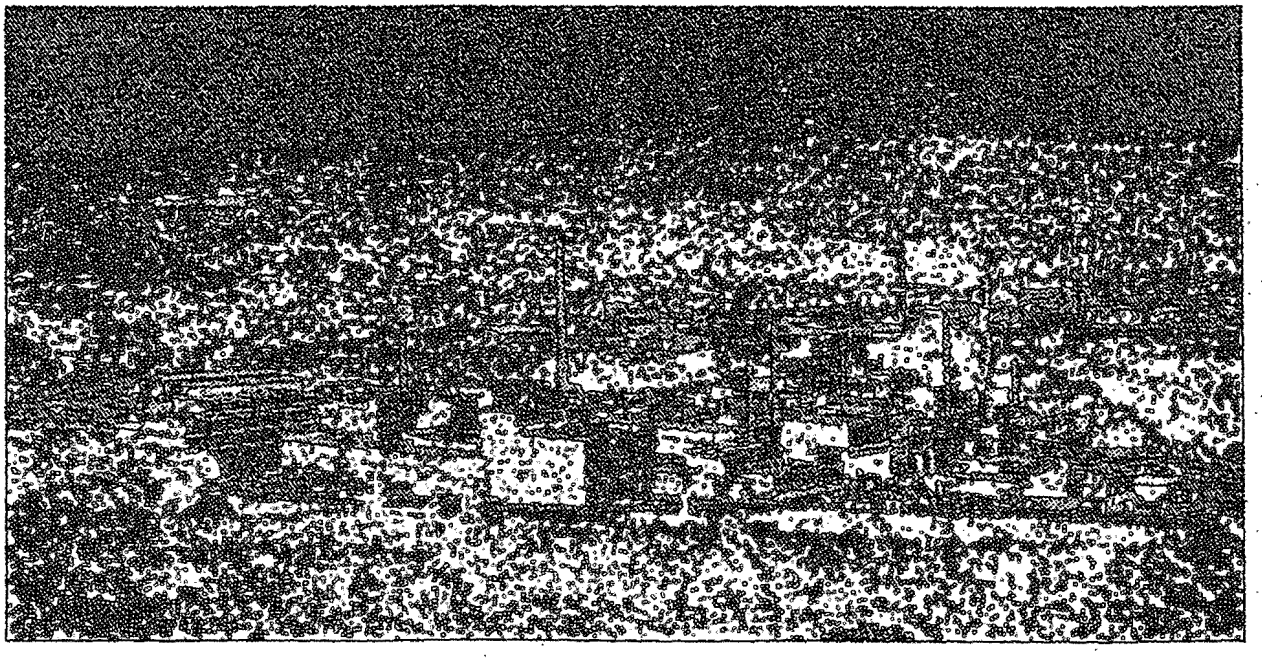
MOUND

Environmental
Restoration
Program

MOUND PLANT

Potential Release Site Package

PRS # 91/92/94/95/96/97/98



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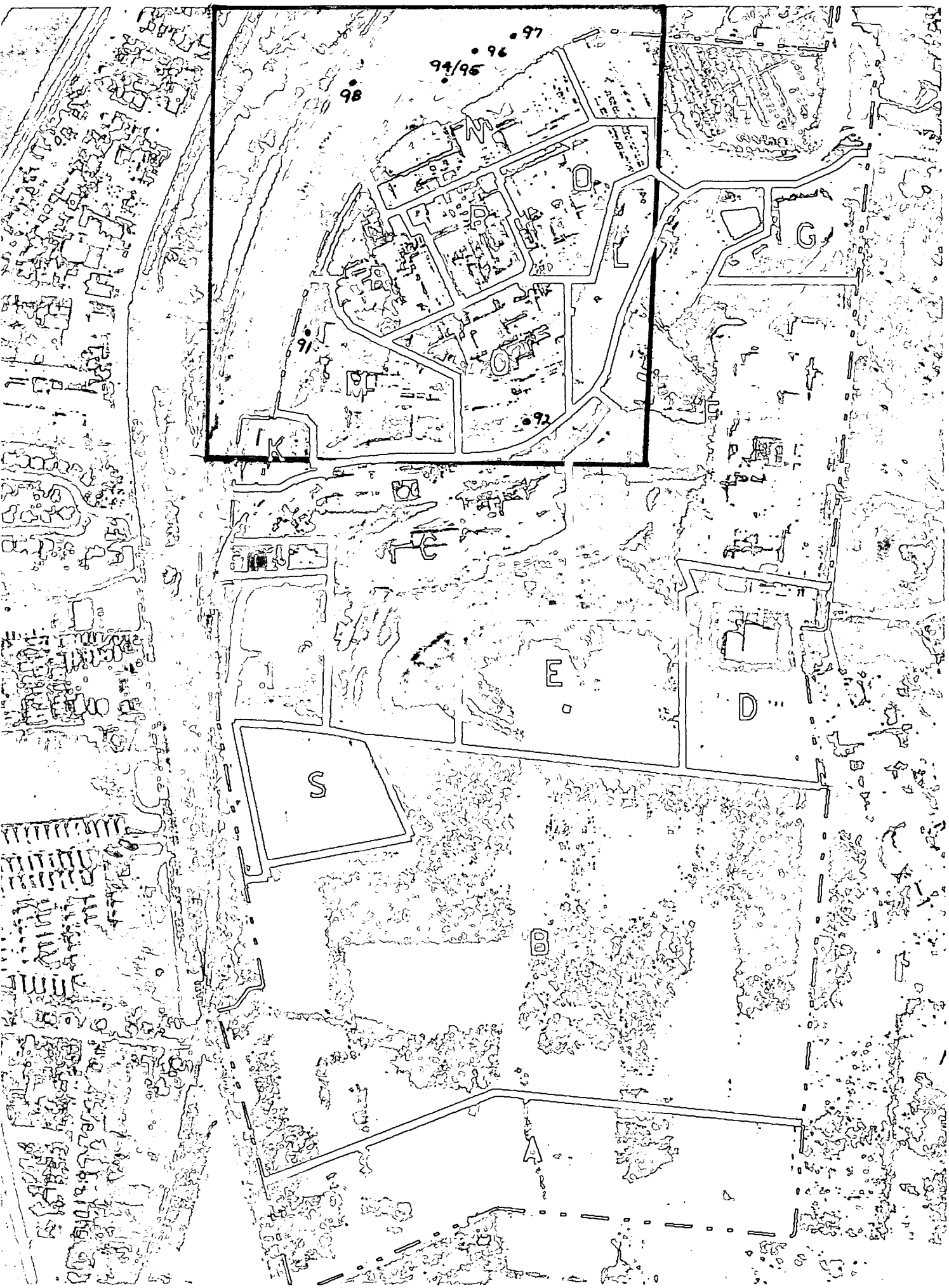
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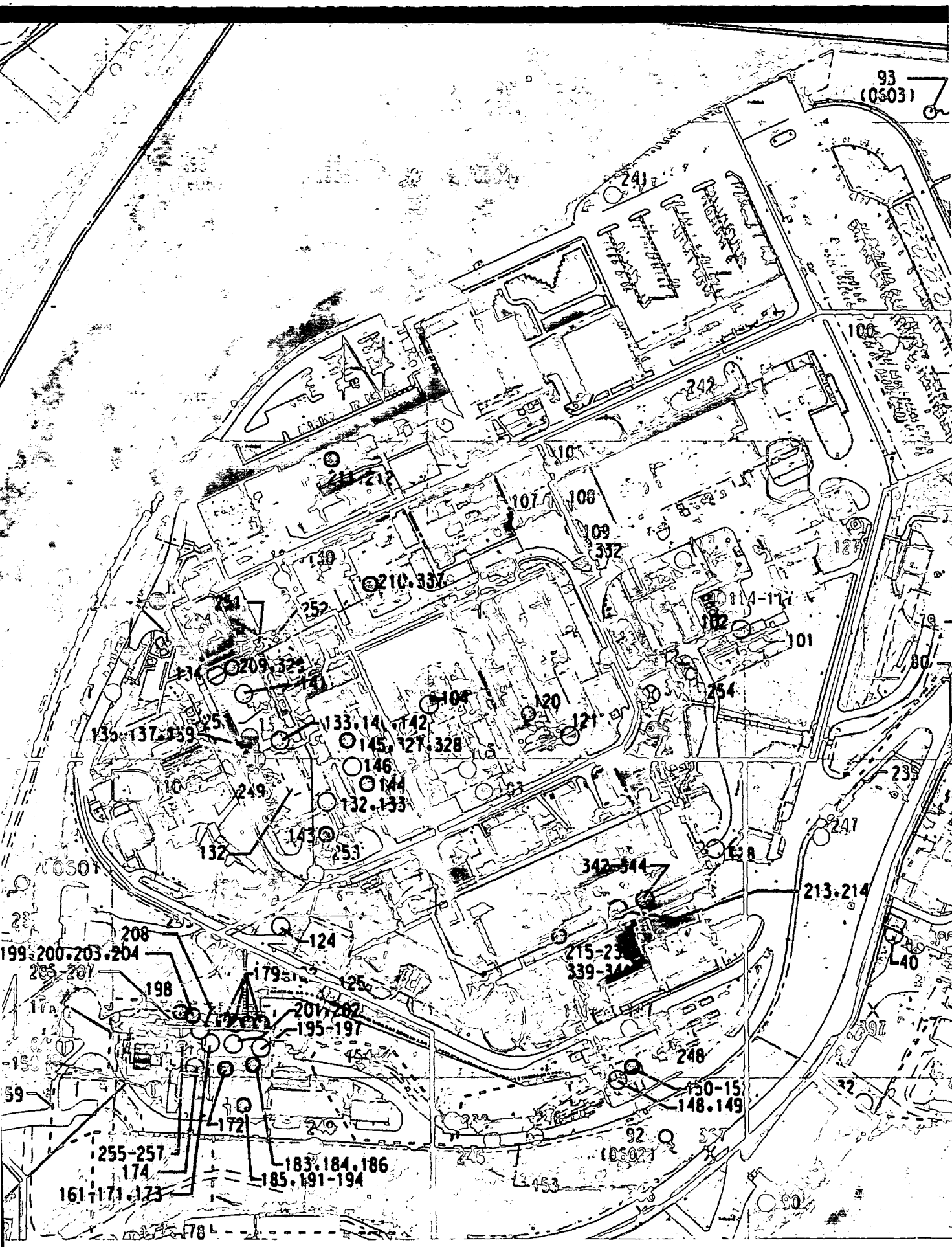
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90
78

PRS 91, 92, 94, 95, 96, 97, and 98

PRS HISTORY:

The investigation for seeps on the Main Hill was initiated in the spring of 1986.[4] 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. PRS 91, 92, 94, 95, 96, 97, and 98 have historically been identified as seeps 601, 602, 604, 605, 606, 607, and 608. PRS 93 was submitted prior to the generations of this package.

PROCESS DESCRIPTION:

No radioactive or hazardous waste generating processes are known to have occurred at the location of PRS 91, 92, 94, 95, 96, 97, and 98. Contamination in the seeps comes from migration from upgradient sources.

CONTAMINATION:

Tritium has been detected in the seeps at levels averaging <1 to 1400 nCi/l since 1987. The range of levels that have been detected in the individual seeps are as follows:

		1995
seep 601, PRS 91	103 to 1400 nCi/l	563 nCi/l
seep 602, PRS 92	10 to 28 nCi/l	16.9 nCi/l
seep 604/605, PRS 94/95	<1.0 to 110 nCi/l	<1.0 nCi/l
seep 606, PRS 96	<1.0 to 97 nCi/l	<1.0 nCi/l
seep 607, PRS 97	6.7 to 66 nCi/l	6.7 nCi/l
seep 608, PRS 98	16 to 37 nCi/l	16.5 nCi/l

The Maximum Contaminate Level (MCL) for Tritium is 20 nCi/l. All other radionuclides detected at the seeps were below MCL values.

Water samples were taken at all seeps as part of the OU2, Preinvestigation Evaluation of Remedial Action Technologies (PERAT) investigation and results indicate Volatile Organic Compounds (VOCs) above MCL values.[4] Water sampling that was performed as part of the OU9, Regional Soils Investigation resulted with Tetrachloroethene above MCL at seep 601.[5] Water samples were also taken as part of monthly seep sampling during the B-Building Solvent Shed Removal Action.[6] The samples were evaluated for VOCs and results indicated levels slightly above the MCL. The following summarizes the results of all seeps for VOCs.

			1995
seep 601, PRS 91	Tetrachloroethene	8 to 25 µg/l	15.0 µg/
	Trichloroethene	3.7 to 7.7 µg/l	3.7 µg/l
seep 602, PRS 92	Trichloroethene	6.6 to 40 µg/l	6.0 µg/l
seep 604/605, PRS 94/95	Trichloroethene	ND to 10.8 µg/l	ND
seep 606, PRS 96	Trichloroethene	ND to 10.6 µg/l	ND
seep 607, PRS 97	Trichloroethene	2.6 to 5.6 µg/l	2.6 µg/l
seep 608, PRS 98	Trichloroethene	2.1 to 9.0 µg/l	2.1 µg/l

ND = Not Detected.

The MCL for Tetrachloroethene and Trichloroethene detected is 5 µg/l.

Soil was sampled at all seeps as part of the OU9 Regional Soils Investigations. All radionuclides detected were below guideline values (GV) or below the Mound Plant As Low As Reasonably Achievable (ALARA). Some inorganic and Anion concentrations, pesticides/PCBs, VOCs, and SVOCs were detected slightly above background, however all below GV except Benzo(a)pyrene. A maximum concentration 480 µg/kg was detected at the on-site seeps (PRS 91 and 92) as compared tc the GV (Industrial) of 410 µg/kg. A maximum concentration of 180 µg/kg was detected at the off-si seeps (PRS 94, 95, 96, 97, and 98) as compared to the GV (Residential) of 88 µg/kg. All other contamination detected in the soil were in the range of background. During the Site Radiological Survey and the Site Soil Gas Survey, sampling was not performed in the locations of PRS 91, 92, 94, 95, 96, 97, and 98.

READING ROOM REFERENCES:

1) OU9, Site Scoping Report, Volume 12 - Site Summary Report, Final, December 1994. (pages 6-
2) OU9, Remedial Investigation/Feasibility Study, Site-Wide Work Plan, Final, May 1992. (pages 15-21)
3) RI/FS OU2, Technical Memorandum Characterization of Main Hill Seeps and Foundation Drains (August 1994 and February 1995). (pages 47-56)
4) OU2, Main Hill PERAT, August 1991. (pages 22-46)
5) OU9, Regional Soils Investigation, August 1995, Rev. 2. (pages 57-152)

OTHER REFERENCES:

6) Monthly Seep Sampling, February 1995. (pages 153-175)

PREPARED BY:

Gary L. Coons, Member of EG&G Technical Staff

MOUND PLANT
PRS 91, 92, 94, 95, 96, 97, and 98

RECOMMENDATION: _____

_____

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_____

CONCURRENCE:

DOE: _____

USEPA: _____

OEPA: _____

REFERENCE MATERIAL
PRS 91, 92, 94, 95, 96, 97, and 98

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
	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
	ilding 49 Solvent Storage Shed	G-7	Inactive	Organic solvents (including trichloroethene, isopropanol, ethanol, freon-TF, hexane)	4 9	Suspected	S	4	No Data		
	Tritium in Buried Valley Aquifer	H-4	Historical	Tritium	1 18	Tritium, historically remediated	GW	18	16	Table B.9	11 18
	est Fire Residual Storage Area	H-7	In service	Unexploded detonation devices	4, 5, 18	None Suspected		5	No Data		
	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	B-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		
97	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
98	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

Table B.6 - Target Compound List - VOC (a,b)

SITE NAME	Acetone	2-Butanone	Toluene	Benzene	Ethyl Benzene	Xylenes	1,2 Dichloroethane	Methylene Chloride	Perchloroethylene	2-Hexanone	4-Methyl-2-Pentanone	Trichloroethene	1,1,2 Trichloroethane	Carbon Disulfide	1,1,1-Trichloroethane	Chloroform	Freon 11	Freon 113	1,1-Dichloroethane	Bromo-dichloromethane	Bromoform	Reference
26. Building 27 Concrete Flume (Tank 217)	0.06	ND	ND	ND	ND	ND	ND	ND	0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7
27 Building 27 Settling Sump (Tank 218)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7
28. Building 27 Solvent/Drum Storage Area	ND	0.08	ND	ND	ND	ND	ND	0.01	ND	ND	ND	ND	ND	.009	ND	ND	ND	ND	ND	ND	ND	7
31. Underground Sewer Line G5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7
32. Underground Sewer Line G12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7
33. Underground Sewer Line G14 East	ND	ND	ND	ND	ND	ND	ND	0.04	ND	ND	0.015	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7
34. Underground Sewer Line G14 West	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7
35. Underground Sewer Lines G19 and G14	ND	0.02	ND	[illegible]												ND	ND	ND	ND	ND	ND	7
36. Underground Sewer Line G15	ND	ND	ND	[illegible]												ND	ND	ND	ND	ND	ND	7
37. Building 51 Waste Solvent Storage Tank (Tank 220)	0.25	0.07	0.207	[illegible]												ND	ND	ND	ND	ND	ND	7
65. Building 61 Area, Former Heavy Equipment Area	0.08	ND	ND	ND	ND	ND	ND	0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7
91. Main Hill Seep 0601 (e)							12	13	25			12			7	1.2			1.3	4.5	0.61	18
92. Main Hill Seep 0602 (e)							10		ND			40			32							18
5. Main Hill Seep 0605 (e)							12		ND			13			0.9							18
97. Main Hill Seep 0607 (e)							4.1		0.4			5.5			2.2							18
98. Main Hill Seep 0608 (e)							2.6		ND			9			0.4							18
510. Paint Shop Area	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7

General Chemistry

Table B.7. Target Compound List - SVOC, P/PCB, PAH, and EPH [a]

SITE NAME	SVOC	Polycyclic Aromatic Hydrocarbons (PAH)											Pesticides, Polychlorinated Biphenyls						EPH & TPH		
	Bis(2-ethylhexyl)phthalate	Acenapthene	Anthracene	Phenanthrene	Pyrene	Fluoranthene	Benzopyrene	Benzofluoranthene	Benzoanthracene	Indeno(1,2,3-CD)pyrene	Chrysene1	Benzo(g,h,i)perelene	PCBs	Chlordane	Endrin	Alpha,Beta,Delta, BHC (Lindane)	Dieldrin	4,4'-DDT, 4,4'-DDE	Extractable Petrol. Hydrocarbons	Total Petrol. Hydrocarbons	Reference
21. Building 1 Leach Pit (Area 1)	3.0	1.3	0.8	3.9	3.3	5.6	2.3	3.9	2.3	1.3	4.0	1.1	ND	ND	ND	ND	ND	ND	ND		7
25. Building 27 Leach Pit (Area 1)	3.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			7
26. Building 27 Concrete Plenum (Tank 217)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			7
27. Building 27 Settling Sump (Tank 218)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			7
28. Building 27 Solvent/Drum Storage Area	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.182	ND	ND	ND	ND	ND			7
31. Underground Sewer Line G5	1.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			7
32. Underground Sewer Line G12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			7
33. Underground Sewer Line G14 East	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			7
34. Underground Sewer Line G14 West	ND	ND	ND										ND	ND	ND	ND	ND	ND			7
35. Underground Sewer Lines G19 and G14	ND	ND	ND										ND	ND	ND	ND	ND	ND			7
36. Underground Sewer Line G15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			7
37. Building 51 Waste Solvent Storage Tank (Tank 220)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.014	ND	ND			7
5. Building 61 Area, Former Heavy Equipment Area	12	1	ND	1.7	2	2.1	ND	ND	ND	ND	ND	ND	ND	0.53	ND	ND	0.0069	ND	2600		7
91. Main Hill Seep 0601 (d)																					18
92. Main Hill Seep 0602 (d)																					18

General Chemistry

Table B.7. Target Compound List - SVOC, P/PCB, PAH, and EPH [a]

SITE NAME	SVOC	Polycyclic Aromatic Hydrocarbons (PAH)											Pesticides, Polychlorinated Biphenyls						EPH & TPH		
	Bis(2-ethylhexyl)phthalate	Acenapthene	Anthracene	Phenanthrene	Pyrene	Fluoranthene	Benzopyrene	Benzofluoranthene	Benzoanthracene	Indeno(1,2,3-CD)pyrene	Chrysene1	Benzo(g,h,i)perelene	PCBs	Chlordane	Endrin	Alpha,Beta,Delta, BHC (Lindane)	Dieldrin	4,4'-DDT, 4,4'-DDE	Extractable Petrol. Hydrocarbons	Total Petrol. Hydrocarbons	Reference
95. Main Hill Seep 0605 (d)																					18
97. Main Hill Seep 0607 (d)																					18
98. Main Hill Seep 0608 (d)																					18
112. Paint Shop Area	1.7	ND	ND	0.83	1.3	1.3	0.35	0.75	0.51	ND	0.73	ND	ND	ND	ND	ND	ND	ND			7
114-117. Powerhouse Area Fuel Tanks (Tanks 113, 114, 115, 116)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4800		7
125. Underground Sanitary Sewer Line G24																					7
159. Area 4A, Sewage Sludge Drying Pits																					8
172. WDA Building Basement Wash Sump (AKA Glass Melter Room Sump)	ND	ND	Ni												ND	ND	ND	ND	ND		7
174. WD Building Drum Staging Area	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			7
175. Area 4, WD Building Influent Tank Overflow																					8
176. Area 14, Radioactive Waste Line Break	4,800				2,800											13.0		2754			8
258. Area H Open Burn Pit (AKA Pyrotechnic Waste Disposal Area)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			7
259. Pyrotechnic Waste Shed	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			7

General Chemistry

Table B.8. Target Analyte List (TAL) - Inorganics[a]

SITE NAME	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chloride	Chromium	Cobalt	Copper	Lead	Manganese	Nickel	Nitrate	Nitrite	Silver	Thallium	Zinc	Cyanide	Lithium	Mercury	Vanadium	Reference
28. Building 27 Solvent/Drum Storage Area	53.3	7.6	85.6	0.87	12.7		27.6	17.1	22.1	14.9	1,320	29			19.6	ND	60.4	ND		ND	29.2	7
31. Underground Sewer Line G5	13.8	3.7	42.9	0.82	2.4	122.7	28.9	14.7	22.4	8.8	608	28.9	21	3.89	12.6	0.56	46.6	ND		ND	25.6	7
32. Underground Sewer Line G12	35.7	3.8	17.4	0.68	7.8	8.3	27.5	18.2	18.2	5	267	26.9	ND	ND	18.7	ND	34.9	ND		ND	23.1	7
33. Underground Sewer Line G14 East	15.9	1.9	18.7	0.83	2.5	ND	30.2	16.8	18.8	4.5	534	32.8	ND	ND	12.7	ND	64	ND		ND	25.6	7
34. Underground Sewer Line G14 West	11.9	1.5	22.1	0.83	2	ND	34.5	16.9	22.3	3.4	591	35	ND	ND	11.2	ND	68	ND		ND	25.2	7
35. Underground Sewer Lines G19 and G14	21	11.8	106	0.84	5.6	109.7	24.7	15.7	20.9	22.7	520	41.1	4.2	ND	13.3	0.6	69.9	ND	12.7	ND	34.7	7
36. Underground Sewer Line G15	33	3.7	31.9	0.86	6.1	15.6	32.1	14	23.6	6	864	264	3.9	ND	17.1	ND	43.4	0.31		ND	25.9	7
7. Building 51 Waste Solvent Storage Tank (Tank 220)	ND	13.2	89.												)	0.26	112	ND		ND	38.5	7
5. Building 61 Area, Former Heavy Equipment Area	ND	9.5	10												74	ND	66.6	31.4	12.4	0.1	31.1	7
8. Asphalt-Lined Pond			.40																			18
9. Overflow Pond			.52																			18
0. Retention Basins and Weir Basin			.31																			18
1. Main Hill Seep 0601 (d)						17.5							76									18
2. Main Hill Seep 0602 (d)																						18
95. Main Hill Seep 0605 (d)																						18
97. Main Hill Seep 0607 (d)																						18
98. Main Hill Seep 0608 (d)																						18
112. Paint Shop Area	38	5.5	87.1	0.74	18		35.8	9.8	22.9	148	521	18.2			21.1	ND	104	ND		ND	25.5	7
114-117. Powerhouse Area Fuel Tanks (Tanks 113, 114, 115, 116)	33.4	6.5	[illegible]	0.7	6.3		28.3	10	21.6	19	486	20.3			17.1	ND	47.9	ND		ND	25.6	7
125. Underground Sewer Line G24																						7

General Chemistry

Table B.9. Summary of Radiological Data[a,b]

Site Name	Radiological Contaminants															
	Potassium-40	Plutonium-239	Plutonium-238	Cesium-137	Thorium-Total	Tritium	Thorium-232	Cobalt-60	Radium-224, -226, -228	Radon-222	Americium-241	Actinium-227	Uranium-233, -234, -238	Bismuth-210m	Bismuth-207	Reference
79. Warehouse 15			0.52		<2		10.									6
80. Warehouse 15A			0.7				10.									6
85. Building 29 Solvent Storage Shed	NA	NA	0.29	NA	<2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6
86. Building 29 Septic Tank (Tank 224)				1.2					2.0			1,400				6
88. Tritium in Buried Valley Aquifer						20										11,18
90. Site Survey Project Potential Hot Spot Location S0425			1.08		5.74											6
91. Main Hill Seep 0601 (f)				10		1033		82								18
92. Main Hill Seep 0602 (f)						16.17										18
95. Main Hill Seep 0605 (f)						56.60										18
97. Main Hill Seep 0607 (f)						89.56										18
98. Main Hill Seep 0608 (f)						27.60										18
103. E Building Soils	NA	NA	0.25	NA	<2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6
106. G Building Soils (AKA Garage Area)	NA	NA	0.68	NA	<2	NA	NA	NA	[illegible]		NA	NA	NA	NA	NA	6
110. I Building Soils	NA										NA	NA	NA	NA	NA	6
112. Paint Shop Area																7
113. Powerhouse Soils	NA										NA	NA	NA	NA	NA	6
118. M Building Soils	NA							[illegible]	NA	NA	NA	NA	NA	NA	NA	6
128. DS Building Solvent Storage Shed	NA	NA	0.12	NA	<2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6
129. B Building Solvent Storage Shed	NA	NA	0.64	NA	<2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6
130. B Building Temporary Drum Storage Area	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6

RADIOCHEMICAL ANALYSIS

Table B.9. Summary of Radiological Data[a,b]

Site Name	Radiological Contaminants															
	Potassium-40	Plutonium-239	Plutonium-238	Cesium-137	Thorium-Total	Tritium	Thorium-232	Cobalt-60	Radium-224, -226, -228	Radon-222	Americium-241	Actinium-227	Uranium-233, -234, -238	Bismuth-210m	Bismuth-207	Reference
308. Site Survey Project Potential Hot Spot Location C0028			11.4		109.											6
309. Site Survey Project Potential Hot Spot Location S0307			5.36		6.46											6
310. Site Survey Project Potential Hot Spot Location S0647				270					1.3							6
311. Site Survey Project Potential Hot Spot Location S0706			28.9													6
312. Site Survey Project Potential Hot Spot Location S0971			0.15		5.02	2										6
313. Site Survey Project Potential Hot Spot Location S0982			0.43		14.94											6
314. Farm Trash Area			0.02				<2									7
319. Epoxy Resin Disposal																7

(a) - All units are reported in pCi/g unless otherwise noted.
(b) - Blank spaces implies not sampled.
(c) - Additional data on other analytes are available in reference 16.
(d) - Groundwater data. Unit of measure is pCi/L.
(e) - This site is the same as Site #19.
(f) - Groundwater data. Unit of measure is nCi/L.

LDL - Lower Detection Limit.
ND - Not detected.
NA - Not analzyed for.
NR - No result reported.

References:
6) DOE 1993d
7) DOE 1993c
11) Styron and Meyer 1981
13) DOE 1993d
18) DOE 1992a
24) DOE 1994

RADIOCHEMICAL ANALYSIS

Document Control No. _____

Environmental Restoration Program

REMEDIAL INVESTIGATION/FEASIBILITY STUDY OPERABLE UNIT 9, SITE WIDE WORK PLAN

MOUND PLANT MIAMISBURG, OHIO

May 1992

FINAL

Department of Energy
Albuquerque Field Office

Environmental Restoration Program
Technical Support Office
Los Alamos National Laboratory

The Buried Valley aquifer underlies the Great Miami River valley with contiguous, unconsolidated deposits, extending into tributary valleys. Groundwater flow follows the course of the river, generally north to south. The tributary tongue that extends onto the plant, through Area B, is a potential preferential pathway of contaminant migration. Groundwater flow along this tongue is primarily northeast to southwest toward the Great Miami River. The Great Miami River partially penetrates the unconsolidated materials that comprise the aquifer, but has not been shown to be a hydraulic discontinuity in the aquifer. Therefore, the river may act as a partial but not complete barrier to groundwater flow to the southwest. Discharge of contaminated groundwater would be diluted by mixing with the surface water in the river. Also, upon entering the surface water, VOCs may volatilize into the air rather than remaining in the water.

The most likely off-plant receptors of groundwater contamination are several domestic wells south of Area B, on the east bank of the Great Miami River. The Mound Plant monitors water quality from samples collected at these wells and has found tritium and low concentrations of volatiles. Trichloroethene, tetrachloroethene, and 1,2-dichloroethene (total) were not detected in any other off-plant monitoring wells from January to July 1990. Extremely low concentrations of 1,1,1-trichloroethane (0.3-1.4 µg/L) were detected in both on-plant and off-plant wells during this time period. However, the MCL for 1,1,1-trichloroethane is 200 µg/L, indicating that this is not currently a contaminant of concern. Other potential off-plant groundwater receptors are as follows:

- the Miamisburg municipal production wells, which are along the opposite, west bank of the Great Miami River and northwest from Area B;
- the Hutching Power Station industrial supply wells, which are along the opposite, west bank of the Great Miami River and 1.5 miles south of Area B; and
- private wells at homes and businesses east and west of the Great Miami River. Except for a single residence that refused municipal water services, the closest homes and businesses, directly west, are supplied with municipal water; the wells supply water for miscellaneous uses, such as lawn irrigation, not requiring potability. Domestic wells to the southwest and approximately 1,400 ft from Area B are still used for potable water.

3.2. MAIN HILL SEEPS, OPERABLE UNIT 2

The Main Hill Seeps, Operable Unit 2, addresses groundwater perched in the bedrock and potential source terms on the Main Hill. The Main Hill has been the central operating portion of Mound Plant since the plant opened in 1948. The Main Hill includes eight potential sites: Area 15, crane tracks and shielding from the old SW cave; Area 6, WD Building filter cleaning wastes; Area F, chromium solution disposal trench; the cooling tower basins; Building E, solvent storage shed; Building G, garage area; Monitoring Well 0034; and the Main Hill seeps (Figure 3.3). The seeps are believed to be the expression of groundwater discharge

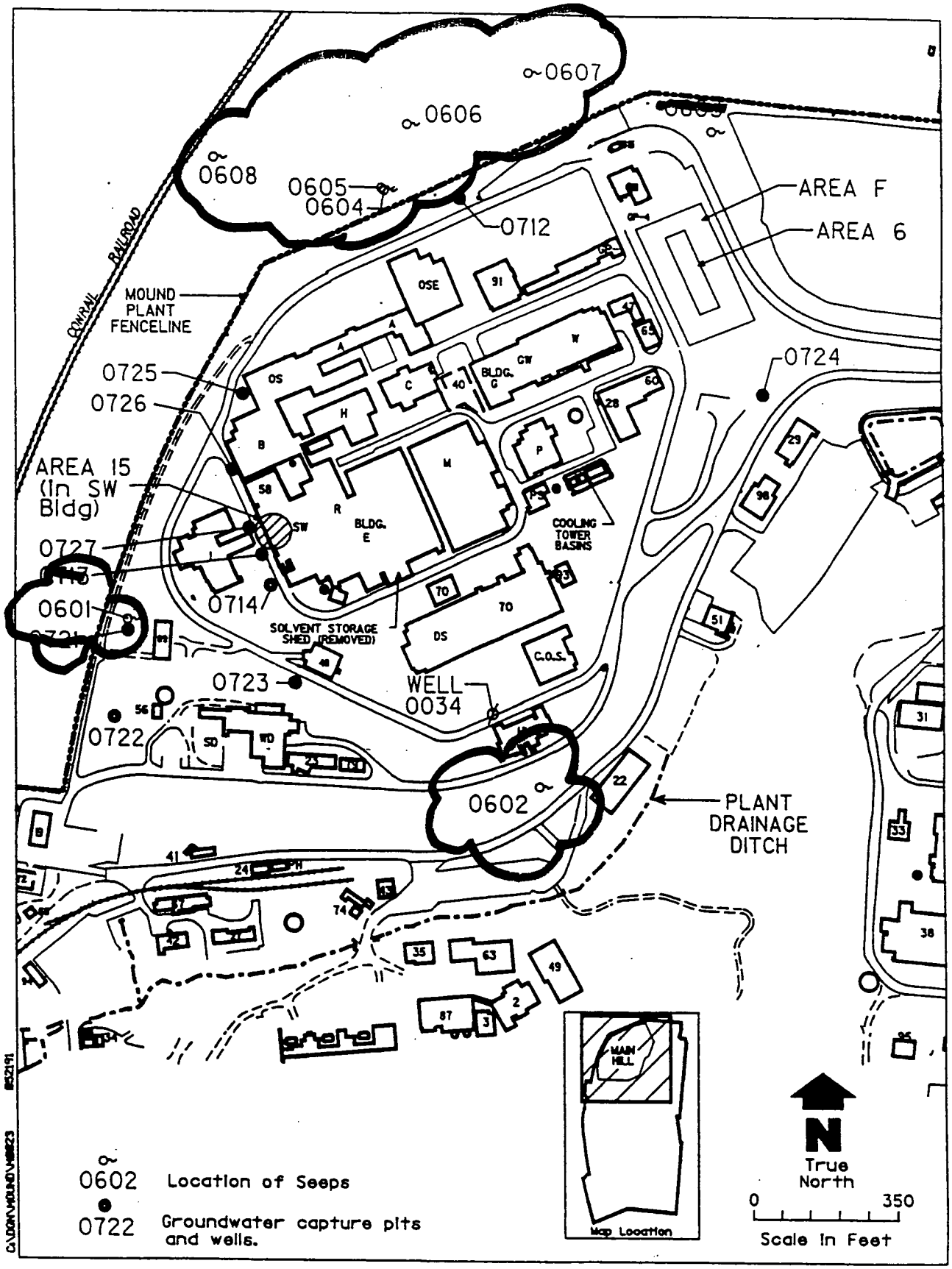

Figure 3.3. Main Hill Seeps and potential release sites, Operable Unit 2.

from the indurated bedrock on or adjacent to the Main Hill and have a history of VOC and tritium contamination (Table III.1).

The characterization of the tritium migration in the groundwater on Main Hill and subsequent tritium migration pathways is based on data generated by the routine monitoring program and by the Mound tritium groundwater assessment program (DOE 1989d). There are approximately five seeps located off Mound Plant property (Figure 3.3), but only two have significant flow (≤5 gallons per minute [gal/min]). It has been concluded that the tritium in the seeps originates from tritium in the soil moisture below the SW Building. See section 2 of this Work Plan for information on previous investigations and results. Low concentrations of volatile organic chemicals have also been found in all the seeps on the Main Hill.

Conceptually, the Site hydrogeology can be divided into two hydrostratigraphic units–the Buried Valley aquifer and the bedrock system. The Buried Valley aquifer consists of glacial sands and gravels associated with the Great Miami River. The bedrock system comprises the hills on which the Mound Plant is situated. The degree of hydraulic interconnection of this system with the Buried Valley aquifer is unknown at this time. Although several seeps discharge along the hillsides, it is possible that fractures also transmit water directly to the Buried Valley aquifer or that hidden seepage discharges below the hillside colluvial veneer. Whether the seeps are the result of an underlying impermeable shale that restricts the downward movement of groundwater or are the point at which the water table intersects the hillslope is unclear at this time.

Previous investigations have identified SW Building as the most likely source of tritium contamination. SW Building has been the principal tritium facility at the Mound Plant since the early 1960s (DOE 1989d). In 1977, Dames and Moore collected soil samples from under Buildings SW and R and analyzed soil moisture distillate for tritium. Based on their calculations, as much as 1,300 Ci of tritium was present in the soil moisture beneath SW Building (Dames and Moore 1977a). Even considering the tritium decay since 1977 (half-life = 12.3 years), the activity in 1990 would be about 625 Ci. Assuming no additional tritium was added to this inventory after 1970, there may be a sufficient quantity present (625 Ci) to explain the present levels of tritium observed in the seeps (DOE 1989d).

Sources for the VOCs are less certain. Six areas on the Main Hill are potential chemical release sites: Building E (solvent storage shed), Building G (garage area), monitoring well 0034, Areas F and 6, the cooling tower basins, and the drum storage area. One of these sites has handled solvents (Building E Solvent Storage Shed), and soil cleanup was performed when the building was dismantled in 1988 (RFA 1988). Building G and Monitoring Well 0034 may be contaminated with fuel and/or waste oils. The cooling tower site may be contaminated with waste oils, ethylene glycol, and various cooling water additives. The presence and extent of VOC contamination at any of the sites is not known.

Table III.1. Contaminants Detected in Groundwater Seeps

Volatile organic compounds (μg/L)[a]	Location (Seep No.) 601	602	603	605	606	607	608
Tetrachloroethene	8.2	U		U		U	U
Trichloroethene	5.6	14		13		5.5	7.1
1,2-*trans*-Dichloroethene	2.1	10		12		4.1	2.6
1,1,1-Trichloroethane	U	1.5		U		U	U
1,1-Dichloroethane	U	1.3		U		U	U
Chloroform	U	1.2		U		U	U
Bromodichloromethane	U	0.65		U		U	U
Bromoform	U	0.61		U		U	U
Tritium (nCi/L)[b]	395	33	109	110	27	41	37

[a]Highest values from samples collected in September and December 1988.
[b]Highest values from samples collected from January 1989 to July 1990.

RADIOCHEMICAL ANALYSIS

Figure 3.4 depicts the conceptual model for the seeps, Operable Unit 2. Leaks and spills are assumed to have caused contaminated soil. The fractured shale and limestone of the bedrock aquifer provide a likely transport mechanism for VOCs, tritium, and any other contaminants present in the seeps. Near-surface contamination has most likely been mobilized by recharge water and transmitted through the fracture system in the bedrock. The trench backfill associated with underground utilities such as water and waste water lines, etc., may also provide a permeable conduit for the infiltration of contaminants into pipe chases and transmission lines. Area 15 (crane tracks and shielding) is represented by the old cave.

Organic contaminants in off-plant seeps 0605, 0607, and 0608 (Table III.1) are significant in that they discharge off the Mound Plant property onto city-owned land. Tritium contamination for the largest off-plant seep (0607) ranged from 20 to 100 nCi/L for the period of August 1986 through December 1988. This is below the effluent discharge standard (3000 nCi/L) and mostly below the proposed drinking water standard (90 nCi/L), but above the current primary drinking water standard (20 nCi/L) for tritium concentrations (DOE 1989a). The runoff from the largest seep (0607) ponds at the base of the hill (0617) and thus probably contributes recharge to the Buried Valley aquifer. However, the flow from seep 0607 is so small (<1 gpm) that dilution by the groundwater has prevented the seep discharge from contaminating the aquifer above the drinking water standard. The seep discharge was sampled at the base of the hill, and no VOCs were present; apparently the low concentration of VOCs volatilizes before contaminating the aquifer. Seep 0605 is located below Mound Plant Building OSE, and discharge is small enough that no appreciable surface runoff occurs (Price 1989a).

The presence of contamination in test pit wells and sampling wells clustered around Buildings SW and B suggests one or more sources in that area. Contamination in five seeps also suggests more than one source of contamination and/or that the fracture flow pathways are interrelated.

Although the results reported above do not indicate an immediate health concern, they do indicate the need for additional investigation of flow pathways and source characterization. The development of the Operable Unit 2, Main Hill Seeps Work Plan is in progress.

3.6 MISCELLANEOUS SITES, OPERABLE UNIT 3

Miscellaneous Sites, Operable Unit 3, includes 22 areas at Mound Plant that require limited field investigations since little or no data are available. The sites included in Miscellaneous Sites, Operable Unit 3 were identified in either the Installation Assessment Report (DOE 1986) or the RFA Report (RFA 1988), or both. Many of the sites identified by the visual site inspection (RFA 1988) were not known to be contaminated or suspected of being contaminated. The primary goal of the Miscellaneous Sites, Limited

Historically, this pipeline may have been a contributing factor to the tritium contamination in the Buried Valley aquifer, a situation alleviated by intermittent, high-volume pumping of the aquifer. Currently, there is no evidence that any leaks from the pipeline caused groundwater contamination other than tritium. Analyses of ER Program monitoring wells in the area indicate that tritium levels are below regulatory standards (see discussion of the Buried Valley aquifer in section 6) and there is no indication of heavy metals or radioactivity other than tritium that may have originated at Mound Plant.

There is little data, however, concerning potential soil contamination along the length of the pipeline other than tritium. The Buried Valley Aquifer Evaluation Project (Dames and Moore 1976b) investigated tritium contamination along the southern margin of the pipeline. Their borehole logs indicate elevated tritium concentration through the entire depth of the upper unit of the Buried Valley aquifer, and minor concentrations below the interbedded till unit interpreted to be an aquitard. There is no data on less mobile contaminants. If the pipeline was a contributing factor to the tritium contamination prior to the installation of the liner, the less mobile contaminants may still be present in the soils.

8.1.2.6. Characterization of Potentially Contaminated Soils at the Main Hill Seeps

Eight seeps have been identified on the steep flanks of the Main Hill at Mound Plant. These seeps are believed to be discharging from a shallow perched groundwater flow system within open bedding planes and fractures in the bedrock and in pore spaces in the overlying unconsolidated materials. Historically, the seeps on the Main Hill were part of the natural groundwater flow system before the construction of Mound Plant. However, the facility has altered the natural flow system by controlling the distribution of recharge across the landscape of the Main Hill and by enhancing groundwater flow in some areas due to leakage from buried water supply lines (DOE 1991n).

Contaminants known to be present in the water discharging at the seeps include tritium, uranium-233, VOCs, nitrate, sulfate, and chloride (DOE 1991n). Little data exist, however, concerning potential soil contamination at the seeps. Due to the known contamination of water emanating from the seeps, soils immediately adjacent to and down-slope of the seeps are suspected of containing similar contaminants. Soils affected by seeps may be a secondary source of contamination available to the environment.

8.2. INITIAL EVALUATION AND DATA NEEDS

There are several types of soils investigations that may be performed at CERCLA sites, depending on the goal of the investigation stage. These include an exploratory study, a preliminary site investigation, RI/FS characterization, emergency cleanups, remedial response studies, planned removal studies, and

ENVIRONMENTAL RESTORATION PROGRAM

OPERABLE UNIT 2
TECHNICAL MEMORANDUM #1
PREINVESTIGATION EVALUATION OF REMEDIAL ACTION TECHNOLOGIES (PERAT)

MOUND PLANT
MIAMISBURG, OHIO

August 1991

DEPARTMENT OF ENERGY
ALBUQUERQUE OPERATIONS OFFICE

ENVIRONMENTAL RESTORATION PROGRAM
TECHNICAL SUPPORT OFFICE
LOS ALAMOS NATIONAL LABORATORY

DRAFT
(REVISION 0)

and contaminant concentrations related to rainfall events. This response indicates that the seeps represent discharge from a shallow groundwater flow system that is open to recharge from rainfall events.

2.6. REVIEW OF PREVIOUS INVESTIGATIONS OF GROUNDWATER ON THE MAIN HILL

All of the data discussed in the following subsections are considered reliable but are recognized to be assessment-level data. These data are useful for suggesting trends or for gaining insights into hydrogeologic properties but are not considered to be conclusive evidence. Because the data tend to be incomplete (gathered over short time periods or only considering selected variables), other explanations for the apparent relationships may exist. One of the objectives of the RI is to gather complete data sets that fully address the conceptual model of groundwater flow and transport.

2.6.1. Tritium Concentrations in Groundwater on the Main Hill

During several investigations at Mound Plant, information has been gathered on tritium contamination in groundwater and soil. The results of these investigations are summarized in this section.

2.6.1.1. The Mound Groundwater Assessment Program

Investigation of tritium contamination in groundwater on the Main Hill was initiated in 1986 when elevated tritium concentrations were measured in water samples collected in the T-6 arterial sampler located on the west side of Mound Plant at the base of the Main Hill. The location of the T-6 sampler is shown on Figure 2.5. Mound Plant established an interdepartmental program in 1986 (the Mound Groundwater Assessment Program) to assess the nature and extent of tritium contamination in groundwater on the Main Hill. As part of this program, Mound Plant continues to monitor tritium concentrations at sample locations on the Main Hill. The monitoring network is shown in Figure 2.5. In 1987, the ER Program initiated an investigation of the nature and extent of contamination at Mound Plant, including the geographic area of the Main Hill. The ER Program included collection of groundwater samples from many of the sampling locations in the Mound Plant monitoring network and the installation of new monitoring wells that were constructed to be in compliance with the RCRA Technical Enforcement Guidance Document (EPA 1986). The ER Program groundwater sampling network on the Main Hill is shown in Figure 2.6. ER Program analyses on collected samples has included tritium. The history of development of the Mound Plant monitoring network and the ER Program network is discussed in the following sections.

The soil that was contaminated with tritium below the SW Building (see subsection 3.2) was suspected of being a source for tritium contamination in groundwater. Therefore, a groundwater capture system was installed on the west side of the SW Building. Figure 2.8 presents areal and profile views of the groundwater capture system. Sample location 0727 is for the 8-inch capture well, sample location 0714 is for the collector sump, and sample location 0714 is for the capture trench. The sample locations are shown on Figure 2.6. The SW Building groundwater capture system and the 0712 intercepter trench were put into operation in October 1987.

2.6.1.3. Real-Time Monitoring of Seeps 0601 and 0607

Instruments were installed at seeps 0601 and 0607 for continuous measurement of selected parameters over the period October 1987 through February 1988 (MRC 1988). One objective of the continuous monitoring of the seeps was to evaluate the reduction in groundwater discharge and tritium concentrations due to the groundwater capture systems that were placed in operation in October 1987 on the Main Hill. A second objective was to evaluate the relationship of rainfall to groundwater flow and tritium concentration at the seeps.

The parameters measured at the seeps included flow rate, water temperature, specific conductance, pH, Eh, and air temperature; rainfall was monitored at seep 0601. During the monitoring program, samples of groundwater were collected at both seeps to measure tritium concentration. Samples for tritium concentration were collected more frequently at seep 0601 than at seep 0607. A graphic presentation of the data gathered during the monitoring program is contained in the notes documenting a meeting between Roy F. Weston, Inc. (WESTON), Terran Corporation, and Mound Plant staff (WESTON 1991). The raw data from the monitoring program are on file in the office of Terran Corporation.

A general decline in groundwater tritium concentrations was observed at both seeps during the duration of the program. This decline is interpreted to be due to the capture of tritium-contaminated groundwater by the SW Building groundwater capture system. Tritium concentrations measured in the 0712 intercepter trench, located above seep 0607 (see Figure 2.6 for location), were very low (3 to 7 nCi/L), indicating that this trench was not capturing tritium-contaminated groundwater. Figure 2.9 presents tritium analyses for groundwater samples from seep 0607 for the period August 1986 to October 1988 (WESTON 1991). The figure shows a decline in tritium concentrations for samples collected following operation of the SW Building capture systems. Figures 2.10 and 2.11 illustrate the decline in tritium concentration in groundwater at seep 0601 by comparing data from October 1987 and January 1988 (WESTON 1991). Maximum values in October 1987 we[illegible] while

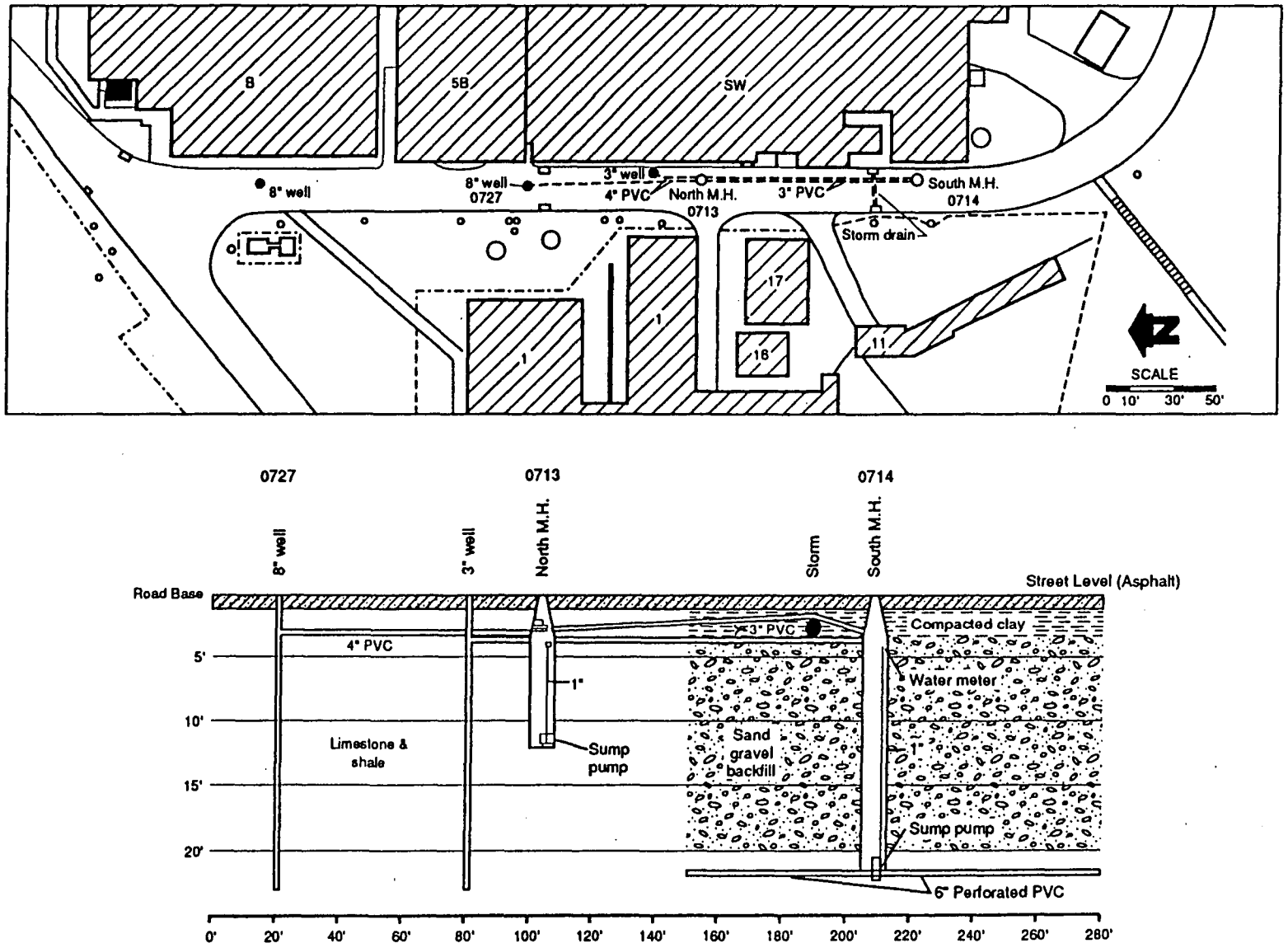

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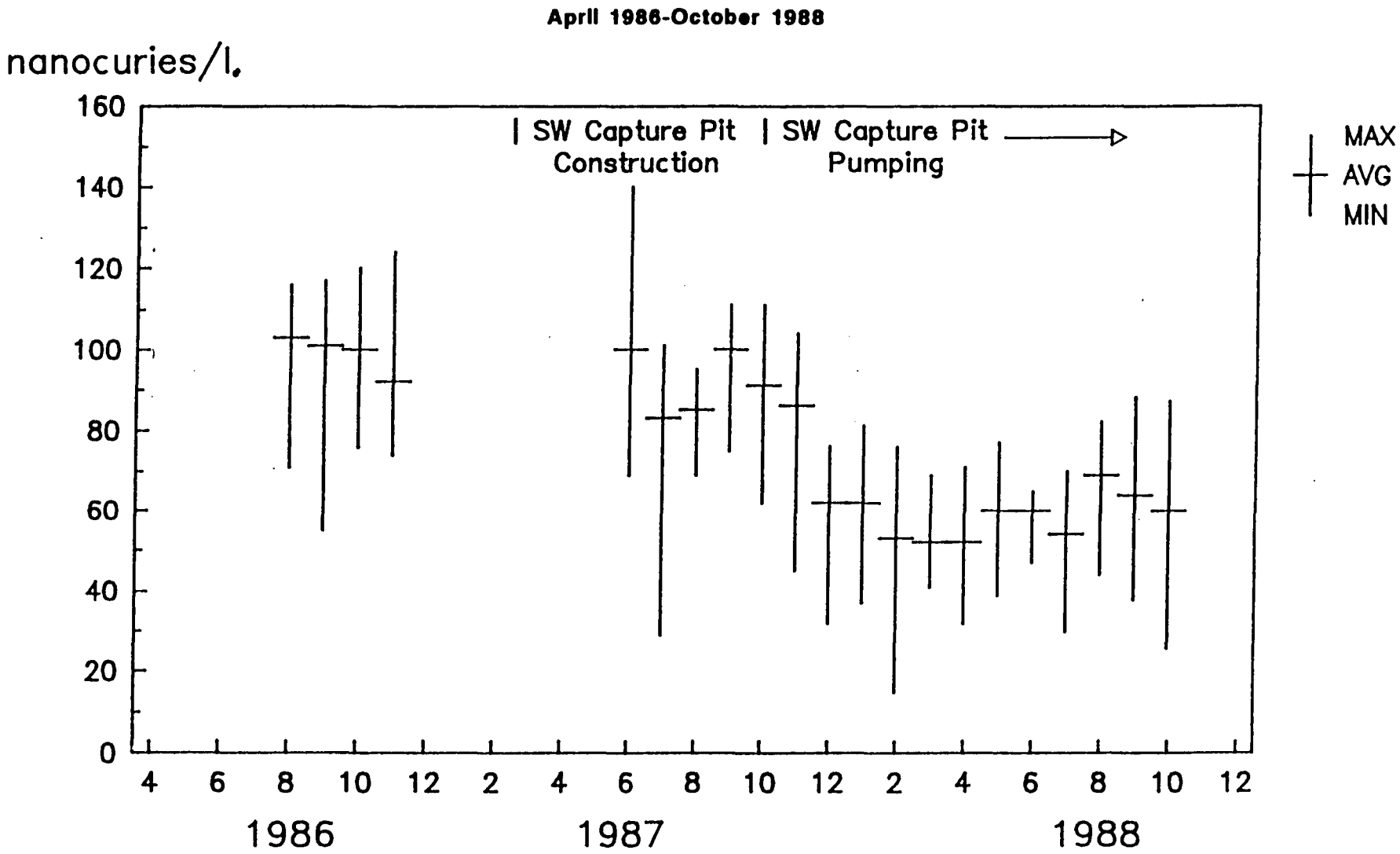
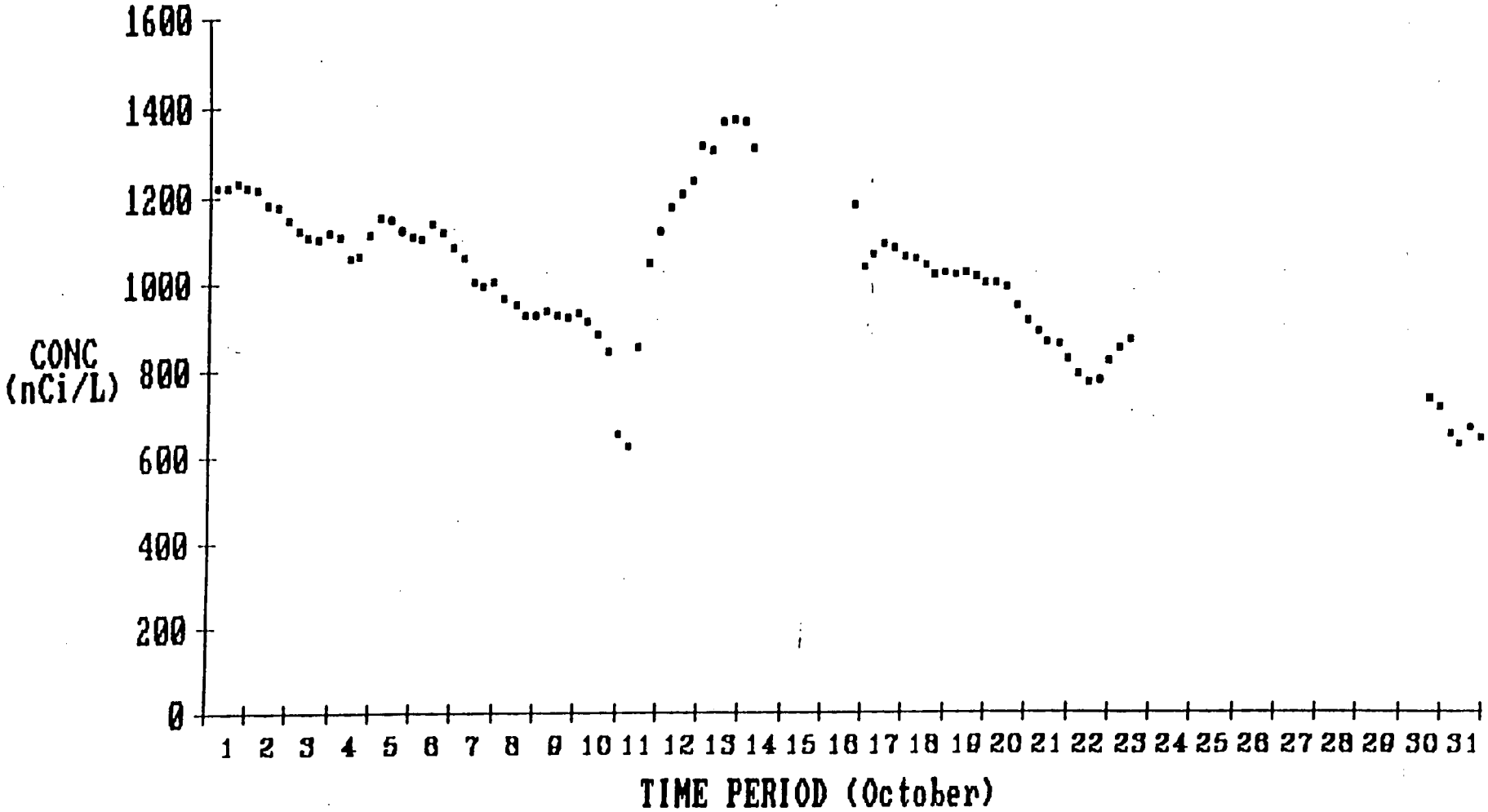
Figure 2.8. Aerial and profile views of the capture system associated with SW building.



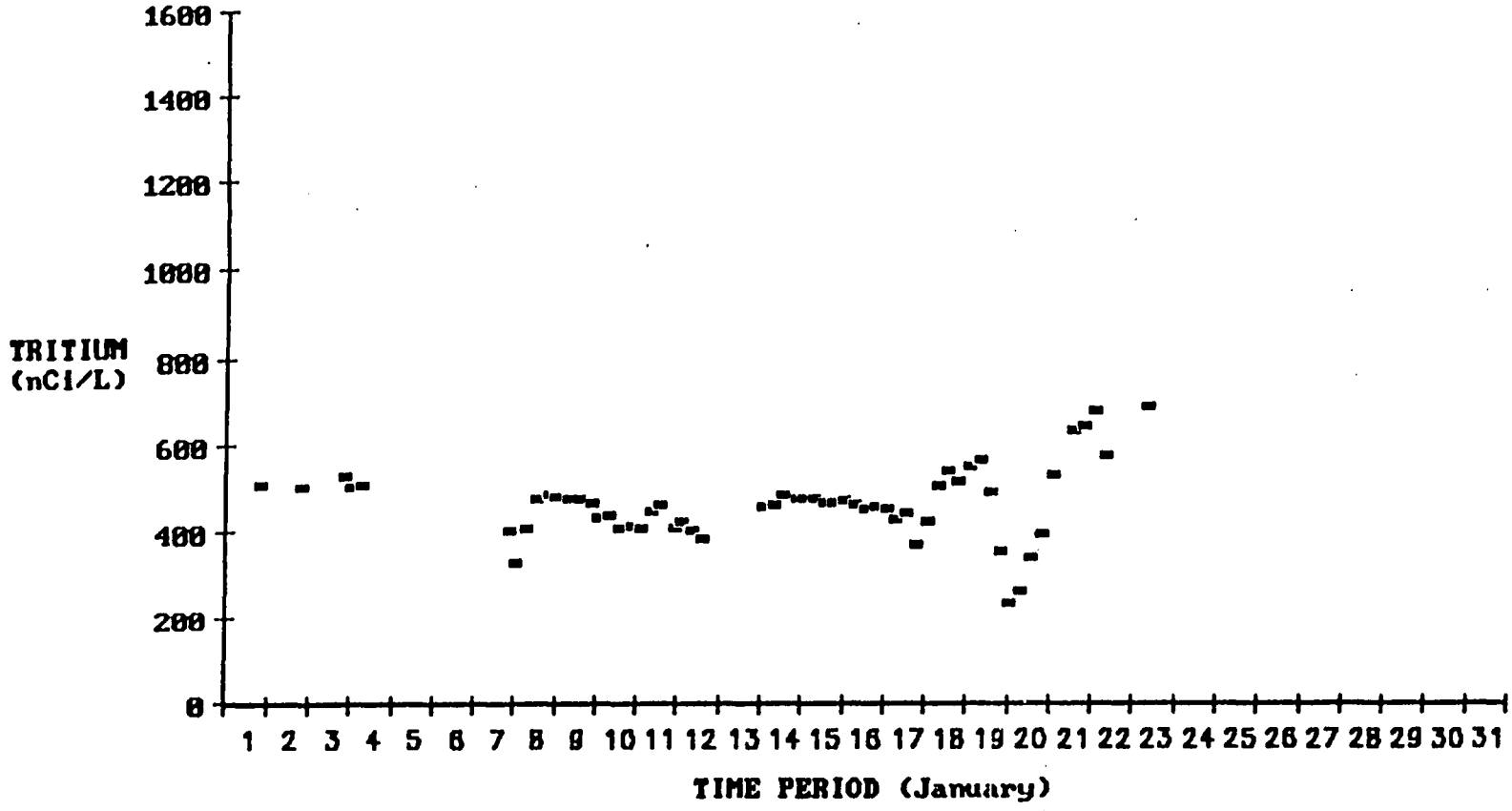
Ref: DOE 1989
[a]Analyses by Mound Plant

Figure 2.9. Average monthly tritium concentrations at seep 0607 [a]



Ref: DOE 1989
[a]Analyses by Mound Plant

Figure 2.10. Tritium concentrations measured at seep 0601 during October 1987[a].



Ref: DOE 1989
[a]Analyses by Mound Plant

Figure 2.11. Tritium concentrations in water from seep 0601 during January 1988[a].

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 system was placed in operation. Tritium concentrations in seeps 0605, 0606, and 0607 are much higher than concentrations in groundwater collected in the 0712 intercepter trench that is located upslope from the three seeps.

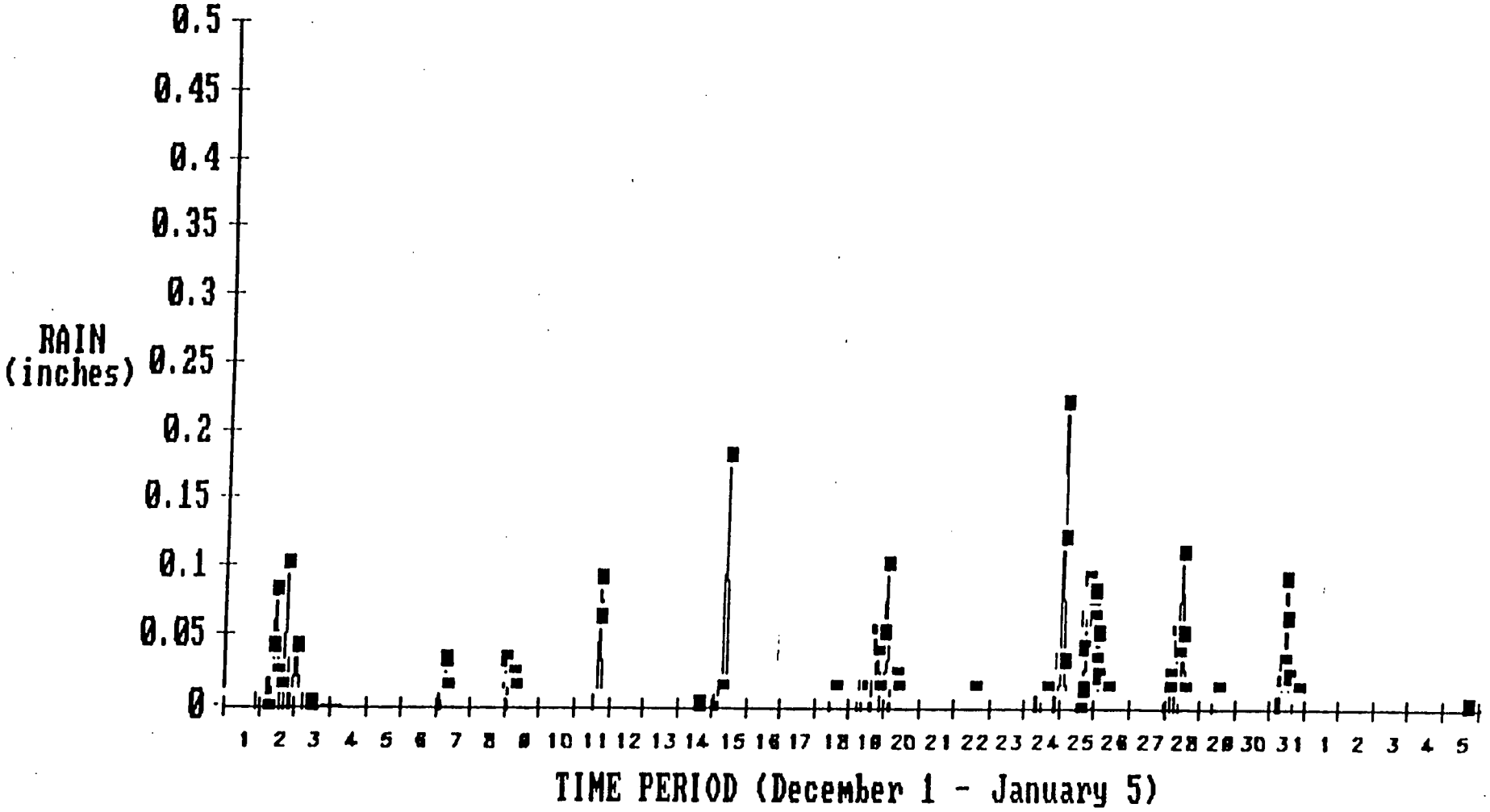
Table II.4. Monthly Averages of Tritium (nCi/L)
from January 1989 through July 1990[a]

				Sample Location					
Date	712	713	714	601	602	603	605	606	607
1/89	3.7	20	383	227	14	2.2	88	25	32
2/89	3.9	19	393	258	13	1.7	83	16	28
3/89	3.7	1607	424	395	11	1.7	83	16	28
4/89	3.3	565	410	251	11	1.5	67	15	25
5/89	3.1	427	476	205	10	3.9	59	16	26
6/89	2.8	233	309	170	13	-	73	27	31
7/89	3.5	443	496	196	18	-	69	--	36
8/89	3.1	652	516	220	--	-	87	--	36
9/89	3.2	507	447	190	29	-	87	--	37
10/89	2.9	29[illegible]	464	152	--	-	66	--	41
11/89	3.6	328	392	159	24	-	92	--	35
12/89	--	418	481	103	--	-	110	--	33
01/90	3.6	60	280	136	19	1.9	92	--	24
02/90	3.1	315	222	112	21	-	87	15	21
03/90	3.3	335	261	106	26	-	72	12	26
04/90	3.5	468	330	119	--	-	75	18	26
05/90	3.4	530	229	111	33	-	67	25	18
06/90	4.4	302	291	132	--	-	53	--	22
07/90	3.6	335	307	128	28	-	63	--	24

				Sample Location					
Date	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	535	
3/89	30	24	18	16	11	5.4	7.8	693	
4/89	29	15	18	12	5.4	5.3	7.1	636	
5/89	30	39	20	18	5.5	3.8	8.2	439	
6/89	27	39	30	15	5.5	4.9	7.6	461	
7/89	26	48	32	19	6.8	5.8	9.7	526	
8/89	30	44	28	15	7.0	5.3	11	545	
9/89	30	25	26	13	5.[illegible]	5.5	9.4	444	
10/89	28	12	35	18	5.2	5.0	13	512	
11/89	32	10	36	16	5.9	6.2	8.8	396	
12/89	--	6.5	39	20	6.0	5.8	80	439	
01/90	--	15	35	--	5.5	8.0	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	430	
05/90	--	22	25	--	4.9	5.2	8.0	450	
06/90	--	29	80	--	5.1	5.1	7.2	374	
07/90	--	28	253	--	4.6	4.9	7.4	449	

[a] Analyses by Mound Plant personnel

RADIOCHEMICAL ANALYSIS



Ref: DOE 1989

Figure 2.12. Inches of rainfall recorded at seep 0601 during December 1987 and the beginning of January 1988.

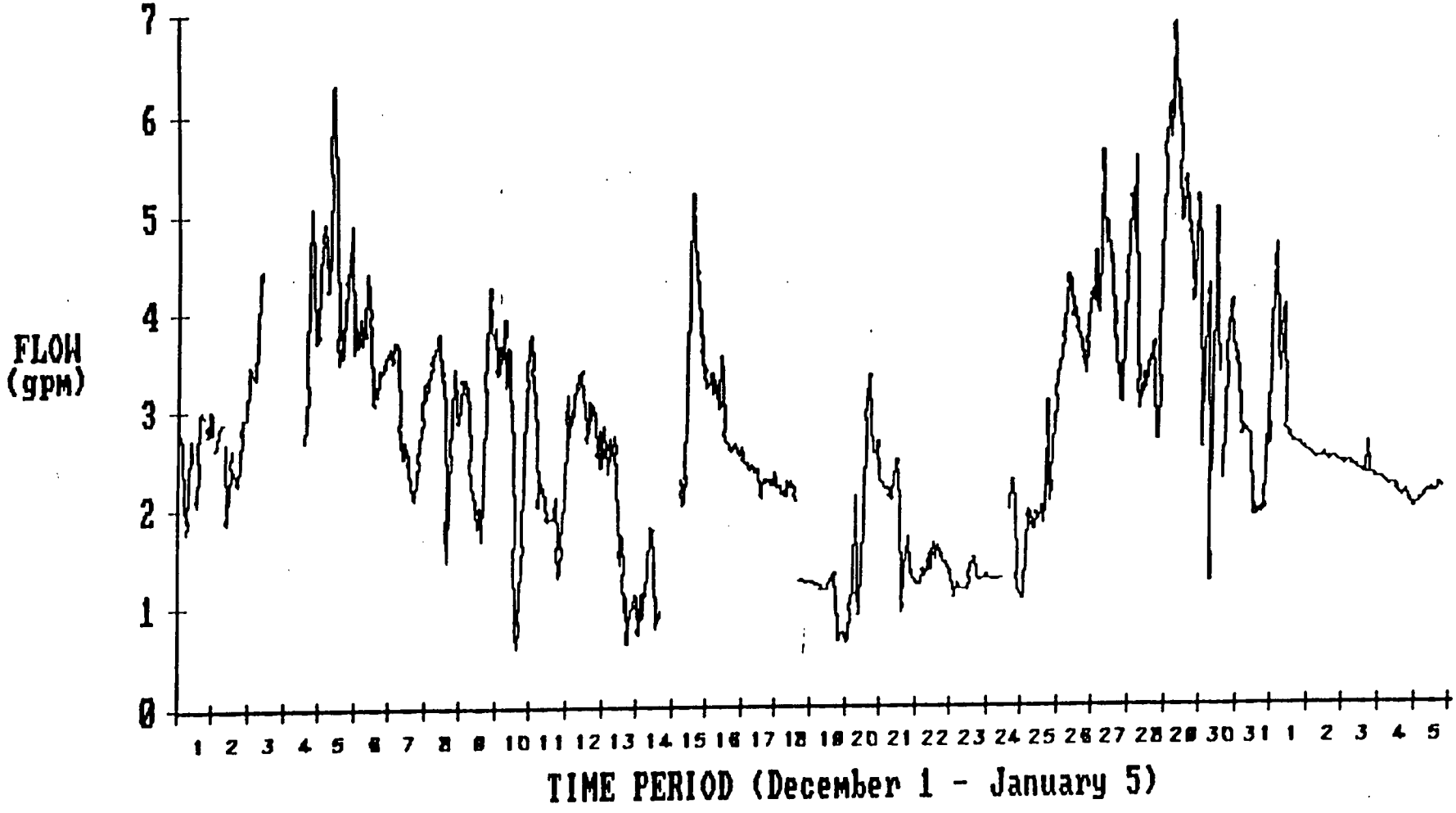


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Figure 2.13. Flow recorded at seep 0601 during December 1987 and the beginning of January 1988.

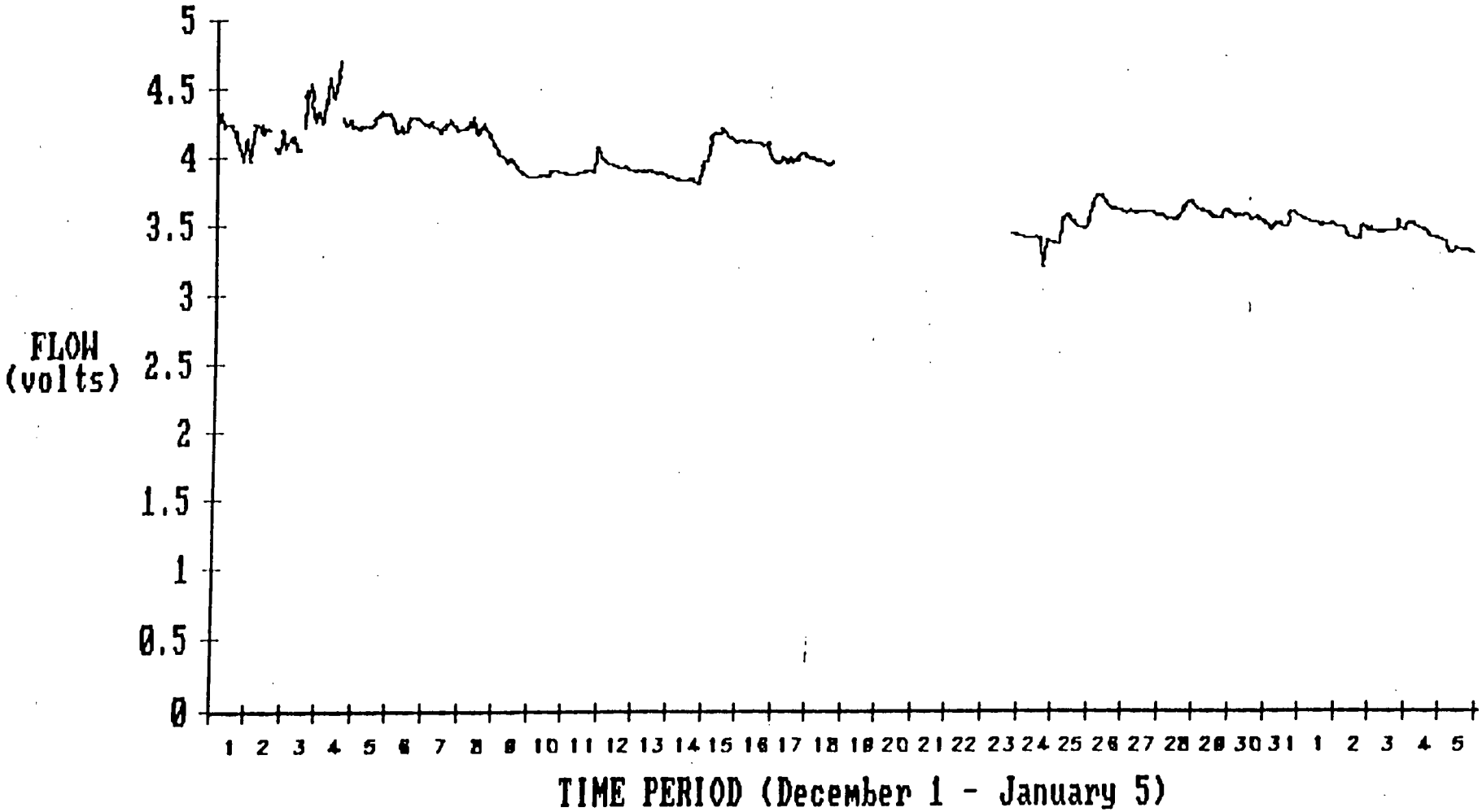

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Figure 2.14. Flow voltages recorded at seep 0607 during December 1987 and the beginning of January 1988.

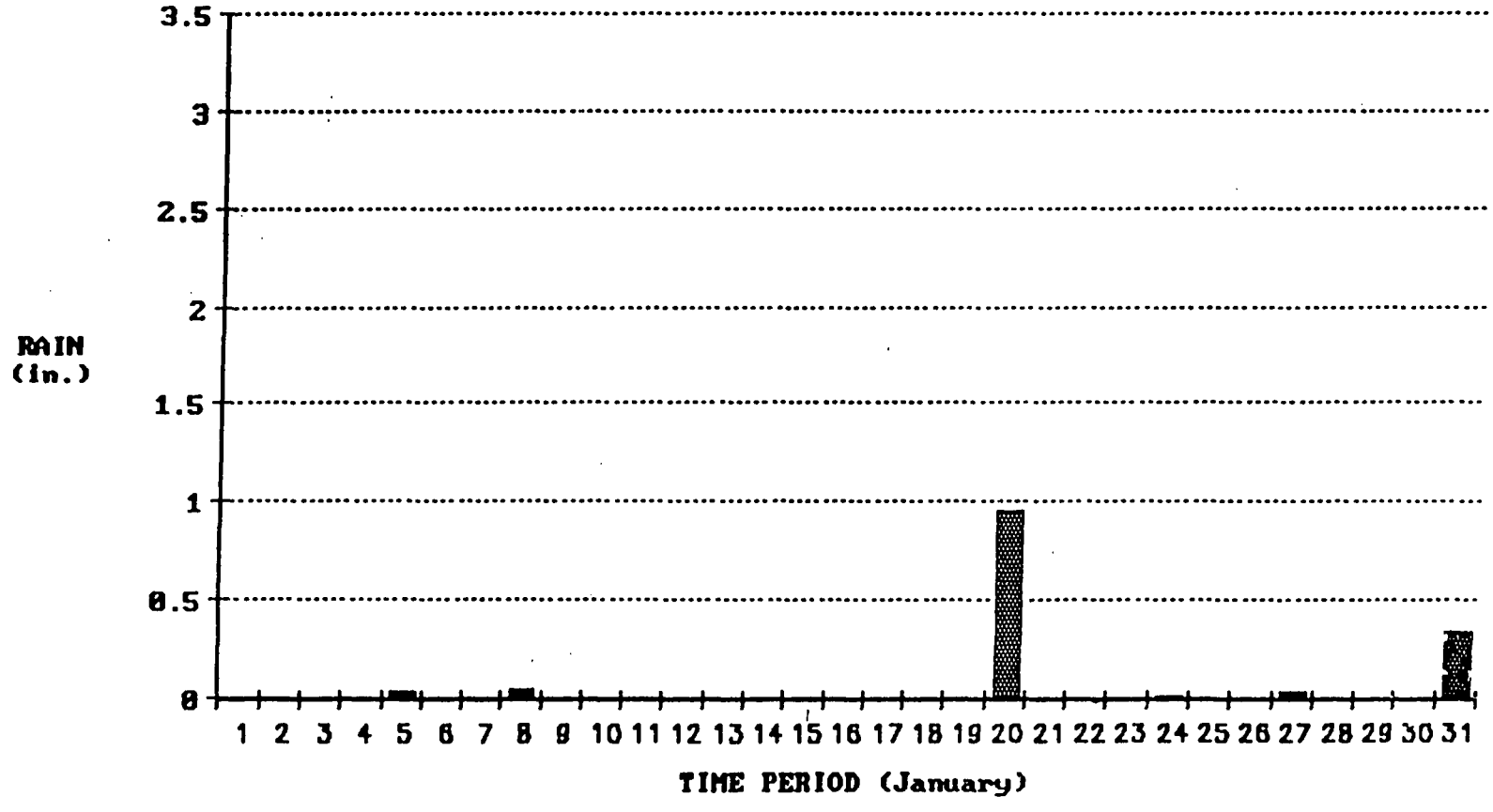

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Figure 2.15. Rainfall recorded at seep 0601 during January 1988.

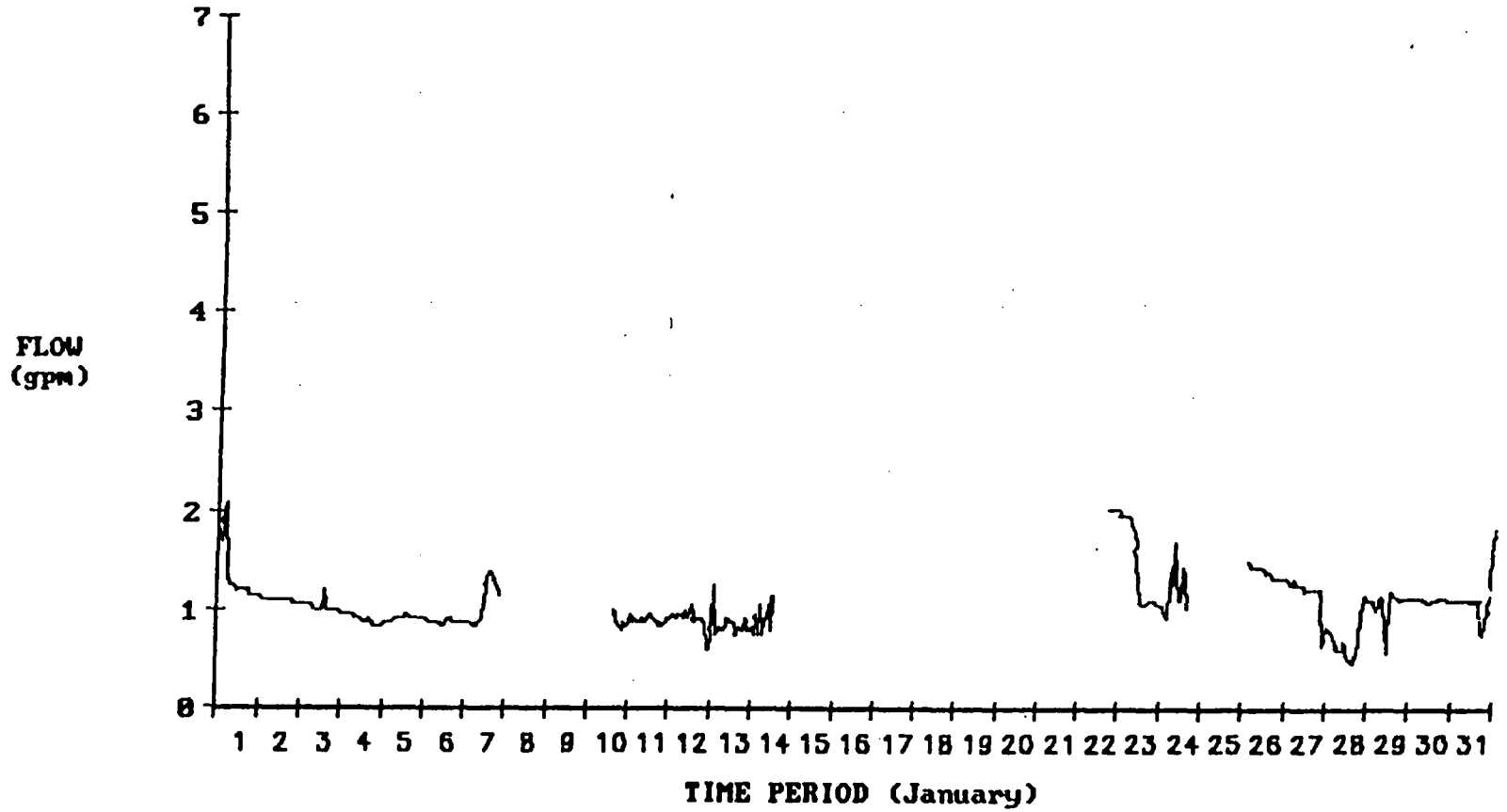

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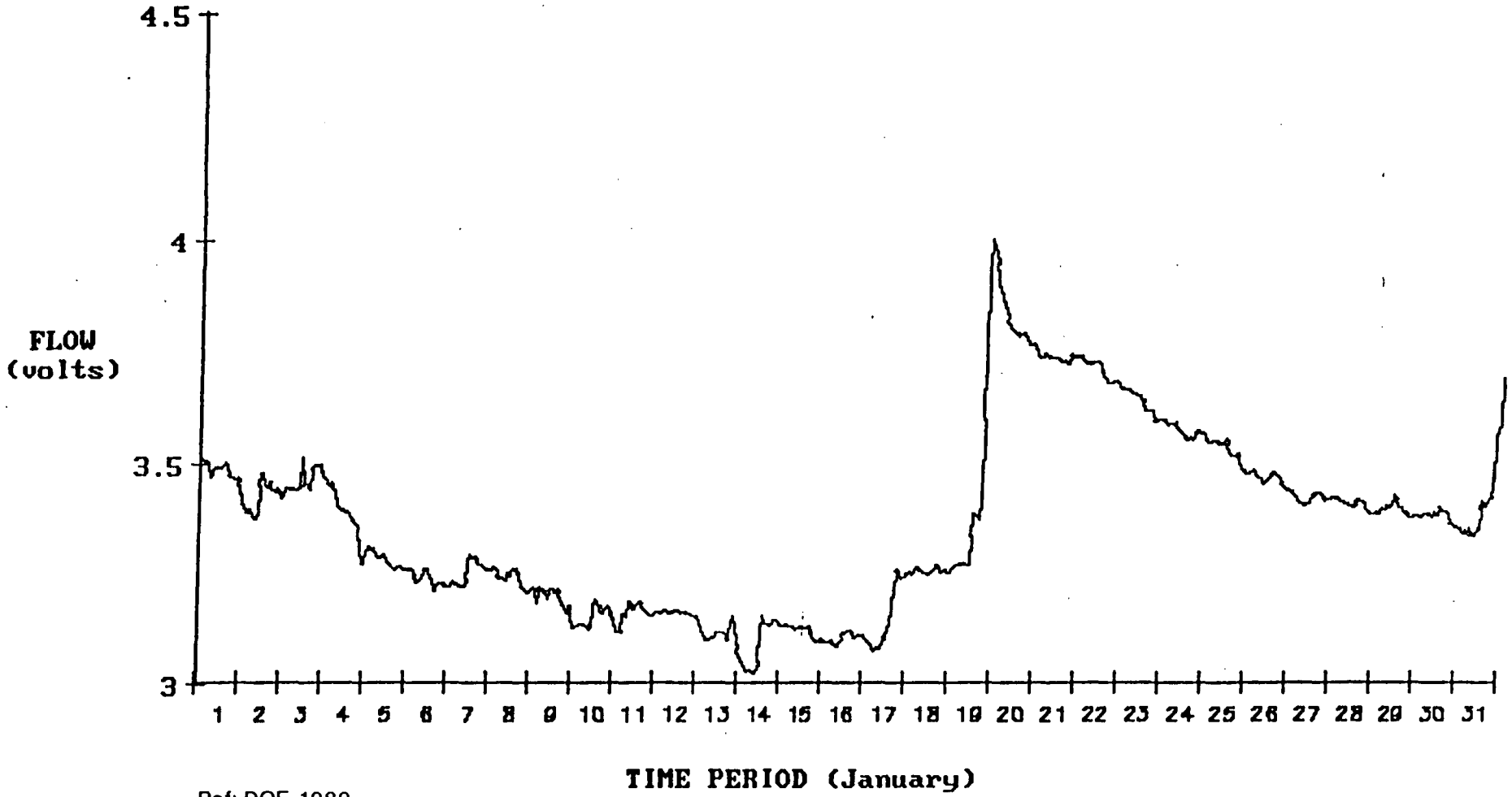
Figure 2.16. Flows recorded in the weir at seep 0601 during January 1988.



Ref: DOE 1989

Figure 2.17. Flow raw data recorded at seep 0607 during January 1988.

It appears that the intercepter trench is not effective in capturing tritium-contaminated groundwater that is migrating to the seeps. The decline in tritium concentration in groundwater at the seeps appears to be related to the groundwater capture system, located west of the SW Building, rather than to the 0712 intercepter trench.

Tritium concentrations measured in samples from one of the monitoring wells (0120) slightly exceed 20 nCi/L. Tritium concentrations in groundwater samples collected from monitoring pit 0722 show a marked increase in the most recent samples, with a measured average concentration of 253 nCi/L in July 1990. The monitoring pit is located downslope from seep 0601. The average concentration for groundwater samples from the monitoring pit in July 1990 is higher than average monthly values measured in seep 0601 since April 1989.

2.6.2. Uranium Concentration in Groundwater on the Main Hill

The use of uranium-233 in processes at the SW Building caused concern that uranium-233 might be present as a contaminant in groundwater on the Main Hill. It was believed that the presence of uranium-233 in groundwater that was contaminated with tritium would determine that the SW Building was a source for the tritium contamination. Earlier investigations established that soil below the SW Building was contaminated with tritium (see subsection 3.2). A sump in Room SW-137 of the SW Building was believed to be responsible for release of uranium-233 to soil below the building.

Personnel at Mound Plant investigated the presence of uranium isotopes in groundwater at seeps on the Main Hill and at 0700 series sample locations, including the SW Building groundwater capture system, the groundwater intercepter trench on the north side of the Main Hill, and the groundwater monitoring pits located around the Main Hill. Sample locations are shown on Figure 2.6. The investigation was conducted over the period from mid-January 1988 to mid-May 1988. Table II.7 presents selected analytical data from the investigation. The complete file of analytical data is in the notes covering a meeting of WESTON, Terran Corporation, and Mound Plant staff (WESTON 1991).

The approach taken by Mound Plant personnel to evaluate the presence of uranium-233 in groundwater samples was to count the activity of uranium-233, uranium-234, and uranium-238 on a multichannel analyzer. However, uranium-233 and uranium-234 appear in the same channel and are, therefore, counted together. The analysis determined an activity concentration for uranium-233 plus uranium-234 and an activity concentration for uranium-238.

Uranium-234 is a daughter nuclide of uranium-238, and both isotopes occur naturally in groundwater. In closed systems, daughter nuclides will establish secular equilibrium with the parent, and activity concentrations of parent and daughter nuclides will be equal. At sec
concentrations between parent and daughter nuclides are equal to one. H

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) (nCi/L)[b]
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						
03/28/88	0713	105.2	2.6	40.4	51	33-549
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	1.68	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.

RADIOCHEMICAL ANALYSIS

may exhibit great disequilibrium in natural systems. A literature review on uranium series disequilibrium by Osmond and Cowart (1976) found that most natural waters have disequilibrium between uranium-234 and uranium-238, with most waters being enriched in uranium-234. Uranium-234/uranium-238 ratios as great as 6.4 were reported for water in small streams. Uranium disequilibrium in groundwater varied widely, with uranium-234/uranium-238 activity ratios ranging from 0.5 to greater than 20. To the present time, the highest ratios reported for uranium-234 enrichment in groundwater were from research by Gilkeson, et al. (1983) on aquifers in the midwestern United States. Ratios greater than 20 were common and ratios as high as 40 occurred locally.

The natural disequilibrium that occurs between uranium-234 and uranium-238 poses problems to the use of the ratio of uranium-233 plus uranium-234 to uranium-238 as an indicator of the presence of uranium-233 in groundwater on the Main Hill. Nevertheless, the high activity concentrations measured in groundwater samples from the SW Building groundwater capture system (locations 0713, 0714, and 0727 on Figure 2.6 and Table II.7) and seep 0601 are interpreted to represent uranium-233 contamination of groundwater at these locations. The disequilibrium observed at all other sampling locations may represent natural enrichment in uranium-234 rather than the presence of uranium-233. An accurate determination of the presence of uranium-233 at these locations would require a specific analysis for the uranium-233 isotope.

Table II.7 presents the maximum activity concentrations measured for uranium isotopes for all samples collected at each sampling location. Concentrations measured at seep 0601 and the SW Building capture zone location exceed 5 picocuries per liter (pCi/L). Maximum concentrations measured at the SW Building capture system location 0713 exceed 100 pCi/L. Analyses on groundwater samples collected at all other sample locations measured uranium concentrations lower than 5 pCi/L.

Multiple analyses are shown in Table II.7 for seep 0601 to show the relationship between tritium concentrations and uranium-233 plus uranium-234 concentrations in groundwater. An increase in tritium concentration correlates directly with increased concentrations for the uranium isotopes. This relationship indicates that the SW Building is a source for the tritium present in groundwater samples collected at seep 0601.

Multiple analyses are shown in Table II.7 for seep 0607 to illustrate that changes in uranium isotope activity concentrations and disequilibrium ratios do not correlate to changes in tritium concentrations. Activity ratios range from 1.9 to 13.6, with the highest ratio due to an anomolously low measured concentration of uranium-238. There has been speculation that the disequilibrium measured in groundwater samples at 0607 is due to the presence of uranium-233. Actually, the measured ratios may be explained by natural disequilibrium between uranium-234 and uranium-238 or by analytical error. Determination of the presence of uranium-233 in groundwater at see
analysis for the uranium-233 isotope.

Multiple analyses for samples from groundwater intercepter trench 0712 are shown in Table II.7 to illustrate that the activity ratio of 8, measured for the sample with the highest uranium-233 plus uranium-234 activity concentration, is an outlier compared to activity ratios of 2.2 and 1.6 for the samples with the second and third highest concentrations of the isotopes. The analytical data for samples from trench 0712, taken as a whole, indicate low activity ratios and no reason to suspect the presence of uranium-233. This conclusion is supported by the low tritium concentrations, which range from 3 to 7 nCi/L, in groundwater samples collected from the trench.

2.6.3. VOC Contamination in Groundwater on the Main Hill

The evaluation of VOCs in groundwater on the Main Hill is based on analytical results from samples collected from monitoring pits, intercepter trenches, monitoring wells, and the seeps on the Main Hill. The following VOCs were detected in groundwater samples:

Trichloroethene
Tetrachloroethene
Methylene chloride
1,2-*trans*-Dichloroethene
1,1,1-Trichloroethane
1,1-Dichloroethane
Chloroform
Bromodichloromethane
Bromoform

2.6.3.1. VOC Concentrations in Intercepter Trenches and Monitoring Pits

VOC analyses on groundwater samples collected from monitoring pits, the SW Building groundwater capture system (0713, 0714, and 0726), and the 0712 intercepter trench are available from one sampling event conducted over the period November 30 to December 2, 1988. The data are presented in Table II.8. Monitoring pit and trench locations (0700 series) are shown on Figure 2.6.

Trichloroethene concentrations exceed 5 micrograms per liter (μg/L) at sample locations 0725, 0726, and 0727, with the highest concentration (54 μg/L) at sample location 0726. Trichloroethene was detected in samples collected at 0712, 0713, and 0714 at concentrations less than 5 μg/L. Trichloroethene was not detected at other 0700 series sampling sites. The available information indicates that contaminated soil below the SW Building is a potential source for trichloroethene in groundwater west of the building.

Table II.8. Volatile Organic Compounds Measured in Groundwater Samples From 0700 Series Monitoring Locations on the Main Hill

Sample Location Sample Date	0712 12/01/88	0713 12/01/88	0714 12/01/88	0721 11/30/88	0722 11/30/88	0723 11/30/88	0724 11/30/88	0725 12/01/88	0726 12/01/88	0727 12/01/88
Volatile Organic Compounds (μg/L):										
Trichloroethene	2.7	1.3	2.1	ND	ND	ND	ND	16	54	23
Tetrachloroethane	ND	55	ND	ND	ND	ND	ND	ND	ND	ND
1,2-*trans*-Dichloroethene	2.5	ND	ND	ND	ND	ND	ND	ND	19	13
Methylene chloride	4.4	5.5	7.5	9.0	9.6	12	23	28	28	29
Toluene	ND	ND	ND	3.2	2.1	0.8	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0

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Trichloroethene	5 μg/L
Tetrachloroethane	5 μg/L
1,2-*trans*-Dichloroethene	100 μg/L (proposed)
Methylene chloride	5 μg/L
Toluene	2,000 μg/L (proposed)
1,1,1-Trichloroethane	200 μg/L

ND = Not detected

A tetrachloroethene concentration of 55 μg/L was measured in groundwater from sample location 0713. Tetrachloroethene was not detected at any other 0700 series location. The concentration measured at intercepter trench site 0713 indicates that contaminated soil below the SW Building is a potential source for tetrachloroethene in groundwater west of the building.

Methylene chloride was detected at all 0700 series sample locations, with the highest concentrations (ranging from 28 to 29 μg/L) measured in samples from 0725, 0726, and 0727, located west and north of the SW Building. A concentration of 23 μg/L was measured in the groundwater sample from monitoring pit 0724, which is located on the east side of the Main Hill. Methylene chloride was the only VOC detected in pit 0724. It is possible that all of the measured methylene chloride concentrations are the result of laboratory contamination. Similarly, the low values of toluene measured at three sampling locations (0721, 0722, and 0723) may be due to laboratory contamination.

1,2-*trans*-Dichloroethene was measured at low concentrations at sample locations 0712, 0726, and 0727. This VOC was not detected in any other 0700 series sample location. The values measured at 0726 and 0727 indicate that contaminated soil below the northwestern part of the SW Building is a potential source for 1,2-*trans*-dichloroethene contamination in groundwater.

The only other VOC detected in groundwater collected from the 0700 series locations was 1,1,1-trichloroethane at a concentration of 1.0 μg/L at the SW Building intercepter trench 0727.

In summary, analysis of VOCs in groundwater samples collected from intercepter trenches and monitoring pits indicates that contaminated soil below the SW Building is a potential source for trichloroethene, tetrachloroethene, and 1,2-*trans*-dichloroethene; three VOCs that commonly occur in groundwater samples collected from seeps and monitoring wells on the Main Hill.

2.6.3.2. VOC Contaminants in Groundwater Samples from the Main Hill Seeps

Table II.9 summarizes concentrations of VOC contaminants measured in groundwater samples collected at seeps on the Main Hill in September and December 1988 and in 1990. The seeps were not sampled for VOCs during 1989. Locations of the seeps are shown on Figure 2.6. Seeps 0605, 0606, 0607, and 0608 are located beyond the Mound Plant property line. All other seeps are located within the plant. Groundwater has never been analyzed for VOCs at seep 0603.

Trichloroethene was detected at concentrations ranging from 2.2 μg/L to 40 μg/L in groundwater samples collected from all of the seeps. The highest concentrations were measured at seep 0602. Trichloroethene is also present in all samples collected at seep 0601, with many measurements exceeding 5 μg/L. Trichloroethene is the most common VOC detected in the seeps that are located

Table II.9. VOC Concentrations (μg/L) in Groundwater Samples Collected from Seeps in September and December 1988 and from January to October 1990

Seep	Parameter	1988 Sep	1988 Dec	1990 Jan	1990 Feb	1990 Mar	1990 Apr	1990 Jul	1990 Oct	MCL[a]
0601	Methylene chloride	ND	9.7	13	ND	ND	ND	ND	ND	5
	1,1,1-Trichloroethane	ND	ND	ND	7	2.3	ND	0.6	0.4	200
	Trichloroethene	3.7	5.6	3.7	5.2	4.5	12	7.7	4.5	5
	Tetrachlorethene	6.4	8.2	8.4	12	11	25	11	9.6	5
	1,2-*trans*-Dichloroethene	2.1	1.2	ND	ND	ND	ND	ND	ND	100[a]
0602	Trichloromethane	ND	1.2	0.6	ND	0.9	ND	ND	1	100[a]
	1,2-Dichloroethene (total)	10	6.5	ND	ND	ND	14	ND	ND	70[b]
	1,1-Dichloroethane	ND	1.3	ND	ND	1	ND	ND	ND	NA
	Trichloroethene	14	9.5	16	6.6	38	40	26	15	5
	1,1,1-Trichloroethane	2	1.5	32	0.6	2	1*	6.1	1.1	200
	Methylene chloride	4[c,d]	10	ND	ND	ND	1[e,d]	ND	ND	5
0605	1,1,1-Trichloroethane	NS	ND	0.5	0.9	0.8	ND	0.5	0.4	200
	1,2-Dichloroethene (total)	NS	12	ND	ND	ND	12	ND	ND	70[b]
	Trichloromethane	NS	ND	ND	ND	ND	3*	ND	ND	100[a]
	Trichloroethene	NS	13	4.9	7.1	6.4	9	9	8.9	5
	Methylene chloride	NS	28	ND	ND	ND	7[d]	ND	ND	5
0607	1,1,1-Trichloroethane	ND	ND	1.1	2	1.9	1*	2.2	0.9	200
	Methylene chloride	ND	4.5	ND	ND	ND	25[d]	ND	ND	5
	Acetone	3[c,d]	ND	ND	ND	ND	17[d]	ND	ND	NA
	1,2-Dichloroethene (total)	4.1	ND	ND	ND	ND	5	ND	ND	70[b]
	Trichloromethane	ND	ND	ND	ND	ND	1[c]	ND	ND	100[a]
	Toluene	ND	ND	ND	ND	ND	1[c]	ND	ND	2000[c]
	Tetrachlorethene	ND	ND	ND	ND	ND	ND	0.4	ND	5
	Trichloroethene	5.5	ND	1.3	2.7	3.3	4*	4.5	2.2	5
0608	Trichlorofluoromethane	NS	ND	2.8	ND	ND	ND	ND	ND	NA
	1,2-Dichloroethene (total)	NS	2.6	ND	ND	ND	2*	ND	ND	70[b]
	1,1,1-Trichloroethane	NS	ND	ND	ND	ND	ND	0.4	ND	200
	Trichloroethene	NS	7.1	ND	ND	ND	9	2.7	ND	5

[a] Proposed limit
[b] Proposed MCL for *cis*, 70 μg/L; *trans*, 100 μg/L
[c] Estimated value less than the detection limit
[d] Contaminant present in blank
MCL - Maximum Contaminant Level
NA - No current MCL
ND - Contaminant was not detected
NS - Well was not sampled
VOC - Volatile organic compound

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beyond the Mound Plant property. Concentrations measured in 1990 in samples collected from seeps 0605 and 0608 range from 2.7 μg/L to 9 μg/L. Concentrations measured in 1990 in samples collected from seep 0607 range from 1.3 μg/L to 4.5 μg/L.

Tetrachloroethene was only detected in groundwater samples collected from seep 0601, with measured concentrations ranging from 8.2 μg/L to 25 μg/L. 1,1,1-Trichloroethene was detected at low concentrations in groundwater samples collected from all of the seeps, with the highest concentrations measured at seep 0602.

2.6.3.3. VOC Contaminants in Groundwater from Monitoring Wells

The monitoring well network on the Main Hill is shown on Figure 2.6. Construction information for the monitoring wells is presented in Table II.6. Table II.10 lists concentrations for VOCs measured in groundwater samples from wells sampled from January 1989 to January 1990. Table II.11 presents concentrations of VOCs measured in groundwater samples from three monitoring wells located on the west side of Mound Plant at the base of the Main Hill. Locations of the wells are shown on Figure 2.6. Trichloroethene has been measured at concentrations greater than 5 μg/L for samples collected from all three wells, with the highest concentrations measured at well 0312. Tetrachloroethane has been measured at concentrations greater than 5 μg/L for samples collected at wells 0137 and 0315. The source or sources of VOCs at the three monitoring wells are not known. The monitoring wells are located downgradient from potential sources of contamination on the Main Hill.

2.6.4. Inorganic Constituents in Groundwater Samples Collected from Intercepter Trenches and Monitoring Pits on the Main Hill

Table II.12 presents results of analyses for selected inorganic constituents in groundwater samples collected from the SW Building groundwater capture system, the 0712 intercepter trench, and monitoring pits on the Main Hill from January through April in 1988. Sampling locations are shown on Figure 2.6. Location 0712 represents samples from the long intercepter trench located between the OSE Building and the Guardhouse. Locations 0714, 0713, and 0727 are the sampling sites of the groundwater capture system located along the west side of the SW Building. The other 0700 series locations are groundwater monitoring pits.

Chloride concentrations exceeded 250 milligrams per liter (mg/L) for all measurements taken at locations 0712, 0722, 0723, and 0724. The highest chloride concentrations are at 0712, the intercepter trench between the OSE Building and the Guardhouse. High chloride values are also present in groundwater samples collected from monitoring pits 0721, 0722, 0723, and 0724, with

Table II.12. Inorganic Constituents in Groundwater Samples from Seeps, Intercepter Trenches, and Monitoring Pits[a]

Sample Location[b]	Sampling Period[c]	Calcium (mg/L)	Potassium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Nitrate (mg/L)	Sulfate (mg/L)	Specific Conductance µmhos/cm
0601	03/06/88 - 04/08/88	77-126	2-5	26-43	94-138	110-160	190-250	97-200	1107-1660
0602	02/29/88 - 04/08/88	30-44	2-3	6-12	199-285	140-200	18-35	69-100	1060-1530
~~0603~~	~~01/18/88 - 03/18/88~~	~~185-275~~	~~3-8~~	~~41-49~~	~~1303-1770~~	~~2800-3100~~	~~150-200~~	~~91-100~~	~~[illegible]~~
0605	02/29/88 - 04/08/88	86-139	2-4	31-43	124-212	210-420	110-150	110-160	1308-2370
0606	03/07/88 - 03/18/88	108-146	2	27-36	70-108	120	75	110	650-1250
0607	02/29/88 - 04/03/88	130-184	5-9	42-65	95-321	460-640	160-210	130-180	1430-2010
0608	02/29/88 - 04/08/88	117-134	3-5	40-55	70-212	150-190	41-49	150-180	960-1500
~~0712~~	02/29/88 - 03/18/88	263-420	29-33	81-99	527-699	610-1100	830-1300	310-330	1830-5270
0713	02/29/88 - 04/08/88	225-700	6-10	58-84	98-170	110-260	800-2500	71-368	1029-5070
0714	02/09/88 - 04/08/88	272-399	7-13	74-96	140-228	160-300	1300-1600	170-230	1600-3420
0721	02/29/88 - 04/15/88	71-158	3-4	48-77	72-137	190-300	29-63	150-240	1134-1770
0722	02/29/88 - 03/31/88	118-162	3-5	50-71	89-182	270-410	19-33	100-210	1360-1870
0723	03/02/88 - 04/15/88	80-170	5-8	73-96	73-100	280-400	5-23	210-270	1026-1790
0724	02/29/88 - 04/15/88	66-150	3-5	92-124	30-48	260-400	5-12	140-200	1480-1836
0725	02/29/88 - 04/15/88	73-130	2-4	34-45	55-85	61-96	270-450	67-110	940-1520
0726	02/29/88 - 04/15/88	232-312	3-6	51-61	115-164	140-190	940-1200	55-62	1500-2890
~~0727~~	02/29/88 - 04/04/88	174-231	3-5	43-71	91-156	110-210	570-770	110-170	910-2280

[a] Analyses by Mound Plant.
[b] Sample locations are shown on Figure 2.6.
[c] Sampling period for specific conductance was from 01/19/88 through 04/15/88.

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2.6.4.1. Inorganic Constituents in Groundwater Samples Collected From seeps on the Main Hill

Table II.12 presents analyses for selected inorganic constituents in groundwater samples collected from seeps on the Main Hill from January through April in 1988. Concentrations in the samples from all of the seeps exceed 10 mg/L for nitrate. The highest nitrate concentrations were measured at seeps 0601, 0603, 0605, and 0607, where all samples were above 100 mg/L. Potential sources for nitrate on the Main Hill are contaminated soil below the SW Building, deicing agents applied to roads and sidewalks, fertilizers, and leaks from sewage lines or process waste lines.

Chloride concentrations in groundwater samples collected from seeps 0603, 0605, and 0607 exceed 250 mg/L. The highest concentrations (2,600 mg/L to 3,100 mg/L) occurred at seep 0603, located downslope from the main entrance roadway to the Main Hill. Roadway deicing salts are a probable source for the high chloride and nitrates present in seep 0603. This interpretation is supported by the high sodium concentrations (1,323 mg/L to 1,770 mg/L) measured in groundwater samples collected from the seep. The variation over time in the measured specific conductance values for groundwater samples collected from seep 0603 also support an interpretation that the high concentrations of chloride and nitrate are related to deicing agents. The specific conductance values show an increasing trend from 2,760 microohms/centimeters (μmhos/cm) at the start of measurements in January 1988 to peak values in February 1988 (greater than 10,000 μmhos/cm). The measured values then trend downward to 4,450 μmhos/cm at the end of the measurement period in May 1988. Chloride concentrations in all samples collected from all of the seeps are elevated above background concentrations for the natural hydrogeologic environment. Expected background concentrations are based on regional information for midwestern groundwater flow systems (Hem 1970). Potential sources for the chloride are deicing agents applied to roadways and sidewalks, contaminated soil below the SW Building, and leaks from breaks in sewage or waste process lines.

The measured concentrations in groundwater samples collected from the seeps range from 69 mg/L to 200 mg/L, with the highest concentrations occurring at seep 0601. Natural sources for dissolved sulfate are expected to be present in fill materials, the Quaternary deposits, and the bedrock.

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

5. SITE RECONNAISSANCE

5.1. SUMMARY OF ACTIVITIES

5.1.1. Seep Investigation

The hillsides surrounding the Main Hill were investigated with a representative of EG&G who identified several possible seep locations and also the known seeps. The possible seep locations on the northern hillside were areas with vigorous vegetation without visible seepage (Site I, Figure 2.8), while another possible seep was located near the top of the railroad cut where seepage was visible but not measurable (Site G, Figure 2.9). The entire OU-2 area was investigated after review of the IR photographs to confirm the presence or absence of additional seeps. An additional ten potential seep locations were identified from the IR photographs. One of the new locations was labelled seep 0625 by EG&G and is located northwest of B Building. The other potential seeps were identified in areas where storm drain outfalls, drains from chiller units, and roof drains discharge to the ground and are not considered seeps. The remaining areas appear to be seasonal seeps with little or no measurable flow. The location of identified seeps are shown on Figure 5.1.

Seeps 0601 through 0608 and 0625 were monitored at random intervals, approximately twice per week, during the month of June. The seeps were monitored for pH, specific conductivity, temperature, and flow (Table V.1). A new seep (0625) was located at the end of June, and was only monitored four times. Seeps 0604 and 0605 are considered the same seep because the locations are very close together on the north hillside and were covered with soils and debris when the perimeter fence was cleared of vegetation. Neither seep was visible for a few months, and when seepage was again visible it was only from one location.

Each monitored seep was fitted with a 1-inch diameter length of pipe approximately 18 inches long. Before the pipe was set, a small reservoir was dug into the hillside to temporarily hold the seeping water. The pipe was then set into the side wall of the reservoir acting as a drain, allowing the water to flow freely out its end. This allowed access for monitoring by raising the outfall a few inches off the ground. This was done on all seeps except seeps 0601, 0603 and 0607. Seeps 0601 and 0607 have automatic samplers that were installed to monitor the previously discussed parameters. These seeps are fitted with V-notch weirs, and all monitoring was done at the weir outfall. Seep 0603 was fitted with a pipe from a previous sampling event; modification was unnecessary.

When the seeps were monitored, the flow was measured first, followed by temperature, specific conductance, and pH measurements (Table V.1). The flow was measured by recording the amount of

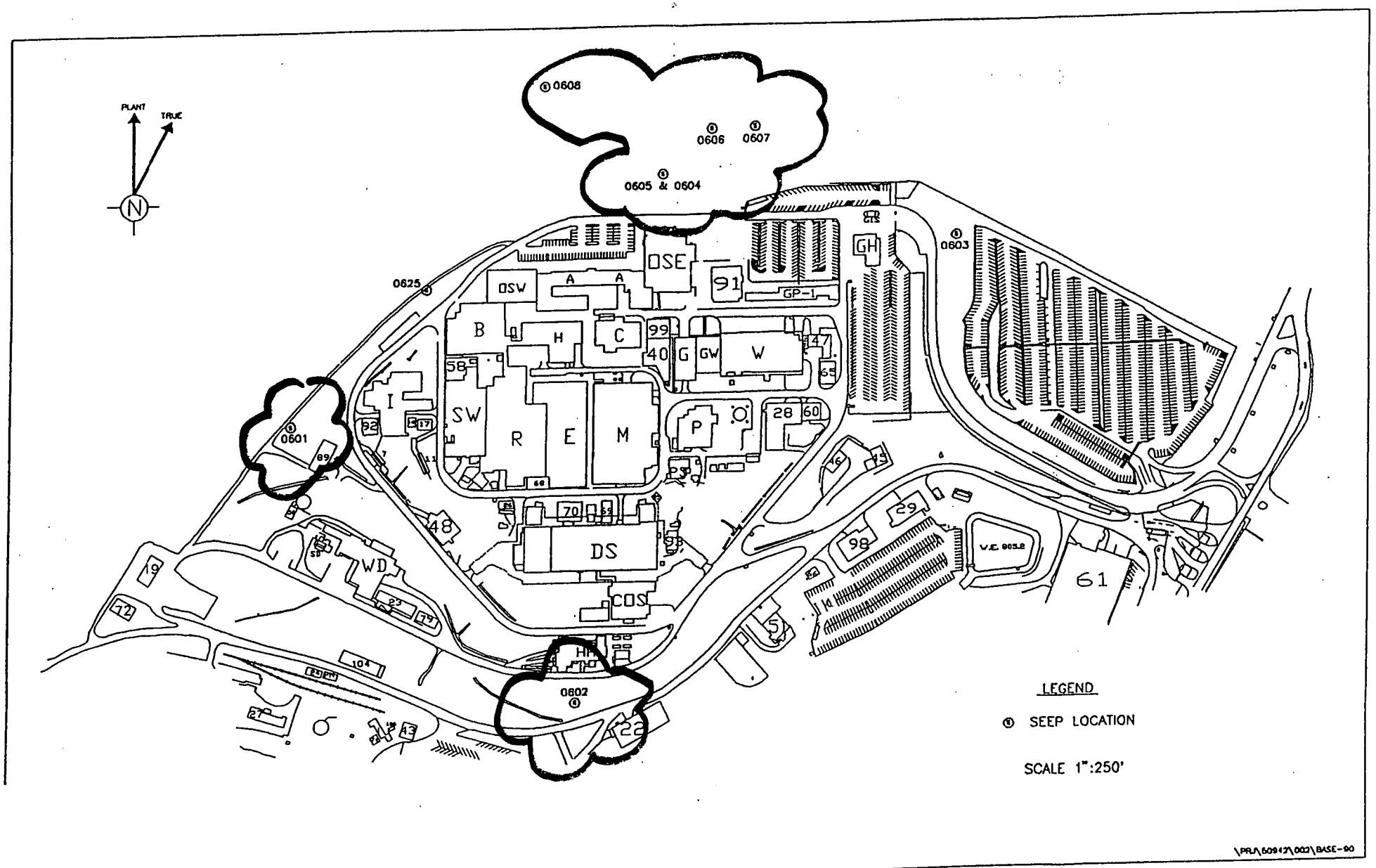


Figure 5.1. Seep Locations

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

Table V.1. Seep Monitoring Results (continued)

Seep No.	Date	pH	Conductivity (µmhos/cm)	Temperature (°F)	Flow (gpm)
0606	6/6/94	N/A	N/A	N/A	N/A
	6/7/94	7.10	3605	63.2	0.0006
	6/9/94	7.10	3530	61.5	0.007
	6/14/94	7.30	4120	65.4	0.013
	6/22/94	7.60	3920	64.8	0.013
	6/27/94	7.49	4040	63.1	0.009
	6/28/94	7.64	3850	65.6	0.007
	6/30/94	7.52	4040	64.9	0.005
0607	6/6/94	7.6	3870	54.7	0.450
	6/7/94	7.35	4140	53.6	0.74
	6/9/94	7.42	3930	54.1	1.20
	6/14/94	7.38	4110	55.4	0.77
	6/22/94	7.37	3670	55.0	1.54
	6/27/94	7.38	3580	55.4	2.70
	6/28/94	7.64	3850	55.5	2.70
	6/30/94	7.59	4010	56.1	2.70
0608	6/6/94	6.79	2006	57.1	0.00
	6/7/94	7.6	2010	57.7	0.063
	6/9/94	7.20	2000	57.2	0.06
	6/14/94	7.13	2050	62.3	0.07
	6/22/94	7.48	2110	60.3	0.06
	6/27/94	7.50	2110	59.0	0.054
	6/28/94	7.63	2240	61.1	0.06
	6/30/94	7.52	2020	61.2	0.054
0626	6/22/94	7.56	1190	63.5	0.09
	6/23/94	N/A	N/A	N/A	0.09
	6/27/94	7.75	1210	62.3	0.098
	6/28/94	7.73	1270	62.5	0.102
	6/30/94	7.71	1270	62.4	0.098

umhos/cm - micromhos per centimeter
°F - Degrees Farenheit
gpm - gallons per minute
N/A - Not Available

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).

Rainfall vs. Higher Seep Flow

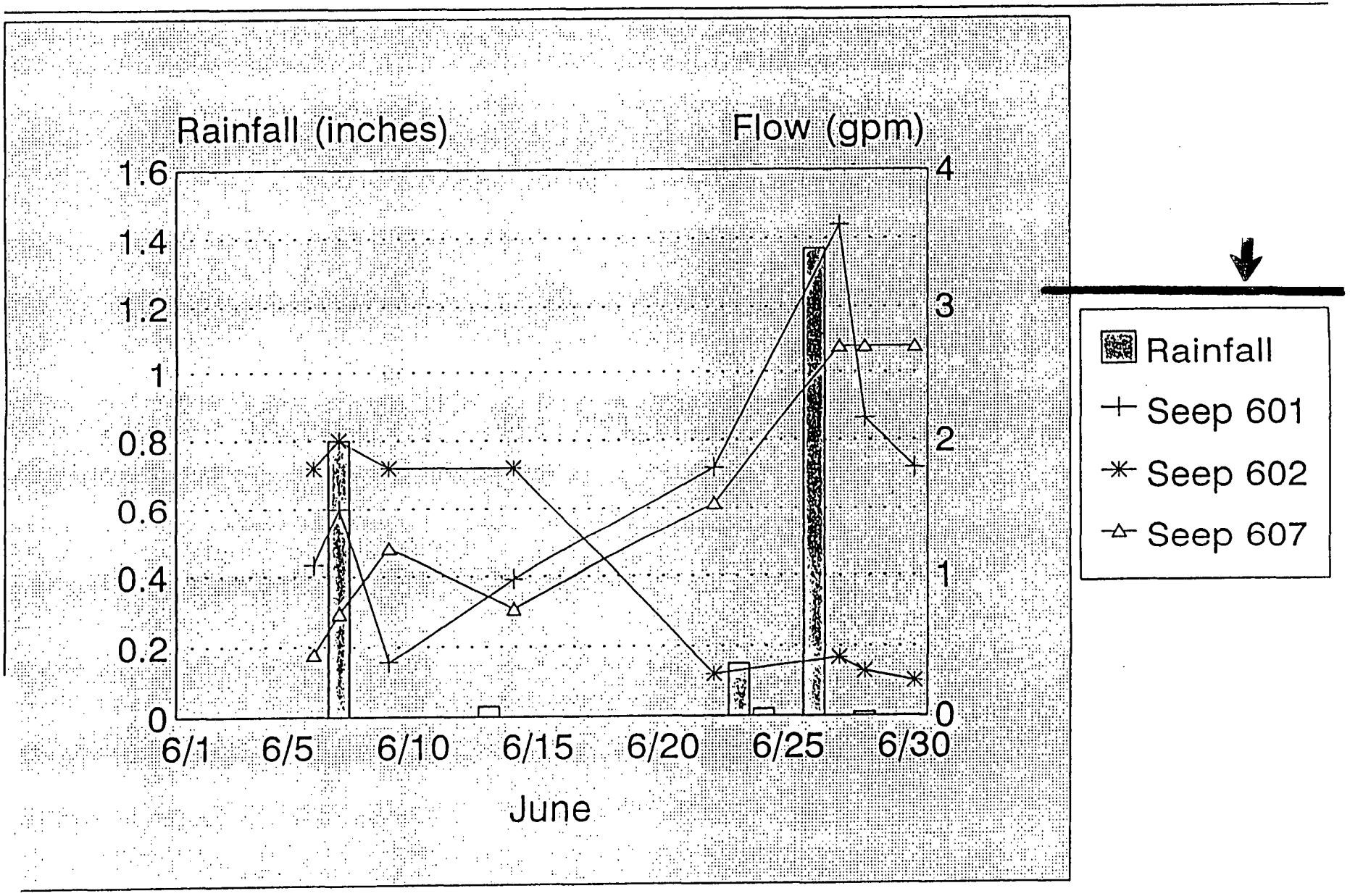


Figure 5.3. Rainfall vs. Higher Seep Flow

Rainfall vs. Lower Seep Flow

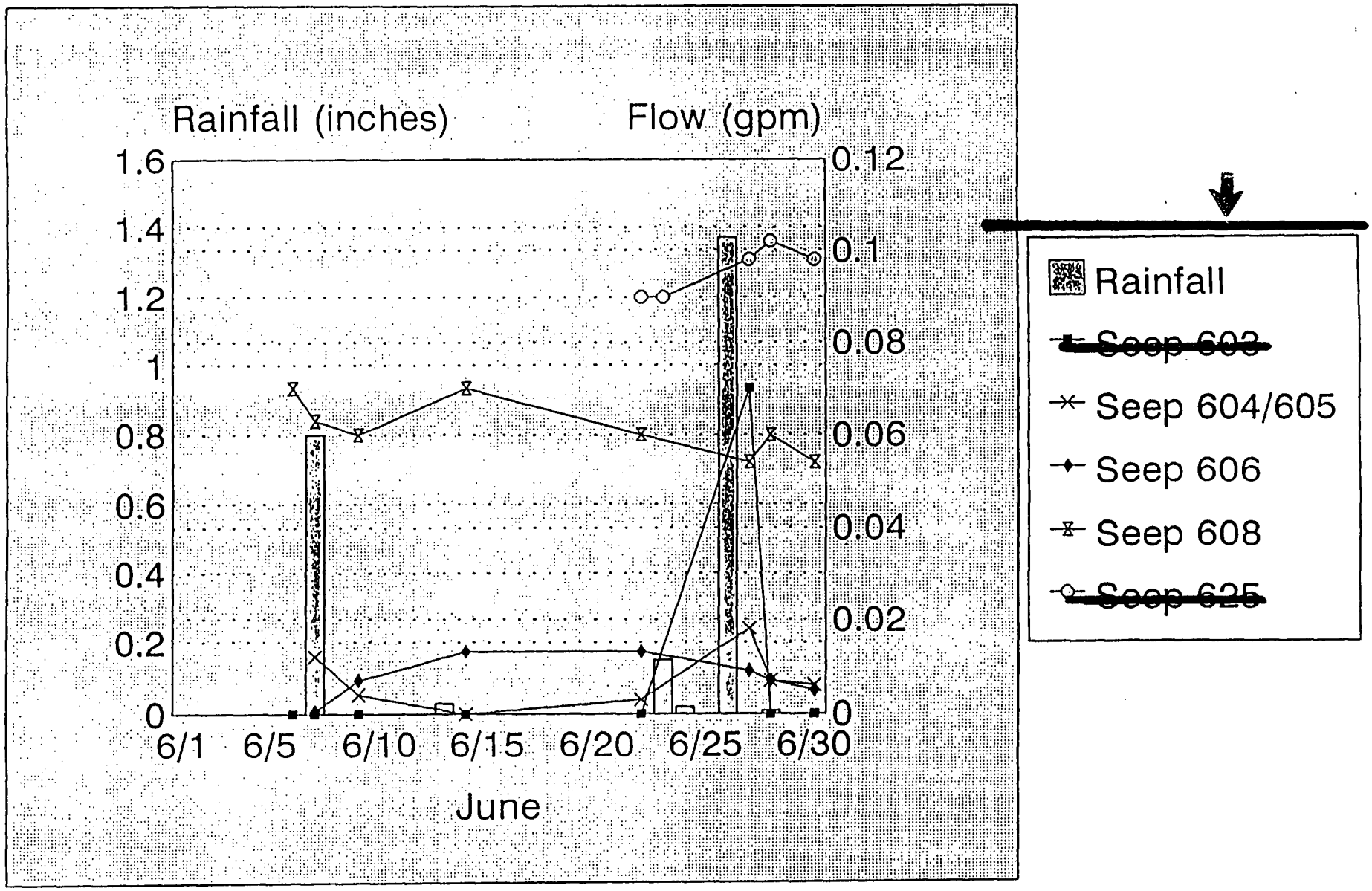


Figure 5.4. Rainfall vs. Lower Seep Flow

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~~	~~63.0~~	~~63.0-63.0~~	~~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
~~0609~~	~~7.70~~	~~7.58-7.75~~	~~1295~~	~~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, 7.35, and 59.5°F, respectively (Table V.3).

Duplicate

29-01-10-07-02

#9508290064

Environmental Restoration Program

OPERABLE UNIT 9
REGIONAL SOILS INVESTIGATION REPORT

MOUND PLANT
MIAMISBURG, OHIO

August 1995

Revision 2

U.S. Department of Energy
Ohio Field Office

EG&G Mound Applied Technologies

~~Strontium-90~~

~~Gamma Spectrometry~~

~~Nitrate/nitrite~~

~~Chloride~~

~~Sulfate~~

~~USATHAMA explosives (20% of locations)~~

2.1.3. Soil and Water Sampling at the Main Hill Seeps

This effort included soil and water sampling of the active seeps, and additional soil sampling downstream of each seep. Surface and multiple depth subsurface soil samples were analyzed for the same parameters list as the NPDES Outfall effort. The following are additional analytes that were required for the seep water analysis:

TAL inorganics (dissolved)

Isotopic plutonium, thorium, uranium (dissolved)

Radium-226

Americium-241

Strontium-90 (dissolved)

In addition, the following field measurements were also required for seep water:

Temperature

Hydrogen Ion Content (pH)

Specific conductivity

Dissolved oxygen

Redox potential

Flow rate

The actual work conducted was performed according to the Standard Operating Procedures (SOPs) from the OU9 Quality Assurance Project Plan (QAPjP) (DOE 1992c). The SOPs used for this investigation were: 1.1, 1.3, 1.4, 1.5, 1.6, 1.8, 1.15, 2.2, 2.8, 2.9, 4.1, 5.1, 5.2, 5.3, 5.4, 5.8, 6.1, 6.2, and 6.3. These SOPs are described in detail in the QAPjP.

2.2. SAMPLE DESIGNATIONS

A six digit identifier was assigned to each sample collected to accommodate the EPA Contract Laboratory Program (CLP) reporting requirements. For tracking the samples collected for the RSI, an identifying label was attached to each sample. Table II.1 indicates characters used to create this six digit identifier. Figure 2.1 shows sample collection methodology.

The Mound Plant ER program has an existing sample numbering scheme for all samples collected for the ER program. The Mound sample identification (ID) system consists of a ten digit sample identifier as explained in the FSP. This system contains too many characters for the CLP laboratories to report the results in their data base. Because of this fact, a sample numbering system was developed for this project which contained only six characters.

For example, RGD311, was a sample ID used for this investigation. The first character, R, represents the regional soil (Airborne Depositional Investigation) sampling event. The second character, G, shows the sample was collected at a distance of 3000 feet from the Mound Plant locus and the third character, D, represents the ENE compass direction. The number 3 indicates that this sample is a soil sample. The number 1 indicates that this is a duplicate sample. The final digit, number 1, represents the number of the order of the sample taken at this location. Therefore, RGD311 is a soil sample taken 3000' to the ENE of the plant locus and is a duplicate of the first sample taken at this location.

A cross reference table to show the original ten digit Mound identifier, the six digit identifier used, and a brief location description can be found in Appendix A.

2.3. SAMPLING ACTIVITIES

During the RSI, a total of 252 locations were sampled. The sections below describe the individual sampling events. Changes or deviations from the FSP are described in their appropriate section.

2.3.1. Airborne Depositional Investigation

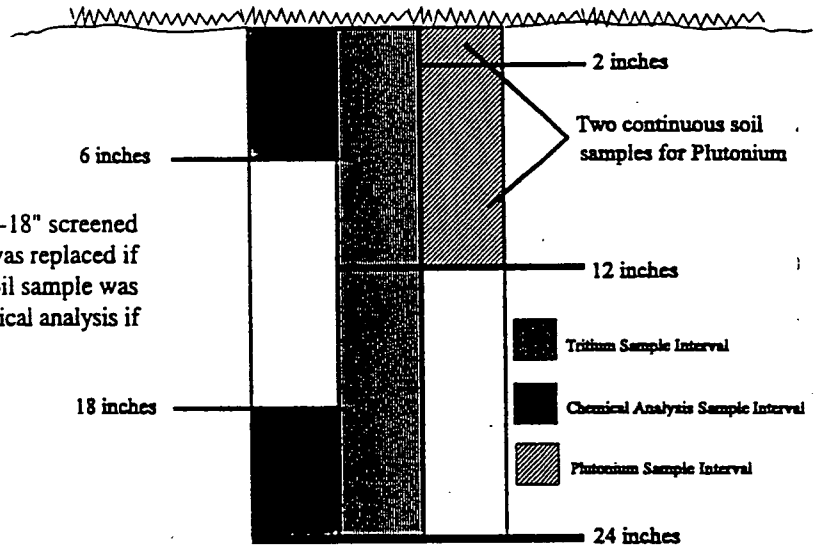
The Airborne Depositional Investigation consisted of sampling the fenceline, fenceline +1000', and the 1,000 to 100,000 feet distances from the plant locus. These distances are located on 16 radial lines

Table II.1. Project Sample Designations Key

Investigation	First	Second	Third	Fourth	Fifth	Sixth
Airborne Deposition Investigation	R	A-Fence Line B-Fence Line + 500' C-Fence Line + 1000' D-1500' E-2000' F-2500' G-3000' H-3500' J-4000' K-4500' M-5000' N-6000' P-7000' R-8000' S-9000' T-10000' U-25000' V-50000' X-75000' Y-100000'	A-N J-S B-NNE K-SSW C-NE M-SW D-ENE N-WSW E-E P-W F-ESE R-WNW G-SE S-NW H-SSE T-NNW			
Soil and Water Sampling at the Main Hill Seeps	S	1-Seep 601 2-Seep 602 3-Seep 603 4-Seep 604 5-Seep 605 6-Seep 606 7-Seep 607 8-Seep 608	1-0' from Seep 2-10' from Seep 3-20' from Seep	1-Water 3-Soil	0-Original 1-Duplicate	1 thru 9 Sample Order
NPDES Outfall 001 Soil Investigation	N	The Second and Third characters are joined together and show the sample location along the NPDES outfall line. 01-Near Manhole 1 02-Near Manhole 2 03-Near Manhole 3 04-Near Manhole 4 05-Near Manhole 5 06-Near Manhole 6 07-Between Manholes 7 and 8 08-Between Manholes 8 and 9				
QA Samples Airborne Deposition Investigation	R	Z-QA Sample	A-Rinsate B-Trip Blank C-Field Ambient Blank D-Sample Bank Blank	001-999 Sample Order		
NPDES Outfall 001 Soil Investigation	N	The Second and Third characters are joined together. 92-Trip Blank 93-Field Ambient Blank 94-Rinsate 97-Sample Bank Blank				
Soil and Water Sampling at the Main Hill Seeps	S					

One, 2-foot deep, 3-inch diameter soil boring was completed to collect the samples at a given location. If necessary, a second boring was completed to attain enough sample volume. Packaged top soil or soil from the surrounding area was added as needed to replace soil removed.

The sod plug was removed prior to sampling to be replaced later. The top soil was removed if necessary to get below the root zone.



Sample Interval 6-18" screened with a HNu, soil was replaced if non-detect, or a soil sample was collected for chemical analysis if there was a hit.

Excess soil from a sample interval was placed in a stainless steel bowl to be composited with soil for the next sample within that interval. As an example, the excess soil from the chemical analysis samples were placed in a stainless steel bowl to be used in the collection of the tritium sample to ensure that there was enough sample volume.

Samples were analyzed for a variety of chemicals depending on the distance from the Mound Plant.

Near the plant:	Organic chemicals, pesticides/PCB's, metals, radionuclides including tritium, thorium, uranium, and plutonium.
Further from the plant:	Plutonium at all locations, tritium, uranium, and thorium at some locations.

Figure 2.1. Sample Collection Methodology

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.

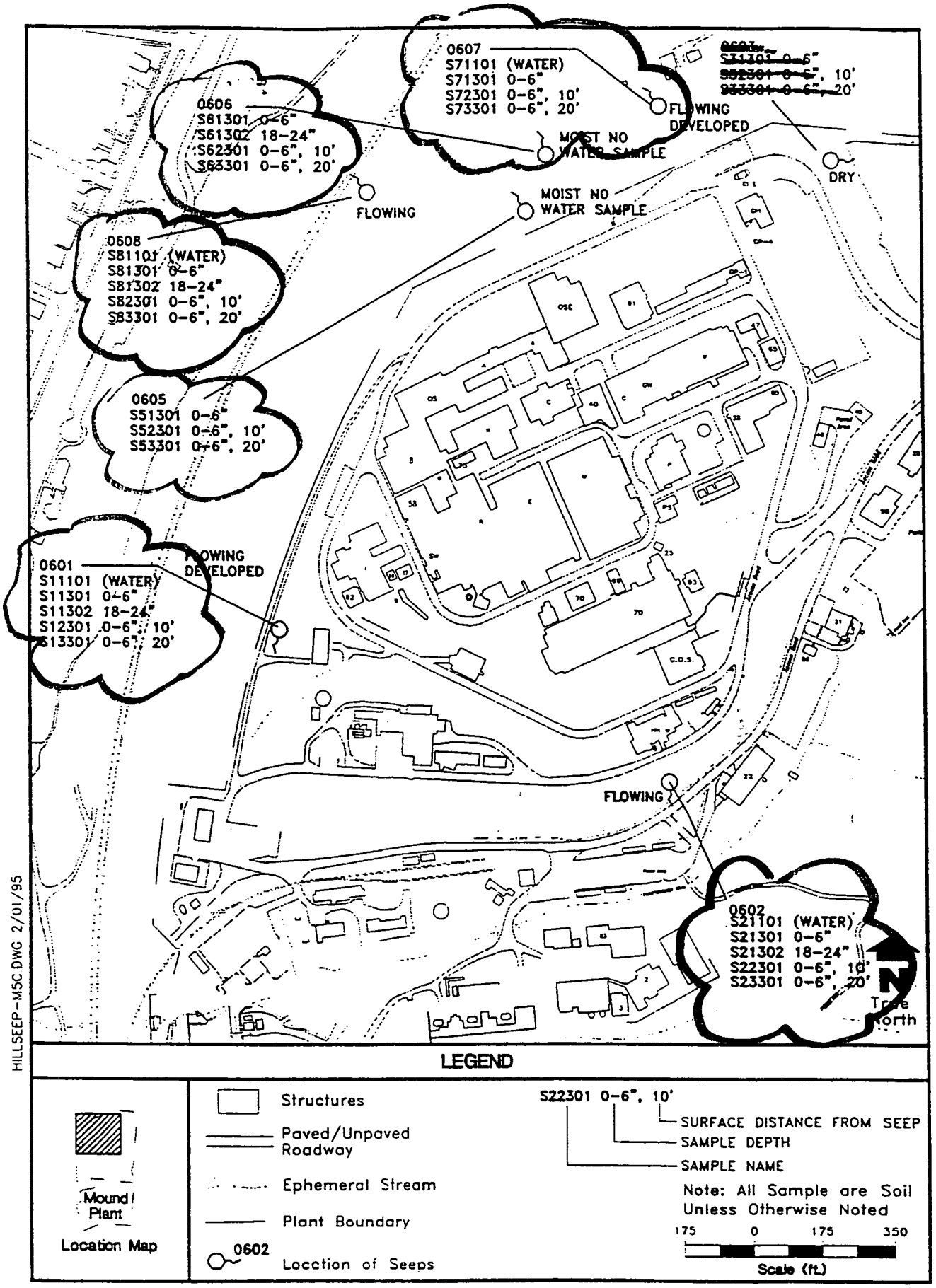


Figure 2.6. Main Hill Seep Sample Locations

2.4. GEOTECHNICAL SAMPLING METHODS

2.4.1. Geotechnical Sampling at Main Hill Seeps

One soil sample was obtained from each of the seven seep locations for geotechnical and mineralogical analyses. The samples were collected from a depth of 0 to 6 inches below ground surface, except at seeps 605 and 607. In both of these two cases, bedrock was encountered at a depth of 5 inches. Sampling sites were located as near to the seep as practical yet outside the main seepage pathway in order to avoid highly saturated samples. After locating a sampling site representative of the area around a particular seep and clearing away the surface debris, the geotechnical sample was collected using a stainless steel spoon according to Mound Plant ER Program SOP 5.2 *Soil Sampling with a Spade and Scoop*. Excavated soil was temporarily placed into a stainless steel bowl and the entire geotechnical sample was then transferred to two polyethylene containers, one 2-liter and one 4-liter.

2.4.2. Geotechnical Sampling Along NPDES Pipeline

A total of eight soil borings were drilled along the NPDES pipeline and geotechnical samples were obtained from six of the borings. Each borehole was advanced using a Mobile B-63 rotary drill rig with 4 1/4 inch inner diameter (I.D.) hollow-stem augers. Soil samples were acquired by driving a standard 3-inch outer diameter (O.D.) split-spoon sampler through and ahead of the augers in accordance with American Society for Testing and Materials (ASTM) standard method D1586-84 and SOP 5.1. *Soil and Rock Borehole Logging and Sampling*. Upon retrieval, the soil sampler was opened and the amount of sample recovery was recorded. The sample was immediately screened with a Field Instrument for the Detection of Low Energy Radiation (FIDLER) and an organic vapor detector by the site geologist. Approximately 300 grams of soil from each sampled interval was reserved for plutonium and thorium analyses by the Mound Plant Soil Screening facility. The remaining sample was sealed in one 2-liter and one 4-liter polyethylene container. Due to the sample volume requirement and the difficulties encountered in obtaining coarse grained samples, it was necessary to drive several split-spoons at each NPDES location in order to collect a sufficient volume of soil for analysis. In general, two boreholes were drilled at each NPDES location to obtain the required sample volume. Where multiple borings were drilled at one NPDES sampling location, the borings were located within five feet of each other.

pipeline investigation are presented for each sample point by parameter in tabular form in Appendix E, which includes data qualifiers applied by the analytical laboratory and data qualifiers applied by the data validation team.

The results presented in the following subsections are geochemical evaluations only. Geochemical analytical results include concentrations of radionuclides, inorganics, pesticides/PCBs, VOCs, SVOCs, and anions in soil samples. Results of geotechnical analyses are discussed in Section 4.5.

4.3.1. Radionuclides

Radium-226 was found at each location except N03 and N08. Other radionuclides were detected at various concentrations as shown in Figure 4.15 with the highest reading being 3.48 pCi/g of Pu-238 (at N06).

4.3.2. Inorganics and Anions

The inorganic concentrations and anions in soil samples that were measured above background for this investigation are shown in Figure 4.16. Of interest are the magnesium readings at all locations except N01 and the only iron concentration being at N01.

4.3.3. Pesticides/PCBs, VOCs, and SVOCs

All detections for pesticides/PCBs, VOCs, and SVOCs were validated with a "J" which means "estimated." These values are shown in Figure 4.17.

4.4. RESULTS OF MAIN HILL SEEPS SOIL AND WATER SAMPLING

This section presents the analytical results for the groundwater and soil geochemical samples collected during the investigation of the Main Hill Seeps. These results are used in conjunction with statistical analyses to identify locations of the maximum concentrations of the selected parameters.

Only the results which were above background values or those which could warrant further investigation (results which indicated abnormal distribution of potential contaminants or results which indicated

influence from "other sources", etc.) are presented in this section. The data from the Main Hill Seeps investigation are presented for each sample point by parameter in tabular form in Appendix E, which includes data qualifiers applied by the analytical laboratory and by the data validation team. The sample locations and field sampling activities for the Main Hill Seeps investigation are described in Section 2.

4.4.1. Soil Results

Geochemical analytical results include concentrations of radionuclides, inorganics, pesticides/PCBs, VOCs, SVOCs, and anions in soil samples.

4.4.1.1. Radionuclides

The radiological concentrations in soil that were measured above background for this investigation are shown in Figure 4.18. Only Pu-238 was detected at each location. The highest non-tritium value was 8.25 pCi/g of U-235 at Seep 601.

4.4.1.2. Inorganics and Anions

The inorganic and anion concentrations in soil that were measured above background for this investigation are shown in Figure 4.19. Copper, iron, lead had significant concentrations at location 605.

4.4.1.3. Pesticides/PCBs, VOCs, and SVOCs

The pesticides/PCBs, VOCs, and SVOCs detections above background are shown in Figure 4.20.

4.4.2. Water Results

4.4.2.1. Radionuclides

The radiological concentrations detected in water samples are shown in Table IV.2. Those concentrations, noted in bold type, represent detected contaminants that are above the reported background for groundwater. Radium-226, cesium-137, and cobalt-60 were not detected in the Main Hill Seeps water

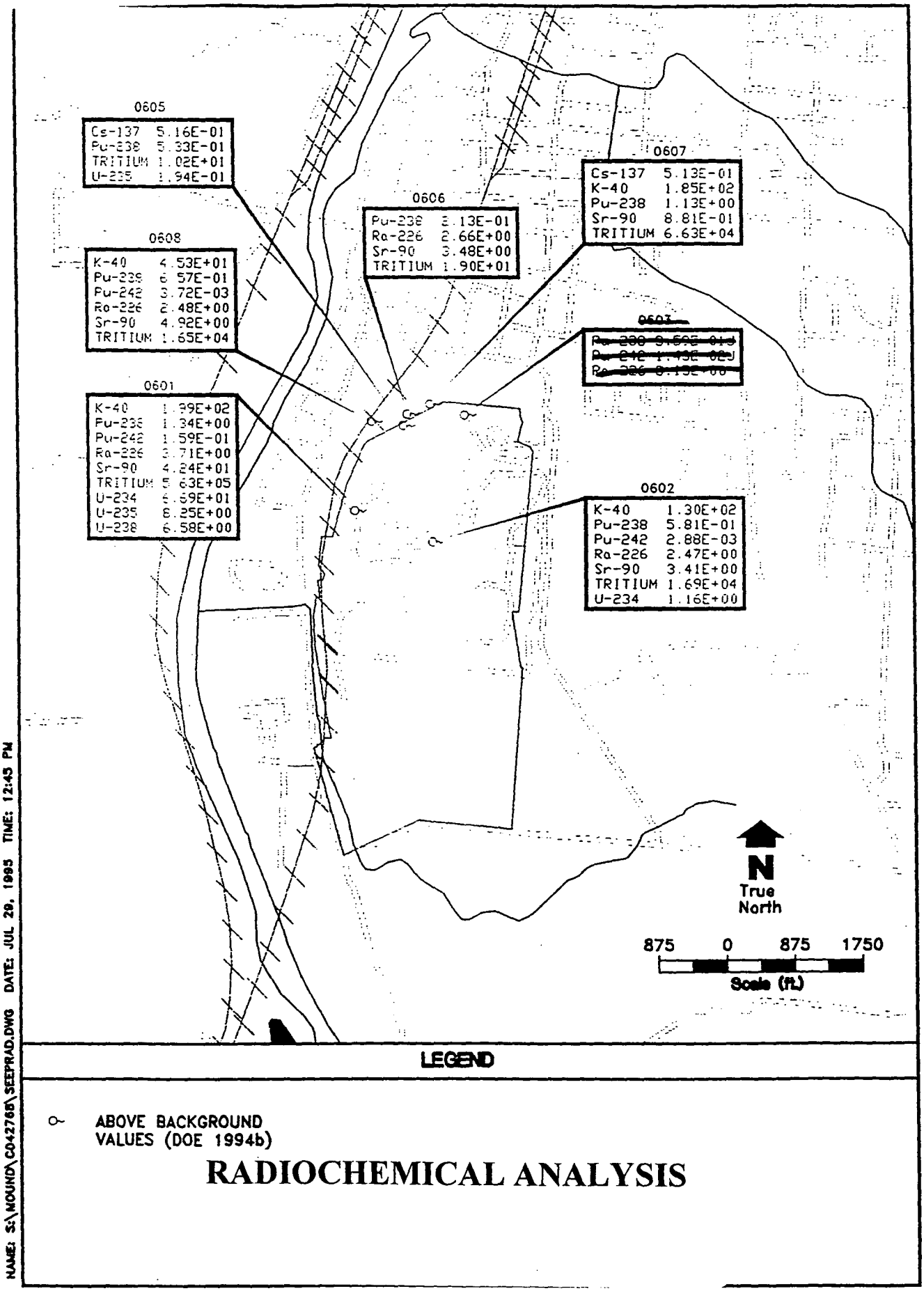


Figure 4.18. Radionuclides Found in the Main Hill Seep Samples (pCi/L).

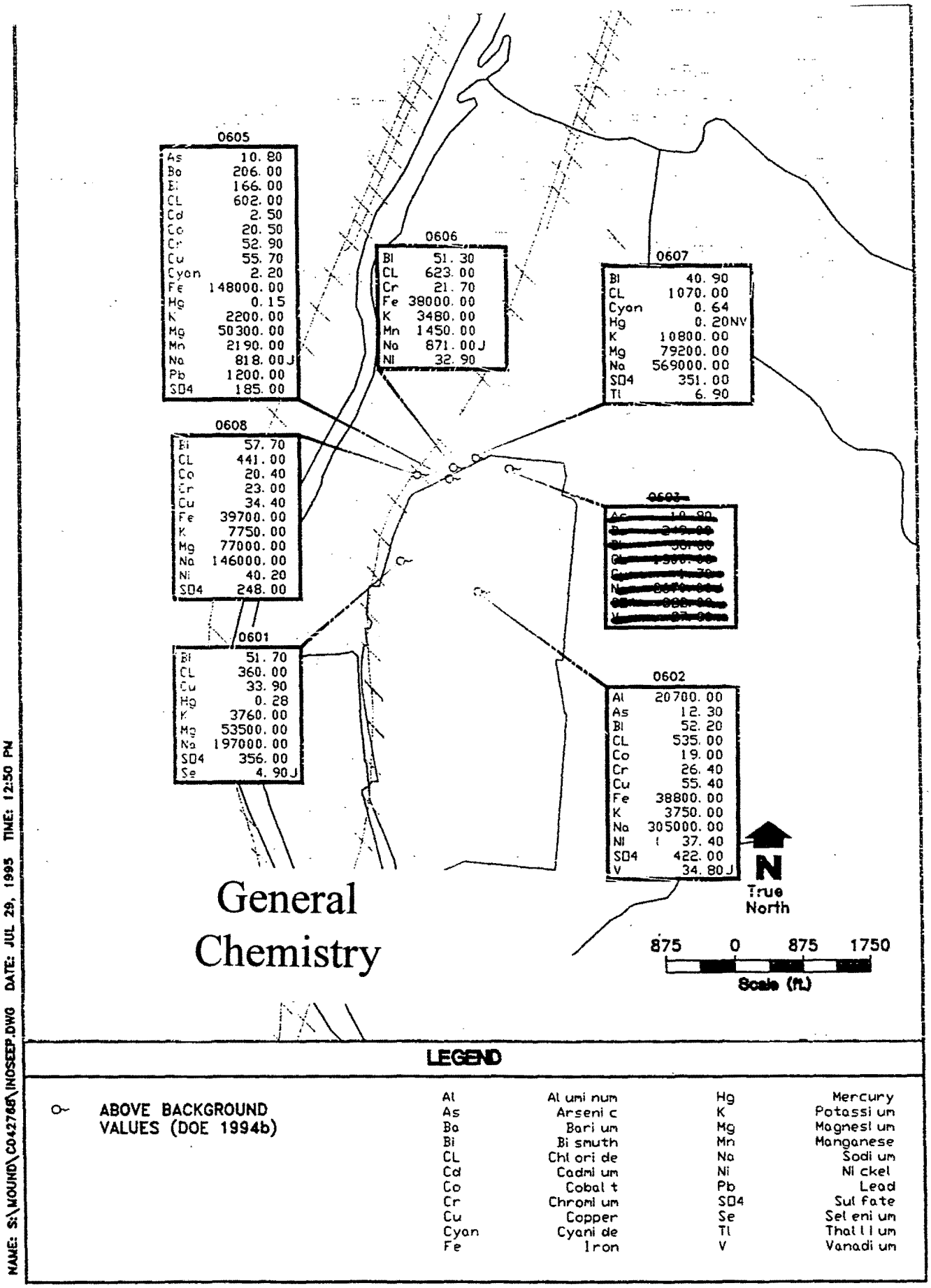


Figure 4.19. Inorganic and Anion Concentrations Above Background in the Main Hill Seeps Soil Samples (mg/kg).

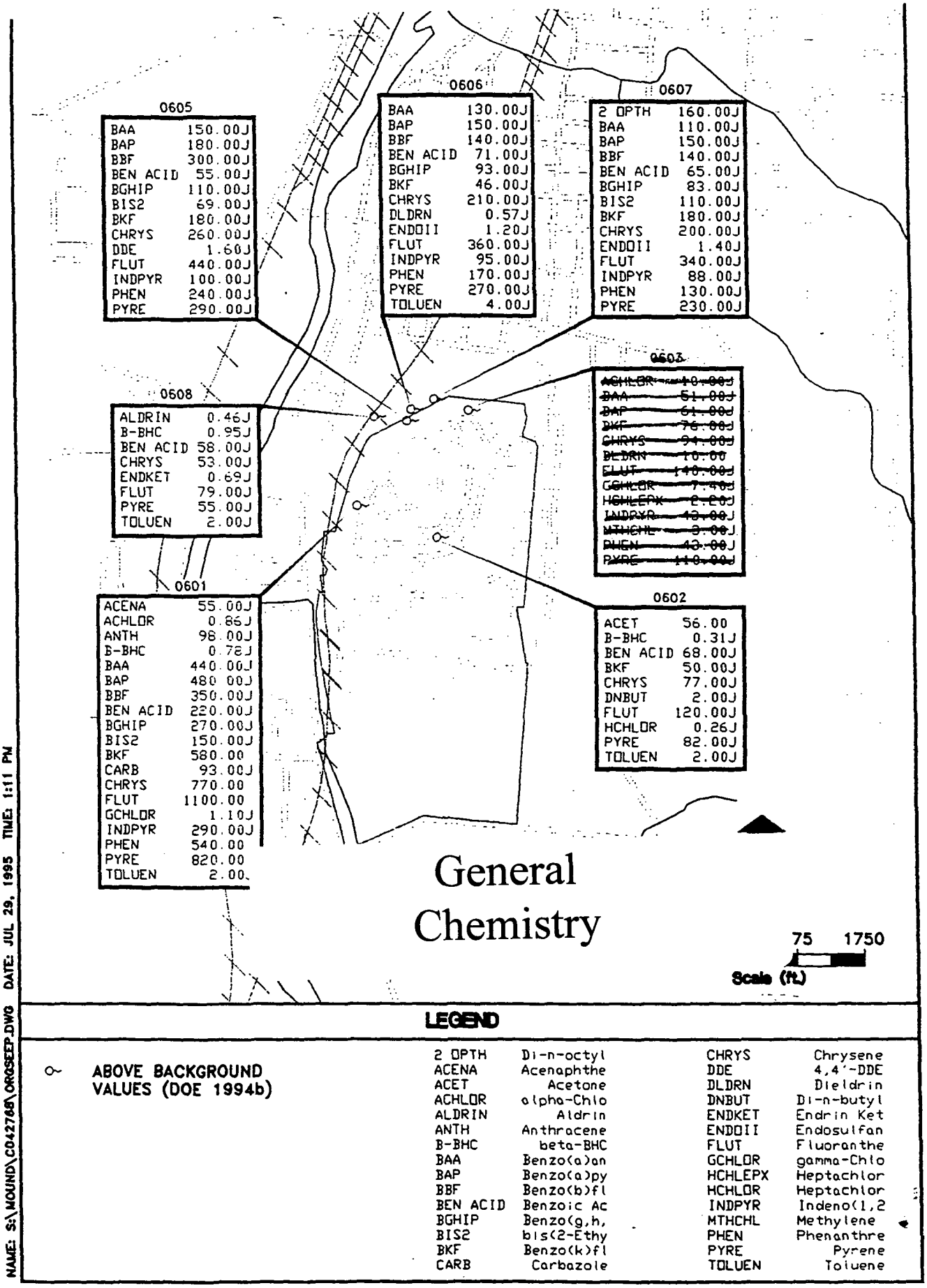


Figure 4.20. Pesticides/PCBs, VOCs, and SVOCs Above Background in the Main Hill Seeps Soil Samples (µg/kg).

Table IV.2. Radionuclide Concentrations in Main Hill Seeps Water Samples

Parameter	Concentration (pCi/L)			
	Location 601	Location 602	Location 607	Location 608
Potassium-40	199	130	185	---
Plutonium-238	**1.98**	---	1.13	---
Strontium-90	**42.4**	---	0.72	4.9
Tritium	**563,000**	16,900	66,300	16,500
Uranium-234	66	---	---	---
Uranium-238	6.6	---	---	---

--- Concentration not above background or analyte not detected
Bold Maximum concentration detected
NA Not available
pCi/L picocuries per liter

RADIOCHEMICAL ANALYSIS

samples. Plutonium-238, strontium-90, tritium, uranium-234, and uranium-238 exceeded the background values in at least one sample.

4.4.2.2. Inorganics

The inorganic concentrations in water samples for this investigation are shown in Table IV.3. Cobalt, copper, mercury, and selenium were not detected in the Main Hill Seeps water samples. Analytes aluminum, calcium, iron, magnesium, phosphorus, potassium, silver, sodium, and thallium, for which no background is available for comparison, were also detected.

4.4.2.3. Pesticides/PCBs

No pesticides or PCBs were detected in any of the Main Hill Seeps water samples.

4.4.2.4. VOCs and SVOCs

Three VOCs and two SVOCs were detected in the Main Hill Seeps water samples (Table IV.4) all at Seep 602.

4.4.2.5. Anions

Anions were detected in both onsite and offsite locations in the Main Hill Seeps water samples (Table IV.5). However, no background values are available for comparison. Maximum anion concentrations occur at location 607.

4.5. GEOTECHNICAL SAMPLING RESULTS

Seven soil samples from the Main Hill seeps and seven from borings along the NPDES pipeline were submitted to the contract laboratory for geotechnical analyses. In accordance with the OU9 Site-Wide FSP, specific parameters were selected for geotechnical testing. These parameters, as well as the method of analysis are listed in Table IV.6.

Table IV.3. Inorganic Concentrations in Main Hill Seeps Water Samples

Parameter	Concentration (mg/L)			
	Location 601	Location 602	Location 607	Location 608
Aluminum	81.5	0.304	0.081	2.11
Beryllium	.55	---	---	0.76
Calcium	169	34.1	231	210
Iron	1.91	1.17	0.10	3.77
Magnesium	43.7	7.4	79.2	77
Phosphorous	---	78	---	---
Potassium	3.2	2.5	10.8	7.8
Silver	---	3.2	---	---
Sodium	197	305	569	146
Thallium	---	---	6.9	---

--- Concentration not above background or analyte not detected
NA Not available
mg/L milligrams per liter

Table IV.4. VOC and SVOC Concentrations in Main Hill Seeps Water Samples

Parameter	Concentration (µg/L)
	Location 602
Bromoform	2
Chlorodibromomethane	3
Chloroform	1
Benzoic Acid	1
Di-n-butylphalate	2

NA Not available
µg/L microgram per liter

Table IV.5. Anion Concentrations in Main Hill Seeps Water Samples

Parameter	Concentration (mg/L)			
	Location 601	Location 602	Location 607	Location 608
Chloride	367	226	**1070**	441
Fluoride	0.17	0.17	**0.18**	—
Nitrate/Nitrite	15	1.4	**6.4**	3.7
Sulfate	92	79	**185**	104

— Analyte not detected
Bold Maximum concentration detected
NA Not available
mg/L milligram per liter

Table IV.6. Geotechnical Sampling: Test Methods Specified vs. Test Methods Used

Test Parameter	Test Method Specified by OU9 Field Sampling Plan	Test Method Used
Moisture Content	ASTM D2974-87	ASTM D2216
Organic Content	ASTM D2974-87	ASTM D2974-87
Particle-Size Analysis	ASTM D422-63	ASTM D422-63
Hydrogen Ion Content (pH)	SW846 9045	SW846 9045
Hydrogen Conductivity	ASTM D2434	ASTM 5084
Specific Gravity	ASTM D854-83	ASTM D854-83
Relative Density	ASTM 4254-83	—
Bulk Density	ASTM 4253-83	—
Cation Exchange Capacity	SW846 9080/9081	SW846 9080/9081

— Test not performed
ASTM American Society for Testing Materials

In several cases it was not possible to adhere to either the parameter or method listed on this table. For instance, tests for porosity, relative density, and bulk density were not performed due to the nature of the sampling method. In order to perform these tests and produce truly representative results, an undisturbed sample is required. Undisturbed samples are best acquired using a thin-walled tube sampler, such as a shelby tube, and hydraulically pressing it into the soil at the specified depth level. However, thin-walled tube samplers are relatively weak and ineffective in coarse-grained sediments that were encountered in the NPDES pipeline borings. The samples obtained in this investigation using small hand tools and split-spoon samplers, were highly disturbed since the original compaction and arrangement of the soil particles was lost in the collection process. Because the disturbed soil test results would not be representative of in-situ conditions, laboratory tests for these three parameters were not performed.

Additionally, the laboratory could not test for permeability or hydraulic conductivity using the requested method (ASTM D-2434) as that method is limited to disturbed granular soils containing not more than 10% soil passing the No. 200 sieve. Since many of the samples submitted contained more than 10% of the soil finer than a No. 200 sieve, the laboratory tested for permeability using ASTM standard method D5084-90.

No inherent problems were reported in testing for the remaining parameters. Results of the laboratory tests performed on the Main Hill Seep and NPDES geotechnical samples are listed in Table IV.7 which is followed by a brief discussion of the results. Graphs of the particle size distribution analyses for each geotechnical sample are presented in Appendix C.

4.5.1. Moisture Content

Moisture content of the Main Hill Seeps geotechnical samples ranges from 14.6% to 35.7%. The sample from Seep 601, comprised predominantly of sand, has the lowest moisture content (14.6%). Caution should be exercised when using these values of moisture content for comparison. At several seeps, a well-defined flow channel and wetted perimeter was present. It was possible at these sites to collect the samples outside the main flowpath and avoid overly saturated soils. Other seep locations did not have a well-defined seepage pathway but rather an entire area or portion of a hillside was noticeably wet. At these sites, it was not possible to avoid the visibly wet areas and still obtain representative samples.

Table IV.7. Results of Geotechnical Laboratory Analyses for Selected NPDES and Main Hill Seep Sediment Samples

Sample Number	Organic Matter Content (%)[a]	Moisture Content (%)[b]	Hydrogen Ion Content (pH) (std. units)	Cation Exchange Capacity (meq/100g)	Specific Gravity	Permeability (cm/sec)
S11301	2.2	14.6	7.8	7.8	2.70	NA
S21301	3.9	25.7	7.8	21.3	2.71	NA
S31301	4.2	25.8	7.8	12.5	2.72	NA
S51301	5.9	24.1	7.8	15.4	2.78	NA
S61301	3.3	22.9	8.1	7.7	2.75	NA
S71301	6.3	19.8	7.4	13.9	2.74	NA
S81301	1.6	19.9	8.6	7.2	2.82	NA
N03301	3.4	16.8	7.9	667	2.73	7.6E-07
N04301	5.62	23.41	7.9	13.6	2.74	1.9E-07
N05302	1.43	7.42	8.7	16.3	2.76	2.4E-04
N06301	3.23	8.88	8.4	19.5	2.67	2.7E-06
N06302	3.01	22.31	8.1	14.0	2.71	4.6E-08
N07301	1.56	8.618	8.0	22.2	2.77	1.2E-04
N08301	3.91	15.9	8.3	26.7	2.71	1.4E-07

NA Not available
[a] Percent of mass of oven-dried sample.
[b] Ratio of mass of water in pore spaces to the solid mass of material, expressed as a percentage.
% percent
std units Standard units
meq/100g milliequivalents per 100 grams
cm/sec centimeters per second

The range in moisture content of the NPDES samples is between 7.42% and 23.41%. Both sand and gravel samples (N05302 and N07301) have relatively low moisture contents. The sample from the clay unit (N06302) which directly overlies the sand and gravel stratigraphic layer at boring N06 has a relatively high moisture content (22.31%).

4.5.2. Organic Matter Content

Typically, organic matter comprises less than 5% of a soil. Organic materials in soil may effectively immobilize metals by complexation reactions or cation exchange. They can strongly sorb many solutes in soil water, particularly polyvalent cations. Soils with an increased organic matter content generally have a higher cation-exchange capacity and may slow the migration of metals through soil.

The organic matter content in the Main Hill Seep samples ranges between 1.6% and 6.3%. Samples from Seeps 605 and 607 are relatively high in organic matter (5.9% and 6.3% respectively). Sample S81301 obtained at Seep 608 has the lowest organic matter content 1.6% of all seep samples. However, this seep is located on the hillside adjacent to the Conrail tracks in the City of Miamisburg. At this location, shale bedrock is exposed at the surface and very little vegetation is present in the vicinity immediately surrounding the seep. The soil at this site is essentially weathered shale bedrock which could account for the low organic matter content.

Organic matter content of the NPDES samples ranges from 1.43 to 5.62%. The sample from boring N04 has a relatively high organic matter content (5.62%). Organic matter makes up less than 4% of the constituents in the remaining NPDES samples. The three NPDES samples collected at depths greater than 5 feet have lower organic matter contents than the samples obtained from shallower depths.

4.5.3. Particle Size Distribution

Soil texture or particle size is a physical characteristic that can influence the fixation of metals by soils. In general, finely textured soils immobilize trace and heavy metals to a greater extent than coarsely textured soils. Also, finely textured soils usually have a greater cation exchange capacity which is an important factor in heavy metal fixation. Coarse-grained soils typically have higher hydraulic conductivities and increased rates of ground water flow.

Graphs of particle-size distribution, as well as the associated test data sheets, for each NPDES and Main Hill Seep geotechnical soil sample are included in Appendix C. However, a qualitative comparison of the graphs reveal that four samples are comprised of predominantly coarse-grained material. NPDES samples N05302 and N07301 can both be classified as silty sand and gravel. These samples were obtained from the sand and gravel stratigraphic horizon in borings N05 and N07, respectively. The sample from the 1 to 3 foot interval in NPDES boring N06 is comprised of silty sand with gravel. The only seep sample which contained predominantly coarse grained sediments is from seep 601. This sample (S11301) is classified as a silty sand with gravel. All of the remaining seep and NPDES samples are comprised of relatively fine-grained silt and clay mixed with lesser quantities of sand. Approximately 95% of sample S81301, collected at Seep 608, is made up of silt and clay. It is likely that this sample is mostly weathering products from the shale bedrock exposed along the hillside.

4.5.4. Hydrogen Ion Content (pH)

Soil pH plays a very important role in the retention and mobility of trace and heavy metals in soil. The pH is a controlling factor in sorption-desorption reactions and precipitation-solubilization reactions. In addition the cation exchange capacity of soils generally increases with an increase in pH. Even with a soil that has a high affinity for a specific metal, the degree to which the metal is fixed is a function of pH. Soil pH has been determined to be a major factor along with cation exchange capacity for the fixation of lead by soils. Soil pH also influences the retention of such metals as zinc, molybdenum, mercury, and copper. The pH of the samples submitted for analyses range from 7.4 to 8.7 standard units, which indicates that the soils are slightly basic to basic.

4.5.5. Permeability

Laboratory permeability tests were performed on each of the NPDES geotechnical soil samples. Values for the NPDES samples range from 1.2×10^{-4} to 4.6×10^{-8} centimeters per second (cm/sec). As expected, samples N05302 and N07301 exhibit the highest permeability values. Both of these samples were obtained from the sand and gravel stratigraphic horizon penetrated by NPDES boreholes N05 and N07, respectively. The lowest permeability value was found in the 14 to 16 foot depth interval sample from boring N06. This low permeability clay directly overlies the sand and gravel stratigraphic horizon of much higher permeability.

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

MAIN HILL SEEP 601									
		S11301		S11302		S12301		S13301	
		902-S11301		902-S11302		902-S12301		902-S13301	
		H4475.D REG		H4476.D REG		H4477.D REG		H4478.D REG	
		6/20/94		6/20/94		6/20/94		6/20/94	
		Result	Val	Result	Val	Result	Val	Result	Val
Volatile Organics	**Units**								
Acetone	UG/KG	13	U	10	U	10	U	10	U
Acetonitrile	UG/KG	130	U	31	J	135	U	156	U
Acrylonitrile	UG/KG	130	U	122	U	135	U	156	U
Benzene	UG/KG	13	U	12	U	14	U	16	U
Bromodichloromethane	UG/KG	13	U	12	U	14	U	16	U
Bromoform	UG/KG	13	U	12	U	14	U	16	U
Bromomethane	UG/KG	13	UJ	12	UJ	14	UJ	16	UJ
2-Butanone	UG/KG	13	U	12	U	14	U	16	U
Carbon Disulfide	UG/KG	13	U	12	U	14	U	16	U
Carbon Tetrachloride	UG/KG	13	U	12	U	14	U	16	U
Chlorobenzene	UG/KG	13	U	12	U	14	U	16	U
Chlorodibromomethane	UG/KG	13	U	12	U	14	U	16	U
Chloroethane	UG/KG	13	U	12	U	14	U	16	U
Chloroform	UG/KG	13	U	12	U	14	U	16	U
Chloromethane	UG/KG	13	U	12	U	14	U	16	U
1,1-Dichloroethane	UG/KG	13	U	12	U	14	U	16	U
1,2-Dichloroethane	UG/KG	13	U	12	U	14	U	16	U
1,1-Dichloroethene	UG/KG	13	U	12	U	14	U	16	U
1,2-Dichloroethene	UG/KG	26	U	24	U	27	U	31	U
1,2-Dichloropropane	UG/KG	13	U	12	U	14	U	16	U
cis-1,3-Dichloropropene	UG/KG	13	U	12	U	14	U	16	U
trans-1,3-Dichloropropene	UG/KG	13	U	12	U	14	U	16	U
1,2-Diethylbenzene	UG/KG	26	U	24	U	27	U	31	U
Ethylbenzene	UG/KG	13	U	12	U	14	U	16	U
Hexane	UG/KG	13	U	12	U	14	U	16	U
2-Hexanone	UG/KG	13	U	12	U	14	U	16	U
Iodomethane	UG/KG	13	U	12	U	14	U	16	U
4-Methyl-2-pentanone	UG/KG	13	U	12	U	14	U	16	U
Methylene Chloride	UG/KG	13	U	12	U	14	U	16	U
Styrene	UG/KG	13	U	12	U	14	U	16	U
1,1,2,2-Tetrachloroethane	UG/KG	13	U	12	U	14	U	16	U
Tetrachloroethene	UG/KG	13	U	12	U	14	U	2	J
Toluene	UG/KG	13	U	12	U	2	J	16	U
1,1,1-Trichloroethane	UG/KG	13	U	12	U	14	U	16	U
1,1,2-Trichloroethane	UG/KG	13	U	12	U	14	U	16	U
Trichloroethene	UG/KG	13	U	12	U	14	U	16	U
Trichlorotrifluoroethane	UG/KG	13	U	12	U	14	U	16	U
Vinyl Acetate	UG/KG	13	U	12	U	14	U	16	U
Vinyl Chloride	UG/KG	13	U	12	U	14	U	16	U
Xylene, Total	UG/KG	26	U	24	U	27	U	31	U

General
Chemistry

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

MAIN HILL SEEP 601									
		S11301		S11302		S12301		S13301	
		902-S11301		902-S11302		902-S12301		902-S13301	
		A1601024.D REG		A1701025.D REG		A1801026.D REG		A0101031.D REG	
		6/20/94		6/20/94		6/20/94		6/20/94	
		Result	Val	Result	Val	Result	Val	Result	Val
Semi-volatile Organics	Units								
Acenaphthene	UG/KG	430	U	410	U	450	U	55	J
Acenaphthylene	UG/KG	430	U	410	U	450	U	520	U
Anthracene	UG/KG	430	U	410	U	450	U	98	J
Benzo(a)anthracene	UG/KG	83	J	410	U	450	U	440	J
Benzo(a)pyrene	UG/KG	97	J	410	U	450	U	480	J
Benzo(b)fluoranthene	UG/KG	88	J	410	U	450	U	350	J
Benzo(g,h,i)perylene	UG/KG	61	J	410	U	450	U	270	J
Benzo(k)fluoranthene	UG/KG	90	J	410	U	450	U	580	
Benzoic Acid	UG/KG	61	J	2000	U	58	J	220	J
Benzyl Alcohol	UG/KG	430	U	410	U	450	U	520	U
2-Benzyl-4-Chlorophenol	UG/KG	430	U	410	U	450	U	520	U
bis(2-Chloroethoxy)methane	UG/KG	430	U	410	U	450	U	520	U
bis(2-Chloroethyl)ether	UG/KG	430	U	410	U	450	U	520	U
bis(2-Ethylhexyl)phthalate	UG/KG	62	J	410	U	150	J	520	U
4-Bromophenyl-phenylether	UG/KG	430	U	410	U	450	U	520	U
Butylbenzylphthalate	UG/KG	430	U	410	U	450	U	520	U
Carbazole	UG/KG	430	U	410	U	450	U	93	J
4-Chloro-3-methylphenol	UG/KG	430	U	410	U	450	U	520	U
4-Chloroaniline	UG/KG	430	U	410	U	450	U	520	U
2-Chloronaphthalene	UG/KG	430	U	410	U	450	U	520	U
2-Chlorophenol	UG/KG	430	U	410	U	450	U	520	U
4-Chlorophenyl-phenylether	UG/KG	430	U	410	U	450	U	520	U
Chrysene	UG/KG	160	J	410	U	69	J	770	
Di-n-butylphthalate	UG/KG	430	U	410	U	450	U	520	U
Di-n-octylphthalate	UG/KG	430	U	410	U	450	U	520	U
Dibenzo(a,h)anthracene	UG/KG	430	U	410	U	450	U	520	U
Dibenzofuran	UG/KG	430	U	410	U	450	U	520	U
1,2-Dichlorobenzene	UG/KG	430	U	410	U	450	U	520	U
1,3-Dichlorobenzene	UG/KG	430	U	410	U	450	U	520	U
1,4-Dichlorobenzene	UG/KG	430	U	410	U	450	U	520	U
3,3'-Dichlorobenzidine	UG/KG	430	U	410	U	450	U	520	U
2,4-Dichlorophenol	UG/KG	430	U	410	U	450	U	520	U
Diethylphthalate	UG/KG	430	U	410	U	450	U	520	U
2,4-Dimethylphenol	UG/KG	430	U	410	U	450	U	520	U
Dimethylphthalate	UG/KG	430	U	410	U	450	U	520	U
4,6-Dinitro-2-methylphenol	UG/KG	1000	U	980	U	1100	U	1200	U
2,4-Dinitrophenol	UG/KG	1000	UJ	980	UJ	1100	UJ	1200	UJ
2,4-Dinitrotoluene	UG/KG	430	U	410	U	450	U	520	UJ
2,6-Dinitrotoluene	UG/KG	430	U	410	U	450	U	520	U
Fluoranthene	UG/KG	220	J	410	U	100	J	1100	
Fluorene	UG/KG	430	U	410	U	450	U	520	U
Hexachlorobenzene	UG/KG	430	U	410	U	450	U	520	U
Hexachlorobutadiene	UG/KG	430	U	410	U	450	U	520	U
Hexachlorocyclopentadiene	UG/KG	430	U	410	U	450	U	520	U
Hexachloroethane	UG/KG	430	U	410	U	450	U	520	U

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

MAIN HILL SEEP 601									
		S11301		S11302		S12301		S13301	
		902-S11301		902-S11302		902-S12301		902-S13301	
		A1601024.D REG		A1701025.D REG		A1801026.D REG		A0101031.D REG	
		6/20/94		6/20/94		6/20/94		6/20/94	
		Result	Val	Result	Val	Result	Val	Result	Val
Semi-volatile Organics	**Units**								
Isophorone	UG/KG	430	U	410	U	450	U	520	U
2-Methylnaphthalene	UG/KG	430	U	410	U	450	U	520	U
2-Methylphenol	UG/KG	430	U	410	U	450	U	520	U
4-Methylphenol	UG/KG	430	UJ	410	UJ	450	UJ	520	U
N-Nitroso-di-n-propylamine	UG/KG	430	UJ	410	UJ	450	UJ	520	U
N-Nitrosodiphenylamine	UG/KG	430	U	410	U	450	U	520	U
Naphthalene	UG/KG	430	U	410	U	450	U	520	U
2-Nitroaniline	UG/KG	1000	UJ	980	UJ	1100	UJ	1200	U
3-Nitroaniline	UG/KG	1000	U	980	U	1100	U	1200	U
4-Nitroaniline	UG/KG	1000	U	980	U	1100	U	1200	U
Nitrobenzene	UG/KG	430	U	410	U	450	U	520	U
2-Nitrophenol	UG/KG	430	U	410	U	450	U	520	U
4-Nitrophenol	UG/KG	1000	U	980	U	1100	U	1200	U
2,2'-oxybis(1-Chloropropane)	UG/KG	430	U	410	U	450	U	520	U
Pentachlorophenol	UG/KG	1000	U	980	U	1100	U	1200	U
Phenanthrene	UG/KG	110	J	410	U	61	J	540	
Phenol	UG/KG	430	U	410	U	450	U	520	U
Pyrene	UG/KG	170	J	410	U	78	J	820	
1,2,4-Trichlorobenzene	UG/KG	430	U	410	U	450	U	520	U
2,4,5-Trichlorophenol	UG/KG	1000	U	980	U	1100	U	1200	U
2,4,6-Trichlorophenol	UG/KG	430	U	410	U	450	U	520	U
Tentatively Identified Compounds		29		16		30		30	

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

MAIN HILL SEEP 601									
		S11301		S11302		S12301		S13301	
		902-S11301		902-S11302		902-S12301		902-S13301	
		36191-08 REG		36191-09 REG		36191-10 REG		36191-11 REG	
		6/20/94		6/20/94		6/20/94		6/20/94	
		Result	Val	Result	Val	Result	Val	Result	Val
Pesticides and PCBs	Units								
Aldrin	UG/KG	0.44	U	0.41	U	0.46	U	1.1	U
alpha-BHC	UG/KG	0.44	U	0.41	U	0.46	U	1.1	U
alpha-Chlordane	UG/KG	0.44	U	0.41	U	0.46	U	0.86	J
Aroclor 1232	UG/KG	8.6	U	8	U	8.9	U	20	U
Aroclor-1016	UG/KG	8.6	U	8	U	8.9	U	20	U
Aroclor-1221	UG/KG	17	U	16	U	18	U	42	U
Aroclor-1242	UG/KG	8.6	U	8	U	8.9	U	20	U
Aroclor-1248	UG/KG	8.6	U	8	U	8.9	U	20	U
Aroclor-1254	UG/KG	8.6	U	8	U	8.9	U	20	U
Aroclor-1260	UG/KG	8.6	U	8	U	8.9	U	20	U
beta-BHC	UG/KG	0.44	U	0.41	U	0.78	J	1.1	U
4,4'-DDD	UG/KG	0.86	U	0.8	U	0.89	U	2	U
4,4'-DDE	UG/KG	0.86	U	0.8	U	0.89	U	2	U
4,4'-DDT	UG/KG	0.86	U	0.8	U	0.89	U	2	U
delta-BHC	UG/KG	0.44	U	0.41	U	0.46	U	1.1	U
Dieldrin	UG/KG	0.86	U	0.8	U	0.89	U	2	U
Endosulfan I	UG/KG	0.44	U	0.41	U	0.46	U	1.1	U
Endosulfan II	UG/KG	0.86	UJ	0.8	UJ	0.89	UJ	2	UJ
Endosulfan Sulfate	UG/KG	0.86	U	0.8	U	0.89	U	2	U
Endrin	UG/KG	0.86	U	0.8	U	0.89	U	2	U
Endrin Aldehyde	UG/KG	0.86	U	0.8	U	0.89	U	2	U
Endrin Ketone	UG/KG	0.86	U	0.8	U	0.89	U	2	U
gamma-BHC (Lindane)	UG/KG	0.44	U	0.41	U	0.46	U	1.1	U
gamma-Chlordane	UG/KG	0.44	U	0.41	U	0.46	U	1.1	J
Heptachlor	UG/KG	0.44	U	0.41	U	0.46	U	1.1	U
Heptachlor Epoxide	UG/KG	0.44	U	0.41	U	0.46	U	1.1	U
p,p'-Methoxychlor	UG/KG	4.4	U	4.1	U	4.6	U	11	U
Toxaphene	UG/KG	44	U	41	U	46	U	110	U

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

MAIN HILL SEEP 601									
		S11301		S11302		S12301		S13301	
		902-S11301		902-S11302		902-S12301		902-S13301	
		3618908 REG		3618909 REG		3618910 REG		3618911 REG	
		6/20/94		6/20/94		6/20/94		6/20/94	
		Result	Val	Result	Val	Result	Val	Result	Val
Inorganics	Units								
Aluminum	MG/KG	5650		13300		3800		12000	
Antimony	MG/KG	0.81	R	0.76	R	0.84	R	0.97	R
Arsenic	MG/KG	4.6		1.2		4		4.9	
Barium	MG/KG	46.2		40.5		36.9		77.3	
Beryllium	MG/KG	0.34		0.68		0.24		0.67	
Bismuth	MG/KG	51.7		50.3		49.2		44.3	
Cadmium	MG/KG	0.6	U	0.56	U	0.62	U	0.72	U
Calcium	MG/KG	96200		85200	J	146000	J	82000	J
Chromium	MG/KG	9.9		19.6		11.8		19.9	
Cobalt	MG/KG	7.2		14.2		5.6		13.6	
Copper	MG/KG	15		22.6		13.4		33.9	
Cyanide	MG/KG	0.01	U	0.01	U	0.01	U	0.02	U
Iron	MG/KG	12600		26900		12200		26900	
Lead	MG/KG	10.1		4.5		15.7		16.6	
Magnesium	MG/KG	26500		10600		53500		12100	
Manganese	MG/KG	394		554		408		537	
Mercury	MG/KG	0.13	U	0.12	U	0.28		0.16	U
Nickel	MG/KG	12.9		29.8		17		25.3	
Potassium	MG/KG	1620		3760		1120		2850	
Selenium	MG/KG	0.52	UJ	4.9	J	0.54	UJ	0.62	UJ
Silver	MG/KG	1.3	U	1.2	U	1.3	U	1.5	U
Sodium	MG/KG	494	U	461	U	512	U	591	U
Thallium	MG/KG	0.94	U	0.88	U	0.98	U	1.1	U
Vanadium	MG/KG	11.1	J	15	J	7.8	J	17.4	J
Zinc	MG/KG	55.1	J	66.7	J	49.1	J	99.8	J

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

MAIN HILL SEEP 601									
		S11301		S11302		S12301		S13301	
		902-S11301		902-S11302		902-S12301		902-S13301	
		0362150011SA REG		0362150012SA REG		0362150013SA REG		0362150014SA REG	
		6/20/94		6/20/94		6/20/94		6/20/94	
		Result	Val	Result	Val	Result	Val	Result	Val
Anions	**Units**								
Chloride	MG/KG	59.7		62.2		225		264	
Fluoride	MG/KG	0.75		3.7		1.2		2.6	
Nitrate/Nitrite (NO3/NO2-N)	MG/KG	1	J	0.59	UJ	0.64	UJ	1	J
Sulfate	MG/KG	61		45.7		356		284	
		S11301		S11302		S12301		S13301	
		902-S11301		902-S11302		902-S12301		902-S13301	
		REG		0362150012SA REG		0362150013SA REG		0362150014SA REG	
		6/20/94		6/20/94		6/20/94		6/20/94	
		Result	Val	Result	Val	Result	Val	Result	Val
Miscellaneous	**Units**								
Cation Exchange Capacity as Na	MEQ/100	7.8							
PH	UNITS	7.8	J	8.2	J	7.4	J	7.3	J
Total Organic Carbon	%	0.7975		0.2		0.6		2	

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

MAIN HILL SEEP 601			
		S11301	
		902-S11301	
		0362150011SA REG	
		6/20/94	
		Result	Val
EXPLOSIVES	Units		
2-Amino-4,6-dinitrotoluene	UG/G	0.33	UJ
1,3-Dinitrobenzene	UG/G	0.33	UJ
2,4-Dinitrotoluene	UG/G	0.33	UJ
2,6-Dinitrotoluene	UG/G	0.34	UJ
HMX	UG/G	2.9	UJ
Nitrobenzene	UG/G	0.34	UJ
PETN	UG/G	1.3	UJ
RDX	UG/G	1.3	UJ
TETRYL	UG/G	0.85	UJ
1,3,5-Trinitrobenzene	UG/G	0.33	UJ
2,4,6-Trinitrotoluene	UG/G	0.33	UJ

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

MAIN HILL SEEP 601													
		S11301			S11302			S12301			S13301		
		902-S11301			902-S11302			902-S12301			902-S13301		
		3228675 REG			3228676 REG			3228671 REG			3228670 REG		
		34505			34505			34505			34505		
		Result	UNC	Val	Result	UNC	Val	Result	UNC	Val	Result	UNC	Val
Radiological	Units												
Am-241	PCI/G	0.0575	NA	U	0.114	NA	U	0.0851	NA	U	0.111	NA	U
Bi-207	PCI/G	0.0158	NA	U	0.0222	NA	U	0.0223	NA	U	0.0283	NA	U
Bi-210m	PCI/G	0.0161	NA	U	0.0247	NA	U	0.0257	NA	U	0.0331	NA	U
Co-60	PCI/G	0.0214	NA	U	0.0298	NA	U	0.0289	NA	U	0.0364	NA	U
Cs-137	PCI/G	0.0509	0.0158		0.0264	NA	U	0.0716	0.022		0.209	0.0381	
K-40	PCI/G	13.1	1.44		23.1	2.5		12.8	1.47		26.6	2.83	
Pu-238	PCI/G	0.941	0.12		0.565	0.0968	J	1.34	0.163		0.267	0.0498	
Pu-239/240	PCI/G	0.0077	0.00574		0.00532	NA	UJ	0.00638	NA	U	0.00643	0.0058	
Pu-242	PCI/G	0.00256	0.00297		0.00532	NA	UJ	0.00432	0.0039		0.00944	NA	U
Ra-226	PCI/G	1.43	0.401		1.44	0.619		1.31	0.583		2.91	0.821	
Sr-90	PCI/G	0.415	NA	U	0.549	NA	U	0.435	0.24	J	0.583	0.286	
Th-228	PCI/G	0.41	0.0836		0.649	0.117		0.45	0.0927		0.998	0.156	
Th-230	PCI/G	0.696	0.119		0.608	0.111		0.725	0.126		0.823	0.134	
Th-232	PCI/G	0.497	0.0932		0.688	0.122		0.457	0.0912		0.892	0.143	
Tritium	PCI/G	0.324	0.0699	R	0.43	0.0758	R	67.4	0.621		132	1.06	
U-234	PCI/G	0.61	0.126		0.837	0.15		0.828	0.151		1.47	0.244	
U-235	PCI/G	0.0243	0.0201		0.0482	ND	U	0.0222	0.0183		0.0896	0.0424	
U-238	PCI/G	0.565	0.119		0.8	0.145		0.652	0.128		0.906	0.17	

RADIOCHEMICAL ANALYSIS

General Chemistry

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

MAIN HILL SEEP 602									
		S21301		S21302		S22301		S23301	
		902-S21301		902-S21302		902-S22301		902-S23301	
		H4479.D REG		H4480.D REG		H4481.D REG		H4482.D REG	
		6/21/94		6/21/94		6/21/94		6/21/94	
		Result	Val	Result	Val	Result	Val	Result	Val
Volatile Organics	Units								
Acetone	UG/KG	46	U	56	=	34	U	14	U
Acetonitrile	UG/KG	135	U	126	U	133	U	145	U
Acrylonitrile	UG/KG	135	U	126	U	133	U	4	J
Benzene	UG/KG	14	U	13	U	13	U	14	U
Bromodichloromethane	UG/KG	14	U	13	U	13	U	14	U
Bromoform	UG/KG	14	U	13	U	13	U	14	U
Bromomethane	UG/KG	14	UJ	13	UJ	13	UJ	14	UJ
2-Butanone	UG/KG	12	J	9	J	7	J	14	U
Carbon Disulfide	UG/KG	14	U	13	U	13	U	14	U
Carbon Tetrachloride	UG/KG	14	U	13	U	13	U	14	U
Chlorobenzene	UG/KG	14	U	13	U	13	U	14	U
Chlorodibromomethane	UG/KG	14	U	13	U	13	U	14	U
Chloroethane	UG/KG	14	U	13	U	13	U	14	U
Chloroform	UG/KG	14	U	13	U	13	U	14	U
Chloromethane	UG/KG	14	U	13	U	13	U	14	U
1,1-Dichloroethane	UG/KG	14	U	13	U	13	U	14	U
1,2-Dichloroethane	UG/KG	14	U	13	U	13	U	14	U
1,1-Dichloroethene	UG/KG	14	U	13	U	13	U	14	U
1,2-Dichloroethene	UG/KG	27	U	25	U	27	U	29	U
1,2-Dichloropropane	UG/KG	14	U	13	U	13	U	14	U
cis-1,3-Dichloropropene	UG/KG	14	U	13	U	13	U	14	U
trans-1,3-Dichloropropene	UG/KG	14	U	13	U	13	U	14	U
1,2-Diethylbenzene	UG/KG	27	U	25	U	27	U	29	U
Ethylbenzene	UG/KG	14	U	13	U	13	U	14	U
Hexane	UG/KG	14	U	13	U	13	U	14	U
2-Hexanone	UG/KG	14	U	13	U	13	U	14	U
Iodomethane	UG/KG	14	U	13	U	13	U	14	U
4-Methyl-2-pentanone	UG/KG	14	U	2	J	13	U	14	U
Methylene Chloride	UG/KG	14	U	13	U	13	U	14	U
Styrene	UG/KG	14	U	13	U	13	U	14	U
1,1,2,2-Tetrachloroethane	UG/KG	14	U	13	U	13	U	14	U
Tetrachloroethene	UG/KG	14	U	13	U	13	U	14	U
Toluene	UG/KG	14	U	2	J	13	U	14	U
1,1,1-Trichloroethane	UG/KG	14	U	13	U	13	U	14	U
1,1,2-Trichloroethane	UG/KG	14	U	13	U	13	U	14	U
Trichloroethene	UG/KG	14	U	13	U	13	U	14	U
Trichlorotrifluoroethane	UG/KG	14	U	13	U	13	U	14	U
Vinyl Acetate	UG/KG	14	U	13	U	13	U	14	U
Vinyl Chloride	UG/KG	14	U	13	U	13	U	14	U
Xylene, Total	UG/KG	27	U	1	J	27	U	29	U

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

MAIN HILL SEEP 602									
		S21301		S21302		S22301		S23301	
		902-S21301		902-S21302		902-S22301		902-S23301	
		A0201032.D REG		A0501035.D REG		A0601036.D REG		A0701037.D REG	
		6/21/94		6/21/94		6/21/94		6/21/94	
		Result	Val	Result	Val	Result	Val	Result	Val
Semi-volatile Organics	**Units**								
Acenaphthene	UG/KG	450	U	420	U	440	U	480	U
Acenaphthylene	UG/KG	450	U	420	U	440	U	480	U
Anthracene	UG/KG	450	U	420	U	440	U	480	U
Benzo(a)anthracene	UG/KG	450	U	420	U	440	U	480	U
Benzo(a)pyrene	UG/KG	450	U	420	U	440	U	480	U
Benzo(b)fluoranthene	UG/KG	450	U	420	U	440	U	480	U
Benzo(g,h,i)perylene	UG/KG	450	U	420	U	440	U	480	U
Benzo(k)fluoranthene	UG/KG	450	U	420	U	440	U	50	J
Benzoic Acid	UG/KG	2200	U	2100	U	2200	U	68	J
Benzyl Alcohol	UG/KG	450	U	420	U	440	U	480	U
2-Benzyl-4-Chlorophenol	UG/KG	110	J	420	U	440	U	480	U
bis(2-Chloroethoxy)methane	UG/KG	450	U	420	U	440	U	480	U
bis(2-Chloroethyl)ether	UG/KG	450	U	420	U	440	U	480	U
bis(2-Ethylhexyl)phthalate	UG/KG	450	U	420	U	440	U	480	U
4-Bromophenyl-phenylether	UG/KG	450	U	420	U	440	U	480	U
Butylbenzylphthalate	UG/KG	450	U	420	U	440	U	480	U
Carbazole	UG/KG	450	U	420	U	440	U	480	U
4-Chloro-3-methylphenol	UG/KG	450	U	420	U	440	U	480	U
4-Chloroaniline	UG/KG	450	U	420	U	440	U	480	U
2-Chloronaphthalene	UG/KG	450	U	420	U	440	U	480	U
2-Chlorophenol	UG/KG	450	U	420	U	440	U	480	U
4-Chlorophenyl-phenylether	UG/KG	450	U	420	U	440	U	480	U
Chrysene	UG/KG	450	U	420	U	440	U	77	J
Di-n-butylphthalate	UG/KG	450	U	420	U	440	U	480	U
Di-n-octylphthalate	UG/KG	450	U	420	U	440	U	480	U
Dibenzo(a,h)anthracene	UG/KG	450	U	420	U	440	U	480	U
Dibenzofuran	UG/KG	450	U	420	U	440	U	480	U
1,2-Dichlorobenzene	UG/KG	450	U	420	U	440	U	480	U
1,3-Dichlorobenzene	UG/KG	450	U	420	U	440	U	480	U
1,4-Dichlorobenzene	UG/KG	450	U	420	U	440	U	480	U
3,3'-Dichlorobenzidine	UG/KG	450	U	420	U	440	U	480	U
2,4-Dichlorophenol	UG/KG	450	U	420	U	440	U	480	U
Diethylphthalate	UG/KG	450	U	420	U	440	U	480	U
2,4-Dimethylphenol	UG/KG	450	U	420	U	440	U	480	U
Dimethylphthalate	UG/KG	450	U	420	U	440	U	480	U
4,6-Dinitro-2-methylphenol	UG/KG	1100	U	1000	U	1100	U	1200	U
2,4-Dinitrophenol	UG/KG	1100	UJ	1000	UJ	1100	UJ	1200	UJ
2,4-Dinitrotoluene	UG/KG	450	UJ	420	UJ	440	UJ	480	UJ
2,6-Dinitrotoluene	UG/KG	450	U	420	U	440	U	480	U
Fluoranthene	UG/KG	450	U	420	U	61	J	120	J
Fluorene	UG/KG	450	U	420	U	440	U	480	U
Hexachlorobenzene	UG/KG	450	U	420	U	440	U	480	U
Hexachlorobutadiene	UG/KG	450	U	420	U	440	U	480	U
Hexachlorocyclopentadiene	UG/KG	450	U	420	U	440	U	480	U
Hexachloroethane	UG/KG	450	U	420	U	440	U	480	U

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

MAIN HILL SEEP 602									
		S21301		S21302		S22301		S23301	
		902-S21301		902-S21302		902-S22301		902-S23301	
		A0201032.D REG		A0501035.D REG		A0601036.D REG		A0701037.D REG	
		6/21/94		6/21/94		6/21/94		6/21/94	
		Result	Val	Result	Val	Result	Val	Result	Val
Semi-volatile Organics	Units								
Isophorone	UG/KG	450	U	420	U	440	U	480	U
2-Methylnaphthalene	UG/KG	450	U	420	U	440	U	480	U
2-Methylphenol	UG/KG	450	U	420	U	440	U	480	U
4-Methylphenol	UG/KG	450	U	420	U	440	U	480	U
N-Nitroso-di-n-propylamine	UG/KG	450	U	420	U	440	U	480	U
N-Nitrosodiphenylamine	UG/KG	450	U	420	U	440	U	480	U
Naphthalene	UG/KG	450	U	420	U	440	U	480	U
2-Nitroaniline	UG/KG	1100	U	1000	U	1100	U	1200	U
3-Nitroaniline	UG/KG	1100	U	1000	U	1100	U	1200	U
4-Nitroaniline	UG/KG	1100	U	1000	U	1100	U	1200	U
Nitrobenzene	UG/KG	450	U	420	U	440	U	480	U
2-Nitrophenol	UG/KG	450	U	420	U	440	U	480	U
4-Nitrophenol	UG/KG	1100	U	1000	U	1100	U	1200	U
2,2'-oxybis(1-Chloropropane)	UG/KG	450	U	420	U	440	U	480	U
Pentachlorophenol	UG/KG	1100	U	1000	U	1100	U	1200	U
Phenanthrene	UG/KG	450	U	420	U	440	U	480	U
Phenol	UG/KG	450	U	420	U	440	U	480	U
Pyrene	UG/KG	450	U	420	U	45	J	82	J
1,2,4-Trichlorobenzene	UG/KG	450	U	420	U	440	U	480	U
2,4,5-Trichlorophenol	UG/KG	1100	U	1000	U	1100	U	1200	U
2,4,6-Trichlorophenol	UG/KG	450	U	420	U	440	U	480	U
Tentatively Identified Compounds		30		21		30		30	

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

MAIN HILL SEEP 602									
		S21301		S21302		S22301		S23301	
		902-S21301		902-S21302		902-S22301		902-S23301	
		36191-12 REG		36191-13 REG		36191-14 REG		36191-15 REG	
		6/21/94		6/21/94		6/21/94		6/21/94	
		Result	Val	Result	Val	Result	Val	Result	Val
Pesticides and PCBs	Units								
Aldrin	UG/KG	0.46	U	0.43	U	0.45	U	0.49	U
alpha-BHC	UG/KG	0.46	U	0.43	U	0.45	U	0.49	U
alpha-Chlordane	UG/KG	0.46	U	0.43	U	0.45	U	0.49	U
Aroclor 1232	UG/KG	8.9	U	8.4	U	8.8	U	9.5	U
Aroclor-1016	UG/KG	8.9	U	8.4	U	8.8	U	9.5	U
Aroclor-1221	UG/KG	18	U	17	U	18	U	19	U
Aroclor-1242	UG/KG	8.9	U	8.4	U	8.8	U	9.5	U
Aroclor-1248	UG/KG	8.9	U	8.4	U	8.8	U	9.5	U
Aroclor-1254	UG/KG	8.9	U	8.4	U	8.8	U	9.5	U
Aroclor-1260	UG/KG	8.9	U	8.4	U	8.8	U	9.5	U
beta-BHC	UG/KG	0.31	J	0.43	U	0.45	U	0.49	U
4,4'-DDD	UG/KG	0.89	U	0.84	U	0.88	U	0.95	U
4,4'-DDE	UG/KG	0.89	U	0.84	U	0.88	U	0.95	U
4,4'-DDT	UG/KG	0.89	U	0.84	U	0.88	U	0.95	U
delta-BHC	UG/KG	0.46	U	0.43	U	0.45	U	0.49	U
Dieldrin	UG/KG	0.89	U	0.84	U	0.88	U	0.95	U
Endosulfan I	UG/KG	0.46	U	0.43	U	0.45	U	0.49	U
Endosulfan II	UG/KG	0.89	UJ	0.84	UJ	0.88	UJ	0.95	UJ
Endosulfan Sulfate	UG/KG	0.89	U	0.84	U	0.88	U	0.95	U
Endrin	UG/KG	0.89	U	0.84	U	0.88	U	0.95	U
Endrin Aldehyde	UG/KG	0.89	U	0.84	U	0.88	U	0.95	U
Endrin Ketone	UG/KG	0.89	U	0.84	U	0.88	U	0.95	U
gamma-BHC (Lindane)	UG/KG	0.46	U	0.43	U	0.45	U	0.49	U
gamma-Chlordane	UG/KG	0.46	U	0.43	U	0.45	U	0.49	U
Heptachlor	UG/KG	0.26	J	0.43	U	0.45	U	0.49	U
Heptachlor Epoxide	UG/KG	0.46	U	0.43	U	0.45	U	0.49	U
p,p'-Methoxychlor	UG/KG	4.6	U	4.3	U	4.5	U	4.9	U
Toxaphene	UG/KG	46	U	43	U	45	U	49	U

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

MAIN HILL SEEP 602									
		S21301		S21302		S22301		S23301	
		902-S21301		902-S21302		902-S22301		902-S23301	
		3618912 REG		3618913 REG		3618914 REG		3618915 REG	
		6/21/94		6/21/94		6/21/94		6/21/94	
		Result	Val	Result	Val	Result	Val	Result	Val
Inorganics	**Units**								
Aluminum	MG/KG	17300		20700		16300		13400	
Antimony	MG/KG	0.84	R	0.79	R	0.82	R	0.9	R
Arsenic	MG/KG	5		10.4		3.9		12.3	
Barium	MG/KG	106		101		47.5		75.8	
Beryllium	MG/KG	0.9		1		0.92		0.74	
Bismuth	MG/KG	49.2		51.2		52.2		46.7	
Cadmium	MG/KG	0.62	U	0.58	U	0.61	U	0.67	U
Calcium	MG/KG	40700	J	4540	J	85600	J	57700	J
Chromium	MG/KG	23		26.4		21.5		20.9	
Cobalt	MG/KG	15.9		17.5		19		13.4	
Copper	MG/KG	25.8		26.7		23.1		28.5	
Cyanide	MG/KG	0.01	U	0.01	U	0.01	U	0.01	U
Iron	MG/KG	32600		38800		31800		30000	
Lead	MG/KG	9.8		15.2		12.1		19.7	
Magnesium	MG/KG	7260		5770		9140		12100	
Manganese	MG/KG	1180		1060		782		570	
Mercury	MG/KG	0.14	U	0.13	U	0.13	U	0.14	U
Nickel	MG/KG	33.2		37.4		34.3		27.6	
Potassium	MG/KG	3750		2800		3420		2650	
Selenium	MG/KG	0.54	UJ	0.51	UJ	0.53	UJ	0.58	UJ
Silver	MG/KG	1.3	U	1.2	U	1.3	U	1.4	U
Sodium	MG/KG	725		752		710		947	
Thallium	MG/KG	0.98	U	0.91	U	0.96	U	1	U
Vanadium	MG/KG	22.3	J	34.8	J	21.4		22.1	J
Zinc	MG/KG	65.1	J	79.9	J	69	J	79.4	J

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

MAIN HILL SEEP 602									
		S21301		S21302		S22301		S23301	
		902-S21301		902-S21302		902-S22301		902-S23301	
		0362150015SA REG		0362150016SA REG		0362150017SA REG		0362150018SA REG	
		6/21/94		6/21/94		6/21/94		6/21/94	
		Result	Val	Result	Val	Result	Val	Result	Val
Anions	**Units**								
Chloride	MG/KG	280		535		114		227	
Fluoride	MG/KG	2.1		1.4		1.6		2.5	
Nitrate/Nitrite (NO3/NO2-N)	MG/KG	0.66	UJ	0.65	UJ	0.66	UJ	1.5	J
Sulfate	MG/KG	292		392		92.1		422	
		S21301		S21302		S22301		S23301	
		902-S21301		902-S21302		902-S22301		902-S23301	
		0362150015SA REG		0362150016SA REG		0362150017SA REG		0362150018SA REG	
		6/21/94		6/21/94		6/21/94		6/21/94	
		Result	Val	Result	Val	Result	Val	Result	Val
Miscellaneous	**Units**								
Cation Exchange Capacity as Na	MEQ/100	21.3							
PH	UNITS	7.8	J	7.6	J	7.8	J	7.6	J
Total Organic Carbon	%	0.6633		0.575		0.315		1.75	

MAIN HILL SEEP 602			
		S21301	
		902-S21301	
		0362150015SA REG	
		6/21/94	
		Result	Val
EXPLOSIVES	Units		
2-Amino-4,6-dinitrotoluene	UG/G	0.34	UJ
1,3-Dinitrobenzene	UG/G	0.34	UJ
2,4-Dinitrotoluene	UG/G	0.34	UJ
2,6-Dinitrotoluene	UG/G	0.35	UJ
HMX	UG/G	3	UJ
Nitrobenzene	UG/G	0.35	UJ
PETN	UG/G	1.4	UJ
RDX	UG/G	1.4	UJ
TETRYL	UG/G	0.88	UJ
1,3,5-Trinitrobenzene	UG/G	0.34	UJ
2,4,6-Trinitrotoluene	UG/G	0.34	UJ

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

MAIN HILL SEEP 602													
		S21301			S21302			S22301			S23301		
		902-S21301			902-S21302			902-S22301			902-S23301		
		3228663 REG			3228664 REG			3228665 REG			3228666 REG		
		34506			34506			34506			34506		
		Result	UNC	Val	Result	UNC	Val	Result	UNC	Val	Result	UNC	Val
Radiological	Units												
Am-241	PCI/G	0.112	NA	U	0.169	NA	U	0.183	NA	U	0.115	NA	U
Bi-207	PCI/G	0.0269	NA	U	0.0675	NA	U	0.0682	NA	U	0.0274	NA	U
Bi-210m	PCI/G	0.0294	NA	U	0.072	NA	U	0.0655	NA	U	0.0306	NA	U
Co-60	PCI/G	0.0345	NA	U	0.089	NA	U	0.101	NA	U	0.0402	NA	U
Cs-137	PCI/G	0.115	0.0319		0.0765	NA	U	0.262	0.0755		0.32	0.046	
K-40	PCI/G	26.8	2.79		28.5	3.53		31.6	3.69		29.4	3.11	
Pu-238	PCI/G	0.284	0.0488		0.154	0.035		0.501	0.0675		0.584	0.092	J
Pu-239/240	PCI/G	0.00809	NA	U	0.0128	NA	U	0.00866	NA	U	0.0156	0.0101	J
Pu-242	PCI/G	0.00808	NA	U	0.0128	NA	U	0.00288	0.00289		0.00423	NA	UJ
Ra-226	PCI/G	2.47	0.7		1.28	NA	U	1.06	NA	U	2.3	0.768	
Sr-90	PCI/G	0.605	NA	U	1.55	0.339		16	0.896	J	0.755	NA	U
Th-228	PCI/G	1.06	0.175		1.2	0.178		1.09	0.169		0.985	0.152	
Th-230	PCI/G	1	0.166		1.36	0.198		0.866	0.14		1.03	0.157	
Th-232	PCI/G	1.01	0.166		1.07	0.163		1.05	0.163		0.846	0.135	
Tritium	PCI/G	1.37	0.114		1.25	0.0966		2.42	0.139		3.04	0.182	
U-234	PCI/G	0.963	0.172		1.16	0.203		0.793	0.152		0.819	0.145	
U-235	PCI/G	0.035	NA	U	0.0575	NA	U	0.05	0.0341		0.06	0.0312	
U-238	PCI/G	0.849	0.158		1.07	0.192		0.827	0.156		0.803	0.143	

RADIOCHEMICAL ANALYSIS

MAIN HILL SEEP 605							
		S51301		S52301		S53301	
		902-S51301		902-S52301		902-S53301	
		H4502.D REG		H4503.D REG		H4504.D REG	
		6/22/94		6/22/94		6/22/94	
		Result	Val	Result	Val	Result	Val
Volatile Organics	Units						
Acetone	UG/KG	15	U	15	U	13	U
Acetonitrile	UG/KG	154	U	152	U	128	U
Acrylonitrile	UG/KG	154	U	152	U	128	U
Benzene	UG/KG	15	U	15	U	13	U
Bromodichloromethane	UG/KG	15	U	15	U	13	U
Bromoform	UG/KG	15	U	15	U	13	U
Bromomethane	UG/KG	15	U	15	U	13	U
2-Butanone	UG/KG	15	U	15	U	13	U
Carbon Disulfide	UG/KG	15	U	15	U	13	U
Carbon Tetrachloride	UG/KG	15	U	15	U	13	U
Chlorobenzene	UG/KG	15	U	15	U	13	U
Chlorodibromomethane	UG/KG	15	U	15	U	13	U
Chloroethane	UG/KG	15	U	15	U	13	U
Chloroform	UG/KG	15	U	15	U	13	U
Chloromethane	UG/KG	15	U	15	U	13	U
1,1-Dichloroethane	UG/KG	15	U	15	U	13	U
1,2-Dichloroethane	UG/KG	15	U	15	U	13	U
1,1-Dichloroethene	UG/KG	15	U	15	U	13	U
1,2-Dichloroethene	UG/KG	31	U	30	U	26	U
1,2-Dichloropropane	UG/KG	15	U	15	U	13	U
cis-1,3-Dichloropropene	UG/KG	15	U	15	U	13	U
trans-1,3-Dichloropropene	UG/KG	15	U	15	U	13	U
1,2-Diethylbenzene	UG/KG	31	U	30	U	26	U
Ethylbenzene	UG/KG	15	U	15	U	13	U
Hexane	UG/KG	15	U	15	U	13	U
2-Hexanone	UG/KG	15	U	15	U	13	U
Iodomethane	UG/KG	15	U	15	U	13	U
4-Methyl-2-pentanone	UG/KG	15	U	15	U	13	U
Methylene Chloride	UG/KG	15	U	15	U	13	U
Styrene	UG/KG	15	U	15	U	13	U
1,1,2,2-Tetrachloroethane	UG/KG	15	U	15	U	13	U
Tetrachloroethene	UG/KG	15	U	15	U	13	U
Toluene	UG/KG	15	U	15	U	13	U
1,1,1-Trichloroethane	UG/KG	15	U	15	U	13	U
1,1,2-Trichloroethane	UG/KG	15	U	15	U	13	U
Trichloroethene	UG/KG	15	U	15	U	13	U
Trichlorotrifluoroethane	UG/KG	15	U	15	U	13	U
Vinyl Acetate	UG/KG	15	U	15	U	13	U
Vinyl Chloride	UG/KG	15	U	15	U	13	U
Xylene, Total	UG/KG	31	U	30	U	26	U

General Chemistry

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

MAIN HILL SEEP 605							
		S51301		S52301		S53301	
		902-S51301		902-S52301		902-S53301	
		A0601155.D REG		A0701156.D REG		A0801157.D REG	
		6/22/94		6/22/94		6/22/94	
		Result	Val	Result	Val	Result	Val
Semi-volatile Organics	Units						
Acenaphthene	UG/KG	510	U	500	U	430	U
Acenaphthylene	UG/KG	510	U	500	U	430	U
Anthracene	UG/KG	510	U	500	U	430	U
Benzo(a)anthracene	UG/KG	150	J	150	J	78	J
Benzo(a)pyrene	UG/KG	180	J	170	J	90	J
Benzo(b)fluoranthene	UG/KG	300	J	180	J	87	J
Benzo(g,h,i)perylene	UG/KG	110	J	100	J	54	J
Benzo(k)fluoranthene	UG/KG	510	U	180	J	110	J
Benzoic Acid	UG/KG	2500	U	55	J	49	J
Benzyl Alcohol	UG/KG	510	U	500	U	430	U
2-Benzyl-4-Chlorophenol	UG/KG	510	UJ	500	UJ	430	UJ
bis(2-Chloroethoxy)methane	UG/KG	510	U	500	U	430	U
bis(2-Chloroethyl)ether	UG/KG	510	U	500	U	430	U
bis(2-Ethylhexyl)phthalate	UG/KG	510	UJ	69	J	430	UJ
4-Bromophenyl-phenylether	UG/KG	510	U	500	U	430	U
Butylbenzylphthalate	UG/KG	510	U	500	U	430	U
Carbazole	UG/KG	510	U	500	U	430	U
4-Chloro-3-methylphenol	UG/KG	510	U	500	U	430	U
4-Chloroaniline	UG/KG	510	U	500	U	430	U
2-Chloronaphthalene	UG/KG	510	U	500	U	430	U
2-Chlorophenol	UG/KG	510	U	500	U	430	U
4-Chlorophenyl-phenylether	UG/KG	510	U	500	U	430	U
Chrysene	UG/KG	260	J	240	J	130	J
Di-n-butylphthalate	UG/KG	510	U	500	U	430	U
Di-n-octylphthalate	UG/KG	510	U	500	U	430	U
Dibenzo(a,h)anthracene	UG/KG	510	U	500	U	430	U
Dibenzofuran	UG/KG	510	U	500	U	430	U
1,2-Dichlorobenzene	UG/KG	510	U	500	U	430	U
1,3-Dichlorobenzene	UG/KG	510	U	500	U	430	U
1,4-Dichlorobenzene	UG/KG	510	U	500	U	430	U
3,3'-Dichlorobenzidine	UG/KG	510	U	500	U	430	U
2,4-Dichlorophenol	UG/KG	510	U	500	U	430	U
Diethylphthalate	UG/KG	510	U	500	U	430	U
2,4-Dimethylphenol	UG/KG	510	U	500	U	430	U
Dimethylphthalate	UG/KG	510	U	500	U	430	U
4,6-Dinitro-2-methylphenol	UG/KG	1200	U	1200	U	1000	U
2,4-Dinitrophenol	UG/KG	1200	U	1200	U	1000	U
2,4-Dinitrotoluene	UG/KG	510	U	500	U	430	U
2,6-Dinitrotoluene	UG/KG	510	U	500	U	430	U
Fluoranthene	UG/KG	440	J	420	J	200	J
Fluorene	UG/KG	510	U	500	U	430	U
Hexachlorobenzene	UG/KG	510	U	500	U	430	U
Hexachlorobutadiene	UG/KG	510	U	500	U	430	U
Hexachlorocyclopentadiene	UG/KG	510	U	500	U	430	U
Hexachloroethane	UG/KG	510	U	500	U	430	U
Indeno(1,2,3-c,d)pyrene	UG/KG	99	J	100	J	50	J

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

MAIN HILL SEEP 605							
		S51301		S52301		S53301	
		902-S51301		902-S52301		902-S53301	
		A0601155.D REG		A0701156.D REG		A0801157.D REG	
		6/22/94		6/22/94		6/22/94	
		Result	Val	Result	Val	Result	Val
Semi-volatile Organics	Units						
Isophorone	UG/KG	510	U	500	U	430	U
2-Methylnaphthalene	UG/KG	510	U	500	U	430	U
2-Methylphenol	UG/KG	510	U	500	U	430	U
4-Methylphenol	UG/KG	510	U	500	U	430	U
N-Nitroso-di-n-propylamine	UG/KG	510	U	500	U	430	U
N-Nitrosodiphenylamine	UG/KG	510	U	500	U	430	U
Naphthalene	UG/KG	510	U	500	U	430	U
2-Nitroaniline	UG/KG	1200	U	1200	U	1000	U
3-Nitroaniline	UG/KG	1200	U	1200	U	1000	U
4-Nitroaniline	UG/KG	1200	UJ	1200	UJ	1000	UJ
Nitrobenzene	UG/KG	510	U	500	U	430	U
2-Nitrophenol	UG/KG	510	U	500	U	430	U
4-Nitrophenol	UG/KG	1200	U	1200	U	1000	U
2,2'-oxybis(1-Chloropropane)	UG/KG	510	U	500	U	430	U
Pentachlorophenol	UG/KG	1200	U	1200	U	1000	U
Phenanthrene	UG/KG	200	J	240	J	92	J
Phenol	UG/KG	510	U	500	U	430	U
Pyrene	UG/KG	290	J	290	J	140	J
1,2,4-Trichlorobenzene	UG/KG	510	U	500	U	430	U
2,4,5-Trichlorophenol	UG/KG	1200	U	1200	U	1000	U
2,4,6-Trichlorophenol	UG/KG	510	U	500	U	430	U
Tentatively Identified Compounds		30		30		30	

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

MAIN HILL SEEP 605							
		S51301		S52301		S53301	
		902-S51301		902-S52301		902-S53301	
		36433-14 REG		36433-15 REG		36433-16 REG	
		6/22/94		6/22/94		6/22/94	
		Result	Val	Result	Val	Result	Val
Pesticides and PCBs	Units						
Aldrin	UG/KG	1	U	1	U	0.87	U
alpha-BHC	UG/KG	1	U	1	U	0.87	U
alpha-Chlordane	UG/KG	1	U	1	U	0.87	U
Aroclor 1232	UG/KG	20	U	20	U	17	U
Aroclor-1016	UG/KG	20	U	20	U	17	U
Aroclor-1221	UG/KG	41	U	40	U	34	U
Aroclor-1242	UG/KG	20	U	20	U	17	U
Aroclor-1248	UG/KG	20	U	20	U	17	U
Aroclor-1254	UG/KG	17	J	6.4	J	4.8	J
Aroclor-1260	UG/KG	20	U	20	U	17	U
beta-BHC	UG/KG	1	U	1	U	0.87	U
4,4'-DDD	UG/KG	2	U	2.7		1.7	U
4,4'-DDE	UG/KG	1.6	J	2	U	1.7	U
4,4'-DDT	UG/KG	2	U	2	U	1.7	U
delta-BHC	UG/KG	1	U	1	U	0.87	U
Dieldrin	UG/KG	2	U	2	U	1.7	U
Endosulfan I	UG/KG	1	U	1	U	0.87	U
Endosulfan II	UG/KG	2	UJ	2	UJ	1.7	UJ
Endosulfan Sulfate	UG/KG	2	U	2	U	1.7	U
Endrin	UG/KG	2	U	2	U	1.7	U
Endrin Aldehyde	UG/KG	2	U	2	U	1.7	U
Endrin Ketone	UG/KG	2	U	2	U	1.7	U
gamma-BHC (Lindane)	UG/KG	1	U	1	U	0.87	U
gamma-Chlordane	UG/KG	1	U	1	U	0.87	U
Heptachlor	UG/KG	1	U	1	U	0.87	U
Heptachlor Epoxide	UG/KG	1	U	1	U	0.87	U
p,p'-Methoxychlor	UG/KG	10	UJ	10	UJ	8.7	UJ
Toxaphene	UG/KG	100	U	100	U	87	U

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

MAIN HILL SEEP 605							
		S51301		S52301		S53301	
		902-S51301		902-S52301		902-S53301	
		3643514 REG		3643515 REG		3643516 REG	
		6/22/94		6/22/94		6/22/94	
		Result	Val	Result	Val	Result	Val
Inorganics	Units						
Aluminum	MG/KG	9490		4910		3340	
Antimony	MG/KG	0.96	R	0.93	R	0.79	R
Arsenic	MG/KG	9		7.9		10.8	
Barium	MG/KG	206		56.4		42.6	
Beryllium	MG/KG	0.6		0.23		0.22	
Bismuth	MG/KG	51.3		166		108	
Cadmium	MG/KG	2.5		1.3		1.9	
Calcium	MG/KG	114000	J	183000	J	129000	J
Chromium	MG/KG	52.9		20.4		16.7	
Cobalt	MG/KG	20.5		8.4		9.8	
Copper	MG/KG	55.7		35.5		45	
Cyanide	MG/KG	0.77	U	2.2		2.1	
Iron	MG/KG	77800		72000		148000	
Lead	MG/KG	1100		1200		926	
Magnesium	MG/KG	7630		50300		46000	
Manganese	MG/KG	2190		538		769	
Mercury	MG/KG	0.15		0.15	U	0.13	U
Nickel	MG/KG	28		16.8		24.4	
Potassium	MG/KG	2200		981		677	
Selenium	MG/KG	0.62	UJ	0.6	UJ	0.51	UJ
Silver	MG/KG	1.5	U	1.4	U	2.4	U
Sodium	MG/KG	818	J	569	U	964	U
Thallium	MG/KG	1.1	U	1.1	U	0.92	U
Vanadium	MG/KG	11.8		6.8		4.2	
Zinc	MG/KG	135		75.2		42.3	

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

MAIN HILL SEEP 605							
		S51301		S52301		S53301	
		902-S51301		902-S52301		902-S53301	
		REG		0364340016SA REG		0364340017SA REG	
		6/22/94		6/22/94		6/22/94	
		Result	Val	Result	Val	Result	Val
Anions	Units						
Chloride	MG/KG	602		224		495	
Fluoride	MG/KG	2		1.5		0.92	
Nitrate/Nitrite (NO3/NO2-N)	MG/KG	3.2		6		0.64	U
Sulfate	MG/KG	115		45.2		185	
		S51301		S52301		S53301	
		902-S51301		902-S52301		902-S53301	
		REG		0364340016SA REG		0364340017SA REG	
		6/22/94		6/22/94		6/22/94	
		Result	Val	Result	Val	Result	Val
Miscellaneous	Units						
Cation Exchange Capacity as Na	MEQ/100	15.4					
PH	UNITS	7.8	J	7.7	J	8.3	J
Total Organic Carbon	%	3.45		1.1		1.825	

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

MAIN HILL SEEP 605			
		S51301	
		902-S51301	
		0364340015SA REG	
		6/22/94	
		Result	Val
EXPLOSIVES	Units		
2-Amino-4,6-dinitrotoluene	UG/G	0.38	U
1,3-Dinitrobenzene	UG/G	0.38	U
2,4-Dinitrotoluene	UG/G	0.38	U
2,6-Dinitrotoluene	UG/G	0.4	U
HMX	UG/G	3.4	U
Nitrobenzene	UG/G	0.4	U
PETN	UG/G	1.5	U
RDX	UG/G	1.5	U
TETRYL	UG/G	1	U
1,3,5-Trinitrobenzene	UG/G	0.38	U
2,4,6-Trinitrotoluene	UG/G	0.38	U

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

MAIN HILL SEEP 605										
		S51301			S52301			S53301		
		902-S51301			902-S52301			902-S53301		
		3229413 REG			3229414 REG			3229415 REG		
		34507			34507			34507		
		Result	UNC	Val	Result	UNC	Val	Result	UNC	Val
Radiological	Units									
Am-241	PCI/G	0.118	NA	U	0.0511	NA	U	0.0812	NA	U
Bi-207	PCI/G	0.0282	NA	U	0.0144	NA	U	0.0167	NA	U
Bi-210m	PCI/G	0.033	NA	U	0.0149	NA	U	0.0195	NA	U
Co-60	PCI/G	0.0347	NA	U	0.019	NA	U	0.0226	NA	U
Cs-137	PCI/G	0.516	0.07		0.183	0.0303		0.115	0.024	
K-40	PCI/G	24.2	2.56		10.2	1.14		8.15	0.99	
Pu-238	PCI/G	0.533	0.0856		0.28	0.0671	J	0.131	0.0344	
Pu-239/240	PCI/G	0.035	0.0161		0.0223	0.016	J	0.0106	NA	U
Pu-242	PCI/G	0.00241	NA	U	0.00755	NA	UJ	0.0106	NA	U
Ra-226	PCI/G	1.79	0.767		1.03	0.366		1.07	0.445	
Sr-90	PCI/G	0.693	0.268		0.469	0.259	R	0.982	NA	UJ
Th-228	PCI/G	1.03	0.174		0.593	0.141	J	0.372	0.0851	
Th-230	PCI/G	0.994	0.168		0.765	0.164	J	0.586	0.115	
Th-232	PCI/G	1.07	0.177		0.416	0.115	J	0.306	0.0743	
Tritium	PCI/G	10.2	0.306		12.1	0.331	U	8.34	0.235	U
U-234	PCI/G	0.705	0.125		0.813	0.147		0.639	0.121	
U-235	PCI/G	0.0373	0.0241		0.194	0.059		0.0677	0.0307	
U-238	PCI/G	0.805	0.138		0.585	0.118		0.572	0.112	

RADIOCHEMICAL ANALYSIS

MAIN HILL SEEP 606											
		S61301		S61302		S62301		S62311		S63301	
		902-S61301		902-S61302		902-S62301		902-S62311		902-S63301	
		H4486.D REG		H4494.D REG		H4495.D REG		H4496.D REG		H4497.D REG	
		6/22/94		6/22/94		6/22/94		06/22/94DUPE		6/22/94	
		Result	Val	Result	Val	Result	Val	Result	Val	Result	Val
Volatile Organics	Units										
Acetone	UG/KG	12	U	12	U	16	U	17	U	14	U
Acetonitrile	UG/KG	123	U	118	U	159	U	167	U	135	U
Acrylonitrile	UG/KG	123	U	118	U	159	U	167	U	135	U
Benzene	UG/KG	12	U	12	U	16	U	17	U	14	U
Bromodichloromethane	UG/KG	12	U	12	U	16	U	17	U	14	U
Bromoform	UG/KG	12	U	12	U	16	U	17	U	14	U
Bromomethane	UG/KG	12	UJ	12	U	16	U	17	U	14	U
2-Butanone	UG/KG	12	U	12	U	16	U	17	U	14	U
Carbon Disulfide	UG/KG	12	U	12	U	16	U	17	U	14	U
Carbon Tetrachloride	UG/KG	12	U	12	U	16	U	17	U	14	U
Chlorobenzene	UG/KG	12	U	12	U	16	U	17	U	14	U
Chlorodibromomethane	UG/KG	12	U	12	U	16	U	17	U	14	U
Chloroethane	UG/KG	12	U	12	U	16	U	17	U	14	U
Chloroform	UG/KG	12	U	12	U	16	U	17	U	14	U
Chloromethane	UG/KG	12	U	12	U	16	U	17	U	14	U
1,1-Dichloroethane	UG/KG	12	U	12	U	16	U	17	U	14	U
1,2-Dichloroethane	UG/KG	12	U	12	U	16	U	17	U	14	U
1,1-Dichloroethene	UG/KG	12	U	12	U	16	U	17	U	14	U
1,2-Dichloroethene	UG/KG	25	U	24	U	32	U	33	U	27	U
1,2-Dichloropropane	UG/KG	12	U	12	U	16	U	17	U	14	U
cis-1,3-Dichloropropene	UG/KG	12	U	12	U	16	U	17	U	14	U
trans-1,3-Dichloropropene	UG/KG	12	U	12	U	16	U	17	U	14	U
1,2-Diethylbenzene	UG/KG	25	U	24	U	32	U	33	U	27	U
Ethylbenzene	UG/KG	12	U	12	U	16	U	17	U	14	U
Hexane	UG/KG	12	U	12	U	16	U	17	U	14	U
2-Hexanone	UG/KG	12	U	12	U	16	U	17	U	14	U
Iodomethane	UG/KG	12	U	12	U	16	U	17	U	14	U
4-Methyl-2-pentanone	UG/KG	12	U	12	U	16	U	17	U	14	U
Methylene Chloride	UG/KG	12	U	12	U	16	U	17	U	14	U
Styrene	UG/KG	12	U	12	U	16	U	17	U	14	U
1,1,2,2-Tetrachloroethane	UG/KG	12	U	12	U	16	U	17	U	14	U
Tetrachloroethene	UG/KG	12	U	12	U	16	U	17	U	14	U
Toluene	UG/KG	12	U	12	U	16	U	17	U	4	J
1,1,1-Trichloroethane	UG/KG	12	U	12	U	16	U	17	U	14	U
1,1,2-Trichloroethane	UG/KG	12	U	12	U	16	U	17	U	14	U
Trichloroethene	UG/KG	12	U	12	U	16	U	17	U	14	U
Trichlorotrifluoroethane	UG/KG	12	U	12	U	16	U	17	U	14	U
Vinyl Acetate	UG/KG	12	U	12	U	16	U	17	U	14	U
Vinyl Chloride	UG/KG	12	U	12	U	16	U	17	U	14	U
Xylene, Total	UG/KG	25	U	24	U	32	U	33	U	27	U
Tentatively Identified Compounds				1						1	

RADIOCHEMICAL ANALYSIS

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

MAIN HILL SEEP 606											
		S61301		S61302		S62301		S62311		S63301	
		902-S61301		902-S61302		902-S62301		902-S62311		902-S63301	
		A0801139.D REG		A0901140.D REG		A1001141.D REG		A1101142.D REG		A1201143.D REG	
		6/22/94		6/22/94		6/22/94		06/22/94DUPE		6/22/94	
		Result	Val	Result	Val	Result	Val	Result	Val	Result	Val
Semi-volatile Organics	Units										
Acenaphthene	UG/KG	410	U	390	U	530	U	550	U	450	U
Acenaphthylene	UG/KG	410	U	390	U	530	U	550	U	450	U
Anthracene	UG/KG	410	U	390	U	530	U	550	U	450	U
Benzo(a)anthracene	UG/KG	410	U	390	U	130	J	550	U	450	U
Benzo(a)pyrene	UG/KG	410	U	390	U	150	J	550	U	49	J
Benzo(b)fluoranthene	UG/KG	410	U	390	U	140	J	550	U	55	J
Benzo(g,h,i)perylene	UG/KG	410	U	390	U	93	J	550	U	450	U
Benzo(k)fluoranthene	UG/KG	410	U	390	U	530	U	550	U	46	J
Benzoic Acid	UG/KG	2000	U	1900	U	71	J	56	J	48	J
Benzyl Alcohol	UG/KG	410	U	390	U	530	U	550	U	450	U
2-Benzyl-4-Chlorophenol	UG/KG	410	U	390	U	530	U	550	U	450	U
bis(2-Chloroethoxy)methane	UG/KG	410	U	390	U	530	U	550	U	450	U
bis(2-Chloroethyl)ether	UG/KG	410	U	390	U	530	U	550	U	450	U
bis(2-Ethylhexyl)phthalate	UG/KG	410	UJ	390	UJ	530	UJ	550	UJ	450	UJ
4-Bromophenyl-phenylether	UG/KG	410	U	390	U	530	U	550	U	450	U
Butylbenzylphthalate	UG/KG	410	U	390	U	530	U	550	U	450	U
Carbazole	UG/KG	410	U	390	U	530	U	550	U	450	U
4-Chloro-3-methylphenol	UG/KG	410	U	390	U	530	U	550	U	450	U
4-Chloroaniline	UG/KG	410	U	390	U	530	U	550	U	450	U
2-Chloronaphthalene	UG/KG	410	U	390	U	530	U	550	U	450	U
2-Chlorophenol	UG/KG	410	U	390	U	530	U	550	U	450	U
4-Chlorophenyl-phenylether	UG/KG	410	U	390	U	530	U	550	U	450	U
Chrysene	UG/KG	410	U	390	U	210	J	56	J	61	J
Di-n-butylphthalate	UG/KG	410	U	390	U	530	U	550	U	450	U
Di-n-octylphthalate	UG/KG	410	U	390	U	530	U	550	U	450	U
Dibenzo(a,h)anthracene	UG/KG	410	U	390	U	530	U	550	U	450	U
Dibenzofuran	UG/KG	410	U	390	U	530	U	550	U	450	U
1,2-Dichlorobenzene	UG/KG	410	U	390	U	530	U	550	U	450	U
1,3-Dichlorobenzene	UG/KG	410	U	390	U	530	U	550	U	450	U
1,4-Dichlorobenzene	UG/KG	410	U	390	U	530	U	550	U	450	U
3,3'-Dichlorobenzidine	UG/KG	410	U	390	U	530	U	550	U	450	U
2,4-Dichlorophenol	UG/KG	410	U	390	U	530	U	550	U	450	U
Diethylphthalate	UG/KG	410	U	390	U	530	U	550	U	450	U
2,4-Dimethylphenol	UG/KG	410	U	390	U	530	U	550	U	450	U
Dimethylphthalate	UG/KG	410	U	390	U	530	U	550	U	450	U
4,6-Dinitro-2-methylphenol	UG/KG	990	U	940	U	1300	U	1300	U	1100	U
2,4-Dinitrophenol	UG/KG	990	U	940	U	1300	U	1300	U	1100	U
2,4-Dinitrotoluene	UG/KG	410	U	390	U	530	U	550	U	450	U
2,6-Dinitrotoluene	UG/KG	410	U	390	U	530	U	550	U	450	U
Fluoranthene	UG/KG	410	U	390	U	360	J	91	J	110	J
Fluorene	UG/KG	410	U	390	U	530	U	550	U	450	U
Hexachlorobenzene	UG/KG	410	U	390	U	530	U	550	U	450	U
Hexachlorobutadiene	UG/KG	410	U	390	U	530	U	550	U	450	U
Hexachlorocyclopentadiene	UG/KG	410	U	390	U	530	U	550	U	450	U
Hexachloroethane	UG/KG	410	U	390	U	530	U	550	U	450	U
Indeno(1,2,3-c,d)pyrene	UG/KG	410	U	390	U	95	J	550	U	450	U

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

MAIN HILL SEEP 606											
		S61301		S61302		S62301		S62311		S63301	
		902-S61301		902-S61302		902-S62301		902-S62311		902-S63301	
		A0801139.D REG		A0901140.D REG		A1001141.D REG		A1101142.D REG		A1201143.D REG	
		6/22/94		6/22/94		6/22/94		06/22/94DUPE		6/22/94	
		Result	Val	Result	Val	Result	Val	Result	Val	Result	Val
Semi-volatile Organics	Units										
Isophorone	UG/KG	410	U	390	U	530	U	550	U	450	U
2-Methylnaphthalene	UG/KG	410	U	390	U	530	U	550	U	450	U
2-Methylphenol	UG/KG	410	U	390	U	530	U	550	U	450	U
4-Methylphenol	UG/KG	410	U	390	U	530	U	550	U	450	U
N-Nitroso-di-n-propylamine	UG/KG	410	U	390	U	530	U	550	U	450	U
N-Nitrosodiphenylamine	UG/KG	410	U	390	U	530	U	550	U	450	U
Naphthalene	UG/KG	410	U	390	U	530	U	550	U	450	U
2-Nitroaniline	UG/KG	990	U	940	U	1300	U	1300	U	1100	U
3-Nitroaniline	UG/KG	990	U	940	U	1300	U	1300	U	1100	U
4-Nitroaniline	UG/KG	990	U	940	U	1300	U	1300	U	1100	U
Nitrobenzene	UG/KG	410	U	390	U	530	U	550	U	450	U
2-Nitrophenol	UG/KG	410	U	390	U	530	U	550	U	450	U
4-Nitrophenol	UG/KG	990	U	940	U	1300	U	1300	U	1100	U
2,2'-oxybis(1-Chloropropane)	UG/KG	410	U	390	U	530	U	550	U	450	U
Pentachlorophenol	UG/KG	990	U	940	U	1300	U	1300	U	1100	U
Phenanthrene	UG/KG	410	U	390	U	170	J	550	U	46	J
Phenol	UG/KG	410	U	390	U	530	U	550	U	450	U
Pyrene	UG/KG	410	U	390	U	270	J	74	J	87	J
1,2,4-Trichlorobenzene	UG/KG	410	U	390	U	530	U	550	U	450	U
2,4,5-Trichlorophenol	UG/KG	990	U	940	U	1300	U	1300	U	1100	U
2,4,6-Trichlorophenol	UG/KG	410	U	390	U	530	U	550	U	450	U
Tentatively Identified Compounds		13		8		30		28		29	

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

MAIN HILL SEEP 606											
		S61301		S61302		S62301		S62311		S63301	
		902-S61301		902-S61302		902-S62301		902-S62311		902-S63301	
		36433-04 REG		36433-05 REG		36433-06 REG		36433-07 REG		36433-08 REG	
		6/22/94		6/22/94		6/22/94		06/22/94DUPE		6/22/94	
		Result	Val	Result	Val	Result	Val	Result	Val	Result	Val
Pesticides and PCBs	Units										
Aldrin	UG/KG	0.42	U	0.4	U	0.54	U	0.56	U	0.46	U
alpha-BHC	UG/KG	0.42	U	0.4	U	0.54	U	0.56	U	0.46	U
alpha-Chlordane	UG/KG	0.42	U	0.4	U	0.54	U	0.56	U	0.46	U
Aroclor 1232	UG/KG	8.1	U	7.8	U	10	U	11	U	8.9	U
Aroclor-1016	UG/KG	8.1	U	7.8	U	10	U	11	U	8.9	U
Aroclor-1221	UG/KG	16	U	16	U	21	U	22	U	18	U
Aroclor-1242	UG/KG	8.1	U	7.8	U	10	U	11	U	8.9	U
Aroclor-1248	UG/KG	8.1	U	7.8	U	10	U	11	U	8.9	U
Aroclor-1254	UG/KG	8.1	U	7.8	U	4.6	J	5.3	J	4.3	J
Aroclor-1260	UG/KG	8.1	U	7.8	U	10	U	11	U	8.9	U
beta-BHC	UG/KG	0.42	U	0.4	U	0.54	U	0.56	U	0.46	U
4,4'-DDD	UG/KG	0.81	U	0.78	U	1	U	1.1	U	0.89	U
4,4'-DDE	UG/KG	0.81	U	0.78	U	1	U	1.1	U	0.89	U
4,4'-DDT	UG/KG	0.81	U	0.78	U	1	U	1.1	U	0.89	U
delta-BHC	UG/KG	0.42	U	0.4	U	0.54	U	0.56	U	0.46	U
Dieldrin	UG/KG	0.81	U	0.78	U	1	U	0.57	J	0.89	U
Endosulfan I	UG/KG	0.42	U	0.4	U	0.54	U	0.56	U	0.46	U
Endosulfan II	UG/KG	0.5	J	0.78	UJ	1	UJ	1.1	UJ	1.2	J
Endosulfan Sulfate	UG/KG	0.81	U	0.78	U	1	U	1.1	U	0.89	U
Endrin	UG/KG	0.81	U	0.78	U	1	U	1.1	U	0.89	U
Endrin Aldehyde	UG/KG	0.81	U	0.78	U	1	U	1.1	U	0.89	U
Endrin Ketone	UG/KG	0.81	U	0.78	U	1	U	1.1	U	0.89	U
gamma-BHC (Lindane)	UG/KG	0.42	U	0.4	U	0.54	U	0.56	U	0.46	U
gamma-Chlordane	UG/KG	0.42	U	0.4	U	0.54	U	0.56	U	0.46	U
Heptachlor	UG/KG	0.42	U	0.4	U	0.54	U	0.56	U	0.46	U
Heptachlor Epoxide	UG/KG	0.42	U	0.4	U	0.54	U	0.56	U	0.46	U
p,p'-Methoxychlor	UG/KG	4.2	UJ	4	UJ	5.4	UJ	5.6	UJ	4.6	UJ
Toxaphene	UG/KG	42	U	40	U	54	U	56	U	46	U

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

MAIN HILL SEEP 606											
		S61301		S61302		S62301		S62311		S63301	
		902-S61301		902-S61302		902-S62301		902-S62311		902-S63301	
		3643504 REG		3643505 REG		3643506 REG		3643507 REG		3643508 REG	
		6/22/94		6/22/94		6/22/94		06/22/94DUPE		6/22/94	
		Result	Val	Result	Val	Result	Val	Result	Val	Result	Val
Inorganics	Units										
Aluminum	MG/KG	11700		13600		17200		15400		16900	
Antimony	MG/KG	0.76	R	0.73	R	0.99	R	1	R	0.84	R
Arsenic	MG/KG	3.2		4.7		5.3		6.7		5.3	
Barium	MG/KG	50.7		60.6		143		126		132	
Beryllium	MG/KG	0.57		0.67		1		0.89		1	
Bismuth	MG/KG	45.7		49.3		51.3		50.1		50.9	
Cadmium	MG/KG	0.57	U	0.54	U	0.73	U	0.77	U	0.62	U
Calcium	MG/KG	131000	J	113000	J	34600	J	49200	J	20300	J
Chromium	MG/KG	15.7		19		20.6		18.5		21.7	
Cobalt	MG/KG	13.1		14.3		16.2		14.3		15.4	
Copper	MG/KG	13.6		19.7		23.2		22.3		23.3	
Cyanide	MG/KG	0.62	U	0.59	U	0.8	U	0.84	U	0.68	U
Iron	MG/KG	27000		29300		37600		33800		38000	
Lead	MG/KG	7.5		5.4		18.7		22.3		21.8	
Magnesium	MG/KG	7280		11300		6350		6110		6090	
Manganese	MG/KG	557		548		1450		1170		1320	
Mercury	MG/KG	0.12	U	0.12	U	0.16	U	0.17	U	0.14	U
Nickel	MG/KG	23.7		28		29.2		26.6		32.9	
Potassium	MG/KG	580		3090		2910		2760		3480	
Selenium	MG/KG	0.49	UJ	4.7	UJ	0.64	UJ	0.67	UJ	0.54	UJ
Silver	MG/KG	1.2	U	1.1	U	1.5	U	1.6	U	1.3	U
Sodium	MG/KG	466	U	446	U	871	J	924	J	513	U
Thallium	MG/KG	0.89	U	0.85	U	1.1	U	1.2	U	0.98	U
Vanadium	MG/KG	12.8		14.6		23.5		20.7		23.5	
Zinc	MG/KG	55.8		55.1		86.2		88.7		93.2	

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

MAIN HILL SEEP 606											
		S61301		S61302		S62301		S62311		S63301	
		902-S61301		902-S61302		902-S62301		902-S62311		902-S63301	
		REG		0364340006SA REG		0364340007SA REG		0364340008SA REG		0364340009SA REG	
		6/22/94		6/22/94		6/22/94		06/22/94DUPE		6/22/94	
		Result	Val	Result	Val	Result	Val	Result	Val	Result	Val
Anions	Units										
Chloride	MG/KG	163		165		623		722		290	
Fluoride	MG/KG	2.6		2.2		1.4		1.4		1.1	
Nitrate/Nitrite (NO3/NO2-N)	MG/KG	1.4		0.59	U	1.9		2.7		4.7	
Sulfate	MG/KG	61.7		99.1		124		108		33.9	U
		S61301		S61302		S62301		S62311		S63301	
		902-S61301		902-S61302		902-S62301		902-S62311		902-S63301	
		REG		0364340006SA REG		0364340007SA REG		0364340008SA REG		03643400	Val
		6/22/94		6/22/94		6/22/94		06/22/94DUPE		6/22/94	
		Result	Val	Result	Val	Result	Val	Result	Val	Result	
Miscellaneous	Units										J
Cation Exchange Capacity as Na	MEQ/100	7.7									
PH	UNITS	8.1	J	8.3	J	7.6	J	7.7	J	7.7	
Total Organic Carbon	%	0.2825		0.2	U	2.475		2.05		3.65	

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

MAIN HILL SEEP 606			
		S61301	
		902-S61301	
		0364340005SA REG	
		6/22/94	
		Result	Val
EXPLOSIVES	Units		
2-Amino-4,6-dinitrotoluene	UG/G	0.31	U
1,3-Dinitrobenzene	UG/G	0.31	U
2,4-Dinitrotoluene	UG/G	0.31	U
2,6-Dinitrotoluene	UG/G	0.32	U
HMX	UG/G	2.7	U
Nitrobenzene	UG/G	0.32	U
PETN	UG/G	1.2	U
RDX	UG/G	1.2	U
TETRYL	UG/G	0.8	U
1,3,5-Trinitrobenzene	UG/G	0.31	U
2,4,6-Trinitrotoluene	UG/G	0.31	U

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

MAIN HILL SEEP 606																
		S61301			S61302			S62301			S62311			S63301		
		902-S61301			902-S61302			902-S62301			902-S62311			902-S63301		
		3229416 REG			3229417 REG			3229418 REG			3229419 REG			3229423 REG		
		34507			34507			34507			06/22/94DUPE			34507		
		Result	UNC	Val	Result	UNC	Val	Result	UNC	Val	Result	UNC	Val	Result	UNC	Val
Radiological	**Units**															
Am-241	PCI/G	0.118	NA	U	0.13	NA	U	0.118	NA	U	0.144	NA	U	0.136	NA	U
Bi-207	PCI/G	0.0317	NA	U	0.0343	NA	U	0.0361	NA	U	0.0375	NA	U	0.0343	NA	U
Bi-210m	PCI/G	0.0357	NA	U	0.04	NA	U	0.0404	NA	U	0.0418	NA	U	0.0392	NA	U
Co-60	PCI/G	0.042	NA	U	0.0448	NA	U	0.0459	NA	U	0.0465	NA	U	0.0461	NA	U
Cs-137	PCI/G	0.0362	NA	U	0.0398	NA	U	0.119	0.0415		0.18	0.0475		0.189	0.0371	
K-40	PCI/G	27.1	2.9		32	3.44		30.3	3.29		29.1	3.1		34.3	3.66	
Pu-238	PCI/G	0.12	0.0295		0.0793	0.0236		0.204	0.0491		0.209	0.0509		0.213	0.0413	
Pu-239/240	PCI/G	0.00349	NA	U	0.00833	NA	U	0.0209	NA	U	0.0169	NA	U	0.0136	0.00939	
Pu-242	PCI/G	0.00567	NA	U	0.00214	NA	U	0.0133	NA	U	0.00584	NA	U	0.00235	NA	U
Ra-226	PCI/G	0.775	NA	U	0.701	NA	U	0.69	NA	U	2.3	0.962		2.66	0.983	
Sr-90	PCI/G	2.17	0.696		0.905	NA	U	2.32	0.609		0.974	NA	U	3.48	0.675	
Th-228	PCI/G	1.22	0.201		1.05	0.189		1.15	0.19		1.27	0.199		1.27	0.199	
Th-230	PCI/G	0.941	0.166		0.946	0.174		1.28	0.206		1.06	0.172		1.25	0.194	
Th-232	PCI/G	1.28	0.209		1.07	0.189		1.13	0.186		1.13	0.18		1.32	0.203	
Tritium	PCI/G	3.66	1.37	U	3.18	0.111		19	0.44		13.2	0.353		3.1	0.165	
U-234	PCI/G	0.746	0.136		0.697	0.127		0.677	0.123		0.641	0.117		0.885	0.15	
U-235	PCI/G	0.0433	0.0246		0.0453	NA	U	0.0477	0.026		0.0305	NA	U	0.0477	0.0246	
U-238	PCI/G	0.783	0.14		0.778	0.138		0.9	0.152		0.858	0.145		0.817	0.141	

RADIOCHEMICAL ANALYSIS

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

General Chemistry

MAIN HILL SEEP 607									
		S71301		S72301		S73301		S73301	
		902-S71301		902-S72301		902-S73301		902-S73301	
		H4505.D REG		H4506.D REG		H4513.D REA		H4513.D REG	
		6/22/94		6/22/94		6/22/94		6/22/94	
		Result	Val	Result	Val	Result	Val	Result	Val
Volatile Organics	Units								
Acetone	UG/KG	12	U	12	U	16		16	U
Acetonitrile	UG/KG	125	U	120	U	159		159	U
Acrylonitrile	UG/KG	125	U	120	U	159		159	U
Benzene	UG/KG	12	U	12	U	16		16	U
Bromodichloromethane	UG/KG	12	U	12	U	16		16	U
Bromoform	UG/KG	12	U	12	U	16		16	U
Bromomethane	UG/KG	12	U	12	U	16		16	U
2-Butanone	UG/KG	12	U	12	U	16		16	U
Carbon Disulfide	UG/KG	12	U	12	U	16		16	U
Carbon Tetrachloride	UG/KG	12	U	12	U	16		16	U
Chlorobenzene	UG/KG	12	U	12	U	16		16	UJ
Chlorodibromomethane	UG/KG	12	U	12	U	16		16	U
Chloroethane	UG/KG	12	U	12	U	16		16	U
Chloroform	UG/KG	12	U	12	U	16		16	U
Chloromethane	UG/KG	12	U	12	U	16		16	U
1,1-Dichloroethane	UG/KG	12	U	12	U	16		16	U
1,2-Dichloroethane	UG/KG	12	U	12	U	16		16	U
1,1-Dichloroethene	UG/KG	12	U	12	U	16		16	U
1,2-Dichloroethene	UG/KG	25	U	24	U	32		32	U
1,2-Dichloropropane	UG/KG	12	U	12	U	16		16	U
cis-1,3-Dichloropropene	UG/KG	12	U	12	U	16		16	U
trans-1,3-Dichloropropene	UG/KG	12	U	12	U	16		16	U
1,2-Diethylbenzene	UG/KG	25	U	24	U	32		32	UJ
Ethylbenzene	UG/KG	12	U	12	U	16		16	UJ
Hexane	UG/KG	12	U	12	U	16		16	U
2-Hexanone	UG/KG	12	U	12	U	16		16	UJ
Iodomethane	UG/KG	12	U	12	U	16		16	U
4-Methyl-2-pentanone	UG/KG	12	U	12	U	16		16	UJ
Methylene Chloride	UG/KG	12	U	12	U	4		16	U
Styrene	UG/KG	12	U	12	U	16		16	UJ
1,1,2,2-Tetrachloroethane	UG/KG	12	U	12	U	16		16	UJ
Tetrachloroethene	UG/KG	12	U	12	U	16		16	UJ
Toluene	UG/KG	12	U	12	U	16		16	UJ
1,1,1-Trichloroethane	UG/KG	12	U	12	U	16		16	U
1,1,2-Trichloroethane	UG/KG	12	U	12	U	16		16	U
Trichloroethene	UG/KG	12	U	4	J	16		16	U
Trichlorotrifluoroethane	UG/KG	12	U	12	U	16		16	U
Vinyl Acetate	UG/KG	12	U	12	U	16		16	U
Vinyl Chloride	UG/KG	12	U	12	U	16		16	U
Xylene, Total	UG/KG	25	U	24	U	32		32	UJ
Tentatively Identified Compounds				1					

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

MAIN HILL SEEP 607							
		S71301		S72301		S73301	
		902-S71301		902-S72301		902-S73301	
		A0901158.D REG		A1001159.D REG		A1101160.D REG	
		6/22/94		6/22/94		6/22/94	
		Result	Val	Result	Val	Result	Val
Semi-volatile Organics	Units						
Acenaphthene	UG/KG	420	U	400	U	530	U
Acenaphthylene	UG/KG	420	U	400	U	530	U
Anthracene	UG/KG	420	U	400	U	530	U
Benzo(a)anthracene	UG/KG	46	J	400	U	110	J
Benzo(a)pyrene	UG/KG	62	J	400	U	150	J
Benzo(b)fluoranthene	UG/KG	63	J	400	U	140	J
Benzo(g,h,i)perylene	UG/KG	420	U	400	U	83	J
Benzo(k)fluoranthene	UG/KG	78	J	400	U	180	J
Benzoic Acid	UG/KG	2000	U	2000	U	65	J
Benzyl Alcohol	UG/KG	420	U	400	U	530	U
2-Benzyl-4-Chlorophenol	UG/KG	420	UJ	400	UJ	530	UJ
bis(2-Chloroethoxy)methane	UG/KG	420	U	400	U	530	U
bis(2-Chloroethyl)ether	UG/KG	420	U	400	U	530	U
bis(2-Ethylhexyl)phthalate	UG/KG	110	J	400	UJ	530	UJ
4-Bromophenyl-phenylether	UG/KG	420	U	400	U	530	U
Butylbenzylphthalate	UG/KG	420	U	400	U	530	U
Carbazole	UG/KG	420	U	400	U	530	U
4-Chloro-3-methylphenol	UG/KG	420	U	400	U	530	U
4-Chloroaniline	UG/KG	420	U	400	U	530	U
2-Chloronaphthalene	UG/KG	420	U	400	U	530	U
2-Chlorophenol	UG/KG	420	U	400	U	530	U
4-Chlorophenyl-phenylether	UG/KG	420	U	400	U	530	U
Chrysene	UG/KG	88	J	400	U	200	J
Di-n-butylphthalate	UG/KG	420	U	400	U	530	U
Di-n-octylphthalate	UG/KG	160	J	400	U	530	U
Dibenzo(a,h)anthracene	UG/KG	420	U	400	U	530	U
Dibenzofuran	UG/KG	420	U	400	U	530	U
1,2-Dichlorobenzene	UG/KG	420	U	400	U	530	U
1,3-Dichlorobenzene	UG/KG	420	U	400	U	530	U
1,4-Dichlorobenzene	UG/KG	420	U	400	U	530	U
3,3'-Dichlorobenzidine	UG/KG	420	U	400	U	530	U
2,4-Dichlorophenol	UG/KG	420	U	400	U	530	U
Diethylphthalate	UG/KG	420	U	400	U	530	U
2,4-Dimethylphenol	UG/KG	420	U	400	U	530	U
Dimethylphthalate	UG/KG	420	U	400	U	530	U
4,6-Dinitro-2-methylphenol	UG/KG	1000	U	960	U	1300	U
2,4-Dinitrophenol	UG/KG	1000	U	960	U	1300	U
2,4-Dinitrotoluene	UG/KG	420	U	400	U	530	U
2,6-Dinitrotoluene	UG/KG	420	U	400	U	530	U
Fluoranthene	UG/KG	150	J	400	U	340	J
Fluorene	UG/KG	420	U	400	U	530	U
Hexachlorobenzene	UG/KG	420	U	400	U	530	U
Hexachlorobutadiene	UG/KG	420	U	400	U	530	U
Hexachlorocyclopentadiene	UG/KG	420	U	400	U	530	U
Hexachloroethane	UG/KG	420	U	400	U	530	U

MAIN HILL SEEP 607							
		S71301		S72301		S73301	
		902-S71301		902-S72301		902-S73301	
		A0901158.D REG		A1001159.D REG		A1101160.D REG	
		6/22/94		6/22/94		6/22/94	
		Result	Val	Result	Val	Result	Val
Semi-volatile Organics	Units						
Isophorone	UG/KG	420	U	400	U	530	U
2-Methylnaphthalene	UG/KG	420	U	400	U	530	U
2-Methylphenol	UG/KG	420	U	400	U	530	U
4-Methylphenol	UG/KG	420	U	400	U	530	U
N-Nitroso-di-n-propylamine	UG/KG	420	U	400	U	530	U
N-Nitrosodiphenylamine	UG/KG	420	U	400	U	530	U
Naphthalene	UG/KG	420	U	400	U	530	U
2-Nitroaniline	UG/KG	1000	U	960	U	1300	U
3-Nitroaniline	UG/KG	1000	U	960	U	1300	U
4-Nitroaniline	UG/KG	1000	U	960	UJ	1300	UJ
Nitrobenzene	UG/KG	420	U	400	U	530	U
2-Nitrophenol	UG/KG	420	U	400	U	530	U
4-Nitrophenol	UG/KG	1000	U	960	U	1300	U
2,2'-oxybis(1-Chloropropane)	UG/KG	420	U	400	U	530	U
Pentachlorophenol	UG/KG	1000	U	960	U	1300	U
Phenanthrene	UG/KG	63	J	400	U	130	J
Phenol	UG/KG	420	U	400	U	530	U
Pyrene	UG/KG	110	J	400	U	230	J
1,2,4-Trichlorobenzene	UG/KG	420	U	400	U	530	U
2,4,5-Trichlorophenol	UG/KG	1000	U	960	U	1300	U
2,4,6-Trichlorophenol	UG/KG	420	U	400	U	530	U
Tentatively Identified Compounds		30		29		30	

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

MAIN HILL SEEP 607							
		S71301		S72301		S73301	
		902-S71301		902-S72301		902-S73301	
		36433-17 REG		36433-18 REG		36433-19 REG	
		6/22/94		6/22/94		6/22/94	
		Result	Val	Result	Val	Result	Val
Pesticides and PCBs	Units						
Aldrin	UG/KG	0.85	U	0.41	U	2.2	U
alpha-BHC	UG/KG	0.85	U	0.41	U	2.2	U
alpha-Chlordane	UG/KG	0.85	U	0.41	U	2.2	U
Aroclor 1232	UG/KG	16	U	7.9	U	42	U
Aroclor-1016	UG/KG	16	U	7.9	U	42	U
Aroclor-1221	UG/KG	33	U	16	U	85	U
Aroclor-1242	UG/KG	16	U	7.9	U	42	U
Aroclor-1248	UG/KG	16	U	7.9	U	42	U
Aroclor-1254	UG/KG	11	J	3	J	17	J
Aroclor-1260	UG/KG	16	U	7.9	U	42	U
beta-BHC	UG/KG	0.85	U	0.41	U	2.2	U
4,4'-DDD	UG/KG	1.6	U	0.56	J	4.2	U
4,4'-DDE	UG/KG	1.6	U	0.79	U	4.2	U
4,4'-DDT	UG/KG	1.6	U	0.79	U	4.2	U
delta-BHC	UG/KG	0.85	U	0.41	U	2.2	U
Dieldrin	UG/KG	1.6	U	0.79	U	4.2	U
Endosulfan I	UG/KG	0.85	U	0.41	U	2.2	U
Endosulfan II	UG/KG	1.4	J	0.79	UJ	4.2	UJ
Endosulfan Sulfate	UG/KG	1.6	U	0.79	U	4.2	U
Endrin	UG/KG	1.6	U	0.79	U	4.2	U
Endrin Aldehyde	UG/KG	1.6	U	0.79	U	4.2	U
Endrin Ketone	UG/KG	1.6	U	0.79	U	4.2	U
gamma-BHC (Lindane)	UG/KG	0.85	U	0.41	U	2.2	U
gamma-Chlordane	UG/KG	0.85	U	0.41	U	2.2	U
Heptachlor	UG/KG	0.85	U	0.41	U	2.2	U
Heptachlor Epoxide	UG/KG	0.85	U	0.41	U	2.2	U
p,p'-Methoxychlor	UG/KG	8.5	UJ	4.1	UJ	22	UJ
Toxaphene	UG/KG	85	U	41	U	220	U

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

MAIN HILL SEEP 607							
		S71301		S72301		S73301	
		902-S71301		902-S72301		902-S73301	
		3643517 REG		3643518 REG		3643519 REG	
		6/22/94		6/22/94		6/22/94	
		Result	Val	Result	Val	Result	Val
Inorganics	Units						
Aluminum	MG/KG	12400		3110		9060	
Antimony	MG/KG	0.77	R	0.75	R	0.99	R
Arsenic	MG/KG	5.5		5.3		4	
Barium	MG/KG	78.6		52.3		103	
Beryllium	MG/KG	0.7		0.24		0.64	
Bismuth	MG/KG	40.9		28.9		33.4	
Cadmium	MG/KG	0.57	U	0.55	U	0.73	U
Calcium	MG/KG	101000	J	217000	J	124000	J
Chromium	MG/KG	16.1		7		12	
Cobalt	MG/KG	12.5		7.3		9.6	
Copper	MG/KG	20.3		10.4		22.9	
Cyanide	MG/KG	0.64		0.6	U	0.8	U
Iron	MG/KG	29400		11800		23400	
Lead	MG/KG	23.4		10		40.3	
Magnesium	MG/KG	6330		5970		6540	
Manganese	MG/KG	756		635		733	
Mercury	MG/KG	0.12	U	0.12	U	0.16	U
Nickel	MG/KG	25.1		8.2		21.7	
Potassium	MG/KG	2200		673		1950	
Selenium	MG/KG	0.5	UJ	0.48	UJ	0.64	UJ
Silver	MG/KG	1.2	U	1.2	U	1.5	U
Sodium	MG/KG	470	U	663	J	1400	J
Thallium	MG/KG	0.9	U	0.87	U	1.2	U
Vanadium	MG/KG	14.1		5.2		12.2	
Zinc	MG/KG	72.3		29.2		66.3	

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

MAIN HILL SEEP 607							
		S71301		S72301		S73301	
		902-S71301		902-S72301		902-S73301	
		REG		0364340019SA REG		0364340020SA REG	
		6/22/94		6/22/94		6/22/94	
		Result	Val	Result	Val	Result	Val
Anions	Units						
Chloride	MG/KG	69.9		323		1020	
Fluoride	MG/KG	3		1.2		1.5	
Nitrate/Nitrite (NO3/NO2-N)	MG/KG	7		1.1		3.7	
Sulfate	MG/KG	31.1	U	30.7		351	
		S71301		S72301		S73301	
		902-S71301		902-S72301		902-S73301	
		REG		0364340019SA REG		0364340020SA REG	
		6/22/94		6/22/94		6/22/94	
		Result	Val	Result	Val	Result	Val
Miscellaneous	Units						
Cation Exchange Capacity as Na	MEQ/100	13.9					
PH	UNITS	7.4	J	8.3	J	8.2	J
Total Organic Carbon	%	1.2		1.5667		5.0667	

MAIN HILL SEEP 607			
		S71301	
		902-S71301	
		0364340018SA REG	
		6/22/94	
		Result	Val
EXPLOSIVES	Units		
2-Amino-4,6-dinitrotoluene	UG/G	0.31	U
1,3-Dinitrobenzene	UG/G	0.31	U
2,4-Dinitrotoluene	UG/G	0.31	U
2,6-Dinitrotoluene	UG/G	0.32	U
HMX	UG/G	2.7	U
Nitrobenzene	UG/G	0.32	U
PETN	UG/G	1.2	U
RDX	UG/G	1.2	U
TETRYL	UG/G	0.81	U
1,3,5-Trinitrobenzene	UG/G	0.31	U
2,4,6-Trinitrotoluene	UG/G	0.31	U

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

MAIN HILL SEEP 607										
		S71301			S72301			S73301		
		902-S71301			902-S72301			902-S73301		
		3229420 REG			3229421 REG			3229422 REG		
		34507			34507			34507		
		Result	UNC	Val	Result	UNC	Val	Result	UNC	Val
Radiological	Units									
Am-241	PCI/G	0.109	NA	U	0.165	NA	U	0.106	NA	U
Bi-207	PCI/G	0.026	NA	U	0.0307	NA	U	0.0277	NA	U
Bi-210m	PCI/G	0.0294	NA	U	0.0351	NA	U	0.0317	NA	U
Co-60	PCI/G	0.0374	NA	U	0.0421	NA	U	0.0377	NA	U
Cs-137	PCI/G	0.513	0.071		0.0943	0.0334		0.45	0.0587	
K-40	PCI/G	31.5	3.4		13.7	1.72		18.7	2.06	
Pu-238	PCI/G	0.211	0.0427		0.212	0.0376		0.312	0.0478	
Pu-239/240	PCI/G	0.0251	0.0128		0.0104	NA	U	0.0148	0.00896	
Pu-242	PCI/G	0.00989	NA	U	0.00512	NA	U	0.0051	NA	U
Ra-226	PCI/G	1.88	0.631		0.628	NA	U	1.85	0.688	
Sr-90	PCI/G	1.05	NA	U	0.827	NA	U	1.02	NA	U
Th-228	PCI/G	1.23	0.192		0.63	0.125		0.917	0.159	
Th-230	PCI/G	1.07	0.173		0.67	0.129		0.876	0.153	
Th-232	PCI/G	1.17	0.185		0.604	0.119		0.813	0.144	
Tritium	PCI/G	1.58	0.122		36.2	0.76		8.66	0.287	
U-234	PCI/G	0.725	0.126		0.593	0.114		0.604	0.111	
U-235	PCI/G	0.0525	0.0249		0.0311	0.0201		0.0222	0.016	
U-238	PCI/G	0.89	0.147		0.593	0.114		0.568	0.107	

RADIOCHEMICAL ANALYSIS

General Chemistry

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

MAIN HILL SEEP 608											
		S81301		S81302		S81311		S82301		S83301	
		902-S81301		902-S81302		902-S81311		902-S82301		902-S83301	
		H4498.D REG		H4500.D REG		H4512.D REG		H4491.D REG		H4501.D REG	
		6/21/94		6/21/94		06/21/94DUPE		6/21/94		6/21/94	
		Result	Val	Result	Val	Result	Val	Result	Val	Result	Val
Volatile Organics	**Units**										
Acetone	UG/KG	12	U	13	U	12	U	15	UJ	16	U
Acetonitrile	UG/KG	125	U	128	U	122	U	154	U	159	U
Acrylonitrile	UG/KG	125	U	128	U	122	U	154	U	159	U
Benzene	UG/KG	12	U	13	U	12	U	15	U	16	U
Bromodichloromethane	UG/KG	12	U	13	U	12	U	15	U	16	U
Bromoform	UG/KG	12	U	13	U	12	U	15	U	16	U
Bromomethane	UG/KG	12	U	13	U	12	U	15	U	16	U
2-Butanone	UG/KG	12	U	13	U	12	U	15	U	16	U
Carbon Disulfide	UG/KG	12	U	13	U	12	U	15	U	16	U
Carbon Tetrachloride	UG/KG	12	U	13	U	12	U	15	U	16	U
Chlorobenzene	UG/KG	12	U	13	U	12	U	15	U	16	U
Chlorodibromomethane	UG/KG	12	U	13	U	12	U	15	U	16	U
Chloroethane	UG/KG	12	U	13	U	12	U	15	U	16	U
Chloroform	UG/KG	12	U	13	U	12	U	15	U	16	U
Chloromethane	UG/KG	12	U	13	U	12	UJ	15	U	16	U
1,1-Dichloroethane	UG/KG	12	U	13	U	12	U	15	U	16	U
1,2-Dichloroethane	UG/KG	12	U	13	U	12	U	15	U	16	U
1,1-Dichloroethene	UG/KG	12	U	13	U	12	U	15	U	16	U
1,2-Dichloroethene	UG/KG	25	U	8	J	24	U	31	U	32	U
1,2-Dichloropropane	UG/KG	12	U	13	U	12	U	15	U	16	U
cis-1,3-Dichloropropene	UG/KG	12	U	13	U	12	U	15	U	16	U
trans-1,3-Dichloropropene	UG/KG	12	U	13	U	12	U	15	U	16	U
1,2-Diethylbenzene	UG/KG	25	U	1	J	24	U	31	U	32	U
Ethylbenzene	UG/KG	12	U	13	U	12	U	15	U	16	U
Hexane	UG/KG	12	U	13	U	12	U	15	U	16	U
2-Hexanone	UG/KG	12	U	13	U	12	U	15	U	16	U
Iodomethane	UG/KG	12	U	13	U	12	U	15	U	16	U
4-Methyl-2-pentanone	UG/KG	12	U	13	U	12	U	15	U	16	U
Methylene Chloride	UG/KG	12	U	13	U	12	U	15	U	16	U
Styrene	UG/KG	12	U	13	U	12	U	15	U	16	U
1,1,2,2-Tetrachloroethane	UG/KG	12	U	13	U	12	U	15	U	16	U
Tetrachloroethene	UG/KG	12	U	13	U	12	U	15	U	16	U
Toluene	UG/KG	2	J	13	U	12	U	2	J	16	U
1,1,1-Trichloroethane	UG/KG	12	U	13	U	12	U	15	U	16	U
1,1,2-Trichloroethane	UG/KG	12	U	13	U	12	U	15	U	16	U
Trichloroethene	UG/KG	19	J	17	-	9	J	3	J	16	U
Trichlorotrifluoroethane	UG/KG	12	U	13	U	12	U	15	U	16	U
Vinyl Acetate	UG/KG	12	U	13	U	12	U	15	U	16	U
Vinyl Chloride	UG/KG	12	U	13	U	12	U	15	U	16	U
Xylene, Total	UG/KG	25	U	26	U	24	U	31	U	32	U
Tentatively Identified Compounds				1				3			

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

MAIN HILL SEEP 608											
		S81301		S81302		S81311		S82301		S83301	
		902-S81301		902-S81302		902-S81311		902-S82301		902-S83301	
		A1301144.D REG		A0101150.D REG		A1401145.D REG		A0201151.D REG		A0501154.D REG	
		6/21/94		6/21/94		06/21/94DUPE		6/21/94		6/21/94	
		Result	Val	Result	Val	Result	Val	Result	Val	Result	Val
Semi-volatile Organics	Units										
Acenaphthene	UG/KG	420	U	430	U	410	U	510	U	530	U
Acenaphthylene	UG/KG	420	U	430	U	410	U	510	U	530	U
Anthracene	UG/KG	420	U	430	U	410	U	510	U	530	U
Benzo(a)anthracene	UG/KG	420	U	430	U	410	U	510	U	530	U
Benzo(a)pyrene	UG/KG	420	U	430	U	410	U	510	U	530	U
Benzo(b)fluoranthene	UG/KG	420	U	430	U	410	U	510	U	530	U
Benzo(g,h,i)perylene	UG/KG	420	U	430	U	410	U	510	U	530	U
Benzo(k)fluoranthene	UG/KG	420	U	430	U	410	U	510	U	530	U
Benzoic Acid	UG/KG	45	J	2100	U	2000	U	58	J	2600	U
Benzyl Alcohol	UG/KG	420	U	430	U	410	U	510	U	530	U
2-Benzyl-4-Chlorophenol	UG/KG	420	U	430	UJ	410	U	510	UJ	530	UJ
bis(2-Chloroethoxy)methane	UG/KG	420	U	430	U	410	U	510	U	530	U
bis(2-Chloroethyl)ether	UG/KG	420	U	430	U	410	U	510	U	530	U
bis(2-Ethylhexyl)phthalate	UG/KG	420	UJ	430	UJ	410	UJ	510	UJ	530	UJ
4-Bromophenyl-phenylether	UG/KG	420	U	430	U	410	U	510	U	530	U
Butylbenzylphthalate	UG/KG	420	U	430	U	410	U	510	U	530	U
Carbazole	UG/KG	420	U	430	U	410	U	510	U	530	U
4-Chloro-3-methylphenol	UG/KG	420	U	430	U	410	U	510	U	530	U
4-Chloroaniline	UG/KG	420	U	430	U	410	U	510	U	530	U
2-Chloronaphthalene	UG/KG	420	U	430	U	410	U	510	U	530	U
2-Chlorophenol	UG/KG	420	U	430	U	410	U	510	U	530	U
4-Chlorophenyl-phenylether	UG/KG	420	U	430	U	410	U	510	U	530	U
Chrysene	UG/KG	420	U	430	U	410	U	510	U	53	J
Di-n-butylphthalate	UG/KG	420	U	430	U	410	U	510	U	530	U
Di-n-octylphthalate	UG/KG	420	U	430	U	410	U	510	U	530	U
Dibenzo(a,h)anthracene	UG/KG	420	U	430	U	410	U	510	U	530	U
Dibenzofuran	UG/KG	420	U	430	U	410	U	510	U	530	U
1,2-Dichlorobenzene	UG/KG	420	U	430	U	410	U	510	U	530	U
1,3-Dichlorobenzene	UG/KG	420	U	430	U	410	U	510	U	530	U
1,4-Dichlorobenzene	UG/KG	420	U	430	U	410	U	510	U	530	U
3,3'-Dichlorobenzidine	UG/KG	420	U	430	U	410	U	510	U	530	U
2,4-Dichlorophenol	UG/KG	420	U	430	U	410	U	510	U	530	U
Diethylphthalate	UG/KG	420	U	430	U	410	U	510	U	530	U
2,4-Dimethylphenol	UG/KG	420	U	430	U	410	U	510	U	530	U
Dimethylphthalate	UG/KG	420	U	430	U	410	U	510	U	530	U
4,6-Dinitro-2-methylphenol	UG/KG	1000	U	1000	U	980	U	1200	U	1300	U
2,4-Dinitrophenol	UG/KG	1000	U	1000	U	980	U	1200	U	1300	U
2,4-Dinitrotoluene	UG/KG	420	U	430	U	410	U	510	U	530	U
2,6-Dinitrotoluene	UG/KG	420	U	430	U	410	U	510	U	530	U
Fluoranthene	UG/KG	420	U	430	U	410	U	510	U	79	J
Fluorene	UG/KG	420	U	430	U	410	U	510	U	530	U
Hexachlorobenzene	UG/KG	420	U	430	U	410	U	510	U	530	U
Hexachlorobutadiene	UG/KG	420	U	430	U	410	U	510	U	530	U
Hexachlorocyclopentadiene	UG/KG	420	U	430	U	410	U	510	U	530	U
Hexachloroethane	UG/KG	420	U	430	U	410	U	510	U	530	U
				430	U	410	U	510	U	530	U

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

MAIN HILL SEEP 608											
		S81301		S81302		S81311		S82301		S83301	
		902-S81301		902-S81302		902-S81311		902-S82301		902-S83301	
		A1301144.D REG		A0101150.D REG		A1401145.D REG		A0201151.D REG		A0501154.D REG	
		6/21/94		6/21/94		06/21/94DUPE		6/21/94		6/21/94	
		Result	Val	Result	Val	Result	Val	Result	Val	Result	Val
Semi-volatile Organics	Units										
Isophorone	UG/KG	420	U	430	U	410	U	510	U	530	U
2-Methylnaphthalene	UG/KG	420	U	430	U	410	U	510	U	530	U
2-Methylphenol	UG/KG	420	U	430	U	410	U	510	U	530	U
4-Methylphenol	UG/KG	420	U	430	U	410	U	510	U	530	U
N-Nitroso-di-n-propylamine	UG/KG	420	U	430	U	410	U	510	U	530	U
N-Nitrosodiphenylamine	UG/KG	420	U	430	U	410	U	510	U	530	U
Naphthalene	UG/KG	420	U	430	U	410	U	510	U	530	U
2-Nitroaniline	UG/KG	1000	U	1000	U	980	U	1200	U	1300	U
3-Nitroaniline	UG/KG	1000	U	1000	U	980	U	1200	U	1300	U
4-Nitroaniline	UG/KG	1000	U	1000	UJ	980	U	1200	UJ	1300	UJ
Nitrobenzene	UG/KG	420	U	430	U	410	U	510	U	530	U
2-Nitrophenol	UG/KG	420	U	430	U	410	U	510	U	530	U
4-Nitrophenol	UG/KG	1000	U	1000	U	980	U	1200	U	1300	U
2,2'-oxybis(1-Chloropropane)	UG/KG	420	U	430	U	410	U	510	U	530	U
Pentachlorophenol	UG/KG	1000	U	1000	U	980	U	1200	U	1300	U
Phenanthrene	UG/KG	420	U	430	U	410	U	510	U	530	U
Phenol	UG/KG	420	U	430	U	410	U	510	U	530	U
Pyrene	UG/KG	420	U	430	U	410	U	510	U	55	J
1,2,4-Trichlorobenzene	UG/KG	420	U	430	U	410	U	510	U	530	U
2,4,5-Trichlorophenol	UG/KG	1000	U	1000	U	980	U	1200	U	1300	U
2,4,6-Trichlorophenol	UG/KG	420	U	430	U	410	U	510	U	530	U
Tentatively Identified Compounds		30		30		30		30		30	

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

MAIN HILL SEEP 608											
		S81301		S81302		S81311		S82301		S83301	
		902-S81301		902-S81302		902-S81311		902-S82301		902-S83301	
		36433-09 REG		36433-11 REG		36433-10 REG		36433-12 REG		36433-13 REG	
		6/21/94		6/21/94		06/21/94DUPE		6/21/94		6/21/94	
		Result	Val	Result	Val	Result	Val	Result	Val	Result	Val
Pesticides and PCBs	**Units**										
Aldrin	UG/KG	0.23	J	0.25	J	0.24	J	0.32	J	0.46	J
alpha-BHC	UG/KG	0.42	U	0.44	U	0.41	U	0.52	U	0.54	U
alpha-Chlordane	UG/KG	0.42	U	0.44	U	0.41	U	0.52	U	0.54	U
Aroclor 1232	UG/KG	8.2	U	8.4	U	8	U	10	U	10	U
Aroclor-1016	UG/KG	8.2	U	8.4	U	8	U	10	U	10	U
Aroclor-1221	UG/KG	17	U	17	U	16	U	20	U	21	U
Aroclor-1242	UG/KG	8.2	U	8.4	U	8	U	10	U	10	U
Aroclor-1248	UG/KG	8.2	U	8.4	U	8	U	10	U	10	U
Aroclor-1254	UG/KG	8.2	U	8.4	U	8	U	10	U	10	U
Aroclor-1260	UG/KG	8.2	U	8.4	U	8	U	10	U	10	U
beta-BHC	UG/KG	0.42	U	0.44	U	0.41	U	0.52	U	0.95	J
4,4'-DDD	UG/KG	0.82	U	0.84	U	0.8	U	1	U	1	U
4,4'-DDE	UG/KG	0.82	U	0.84	U	0.8	U	1	U	1	U
4,4'-DDT	UG/KG	0.82	U	0.84	U	0.8	U	1	U	1	U
delta-BHC	UG/KG	0.42	U	0.44	U	0.41	U	0.52	U	0.54	U
Dieldrin	UG/KG	0.82	U	0.84	U	0.8	U	1	U	1	U
Endosulfan I	UG/KG	0.42	U	0.44	U	0.41	U	0.52	U	0.54	U
Endosulfan II	UG/KG	0.82	UJ	0.84	UJ	0.8	UJ	1	UJ	1	UJ
Endosulfan Sulfate	UG/KG	0.82	U	0.84	U	0.8	U	1	U	1	U
Endrin	UG/KG	0.82	U	0.84	U	0.8	U	1	U	1	U
Endrin Aldehyde	UG/KG	0.82	U	0.84	U	0.8	U	1	U	1	U
Endrin Ketone	UG/KG	0.49	J	0.47	J	0.58	J	0.69	J	0.61	J
gamma-BHC (Lindane)	UG/KG	0.42	U	0.44	U	0.41	U	0.52	U	0.54	U
gamma-Chlordane	UG/KG	0.42	U	0.44	U	0.41	U	0.52	U	0.54	U
Heptachlor	UG/KG	0.42	U	0.44	U	0.41	U	0.52	U	0.54	U
Heptachlor Epoxide	UG/KG	0.42	U	0.44	U	0.41	U	0.52	U	0.54	U
p,p'-Methoxychlor	UG/KG	4.2	UJ	4.4	UJ	4.1	UJ	5.2	UJ	5.4	UJ
Toxaphene	UG/KG	42	U	44	U	41	U	52	U	54	U

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

MAIN HILL SEEP 608											
		S81301		S81302		S81311		S82301		S83301	
		902-S81301		902-S81302		902-S81311		902-S82301		902-S83301	
		3643509 REG		3643511 REG		3643510 REG		3643512 REG		3643513 REG	
		6/21/94		6/21/94		06/21/94DUPE		6/21/94		6/21/94	
		Result	Val	Result	Val	Result	Val	Result	Val	Result	Val
Inorganics	Units										
Aluminum	MG/KG	8580		8010		8060		12800		13700	
Antimony	MG/KG	0.77	R	0.79	R	0.75	R	0.95	R	0.98	R
Arsenic	MG/KG	3.8		4.8		3.4		5.3		4.1	
Barium	MG/KG	27		25.9		33.5		35.3		35.7	
Beryllium	MG/KG	0.44		0.4		0.39		0.64		0.7	
Bismuth	MG/KG	36.2		32.4		32.9		57.6		57.7	
Cadmium	MG/KG	0.57	U	0.59	U	0.56	U	0.71	U	0.73	U
Calcium	MG/KG	39600	J	68100	J	30600	J	182000	J	162000	J
Chromium	MG/KG	23		22.3		24.4		17.3		16.9	
Cobalt	MG/KG	20.4		19.9		20.7		15.7		16.2	
Copper	MG/KG	34.4		34.4		36.3		30.8		31.1	
Cyanide	MG/KG	0.62	U	0.64	U	0.61	U	0.77	U	0.79	U
Iron	MG/KG	39700		37900		41000		34200		34900	
Lead	MG/KG	11.9		8.3		13.4		13		12.3	
Magnesium	MG/KG	10900		10400		11200		11000		11100	
Manganese	MG/KG	538		706		505		980		841	
Mercury	MG/KG	0.12	U	0.13	U	0.12	U	0.15	U	0.16	U
Nickel	MG/KG	40.2		37.1		42		31.7		32.7	
Potassium	MG/KG	3340		3750		3490		3000		2790	
Selenium	MG/KG	0.5	UJ	0.51	UJ	0.49	UJ	0.62	UJ	0.63	UJ
Silver	MG/KG	1.2	U	1.2	U	1.2	U	1.5	U	1.5	U
Sodium	MG/KG	471	U	482	U	459	U	582	U	597	U
Thallium	MG/KG	0.9	U	0.92	U	0.87	U	1.1	U	1.1	U
Vanadium	MG/KG	10.7		10.5		10.3		16.7		17.5	
Zinc	MG/KG	80.4		78.3		67.7		76.2		67.4	

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

MAIN HILL SEEP 608											
		S81301		S81302		S81311		S82301		S83301	
		902-S81301		902-S81302		902-S81311		902-S82301		902-S83301	
		REG		0364340012SA REG		0364340011SA REG		0364340013SA REG		0364340014SA REG	
		6/21/94		6/21/94		06/21/94DUPE		6/21/94		6/21/94	
		Result	Val	Result	Val	Result	Val	Result	Val	Result	Val
Anions	Units										
Chloride	MG/KG	83.3		111		88.5		224		235	
Fluoride	MG/KG	1.2		1.7		1.1		1.4		1.5	
Nitrate/Nitrite (NO3/NO2-N)	MG/KG	0.89		0.83		0.84		0.77	U	0.98	
Sulfate	MG/KG	152		152		146		248		51.4	
		S81301		S81302		S81311		S82301		S83301	
		902-S81301		902-S81302		902-S81311		902-S82301		902-S83301	
		REG		0364340012SA REG		REG		0364340013SA REG		03643400	Val
		6/21/94		6/21/94		06/21/94DUPE		6/21/94		6/21/94	
		Result	Val	Result	Val	Result	Val	Result	Val	Result	
Miscellaneous	Units										J
Cation Exchange Capacity as Na	MEQ/100	7.2									
PH	UNITS	8.6	J			7.7	J	7.7	J	7.3	
Total Organic Carbon	%	0.3913		0.27		0.3425		0.85		0.81	
PH	MEQ/100			8.6							

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

MAIN HILL SEEP 608					
		S81301		S81311	
		902-S81301		902-S81311	
		0364340010SA REG		0364340011SA REG	
		6/21/94		06/21/94DUPE	
		Result	Val	Result	Val
EXPLOSIVES	Units				
2-Amino-4,6-dinitrotoluene	UG/G	0.31	U	0.3	U
1,3-Dinitrobenzene	UG/G	0.31	U	0.3	U
2,4-Dinitrotoluene	UG/G	0.31	U	0.3	U
2,6-Dinitrotoluene	UG/G	0.32	U	0.32	U
HMX	UG/G	2.7	U	2.7	U
Nitrobenzene	UG/G	0.32	U	0.32	U
PETN	UG/G	1.2	U	1.2	U
RDX	UG/G	1.2	U	1.2	U
TETRYL	UG/G	0.81	U	0.79	U
1,3,5-Trinitrobenzene	UG/G	0.31	U	0.3	U
2,4,6-Trinitrotoluene	UG/G	0.31	U	0.3	U

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

MAIN HILL SEEP 608																
		S81301			S81302			S81311			S82301			S83301		
		902-S81301			902-S81302			902-S81311			902-S82301			902-S83301		
		3228660 REG			3228662 REG			3228661 REG			3228667 REG			3228668 REG		
		34506			34506			06/21/94DUPE			34506			34506		
		Result	UNC	Val	Result	UNC	Val	Result	UNC	Val	Result	UNC	Val	Result	UNC	Val
Radiological	**Units**															
Am-241	PCI/G	0.106	NA	U	0.111	NA	U	0.107	NA	U	0.1	NA	U	0.134	NA	U
Bi-207	PCI/G	0.0258	NA	U	0.0272	NA	U	0.0269	NA	U	0.0233	NA	U	0.0262	NA	U
Bi-210m	PCI/G	0.0274	NA	U	0.0311	NA	U	0.0308	NA	U	0.0258	NA	U	0.0302	NA	U
Co-60	PCI/G	0.0367	NA	U	0.0364	NA	U	0.0363	NA	U	0.0356	NA	U	0.0357	NA	U
Cs-137	PCI/G	0.0294	NA	U	0.0306	NA	U	0.0307	NA	U	0.0257	NA	U	0.0289	NA	U
K-40	PCI/G	45.3	4.81		43.6	4.51		41.6	4.26		39.3	4.18		33.3	3.56	
Pu-238	PCI/G	0.0395	0.0229	J	0.0372	0.0223	J	0.099	0.0238		0.0199	0.0108		0.0495	0.0236	J
Pu-239/240	PCI/G	0.0153	NA	UJ	0.0236	NA	UJ	0.0128	NA	U	0.00915	NA	U	0.014	NA	UJ
Pu-242	PCI/G	0.0193	NA	UJ	0.0236	NA	UJ	0.00903	NA	U	0.00372	0.00432		0.014	NA	UJ
Ra-226	PCI/G	2.12	0.688		0.699	NA	U	2.62	0.625		2.48	0.71		1.66	0.698	
Sr-90	PCI/G	0.361	NA	U	0.919	0.365		0.759	NA	U	0.528	NA		1.18	NA	U
Th-228	PCI/G	1.26	0.199		1.27	0.198		1.32	0.204		1.13	0.181		1.08	0.165	
Th-230	PCI/G	1.04	0.171		1.04	0.169		0.974	0.161		0.87	0.148		0.837	0.135	
Th-232	PCI/G	1.25	0.197		1.27	0.197		1.23	0.193		1.04	0.169		0.996	0.155	
Tritium	PCI/G	2.1	0.111		3.68	0.157		2.51	0.119		4.44	0.199		5.71	0.247	
U-234	PCI/G	0.931	0.165		0.965	0.174		0.974	0.169		0.919	0.162		0.795	0.15	
U-235	PCI/G	0.0735	0.0357		0.0593	0.0334		0.0495	0.0306		0.0451	NA	U	0.0506	0.0308	
U-238	PCI/G	1.04	0.18		1.12	0.193		1.05	0.18		1.05	0.178		0.791	0.149	

RADIOCHEMICAL ANALYSIS

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

General Chemistry

MAIN HILL SEEP 601					
		S11101		S11111	
		902-S11101		902-S11111	
		J0869.D REG		J0873.D REG	
		5/24/94		05/24/94DUPE	
		Result	Val	Result	Val
Volatile Organics	Units				
Acetone	UG/L	10	U	10	U
Acetonitrile	UG/L	100	U	100	U
Acrylonitrile	UG/L	100	U	100	U
Benzene	UG/L	5	UJ	5	UJ
Bromodichloromethane	UG/L	5	UJ	5	UJ
Bromoform	UG/L	5	UJ	5	UJ
Bromomethane	UG/L	10	UJ	10	UJ
2-Butanone	UG/L	10	U	10	U
Carbon Disulfide	UG/L	5	UJ	5	UJ
Carbon Tetrachloride	UG/L	5	UJ	5	UJ
Chlorobenzene	UG/L	5	UJ	5	UJ
Chlorodibromomethane	UG/L	5	UJ	5	UJ
Chloroethane	UG/L	10	U	10	U
Chloroform	UG/L	5	UJ	5	UJ
Chloromethane	UG/L	10	U	10	U
1,1-Dichloroethane	UG/L	5	UJ	5	UJ
1,2-Dichloroethane	UG/L	5	UJ	5	UJ
1,1-Dichloroethene	UG/L	5	UJ	5	UJ
1,2-Dichloroethene	UG/L	5	UJ	5	UJ
1,2-Dichloropropane	UG/L	5	UJ	5	UJ
cis-1,3-Dichloropropene	UG/L	5	UJ	5	UJ
trans-1,3-Dichloropropene	UG/L	5	UJ	5	UJ
1,2-Diethylbenzene	UG/L	5	UJ	5	UJ
Ethylbenzene	UG/L	5	UJ	5	UJ
Hexane	UG/L	10	U	10	U
2-Hexanone	UG/L	10	U	10	U
Iodomethane	UG/L	10	U	10	U
4-Methyl-2-pentanone	UG/L	10	U	10	U
Methylene Chloride	UG/L	10	U	10	U
Styrene	UG/L	5	UJ	5	UJ
1,1,2,2-Tetrachloroethane	UG/L	5	UJ	5	UJ
Tetrachloroethene	UG/L	15		17	
Toluene	UG/L	5	UJ	5	UJ
1,1,1-Trichloroethane	UG/L	5	UJ	5	UJ
1,1,2-Trichloroethane	UG/L	5	UJ	5	UJ
Trichloroethene	UG/L	6	J	6	J
Trichlorotrifluoroethane	UG/L	5	UJ	5	UJ
Vinyl Acetate	UG/L	10	U	10	U
Vinyl Chloride	UG/L	10	U	10	U
Xylene, Total	UG/L	5	UJ	5	UJ

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

MAIN HILL SEEP 601					
		S11101		S11111	
		902-S11101		902-S11111	
		A1301273.D REG		A1401274.D REG	
		5/24/94		05/24/94DUPE	
		Result	Val	Result	Val
Semi-volatile Organics	Units				
Acenaphthene	UG/L	10	U	10	U
Acenaphthylene	UG/L	10	U	10	U
Anthracene	UG/L	10	U	10	U
Benzo(a)anthracene	UG/L	10	U	10	U
Benzo(a)pyrene	UG/L	10	U	10	U
Benzo(b)fluoranthene	UG/L	10	U	10	U
Benzo(g,h,i)perylene	UG/L	10	U	10	U
Benzo(k)fluoranthene	UG/L	10	U	10	U
Benzoic Acid	UG/L	1	J	1	J
Benzyl Alcohol	UG/L	10	U	10	U
2-Benzyl-4-Chlorophenol	UG/L	10	U	10	U
bis(2-Chloroethoxy)methane	UG/L	10	U	10	U
bis(2-Chloroethyl)ether	UG/L	10	U	10	U
bis(2-Ethylhexyl)phthalate	UG/L	10	U	2	J
4-Bromophenyl-phenylether	UG/L	10	U	10	U
Butylbenzylphthalate	UG/L	10	U	10	U
Carbazole	UG/L	10	U	10	U
4-Chloro-3-methylphenol	UG/L	10	U	10	U
4-Chloroaniline	UG/L	10	U	10	U
2-Chloronaphthalene	UG/L	10	U	10	U
2-Chlorophenol	UG/L	10	U	10	U
4-Chlorophenyl-phenylether	UG/L	10	U	10	U
Chrysene	UG/L	10	U	10	U
Di-n-butylphthalate	UG/L	10	U	10	U
Di-n-octylphthalate	UG/L	10	U	10	U
Dibenzo(a,h)anthracene	UG/L	10	U	10	U
Dibenzofuran	UG/L	10	U	10	U
1,2-Dichlorobenzene	UG/L	10	U	10	U
1,3-Dichlorobenzene	UG/L	10	U	10	U
1,4-Dichlorobenzene	UG/L	10	U	10	U
3,3'-Dichlorobenzidine	UG/L	10	U	10	U
2,4-Dichlorophenol	UG/L	10	U	10	U
Diethylphthalate	UG/L	10	U	10	U
2,4-Dimethylphenol	UG/L	10	U	10	U
Dimethylphthalate	UG/L	10	U	10	U
4,6-Dinitro-2-methylphenol	UG/L	25	U	25	U
2,4-Dinitrophenol	UG/L	25	U	25	U
2,4-Dinitrotoluene	UG/L	10	U	10	U
2,6-Dinitrotoluene	UG/L	10	U	10	U
Fluoranthene	UG/L	10	U	10	U
Fluorene	UG/L	10	U	10	U
Hexachlorobenzene	UG/L	10	U	10	U
Hexachlorobutadiene	UG/L	10	U	10	U
Hexachlorocyclopentadiene	UG/L	10	U	10	U
Hexachloroethane	UG/L	10	U	10	U

MAIN HILL SEEP 601					
		S11101		S11111	
		902-S11101		902-S11111	
		A1301273.D REG		A1401274.D REG	
		5/24/94		05/24/94DUPE	
		Result	Val	Result	Val
Semi-volatile Organics	Units				
2-Methylphenol	UG/L	10	U	10	U
4-Methylphenol	UG/L	10	U	10	U
N-Nitroso-di-n-propylamine	UG/L	10	U	10	U
N-Nitrosodiphenylamine	UG/L	10	U	10	U
Naphthalene	UG/L	10	U	10	U
2-Nitroaniline	UG/L	25	U	25	U
3-Nitroaniline	UG/L	25	U	25	U
4-Nitroaniline	UG/L	25	U	25	U
Nitrobenzene	UG/L	10	U	10	U
2-Nitrophenol	UG/L	10	U	10	U
4-Nitrophenol	UG/L	25	U	25	U
2,2'-oxybis(1-Chloropropane)	UG/L	10	U	10	U
Pentachlorophenol	UG/L	25	U	25	U
Phenanthrene	UG/L	10	U	10	U
Phenol	UG/L	10	U	10	U
Pyrene	UG/L	10	U	10	U
1,2,4-Trichlorobenzene	UG/L	10	U	10	U
2,4,5-Trichlorophenol	UG/L	25	U	25	U
2,4,6-Trichlorophenol	UG/L	10	U	10	U
Tentatively Identified Compounds		7		8	

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

MAIN HILL SEEP 601					
		S11101		S11111	
		902-S11101		902-S11111	
		35727-01 REG		35727-02 REG	
		5/24/94		05/24/94DUPE	
		Result	Val	Result	Val
Pesticides and PCBs	Units				
Aldrin	UG/L	0.01	U	0.01	U
alpha-BHC	UG/L	0.01	U	0.01	U
alpha-Chlordane	UG/L	0.01	U	0.01	U
Aroclor 1232	UG/L	0.2	U	0.2	U
Aroclor-1016	UG/L	0.2	U	0.2	U
Aroclor-1221	UG/L	0.4	U	0.4	U
Aroclor-1242	UG/L	0.2	U	0.2	U
Aroclor-1248	UG/L	0.2	U	0.2	U
Aroclor-1254	UG/L	0.2	U	0.2	U
Aroclor-1260	UG/L	0.2	U	0.2	U
beta-BHC	UG/L	0.01	U	0.01	U
4,4'-DDD	UG/L	0.02	U	0.02	U
4,4'-DDE	UG/L	0.02	U	0.02	U
4,4'-DDT	UG/L	0.02	U	0.02	U
delta-BHC	UG/L	0.01	U	0.01	U
Dieldrin	UG/L	0.02	U	0.02	U
Endosulfan I	UG/L	0.01	U	0.01	U
Endosulfan II	UG/L	0.02	U	0.02	U
Endosulfan Sulfate	UG/L	0.02	U	0.02	U
Endrin	UG/L	0.01	U	0.01	U
Endrin Aldehyde	UG/L	0.02	U	0.02	U
Endrin Ketone	UG/L	0.02	U	0.02	U
gamma-BHC (Lindane)	UG/L	0.01	U	0.01	U
gamma-Chlordane	UG/L	0.01	U	0.01	U
Heptachlor	UG/L	0.01	U	0.01	U
Heptachlor Epoxide	UG/L	0.01	U	0.01	U
p,p'-Methoxychlor	UG/L	0.1	U	0.1	U
Toxaphene	UG/L	1	U	1	U

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

MAIN HILL SEEP 601					
		S11101		S11111	
		902-S11101		902-S11111	
		3573101 REG		3573102 REG	
		5/24/94		05/24/94DUPE	
		Result	Val	Result	Val
Inorganics	**Units**				
Aluminum	UG/L	81.5		88.7	
Antimony	UG/L	3.1	U	3.1	U
Arsenic	UG/L	4.3	U	4.3	U
Barium	UG/L	71		71.1	
Beryllium	UG/L	0.55		0.5	U
Bismuth	UG/L	140	U	136	U
Cadmium	UG/L	2.3	U	2.3	U
Calcium	UG/L	170000		171000	
Chromium	UG/L	7.9	U	7.9	U
Cobalt	UG/L	6.5	U	6.5	U
Copper	UG/L	4.6	U	4.6	U
Cyanide	UG/L	10	U	10	U
Iron	UG/L	598	J	1910	J
Lead	UG/L	2.8	U	2.8	U
Magnesium	UG/L	44400		44700	
Manganese	UG/L	30.8		38	
Mercury	UG/L	0.2	U	0.2	U
Nickel	UG/L	8.1	U	8.1	U
Potassium	UG/L	2980		3160	
Selenium	UG/L	4.6	U	4.6	U
Silver	UG/L	4.8	U	4.8	U
Sodium	UG/L	197000		199000	
Thallium	UG/L	3.6	U	3.6	U
Vanadium	UG/L	4.9	U	4.9	U
Zinc	UG/L	11.6	U	6.3	U

MAIN HILL SEEP 601					
		S11101		S11111	
		902-S11101		902-S11111	
		3573001 REG		3573002 REG	
		5/24/94		05/24/94DUPE	
		Result	Val	Result	Val
Dissolved Inorganics	**Units**				
Aluminum	UG/L	20.3	U	20.3	U
Antimony	UG/L	3.1	U	3.1	U
Arsenic	UG/L	4.3	U	4.3	U
Barium	UG/L	60.1		65.8	
Beryllium	UG/L	1.7	U	1.7	U
Bismuth	UG/L	NR		NR	
Cadmium	UG/L	2.3	U	2.3	U
Calcium	UG/L	156244		165679	
Chromium	UG/L	9.1	U	9.1	U
Cobalt	UG/L	3.1	U	3.1	U
Copper	UG/L	2.7	U	2.7	U
Cyanide	UG/L	NR		NR	
Iron	UG/L	15.6	U	15.6	U
Lead	UG/L	2.8	U	2.8	U
Magnesium	UG/L	38705		41108	
Manganese	UG/L	19.6		21.4	
Mercury	UG/L	0.2	U	0.2	U
Nickel	UG/L	NR		NR	
Potassium	UG/L	2857		3290	
Selenium	UG/L	NR		NR	
Silver	UG/L	2.8	U	2.8	U
Sodium	UG/L	NR		NR	
Thallium	UG/L	4.9	U	5.3	U
Vanadium	UG/L	4.7	U	4.7	U
Zinc	UG/L	2.5	U	2.4	U

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

MAIN HILL SEEP 601					
		S11101		S11111	
		902-S11101		902-S11111	
		0357290001SA REG		0357290002SA REG	
		5/24/94		05/24/94DUPE	
		Result	Val	Result	Val
Anions	Units				
Ammonia as N	MG/L	0.1	U	0.1	U
Chloride	MG/L	360		373	
Fluoride	MG/L	0.17		0.17	
Nitrate/Nitrite (NO3/NO2-N)	MG/L	7.5	J	14.9	J
Sulfate	MG/L	87	J	97	J

		S11101		S11111	
		902-S11101		902-S11111	
		0357290001SA REG		0357290002SA REG	
		5/24/94		05/24/94DUPE	
		Result	Val	Result	Val
Miscellaneous	Units				
Alkalinity, Total as CaCO3 at	MG/L	342		341	
Phosphorus, Total as P	MG/L	0.05	U	0.05	U
Total Dissolved Solids	MG/L	1060		1030	
Total Kjeldahl Nitrogen as N	MG/L	0.5	U	0.5	U
Total Suspended Solids	MG/L	2	U	2.8	J
Total Organic Carbon	MG/L	1.6		1.15	

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

MAIN HILL SEEP 601					
		S11101		S11111	
		902-S11101		902-S11111	
		0357290001SA REG		0357290002SA REG	
		5/24/94		05/24/94DUPE	
		Result	Val	Result	Val
EXPLOSIVES	Units				
2-Amino-4,6-dinitrotoluene	UG/L	0.035	UJ	0.035	UJ
1,3-Dinitrobenzene	UG/L	0.11	UJ	0.11	UJ
2,4-Dinitrotoluene	UG/L	0.02	UJ	0.02	UJ
2,6-Dinitrotoluene	UG/L	0.31	UJ	0.31	UJ
HMX	UG/L	0.8	UJ	0.8	UJ
Nitrobenzene	UG/L	0.25	UJ	0.25	UJ
PETN	UG/L	1	UJ	1	UJ
RDX	UG/L	0.84	UJ	0.84	UJ
TETRYL	UG/L	0.8	UJ	0.8	UJ
1,3,5-Trinitrobenzene	UG/L	0.26	UJ	0.26	UJ
2,4,6-Trinitrotoluene	UG/L	0.11	UJ	0.11	UJ

MAIN HILL SEEP 601							
		S11101			S11111		
		902-S11101			902-S11111		
		3218521 REG			3218524 REG		
		5/24/94			05/24/94DUPE		
		Result	UNC	Val	Result	UNC	Val
Radiological	Units						
Am-241	PCI/L	9.48E-01	NA	UJ	7.92E-01	NA	UJ
Bi-207	PCI/L	3.29E+00	NA	U	4.97E+00	NA	U
Bi-210m	PCI/L	4.09E+00	NA	U	6.24E+00	NA	U
Co-60	PCI/L	3.73E+00	NA	U	6.17E+00	NA	U
Cs-137	PCI/L	3.66E+00	NA	U	5.45E+00	NA	U
K-40	PCI/L	3.56E+01	NA	U	5.10E+01	NA	U
Pu-238	PCI/L	1.87E+00	4.83E-01		2.08E+00	4.97E-01	
Pu-239/240	PCI/L	6.03E-02	NA	U	2.02E-01	NA	U
Pu-242	PCI/L	1.11E-01	1.01E-01		1.60E-01	NA	U
Ra-226	PCI/L	3.71E+00	4.64E-01		3.46E+00	4.62E-01	
Sr-90	PCI/L	4.24E+01	2.08E+00		4.17E+01	2.09E+00	
Th-228	PCI/L	3.40E-01	NA	U	3.48E-01	NA	U
Th-230	PCI/L	3.63E-01	2.24E-01		5.58E-01	2.64E-01	
Th-232	PCI/L	5.18E-02	1.27E-01		2.47E-01	NA	U
Tritium	PCI/L	5.53E+05	1.97E+03		5.52E+05	1.97E+03	
U-234	PCI/L	5.91E+01	7.55E+00		6.71E+01	8.46E+00	
U-235	PCI/L	1.19E-01	9.84E-02		5.27E-02	NA	U
U-238	PCI/L	6.73E-01	2.58E-01		1.05E+00	3.23E-01	

MAIN HILL SEEP 601							
		S11101			S11111		
		902-S11101			902-S11111		
		3218523 REG			3218524 REG		
		34478			05/24/94DUPE		
		Result	UNC	Val	Result	UNC	Val
Rads, Dissolved	Units						
Am-241	PCI/L	0.532	NA	UJ	1.08	NA	UJ
Bi-207	PCI/L	3.16	NA	U	3.01	NA	U
Bi-210m	PCI/L	4.01	NA	U	3.91	NA	U
Co-60	PCI/L	3.76	NA	U	3.5	NA	U
Cs-137	PCI/L	3.51	NA	U	3.3	NA	U
K-40	PCI/L	199	88.1		31.4	NA	U
Pu-238	PCI/L	1.55	0.492		1.52	0.441	
Pu-239/240	PCI/L	0.0726	NA	U	0.0616	NA	U
Pu-242	PCI/L	0.107	0.108		0.159	0.123	
Ra-226	PCI/L	1.62	0.327		1.51	0.317	
Sr-90	PCI/L	41.5	2.11		46	2.31	
Th-228	PCI/L	0.332	NA	U	0.364	NA	U
Th-230	PCI/L	0.359	0.218		0.387	0.205	
Th-232	PCI/L	0.203	NA	U	0.385	NA	U
Tritium	PCI/L	563000	2010		568000	2010	
U-234	PCI/L	66.9	8.96		62.7	8.01	
U-235	PCI/L	8.25	1.45		0.213	0.142	
U-238	PCI/L	6.58	1.23		1	0.31	

RADIOCHEMICAL ANALYSIS

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

General Chemistry

MAIN HILL SEEP 602			
		S21101	
		902-S21101	
		J0876.D REG	
		5/26/94	
		Result	Val
Volatile Organics	Units		
Acetone	UG/L	10	U
Acetonitrile	UG/L	100	U
Acrylonitrile	UG/L	100	U
Benzene	UG/L	5	UJ
Bromodichloromethane	UG/L	2	J
Bromoform	UG/L	2	J
Bromomethane	UG/L	10	UJ
2-Butanone	UG/L	10	U
Carbon Disulfide	UG/L	5	UJ
Carbon Tetrachloride	UG/L	5	UJ
Chlorobenzene	UG/L	5	UJ
Chlorodibromomethane	UG/L	3	J
Chloroethane	UG/L	10	U
Chloroform	UG/L	1	J
Chloromethane	UG/L	10	U
1,1-Dichloroethane	UG/L	5	UJ
1,2-Dichloroethane	UG/L	5	UJ
1,1-Dichloroethene	UG/L	1	J
1,2-Dichloroethene	UG/L	3	J
1,2-Dichloropropane	UG/L	5	UJ
cis-1,3-Dichloropropene	UG/L	5	UJ
trans-1,3-Dichloropropene	UG/L	5	UJ
1,2-Diethylbenzene	UG/L	5	UJ
Ethylbenzene	UG/L	5	UJ
Hexane	UG/L	10	U
2-Hexanone	UG/L	10	U
Iodomethane	UG/L	10	U
4-Methyl-2-pentanone	UG/L	10	U
Methylene Chloride	UG/L	10	U
Styrene	UG/L	5	UJ
1,1,2,2-Tetrachloroethane	UG/L	5	UJ
Tetrachloroethene	UG/L	5	UJ
Toluene	UG/L	5	UJ
1,1,1-Trichloroethane	UG/L	5	UJ
1,1,2-Trichloroethane	UG/L	5	UJ
Trichloroethene	UG/L	6	J
Trichlorotrifluoroethane	UG/L	5	UJ
Vinyl Acetate	UG/L	10	U
Vinyl Chloride	UG/L	10	U
Xylene, Total	UG/L	5	UJ

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

MAIN HILL SEEP 602			
		S21101	
		902-S21101	
		A1501275.D REG	
		5/26/94	
		Result	Val
Semi-volatile Organics	Units		
Acenaphthene	UG/L	10	U
Acenaphthylene	UG/L	10	U
Anthracene	UG/L	10	U
Benzo(a)anthracene	UG/L	10	U
Benzo(a)pyrene	UG/L	10	U
Benzo(b)fluoranthene	UG/L	10	U
Benzo(g,h,i)perylene	UG/L	10	U
Benzo(k)fluoranthene	UG/L	10	U
Benzoic Acid	UG/L	1	J
Benzyl Alcohol	UG/L	10	U
2-Benzyl-4-Chlorophenol	UG/L	10	U
bis(2-Chloroethoxy)methane	UG/L	10	U
bis(2-Chloroethyl)ether	UG/L	10	U
bis(2-Ethylhexyl)phthalate	UG/L	10	U
4-Bromophenyl-phenylether	UG/L	10	U
Butylbenzylphthalate	UG/L	10	U
Carbazole	UG/L	10	U
4-Chloro-3-methylphenol	UG/L	10	U
4-Chloroaniline	UG/L	10	U
2-Chloronaphthalene	UG/L	10	U
2-Chlorophenol	UG/L	10	U
4-Chlorophenyl-phenylether	UG/L	10	U
Chrysene	UG/L	10	U
Di-n-butylphthalate	UG/L	2	J
Di-n-octylphthalate	UG/L	10	U
Dibenzo(a,h)anthracene	UG/L	10	U
Dibenzofuran	UG/L	10	U
1,2-Dichlorobenzene	UG/L	10	U
1,3-Dichlorobenzene	UG/L	10	U
1,4-Dichlorobenzene	UG/L	10	U
3,3'-Dichlorobenzidine	UG/L	10	U
2,4-Dichlorophenol	UG/L	10	U
Diethylphthalate	UG/L	10	U
2,4-Dimethylphenol	UG/L	10	U
Dimethylphthalate	UG/L	10	U
4,6-Dinitro-2-methylphenol	UG/L	25	U
2,4-Dinitrophenol	UG/L	25	U
2,4-Dinitrotoluene	UG/L	10	U
2,6-Dinitrotoluene	UG/L	10	U
Fluoranthene	UG/L	10	U
Fluorene	UG/L	10	U
Hexachlorobenzene	UG/L	10	U
Hexachlorobutadiene	UG/L	10	U
Hexachlorocyclopentadiene	UG/L	10	U
Hexachloroethane	UG/L	10	U
Indeno(1,2,3-c,d)pyrene	UG/L	10	U
Isophorone	UG/L	10	U
2-Methylnaphthalene	UG/L	10	U

MAIN HILL SEEP 602			
		S21101	
		902-S21101	
		A1501275.D REG	
		5/26/94	
		Result	Val
Semi-volatile Organics	Units		
2-Methylphenol	UG/L	10	U
4-Methylphenol	UG/L	10	U
N-Nitroso-di-n-propylamine	UG/L	10	U
N-Nitrosodiphenylamine	UG/L	10	U
Naphthalene	UG/L	10	U
2-Nitroaniline	UG/L	25	U
3-Nitroaniline	UG/L	25	U
4-Nitroaniline	UG/L	25	U
Nitrobenzene	UG/L	10	U
2-Nitrophenol	UG/L	10	U
4-Nitrophenol	UG/L	25	U
2,2'-oxybis(1-Chloropropane)	UG/L	10	U
Pentachlorophenol	UG/L	25	U
Phenanthrene	UG/L	10	U
Phenol	UG/L	10	U
Pyrene	UG/L	10	U
1,2,4-Trichlorobenzene	UG/L	10	U
2,4,5-Trichlorophenol	UG/L	25	U
2,4,6-Trichlorophenol	UG/L	10	U
Tentatively Identified Compounds		11	

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

MAIN HILL SEEP 602			
		S21101	
		902-S21101	
		35727-05 REG	
		5/26/94	
		Result	Val
Pesticides and PCBs	**Units**		
Aldrin	UG/L	0.01	U
alpha-BHC	UG/L	0.01	U
alpha-Chlordane	UG/L	0.01	U
Aroclor 1232	UG/L	0.2	U
Aroclor-1016	UG/L	0.2	U
Aroclor-1221	UG/L	0.4	U
Aroclor-1242	UG/L	0.2	U
Aroclor-1248	UG/L	0.2	U
Aroclor-1254	UG/L	0.2	U
Aroclor-1260	UG/L	0.2	U
beta-BHC	UG/L	0.01	U
4,4'-DDD	UG/L	0.02	U
4,4'-DDE	UG/L	0.02	U
4,4'-DDT	UG/L	0.02	U
delta-BHC	UG/L	0.01	U
Dieldrin	UG/L	0.02	U
Endosulfan I	UG/L	0.01	U
Endosulfan II	UG/L	0.02	U
Endosulfan Sulfate	UG/L	0.02	U
Endrin	UG/L	0.01	U
Endrin Aldehyde	UG/L	0.02	U
Endrin Ketone	UG/L	0.02	U
gamma-BHC (Lindane)	UG/L	0.01	U
gamma-Chlordane	UG/L	0.01	U
Heptachlor	UG/L	0.01	U
Heptachlor Epoxide	UG/L	0.01	U
p,p'-Methoxychlor	UG/L	0.1	U
Toxaphene	UG/L	1	U

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

MAIN HILL SEEP 602			
		S21101	
		902-S21101	
		3573103 REG	
		5/26/94	
		Result	Val
Inorganics	Units		
Aluminum	UG/L	304	
Antimony	UG/L	3.1	U
Arsenic	UG/L	4.3	U
Barium	UG/L	18.5	
Beryllium	UG/L	0.5	U
Bismuth	UG/L	60.4	U
Cadmium	UG/L	2.3	U
Calcium	UG/L	34100	
Chromium	UG/L	7.9	U
Cobalt	UG/L	6.5	U
Copper	UG/L	69.2	U
Cyanide	UG/L	10	U
Iron	UG/L	1170	J
Lead	UG/L	2.8	U
Magnesium	UG/L	7400	
Manganese	UG/L	18.7	
Mercury	UG/L	0.2	U
Nickel	UG/L	8.1	U
Potassium	UG/L	2520	
Selenium	UG/L	4.6	U
Silver	UG/L	4.8	U
Sodium	UG/L	305000	
Thallium	UG/L	3.6	U
Vanadium	UG/L	4.9	U
Zinc	UG/L	18.6	U

MAIN HILL SEEP 602			
		S21101	
		902-S21101	
		3573003 REG	
		5/26/94	
		Result	Val
Dissolved Inorganics	Units		
Aluminum	UG/L	32.7	
Antimony	UG/L	3.1	U
Arsenic	UG/L	4.3	U
Barium	UG/L	15.7	
Beryllium	UG/L	1.7	U
Bismuth	UG/L	NR	
Cadmium	UG/L	2.3	U
Calcium	UG/L	31800	
Chromium	UG/L	9.1	U
Cobalt	UG/L	3.1	U
Copper	UG/L	55.4	
Cyanide	UG/L	NR	
Iron	UG/L	61.6	
Lead	UG/L	2.8	U
Magnesium	UG/L	6770	
Manganese	UG/L	6.2	U
Mercury	UG/L	0.2	U
Nickel	UG/L	NR	
Potassium	UG/L	2340	
Selenium	UG/L	NR	
Silver	UG/L	3.2	J
Sodium	UG/L	NR	
Thallium	UG/L	8.2	U
Vanadium	UG/L	4.7	U
Zinc	UG/L	3	U

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

MAIN HILL SEEP 602			
		S21101	
		902-S21101	
		0357290003SA REG	
		5/26/94	
		Result	Val
Anions	Units		
Ammonia as N	MG/L	0.1	U
Chloride	MG/L	226	
Fluoride	MG/L	0.17	
Nitrate/Nitrite (NO3/NO2-N)	MG/L	1.4	
Sulfate	MG/L	79.2	J

		S21101	
		902-S21101	
		0357290003SA REG	
		5/26/94	
		Result	Val
Miscellaneous	Units		
Alkalinity, Total as CaCO3 at	MG/L	350	
Phosphorus, Total as P	MG/L	0.078	
Total Dissolved Solids	MG/L	1020	
Total Kjeldahl Nitrogen as N	MG/L	0.5	U
Total Suspended Solids	MG/L	2	
Total Organic Carbon	MG/L	1.15	

MAIN HILL SEEP 602				
		S21101		
		902-S21101		
		3219708 REG		
		5/26/94		
		Result	UNC	Val
Radiological	Units			
Am-241	PCI/L	7.96E-01	NA	UJ
Bi-207	PCI/L	3.27E+00	NA	U
Bi-210m	PCI/L	3.55E+00	NA	U
Co-60	PCI/L	4.06E+00	NA	U
Cs-137	PCI/L	3.49E+00	NA	U
K-40	PCI/L	1.30E+02	5.14E+01	
Pu-238	PCI/L	5.79E-01	2.95E-01	
Pu-239/240	PCI/L	2.03E-01	NA	U
Pu-242	PCI/L	7.47E-02	NA	U
Ra-226	PCI/L	1.68E+00	NA	U
Sr-90	PCI/L	2.49E+00	NA	U
Th-228	PCI/L	4.33E-01	NA	U
Th-230	PCI/L	4.41E-01	2.32E-01	
Th-232	PCI/L	1.91E-01	NA	U
Tritium	PCI/L	1.69E+04	4.96E+02	
U-234	PCI/L	9.65E-01	3.57E-01	
U-235	PCI/L	2.16E-01	NA	U
U-238	PCI/L	5.26E-01	2.94E-01	

MAIN HILL SEEP 602				
		S21101		
		902-S21101		
		3219708 REG		
		34480		
		Result	UNC	Val
Rads, Dissolved	Units			
Am-241	PCI/L	1.19	NA	UJ
Bi-207	PCI/L	3.6	NA	U
Bi-210m	PCI/L	4.29	NA	U
Co-60	PCI/L	4.29	NA	U
Cs-137	PCI/L	3.91	NA	U
K-40	PCI/L	84.8	NA	U
Pu-238	PCI/L	0.581	0.281	
Pu-239/240	PCI/L	0.0685	NA	U
Pu-242	PCI/L	0.186	NA	U
Ra-226	PCI/L	0.454	NA	U
Sr-90	PCI/L	3.41	1.01	
Th-228	PCI/L	0.482	NA	U
Th-230	PCI/L	0.239	0.183	
Th-232	PCI/L	0.252	NA	U
Tritium	PCI/L	5240	332	
U-234	PCI/L	0.435	0.246	
U-235	PCI/L	0.201	NA	U
U-238	PCI/L	0.462	0.288	

RADIOCHEMICAL ANALYSIS

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

General Chemistry

MAIN HILL SEEP 607			
		S71101	
		902-S71101	
		J1225.D REG	
		6/14/94	
		Result	Val
Volatile Organics	Units		
Acetone	UG/L	10	U
Acetonitrile	UG/L	100	U
Acrylonitrile	UG/L	100	UJ
Benzene	UG/L	5	UJ
Bromodichloromethane	UG/L	5	UJ
Bromoform	UG/L	5	UJ
Bromomethane	UG/L	10	U
2-Butanone	UG/L	10	U
Carbon Disulfide	UG/L	5	UJ
Carbon Tetrachloride	UG/L	5	UJ
Chlorobenzene	UG/L	5	UJ
Chlorodibromomethane	UG/L	5	UJ
Chloroethane	UG/L	10	U
Chloroform	UG/L	5	UJ
Chloromethane	UG/L	10	U
1,1-Dichloroethane	UG/L	5	UJ
1,2-Dichloroethane	UG/L	5	UJ
1,1-Dichloroethene	UG/L	5	UJ
1,2-Dichloroethene	UG/L	2	J
1,2-Dichloropropane	UG/L	5	UJ
cis-1,3-Dichloropropene	UG/L	5	UJ
trans-1,3-Dichloropropene	UG/L	5	UJ
1,2-Diethylbenzene	UG/L	5	UJ
Ethylbenzene	UG/L	5	UJ
Hexane	UG/L	10	U
2-Hexanone	UG/L	10	U
Iodomethane	UG/L	10	U
4-Methyl-2-pentanone	UG/L	10	U
Methylene Chloride	UG/L	6	UJ
Styrene	UG/L	5	UJ
1,1,2,2-Tetrachloroethane	UG/L	5	UJ
Tetrachloroethene	UG/L	5	UJ
Toluene	UG/L	5	UJ
1,1,1-Trichloroethane	UG/L	5	UJ
1,1,2-Trichloroethane	UG/L	5	UJ
Trichloroethene	UG/L	4	J
Trichlorotrifluoroethane	UG/L	5	UJ
Vinyl Acetate	UG/L	10	U
Vinyl Chloride	UG/L	10	U
Xylene, Total	UG/L	5	UJ

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

MAIN HILL SEEP 607			
		S71101	
		902-S71101	
		REG	
		6/14/94	
		Result	Val
Semi-volatile Organics	Units		
Acenaphthene	UG/L	10	U
Acenaphthylene	UG/L	10	U
Anthracene	UG/L	10	U
Benzo(a)anthracene	UG/L	10	U
Benzo(a)pyrene	UG/L	10	U
Benzo(b)fluoranthene	UG/L	10	U
Benzo(g,h,i)perylene	UG/L	10	U
Benzo(k)fluoranthene	UG/L	10	U
Benzoic Acid	UG/L	50	U
Benzyl Alcohol	UG/L	10	U
2-Benzyl-4-Chlorophenol	UG/L	10	U
bis(2-Chloroethoxy)methane	UG/L	10	U
bis(2-Chloroethyl)ether	UG/L	10	U
bis(2-Ethylhexyl)phthalate	UG/L	10	U
4-Bromophenyl-phenylether	UG/L	10	U
Butylbenzylphthalate	UG/L	10	U
Carbazole	UG/L	10	U
4-Chloro-3-methylphenol	UG/L	10	U
4-Chloroaniline	UG/L	10	U
2-Chloronaphthalene	UG/L	10	U
2-Chlorophenol	UG/L	10	U
4-Chlorophenyl-phenylether	UG/L	10	U
Chrysene	UG/L	10	U
Di-n-butylphthalate	UG/L	10	U
Di-n-octylphthalate	UG/L	10	U
Dibenzo(a,h)anthracene	UG/L	10	U
Dibenzofuran	UG/L	10	U
1,2-Dichlorobenzene	UG/L	10	U
1,3-Dichlorobenzene	UG/L	10	U
1,4-Dichlorobenzene	UG/L	10	U
3,3'-Dichlorobenzidine	UG/L	10	U
2,4-Dichlorophenol	UG/L	10	U
Diethylphthalate	UG/L	10	U
2,4-Dimethylphenol	UG/L	10	U
Dimethylphthalate	UG/L	10	U
4,6-Dinitro-2-methylphenol	UG/L	25	U
2,4-Dinitrophenol	UG/L	25	U
2,4-Dinitrotoluene	UG/L	10	U
2,6-Dinitrotoluene	UG/L	10	U
Fluoranthene	UG/L	10	U
Fluorene	UG/L	10	U
Hexachlorobenzene	UG/L	10	U
Hexachlorobutadiene	UG/L	10	U
Hexachlorocyclopentadiene	UG/L	10	U
Hexachloroethane	UG/L	10	U
Indeno(1,2,3-c,d)pyrene	UG/L	10	U
Isophorone	UG/L	10	U
2-Methylnaphthalene	UG/L	10	U

MAIN HILL SEEP 607			
		S71101	
		902-S71101	
		REG	
		6/14/94	
		Result	Val
Semi-volatile Organics	Units		
2-Methylphenol	UG/L	10	U
4-Methylphenol	UG/L	10	U
N-Nitroso-di-n-propylamine	UG/L	10	U
N-Nitrosodiphenylamine	UG/L	10	U
Naphthalene	UG/L	10	U
2-Nitroaniline	UG/L	25	U
3-Nitroaniline	UG/L	25	U
4-Nitroaniline	UG/L	25	U
Nitrobenzene	UG/L	10	U
2-Nitrophenol	UG/L	10	U
4-Nitrophenol	UG/L	25	U
2,2'-oxybis(1-Chloropropane)	UG/L	10	U
Pentachlorophenol	UG/L	25	U
Phenanthrene	UG/L	10	U
Phenol	UG/L	10	U
Pyrene	UG/L	10	U
1,2,4-Trichlorobenzene	UG/L	10	U
2,4,5-Trichlorophenol	UG/L	25	U
2,4,6-Trichlorophenol	UG/L	10	U
Tentatively Identified Compounds		9	

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

MAIN HILL SEEP 607			
		S71101	
		902-S71101	
		36135-07 REG	
		6/14/94	
		Result	Val
Pesticides and PCBs	Units		
Aldrin	UG/L	0.01	U
alpha-BHC	UG/L	0.01	U
alpha-Chlordane	UG/L	0.01	U
Aroclor 1232	UG/L	0.2	U
Aroclor-1016	UG/L	0.2	U
Aroclor-1221	UG/L	0.4	U
Aroclor-1242	UG/L	0.2	U
Aroclor-1248	UG/L	0.2	U
Aroclor-1254	UG/L	0.2	U
Aroclor-1260	UG/L	0.2	U
beta-BHC	UG/L	0.01	U
4,4'-DDD	UG/L	0.02	U
4,4'-DDE	UG/L	0.02	U
4,4'-DDT	UG/L	0.02	UJ
delta-BHC	UG/L	0.01	U
Dieldrin	UG/L	0.02	U
Endosulfan I	UG/L	0.01	U
Endosulfan II	UG/L	0.02	U
Endosulfan Sulfate	UG/L	0.02	U
Endrin	UG/L	0.01	UJ
Endrin Aldehyde	UG/L	0.02	U
Endrin Ketone	UG/L	0.02	U
gamma-BHC (Lindane)	UG/L	0.01	U
gamma-Chlordane	UG/L	0.01	U
Heptachlor	UG/L	0.01	U
Heptachlor Epoxide	UG/L	0.01	U
p,p'-Methoxychlor	UG/L	0.1	UJ
Toxaphene	UG/L	1	U

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

MAIN HILL SEEP 607			
		S71101	
		902-S71101	
		3621601 REG	
		6/14/94	
		Result	Val
Inorganics	Units		
Aluminum	UG/L	80.9	
Antimony	UG/L	3.1	U
Arsenic	UG/L	4.3	U
Barium	UG/L	115	
Beryllium	UG/L	0.5	U
Bismuth	UG/L	114	U
Cadmium	UG/L	2.3	U
Calcium	UG/L	194000	
Chromium	UG/L	7.9	U
Cobalt	UG/L	6.5	U
Copper	UG/L	4.6	U
Cyanide	UG/L	10	U
Iron	UG/L	101	
Lead	UG/L	2.8	U
Magnesium	UG/L	67600	
Manganese	UG/L	1.4	U
Mercury	UG/L	0.2	U
Nickel	UG/L	8.1	U
Potassium	UG/L	8410	
Selenium	UG/L	4.6	U
Silver	UG/L	4.8	U
Sodium	UG/L	569000	
Thallium	UG/L	6.9	
Vanadium	UG/L	4.9	U
Zinc	UG/L	3.4	U

MAIN HILL SEEP 607			
		S71101	
		902-S71101	
		3621601 REG	
		6/14/94	
		Result	Val
Dissolved Inorganics	Units		
Aluminum	UG/L	30.5	U
Antimony	UG/L	3.1	U
Arsenic	UG/L	4.3	U
Barium	UG/L	131	J
Beryllium	UG/L	0.71	U
Bismuth	UG/L	NR	
Cadmium	UG/L	2.3	U
Calcium	UG/L	231000	J
Chromium	UG/L	7.9	U
Cobalt	UG/L	8.4	U
Copper	UG/L	4.6	U
Cyanide	UG/L	NR	
Iron	UG/L	60.5	U
Lead	UG/L	2.8	U
Magnesium	UG/L	79200	J
Manganese	UG/L	1.4	U
Mercury	UG/L	0.2	NV
Nickel	UG/L	NR	
Potassium	UG/L	10800	
Selenium	UG/L	NR	
Silver	UG/L	4.8	U
Sodium	UG/L	NR	
Thallium	UG/L	9.5	U
Vanadium	UG/L	4.9	U
Zinc	UG/L	2.4	U

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

MAIN HILL SEEP 607			
		S71101	
		902-S71101	
		0362150001SA REG	
		6/14/94	
		Result	Val
Anions	Units		
Ammonia as N	MG/L	0.1	UJ
Chloride	MG/L	1070	
Fluoride	MG/L	0.18	
Nitrate/Nitrite (NO3/NO2-N)	MG/L	6.4	
Sulfate	MG/L	185	

		S71101	
		902-S71101	
		0362150001SA REG	
		6/14/94	
		Result	Val
Miscellaneous	Units		
Alkalinity, Total as CaCO3 at	MG/L	285	
Phosphorus, Total as P	MG/L	0.05	U
Total Dissolved Solids	MG/L	2390	
Total Kjeldahl Nitrogen as N	MG/L	0.5	U
Total Suspended Solids	MG/L	6.4	
Total Organic Carbon	MG/L	1.25	

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

MAIN HILL SEEP 607			
		S71101	
		902-S71101	
		0362150001SA REG	
		6/14/94	
		Result	Val
EXPLOSIVES	Units		
2-Amino-4,6-dinitrotoluene	UG/L	0.035	UJ
1,3-Dinitrobenzene	UG/L	0.11	UJ
2,4-Dinitrotoluene	UG/L	0.02	UJ
2,6-Dinitrotoluene	UG/L	0.31	UJ
HMX	UG/L	0.8	UJ
Nitrobenzene	UG/L	0.25	UJ
PETN	UG/L	1	UJ
RDX	UG/L	0.84	UJ
TETRYL	UG/L	0.8	UJ
1,3,5-Trinitrobenzene	UG/L	0.26	UJ
2,4,6-Trinitrotoluene	UG/L	0.11	UJ

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

MAIN HILL SEEP 607				
		S71101		
		902-S71101		
		3225703 REG		
		6/14/94		
		Result	UNC	Val
Radiological	Units			
Am-241	PCI/L	1.14E+00	NA	UJ
Bi-207	PCI/L	3.42E+00	NA	U
Bi-210m	PCI/L	4.38E+00	NA	U
Co-60	PCI/L	4.09E+00	NA	U
Cs-137	PCI/L	3.88E+00	NA	U
K-40	PCI/L	3.66E+01	NA	U
Pu-238	PCI/L	1.57E-01	NA	UJ
Pu-239/240	PCI/L	8.80E-02	NA	UJ
Pu-242	PCI/L	1.11E-01	NA	UJ
Ra-226	PCI/L	1.54E+00	NA	U
Sr-90	PCI/L	1.01E+00	NA	U
Th-228	PCI/L	4.64E-01	NA	U
Th-230	PCI/L	4.02E-01	2.60E-01	
Th-232	PCI/L	2.87E-01	NA	U
Tritium	PCI/L	6.63E+04	8.95E+02	
U-234	PCI/L	6.59E-01	3.07E-01	
U-235	PCI/L	2.36E-01	NA	U
U-238	PCI/L	3.55E-01	2.20E-01	

MAIN HILL SEEP 607				
		S71101		
		902-S71101		
		3225703 REG		
		34499		
		Result	UNC	Val
Rads, Dissolved	Units			
Am-241	PCI/L	0.553	NA	UJ
Bi-207	PCI/L	3.2	NA	U
Bi-210m	PCI/L	3.81	NA	U
Co-60	PCI/L	3.39	NA	U
Cs-137	PCI/L	3.48	NA	U
K-40	PCI/L	185	75.4	
Pu-238	PCI/L	1.13	0.287	
Pu-239/240	PCI/L	0.145	NA	U
Pu-242	PCI/L	0.145	NA	U
Ra-226	PCI/L	1.56	NA	U
Sr-90	PCI/L	0.881	NA	
Th-228	PCI/L	0.471	NA	U
Th-230	PCI/L	0.367	0.208	
Th-232	PCI/L	0.261	NA	U
Tritium	PCI/L	64800	883	
U-234	PCI/L	0.837	0.323	
U-235	PCI/L	0.0758	NA	U
U-238	PCI/L	0.474	0.25	

RADIOCHEMICAL ANALYSIS

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

General Chemistry

MAIN HILL SEEP 608			
		S81101	
		902-S81101	
		J0870.D REG	
		5/31/94	
		Result	Val
Volatile Organics	Units		
Acetone	UG/L	10	U
Acetonitrile	UG/L	100	U
Acrylonitrile	UG/L	100	U
Benzene	UG/L	5	UJ
Bromodichloromethane	UG/L	5	UJ
Bromoform	UG/L	5	UJ
Bromomethane	UG/L	10	UJ
2-Butanone	UG/L	10	U
Carbon Disulfide	UG/L	5	UJ
Carbon Tetrachloride	UG/L	5	UJ
Chlorobenzene	UG/L	5	UJ
Chlorodibromomethane	UG/L	5	UJ
Chloroethane	UG/L	10	U
Chloroform	UG/L	5	UJ
Chloromethane	UG/L	10	U
1,1-Dichloroethane	UG/L	5	UJ
1,2-Dichloroethane	UG/L	5	UJ
1,1-Dichloroethene	UG/L	1	J
1,2-Dichloroethene	UG/L	1	J
1,2-Dichloropropane	UG/L	5	UJ
cis-1,3-Dichloropropene	UG/L	5	UJ
trans-1,3-Dichloropropene	UG/L	5	UJ
1,2-Diethylbenzene	UG/L	5	UJ
Ethylbenzene	UG/L	5	UJ
Hexane	UG/L	10	U
2-Hexanone	UG/L	10	U
Iodomethane	UG/L	10	U
4-Methyl-2-pentanone	UG/L	10	U
Methylene Chloride	UG/L	10	U
Styrene	UG/L	5	UJ
1,1,2,2-Tetrachloroethane	UG/L	5	UJ
Tetrachloroethene	UG/L	5	UJ
Toluene	UG/L	5	UJ
1,1,1-Trichloroethane	UG/L	5	UJ
1,1,2-Trichloroethane	UG/L	5	UJ
Trichloroethene	UG/L	7	J
Trichlorotrifluoroethane	UG/L	5	UJ
Vinyl Acetate	UG/L	10	U
Vinyl Chloride	UG/L	10	U
Xylene, Total	UG/L	5	UJ

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

MAIN HILL SEEP 608			
		S81101	
		902-S81101	
		A1801278.D REG	
		5/31/94	
		Result	Val
Semi-volatile Organics	Units		
Acenaphthene	UG/L	10	U
Acenaphthylene	UG/L	10	U
Anthracene	UG/L	10	U
Benzo(a)anthracene	UG/L	10	U
Benzo(a)pyrene	UG/L	10	U
Benzo(b)fluoranthene	UG/L	10	U
Benzo(g,h,i)perylene	UG/L	10	U
Benzo(k)fluoranthene	UG/L	10	U
Benzoic Acid	UG/L	50	U
Benzyl Alcohol	UG/L	10	U
2-Benzyl-4-Chlorophenol	UG/L	10	U
bis(2-Chloroethoxy)methane	UG/L	10	U
bis(2-Chloroethyl)ether	UG/L	10	U
bis(2-Ethylhexyl)phthalate	UG/L	10	U
4-Bromophenyl-phenylether	UG/L	10	U
Butylbenzylphthalate	UG/L	10	U
Carbazole	UG/L	10	U
4-Chloro-3-methylphenol	UG/L	10	U
4-Chloroaniline	UG/L	10	U
2-Chloronaphthalene	UG/L	10	U
2-Chlorophenol	UG/L	10	U
4-Chlorophenyl-phenylether	UG/L	10	U
Chrysene	UG/L	10	U
Di-n-butylphthalate	UG/L	10	U
Di-n-octylphthalate	UG/L	10	U
Dibenzo(a,h)anthracene	UG/L	10	U
Dibenzofuran	UG/L	10	U
1,2-Dichlorobenzene	UG/L	10	U
1,3-Dichlorobenzene	UG/L	10	U
1,4-Dichlorobenzene	UG/L	10	U
3,3'-Dichlorobenzidine	UG/L	10	U
2,4-Dichlorophenol	UG/L	10	U
Diethylphthalate	UG/L	10	U
2,4-Dimethylphenol	UG/L	10	U
Dimethylphthalate	UG/L	10	U
4,6-Dinitro-2-methylphenol	UG/L	25	U
2,4-Dinitrophenol	UG/L	25	U
2,4-Dinitrotoluene	UG/L	10	U
2,6-Dinitrotoluene	UG/L	10	U
Fluoranthene	UG/L	10	U
Fluorene	UG/L	10	U
Hexachlorobenzene	UG/L	10	U
Hexachlorobutadiene	UG/L	10	U
Hexachlorocyclopentadiene	UG/L	10	U
Hexachloroethane	UG/L	10	U
[illegible]	UG/L	10	U

MAIN HILL SEEP 608			
		S81101	
		902-S81101	
		A1801278.D REG	
		5/31/94	
		Result	Val
Semi-volatile Organics	Units		
2-Methylphenol	UG/L	10	U
4-Methylphenol	UG/L	10	U
N-Nitroso-di-n-propylamine	UG/L	10	U
N-Nitrosodiphenylamine	UG/L	10	U
Naphthalene	UG/L	10	U
2-Nitroaniline	UG/L	25	U
3-Nitroaniline	UG/L	25	U
4-Nitroaniline	UG/L	25	U
Nitrobenzene	UG/L	10	U
2-Nitrophenol	UG/L	10	U
4-Nitrophenol	UG/L	25	U
2,2'-oxybis(1-Chloropropane)	UG/L	10	U
Pentachlorophenol	UG/L	25	U
Phenanthrene	UG/L	10	U
Phenol	UG/L	10	U
Pyrene	UG/L	10	U
1,2,4-Trichlorobenzene	UG/L	10	U
2,4,5-Trichlorophenol	UG/L	25	U
2,4,6-Trichlorophenol	UG/L	10	U
Tentatively Identified Compounds		3	

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

MAIN HILL SEEP 608			
		S81101	
		902-S81101	
		35727-07 REG	
		5/31/94	
		Result	Val
Pesticides and PCBs	Units		
Aldrin	UG/L	0.01	U
alpha-BHC	UG/L	0.01	U
alpha-Chlordane	UG/L	0.01	U
Aroclor 1232	UG/L	0.2	U
Aroclor-1016	UG/L	0.2	U
Aroclor-1221	UG/L	0.4	U
Aroclor-1242	UG/L	0.2	U
Aroclor-1248	UG/L	0.2	U
Aroclor-1254	UG/L	0.2	U
Aroclor-1260	UG/L	0.2	U
beta-BHC	UG/L	0.01	U
4,4'-DDD	UG/L	0.02	U
4,4'-DDE	UG/L	0.02	U
4,4'-DDT	UG/L	0.02	U
delta-BHC	UG/L	0.01	U
Dieldrin	UG/L	0.02	U
Endosulfan I	UG/L	0.01	U
Endosulfan II	UG/L	0.02	U
Endosulfan Sulfate	UG/L	0.02	U
Endrin	UG/L	0.01	U
Endrin Aldehyde	UG/L	0.02	U
Endrin Ketone	UG/L	0.02	U
gamma-BHC (Lindane)	UG/L	0.01	U
gamma-Chlordane	UG/L	0.01	U
Heptachlor	UG/L	0.01	U
Heptachlor Epoxide	UG/L	0.01	U
p,p'-Methoxychlor	UG/L	0.1	U
Toxaphene	UG/L	1	U

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

MAIN HILL SEEP 608			
		S81101	
		902-S81101	
		3573104 REG	
		5/31/94	
		Result	Val
Inorganics	Units		
Aluminum	UG/L	2110	
Antimony	UG/L	3.1	U
Arsenic	UG/L	4.3	U
Barium	UG/L	76.2	
Beryllium	UG/L	0.76	
Bismuth	UG/L	2.17	U
Cadmium	UG/L	2.3	U
Calcium	UG/L	200000	
Chromium	UG/L	7.9	U
Cobalt	UG/L	7.8	
Copper	UG/L	5.3	
Cyanide	UG/L	10	U
Iron	UG/L	3770	J
Lead	UG/L	2.8	U
Magnesium	UG/L	74100	
Manganese	UG/L	51.5	
Mercury	UG/L	0.2	U
Nickel	UG/L	8.1	U
Potassium	UG/L	6450	
Selenium	UG/L	4.6	U
Silver	UG/L	4.8	U
Sodium	UG/L	146000	
Thallium	UG/L	3.6	U
Vanadium	UG/L	4.9	U
Zinc	UG/L	13.3	U

MAIN HILL SEEP 608			
		S81101	
		902-S81101	
		3573004 REG	
		5/31/94	
		Result	Val
Dissolved Inorganics	Units		
Aluminum	UG/L	20.3	U
Antimony	UG/L	3.1	U
Arsenic	UG/L	4.3	U
Barium	UG/L	78.8	
Beryllium	UG/L	1.7	U
Bismuth	UG/L	NR	
Cadmium	UG/L	2.3	U
Calcium	UG/L	210000	
Chromium	UG/L	9.1	U
Cobalt	UG/L	3.1	U
Copper	UG/L	2.7	U
Cyanide	UG/L	NR	
Iron	UG/L	15.6	U
Lead	UG/L	2.8	U
Magnesium	UG/L	77000	
Manganese	UG/L	6.2	U
Mercury	UG/L	0.2	U
Nickel	UG/L	NR	
Potassium	UG/L	7750	
Selenium	UG/L	NR	
Silver	UG/L	2.8	U
Sodium	UG/L	NR	
Thallium	UG/L	6.1	U
Vanadium	UG/L	4.7	U
Zinc	UG/L	1.7	U

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

MAIN HILL SEEP 608			
		S81101	
		902-S81101	
		0357290004SA REG	
		5/31/94	
		Result	Val
Anions	Units		
Ammonia as N	MG/L	0.1	U
Chloride	MG/L	441	
Fluoride	MG/L	0.1	U
Nitrate/Nitrite (NO3/NO2-N)	MG/L	3.7	
Sulfate	MG/L	104	J

		S81101	
		902-S81101	
		0357290004SA REG	
		5/31/94	
		Result	Val
Miscellaneous	Units		
Alkalinity, Total as CaCO3 at	MG/L	293	
Phosphorus, Total as P	MG/L	0.05	U
Total Dissolved Solids	MG/L	1090	
Total Kjeldahl Nitrogen as N	MG/L	0.5	U
Total Suspended Solids	MG/L	58.4	
Total Organic Carbon	MG/L	1	U

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

MAIN HILL SEEP 608				
		S81101		
		902-S81101		
		3219709 REG		
		5/31/94		
		Result	UNC	Val
Radiological	Units			
Am-241	PCI/L	9.79E-01	NA	UJ
Bi-207	PCI/L	2.18E+00	NA	U
Bi-210m	PCI/L	2.51E+00	NA	U
Co-60	PCI/L	2.80E+00	NA	U
Cs-137	PCI/L	2.32E+00	NA	U
K-40	PCI/L	3.86E+01	NA	U
Pu-238	PCI/L	6.57E-01	3.48E-01	
Pu-239/240	PCI/L	8.10E-02	NA	U
Pu-242	PCI/L	8.10E-02	NA	U
Ra-226	PCI/L	4.11E-01	NA	U
Sr-90	PCI/L	4.26E+00	NA	U
Th-228	PCI/L	4.05E-01	NA	U
Th-230	PCI/L	2.04E-01	1.47E-01	
Th-232	PCI/L	2.37E-01	NA	U
Tritium	PCI/L	5.52E+03	3.38E+02	
U-234	PCI/L	4.47E-01	2.69E-01	
U-235	PCI/L	7.14E-02	NA	U
U-238	PCI/L	3.68E-01	2.62E-01	

MAIN HILL SEEP 608				
		S81101		
		902-S81101		
		3219709 REG		
		34485		
		Result	UNC	Val
Rads, Dissolved	Units			
Am-241	PCI/L	0.527	NA	UJ
Bi-207	PCI/L	4.69	NA	U
Bi-210m	PCI/L	5.45	NA	U
Co-60	PCI/L	5.28	NA	U
Cs-137	PCI/L	5.29	NA	U
K-40	PCI/L	148	NA	U
Pu-238	PCI/L	0.431	NA	U
Pu-239/240	PCI/L	0.0827	NA	U
Pu-242	PCI/L	0.0827	NA	U
Ra-226	PCI/L	0.453	NA	U
Sr-90	PCI/L	4.92	1.33	
Th-228	PCI/L	0.611	NA	U
Th-230	PCI/L	0.302	NA	U
Th-232	PCI/L	0.301	NA	U
Tritium	PCI/L	16500	489	
U-234	PCI/L	0.453	NA	UJ
U-235	PCI/L	0.311	NA	UJ
U-238	PCI/L	0.505	0.363	J

RADIOCHEMICAL ANALYSIS

Monthly Seep Sampling

ICF KAISER
ENVIRONMENT & ENERGY GROUP

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4501 Erskine Road, Suite 100
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513/745-2760 Fax 513/745-2765

February 17, 1995

Mr. Gary Coons
EG&G Mound Applied Technologies
Mail Stop: OSE-2
P.O. Box 3000
Miamisburg, Ohio 45343-3000

Subject: Seep Sampling
Mound Plant, Main Hill
ICF KE Project No. 93134-016-00

Dear Gary:

This letter presents the results of the final seep monitoring and sampling activities performed on January 5, 1995. Sampling activities were conducted to assess the correlation between remedial activities at the B Building Solvent Storage Shed Area (Soil Vapor Extraction) and concentrations of volatile organic compounds (VOCs) reported in water samples from the Main Hill seeps. In addition, correlations between other parameters are to be assessed.

Seeps 0601, 0604/0605, 0606, 0607, 0608, and 0625 (Figure 1) were sampled in the field for pH, specific conductance, and temperature using a Hydac combination meter. Flow rates were also calculated in the field by collecting a volume of water and recording the time required to collect it.

In accordance with the Field Sampling Plan, water samples were collected in 40 ml prepreserved laboratory supplied vials and transferred to Ross Analytical Services, Inc. in Strongsville, Ohio for analysis. The water samples were analyzed for VOCs by EPA Test Methods 8010 and 8020. A review of the laboratory data suggests that DCA concentrations reported for January 5, 1995 are the result of laboratory or glassware contamination. Each of these samples reported DCA concentrations ranging from 7.3 to 8.0 µg/L including the field blank.

The cumulative results of the water sampling events since August 8, 1994 are presented in Table 1-1. The laboratory results from the January 5, 1995 sampling are documented in Attachment I. Equipment blank and laboratory QA/QC samples were also transferred to the laboratory for analysis and are documented in Attachment I.

A multivariate statistical technique called "cluster analysis" was used to evaluate seep data collected between August 1994 and January 1995. Cluster analysis is a robust statistical tool which creates groups, or clusters, by progressively pooling individuals on the basis of overall similarities with respect to all measured parameters. A requirement of cluster analysis is a low percentage of "missing data" within the

overall dataset being analyzed. One of the strengths of cluster analysis is that the parameters being analyzed need not be of the same type; that is, physical data (temperature, flow rate) can be combined with chemical data (water chemistry).

Parameters considered during evaluation of the Main Hill seeps included:

- analytical data for
  - chloromethane,
  - dichloromethane (DCA),
  - 1,2-dichloroethene (1,2-DCE),
  - trichloroethene (TCE),
  - 1,1,1-trichloroethane (1,1,1-TCA), and
  - tetrachloroethene (PCE);
- conductivity;
- pH;
- temperature; and
- seep flow rate.

The first iteration of this technique, using all of the above listed parameters, resulted in clusters which were controlled largely by conductivity of the water flowing from the seeps. The conductivity associated with seeps 601, 608, and 625 were unique for each seep, and consistent throughout the sampling period. Conductivities for seeps 606 and 607 were similar, and samples from these two seeps were grouped together. Clustering by individual seep suggests unique composition, and perhaps unique sources, for water in seeps 601, 608, and [redacted]. The grouping of samples from seeps 606 and 607 suggests a similar source. Variable conductivity in seep water may reflect varying degrees of interaction with deep, unweathered shale bedrock.

To evaluate this influence of contaminants on clustering, conductivity, and temperature were deleted from the dataset prior to analysis. This evaluation revealed the following clusters and their unique characteristics:

Seep 601, characterized by elevated levels of PCE (in fact, the only PCE "hits" in the entire dataset;

Seep 607, moderate levels of 1,2-DCE and TCE;

Seep 608, moderate levels of TCE only;

[redacted];

Seep 606, elevated levels of 1,2-DCE and TCE;

A cluster composed of samples from seeps 606, 607, 608, and [redacted], all were collected on August 9, 1994, and all are characterized by chloromethane (the only chloromethane hits of the entire dataset). As these seeps are geographically separated, and this parameter was detected only for this sample period, it seems likely that this cluster may represent laboratory contamination.

In summary, cluster analysis suggests that these seeps have consistently unique characteristics, possibly reflecting unique sources for contaminants measured in each seep, as well as for the source of water which feeds seep flow.

A comparison of the seep flow (Figure 2) and tetrachlorethene (PCE) concentrations (Figure 3) for seep 0601 suggests that PCE concentrations increase with increased seep flow. This increase in PCE concentrations with increased seep flow may be the result of PCE held in the vadose zone and released to groundwater during periods of high precipitation. The concentrations of chloromethane, cis-1,2-dichloroethene, dichloromethane, trichloroethene (TCE), and 1,1,1-trichloroethane in the Main Hill seeps do not indicate any correlation to seep flow and are plotted in Figures 4, 5, 6, 7, and 8, respectively.

The cluster analysis and the correlation between seep flow and the concentration of PCE in seep 0601 and the lack of correlation between seep flow and other compounds suggests that there may be different contaminant source areas on the Main Hill. One potential source area of PCE is located on the east side of I Building where previous soil gas surveys identified PCE concentrations of 1,191 ppb.

If you should have any questions, please feel free to contact Tom Kilbane at (513) 745-2773.

Sincerely,

ICF KAISER ENGINEERS

Thomas J. Kilbane

Thomas J. Kilbane
Hydrogeologist

Keith Egan

Keith Egan
Project Manager

Attachment

93134-116-F

Table 1.1. Seep Sampling Results

Seep #	Sample Date	Sample I.D.	Chloromethane	Dichloromethane	Cis-1,2-DCE	TCE	1,1,1-TCA	PCE	pH	Conductivity	Temperature	Flow
0601	08/09/94	M2302-80-0601-0	<2	4.2	<2	6.9	<0.4	16	6.2	2,230	60.1	1.35
	08/31/94	203-000001	<2	<2	2	7.5	<2	17	7.2	1,900	61	1.408
	08/31/94(D)	203-000002	<2	<2	<2	7.1	<2	16	NS	NS	NS	NS
	10/05/94	203-000010	<2	2.0	<2	5.0	<2	6.2	6.1	1,970	60.1	0.9
	10/05/94(D)	203-000011	<2	<2	<2	5.8	<2	7.0	NS	NS	NS	NS
	11/02/94	203-000017	<2	2.6	<2	3.9	<0.4	4.4	6.4	2,010	60.1	0.938
	11/02/94(D)	203-000018	<2	2.6	<2	3.8	<0.4	4.2	NS	NS	NS	NS
	12/06/94	203-000024	<1	<0.5	<0.5	5.6	<0.5	14.4	6.5	2,020	60.1	1.875
	12/06/94(D)	203-000025	<1	<0.5	<0.5	5.3	<0.5	14.4	NS	NS	NS	NS
	1/05/95	203-000032	<2	(7.6)	<2	4.1	<0.4	5.7	6.6	2,110	56.1	1.125
	1/05/95(D)	203-000033	<2	(8.0)	<2	3.8	<0.4	5.1	NS	NS	NS	NS
0604/0605	08/09/94	M2302-80-0604-0	<2	3.8	<2	0.7	<0.4	<2	6.7	3,500	66.5	0.07
	08/31/94	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	10/05/94	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	11/02/94	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	12/06/94	203-000028	<1	<0.5	21.1	10.8	<0.5	<0.5	6.8	2,250	52.6	0.053
	1/05/95	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Notes:
Sample identification system was changed between the 08/09/94 and 08/31/94 sampling events
Cis-1,2-DCE = Cis-1,2-Dichloroethene
TCE = Trichloroethene
1,1,1-TCA = 1,1,1-Trichloroethane
PCE = Tetrachloroethene
< = less than estimated quantitation limits
NS = Not sampled
(D) = duplicate samples
(7.3) = sample suspect due to laboratory contamination
Conductivity units in µhmos
Temperature units in degrees Fahrenheit
Flow units are gallons per minute
Parameter concentrations in µg/L (parts per billion)
* Temperature measurement has likely been affected low ambient air temperatures.

Table 1.1. Seep Sampling Results (continued)

Seep #	Sample Date	Sample I.D.	Chloromethane	Dichloromethane	Cis-1,2-DCE	TCE	1,1,1-TCA	PCE	pH	Conductivity	Temperature	Flow
0606	08/09/94	M2302-80-0606-0	3.9	3.5	<2	1.4	<0.4	<2	6.9	3,600	67	0.001
	08/31/94	203-000006	<2	<2	4.3	9.2	<2	<2	6.4	3,810	66.7	0.006
	10/05/94	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	11/02/94	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	12/06/94	203-000029	<1	<0.5	3.9	10.6	<0.5	<0.5	7.0	3,050	52.1	0.008
	1/05/95	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
0607	08/09/94	M2302-80-0607-0	3.4	3.7	2.6	4.9	0.7	<2	7.2	3,800	57.5	1.125
	08/31/94	203-000007	<2	<2	3.0	5.6	<2	<2	7.1	3,780	57.4	1.407
	10/05/94	203-000015	<2	<2	2.3	5.2	1.3	<2	6.7	3,700	57.4	0.415
	11/02/94	203-000022	<2	2.3	<2	3.0	<0.4	<2	6.7	3,700	56.1	0.703
	12/06/94	203-000030	<1	<0.5	2.2	2.6	<0.5	<0.5	6.9	3,120	55.1	1.875
	1/05/95	203-000035	<2	(7.3)	<2	2.6	<0.4	<2	6.7	3,420	48.5*	0.804
0608	08/09/94	M2302-80-0608-0	7.1	4.0	<2	3.6	<0.4	<2	6.2	2,230	60.1	0.035
	08/31/94	203-000005	<2	<2	<2	4.5	<2	<2	6.9	2,240	60.3	0.035
	10/05/94	203-000014	<2	<2	<2	4.0	<0.5	<2	6.9	2,230	60.1	0.028
	11/02/94	203-000021	<2	2.6	<2	2.6	<0.4	<2	6.6	2,240	47.7*	0.023
	12/06/94	203-000027	<1	<0.5	<0.5	2.1	<0.5	<0.5	6.6	2,240	47.7*	0.015
	1/05/95	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Notes:
Sample identification system was changed between the 08/09/94 and 08/31/94 sampling events
Cis-1,2-DCE = Cis-1,2-Dichloroethene
TCE = Trichloroethene
1,1,1-TCA = 1,1,1-Trichloroethane
PCE = Tetrachloroethene
< = less than estimated quantitation limits
NS = Not sampled
(D) = duplicate samples
(7.3) = sample suspect due to laboratory contamination
Conductivity units in µhmos
Temperature units in degrees Fahrenheit
Flow units are gallons per minute
Parameter concentrations in µg/L (parts per billion)
* Temperature measurement has likely been affected low ambient air temperatures.

Table 1.1. Seep Sampling Results (continued)

Seep #	Sample Date	Sample I.D.	Chloromethane	Dichloromethane	Cis-1,2-DCE	TCE	1,1,1-TCA	PCE	pH	Conductivity	Temperature	Flow
0625	08/09/94	M2302-80-0601A-0	4.4	4.2	<2	0.4	0.6	<2	7.5	1,300	67.5	0.017
	08/09/94(D)	M2302-81-0601A-0	6.5	4.0	<2	<0.4	<0.4	<2	NS	NS	NS	NS
	08/31/94	203-000004	<2	<2	<2	0.6	<2	<2	7.5	1,220	67.3	0.02
	10/05/94	203-000013	<2	<2	<2	<0.5	<0.5	<2	6.2	1,320	59.6	0.02
	11/02/94	203-000020	<2	2.6	<2	<0.4	<0.4	<2	6.2	1,320	59.6	0.039
	12/06/94	203-000026	<1	<0.5	<0.5	<.05	<0.5	<0.5	6.6	1,320	60.0	0.10
	1/05/95	203-000034	<2	(7.9)	<2	<0.4	<0.4	<2	6.8	1,410	43.3*	0.114

Notes:
Sample identification system was changed between the 08/09/94 and 08/31/94 sampling events
Cis-1,2-DCE = Cis-1,2-Dichloroethene
TCE = Trichloroethene
1,1,1-TCA = 1,1,1-Trichloroethane
PCE = Tetrachloroethene
< = less than estimated quantitation limits
NS = Not sampled
(D) = duplicate samples
(7.3) = sample suspect due to laboratory contamination
Conductivity units in µhmos
Temperature units in degrees Fahrenheit
Flow units are gallons per minute
Parameter concentrations in µg/L (parts per billion)
* Temperature measurement has likely been affected low ambient air temperatures.

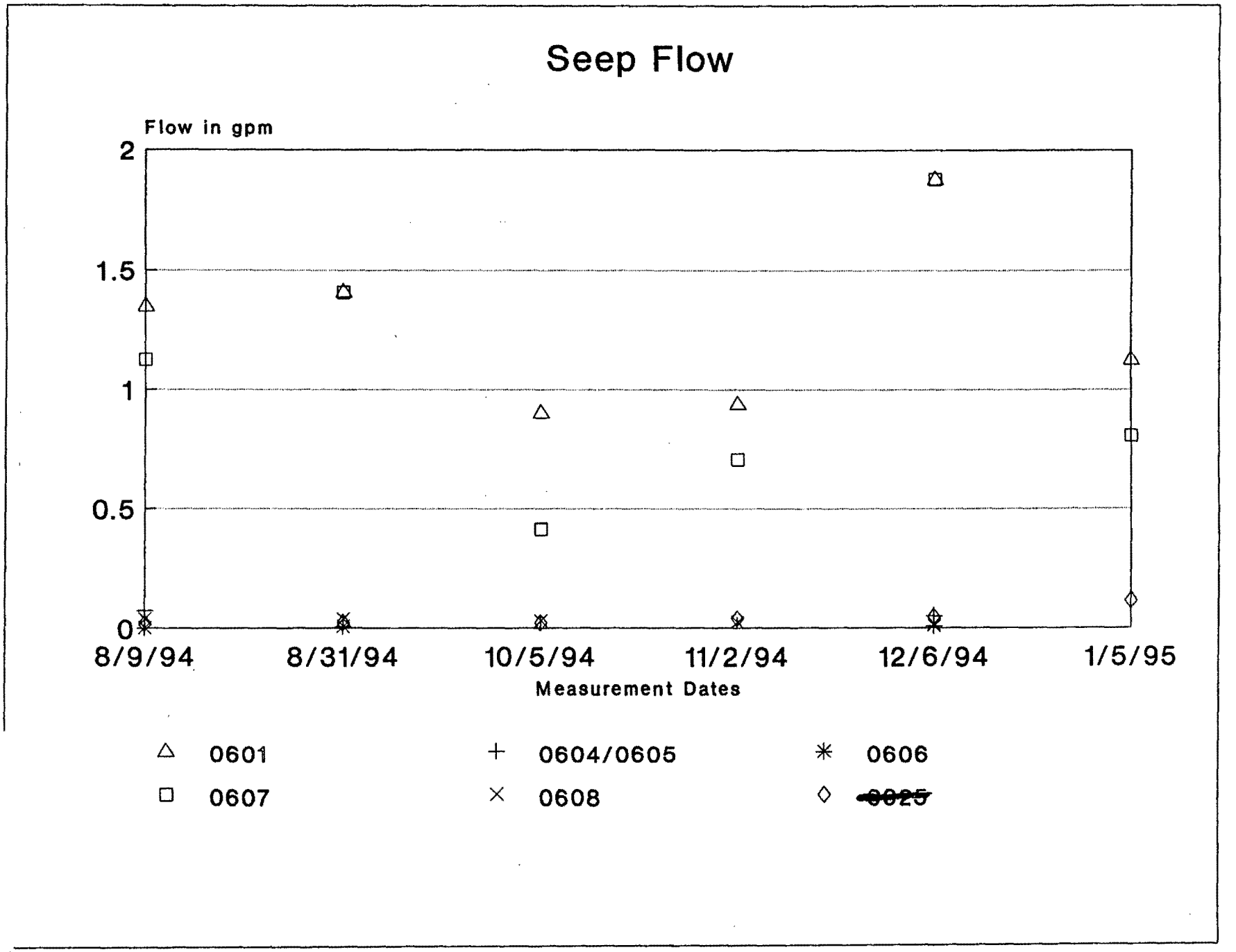

Figure 2. Seep Flow

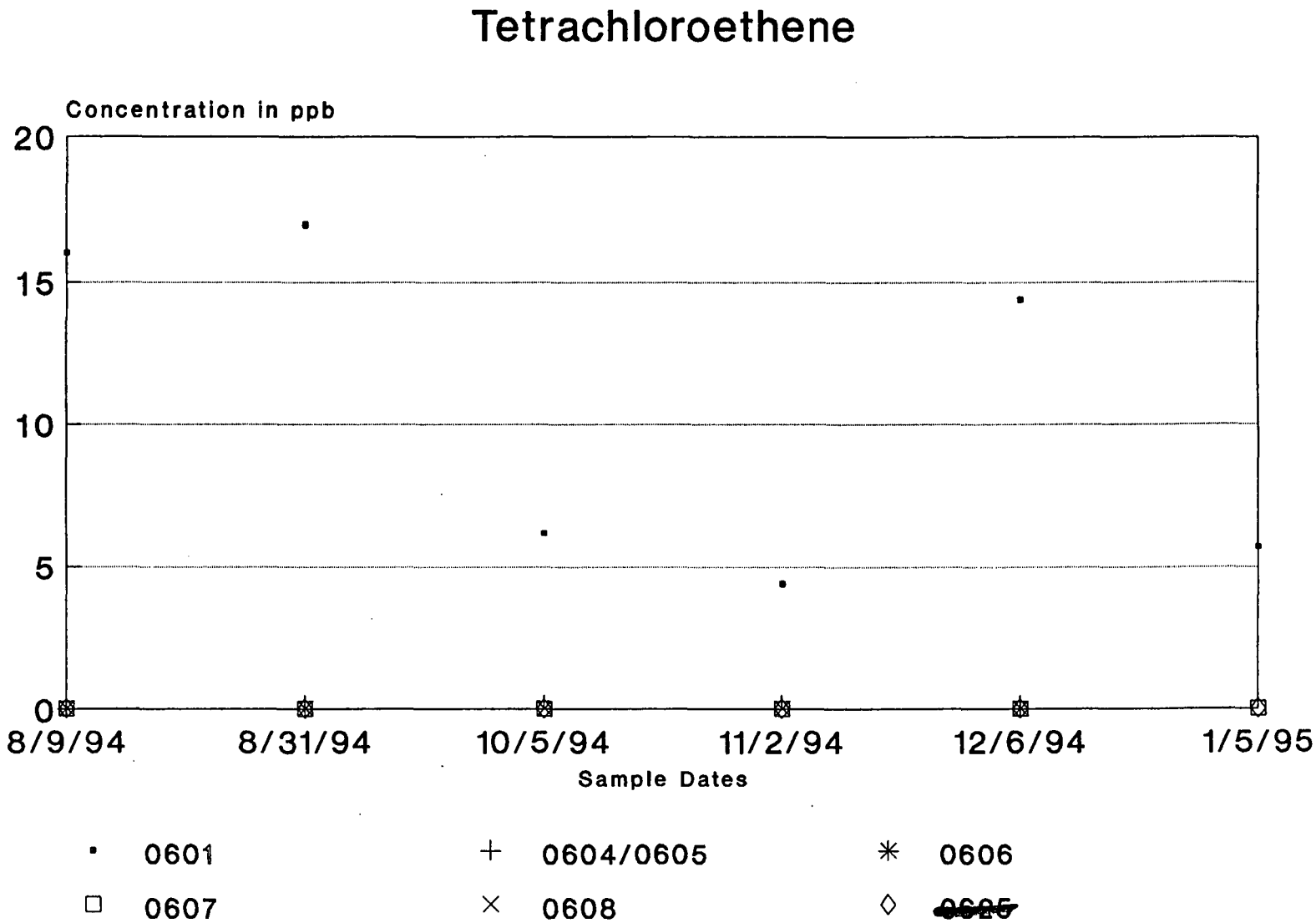

Figure 3. Tetrachloroethene Concentrations

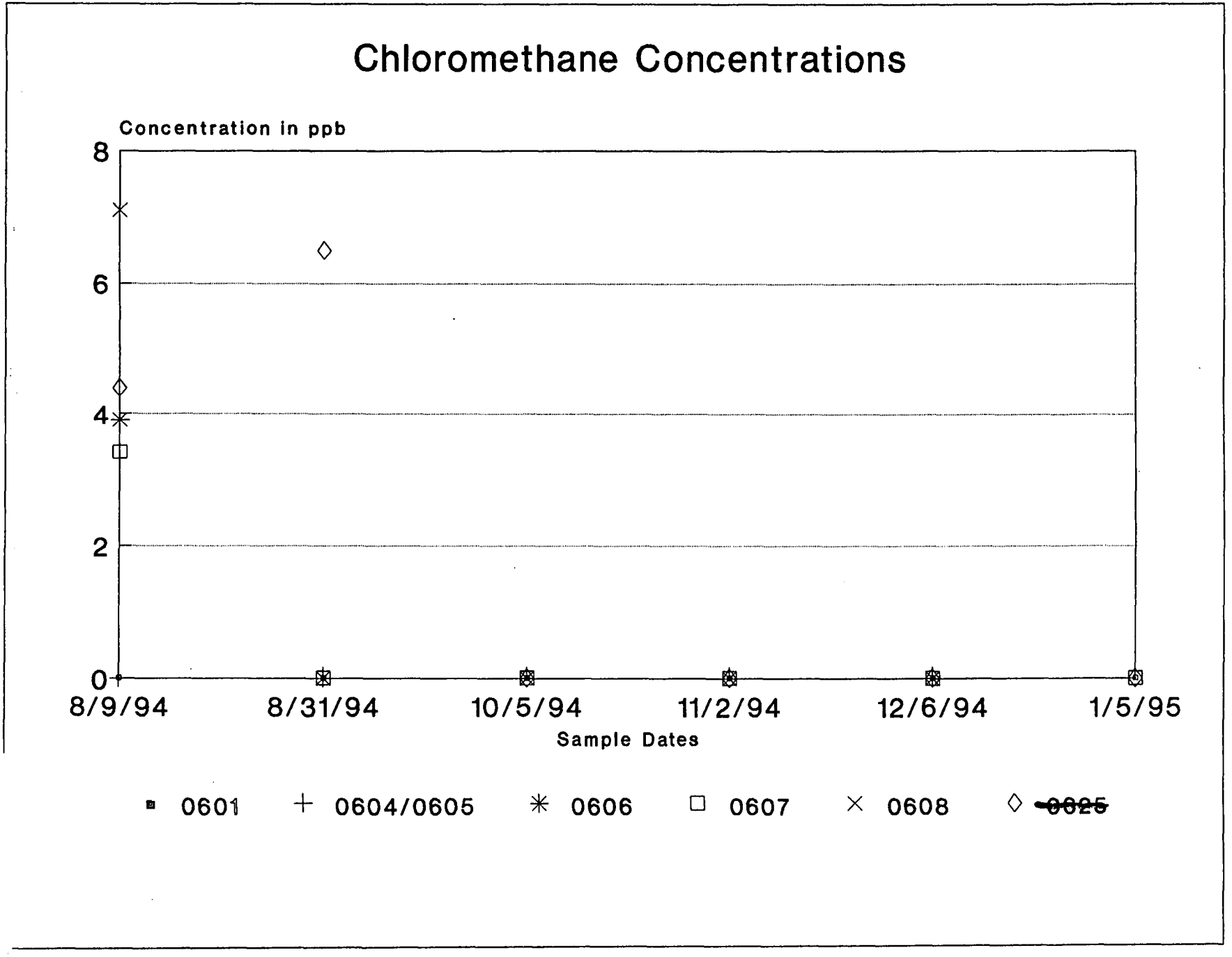

Figure 4. Chloromethene Concentrations

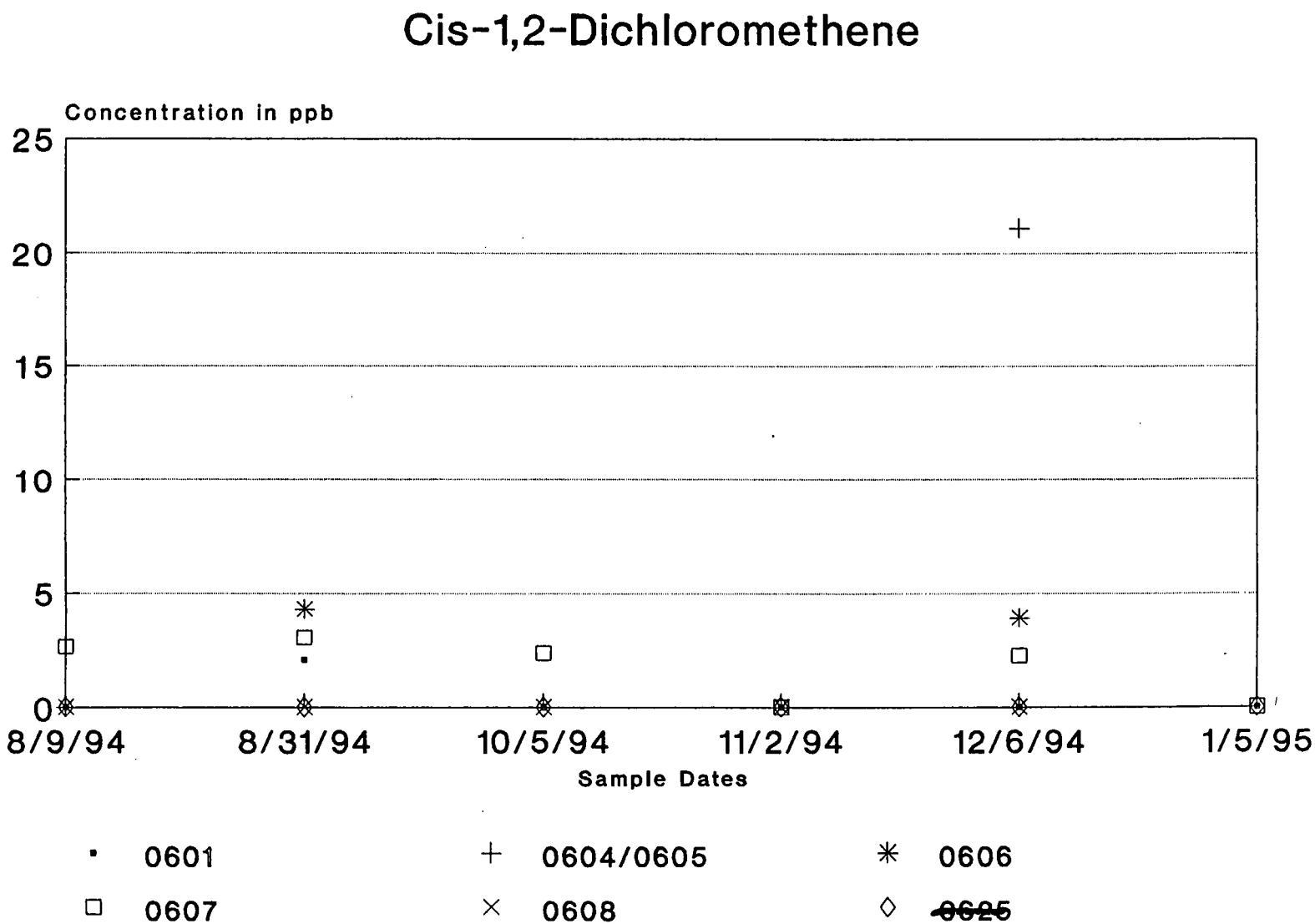

Figure 5. Cis-1,2-Dichloroethene Concentrations

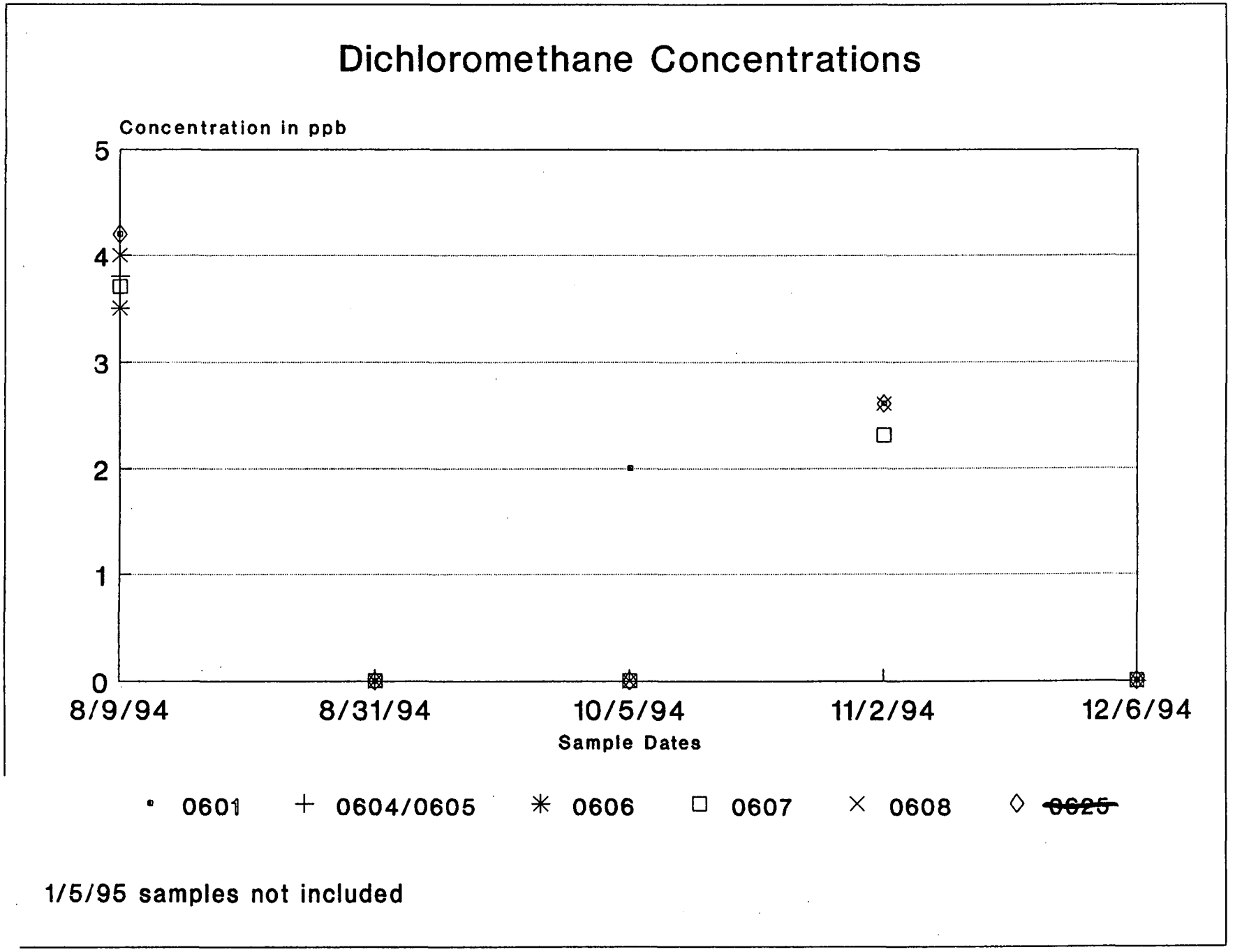

Figure 6. Dichlormethane Concentrations

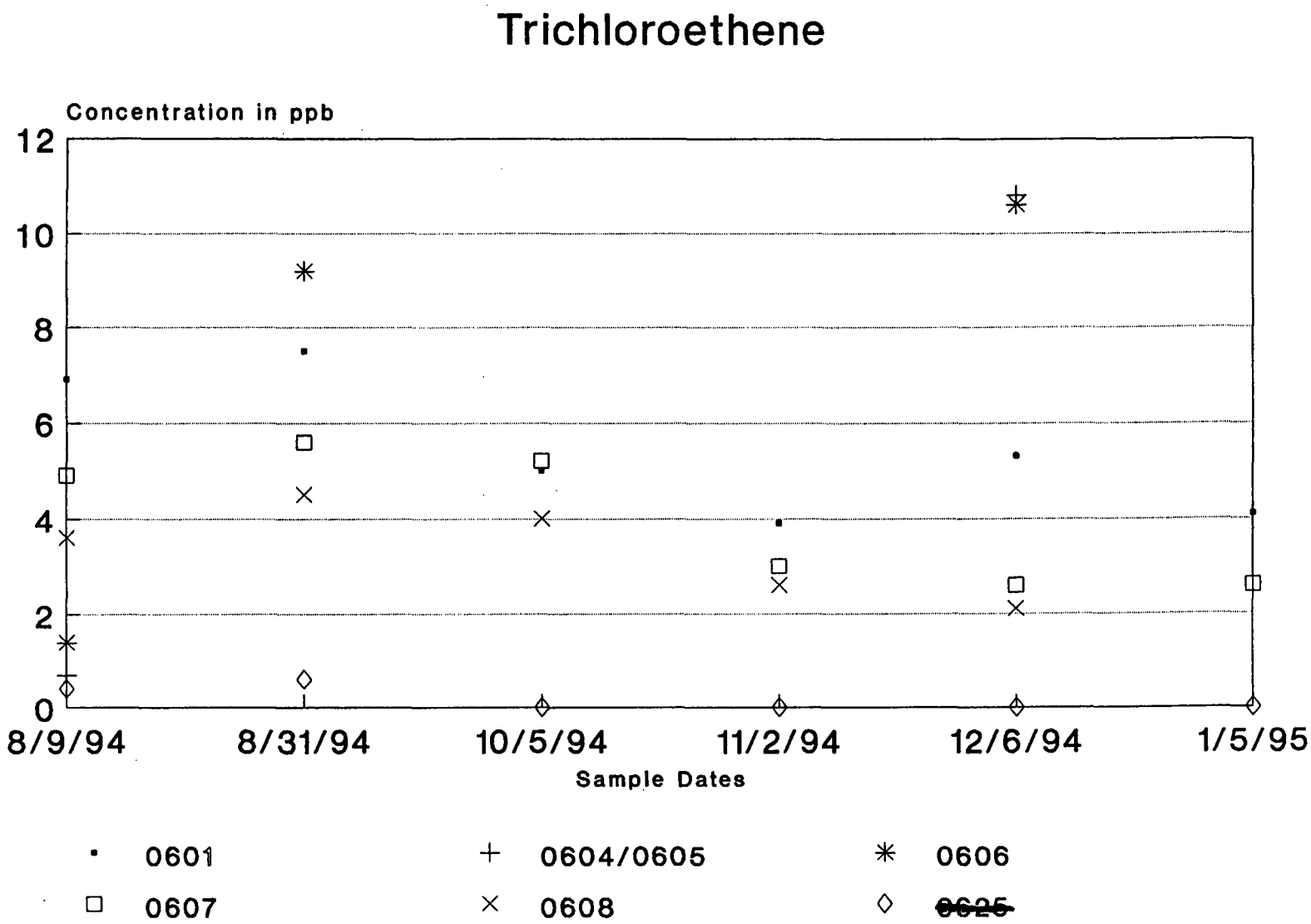

Figure 7. Trichloroethene Concentrations

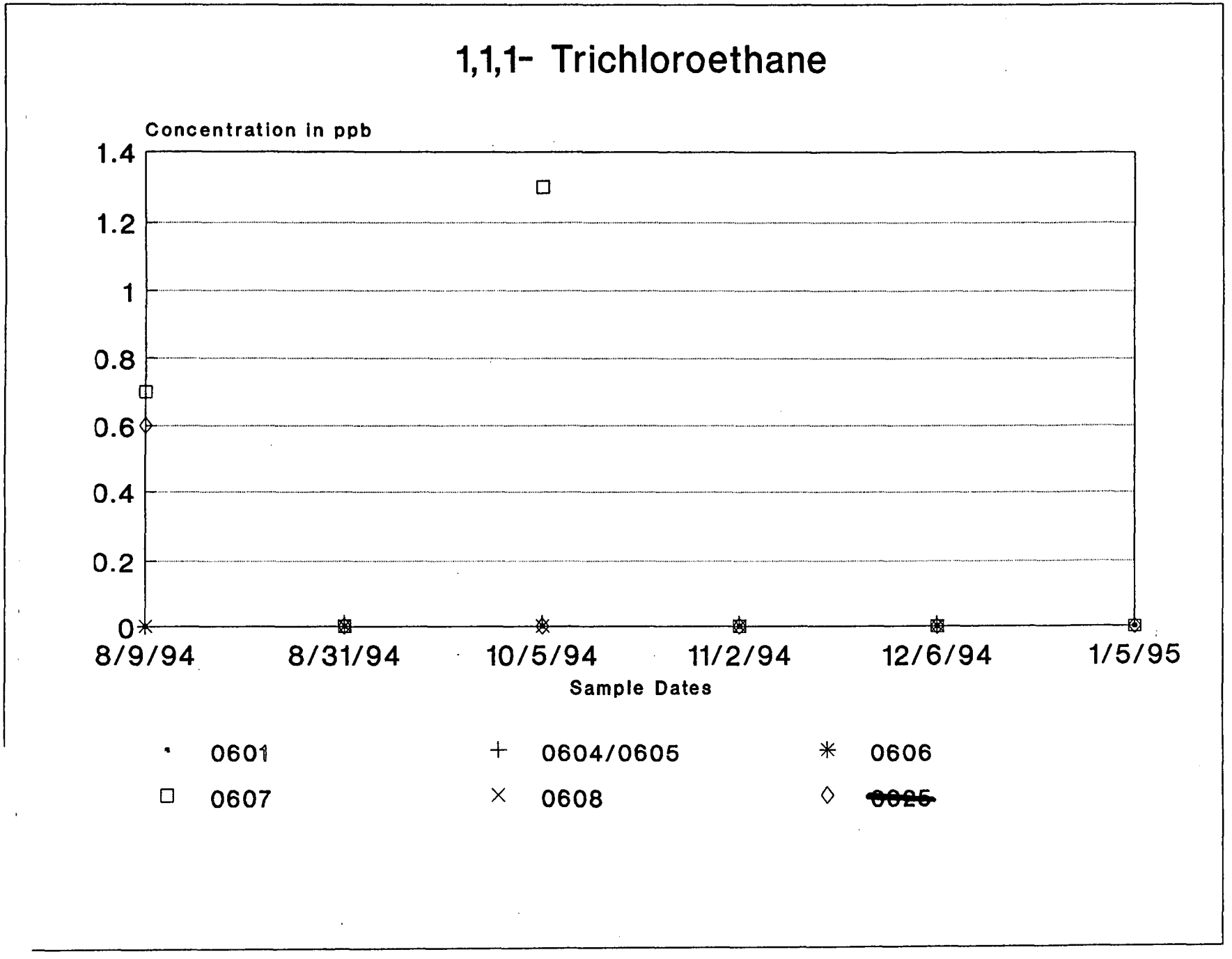

Figure 8. 1,1,1-Trichloroethane Concentrations

ATTACHMENT I

JANUARY 5, 1995 ANALYTICAL DATA

Ross Analytical Services, Inc.
16433 Foltz Industrial Parkway • Strongsville, Ohio 44136
(216) 572-3200 • Fax (216) 572-7620 • 1-800-325-7737

CERTIFICATE OF ANALYSIS

Client:

ICF Kaiser Engineers, Inc.
4501 Erskine Rd. Suite 100
Cincinnati, OH 45242

Attn: Keith Egan

Work Order #: 95-01-040
Client Code: ICF_KAISER_2
Report Date: 01/16/95
Work ID: Waters for 8021
Date Received: 01/06/95

Purchase Order: Proj # 93134-016-00

SAMPLE IDENTIFICATION

Lab Number	Sample Description	Lab Number	Sample Description
01	Water 203-000032	02	Water 203-000033
03	Water 203-000034	04	Water 203-000035
05	Water 203-000036	06	Disk

Data are reported on an as-received basis unless stated otherwise. Estimated Quantitation Limits (EQL's) are listed for most analytes. EQL's are the lowest concentrations that can be reliably measured under routine laboratory conditions. Unless otherwise noted, method blanks had no targets found above their EQL's and results were not corrected for blanks.

Amy E. Nasr

Certificate approved by
Amy E. Nasr

Sample Description Water 203-000032 Lab No. 01
Test Description 8010/8020 in series Test Code 8021

DATE RUN 01/12/95 DILUTION FACTOR 1 UNITS ug/L

Halogenated (8010) Volatiles

CAS No.	Compound	Result	EQL	CAS No.	Compound	Result	EQL
75-25-7	Bromodichloromethane	<EQL	2.0	107-06-2	1,2-Dichloroethane	<EQL	2.0
75-25-2	Bromoform	<EQL	2.0	75-35-4	1,1-Dichloroethene	<EQL	2.0
56-23-5	Carbon tetrachloride	<EQL	2.0	156-60-5	trans-1,2-Dichloroethene	<EQL	2.0
108-90-7	Chlorobenzene	<EQL	2.0	75-09-2	Dichloromethane	7.6	2.0
75-00-3	Chloroethane	<EQL	2.0	78-87-5	1,2-Dichloropropane	<EQL	2.0
67-66-3	Chloroform	<EQL	2.0	10061-02-6	trans-1,3-Dichloropropene	<EQL	2.0
74-87-3	Chloromethane	<EQL	2.0	79-34-5	1,1,2,2-Tetrachloroethane	<EQL	2.0
124-48-1	Dibromochloromethane	<EQL	2.0	127-18-4	Tetrachloroethene	5.7	2.0
95-50-1	1,2-Dichlorobenzene	<EQL	2.0	71-55-6	1,1,1-Trichloroethane	<EQL	0.4
541-73-1	1,3-Dichlorobenzene	<EQL	2.0	79-00-5	1,1,2-Trichloroethane	<EQL	2.0
106-46-7	1,4-Dichlorobenzene	<EQL	2.0	79-01-6	Trichloroethene	4.1	0.4
75-34-3	1,1-Dichloroethane	<EQL	2.0	75-01-4	Vinyl Chloride	<EQL	2.0
76-13-1	Freon 113	<EQL	2.0	156-59-2	cis-1,2-Dichloroethene	<EQL	2.0

Aromatic (8020) Volatiles

CAS No.	Compound	Result	EQL	CAS No.	Compound	Result	EQL
71-43-2	Benzene	<EQL	2.0	106-46-7	1,4-Dichlorobenzene	<EQL	2.0
108-90-7	Chlorobenzene	<EQL	2.0	100-41-4	Ethylbenzene	<EQL	2.0
95-50-1	1,2-Dichlorobenzene	<EQL	2.0	108-88-3	Toluene	<EQL	2.0
541-73-1	1,3-Dichlorobenzene	<EQL	2.0		Xylenes	<EQL	4.0

8010 Surrogate	% Recovery	Limits
1-Chloro-4-fluorobenzene	116	59 - 158

8020 Surrogate	% Recovery	Limits
1-Chloro-4-fluorobenzene	106	67 - 136

TEST METHODOLOGIES

Purgeable halocarbons and aromatics were determined using gas chromatography with electrolytic conductivity and photoionization detection as in EPA Method 8021.

Work Order # 95-01-040 Ross Analytical Services, Inc Reported: 01/16/95

Sample Description Water 203-000033 Lab No. 02
Test Description 8010/8020 in series Test Code 8021

DATE RUN 01/12/95 DILUTION FACTOR 1 UNITS ug/L

Halogenated (8010) Volatiles

CAS No.	Compound	Result	EQL	CAS No.	Compound	Result	EQL
75-25-7	Bromodichloromethane	<EQL	2.0	107-06-2	1,2-Dichloroethane	<EQL	2.0
75-25-2	Bromoform	<EQL	2.0	75-35-4	1,1-Dichloroethene	<EQL	2.0
56-23-5	Carbon tetrachloride	<EQL	2.0	156-60-5	trans-1,2-Dichloroethene	<EQL	2.0
108-90-7	Chlorobenzene	<EQL	2.0	75-09-2	Dichloromethane	8.0	2.0
75-00-3	Chloroethane	<EQL	2.0	78-87-5	1,2-Dichloropropane	<EQL	2.0
67-66-3	Chloroform	<EQL	2.0	10061-02-6	trans-1,3-Dichloropropene	<EQL	2.0
74-87-3	Chloromethane	<EQL	2.0	79-34-5	1,1,2,2-Tetrachloroethane	<EQL	2.0
124-48-1	Dibromochloromethane	<EQL	2.0	127-18-4	Tetrachloroethene	5.1	2.0
95-50-1	1,2-Dichlorobenzene	<EQL	2.0	71-55-6	1,1,1-Trichloroethane	<EQL	0.4
541-73-1	1,3-Dichlorobenzene	<EQL	2.0	79-00-5	1,1,2-Trichloroethane	<EQL	2.0
106-46-7	1,4-Dichlorobenzene	<EQL	2.0	79-01-6	Trichloroethene	3.8	0.4
75-34-3	1,1-Dichloroethane	<EQL	2.0	75-01-4	Vinyl Chloride	<EQL	2.0
76-13-1	Freon 113	<EQL	2.0	156-59-2	cis-1,2-Dichloroethene	<EQL	2.0

Aromatic (8020) Volatiles

CAS No.	Compound	Result	EQL	CAS No.	Compound	Result	EQL
71-43-2	Benzene	<EQL	2.0	106-46-7	1,4-Dichlorobenzene	<EQL	2.0
108-90-7	Chlorobenzene	<EQL	2.0	100-41-4	Ethylbenzene	<EQL	2.0
95-50-1	1,2-Dichlorobenzene	<EQL	2.0	108-88-3	Toluene	<EQL	2.0
541-73-1	1,3-Dichlorobenzene	<EQL	2.0		Xylenes	<EQL	4.0

8010 Surrogate	% Recovery	Limits
1-Chloro-4-fluorobenzene	119	59 - 158

8020 Surrogate	% Recovery	Limits
1-Chloro-4-fluorobenzene	107	67 - 136

Work Order # 95-01-040 Ross Analytical Services, Inc Reported: 01/16/95

Sample Description Water 203-000034 Lab No. 03
Test Description 8010/8020 in series Test Code 8021

DATE RUN 01/12/95 DILUTION FACTOR 1 UNITS ug/L

Halogenated (8010) Volatiles

CAS No.	Compound	Result	EQL	CAS No.	Compound	Result	EQL
75-25-7	Bromodichloromethane	<EQL	2.0	107-06-2	1,2-Dichloroethane	<EQL	2.0
75-25-2	Bromoform	<EQL	2.0	75-35-4	1,1-Dichloroethene	<EQL	2.0
56-23-5	Carbon tetrachloride	<EQL	2.0	156-60-5	trans-1,2-Dichloroethene	<EQL	2.0
108-90-7	Chlorobenzene	<EQL	2.0	75-09-2	Dichloromethane	7.9	2.0
75-00-3	Chloroethane	<EQL	2.0	78-87-5	1,2-Dichloropropane	<EQL	2.0
67-66-3	Chloroform	<EQL	2.0	10061-02-6	trans-1,3-Dichloropropene	<EQL	2.0
74-87-3	Chloromethane	<EQL	2.0	79-34-5	1,1,2,2-Tetrachloroethane	<EQL	2.0
124-48-1	Dibromochloromethane	<EQL	2.0	127-18-4	Tetrachloroethene	<EQL	2.0
95-50-1	1,2-Dichlorobenzene	<EQL	2.0	71-55-6	1,1,1-Trichloroethane	<EQL	0.4
541-73-1	1,3-Dichlorobenzene	<EQL	2.0	79-00-5	1,1,2-Trichloroethane	<EQL	2.0
106-46-7	1,4-Dichlorobenzene	<EQL	2.0	79-01-6	Trichloroethene	<EQL	0.4
75-34-3	1,1-Dichloroethane	<EQL	2.0	75-01-4	Vinyl Chloride	<EQL	2.0
76-13-1	Freon 113	<EQL	2.0	156-59-2	cis-1,2-Dichloroethene	<EQL	2.0

Aromatic (8020) Volatiles

CAS No.	Compound	Result	EQL	CAS No.	Compound	Result	EQL
71-43-2	Benzene	<EQL	2.0	106-46-7	1,4-Dichlorobenzene	<EQL	2.0
108-90-7	Chlorobenzene	<EQL	2.0	100-41-4	Ethylbenzene	<EQL	2.0
95-50-1	1,2-Dichlorobenzene	<EQL	2.0	108-88-3	Toluene	<EQL	2.0
541-73-1	1,3-Dichlorobenzene	<EQL	2.0		Xylenes	<EQL	4.0

8010 Surrogate	% Recovery	Limits
1-Chloro-4-fluorobenzene	115	59 - 158

8020 Surrogate	% Recovery	Limits
1-Chloro-4-fluorobenzene	108	67 - 136

Work Order # 95-01-040 Ross Analytical Services, Inc Reported: 01/16/95

Sample Description Water 203-000035 Lab No. 04
Test Description 8010/8020 in series Test Code 8021

DATE RUN 01/12/95 DILUTION FACTOR 1 UNITS ug/L

Halogenated (8010) Volatiles

CAS No.	Compound	Result	EQL	CAS No.	Compound	Result	EQL
75-25-7	Bromodichloromethane	<EQL	2.0	107-06-2	1,2-Dichloroethane	<EQL	2.0
75-25-2	Bromoform	<EQL	2.0	75-35-4	1,1-Dichloroethene	<EQL	2.0
56-23-5	Carbon tetrachloride	<EQL	2.0	156-60-5	trans-1,2-Dichloroethene	<EQL	2.0
108-90-7	Chlorobenzene	<EQL	2.0	75-09-2	Dichloromethane	7.3	2.0
75-00-3	Chloroethane	<EQL	2.0	78-87-5	1,2-Dichloropropane	<EQL	2.0
67-66-3	Chloroform	<EQL	2.0	10061-02-6	trans-1,3-Dichloropropene	<EQL	2.0
74-87-3	Chloromethane	<EQL	2.0	79-34-5	1,1,2,2-Tetrachloroethane	<EQL	2.0
124-48-1	Dibromochloromethane	<EQL	2.0	127-18-4	Tetrachloroethene	<EQL	2.0
95-50-1	1,2-Dichlorobenzene	<EQL	2.0	71-55-6	1,1,1-Trichloroethane	<EQL	0.4
541-73-1	1,3-Dichlorobenzene	<EQL	2.0	79-00-5	1,1,2-Trichloroethane	<EQL	2.0
106-46-7	1,4-Dichlorobenzene	<EQL	2.0	79-01-6	Trichloroethene	2.6	0.4
75-34-3	1,1-Dichloroethane	<EQL	2.0	75-01-4	Vinyl Chloride	<EQL	2.0
76-13-1	Freon 113	<EQL	2.0	156-59-2	cis-1,2-Dichloroethene	<EQL	2.0

Aromatic (8020) Volatiles

CAS No.	Compound	Result	EQL	CAS No.	Compound	Result	EQL
71-43-2	Benzene	<EQL	2.0	106-46-7	1,4-Dichlorobenzene	<EQL	2.0
108-90-7	Chlorobenzene	<EQL	2.0	100-41-4	Ethylbenzene	<EQL	2.0
95-50-1	1,2-Dichlorobenzene	<EQL	2.0	108-88-3	Toluene	<EQL	2.0
541-73-1	1,3-Dichlorobenzene	<EQL	2.0		Xylenes	<EQL	4.0

8010 Surrogate	% Recovery	Limits
1-Chloro-4-fluorobenzene	113	59 - 158

8020 Surrogate	% Recovery	Limits
1-Chloro-4-fluorobenzene	106	67 - 136

Work Order # 95-01-040 Ross Analytical Services, Inc Reported: 01/16/95

Sample Description Water 203-000036 Lab No. 05
Test Description 8010/8020 in series Test Code 8021

DATE RUN 01/12/95 DILUTION FACTOR 1 UNITS ug/L

Halogenated (8010) Volatiles

CAS No.	Compound	Result	EQL	CAS No.	Compound	Result	E
75-25-7	Bromodichloromethane	<EQL	2.0	107-06-2	1,2-Dichloroethane	<EQL	2
75-25-2	Bromoform	<EQL	2.0	75-35-4	1,1-Dichloroethene	<EQL	2
56-23-5	Carbon tetrachloride	<EQL	2.0	156-60-5	trans-1,2-Dichloroethene	<EQL	2
108-90-7	Chlorobenzene	<EQL	2.0	75-09-2	Dichloromethane	7.5	2
75-00-3	Chloroethane	<EQL	2.0	78-87-5	1,2-Dichloropropane	<EQL	2
67-66-3	Chloroform	<EQL	2.0	10061-02-6	trans-1,3-Dichloropropene	<EQL	2
74-87-3	Chloromethane	<EQL	2.0	79-34-5	1,1,2,2-Tetrachloroethane	<EQL	2
124-48-1	Dibromochloromethane	<EQL	2.0	127-18-4	Tetrachloroethene	<EQL	2
95-50-1	1,2-Dichlorobenzene	<EQL	2.0	71-55-6	1,1,1-Trichloroethane	<EQL	0
541-73-1	1,3-Dichlorobenzene	<EQL	2.0	79-00-5	1,1,2-Trichloroethane	<EQL	2
106-46-7	1,4-Dichlorobenzene	<EQL	2.0	79-01-6	Trichloroethene	<EQL	0
75-34-3	1,1-Dichloroethane	<EQL	2.0	75-01-4	Vinyl Chloride	<EQL	2
76-13-1	Freon 113	<EQL	2.0	156-59-2	cis-1,2-Dichloroethene	<EQL	2

Aromatic (8020) Volatiles

CAS No.	Compound	Result	EQL	CAS No.	Compound	Result	E
71-43-2	Benzene	<EQL	2.0	106-46-7	1,4-Dichlorobenzene	<EQL	2
108-90-7	Chlorobenzene	<EQL	2.0	100-41-4	Ethylbenzene	<EQL	2
95-50-1	1,2-Dichlorobenzene	<EQL	2.0	108-88-3	Toluene	<EQL	2
541-73-1	1,3-Dichlorobenzene	<EQL	2.0		Xylenes	<EQL	4

8010 Surrogate	% Recovery	Limits
1-Chloro-4-fluorobenzene	113	59 - 158

8020 Surrogate	% Recovery	Limits
1-Chloro-4-fluorobenzene	107	67 - 136

Work Order # 95-01-040 Ross Analytical Services, Inc Reported: 01/16/95

Sample Description Method 8021 blank
Test Description 8010/8020 in series Test Code 8021

DATE RUN 01/12/95 DILUTION FACTOR 1 UNITS ug/L

Halogenated (8010) Volatiles

CAS No.	Compound	Result	EQL	CAS No.	Compound	Result	EQL
75-25-7	Bromodichloromethane	<EQL	2.0	107-06-2	1,2-Dichloroethane	<EQL	2.0
75-25-2	Bromoform	<EQL	2.0	75-35-4	1,1-Dichloroethene	<EQL	2.0
56-23-5	Carbon tetrachloride	<EQL	2.0	156-60-5	trans-1,2-Dichloroethene	<EQL	2.0
108-90-7	Chlorobenzene	<EQL	2.0	75-09-2	Dichloromethane	<EQL	2.0
75-00-3	Chloroethane	<EQL	2.0	78-87-5	1,2-Dichloropropane	<EQL	2.0
67-66-3	Chloroform	<EQL	2.0	10061-02-6	trans-1,3-Dichloropropene	<EQL	2.0
74-87-3	Chloromethane	<EQL	2.0	79-34-5	1,1,2,2-Tetrachloroethane	<EQL	2.0
124-48-1	Dibromochloromethane	<EQL	2.0	127-18-4	Tetrachloroethene	<EQL	2.0
95-50-1	1,2-Dichlorobenzene	<EQL	2.0	71-55-6	1,1,1-Trichloroethane	<EQL	0.4
541-73-1	1,3-Dichlorobenzene	<EQL	2.0	79-00-5	1,1,2-Trichloroethane	<EQL	2.0
106-46-7	1,4-Dichlorobenzene	<EQL	2.0	79-01-6	Trichloroethene	<EQL	0.4
75-34-3	1,1-Dichloroethane	<EQL	2.0	75-01-4	Vinyl Chloride	<EQL	2.0
76-13-1	Freon 113	<EQL	2.0	156-59-2	cis-1,2-Dichloroethene	<EQL	2.0

Aromatic (8020) Volatiles

CAS No.	Compound	Result	EQL	CAS No.	Compound	Result	EQL
71-43-2	Benzene	<EQL	2.0	106-46-7	1,4-Dichlorobenzene	<EQL	2.0
108-90-7	Chlorobenzene	<EQL	2.0	100-41-4	Ethylbenzene	<EQL	2.0
95-50-1	1,2-Dichlorobenzene	<EQL	2.0	108-88-3	Toluene	<EQL	2.0
541-73-1	1,3-Dichlorobenzene	<EQL	2.0		Xylenes	<EQL	4.0

8010 Surrogate	% Recovery	Limits
1-Chloro-4-fluorobenzene	114	59 - 158

8020 Surrogate	% Recovery	Limits
1-Chloro-4-fluorobenzene	115	67 - 136