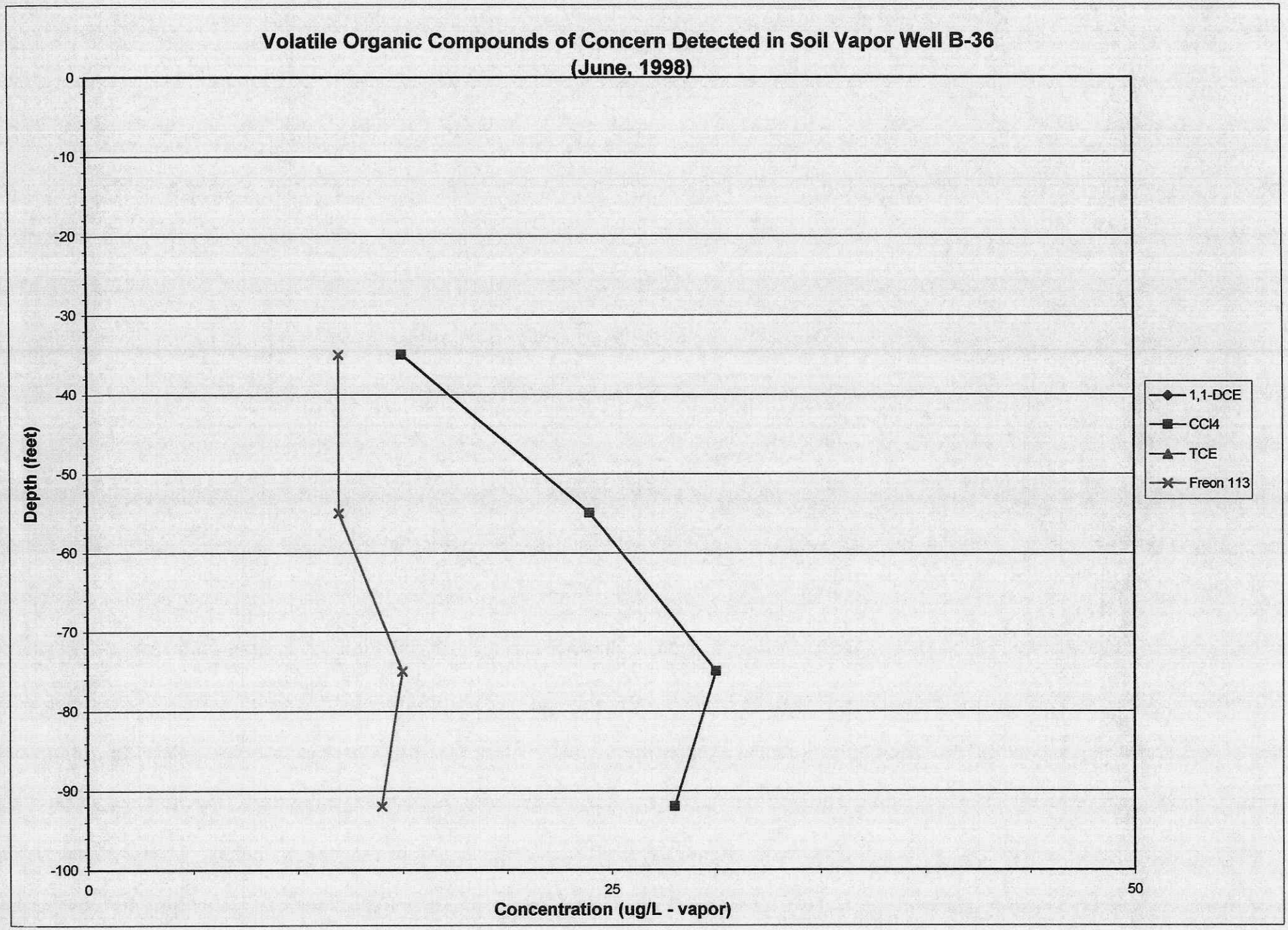
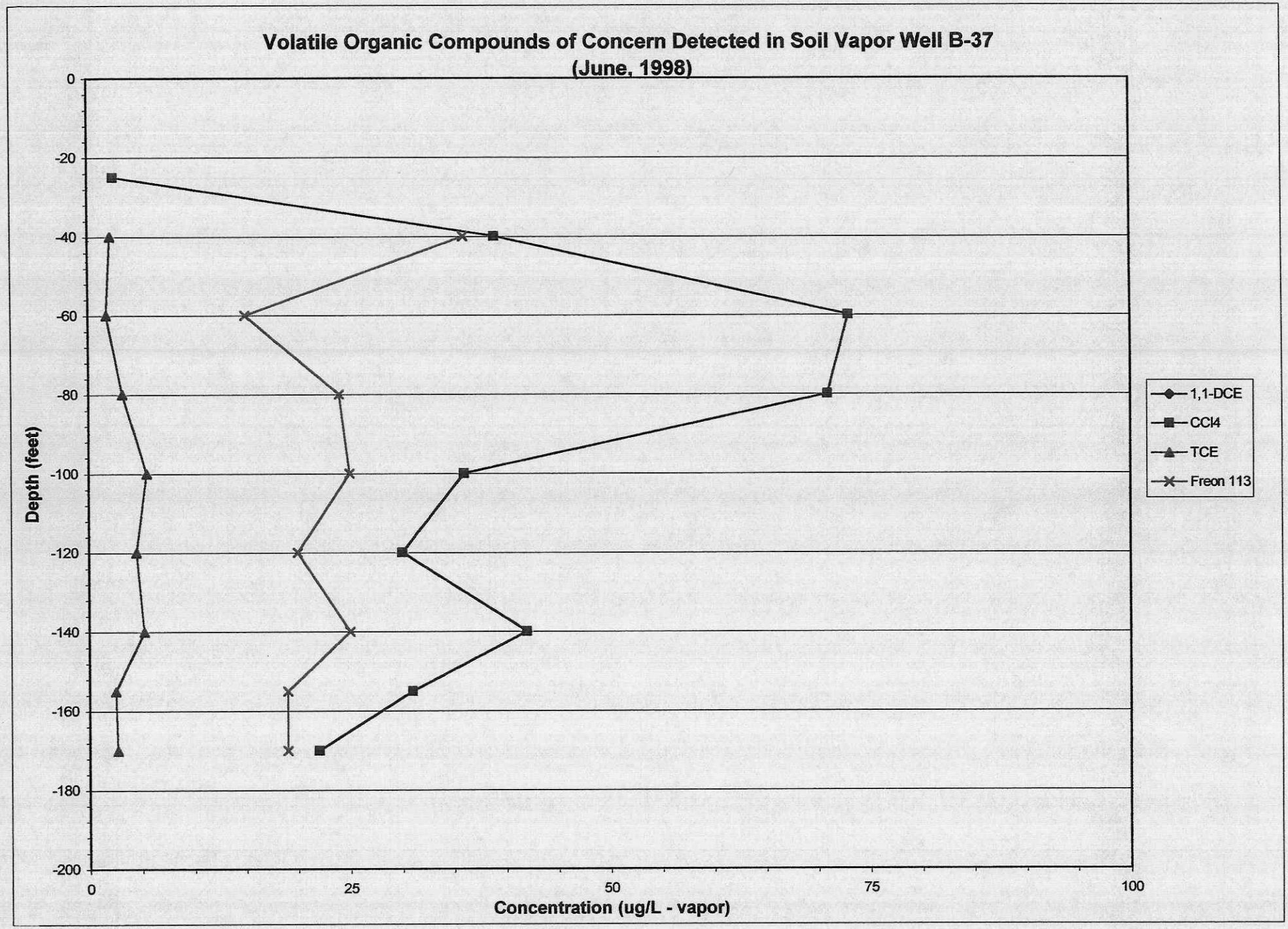
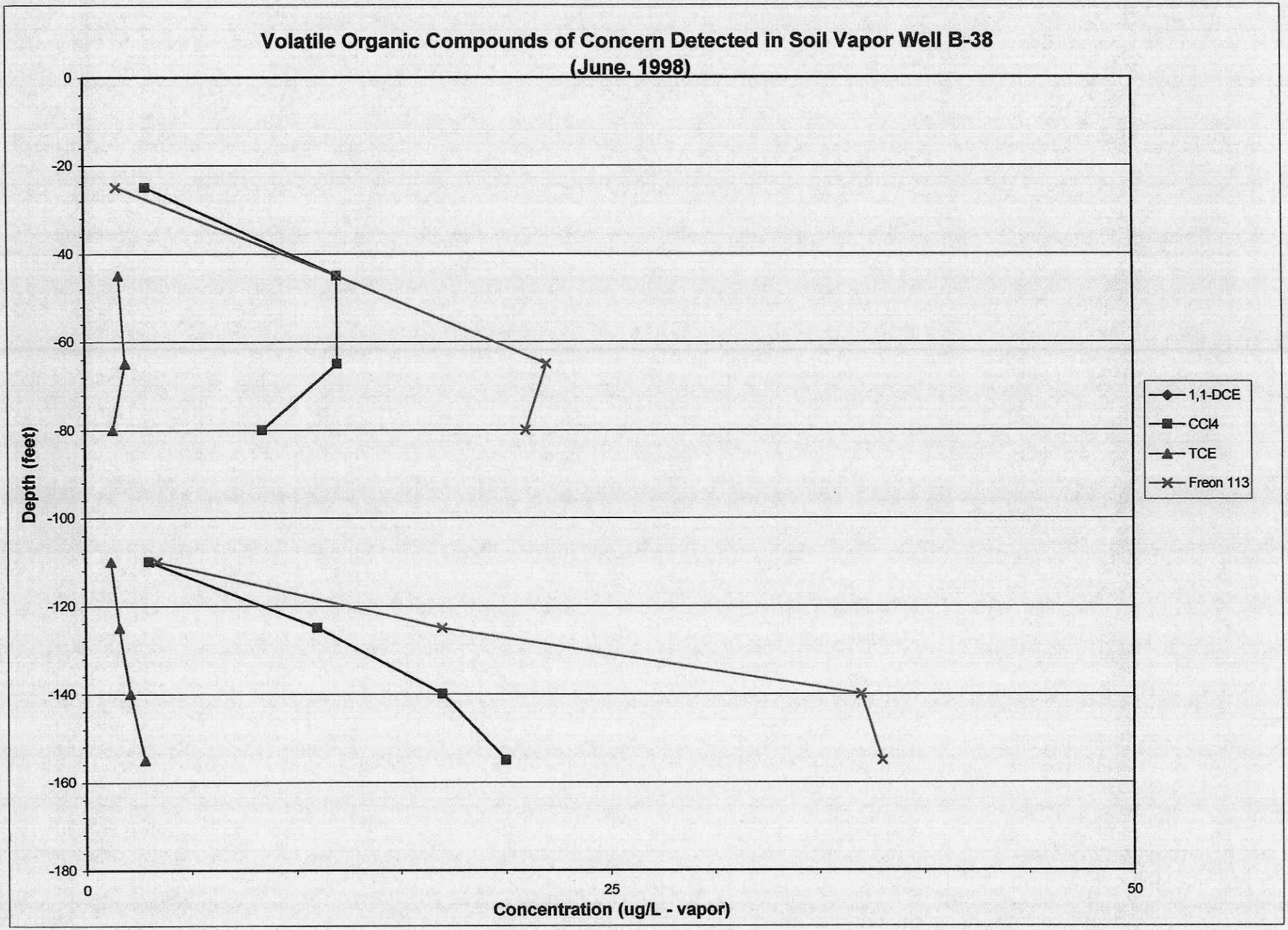
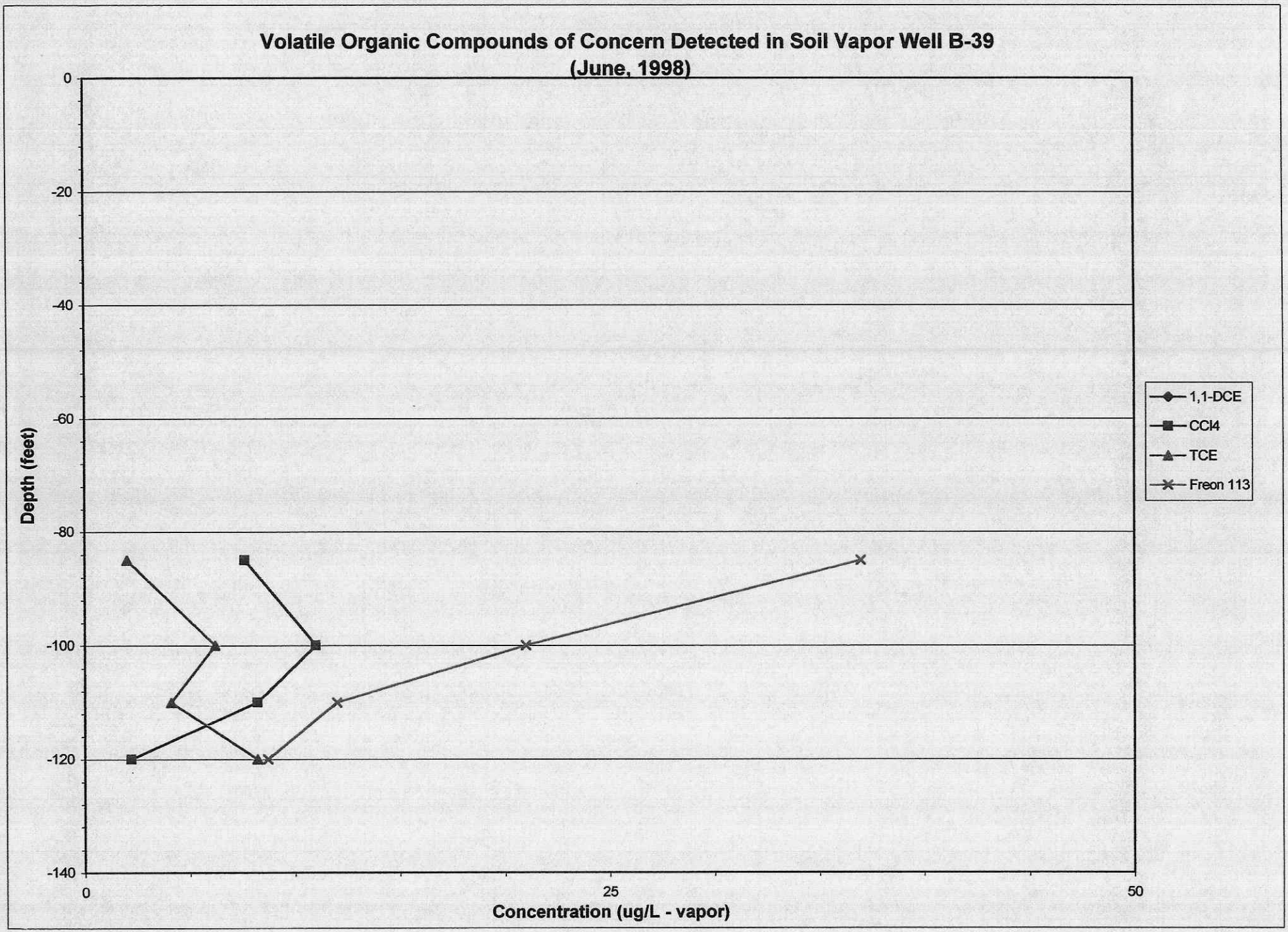
Previous


Volatile Organic Compounds of Concern Detected in Soil Vapor Well B-36
(June, 1998)
Depth (feet)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
0
25
50
Concentration (ug/L - vapor)
1,1-DCE
CCl4
TCE
Freon 113


Volatile Organic Compounds of Concern Detected in Soil Vapor Well B-37
(June, 1998)
Depth (feet)
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-200
0
25
50
75
100
Concentration (ug/L - vapor)
1,1-DCE
CCl4
TCE
Freon 113


Volatile Organic Compounds of Concern Detected in Soil Vapor Well B-38
(June, 1998)
Depth (feet)
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
0
25
50
Concentration (ug/L - vapor)
1,1-DCE
CCl4
TCE
Freon 113


Volatile Organic Compounds of Concern Detected in Soil Vapor Well B-39
(June, 1998)
Depth (feet)
0
-20
-40
-60
-80
-100
-120
-140
0
25
50
Concentration (ug/L - vapor)
1,1-DCE
CCl4
TCE
Freon 113

APPENDIX F

F1 – RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS ANALYSES FOR SOIL

F2 – RESULTS OF POLYNUCLEAR AROMATIC HYDROCARBONS ANALYSES FOR SOIL

F3 – RESULTS OF VOLATILE ORGANIC COMPOUNDS ANALYSES FOR SOIL

APPENDIX F

F1 – RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS ANALYSES FOR SOIL

F2 – RESULTS OF POLYNUCLEAR AROMATIC HYDROCARBONS ANALYSES FOR SOIL

F1 – RESULTS OF VOLATILE ORGANIC COMPOUNDS ANALYSES FOR SOIL

APPENDIX F1

RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS ANALYSES FOR SOIL

RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS ANALYSES FOR SOIL

(Concentration in µg/kg)

Boring/Test Pit Number	Depth (ft bgs)	Date	Sample Number	1,2,4-TRICHLORO-BENZENE	1,2-DICHLORO-BENZENE	1,3-DICHLORO-BENZENE	1,4-DICHLORO-BENZENE	2-NITRO-ANILINE	2,4,5-TRICHLORO-PHENOL	2,4,6-TRICHLORO-PHENOL	2,4-DICHLORO-PHENOL	2,4-DIMETHYL-PHENOL	2,4-DINITRO-PHENOL	2,4-DINITRO-TOLUENE	2,6-DINITRO-TOLUENE	2-CHLORO-NAPHTHALENE
1	20	8/29/94	VPSS-1	< 3700	< 3700	< 3700	< 3700	< 9200	< 9200	< 3700	< 3700	< 3700	< 9200	< 3700	< 3700	< 3700
1	37	8/29/94	VPSS-2	< 170	< 170	< 170	< 170	< 430	< 430	< 170	< 170	< 170	< 430	< 170	< 170	< 170
2	10	8/30/94	VPSS-3	< 170	< 170	< 170	< 170	< 420	< 420	< 170	< 170	< 170	< 420	< 170	< 170	< 170
2	38	8/30/94	VPSS-4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3	30	9/1/94	VPSS-5	< 360	< 360	< 360	< 360	< 900	< 900	< 360	< 360	< 360	< 900	< 360	< 360	< 360
3	50	9/1/94	VPSS-6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4	10	9/2/94	VPSS-7	< 350	< 350	< 350	< 350	< 870	< 870	< 350	< 350	< 350	< 870	< 350	< 350	< 350
4	20	9/2/94	VPSS-8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4	35	9/2/94	VPSS-9	< 360	< 360	< 360	< 360	< 900	< 900	< 360	< 360	< 360	< 900	< 360	< 360	< 360
4	40	9/2/94	VPSS-10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4	50	9/2/94	VPSS-11	< 340	< 340	< 340	< 340	< 860	< 860	< 340	< 340	< 340	< 860	< 340	< 340	< 340
4	61	9/2/94	VPSS-12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5	10	9/3/94	VPSS-13	< 350	< 350	< 350	< 350	< 870	< 870	< 350	< 350	< 350	< 870	< 350	< 350	< 350
6	10	9/4/94	VPSS-14	< 370	< 370	< 370	< 370	< 920	< 920	< 370	< 370	< 370	< 920	< 370	< 370	< 370
6	20	9/4/94	VPSS-15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6	30	9/4/94	VPSS-16	< 340	< 340	< 340	< 340	< 860	< 860	< 340	< 340	< 340	< 860	< 340	< 340	< 340
6	48.5	9/4/94	VPSS-17	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6	51	9/4/94	VPSS-18	< 350	< 350	< 350	< 350	< 890	< 890	< 350	< 350	< 350	< 890	< 350	< 350	< 350
6	60.5	9/4/94	VPSS-19	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6	70	9/4/94	VPSS-20	< 340	< 340	< 340	< 340	< 860	< 860	< 340	< 340	< 340	< 860	< 340	< 340	< 340
7	30	9/5/94	VPSS-21	< 350	< 350	< 350	< 350	< 870	< 870	< 350	< 350	< 350	< 870	< 350	< 350	< 350
7	50	9/5/94	VPSS-22	< 360	< 360	< 360	< 360	< 900	< 900	< 360	< 360	< 360	< 900	< 360	< 360	< 360
7	60	9/5/94	VPSS-23	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8	10	9/8/94	VPSS-24	< 360	< 360	< 360	< 360	< 900	< 900	< 360	< 360	< 360	< 900	< 360	< 360	< 360
8	20	9/8/94	VPSS-25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8	30	9/8/94	VPSS-26	< 370	< 370	< 370	< 370	< 920	< 920	< 370	< 370	< 370	< 920	< 370	< 370	< 370
8	40	9/8/94	VPSS-27	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8	50	9/8/94	VPSS-28	< 380	< 380	< 380	< 380	< 960	< 960	< 380	< 380	< 380	< 960	< 380	< 380	< 380
8	65	9/8/94	VPSS-29	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8	81	9/9/94	VPSS-30	< 370	< 370	< 370	< 370	< 920	< 920	< 370	< 370	< 370	< 920	< 370	< 370	< 370
8	101	9/9/94	VPSS-31	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9	10	9/10/94	VPSS-32	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9	21(DUP)	9/10/94	VPSS-34	< 350	< 350	< 350	< 350	< 890	< 890	< 350	< 350	< 350	< 890	< 350	< 350	< 350
9	21.5	9/10/94	VPSS-33	< 360	< 360	< 360	< 360	< 900	< 900	< 360	< 360	< 360	< 900	< 360	< 360	< 360
9	40.5	9/10/94	VPSS-35	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9	48	9/10/94	VPSS-36	< 360	< 360	< 360	< 360	< 900	< 900	< 360	< 360	< 360	< 900	< 360	< 360	< 360
9	51	9/10/94	VPSS-37	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9	60.5	9/10/94	VPSS-38	< 340	< 340	< 340	< 340	< 860	< 860	< 340	< 340	< 340	< 860	< 340	< 340	< 340
9	80.5	9/10/94	VPSS-39	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10	11	9/12/94	VPSS-40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10	0.5(DUP	9/12/94	VPSS-42	< 370	< 370	< 370	< 370	< 920	< 920	< 370	< 370	< 370	< 920	< 370	< 370	< 370
10	21	9/12/94	VPSS-41	< 360	< 360	< 360	< 360	< 900	< 900	< 360	< 360	< 360	< 900	< 360	< 360	< 360
10	31	9/12/94	VPSS-43	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10	40.5	9/12/94	VPSS-44	< 360	< 360	< 360	< 360	< 900	< 900	< 360	< 360	< 360	< 900	< 360	< 360	< 360

RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS ANALYSES FOR SOIL

(Concentration in µg/kg)

Boring/Test Pit Number	Depth (ft bgs)	Date	Sample Number	2-CHLORO-PHENOL	2-METHYL-NAPHTHALENE	2-METHYL-4,6-DINITROPHENOL	2-METHYL-PHENOL	2-NITROPHENOL	3,3'-DICHLORO-BENZIDINE	3-NITRO-ANILINE	4-BROMOPHENYL-PHENYLETHER	4-CHLORO-3-METHYLPHENOL	4-CHLORO-ANILINE	4-CHLOROPHENYL-PHENYLETHER	4-METHYL-PHENOL	4-NITRO-ANILINE
1	20	8/29/94	VPSS-1	< 3700	< 3700	< 9200	< 3700	< 3700	< 9200	< 9200	< 3700	< 3700	< 15000	< 3700	< 3700	< 9200
1	37	8/29/94	VPSS-2	< 170	< 170	< 430	< 170	< 170	< 430	< 430	< 170	< 170	< 690	< 170	< 170	< 430
2	10	8/30/94	VPSS-3	< 170	< 170	< 420	< 170	< 170	< 420	< 420	< 170	< 170	< 680	< 170	< 170	< 420
2	38	8/30/94	VPSS-4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3	30	9/1/94	VPSS-5	< 360	< 360	< 900	< 360	< 360	< 900	< 900	< 360	< 360	< 1400	< 360	< 360	< 900
3	50	9/1/94	VPSS-6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4	10	9/2/94	VPSS-7	< 350	< 350	< 870	< 350	< 350	< 870	< 870	< 350	< 350	< 1400	< 350	< 350	< 870
4	20	9/2/94	VPSS-8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4	35	9/2/94	VPSS-9	< 360	< 360	< 900	< 360	< 360	< 900	< 900	< 360	< 360	< 1400	< 360	< 360	< 900
4	40	9/2/94	VPSS-10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4	50	9/2/94	VPSS-11	< 340	< 340	< 860	< 340	< 340	< 860	< 860	< 340	< 340	< 1400	< 340	< 340	< 860
4	61	9/2/94	VPSS-12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5	10	9/3/94	VPSS-13	< 350	< 350	< 870	< 350	< 350	< 870	< 870	< 350	< 350	< 1400	< 350	< 350	< 870
6	10	9/4/94	VPSS-14	< 370	< 370	< 920	< 370	< 370	< 920	< 920	< 370	< 370	< 1500	< 370	< 370	< 920
6	20	9/4/94	VPSS-15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6	30	9/4/94	VPSS-16	< 340	< 340	< 860	< 340	< 340	< 860	< 860	< 340	< 340	< 1400	< 340	< 340	< 860
6	48.5	9/4/94	VPSS-17	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6	51	9/4/94	VPSS-18	< 350	< 350	< 890	< 350	< 350	< 890	< 890	< 350	< 350	< 1400	< 350	< 350	< 890
6	60.5	9/4/94	VPSS-19	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6	70	9/4/94	VPSS-20	< 340	< 340	< 860	< 340	< 340	< 860	< 860	< 340	< 340	< 1400	< 340	< 340	< 860
7	30	9/5/94	VPSS-21	< 350	< 350	< 870	< 350	< 350	< 870	< 870	< 350	< 350	< 1400	< 350	< 350	< 870
7	50	9/5/94	VPSS-22	< 360	< 360	< 900	< 360	< 360	< 900	< 900	< 360	< 360	< 1400	< 360	< 360	< 900
7	60	9/5/94	VPSS-23	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8	10	9/8/94	VPSS-24	< 360	< 360	< 900	< 360	< 360	< 900	< 900	< 360	< 360	< 1400	< 360	< 360	< 900
8	20	9/8/94	VPSS-25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8	30	9/8/94	VPSS-26	< 370	< 370	< 920	< 370	< 370	< 920	< 920	< 370	< 370	< 1500	< 370	< 370	< 920
8	40	9/8/94	VPSS-27	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8	50	9/8/94	VPSS-28	< 380	< 380	< 960	< 380	< 380	< 960	< 960	< 380	< 380	< 1500	< 380	< 380	< 960
8	65	9/8/94	VPSS-29	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8	81	9/9/94	VPSS-30	< 370	< 370	< 920	< 370	< 370	< 920	< 920	< 370	< 370	< 1500	< 370	< 370	< 920
8	101	9/9/94	VPSS-31	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9	10	9/10/94	VPSS-32	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9	21(DUP)	9/10/94	VPSS-34	< 350	< 350	< 890	< 350	< 350	< 890	< 890	< 350	< 350	< 1400	< 350	< 350	< 890
9	21.5	9/10/94	VPSS-33	< 360	< 360	< 900	< 360	< 360	< 900	< 900	< 360	< 360	< 1400	< 360	< 360	< 900
9	40.5	9/10/94	VPSS-35	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9	48	9/10/94	VPSS-36	< 360	< 360	< 900	< 360	< 360	< 900	< 900	< 360	< 360	< 1400	< 360	< 360	< 900
9	51	9/10/94	VPSS-37	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9	60.5	9/10/94	VPSS-38	< 340	< 340	< 860	< 340	< 340	< 860	< 860	< 340	< 340	< 1400	< 340	< 340	< 860
9	80.5	9/10/94	VPSS-39	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10	11	9/12/94	VPSS-40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10	0.5(DUP	9/12/94	VPSS-42	< 370	< 370	< 920	< 370	< 370	< 920	< 920	< 370	< 370	< 1500	< 370	< 370	< 920
10	21	9/12/94	VPSS-41	< 360	< 360	< 900	< 360	< 360	< 900	< 900	< 360	< 360	< 1400	< 360	< 360	< 900
10	31	9/12/94	VPSS-43	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10	40.5	9/12/94	VPSS-44	< 360	< 360	< 900	< 360	< 360	< 900	< 900	< 360	< 360	< 1400	< 360	< 360	< 900

RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS ANALYSES FOR SOIL

(Concentration in µg/kg)

Boring/Test Pit Number	Depth (ft bgs)	Date	Sample Number	4-NITROPHENOL	BENZOIC ACID	BENZYL ALCOHOL	BIS(2-CHLORO-ISOPROPYL)ETHER	BIS(2-CHLORO-ETHOXY) METHANE	BIS(2-CHLORO-ETHYL)ETHER	BIS(2-ETHYLHEXYL)-PHTHALATE	BUTYLBENZYL-PHTHALATE	DIBENZOFURAN	DIETHYL-PHTHALATE	DIMETHYL-PHTHALATE	DI-N-BUTYL-PHTHALATE	DI-N-OCTYL-PHATHALATE
1	20	8/29/94	VPSS-1	< 9200	< 15000	< 15000	< 3700	< 3700	< 3700	< 3700	< 3700	< 3700	< 3700	< 3700	< 3700	< 3700
1	37	8/29/94	VPSS-2	< 430	< 690	< 690	< 170	< 170	< 170	86 J	< 170	< 170	< 170	< 170	< 170	< 170
2	10	8/30/94	VPSS-3	< 420	< 680	< 680	< 170	< 170	< 170	< 170	< 170	< 170	< 170	< 170	< 170	< 170
2	38	8/30/94	VPSS-4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3	30	9/1/94	VPSS-5	< 900	< 1400	< 1400	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
3	50	9/1/94	VPSS-6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4	10	9/2/94	VPSS-7	< 870	< 1400	< 1400	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
4	20	9/2/94	VPSS-8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4	35	9/2/94	VPSS-9	< 900	< 1400	< 1400	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
4	40	9/2/94	VPSS-10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4	50	9/2/94	VPSS-11	< 860	< 1400	< 1400	< 340	< 340	< 340	< 340	< 340	< 340	< 340	< 340	< 340	< 340
4	61	9/2/94	VPSS-12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5	10	9/3/94	VPSS-13	< 870	< 1400	< 1400	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
6	10	9/4/94	VPSS-14	< 920	< 1500	< 1500	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
6	20	9/4/94	VPSS-15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6	30	9/4/94	VPSS-16	< 860	< 1400	< 1400	< 340	< 340	< 340	< 340	< 340	< 340	< 340	< 340	< 340	< 340
6	48.5	9/4/94	VPSS-17	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6	51	9/4/94	VPSS-18	< 890	< 1400	< 1400	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
6	60.5	9/4/94	VPSS-19	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6	70	9/4/94	VPSS-20	< 860	< 1400	< 1400	< 340	< 340	< 340	< 340	< 340	< 340	< 340	< 340	< 340	< 340
7	30	9/5/94	VPSS-21	< 870	< 1400	< 1400	< 350	< 350	< 350	1900	< 350	< 350	< 350	< 350	< 350	< 350
7	50	9/5/94	VPSS-22	< 900	< 1400	< 1400	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
7	60	9/5/94	VPSS-23	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8	10	9/8/94	VPSS-24	< 900	< 1400	< 1400	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8	20	9/8/94	VPSS-25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8	30	9/8/94	VPSS-26	< 920	< 1500	< 1500	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
8	40	9/8/94	VPSS-27	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8	50	9/8/94	VPSS-28	< 960	< 1500	< 1500	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380
8	65	9/8/94	VPSS-29	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8	81	9/9/94	VPSS-30	< 920	< 1500	< 1500	< 370	< 370	< 370	170 J	< 370	< 370	< 370	< 370	< 370	< 370
8	101	9/9/94	VPSS-31	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9	10	9/10/94	VPSS-32	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9	21(DUP)	9/10/94	VPSS-34	< 890	< 1400	< 1400	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
9	21.5	9/10/94	VPSS-33	< 900	< 1400	< 1400	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
9	40.5	9/10/94	VPSS-35	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9	48	9/10/94	VPSS-36	< 900	< 1400	< 1400	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
9	51	9/10/94	VPSS-37	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9	60.5	9/10/94	VPSS-38	< 860	< 1400	< 1400	< 340	< 340	< 340	< 340	< 340	< 340	< 340	< 340	< 340	< 340
9	80.5	9/10/94	VPSS-39	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10	11	9/12/94	VPSS-40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10	0.5(DUP	9/12/94	VPSS-42	< 920	< 1500	< 1500	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
10	21	9/12/94	VPSS-41	< 900	< 1400	< 1400	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
10	31	9/12/94	VPSS-43	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10	40.5	9/12/94	VPSS-44	< 900	< 1400	< 1400	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360

RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS ANALYSES FOR SOIL

(Concentration in µg/kg)

Boring/Test Pit Number	Depth (ft bgs)	Date	Sample Number	HEXACHLORO-BENZENE	HEXACHLORO-BUTADIENE	HEXACHLORO-CYCLO-PENTADIENE	HEXACHLORO-ETHANE	ISOPHORONE	NITROBENZENE	N-NITROSO-DI-N-PROPYLAMINE	N-NITROSODI-PHENYLAMINE	PENTACHLORO-PHENOL	PHENOL
1	20	8/29/94	VPSS-1	< 3700	< 3700	< 3700	< 3700	< 3700	< 3700	< 3700	< 3700	< 9200	< 3700
1	37	8/29/94	VPSS-2	< 170	< 170	< 170	< 170	< 170	< 170	< 170	< 170	< 430	< 170
2	10	8/30/94	VPSS-3	< 170	< 170	< 170	< 170	< 170	< 170	< 170	< 170	< 420	< 170
2	38	8/30/94	VPSS-4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3	30	9/1/94	VPSS-5	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 900	< 360
3	50	9/1/94	VPSS-6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4	10	9/2/94	VPSS-7	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 870	< 350
4	20	9/2/94	VPSS-8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4	35	9/2/94	VPSS-9	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 900	< 360
4	40	9/2/94	VPSS-10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4	50	9/2/94	VPSS-11	< 340	< 340	< 340	< 340	< 340	< 340	< 340	< 340	< 860	< 340
4	61	9/2/94	VPSS-12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5	10	9/3/94	VPSS-13	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 870	< 350
6	10	9/4/94	VPSS-14	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 920	< 370
6	20	9/4/94	VPSS-15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6	30	9/4/94	VPSS-16	< 340	< 340	< 340	< 340	< 340	< 340	< 340	< 340	< 860	< 340
6	48.5	9/4/94	VPSS-17	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6	51	9/4/94	VPSS-18	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 890	< 350
6	60.5	9/4/94	VPSS-19	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6	70	9/4/94	VPSS-20	< 340	< 340	< 340	< 340	< 340	< 340	< 340	< 340	< 860	< 340
7	30	9/5/94	VPSS-21	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 870	< 350
7	50	9/5/94	VPSS-22	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 900	< 360
7	60	9/5/94	VPSS-23	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8	10	9/8/94	VPSS-24	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 900	< 360
8	20	9/8/94	VPSS-25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8	30	9/8/94	VPSS-26	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 920	< 370
8	40	9/8/94	VPSS-27	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8	50	9/8/94	VPSS-28	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 960	< 380
8	65	9/8/94	VPSS-29	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8	81	9/9/94	VPSS-30	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 920	< 370
8	101	9/9/94	VPSS-31	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9	10	9/10/94	VPSS-32	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9	21(DUP)	9/10/94	VPSS-34	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 890	< 350
9	21.5	9/10/94	VPSS-33	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 900	< 360
9	40.5	9/10/94	VPSS-35	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9	48	9/10/94	VPSS-36	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 900	< 360
9	51	9/10/94	VPSS-37	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9	60.5	9/10/94	VPSS-38	< 340	< 340	< 340	< 340	< 340	< 340	< 340	< 340	< 860	< 340
9	80.5	9/10/94	VPSS-39	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10	11	9/12/94	VPSS-40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10	0.5(DUP	9/12/94	VPSS-42	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 920	< 370
10	21	9/12/94	VPSS-41	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 900	< 360
10	31	9/12/94	VPSS-43	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10	40.5	9/12/94	VPSS-44	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 900	< 360

RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS ANALYSES FOR SOIL

(Concentration in µg/kg)

Boring/Test Pit Number	Depth (ft bgs)	Date	Sample Number	1,2,4-TRICHLORO-BENZENE	1,2-DICHLORO-BENZENE	1,3-DICHLORO-BENZENE	1,4-DICHLORO-BENZENE	2- NITRO-ANILINE	2,4,5-TRICHLORO-PHENOL	2,4,6-TRICHLORO-PHENOL	2,4-DICHLORO-PHENOL	2,4-DIMETHYL-PHENOL	2,4-DINITRO-PHENOL	2,4-DINITRO-TOLUENE	2,6-DINITRO-TOLUENE	2-CHLORO-NAPHTHALENE
10	50.5	9/12/94	VPSS-45	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10	60.5	9/12/94	VPSS-46	< 380	< 380	< 380	< 380	< 950	< 950	< 380	< 380	< 380	< 950	< 380	< 380	< 380
10	70.5	9/12/94	VPSS-47	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
11	11	9/17/94	VPSS-48	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
11	21	9/17/94	VPSS-49	< 370	< 370	< 370	< 370	< 920	< 920	< 370	< 370	< 370	< 920	< 370	< 370	< 370
11	31	9/17/94	VPSS-50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
11	40.5	9/17/94	VPSS-51	< 360	< 360	< 360	< 360	< 900	< 900	< 360	< 360	< 360	< 900	< 360	< 360	< 360
11	41	9/17/94	VPSS-52	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
11	51	9/17/94	VPSS-53	< 360	< 360	< 360	< 360	< 900	< 900	< 360	< 360	< 360	< 900	< 360	< 360	< 360
11	68.5	9/17/94	VPSS-54	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
11	71	9/17/94	VPSS-55	< 360	< 360	< 360	< 360	< 910	< 910	< 360	< 360	< 360	< 910	< 360	< 360	< 360
11	99.5	9/17/94	VPSS-57	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
12	10	9/19/94	VPSS-58	< 350	< 350	< 350	< 350	< 880	< 880	< 350	< 350	< 350	< 880	< 350	< 350	< 350
12	25.5	9/19/94	VPSS-59	< 350	< 350	< 350	< 350	< 880	< 880	< 350	< 350	< 350	< 880	< 350	< 350	< 350
12	34	9/19/94	VPSS-60	< 350	< 350	< 350	< 350	< 880	< 880	< 350	< 350	< 350	< 880	< 350	< 350	< 350
12	40.5	9/19/94	VPSS-61	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
12	60.5	9/19/94	VPSS-62	< 350	< 350	< 350	< 350	< 890	< 890	< 350	< 350	< 350	< 890	< 350	< 350	< 350
12	71	9/19/94	VPSS-63	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13	10.5	9/20/94	VPSS-64	< 360	< 360	< 360	< 360	< 900	< 900	< 360	< 360	< 360	< 900	< 360	< 360	< 360
13	20.5	9/20/94	VPSS-65	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13	30.5	9/20/94	VPSS-66	< 360	< 360	< 360	< 360	< 900	< 900	< 360	< 360	< 360	< 900	< 360	< 360	< 360
14	11	9/22/94	VPSS-67	< 370	< 370	< 370	< 370	< 920	< 920	< 370	< 370	< 370	< 920	< 370	< 370	< 370
15	11	9/24/94	VPSS-68	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
15	21	9/24/94	VPSS-69	< 360	< 360	< 360	< 360	< 900	< 900	< 360	< 360	< 360	< 900	< 360	< 360	< 360
15	31	9/24/94	VPSS-70	< 360	< 360	< 360	< 360	< 900	< 900	< 360	< 360	< 360	< 900	< 360	< 360	< 360
15	57	9/24/94	VPSS-71	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
15	61	9/24/94	VPSS-72	< 350	< 350	< 350	< 350	< 880	< 880	< 350	< 350	< 350	< 880	< 350	< 350	< 350
15	70	9/24/94	VPSS-73	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
15	81	9/24/94	VPSS-74	< 350	< 350	< 350	< 350	< 880	< 880	< 350	< 350	< 350	< 880	< 350	< 350	< 350
16	0.5(DUP	9/28/94	VPSS-75	< 350	< 350	< 350	< 350	< 880	< 880	< 350	< 350	< 350	< 880	< 350	< 350	< 350
16	21	9/28/94	VPSS-76	< 350	< 350	< 350	< 350	< 880	< 880	< 350	< 350	< 350	< 880	< 350	< 350	< 350
16	31	9/28/94	VPSS-77	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
16	41	9/28/94	VPSS-78	< 360	< 360	< 360	< 360	< 900	< 900	< 360	< 360	< 360	< 900	< 360	< 360	< 360
16	50.5	9/28/94	VPSS-80	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
16	51	9/28/94	VPSS-79	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
16	61	9/28/94	VPSS-81	< 370	< 370	< 370	< 370	< 920	< 920	< 370	< 370	< 370	< 920	< 370	< 370	< 370
16	71	9/28/94	VPSS-82	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
16	81	9/28/94	VPSS-83	< 370	< 370	< 370	< 370	< 920	< 920	< 370	< 370	< 370	< 920	< 370	< 370	< 370
16	91	9/28/94	VPSS-84	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
16	101	9/28/94	VPSS-85	< 350	< 350	< 350	< 350	< 890	< 890	< 350	< 350	< 350	< 890	< 350	< 350	< 350
17	20.5	9/30/94	VPSS-86	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
17	26.5	9/30/94	VPSS-87	< 350	< 350	< 350	< 350	< 870	< 870	< 350	< 350	< 350	< 870	< 350	< 350	< 350
18	10	10/1/94	VPSS-88	< 370	< 370	< 370	< 370	< 920	< 920	< 370	< 370	< 370	< 920	< 370	< 370	< 370
18	34.5	10/1/94	VPSS-89	< 350	< 350	< 350	< 350	< 870	< 870	< 350	< 350	< 350	< 870	< 350	< 350	< 350

RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS ANALYSES FOR SOIL

(Concentration in µg/kg)

Boring/Test Pit Number	Depth (ft bgs)	Date	Sample Number	2-CHLORO-PHENOL	2-METHYL-NAPHTHALENE	2-METHYL-4,6-DINITROPHENOL	2-METHYL-PHENOL	2-NITROPHENOL	3,3'-DICHLORO-BENZIDINE	3-NITRO-ANILINE	4-BROMOPHENYL-PHENYLETHER	4-CHLORO-3-METHYLPHENOL	4-CHLORO-ANILINE	4-CHLOROPHENYL-PHENYLETHER	4-METHYL-PHENOL	4-NITRO-ANILINE
10	50.5	9/12/94	VPSS-45	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10	60.5	9/12/94	VPSS-46	< 380	< 380	< 950	< 380	< 380	< 950	< 950	< 380	< 380	< 1500	< 380	< 380	< 950
10	70.5	9/12/94	VPSS-47	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
11	11	9/17/94	VPSS-48	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
11	21	9/17/94	VPSS-49	< 370	< 370	< 920	< 370	< 370	< 920	< 920	< 370	< 370	< 1500	< 370	< 370	< 920
11	31	9/17/94	VPSS-50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
11	40.5	9/17/94	VPSS-51	< 360	< 360	< 900	< 360	< 360	< 900	< 900	< 360	< 360	< 1400	< 360	< 360	< 900
11	41	9/17/94	VPSS-52	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
11	51	9/17/94	VPSS-53	< 360	< 360	< 900	< 360	< 360	< 900	< 900	< 360	< 360	< 1400	< 360	< 360	< 900
11	68.5	9/17/94	VPSS-54	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
11	71	9/17/94	VPSS-55	< 360	< 360	< 910	< 360	< 360	< 910	< 910	< 360	< 360	< 1400	< 360	< 360	< 910
11	99.5	9/17/94	VPSS-57	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
12	10	9/19/94	VPSS-58	< 350	< 350	< 880	< 350	< 350	< 880	< 880	< 350	< 350	< 1400	< 350	< 350	< 880
12	25.5	9/19/94	VPSS-59	< 350	< 350	< 880	< 350	< 350	< 880	< 880	< 350	< 350	< 1400	< 350	< 350	< 880
12	34	9/19/94	VPSS-60	< 350	< 350	< 880	< 350	< 350	< 880	< 880	< 350	< 350	< 1400	< 350	< 350	< 880
12	40.5	9/19/94	VPSS-61	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
12	60.5	9/19/94	VPSS-62	< 350	< 350	< 890	< 350	< 350	< 890	< 890	< 350	< 350	< 1400	< 350	< 350	< 890
12	71	9/19/94	VPSS-63	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13	10.5	9/20/94	VPSS-64	< 360	< 360	< 900	< 360	< 360	< 900	< 900	< 360	< 360	< 1400	< 360	< 360	< 900
13	20.5	9/20/94	VPSS-65	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13	30.5	9/20/94	VPSS-66	< 360	< 360	< 900	< 360	< 360	< 900	< 900	< 360	< 360	< 1400	< 360	< 360	< 900
14	11	9/22/94	VPSS-67	< 370	< 370	< 920	< 370	< 370	< 920	< 920	< 370	< 370	< 1500	< 370	< 370	< 920
15	11	9/24/94	VPSS-68	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
15	21	9/24/94	VPSS-69	< 360	< 360	< 900	< 360	< 360	< 900	< 900	< 360	< 360	< 1400	< 360	< 360	< 900
15	31	9/24/94	VPSS-70	< 360	< 360	< 900	< 360	< 360	< 900	< 900	< 360	< 360	< 1400	< 360	< 360	< 900
15	57	9/24/94	VPSS-71	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
15	61	9/24/94	VPSS-72	< 350	< 350	< 880	< 350	< 350	< 880	< 880	< 350	< 350	< 1400	< 350	< 350	< 880
15	70	9/24/94	VPSS-73	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
15	81	9/24/94	VPSS-74	< 350	< 350	< 880	< 350	< 350	< 880	< 880	< 350	< 350	< 1400	< 350	< 350	< 880
16	0.5(DUP	9/28/94	VPSS-75	< 350	< 350	< 880	< 350	< 350	< 880	< 880	< 350	< 350	< 1400	< 350	< 350	< 880
16	21	9/28/94	VPSS-76	< 350	< 350	< 880	< 350	< 350	< 880	< 880	< 350	< 350	< 1400	< 350	< 350	< 880
16	31	9/28/94	VPSS-77	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
16	41	9/28/94	VPSS-78	< 360	< 360	< 900	< 360	< 360	< 900	< 900	< 360	< 360	< 1400	< 360	< 360	< 900
16	50.5	9/28/94	VPSS-80	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
16	51	9/28/94	VPSS-79	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
16	61	9/28/94	VPSS-81	< 370	< 370	< 920	< 370	< 370	< 920	< 920	< 370	< 370	< 1500	< 370	< 370	< 920
16	71	9/28/94	VPSS-82	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
16	81	9/28/94	VPSS-83	< 370	< 370	< 920	< 370	< 370	< 920	< 920	< 370	< 370	< 1500	< 370	< 370	< 920
16	91	9/28/94	VPSS-84	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
16	101	9/28/94	VPSS-85	< 350	< 350	< 890	< 350	< 350	< 890	< 890	< 350	< 350	< 1400	< 350	< 350	< 890
17	20.5	9/30/94	VPSS-86	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
17	26.5	9/30/94	VPSS-87	< 350	< 350	< 870	< 350	< 350	< 870	< 870	< 350	< 350	< 1400	< 350	< 350	< 870
18	10	10/1/94	VPSS-88	< 370	< 370	< 920	< 370	< 370	< 920	< 920	< 370	< 370	< 1500	< 370	< 370	< 920
18	34.5	10/1/94	VPSS-89	< 350	< 350	< 870	< 350	< 350	< 870	< 870	< 350	< 350	< 1400	< 350	< 350	< 870

RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS ANALYSES FOR SOIL

(Concentration in µg/kg)

Boring/Test Pit Number	Depth (ft bgs)	Date	Sample Number	4-NITROPHENOL	BENZOIC ACID	BENZYL ALCOHOL	BIS(2-CHLORO-ISOPROPYL)ETHER	BIS(2-CHLORO-ETHOXY) METHANE	BIS(2-CHLORO-ETHYL)ETHER	BIS(2-ETHYLHEXYL)-PHTHALATE	BUTYLBENZYL-PHTHALATE	DIBENZOFURAN	DIETHYL-PHTHALATE	DIMETHYL-PHTHALATE	DI-N-BUTYL-PHTHALATE	DI-N-OCTYL-PHATHALATE
10	50.5	9/12/94	VPSS-45	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10	60.5	9/12/94	VPSS-46	< 950	< 1500	< 1500	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380
10	70.5	9/12/94	VPSS-47	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
11	11	9/17/94	VPSS-48	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
11	21	9/17/94	VPSS-49	< 920	< 1500	< 1500	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
11	31	9/17/94	VPSS-50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
11	40.5	9/17/94	VPSS-51	< 900	< 1400	< 1400	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
11	41	9/17/94	VPSS-52	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
11	51	9/17/94	VPSS-53	< 900	< 1400	< 1400	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
11	68.5	9/17/94	VPSS-54	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
11	71	9/17/94	VPSS-55	< 910	< 1400	< 1400	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
11	99.5	9/17/94	VPSS-57	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
12	10	9/19/94	VPSS-58	< 880	< 1400	< 1400	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
12	25.5	9/19/94	VPSS-59	< 880	< 1400	< 1400	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
12	34	9/19/94	VPSS-60	< 880	< 1400	< 1400	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
12	40.5	9/19/94	VPSS-61	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
12	60.5	9/19/94	VPSS-62	< 890	< 1400	< 1400	< 350	< 350	< 350	360	< 350	< 350	< 350	< 350	< 350	< 350
12	71	9/19/94	VPSS-63	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13	10.5	9/20/94	VPSS-64	< 900	< 1400	< 1400	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
13	20.5	9/20/94	VPSS-65	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13	30.5	9/20/94	VPSS-66	< 900	< 1400	< 1400	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
14	11	9/22/94	VPSS-67	< 920	< 1500	< 1500	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
15	11	9/24/94	VPSS-68	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
15	21	9/24/94	VPSS-69	< 900	< 1400	< 1400	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
15	31	9/24/94	VPSS-70	< 900	< 1400	< 1400	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
15	57	9/24/94	VPSS-71	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
15	61	9/24/94	VPSS-72	< 880	< 1400	< 1400	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
15	70	9/24/94	VPSS-73	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
15	81	9/24/94	VPSS-74	< 880	< 1400	< 1400	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
16	0.5(DUP	9/28/94	VPSS-75	< 880	< 1400	< 1400	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
16	21	9/28/94	VPSS-76	< 880	< 1400	< 1400	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
16	31	9/28/94	VPSS-77	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
16	41	9/28/94	VPSS-78	< 900	< 1400	< 1400	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
16	50.5	9/28/94	VPSS-80	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
16	51	9/28/94	VPSS-79	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
16	61	9/28/94	VPSS-81	< 920	< 1500	< 1500	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
16	71	9/28/94	VPSS-82	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
16	81	9/28/94	VPSS-83	< 920	< 1500	< 1500	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
16	91	9/28/94	VPSS-84	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
16	101	9/28/94	VPSS-85	< 890	< 1400	< 1400	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
17	20.5	9/30/94	VPSS-86	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
17	26.5	9/30/94	VPSS-87	< 870	< 1400	< 1400	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
18	10	10/1/94	VPSS-88	< 920	< 1500	< 1500	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
18	34.5	10/1/94	VPSS-89	< 870	< 1400	< 1400	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350

RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS ANALYSES FOR SOIL

(Concentration in µg/kg)

Boring/Test Pit Number	Depth (ft bgs)	Date	Sample Number	HEXACHLORO-BENZENE	HEXACHLORO-BUTADIENE	HEXACHLORO-CYCLO-PENTADIENE	HEXACHLORO-ETHANE	ISOPHORONE	NITROBENZENE	N-NITROSO-DI-N-PROPYLAMINE	N-NITROSODI-PHENYLAMINE	PENTACHLORO-PHENOL	PHENOL
10	50.5	9/12/94	VPSS-45	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10	60.5	9/12/94	VPSS-46	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 950	< 380
10	70.5	9/12/94	VPSS-47	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
11	11	9/17/94	VPSS-48	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
11	21	9/17/94	VPSS-49	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 920	< 370
11	31	9/17/94	VPSS-50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
11	40.5	9/17/94	VPSS-51	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 900	< 360
11	41	9/17/94	VPSS-52	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
11	51	9/17/94	VPSS-53	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 900	< 360
11	68.5	9/17/94	VPSS-54	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
11	71	9/17/94	VPSS-55	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 910	< 360
11	99.5	9/17/94	VPSS-57	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
12	10	9/19/94	VPSS-58	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 880	< 350
12	25.5	9/19/94	VPSS-59	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 880	< 350
12	34	9/19/94	VPSS-60	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 880	< 350
12	40.5	9/19/94	VPSS-61	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
12	60.5	9/19/94	VPSS-62	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 890	< 350
12	71	9/19/94	VPSS-63	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13	10.5	9/20/94	VPSS-64	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 900	< 360
13	20.5	9/20/94	VPSS-65	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13	30.5	9/20/94	VPSS-66	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 900	< 360
14	11	9/22/94	VPSS-67	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 920	< 370
15	11	9/24/94	VPSS-68	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
15	21	9/24/94	VPSS-69	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 900	< 360
15	31	9/24/94	VPSS-70	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 900	< 360
15	57	9/24/94	VPSS-71	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
15	61	9/24/94	VPSS-72	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 880	< 350
15	70	9/24/94	VPSS-73	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
15	81	9/24/94	VPSS-74	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 880	< 350
16	0.5(DUP	9/28/94	VPSS-75	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 880	< 350
16	21	9/28/94	VPSS-76	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 880	< 350
16	31	9/28/94	VPSS-77	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
16	41	9/28/94	VPSS-78	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 900	< 360
16	50.5	9/28/94	VPSS-80	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
16	51	9/28/94	VPSS-79	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
16	61	9/28/94	VPSS-81	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 920	< 370
16	71	9/28/94	VPSS-82	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
16	81	9/28/94	VPSS-83	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 920	< 370
16	91	9/28/94	VPSS-84	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
16	101	9/28/94	VPSS-85	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 890	< 350
17	20.5	9/30/94	VPSS-86	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
17	26.5	9/30/94	VPSS-87	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 870	< 350
18	10	10/1/94	VPSS-88	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 920	< 370
18	34.5	10/1/94	VPSS-89	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 870	< 350

RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS ANALYSES FOR SOIL

(Concentration in µg/kg)

Boring/Test Pit Number	Depth (ft bgs)	Date	Sample Number	1,2,4-TRICHLORO-BENZENE	1,2-DICHLORO-BENZENE	1,3-DICHLORO-BENZENE	1,4-DICHLORO-BENZENE	2-NITRO-ANILINE	2,4,5-TRICHLORO-PHENOL	2,4,6-TRICHLORO-PHENOL	2,4-DICHLORO-PHENOL	2,4-DIMETHYL-PHENOL	2,4-DINITRO-PHENOL	2,4-DINITRO-TOLUENE	2,6-DINITRO-TOLUENE	2-CHLORO-NAPHTHALENE
18	45	10/1/94	VPSS-90	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
18	50	10/1/94	VPSS-91	< 350	< 350	< 350	< 350	< 870	< 870	< 350	< 350	< 350	< 870	< 350	< 350	< 350
18	60	10/1/94	VPSS-92	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
18	70	10/1/94	VPSS-93	< 350	< 350	< 350	< 350	< 880	< 880	< 350	< 350	< 350	< 880	< 350	< 350	< 350
19	10.5	10/3/94	VPSS-94	< 350	< 350	< 350	< 350	< 880	< 880	< 350	< 350	< 350	< 880	< 350	< 350	< 350
19	30.5	10/3/94	VPSS-95	< 380	< 380	< 380	< 380	< 960	< 960	< 380	< 380	< 380	< 960	< 380	< 380	< 380
19A	20.5	10/4/94	VPSS-96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
19A	40.5	10/4/94	VPSS-97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
19A	51	10/4/94	VPSS-98	< 360	< 360	< 360	< 360	< 900	< 900	< 360	< 360	< 360	< 900	< 360	< 360	< 360
19A	61	10/4/94	VPSS-99	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
19A	70.5	10/4/94	VPSS-100	< 450	< 450	< 450	< 450	< 1100	< 1100	< 450	< 450	< 450	< 1100	< 450	< 450	< 450
19A	90.5	10/4/94	VPSS-101	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
19A	100.5	10/4/94	VPSS-102	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
20	11	10/13/94	VPSS-114	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
20	21	10/13/94	VPSS-115	< 360	< 360	< 360	< 360	< 900	< 900	< 360	< 360	< 360	< 900	< 360	< 360	< 360
20	31	10/13/94	VPSS-116	< 380	< 380	< 380	< 380	< 950	< 950	< 380	< 380	< 380	< 950	< 380	< 380	< 380
20A	11	10/22/94	VPSS-125	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
20A	0.5(DUP	10/22/94	VPSS-126	< 370	< 370	< 370	< 370	< 940	< 940	< 370	< 370	< 370	< 940	< 370	< 370	< 370
20A	21	10/22/94	VPSS-127	< 370	< 370	< 370	< 370	< 920	< 920	< 370	< 370	< 370	< 920	< 370	< 370	< 370
20A	50.5	10/22/94	VPSS-128	< 380	< 380	< 380	< 380	< 950	< 950	< 380	< 380	< 380	< 950	< 380	< 380	< 380
20A	71	10/22/94	VPSS-129	< 360	< 360	< 360	< 360	< 900	< 900	< 360	< 360	< 360	< 900	< 360	< 360	< 360
21	9	10/8/94	VPSS-103	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
21	19(DUP)	10/8/94	VPSS-104	< 430	< 430	< 430	< 430	< 1100	< 1100	< 430	< 430	< 430	< 1100	< 430	< 430	< 430
21	19.5	10/8/94	VPSS-105	< 400	< 400	< 400	< 400	< 1000	< 1000	< 400	< 400	< 400	< 1000	< 400	< 400	< 400
21	29.5	10/8/94	VPSS-106	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
21	49	10/9/94	VPSS-107	< 400	< 400	< 400	< 400	< 990	< 990	< 400	< 400	< 400	< 990	< 400	< 400	< 400
21	59.5	10/9/94	VPSS-108	< 420	< 420	< 420	< 420	< 1000	< 1000	< 420	< 420	< 420	< 1000	< 420	< 420	< 420
22	11	10/11/94	VPSS-109	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
22	0.5(DUP	10/11/94	VPSS-110	< 350	< 350	< 350	< 350	< 890	< 890	< 350	< 350	< 350	< 890	< 350	< 350	< 350
22	21	10/11/94	VPSS-111	< 350	< 350	< 350	< 350	< 890	< 890	< 350	< 350	< 350	< 890	< 350	< 350	< 350
22	31	10/11/94	VPSS-112	< 350	< 350	< 350	< 350	< 880	< 880	< 350	< 350	< 350	< 880	< 350	< 350	< 350
22	50.5	10/11/94	VPSS-113	< 350	< 350	< 350	< 350	< 870	< 870	< 350	< 350	< 350	< 870	< 350	< 350	< 350
23A	1.5	10/18/94	VPSS-123	< 360	< 360	< 360	< 360	< 900	< 900	< 360	< 360	< 360	< 900	< 360	< 360	< 360
23A	26	10/18/94	VPSS-124	< 370	< 370	< 370	< 370	< 940	< 940	< 370	< 370	< 370	< 940	< 370	< 370	< 370
24	10	10/15/94	VPSS-117	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
24	20	10/15/94	VPSS-118	< 360	< 360	< 360	< 360	< 900	< 900	< 360	< 360	< 360	< 900	< 360	< 360	< 360
24	29.5	10/15/94	VPSS-119	< 350	< 350	< 350	< 350	< 890	< 890	< 350	< 350	< 350	< 890	< 350	< 350	< 350
24	49.5	10/15/94	VPSS-120	< 350	< 350	< 350	< 350	< 890	< 890	< 350	< 350	< 350	< 890	< 350	< 350	< 350
24	59.5	10/15/94	VPSS-121	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
24	69.5	10/15/94	VPSS-122	< 350	< 350	< 350	< 350	< 890	< 890	< 350	< 350	< 350	< 890	< 350	< 350	< 350
29	4	4/11/97	VPSS-148	<350	<350	<350	<350	<350	<1800	<350	<350	<350	<1800	<350	<350	<350
29	7	4/11/97	VPSS-149	<340	<340	<340	<340	<340	<1800	<340	<340	<340	<1800	<340	<340	<340
29	10	4/11/97	VPSS-150	<350	<350	<350	<350	<350	<1800	<350	<350	<350	<1800	<350	<350	<350
29	15	4/11/97	VPSS-151	<330	<330	<330	<330	<330	<1700	<330	<330	<330	<1700	<330	<330	<330

RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS ANALYSES FOR SOIL

(Concentration in µg/kg)

Boring/Test Pit Number	Depth (ft bgs)	Date	Sample Number	2-CHLORO-PHENOL	2-METHYL-NAPHTHALENE	2-METHYL-4,6-DINITROPHENOL	2-METHYL-PHENOL	2-NITROPHENOL	3,3'-DICHLORO-BENZIDINE	3-NITRO-ANILINE	4-BROMOPHENYL-PHENYLETHER	4-CHLORO-3-METHYLPHENOL	4-CHLORO-ANILINE	4-CHLOROPHENYL-PHENYLETHER	4-METHYL-PHENOL	4-NITRO-ANILINE
18	45	10/1/94	VPSS-90	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
18	50	10/1/94	VPSS-91	< 350	< 350	< 870	< 350	< 350	< 870	< 870	< 350	< 350	< 1400	< 350	< 350	< 870
18	60	10/1/94	VPSS-92	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
18	70	10/1/94	VPSS-93	< 350	< 350	< 880	< 350	< 350	< 880	< 880	< 350	< 350	< 1400	< 350	< 350	< 880
19	10.5	10/3/94	VPSS-94	< 350	< 350	< 880	< 350	< 350	< 880	< 880	< 350	< 350	< 1400	< 350	< 350	< 880
19	30.5	10/3/94	VPSS-95	< 380	< 380	< 960	< 380	< 380	< 960	< 960	< 380	< 380	< 1500	< 380	< 380	< 960
19A	20.5	10/4/94	VPSS-96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
19A	40.5	10/4/94	VPSS-97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
19A	51	10/4/94	VPSS-98	< 360	< 360	< 900	< 360	< 360	< 900	< 900	< 360	< 360	< 1400	< 360	< 360	< 900
19A	61	10/4/94	VPSS-99	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
19A	70.5	10/4/94	VPSS-100	< 450	< 450	< 1100	< 450	< 450	< 1100	< 1100	< 450	< 450	< 1800	< 450	< 450	< 1100
19A	90.5	10/4/94	VPSS-101	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
19A	100.5	10/4/94	VPSS-102	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
20	11	10/13/94	VPSS-114	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
20	21	10/13/94	VPSS-115	< 360	< 360	< 900	< 360	< 360	< 900	< 900	< 360	< 360	< 1400	< 360	< 360	< 900
20	31	10/13/94	VPSS-116	< 380	< 380	< 950	< 380	< 380	< 950	< 950	< 380	< 380	< 1500	< 380	< 380	< 950
20A	11	10/22/94	VPSS-125	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
20A	0.5(DUP	10/22/94	VPSS-126	< 370	< 370	< 940	< 370	< 370	< 940	< 940	< 370	< 370	< 1500	< 370	< 370	< 940
20A	21	10/22/94	VPSS-127	< 370	< 370	< 920	< 370	< 370	< 920	< 920	< 370	< 370	< 1500	< 370	< 370	< 920
20A	50.5	10/22/94	VPSS-128	< 380	< 380	< 950	< 380	< 380	< 950	< 950	< 380	< 380	< 1500	< 380	< 380	< 950
20A	71	10/22/94	VPSS-129	< 360	< 360	< 900	< 360	< 360	< 900	< 900	< 360	< 360	< 1400	< 360	< 360	< 900
21	9	10/8/94	VPSS-103	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
21	19(DUP)	10/8/94	VPSS-104	< 430	< 430	< 1100	< 430	< 430	< 1100	< 1100	< 430	< 430	< 1700	< 430	< 430	< 1100
21	19.5	10/8/94	VPSS-105	< 400	< 400	< 1000	< 400	< 400	< 1000	< 1000	< 400	< 400	< 1600	< 400	< 400	< 1000
21	29.5	10/8/94	VPSS-106	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
21	49	10/9/94	VPSS-107	< 400	< 400	< 990	< 400	< 400	< 990	< 990	< 400	< 400	< 1600	< 400	< 400	< 990
21	59.5	10/9/94	VPSS-108	< 420	< 420	< 1000	< 420	< 420	< 1000	< 1000	< 420	< 420	< 1700	< 420	< 420	< 1000
22	11	10/11/94	VPSS-109	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
22	0.5(DUP	10/11/94	VPSS-110	< 350	< 350	< 890	< 350	< 350	< 890	< 890	< 350	< 350	< 1400	< 350	< 350	< 890
22	21	10/11/94	VPSS-111	< 350	< 350	< 890	< 350	< 350	< 890	< 890	< 350	< 350	< 1400	< 350	< 350	< 890
22	31	10/11/94	VPSS-112	< 350	< 350	< 880	< 350	< 350	< 880	< 880	< 350	< 350	< 1400	< 350	< 350	< 880
22	50.5	10/11/94	VPSS-113	< 350	< 350	< 870	< 350	< 350	< 870	< 870	< 350	< 350	< 1400	< 350	< 350	< 870
23A	1.5	10/18/94	VPSS-123	< 360	< 360	< 900	< 360	< 360	< 900	< 900	< 360	< 360	< 1400	< 360	< 360	< 900
23A	26	10/18/94	VPSS-124	< 370	< 370	< 940	< 370	< 370	< 940	< 940	< 370	< 370	< 1500	< 370	< 370	< 940
24	10	10/15/94	VPSS-117	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
24	20	10/15/94	VPSS-118	< 360	< 360	< 900	< 360	< 360	< 900	< 900	< 360	< 360	< 1400	< 360	< 360	< 900
24	29.5	10/15/94	VPSS-119	< 350	< 350	< 890	< 350	< 350	< 890	< 890	< 350	< 350	< 1400	< 350	< 350	< 890
24	49.5	10/15/94	VPSS-120	< 350	< 350	< 890	< 350	< 350	< 890	< 890	< 350	< 350	< 1400	< 350	< 350	< 890
24	59.5	10/15/94	VPSS-121	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
24	69.5	10/15/94	VPSS-122	< 350	< 350	< 890	< 350	< 350	< 890	< 890	< 350	< 350	< 1400	< 350	< 350	< 890
29	4	4/11/97	VPSS-148	<350	<350	<1800	<350	<350	<710	<1800	<350	<350	<350	<350	<350	<1800
29	7	4/11/97	VPSS-149	<340	<340	<1800	<340	<340	<680	<1800	<340	<340	<340	<340	<340	<1800
29	10	4/11/97	VPSS-150	<350	<350	<1800	<350	<350	<690	<1800	<350	<350	<350	<350	<350	<1800
29	15	4/11/97	VPSS-151	<330	<330	<1700	<330	<330	<670	<1700	<330	<330	<330	<330	<330	<1700

RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS ANALYSES FOR SOIL

(Concentration in µg/kg)

Boring/Test Pit Number	Depth (ft bgs)	Date	Sample Number	4-NITROPHENOL	BENZOIC ACID	BENZYL ALCOHOL	BIS(2-CHLORO-ISOPROPYL)ETHER	BIS(2-CHLORO-ETHOXY) METHANE	BIS(2-CHLORO-ETHYL)ETHER	BIS(2-ETHYLHEXYL)-PHTHALATE	BUTYLBENZYL-PHTHALATE	DIBENZOFURAN	DIETHYL-PHTHALATE	DIMETHYL-PHTHALATE	DI-N-BUTYL-PHTHALATE	DI-N-OCTYL-PHATHALATE
18	45	10/1/94	VPSS-90	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
18	50	10/1/94	VPSS-91	< 870	< 1400	< 1400	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
18	60	10/1/94	VPSS-92	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
18	70	10/1/94	VPSS-93	< 880	< 1400	< 1400	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
19	10.5	10/3/94	VPSS-94	< 880	< 1400	< 1400	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
19	30.5	10/3/94	VPSS-95	< 960	< 1500	< 1500	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380
19A	20.5	10/4/94	VPSS-96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
19A	40.5	10/4/94	VPSS-97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
19A	51	10/4/94	VPSS-98	< 900	< 1400	< 1400	< 360	< 360	< 360	450	< 360	< 360	< 360	< 360	< 360	< 360
19A	61	10/4/94	VPSS-99	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
19A	70.5	10/4/94	VPSS-100	< 1100	< 1800	< 1800	< 450	< 450	< 450	< 450	< 450	< 450	< 450	< 450	< 450	< 450
19A	90.5	10/4/94	VPSS-101	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
19A	100.5	10/4/94	VPSS-102	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
20	11	10/13/94	VPSS-114	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
20	21	10/13/94	VPSS-115	< 900	< 1400	< 1400	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
20	31	10/13/94	VPSS-116	< 950	< 1500	< 1500	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380
20A	11	10/22/94	VPSS-125	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
20A	0.5(DUP	10/22/94	VPSS-126	< 940	< 1500	< 1500	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
20A	21	10/22/94	VPSS-127	< 920	< 1500	< 1500	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
20A	50.5	10/22/94	VPSS-128	< 950	< 1500	< 1500	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380
20A	71	10/22/94	VPSS-129	< 900	< 1400	< 1400	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
21	9	10/8/94	VPSS-103	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
21	19(DUP)	10/8/94	VPSS-104	< 1100	< 1700	< 1700	< 430	< 430	< 430	< 430	< 430	< 430	< 430	< 430	< 430	< 430
21	19.5	10/8/94	VPSS-105	< 1000	< 1600	< 1600	< 400	< 400	< 400	< 400	< 400	< 400	< 400	< 400	< 400	< 400
21	29.5	10/8/94	VPSS-106	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
21	49	10/9/94	VPSS-107	< 990	< 1600	< 1600	< 400	< 400	< 400	< 400	< 400	< 400	< 400	< 400	< 400	< 400
21	59.5	10/9/94	VPSS-108	< 1000	< 1700	< 1700	< 420	< 420	< 420	< 420	< 420	< 420	< 420	< 420	< 420	< 420
22	11	10/11/94	VPSS-109	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
22	0.5(DUP	10/11/94	VPSS-110	< 890	< 1400	< 1400	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
22	21	10/11/94	VPSS-111	< 890	< 1400	< 1400	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
22	31	10/11/94	VPSS-112	< 880	< 1400	< 1400	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
22	50.5	10/11/94	VPSS-113	< 870	< 1400	< 1400	< 350	< 350	< 350	150 J	< 350	< 350	< 350	< 350	< 350	< 350
23A	1.5	10/18/94	VPSS-123	< 900	< 1400	< 1400	< 360	< 360	< 360	150 J	< 360	< 360	< 360	< 360	< 360	< 360
23A	26	10/18/94	VPSS-124	< 940	< 1500	< 1500	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
24	10	10/15/94	VPSS-117	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
24	20	10/15/94	VPSS-118	< 900	< 1400	< 1400	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
24	29.5	10/15/94	VPSS-119	< 890	< 1400	< 1400	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
24	49.5	10/15/94	VPSS-120	< 890	< 1400	< 1400	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
24	59.5	10/15/94	VPSS-121	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
24	69.5	10/15/94	VPSS-122	< 890	< 1400	< 1400	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
29	4	4/11/97	VPSS-148	<1800	<1800	<350	<350	<350	<350	<710	<350	<350	<350	<350	<350	<350
29	7	4/11/97	VPSS-149	<1800	<1800	<340	<340	<340	<340	<680	<340	<340	<340	<340	<340	<340
29	10	4/11/97	VPSS-150	<1800	<1800	<350	<350	<350	<350	<690	<350	<350	<350	<350	<350	<350
29	15	4/11/97	VPSS-151	<1700	<1700	<330	<330	<330	<330	<670	<330	<330	<330	<330	<330	<330

RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS ANALYSES FOR SOIL

(Concentration in µg/kg)

Boring/Test Pit Number	Depth (ft bgs)	Date	Sample Number	HEXACHLORO-BENZENE	HEXACHLORO-BUTADIENE	HEXACHLORO-CYCLO-PENTADIENE	HEXACHLORO-ETHANE	ISOPHORONE	NITROBENZENE	N-NITROSO-DI-N-PROPYLAMINE	N-NITROSODI-PHENYLAMINE	PENTACHLORO-PHENOL	PHENOL
18	45	10/1/94	VPSS-90	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
18	50	10/1/94	VPSS-91	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 870	< 350
18	60	10/1/94	VPSS-92	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
18	70	10/1/94	VPSS-93	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 880	< 350
19	10.5	10/3/94	VPSS-94	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 880	< 350
19	30.5	10/3/94	VPSS-95	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 960	< 380
19A	20.5	10/4/94	VPSS-96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
19A	40.5	10/4/94	VPSS-97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
19A	51	10/4/94	VPSS-98	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 900	< 360
19A	61	10/4/94	VPSS-99	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
19A	70.5	10/4/94	VPSS-100	< 450	< 450	< 450	< 450	< 450	< 450	< 450	< 450	< 1100	< 450
19A	90.5	10/4/94	VPSS-101	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
19A	100.5	10/4/94	VPSS-102	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
20	11	10/13/94	VPSS-114	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
20	21	10/13/94	VPSS-115	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 900	< 360
20	31	10/13/94	VPSS-116	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 950	< 380
20A	11	10/22/94	VPSS-125	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
20A	0.5(DUP	10/22/94	VPSS-126	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 940	< 370
20A	21	10/22/94	VPSS-127	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 920	< 370
20A	50.5	10/22/94	VPSS-128	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 950	< 380
20A	71	10/22/94	VPSS-129	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 900	< 360
21	9	10/8/94	VPSS-103	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
21	19(DUP)	10/8/94	VPSS-104	< 430	< 430	< 430	< 430	< 430	< 430	< 430	< 430	< 1100	< 430
21	19.5	10/8/94	VPSS-105	< 400	< 400	< 400	< 400	< 400	< 400	< 400	< 400	< 1000	< 400
21	29.5	10/8/94	VPSS-106	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
21	49	10/9/94	VPSS-107	< 400	< 400	< 400	< 400	< 400	< 400	< 400	< 400	< 990	< 400
21	59.5	10/9/94	VPSS-108	< 420	< 420	< 420	< 420	< 420	< 420	< 420	< 420	< 1000	< 420
22	11	10/11/94	VPSS-109	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
22	0.5(DUP	10/11/94	VPSS-110	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 890	< 350
22	21	10/11/94	VPSS-111	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 890	< 350
22	31	10/11/94	VPSS-112	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 880	< 350
22	50.5	10/11/94	VPSS-113	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 870	< 350
23A	1.5	10/18/94	VPSS-123	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 900	< 360
23A	26	10/18/94	VPSS-124	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 940	< 370
24	10	10/15/94	VPSS-117	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
24	20	10/15/94	VPSS-118	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 900	< 360
24	29.5	10/15/94	VPSS-119	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 890	< 350
24	49.5	10/15/94	VPSS-120	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 890	< 350
24	59.5	10/15/94	VPSS-121	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
24	69.5	10/15/94	VPSS-122	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 890	< 350
29	4	4/11/97	VPSS-148	<350	<350	<350	<350	<350	<350	<350	<350	<350	<350
29	7	4/11/97	VPSS-149	<340	<340	<340	<340	<340	<340	<340	<340	<340	<340
29	10	4/11/97	VPSS-150	<350	<350	<350	<350	<350	<350	<350	<350	<350	<350
29	15	4/11/97	VPSS-151	<330	<330	<330	<330	<330	<330	<330	<330	<330	<330

RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS ANALYSES FOR SOIL

(Concentration in µg/kg)

Boring/Test Pit Number	Depth (ft bgs)	Date	Sample Number	1,2,4-TRICHLORO-BENZENE	1,2-DICHLORO-BENZENE	1,3-DICHLORO-BENZENE	1,4-DICHLORO-BENZENE	2- NITRO-ANILINE	2,4,5-TRICHLORO-PHENOL	2,4,6-TRICHLORO-PHENOL	2,4-DICHLORO-PHENOL	2,4-DIMETHYL-PHENOL	2,4-DINITRO-PHENOL	2,4-DINITRO-TOLUENE	2,6-DINITRO-TOLUENE	2-CHLORO-NAPHTHALENE
29	20	4/11/97	VPSS-152	<350	<350	<350	<350	<350	<1800	<350	<350	<350	<1800	<350	<350	<350
29	20(DUP)	4/11/97	VPSS-153	<360	<360	<360	<360	<360	<1900	<360	<360	<360	<1900	<360	<360	<360
29	30	4/11/97	VPSS-154	<380	<380	<380	<380	<380	<2000	<380	<380	<380	<2000	<380	<380	<380
29	40	4/11/97	VPSS-155	<340	<340	<340	<340	<340	<1800	<340	<340	<340	<1800	<340	<340	<340
29	49	4/12/97	VPSS-156	<360	<360	<360	<360	<360	<1800	<360	<360	<360	<1800	<360	<360	<360
29	60	4/12/97	VPSS-157	<350	<350	<350	<350	<350	<1800	<350	<350	<350	<1800	<350	<350	<350
29	70	4/12/97	VPSS-158	<350	<350	<350	<350	<350	<1800	<350	<350	<350	<1800	<350	<350	<350
29	79.5	4/12/97	VPSS-159	<370	<370	<370	<370	<370	<1900	<370	<370	<370	<1900	<370	<370	<370
30	5	4/1/97	VPSS-130	<340	<340	<340	<340	<1700	<1700	<340	<340	<340	<1700	<340	<340	<340
30	10	4/1/97	VPSS-131	<340	<340	<340	<340	<1800	<1800	<340	<340	<340	<1800	<340	<340	<340
30	15	4/1/97	VPSS-132	<340	<340	<340	<340	<1800	<1800	<340	<340	<340	<1800	<340	<340	<340
30	20	4/1/97	VPSS-133	<340	<340	<340	<340	<1800	<1800	<340	<340	<340	<1800	<340	<340	<340
30	30	4/1/97	VPSS-134	<370	<370	<370	<370	<1900	<1900	<370	<370	<370	<1900	<370	<370	<370
30	40	4/2/97	VPSS-135	<340	<340	<340	<340	<1800	<1800	<340	<340	<340	<1800	<340	<340	<340
30	50	4/2/97	VPSS-136	<350	<350	<350	<350	<1800	<1800	<350	<350	<350	<1800	<350	<350	<350
30	60	4/2/97	VPSS-137	<340	<340	<340	<340	<1800	<1800	<340	<340	<340	<1800	<340	<340	<340
30	69.5	4/2/97	VPSS-138	<360	<360	<360	<360	<1800	<1800	<360	<360	<360	<1800	<360	<360	<360
31	5	4/8/97	VPSS-139	<340	<340	<340	<340	<1800	<1800	<340	<340	<340	<1800	<340	<340	<340
31	10	4/8/97	VPSS-140	<340	<340	<340	<340	<1700	<1700	<340	<340	<340	<1700	<340	<340	<340
31	15	4/8/97	VPSS-141	<340	<340	<340	<340	<1800	<1800	<340	<340	<340	<1800	<340	<340	<340
31	20	4/8/97	VPSS-142	<340	<340	<340	<340	<1800	<1800	<340	<340	<340	<1800	<340	<340	<340
31	30	4/8/97	VPSS-143	<340	<340	<340	<340	<1700	<1700	<340	<340	<340	<1700	<340	<340	<340
31	40	4/8/97	VPSS-144	<380	<380	<380	<380	<2000	<2000	<380	<380	<380	<2000	<380	<380	<380
31	50	4/8/97	VPSS-145	<370	<370	<370	<370	<1900	<1900	<370	<370	<370	<1900	<370	<370	<370
31	59.5	4/8/97	VPSS-146	<340	<340	<340	<340	<1700	<1700	<340	<340	<340	<1700	<340	<340	<340
31	70	4/9/97	VPSS-147	<360	<360	<360	<360	<1900	<1900	<360	<360	<360	<1900	<360	<360	<360
TP-1	5-5.5	4/14/97	VPSS-160	<340	<340	<340	<340	<340	<1800	<340	<340	<340	<1800	<340	<340	<340
TP-1	2.4	4/14/97	VPSS-161	<350	<350	<350	<350	<350	<1800	<350	<350	<350	<1800	<350	<350	<350
TP-2	1-1.3	4/14/97	VPSS-162	<370	<370	<370	<370	<370	<1900	<370	<370	<370	<1900	<370	<370	<370
TP-2	5-5.5	4/14/97	VPSS-163	<350	<350	<350	<350	<350	<1800	<350	<350	<350	<1800	<350	<350	<350
TP-3	2.2-2.7	4/14/97	VPSS-164	<370	<370	<370	<370	<370	<1900	<370	<370	<370	<1900	<370	<370	<370
TP-3	4.5-5.5	4/14/97	VPSS-165	<340	<340	<340	<340	<340	<1800	<340	<340	<340	<1800	<340	<340	<340
TP-1A	2-2.5	6/10/99	VPSS-166	<350	<350	<350	<350	<1700	<350	<350	<350	<350	<350	<350	<350	<350
TP-1A	4.7-5.5	6/10/99	VPSS-167	<350	<350	<350	<350	<1700	<350	<350	<350	<350	<350	<350	<350	<350
TP-2A	1-1.5	6/10/99	VPSS-168	<370	<370	<370	<370	<1800	<370	<370	<370	<370	<370	<370	<370	<370
TP-2A	5-5.5	6/10/99	VPSS-169	<350	<350	<350	<350	<1700	<350	<350	<350	<350	<350	<350	<350	<350
TP-3A	1.5-2.5	6/10/99	VPSS-170	<340	<340	<340	<340	<1700	<340	<340	<340	<340	<340	<340	<340	<340
TP-3A	5-5.5	6/10/99	VPSS-171	<350	<350	<350	<350	<1700	<350	<350	<350	<350	<350	<350	<350	<350

Notes:

BG - Background samples.

bgs - Below ground surface.

DUP - Duplicate samples.

J - *Estimated result; value is less than reporting limit.*

NA - Not analyzed.

TP - Test pit.

RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS ANALYSES FOR SOIL

(Concentration in µg/kg)

Boring/Test Pit Number	Depth (ft bgs)	Date	Sample Number	2-CHLORO-PHENOL	2-METHYL-NAPHTHALENE	2-METHYL-4,6-DINITROPHENOL	2-METHYL-PHENOL	2-NITROPHENOL	3,3'-DICHLORO-BENZIDINE	3-NITRO-ANILINE	4-BROMOPHENYL-PHENYLETHER	4-CHLORO-3-METHYLPHENOL	4-CHLORO-ANILINE	4-CHLOROPHENYL-PHENYLETHER	4-METHYL-PHENOL	4-NITRO-ANILINE
29	20	4/11/97	VPSS-152	<350	<350	<1800	<350	<350	<700	<1800	<350	<350	<350	<350	<350	<1800
29	20(DUP)	4/11/97	VPSS-153	<360	<360	<1900	<360	<360	<760	<1900	<360	<360	<360	<360	<360	<1900
29	30	4/11/97	VPSS-154	<380	<380	<2000	<380	<380	<720	<2000	<380	<380	<380	<380	<380	<2000
29	40	4/11/97	VPSS-155	<340	<340	<1800	<340	<340	<680	<1800	<340	<340	<340	<340	<340	<1800
29	49	4/12/97	VPSS-156	<360	<360	<1800	<360	<360	<720	<1800	<360	<360	<360	<360	<360	<1800
29	60	4/12/97	VPSS-157	<350	<350	<1800	<350	<350	<690	<1800	<350	<350	<350	<350	<350	<1800
29	70	4/12/97	VPSS-158	<350	<350	<1800	<350	<350	<700	<1800	<350	<350	<350	<350	<350	<1800
29	79.5	4/12/97	VPSS-159	<370	<370	<1900	<370	<370	<740	<1900	<370	<370	<370	<370	<370	<1900
30	5	4/1/97	VPSS-130	<340	<340	<1700	<340	<340	<670	<1700	<340	<340	<340	<340	<340	<1700
30	10	4/1/97	VPSS-131	<340	<340	<1800	<340	<340	<690	<1800	<340	<340	<340	<340	<340	<1800
30	15	4/1/97	VPSS-132	<340	<340	<1800	<340	<340	<680	<1800	<340	<340	<340	<340	<340	<1800
30	20	4/1/97	VPSS-133	<340	<340	<1800	<340	<340	<690	<1800	<340	<340	<340	<340	<340	<1800
30	30	4/1/97	VPSS-134	<370	<370	<1900	<370	<370	<730	<1900	<370	<370	<370	<370	<370	<1900
30	40	4/2/97	VPSS-135	<340	<340	<1800	<340	<340	<690	<1800	<340	<340	<340	<340	<340	<1800
30	50	4/2/97	VPSS-136	<350	<350	<1800	<350	<350	<690	<1800	<350	<350	<350	<350	<350	<1800
30	60	4/2/97	VPSS-137	<340	<340	<1800	<340	<340	<680	<1800	<340	<340	<340	<340	<340	<1800
30	69.5	4/2/97	VPSS-138	<360	<360	<1800	<360	<360	<720	<1800	<360	<360	<360	<360	<360	<1800
31	5	4/8/97	VPSS-139	<340	<340	<1800	<340	<340	<690	<1800	<340	<340	<340	<340	<340	<1800
31	10	4/8/97	VPSS-140	<340	<340	<1700	<340	<340	<670	<1700	<340	<340	<340	<340	<340	<1700
31	15	4/8/97	VPSS-141	<340	<340	<1800	<340	<340	<680	<1800	<340	<340	<340	<340	<340	<1800
31	20	4/8/97	VPSS-142	<340	<340	<1800	<340	<340	<680	<1800	<340	<340	<340	<340	<340	<1800
31	30	4/8/97	VPSS-143	<340	<340	<1700	<340	<340	<670	<1700	<340	<340	<340	<340	<340	<1700
31	40	4/8/97	VPSS-144	<380	<380	<2000	<380	<380	<760	<2000	<380	<380	<380	<380	<380	<2000
31	50	4/8/97	VPSS-145	<370	<370	<1900	<370	<370	<730	<1900	<370	<370	<370	<370	<370	<1900
31	59.5	4/8/97	VPSS-146	<340	<340	<1700	<340	<340	<670	<1700	<340	<340	<340	<340	<340	<1700
31	70	4/9/97	VPSS-147	<360	<360	<1900	<360	<360	<720	<1900	<360	<360	<360	<360	<360	<1900
TP-1	5-5.5	4/14/97	VPSS-160	<340	<340	<1800	<340	<340	<680	<1800	<340	<340	<340	<340	<340	<1800
TP-1	2.4	4/14/97	VPSS-161	<350	<350	<1800	<350	<350	<690	<1800	<350	<350	<350	<350	<350	<1800
TP-2	1-1.3	4/14/97	VPSS-162	<370	<370	<1900	<370	<370	<730	<1900	<370	<370	<370	<370	<370	<1900
TP-2	5-5.5	4/14/97	VPSS-163	<350	<350	<1800	<350	<350	<690	<1800	<350	<350	<350	<350	<350	<1800
TP-3	2.2-2.7	4/14/97	VPSS-164	<370	<370	<1900	<370	<370	<730	<1900	<370	<370	<370	<370	<370	<1900
TP-3	4.5-5.5	4/14/97	VPSS-165	<340	<340	<1800	<340	<340	<680	<1800	<340	<340	<340	<340	<340	<1800
TP-1A	2-2.5	6/10/99	VPSS-166	<350	<350	<1700	<350	<350	<1700	<1700	<350	<350	<350	<350	<350	<1700
TP-1A	4.7-5.5	6/10/99	VPSS-167	<350	<350	<1700	<350	<350	<1700	<1700	<350	<350	<350	<350	<350	<1700
TP-2A	1-1.5	6/10/99	VPSS-168	<370	<370	<1800	<370	<370	<1800	<1800	<370	<370	<370	<370	<370	<1800
TP-2A	5-5.5	6/10/99	VPSS-169	<350	<350	<1700	<350	<350	<1700	<1700	<350	<350	<350	<350	<350	<1700
TP-3A	1.5-2.5	6/10/99	VPSS-170	<340	<340	<1700	<340	<340	<1700	<1700	<340	<340	<340	<340	<340	<1700
TP-3A	5-5.5	6/10/99	VPSS-171	<350	<350	<1700	<350	<350	<1700	<1700	<350	<350	<350	<350	<350	<1700

Notes:

BG - Background samples.
bgs - Below ground surface.
DUP - Duplicate samples.
J - Estimated result; value is less than reporting lim
NA - Not analyzed.
TP - Test pit.

RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS ANALYSES FOR SOIL

(Concentration in µg/kg)

Boring/Test Pit Number	Depth (ft bgs)	Date	Sample Number	4-NITROPHENOL	BENZOIC ACID	BENZYL ALCOHOL	BIS(2-CHLORO-ISOPROPYL)ETHER	BIS(2-CHLORO-ETHOXY) METHANE	BIS(2-CHLORO-ETHYL)ETHER	BIS(2-ETHYLHEXYL)-PHTHALATE	BUTYLBENZYL-PHTHALATE	DIBENZOFURAN	DIETHYL-PHTHALATE	DIMETHYL-PHTHALATE	DI-N-BUTYL-PHTHALATE	DI-N-OCTYL-PHATHALATE
29	20	4/11/97	VPSS-152	<1800	<1800	<350	<350	<350	<350	<700	<350	<350	<350	<350	<350	<350
29	20(DUP)	4/11/97	VPSS-153	<1900	<1900	<360	<360	<360	<360	<760	<360	<360	<360	<360	<360	<360
29	30	4/11/97	VPSS-154	<2000	<2000	<380	<380	<380	<380	<720	<380	<380	<380	<380	<380	<380
29	40	4/11/97	VPSS-155	<1800	<1800	<340	<340	<340	<340	<680	<340	<340	<340	<340	<340	<340
29	49	4/12/97	VPSS-156	<1800	<1800	<360	<360	<360	<360	<720	<360	<360	<360	<360	<360	<360
29	60	4/12/97	VPSS-157	<1800	<1800	<350	<350	<350	<350	<690	<350	<350	<350	<350	<350	<350
29	70	4/12/97	VPSS-158	<1800	<1800	<350	<350	<350	<350	<700	<350	<350	<350	<350	<350	<350
29	79.5	4/12/97	VPSS-159	<1900	<1900	<370	<370	<370	<370	<740	<370	<370	<370	<370	<370	<370
30	5	4/1/97	VPSS-130	<1700	<1700	<340	<340	<340	<340	<670	<340	<340	<340	<340	<340	<340
30	10	4/1/97	VPSS-131	<1800	<1800	<340	<340	<340	<340	<690	<340	<340	<340	<340	<340	<340
30	15	4/1/97	VPSS-132	<1800	<1800	<340	<340	<340	<340	<680	<340	<340	<340	<340	<340	<340
30	20	4/1/97	VPSS-133	<1800	<1800	<340	<340	<340	<340	<690	<340	<340	<340	<340	<340	<340
30	30	4/1/97	VPSS-134	<1900	<1900	<370	<370	<370	<370	<730	<370	<370	<370	<370	<370	<370
30	40	4/2/97	VPSS-135	<1800	<1800	<340	<340	<340	<340	<690	<340	<340	<340	<340	<340	<340
30	50	4/2/97	VPSS-136	<1800	<1800	<350	<350	<350	<350	<690	<350	<350	<350	<350	<350	<350
30	60	4/2/97	VPSS-137	<1800	<1800	<340	<340	<340	<340	<680	<340	<340	<340	<340	<340	<340
30	69.5	4/2/97	VPSS-138	<1800	<1800	<360	<360	<360	<360	<720	<360	<360	<360	<360	<360	<360
31	5	4/8/97	VPSS-139	<1800	<1800	<340	<340	<340	<340	<690	<340	<340	<340	<340	<340	<340
31	10	4/8/97	VPSS-140	<1700	<1700	<340	<340	<340	<340	<670	<340	<340	<340	<340	<340	<340
31	15	4/8/97	VPSS-141	<1800	<1800	<340	<340	<340	<340	<680	<340	<340	<340	<340	<340	<340
31	20	4/8/97	VPSS-142	<1800	<1800	<340	<340	<340	<340	<680	<340	<340	<340	<340	<340	<340
31	30	4/8/97	VPSS-143	<1700	<1700	<340	<340	<340	<340	<670	<340	<340	<340	<340	<340	<340
31	40	4/8/97	VPSS-144	<2000	<2000	<380	<380	<380	<380	<760	<380	<380	<380	<380	<380	<380
31	50	4/8/97	VPSS-145	<1900	<1900	<370	<370	<370	<370	<730	<370	<370	<370	<370	<370	<370
31	59.5	4/8/97	VPSS-146	<1700	<1700	<340	<340	<340	<340	<670	<340	<340	<340	<340	<340	<340
31	70	4/9/97	VPSS-147	<1900	<1900	<360	<360	<360	<360	<720	<360	<360	<360	<360	<360	<360
TP-1	5-5.5	4/14/97	VPSS-160	<1800	<1800	<340	<340	<340	<340	<680	<340	<340	<340	<340	<340	<340
TP-1	2.4	4/14/97	VPSS-161	<1800	<1800	<350	<350	<350	<350	<690	<350	<350	<350	<350	<350	<350
TP-2	1-1.3	4/14/97	VPSS-162	<1900	<1900	<370	<370	<370	<370	440 J	160 J	<370	<370	<370	250 J	<370
TP-2	5-5.5	4/14/97	VPSS-163	<1800	<1800	<350	<350	<350	<350	<690	<350	<350	<350	<350	<350	<350
TP-3	2.2-2.7	4/14/97	VPSS-164	<1900	<1900	<370	<370	<370	<370	<730	<370	<370	<370	<370	<370	<370
TP-3	4.5-5.5	4/14/97	VPSS-165	<1800	<1800	<340	<340	<340	<340	<680	<340	<340	<340	<340	<340	<340
TP-1A	2-2.5	6/10/99	VPSS-166	<1700	<1700	<350	<350	<350	<350	<350	<350	<350	<350	<350	<350	<350
TP-1A	4.7-5.5	6/10/99	VPSS-167	<1700	<1700	<350	<350	<350	<350	<350	<350	<350	<350	<350	<350	<350
TP-2A	1-1.5	6/10/99	VPSS-168	<1800	<1800	<370	<370	<370	<370	480	75 J	<370	<370	<370	<370	<370
TP-2A	5-5.5	6/10/99	VPSS-169	<1700	<1700	<350	<350	<350	<350	50 J	<350	<350	<350	<350	<350	<350
TP-3A	1.5-2.5	6/10/99	VPSS-170	<1700	<1700	<340	<340	<340	<340	<340	<340	<340	<340	<340	<340	<340
TP-3A	5-5.5	6/10/99	VPSS-171	<1700	<1700	<350	<350	<350	<350	<350	<350	<350	<350	<350	<350	<350

Notes:

BG - Background samples.
bgs - Below ground surface.
DUP - Duplicate samples.
J - Estimated result; value is less than reporting lim
NA - Not analyzed.
TP - Test pit.

RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS ANALYSES FOR SOIL

(Concentration in µg/kg)

Boring/Test Pit Number	Depth (ft bgs)	Date	Sample Number	HEXACHLORO-BENZENE	HEXACHLORO-BUTADIENE	HEXACHLORO-CYCLO-PENTADIENE	HEXACHLORO-ETHANE	ISOPHORONE	NITROBENZENE	N-NITROSO-DI-N-PROPYLAMINE	N-NITROSODI-PHENYLAMINE	PENTACHLORO-PHENOL	PHENOL
29	20	4/11/97	VPSS-152	<350	<350	<350	<350	<350	<350	<350	<350	<350	<350
29	20(DUP)	4/11/97	VPSS-153	<360	<360	<360	<360	<360	<360	<360	<360	<360	<360
29	30	4/11/97	VPSS-154	<380	<380	<380	<380	<380	<380	<380	<380	<380	<380
29	40	4/11/97	VPSS-155	<340	<340	<340	<340	<340	<340	<340	<340	<340	<340
29	49	4/12/97	VPSS-156	<360	<360	<360	<360	<360	<360	<360	<360	<360	<360
29	60	4/12/97	VPSS-157	<350	<350	<350	<350	<350	<350	<350	<350	<350	<350
29	70	4/12/97	VPSS-158	<350	<350	<350	<350	<350	<350	<350	<350	<350	<350
29	79.5	4/12/97	VPSS-159	<370	<370	<370	<370	<370	<370	<370	<370	<370	<370
30	5	4/1/97	VPSS-130	<340	<340	<340	<340	<340	<340	<340	<340	<340	<340
30	10	4/1/97	VPSS-131	<340	<340	<340	<340	<340	<340	<340	<340	<340	<340
30	15	4/1/97	VPSS-132	<340	<340	<340	<340	<340	<340	<340	<340	<340	<340
30	20	4/1/97	VPSS-133	<340	<340	<340	<340	<340	<340	<340	<340	<340	<340
30	30	4/1/97	VPSS-134	<370	<370	<370	<370	<370	<370	500	<370	<370	<370
30	40	4/2/97	VPSS-135	<340	<340	<340	<340	<340	<340	<340	<340	<340	<340
30	50	4/2/97	VPSS-136	<350	<350	<350	<350	<350	<350	<350	<350	<350	<350
30	60	4/2/97	VPSS-137	<340	<340	<340	<340	<340	<340	<340	<340	<340	<340
30	69.5	4/2/97	VPSS-138	<360	<360	<360	<360	<360	<360	<360	<360	<360	<360
31	5	4/8/97	VPSS-139	<340	<340	<340	<340	<340	<340	<340	<340	<340	<340
31	10	4/8/97	VPSS-140	<340	<340	<340	<340	<340	<340	<340	<340	<340	<340
31	15	4/8/97	VPSS-141	<340	<340	<340	<340	<340	<340	<340	<340	<340	<340
31	20	4/8/97	VPSS-142	<340	<340	<340	<340	<340	<340	<340	<340	<340	<340
31	30	4/8/97	VPSS-143	<340	<340	<340	<340	<340	<340	<340	<340	<340	<340
31	40	4/8/97	VPSS-144	<380	<380	<380	<380	<380	<380	<380	<380	<380	<380
31	50	4/8/97	VPSS-145	<370	<370	<370	<370	<370	<370	<370	<370	<370	<370
31	59.5	4/8/97	VPSS-146	<340	<340	<340	<340	<340	<340	<340	<340	<340	<340
31	70	4/9/97	VPSS-147	<360	<360	<360	<360	<360	<360	<360	<360	<360	<360
TP-1	5-5.5	4/14/97	VPSS-160	<340	<340	<340	<340	<340	<340	<340	<340	<340	<340
TP-1	2.4	4/14/97	VPSS-161	<350	<350	<350	<350	<350	<350	<350	<350	<350	<350
TP-2	1-1.3	4/14/97	VPSS-162	<370	<370	<370	<370	<370	<370	<370	<370	<370	<370
TP-2	5-5.5	4/14/97	VPSS-163	<350	<350	<350	<350	<350	<350	<350	<350	<350	<350
TP-3	2.2-2.7	4/14/97	VPSS-164	<370	<370	<370	<370	<370	<370	<370	<370	<370	<370
TP-3	4.5-5.5	4/14/97	VPSS-165	<340	<340	<340	<340	<340	<340	<340	<340	<340	<340
TP-1A	2-2.5	6/10/99	VPSS-166	<350	<350	<350	<350	<350	<350	<350	<350	<1700	<350
TP-1A	4.7-5.5	6/10/99	VPSS-167	<350	<350	<350	<350	<350	<350	<350	<350	<1700	<350
TP-2A	1-1.5	6/10/99	VPSS-168	<370	<370	<370	<370	<370	<370	<370	<370	<1800	<370
TP-2A	5-5.5	6/10/99	VPSS-169	<350	<350	<350	<350	<350	<350	<350	<350	<1700	<350
TP-3A	1.5-2.5	6/10/99	VPSS-170	<340	<340	<340	<340	<340	<340	<340	<340	<1700	<340
TP-3A	5-5.5	6/10/99	VPSS-171	<350	<350	<350	<350	<350	<350	<350	<350	<1700	<350

Notes:

BG - Background samples.
bgs - Below ground surface.
DUP - Duplicate samples.
J - Estimated result; value less than reporting limit.
NA - Not analyzed.
TP - Test pit.

APPENDIX F2

RESULTS OF POLYNUCLEAR AROMATIC HYDROCARBONS ANALYSES FOR SOIL

RESULTS OF POLYNUCLEAR AROMATIC HYDROCARBONS (PAHs) ANALYSES FOR SOIL

(Concentrations in µg/kg)

Method	Boring/Test Pit Number	Depth (ft bgs)	Date	Sample Number	ACENAPH-THENE	ACENAPH-THYLENE	ANTHRA-CENE	BENZO(a)-ANTHRACENE	BENZO(a)-PYRENE	BENZO(b)-FLUORANTHENE	BENZO(g,h,i)-PERYLENE	BENZO(k)FLUOR-ANTHENE
8270	1	20	8/29/94	VPSS-1	< 3700	< 3700	< 3700	< 3700	< 3700	< 3700	< 3700	< 3700
8270	1	37	8/29/94	VPSS-2	< 170	< 170	< 170	< 170	< 170	< 170	< 170	< 170
8270	2	10	8/30/94	VPSS-3	< 170	< 170	< 170	< 170	< 170	< 170	< 170	< 170
8270	2	38	8/30/94	VPSS-4	NA	NA	NA	NA	NA	NA	NA	NA
8270	3	30	9/1/94	VPSS-5	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	3	50	9/1/94	VPSS-6	NA	NA	NA	NA	NA	NA	NA	NA
8270	4	10	9/2/94	VPSS-7	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	4	20	9/2/94	VPSS-8	NA	NA	NA	NA	NA	NA	NA	NA
8270	4	35	9/2/94	VPSS-9	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	4	40	9/2/94	VPSS-10	NA	NA	NA	NA	NA	NA	NA	NA
8270	4	50	9/2/94	VPSS-11	< 340	< 340	< 340	< 340	< 340	< 340	< 340	< 340
8270	4	61	9/2/94	VPSS-12	NA	NA	NA	NA	NA	NA	NA	NA
8270	5	10	9/3/94	VPSS-13	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	6	10	9/4/94	VPSS-14	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
8270	6	20	9/4/94	VPSS-15	NA	NA	NA	NA	NA	NA	NA	NA
8270	6	30	9/4/94	VPSS-16	< 340	< 340	< 340	< 340	< 340	< 340	< 340	< 340
8270	6	48.5	9/4/94	VPSS-17	NA	NA	NA	NA	NA	NA	NA	NA
8270	6	51	9/4/94	VPSS-18	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	6	60.5	9/4/94	VPSS-19	NA	NA	NA	NA	NA	NA	NA	NA
8270	6	70	9/4/94	VPSS-20	< 340	< 340	< 340	< 340	< 340	< 340	< 340	< 340
8270	7	30	9/5/94	VPSS-21	< 350	< 350	< 350	< 350	< 350	<350	< 350	<350
8270	7	50	9/5/94	VPSS-22	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	7	60	9/5/94	VPSS-23	NA	NA	NA	NA	NA	NA	NA	NA
8270	8	10	9/8/94	VPSS-24	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	8	20	9/8/94	VPSS-25	NA	NA	NA	NA	NA	NA	NA	NA
8270	8	30	9/8/94	VPSS-26	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
8270	8	40	9/8/94	VPSS-27	NA	NA	NA	NA	NA	NA	NA	NA
8270	8	50	9/8/94	VPSS-28	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380
8270	8	65	9/8/94	VPSS-29	NA	NA	NA	NA	NA	NA	NA	NA
8270	8	81	9/9/94	VPSS-30	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
8270	8	101	9/9/94	VPSS-31	NA	NA	NA	NA	NA	NA	NA	NA
8270	9	10	9/10/94	VPSS-32	NA	NA	NA	NA	NA	NA	NA	NA
8270	9	21(DUP)	9/10/94	VPSS-34	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	9	21.5	9/10/94	VPSS-33	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	9	40.5	9/10/94	VPSS-35	NA	NA	NA	NA	NA	NA	NA	NA
8270	9	48	9/10/94	VPSS-36	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	9	51	9/10/94	VPSS-37	NA	NA	NA	NA	NA	NA	NA	NA
8270	9	60.5	9/10/94	VPSS-38	< 340	< 340	< 340	< 340	< 340	< 340	< 340	< 340
8270	9	80.5	9/10/94	VPSS-39	NA	NA	NA	NA	NA	NA	NA	NA
8270	10	11	9/12/94	VPSS-40	NA	NA	NA	NA	NA	NA	NA	NA
8270	10	0.5(DU	9/12/94	VPSS-42	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
8270	10	21	9/12/94	VPSS-41	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	10	31	9/12/94	VPSS-43	NA	NA	NA	NA	NA	NA	NA	NA
8270	10	40.5	9/12/94	VPSS-44	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	10	50.5	9/12/94	VPSS-45	NA	NA	NA	NA	NA	NA	NA	NA
8270	10	60.5	9/12/94	VPSS-46	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380
8270	10	70.5	9/12/94	VPSS-47	NA	NA	NA	NA	NA	NA	NA	NA
8270	11	11	9/17/94	VPSS-48	NA	NA	NA	NA	NA	NA	NA	NA
8270	11	21	9/17/94	VPSS-49	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
8270	11	31	9/17/94	VPSS-50	NA	NA	NA	NA	NA	NA	NA	NA
8270	11	40.5	9/17/94	VPSS-51	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	11	41	9/17/94	VPSS-52	NA	NA	NA	NA	NA	NA	NA	NA
8270	11	51	9/17/94	VPSS-53	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	11	68.5	9/17/94	VPSS-54	NA	NA	NA	NA	NA	NA	NA	NA
8270	11	71	9/17/94	VPSS-55	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	11	99.5	9/17/94	VPSS-57	NA	NA	NA	NA	NA	NA	NA	NA
8270	12	10	9/19/94	VPSS-58	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	12	25.5	9/19/94	VPSS-59	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	12	34	9/19/94	VPSS-60	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	12	40.5	9/19/94	VPSS-61	NA	NA	NA	NA	NA	NA	NA	NA
8270	12	60.5	9/19/94	VPSS-62	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	12	71	9/19/94	VPSS-63	NA	NA	NA	NA	NA	NA	NA	NA
8270	13	10.5	9/20/94	VPSS-64	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	13	20.5	9/20/94	VPSS-65	NA	NA	NA	NA	NA	NA	NA	NA
8270	13	30.5	9/20/94	VPSS-66	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	14	11	9/22/94	VPSS-67	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
8270	15	11	9/24/94	VPSS-68	NA	NA	NA	NA	NA	NA	NA	NA
8270	15	21	9/24/94	VPSS-69	< 360	< 360	< 360	<360	< 360	< 360	< 360	< 360
8270	15	31	9/24/94	VPSS-70	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	15	57	9/24/94	VPSS-71	NA	NA	NA	NA	NA	NA	NA	NA
8270	15	61	9/24/94	VPSS-72	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	15	70	9/24/94	VPSS-73	NA	NA	NA	NA	NA	NA	NA	NA
8270	15	81	9/24/94	VPSS-74	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350

RESULTS OF POLYNUCLEAR AROMATIC HYDROCARBONS (PAHs) ANALYSES FOR SOIL

(Concentrations in µg/kg)

Method	Boring/Test Pit Number	Depth (ft bgs)	Date	Sample Number	CHRYSENE	DIBENZ(a,h)-ANTHRACENE	FLUORAN-THENE	FLUORENE	INDENO(1,2,3-cd) PYRENE	NAPHTH-ALENE	PHENAN-THRENE	PYRENE
8270	1	20	8/29/94	VPSS-1	< 3700	< 3700	< 3700	< 3700	< 3700	< 3700	< 3700	< 3700
8270	1	37	8/29/94	VPSS-2	< 170	< 170	< 170	< 170	< 170	< 170	< 170	< 170
8270	2	10	8/30/94	VPSS-3	< 170	< 170	< 170	< 170	< 170	< 170	< 170	< 170
8270	2	38	8/30/94	VPSS-4	NA	NA	NA	NA	NA	NA	NA	NA
8270	3	30	9/1/94	VPSS-5	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	3	50	9/1/94	VPSS-6	NA	NA	NA	NA	NA	NA	NA	NA
8270	4	10	9/2/94	VPSS-7	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	4	20	9/2/94	VPSS-8	NA	NA	NA	NA	NA	NA	NA	NA
8270	4	35	9/2/94	VPSS-9	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	4	40	9/2/94	VPSS-10	NA	NA	NA	NA	NA	NA	NA	NA
8270	4	50	9/2/94	VPSS-11	< 340	< 340	< 340	< 340	< 340	< 340	< 340	< 340
8270	4	61	9/2/94	VPSS-12	NA	NA	NA	NA	NA	NA	NA	NA
8270	5	10	9/3/94	VPSS-13	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	6	10	9/4/94	VPSS-14	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
8270	6	20	9/4/94	VPSS-15	NA	NA	NA	NA	NA	NA	NA	NA
8270	6	30	9/4/94	VPSS-16	< 340	< 340	< 340	< 340	< 340	< 340	< 340	< 340
8270	6	48.5	9/4/94	VPSS-17	NA	NA	NA	NA	NA	NA	NA	NA
8270	6	51	9/4/94	VPSS-18	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	6	60.5	9/4/94	VPSS-19	NA	NA	NA	NA	NA	NA	NA	NA
8270	6	70	9/4/94	VPSS-20	< 340	< 340	< 340	< 340	< 340	< 340	< 340	< 340
8270	7	30	9/5/94	VPSS-21	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	7	50	9/5/94	VPSS-22	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	7	60	9/5/94	VPSS-23	NA	NA	NA	NA	NA	NA	NA	NA
8270	8	10	9/8/94	VPSS-24	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	8	20	9/8/94	VPSS-25	NA	NA	NA	NA	NA	NA	NA	NA
8270	8	30	9/8/94	VPSS-26	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
8270	8	40	9/8/94	VPSS-27	NA	NA	NA	NA	NA	NA	NA	NA
8270	8	50	9/8/94	VPSS-28	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380
8270	8	65	9/8/94	VPSS-29	NA	NA	NA	NA	NA	NA	NA	NA
8270	8	81	9/9/94	VPSS-30	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
8270	8	101	9/9/94	VPSS-31	NA	NA	NA	NA	NA	NA	NA	NA
8270	9	10	9/10/94	VPSS-32	NA	NA	NA	NA	NA	NA	NA	NA
8270	9	21(DUP)	9/10/94	VPSS-34	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	9	21.5	9/10/94	VPSS-33	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	9	40.5	9/10/94	VPSS-35	NA	NA	NA	NA	NA	NA	NA	NA
8270	9	48	9/10/94	VPSS-36	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	9	51	9/10/94	VPSS-37	NA	NA	NA	NA	NA	NA	NA	NA
8270	9	60.5	9/10/94	VPSS-38	< 340	< 340	< 340	< 340	< 340	< 340	< 340	< 340
8270	9	80.5	9/10/94	VPSS-39	NA	NA	NA	NA	NA	NA	NA	NA
8270	10	11	9/12/94	VPSS-40	NA	NA	NA	NA	NA	NA	NA	NA
8270	10	0.5(DU	9/12/94	VPSS-42	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
8270	10	21	9/12/94	VPSS-41	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	10	31	9/12/94	VPSS-43	NA	NA	NA	NA	NA	NA	NA	NA
8270	10	40.5	9/12/94	VPSS-44	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	10	50.5	9/12/94	VPSS-45	NA	NA	NA	NA	NA	NA	NA	NA
8270	10	60.5	9/12/94	VPSS-46	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380
8270	10	70.5	9/12/94	VPSS-47	NA	NA	NA	NA	NA	NA	NA	NA
8270	11	11	9/17/94	VPSS-48	NA	NA	NA	NA	NA	NA	NA	NA
8270	11	21	9/17/94	VPSS-49	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
8270	11	31	9/17/94	VPSS-50	NA	NA	NA	NA	NA	NA	NA	NA
8270	11	40.5	9/17/94	VPSS-51	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	11	41	9/17/94	VPSS-52	NA	NA	NA	NA	NA	NA	NA	NA
8270	11	51	9/17/94	VPSS-53	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	11	68.5	9/17/94	VPSS-54	NA	NA	NA	NA	NA	NA	NA	NA
8270	11	71	9/17/94	VPSS-55	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	11	99.5	9/17/94	VPSS-57	NA	NA	NA	NA	NA	NA	NA	NA
8270	12	10	9/19/94	VPSS-58	< 350	< 350	110 J	< 350	< 350	< 350	< 350	100 J
8270	12	25.5	9/19/94	VPSS-59	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	12	34	9/19/94	VPSS-60	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	12	40.5	9/19/94	VPSS-61	NA	NA	NA	NA	NA	NA	NA	NA
8270	12	60.5	9/19/94	VPSS-62	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	12	71	9/19/94	VPSS-63	NA	NA	NA	NA	NA	NA	NA	NA
8270	13	10.5	9/20/94	VPSS-64	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	13	20.5	9/20/94	VPSS-65	NA	NA	NA	NA	NA	NA	NA	NA
8270	13	30.5	9/20/94	VPSS-66	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	14	11	9/22/94	VPSS-67	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
8270	15	11	9/24/94	VPSS-68	NA	NA	NA	NA	NA	NA	NA	NA
8270	15	21	9/24/94	VPSS-69	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	15	31	9/24/94	VPSS-70	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	15	57	9/24/94	VPSS-71	NA	NA	NA	NA	NA	NA	NA	NA
8270	15	61	9/24/94	VPSS-72	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	15	70	9/24/94	VPSS-73	NA	NA	NA	NA	NA	NA	NA	NA
8270	15	81	9/24/94	VPSS-74	< 350	< 350	< 350	< 350	< 350	< 350	< 850	< 350

RESULTS OF POLYNUCLEAR AROMATIC HYDROCARBONS (PAHs) ANALYSES FOR SOIL

(Concentrations in µg/kg)

Method	Boring/Test Pit Number	Depth (ft bgs)	Date	Sample Number	ACENAPH-THENE	ACENAPH-THYLENE	ANTHRA-CENE	BENZO(a)-ANTHRACENE	BENZO(a)-PYRENE	BENZO(b)-FLUORANTHENE	BENZO(g,h,i)-PERYLENE	BENZO(k)FLUOR-ANTHENE
8270	16	0.5(DU	9/28/94	VPSS-75	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	16	21	9/28/94	VPSS-76	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	16	31	9/28/94	VPSS-77	NA	NA	NA	NA	NA	NA	NA	NA
8270	16	41	9/28/94	VPSS-78	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	16	50.5	9/28/94	VPSS-80	NA	NA	NA	NA	NA	NA	NA	NA
8270	16	51	9/28/94	VPSS-79	NA	NA	NA	NA	NA	NA	NA	NA
8270	16	61	9/28/94	VPSS-81	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
8270	16	71	9/28/94	VPSS-82	NA	NA	NA	NA	NA	NA	NA	NA
8270	16	81	9/28/94	VPSS-83	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
8270	16	91	9/28/94	VPSS-84	NA	NA	NA	NA	NA	NA	NA	NA
8270	16	101	9/28/94	VPSS-85	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	17	20.5	9/30/94	VPSS-86	NA	NA	NA	NA	NA	NA	NA	NA
8270	17	26.5	9/30/94	VPSS-87	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	18	10	10/1/94	VPSS-88	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
8270	18	34.5	10/1/94	VPSS-89	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	18	45	10/1/94	VPSS-90	NA	NA	NA	NA	NA	NA	NA	NA
8270	18	50	10/1/94	VPSS-91	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	18	60	10/1/94	VPSS-92	NA	NA	NA	NA	NA	NA	NA	NA
8270	18	70	10/1/94	VPSS-93	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	19	10.5	10/3/94	VPSS-94	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	19	30.5	10/3/94	VPSS-95	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380
8270	19A	20.5	10/4/94	VPSS-96	NA	NA	NA	NA	NA	NA	NA	NA
8270	19A	40.5	10/4/94	VPSS-97	NA	NA	NA	NA	NA	NA	NA	NA
8270	19A	51	10/4/94	VPSS-98	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	19A	61	10/4/94	VPSS-99	NA	NA	NA	NA	NA	NA	NA	NA
8270	19A	70.5	10/4/94	VPSS-100	< 450	< 450	< 450	< 450	< 450	< 450	< 450	< 450
8270	19A	90.5	10/4/94	VPSS-101	NA	NA	NA	NA	NA	NA	NA	NA
8270	19A	100.5	10/4/94	VPSS-102	NA	NA	NA	NA	NA	NA	NA	NA
8270	20	11	10/13/94	VPSS-114	NA	NA	NA	NA	NA	NA	NA	NA
8270	20	21	10/13/94	VPSS-115	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	20	31	10/13/94	VPSS-116	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380
8270	20A	11	10/22/94	VPSS-125	NA	NA	NA	NA	NA	NA	NA	NA
8270	20A	0.5(DU	10/22/94	VPSS-126	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
8270	20A	21	10/22/94	VPSS-127	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
8270	20A	50.5	10/22/94	VPSS-128	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380
8270	20A	71	10/22/94	VPSS-129	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	21	9	10/8/94	VPSS-103	NA	NA	NA	NA	NA	NA	NA	NA
8270	*21*	*19(DUP)*	*10/8/94*	*VPSS-104*	*< 430*	*< 430*	*< 430*	*< 430*	*< 430*	*< 430*	*< 430*	*< 430*
8270	21	19.5	10/8/94	VPSS-105	< 400	< 400	< 400	< 400	< 400	< 400	< 400	< 400
8270	21	29.5	10/8/94	VPSS-106	NA	NA	NA	NA	NA	NA	NA	NA
8270	21	49	10/9/94	VPSS-107	< 400	< 400	< 400	< 400	< 400	< 400	< 400	< 400
8270	21	59.5	10/9/94	VPSS-108	< 420	< 420	< 420	< 420	< 420	< 420	< 420	< 420
8270	22	11	10/11/94	VPSS-109	NA	NA	NA	NA	NA	NA	NA	NA
8270	22	0.5(DU	10/11/94	VPSS-110	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	22	21	10/11/94	VPSS-111	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	22	31	10/11/94	VPSS-112	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	22	50.5	10/11/94	VPSS-113	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	23A	1.5	10/18/94	VPSS-123	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	23A	26	10/18/94	VPSS-124	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
8270	24	10	10/15/94	VPSS-117	NA	NA	NA	NA	NA	NA	NA	NA
8270	24	20	10/15/94	VPSS-118	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	24	29.5	10/15/94	VPSS-119	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	24	49.5	10/15/94	VPSS-120	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	24	59.5	10/15/94	VPSS-121	NA	NA	NA	NA	NA	NA	NA	NA
8270	24	69.5	10/15/94	VPSS-122	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	29	4	4/11/97	VPSS-148	<350	<350	<350	<350	<350	<350	<350	<350
8270	29	7	4/11/97	VPSS-149	<340	<340	<340	<340	<340	<340	<340	<340
8270	29	10	4/11/97	VPSS-150	<350	<350	<350	<350	<350	<350	<350	<350
8270	29	15	4/11/97	VPSS-151	<330	<330	<330	<330	<330	<330	<330	<330
8270	29	20	4/11/97	VPSS-152	<350	<350	<350	<350	<350	<350	<350	<350
8270	29	20(DUP)	4/11/97	VPSS-153	<360	<360	<360	<360	<360	<360	<360	<360
8270	29	30	4/11/97	VPSS-154	<380	<380	<380	<380	<380	<380	<380	<380
8270	29	40	4/11/97	VPSS-155	<340	<340	<340	<340	<340	<340	<340	<340
8270	29	49	4/12/97	VPSS-156	<360	<360	<360	<360	<360	<360	<360	<360
8270	29	60	4/12/97	VPSS-157	<350	<350	<350	<350	<350	<350	<350	<350
8270	29	70	4/12/97	VPSS-158	<350	<350	<350	<350	<350	<350	<350	<350
8270	29	79.5	4/12/97	VPSS-159	<370	<370	<370	<370	<370	<370	<370	<370
8270	30	5	4/1/97	VPSS-130	<340	<340	<340	<340	<340	<340	<340	<340
8270	30	10	4/1/97	VPSS-131	<340	<340	<340	<340	<340	<340	<340	<340
8270	30	15	4/1/97	VPSS-132	<340	<340	<340	<340	<340	<340	<340	<340
8270	30	20	4/1/97	VPSS-133	<340	<340	<340	<340	<340	<340	<340	<340
8270	30	30	4/1/97	VPSS-134	<370	<370	<370	<370	<370	<370	<370	<370
8270	30	40	4/2/97	VPSS-135	<340	<340	<340	<340	<340	<340	<340	<340
8270	30	50	4/2/97	VPSS-136	<350	<350	<350	<350	<350	<350	<350	<350
8270	30	60	4/2/97	VPSS-137	<340	<340	<340	<340	<340	<340	<340	<340
8270	30	69.5	4/2/97	VPSS-138	<360	<360	<360	<360	<360	<360	<360	<360

RESULTS OF POLYNUCLEAR AROMATIC HYDROCARBONS (PAHs) ANALYSES FOR SOIL

(Concentrations in µg/kg)

Method	Boring/Test Pit Number	Depth (ft bgs)	Date	Sample Number	CHRYSENE	DIBENZ(a,h)-ANTHRACENE	FLUORAN-THENE	FLUORENE	INDENO(1,2,3-cd) PYRENE	NAPHTH-ALENE	PHENAN-THRENE	PYRENE
8270	16	0.5(DU	9/28/94	VPSS-75	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	16	21	9/28/94	VPSS-76	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	16	31	9/28/94	VPSS-77	NA	NA	NA	NA	NA	NA	NA	NA
8270	16	41	9/28/94	VPSS-78	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	16	50.5	9/28/94	VPSS-80	NA	NA	NA	NA	NA	NA	NA	NA
8270	16	51	9/28/94	VPSS-79	NA	NA	NA	NA	NA	NA	NA	NA
8270	16	61	9/28/94	VPSS-81	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
8270	16	71	9/28/94	VPSS-82	NA	NA	NA	NA	NA	NA	NA	NA
8270	16	81	9/28/94	VPSS-83	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
8270	16	91	9/28/94	VPSS-84	NA	NA	NA	NA	NA	NA	NA	NA
8270	16	101	9/28/94	VPSS-85	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	17	20.5	9/30/94	VPSS-86	NA	NA	NA	NA	NA	NA	NA	NA
8270	17	26.5	9/30/94	VPSS-87	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	18	10	10/1/94	VPSS-88	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
8270	18	34.5	10/1/94	VPSS-89	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	18	45	10/1/94	VPSS-90	NA	NA	NA	NA	NA	NA	NA	NA
8270	18	50	10/1/94	VPSS-91	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	18	60	10/1/94	VPSS-92	NA	NA	NA	NA	NA	NA	NA	NA
8270	18	70	10/1/94	VPSS-93	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	19	10.5	10/3/94	VPSS-94	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	19	30.5	10/3/94	VPSS-95	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380
8270	19A	20.5	10/4/94	VPSS-96	NA	NA	NA	NA	NA	NA	NA	NA
8270	19A	40.5	10/4/94	VPSS-97	NA	NA	NA	NA	NA	NA	NA	NA
8270	19A	51	10/4/94	VPSS-98	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	19A	61	10/4/94	VPSS-99	NA	NA	NA	NA	NA	NA	NA	NA
8270	19A	70.5	10/4/94	VPSS-100	< 450	< 450	< 450	< 450	< 450	< 450	< 450	< 450
8270	19A	90.5	10/4/94	VPSS-101	NA	NA	NA	NA	NA	NA	NA	NA
8270	19A	100.5	10/4/94	VPSS-102	NA	NA	NA	NA	NA	NA	NA	NA
8270	20	11	10/13/94	VPSS-114	NA	NA	NA	NA	NA	NA	NA	NA
8270	20	21	10/13/94	VPSS-115	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	20	31	10/13/94	VPSS-116	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380
8270	20A	11	10/22/94	VPSS-125	NA	NA	NA	NA	NA	NA	NA	NA
8270	20A	0.5(DU	10/22/94	VPSS-126	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
8270	20A	21	10/22/94	VPSS-127	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
8270	20A	50.5	10/22/94	VPSS-128	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380
8270	20A	71	10/22/94	VPSS-129	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	21	9	10/8/94	VPSS-103	NA	NA	NA	NA	NA	NA	NA	NA
8270	21	19(DUP)	10/8/94	VPSS-104	< 430	< 430	< 430	< 430	< 430	< 430	< 430	< 430
8270	21	19.5	10/8/94	VPSS-105	< 400	< 400	< 400	< 400	< 400	< 400	< 400	< 400
8270	21	29.5	10/8/94	VPSS-106	NA	NA	NA	NA	NA	NA	NA	NA
8270	21	49	10/9/94	VPSS-107	< 400	< 400	< 400	< 400	< 400	< 400	< 400	< 400
8270	21	59.5	10/9/94	VPSS-108	< 420	< 420	< 420	< 420	< 420	< 420	< 420	< 420
8270	22	11	10/11/94	VPSS-109	NA	NA	NA	NA	NA	NA	NA	NA
8270	22	0.5(DU	10/11/94	VPSS-110	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	22	21	10/11/94	VPSS-111	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	22	31	10/11/94	VPSS-112	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	22	50.5	10/11/94	VPSS-113	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	23A	1.5	10/18/94	VPSS-123	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	23A	26	10/18/94	VPSS-124	< 370	< 370	< 370	< 370	< 370	< 370	< 370	< 370
8270	24	10	10/15/94	VPSS-117	NA	NA	NA	NA	NA	NA	NA	NA
8270	24	20	10/15/94	VPSS-118	< 360	< 360	< 360	< 360	< 360	< 360	< 360	< 360
8270	24	29.5	10/15/94	VPSS-119	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	24	49.5	10/15/94	VPSS-120	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	24	59.5	10/15/94	VPSS-121	NA	NA	NA	NA	NA	NA	NA	NA
8270	24	69.5	10/15/94	VPSS-122	< 350	< 350	< 350	< 350	< 350	< 350	< 350	< 350
8270	29	4	4/11/97	VPSS-148	<350	<350	<350	<350	<350	<350	<350	<350
8270	29	7	4/11/97	VPSS-149	<340	<340	<340	<340	<340	<340	<340	<340
8270	29	10	4/11/97	VPSS-150	<350	<350	<350	<350	<350	<350	<350	<350
8270	29	15	4/11/97	VPSS-151	<330	<330	<330	<330	<330	<330	<330	<330
8270	29	20	4/11/97	VPSS-152	<350	<350	<350	<350	<350	<350	<350	<350
8270	29	20(DUP)	4/11/97	VPSS-153	<360	<360	<360	<360	<360	<360	<360	<360
8270	29	30	4/11/97	VPSS-154	<380	<380	<380	<380	<380	<380	<380	<380
8270	29	40	4/11/97	VPSS-155	<340	<340	<340	<340	<340	<340	<340	<340
8270	29	49	4/12/97	VPSS-156	<360	<360	<360	<360	<360	<360	<360	<360
8270	29	60	4/12/97	VPSS-157	<350	<350	<350	<350	<350	<350	<350	<350
8270	29	70	4/12/97	VPSS-158	<350	<350	<350	<350	<350	<350	<350	<350
8270	29	79.5	4/12/97	VPSS-159	<370	<370	<370	<370	<370	<370	<370	<370
8270	30	5	4/1/97	VPSS-130	<340	<340	<340	<340	<340	<340	<340	<340
8270	30	10	4/1/97	VPSS-131	<340	<340	<340	<340	<340	<340	<340	<340
8270	30	15	4/1/97	VPSS-132	<340	<340	<340	<340	<340	<340	<340	<340
8270	30	20	4/1/97	VPSS-133	<340	<340	<340	<340	<340	<340	<340	<340
8270	30	30	4/1/97	VPSS-134	<370	<370	<370	<370	<370	<370	<370	<370
8270	30	40	4/2/97	VPSS-135	<340	<340	<340	<340	<340	<340	<340	<340
8270	30	50	4/2/97	VPSS-136	<350	<350	<350	<350	<350	<350	<350	<350
8270	30	60	4/2/97	VPSS-137	<340	<340	<340	<340	<340	<340	<340	<340
8270	30	69.5	4/2/97	VPSS-138	<360	<360	<360	<360	<360	<360	<360	<360

RESULTS OF POLYNUCLEAR AROMATIC HYDROCARBONS (PAHs) ANALYSES FOR SOIL

(Concentrations in µg/kg)

Method	Boring/Test Pit Number	Depth (ft bgs)	Date	Sample Number	ACENAPH-THENE	ACENAPH-THYLENE	ANTHRA-CENE	BENZO(a)-ANTHRACENE	BENZO(a)-PYRENE	BENZO(b)-FLUORANTHENE	BENZO(g,h,i)-PERYLENE	BENZO(k)FLUOR-ANTHENE
8270	31	5	4/8/97	VPSS-139	<340	<340	<340	<340	<340	<340	<340	<340
8270	31	10	4/8/97	VPSS-140	<340	<340	<340	<340	<340	<340	<340	<340
8270	31	15	4/8/97	VPSS-141	<340	<340	<340	<340	<340	<340	<340	<340
8270	31	20	4/8/97	VPSS-142	<340	<340	<340	<340	<340	<340	<340	<340
8270	31	30	4/8/97	VPSS-143	<340	<340	<340	<340	<340	<340	<340	<340
8270	31	40	4/8/97	VPSS-144	<380	<380	<380	<380	<380	<380	<380	<380
8270	31	50	4/8/97	VPSS-145	<370	<370	<370	<370	<370	<370	<370	<370
8270	31	59.5	4/8/97	VPSS-146	<340	<340	<340	<340	<340	<340	<340	<340
8270	31	70	4/9/97	VPSS-147	<360	<360	<360	<360	<360	<360	<360	<360
8270	TP-1	5-5.5	4/14/97	VPSS-160	<340	<340	<340	<340	<340	<340	<340	<340
8270	TP-1	2.4	4/14/97	VPSS-161	<350	<350	<350	<350	<350	<350	<350	<350
8270	TP-2	1-1.3	4/14/97	VPSS-162	<370	<370	<370	<370	<370	<370	<370	<370
8270	TP-2	5-5.5	4/14/97	VPSS-163	<350	<350	<350	<350	<350	<350	<350	<350
8270	TP-3	2.2-2.7	4/14/97	VPSS-164	<370	<370	<370	<370	<370	<370	<370	<370
8270	TP-3	4.5-5.5	4/14/97	VPSS-165	<340	<340	<340	<340	<340	<340	<340	<340
8310	29	4	4/11/97	VPSS-148	<270	<270	<90	<3.8	<3.6	<3.8	<9.0	<3.8
8310	29	7	4/11/97	VPSS-149	<260	<260	<86	<3.6	<3.5	<3.6	<8.6	<3.6
8310	29	10	4/11/97	VPSS-150	<260	<260	<89	<3.7	<3.6	<3.7	<8.9	<3.7
8310	29	15	4/11/97	VPSS-151	<260	<260	<86	<3.6	<3.5	<3.6	<8.6	<3.6
8310	29	20	4/11/97	VPSS-152	<280	<280	<94	<3.9	<3.8	<3.9	<9.4	<3.9
8310	29	20 (DUP	4/11/97	VPSS-153	<280	<280	<93	<3.9	<3.8	<3.9	<9.3	<3.9
8310	29	30	4/11/97	VPSS-154	<300	<300	<100	<4.2	<4.1	<4.2	<10	<4.2
8310	29	40	4/11/97	VPSS-155	<260	<260	<88	<3.6	<3.5	<3.6	<8.8	<3.6
8310	29	49	4/12/97	VPSS-156	<260	<260	<88	<3.7	<3.6	<3.7	<8.8	<3.7
8310	29	60	4/12/97	VPSS-157	<260	<260	<88	<3.6	<3.5	<3.6	<8.8	<3.6
8310	29	70	4/12/97	VPSS-158	<260	<260	<86	<3.6	<3.5	<3.6	<8.6	<3.6
8310	29	79.5	4/12/97	VPSS-159	<270	<270	<92	<3.8	<3.7	<3.8	<9.2	<3.8
8310	30	5	4/1/97	VPSS-130	<260	<260	<88	<3.6	<3.5	<3.6	<8.8	<3.6
8310	30	10	4/1/97	VPSS-131	<260	<260	<88	3.6	5.8	6.3	11	<3.7
8310	30	15	4/1/97	VPSS-132	<270	<270	<90	<3.8	<3.6	<3.8	<9.0	<3.8
8310	30	20	4/1/97	VPSS-133	<260	<260	<88	<3.6	<3.5	<3.6	<8.8	<3.6
8310	30	30	4/1/97	VPSS-134	<270	<270	<92	<3.8	<3.7	<3.8	<9.2	<3.8
8310	30	40	4/2/97	VPSS-135	<270	<270	<91	<3.8	<3.7	<3.8	<9.1	<3.8
8310	30	50	4/2/97	VPSS-136	<270	<270	<90	<3.8	<3.6	<3.8	<9.0	<3.8
8310	30	60	4/2/97	VPSS-137	<260	<260	<88	<3.7	<3.6	<3.7	<8.8	<3.7
8310	30	69.5	4/2/97	VPSS-138	<270	<270	<92	<3.8	<3.7	<3.8	<9.2	<3.8
8310	31	5	4/8/97	VPSS-139	<270	<270	<90	<3.8	<3.6	<3.8	<9.0	<3.8
8310	31	10	4/8/97	VPSS-140	<270	<270	<91	<3.8	<3.7	<3.8	<9.1	<3.8
8310	31	15	4/8/97	VPSS-141	<270	<270	<92	<3.8	<3.7	<3.8	<9.2	<3.8
8310	31	20	4/8/97	VPSS-142	<260	<260	<88	<3.7	<3.6	<3.7	<8.9	<3.7
8310	31	30	4/8/97	VPSS-143	<320	<320	<100	<4.4	<4.3	<4.4	<10	<4.4
8310	31	40	4/8/97	VPSS-144	<270	<270	<91	<3.8	<3.7	<3.8	<9.1	<3.8
8310	31	50	4/8/97	VPSS-145	<270	<270	<92	<3.8	<3.7	<3.8	<9.2	<3.8
8310	31	59.5	4/8/97	VPSS-146	<280	<280	<93	<3.9	<3.8	<3.9	<9.3	<3.9
8310	31	70	4/9/97	VPSS-147	<270	<270	<91	<3.8	<3.7	<3.8	<9.1	<3.8
8310	TP-1	5-5.5	4/14/97	VPSS-160	<260	<260	<86	<3.6	<3.5	<3.6	<8.6	<3.6
8310	TP-1	2.4	4/14/97	VPSS-161	<260	<260	<89	<3.7	<3.6	<3.7	<8.9	<3.7
8310	TP-2	1-1.3	4/14/97	VPSS-162	<270	<270	<92	<3.8	<3.7	6.4	48	<3.8
8310	TP-2	5-5.5	4/14/97	VPSS-163	<260	<260	<89	<3.7	<3.6	<3.7	<8.9	<3.7
8310	TP-3	2.2-2.7	4/14/97	VPSS-164	<280	<280	<94	<3.9	4.2	<3.9	11	<3.9
8310	TP-3	4.5-5.5	4/14/97	VPSS-165	<260	<260	<87	<3.6	<3.5	<3.6	<8.7	<3.6
8310	TP-1A	2-2.5	6/10/99	VPSS-166	<420	<210	<8.4	<17	<11	<4.2	<17	<4.2
8310	TP-1A	4.7-5.5	6/10/99	VPSS-167	<420	<210	<8.4	<17	<11	<4.2	<17	<4.2
8310	TP-2A	1-1.5	6/10/99	VPSS-168	<450	<220	<8.9	7.7 J	<11	8.8	<18	<4.5
8310	TP-2A	5-5.5	6/10/99	VPSS-169	<430	<210	<8.5	<17	<11	<4.3	<17	<4.3
8310	TP-3A	1.5-2.5	6/10/99	VPSS-170	<410	<210	<8.3	<17	<10	<4.1	<17	<4.1
8310	TP-3A	5-5.5	6/10/99	VPSS-171	<430	<210	<8.6	<17	<11	<4.3	<17	<4.3

Notes:

bgs - Below ground surface.

DUP - Duplicate samples.

J - Estimated result; value is less than reporting limit.

NA - Not analyzed.

TP - Test pit.

RESULTS OF POLYNUCLEAR AROMATIC HYDROCARBONS (PAHs) ANALYSES FOR SOIL

(Concentrations in µg/kg)

Method	Boring/Test Pit Number	Depth (ft bgs)	Date	Sample Number	CHRYSENE	DIBENZ(a,h)-ANTHRACENE	FLUORAN-THENE	FLUORENE	INDENO(1,2,3-cd) PYRENE	NAPHTH-ALENE	PHENAN-THRENE	PYRENE
8270	31	5	4/8/97	VPSS-139	<340	<340	<340	<340	<340	<340	<340	<340
8270	31	10	4/8/97	VPSS-140	<340	<340	<340	<340	<340	<340	<340	<340
8270	31	15	4/8/97	VPSS-141	<340	<340	<340	<340	<340	<340	<340	<340
8270	31	20	4/8/97	VPSS-142	<340	<340	<340	<340	<340	<340	<340	<340
8270	31	30	4/8/97	VPSS-143	<340	<340	<340	<340	<340	<340	<340	<340
8270	31	40	4/8/97	VPSS-144	<380	<380	<380	<380	<380	<380	<380	<380
8270	31	50	4/8/97	VPSS-145	<370	<370	<370	<370	<370	<370	<370	<370
8270	31	59.5	4/8/97	VPSS-146	<340	<340	<340	<340	<340	<340	<340	<340
8270	31	70	4/9/97	VPSS-147	<360	<360	<360	<360	<360	<360	<360	<360
8270	TP-1	5-5.5	4/14/97	VPSS-160	<340	<340	<340	<340	<340	<340	<340	<340
8270	TP-1	2.4	4/14/97	VPSS-161	<350	<350	<350	<350	<350	<350	<350	<350
8270	TP-2	1-1.3	4/14/97	VPSS-162	<370	<370	46 J	<370	<370	<370	22 J	55 J
8270	TP-2	5-5.5	4/14/97	VPSS-163	<350	<350	<350	<350	<350	<350	<350	<350
8270	TP-3	2.2-2.7	4/14/97	VPSS-164	<370	<370	<370	<370	<370	<370	<370	<370
8270	TP-3	4.5-5.5	4/14/97	VPSS-165	<340	<340	<340	<340	<340	<340	<340	<340
8310	29	4	4/11/97	VPSS-148	<3.6	<9.0	<9.0	<36	<9.0	<270	<36	<9.0
8310	29	7	4/11/97	VPSS-149	<3.5	<8.6	<8.6	<35	<8.6	<260	<35	<8.6
8310	29	10	4/11/97	VPSS-150	<3.6	<8.9	<8.9	<36	<8.9	<260	<36	<8.9
8310	29	15	4/11/97	VPSS-151	<3.5	<8.6	<8.6	<35	<8.6	<260	<35	<8.6
8310	29	20	4/11/97	VPSS-152	<3.8	<9.4	<9.4	<38	<9.4	<280	<38	<9.4
8310	29	20 (DUP	4/11/97	VPSS-153	<3.8	<9.3	<9.3	<38	<9.3	<280	<38	<9.3
8310	29	30	4/11/97	VPSS-154	<4.1	<10	<10	<41	<10	<300	<41	<10
8310	29	40	4/11/97	VPSS-155	<3.5	<8.8	<8.8	<35	<8.8	<260	<35	<8.8
8310	29	49	4/12/97	VPSS-156	<3.6	<8.8	<8.8	<36	<8.8	<260	<36	<8.8
8310	29	60	4/12/97	VPSS-157	<3.5	<8.8	<8.8	<35	<8.8	<260	<35	<8.8
8310	29	70	4/12/97	VPSS-158	<3.5	<8.6	<8.6	<35	<8.6	<260	<35	<8.6
8310	29	79.5	4/12/97	VPSS-159	<3.7	<9.2	<9.2	<37	<9.2	<270	<37	<9.2
8310	30	5	4/1/97	VPSS-130	<3.5	<8.8	<8.8	<35	<8.8	<260	<35	<8.8
8310	30	10	4/1/97	VPSS-131	<3.5	<8.8	<8.8	<36	<8.8	<260	<36	<8.8
8310	30	15	4/1/97	VPSS-132	<3.6	<9.0	<9.0	<36	<9.0	<270	<36	<9.0
8310	30	20	4/1/97	VPSS-133	<3.5	<8.8	<8.8	<35	<8.8	<260	<35	<8.8
8310	30	30	4/1/97	VPSS-134	<3.7	<9.2	<9.2	<37	<9.2	<270	<37	<9.2
8310	30	40	4/2/97	VPSS-135	<3.7	<9.1	<9.1	<37	<9.1	<270	<37	<9.1
8310	30	50	4/2/97	VPSS-136	<3.6	<9.0	<9.0	<36	<9.0	<270	<36	<9.0
8310	30	60	4/2/97	VPSS-137	<3.6	<8.8	<8.8	<36	<8.8	<260	<36	<8.8
8310	30	69.5	4/2/97	VPSS-138	<3.7	<9.2	<9.2	<37	<9.2	<270	<37	<9.2
8310	31	5	4/8/97	VPSS-139	<3.6	<9.0	<9.0	<36	<9.0	<270	<36	<9.0
8310	31	10	4/8/97	VPSS-140	<3.7	<9.1	<9.1	<37	<9.1	<270	<37	<9.1
8310	31	15	4/8/97	VPSS-141	<3.7	<9.2	<9.2	<37	<9.2	<270	<37	<9.2
8310	31	20	4/8/97	VPSS-142	<3.6	<8.9	<8.8	<36	<8.9	<260	<36	<8.9
8310	31	30	4/8/97	VPSS-143	<4.3	<10	<10	<43	<10	<320	<43	<10
8310	31	40	4/8/97	VPSS-144	<3.7	<9.1	<9.1	<37	<9.1	<270	<37	<9.1
8310	31	50	4/8/97	VPSS-145	<3.7	<9.2	<9.2	<37	<9.2	<270	<37	<9.2
8310	31	59.5	4/8/97	VPSS-146	<3.8	<9.3	<9.3	<38	<9.3	<280	<38	<9.3
8310	31	70	4/9/97	VPSS-147	<3.7	<9.1	<9.1	<37	<9.1	<270	<37	<9.1
8310	TP-1	5-5.5	4/14/97	VPSS-160	<3.5	<8.6	<8.6	<35	<8.6	<260	<35	<8.6
8310	TP-1	2.4	4/14/97	VPSS-161	<3.6	<8.9	<8.9	<36	<8.9	<260	<36	<8.9
8310	TP-2	1-1.3	4/14/97	VPSS-162	<3.7	<9.2	<9.2	<37	67	<270	<37	<9.3
8310	TP-2	5-5.5	4/14/97	VPSS-163	<3.6	<8.9	<8.9	<36	<8.9	<260	<36	<8.9
8310	TP-3	2.2-2.7	4/14/97	VPSS-164	<3.8	<9.4	<9.4	<38	<9.4	<280	<38	<9.4
8310	TP-3	4.5-5.5	4/14/97	VPSS-165	<3.5	<8.7	<8.7	<35	<8.7	<260	<35	<8.7
8310	TP-1A	2-2.5	6/10/99	VPSS-166	<21	<42	<21	<42	<21	<210	<17	<42
8310	TP-1A	4.7-5.5	6/10/99	VPSS-167	<21	<42	<21	<42	<21	<210	<17	<42
8310	TP-2A	1-1.5	6/10/99	VPSS-168	18 J	<45	24	<45	<22	<220	12 J	<45
8310	TP-2A	5-5.5	6/10/99	VPSS-169	<21	<43	<21	<43	<21	<210	<17	<43
8310	TP-3A	1.5-2.5	6/10/99	VPSS-170	<21	<41	<21	<41	<21	<210	<17	<41
8310	TP-3A	5-5.5	6/10/99	VPSS-171	<21	<43	<21	<43	<21	<210	<17	<43

Notes:

bgs - Below ground surface.

DUP - Duplicate samples.

J - Estimated result; value is less than reporting limit.

NA - Not analyzed.

TP - Test pit.

APPENDIX F3

RESULTS OF VOLATILE ORGANIC COMPOUNDS ANALYSES FOR SOIL

RESULTS OF VOLATILE ORGANIC COMPOUNDS ANALYSES FOR SOIL

(Concentration in micrograms/kilogram)

Test Pit Number	Depth (feet)	Date	Sample Number	CHLORO-METHANE	BROMO-METHANE	VINYL CHLORIDE	CHLORO-ETHANE	METHYLENE CHLORIDE	ACETONE	CARBON DISULFIDE	1,1-DICHLORO-ETHENE	1,1-DICHLORO-ETHANE	CIS-1,2-DI-CHLORO-ETHENE
TP-1	5-5.5	4/14/97	VPSS-160	<10	<10	<10	<10	3 J,B	<21	<5	<5	<5	<5
TP-1	2.4	4/14/97	VPSS-161	<10	<10	<10	<10	5 J,B	<21	<5	<5	<5	<5
TP-2	1-1.3	4/14/97	VPSS-162	<11	<11	<11	<11	5 J,B	<22	<6	<6	<6	<6
TP-2	5-5.5	4/14/97	VPSS-163	<10	<10	<10	<10	3 J	<21	<5	<5	<5	<5
TP-3	2.2-2.7	4/14/97	VPSS-164	<11	<11	<11	<11	3 J,B	<22	<6	<6	<6	<6
TP-3	4.5-5.5	4/14/97	VPSS-165	<10	<10	<10	<10	4 J,B	<21	<5	<5	<5	<5
TP-1A	2-2.5	6/10/99	VPSS-166	<5.3	<5.3	<5.3	<5.3	<5.3	<11	<5.3	<5.3	<5.3	<5.3
TP-1A	4.7-5.5	6/10/99	VPSS-167	<5.3	<5.3	<5.3	<5.3	<5.3	6.3 J	<5.3	<5.3	<5.3	<5.3
TP-2A	1-1.5	6/10/99	VPSS-168	<5.6	<5.6	<5.6	<5.6	<5.6	<11	<5.6	<5.6	<5.6	<5.6
TP-2A	5-5.5	6/10/99	VPSS-169	<5.3	<5.3	<5.3	<5.3	<5.3	<11	<5.3	<5.3	<5.3	<5.3
TP-3A	1.5-2.5	6/10/99	VPSS-170	<5.2	<5.2	<5.2	<5.2	<5.2	5.4 J,B	<5.2	<5.2	<5.2	<5.2
TP-3A	5-5.5	6/10/99	VPSS-171	<5.3	<5.3	<5.3	<5.3	<5.3	<11	<5.3	<5.3	<5.3	<5.3

Test Pit Number	Depth (feet)	Date	Sample Number	1,1,2-TRI-CHLORO-ETHANE	BENZENE	TRANS-1,3-DICHLORO-PROPENE	BROMOFORM	4-METHYL-2-PENTANONE	2-HEXANONE	TETRA-CHLORO-ETHENE	1,1,2,2-TETRA-CHLORO-ETHANE	TOLUENE	CHLORO-BENZENE
TP-1	5-5.5	4/14/97	VPSS-160	<5	<5	<5	<5	<10	<10	<5	<5	<5	<5
TP-1	2.4	4/14/97	VPSS-161	<5	<5	<5	<5	<10	<10	<5	<5	<5	<5
TP-2	1-1.3	4/14/97	VPSS-162	<6	<6	<6	<6	<11	<11	<6	<6	<6	<6
TP-2	5-5.5	4/14/97	VPSS-163	<5	<5	<5	<5	<10	<10	<5	<5	<5	<5
TP-3	2.2-2.7	4/14/97	VPSS-164	<6	<6	<6	<6	<11	<11	<6	<6	<6	<6
TP-3	4.5-5.5	4/14/97	VPSS-165	<5	<5	<5	<5	<10	<10	<5	<5	<5	<5
TP-1A	2-2.5	6/10/99	VPSS-166	<5.3	<5.3	<5.3	<5.3	<11	<11	<5.3	<5.3	<5.3	<5.3
TP-1A	4.7-5.5	6/10/99	VPSS-167	<5.3	<5.3	<5.3	<5.3	<11	<11	<5.3	<5.3	<5.3	<5.3
TP-2A	1-1.5	6/10/99	VPSS-168	<5.6	<5.6	<5.6	<5.6	<11	<11	<5.6	<5.6	<5.6	<5.6
TP-2A	5-5.5	6/10/99	VPSS-169	<5.3	<5.3	<5.3	<5.3	<11	<11	<5.3	<5.3	<5.3	<5.3
TP-3A	1.5-2.5	6/10/99	VPSS-170	<5.2	<5.2	<5.2	<5.2	<10	<10	<5.2	<5.2	<5.2	<5.2
TP-3A	5-5.5	6/10/99	VPSS-171	<5.3	<5.3	<5.3	<5.3	<11	<11	<5.3	<5.3	<5.3	<5.3

Notes:

B - Compound detected in method blank.

J - Estimated result; value is less than reporting limit.

TP - Test pit.

RESULTS OF VOLATILE ORGANIC COMPOUNDS ANALYSES FOR SOIL

(Concentration in micrograms/kilogram)

Test Pit Number	Depth (feet)	Date	Sample Number	CHLOROFORM	1,2-DICHLORO-ETHENE	2-BUTANONE	1,1,1-TRI-CHLORO-ETHANE	CARBON-TETRA-CHLORIDE	BROMO-DICHLORO-METHANE	1,2-DI-CHLORO-PROPANE	CIS-1,3-DI CHLORO-PROPENE	TRICHLORO-ETHENE	DIBROMO-CHLORO-METHANE
TP-1	5-5.5	4/14/97	VPSS-160	<5	<5	<21	<5	<5	<5	<5	<5	<5	<5
TP-1	2.4	4/14/97	VPSS-161	<5	<5	<21	<5	<5	<5	<5	<5	<5	<5
TP-2	1-1.3	4/14/97	VPSS-162	<6	<6	<22	<6	<6	<6	<6	<6	<6	<6
TP-2	5-5.5	4/14/97	VPSS-163	<5	<5	<21	<5	<5	<5	<5	<5	<5	<5
TP-3	2.2-2.7	4/14/97	VPSS-164	<6	<6	<22	<6	<6	<6	<6	<6	<6	<6
TP-3	4.5-5.5	4/14/97	VPSS-165	<5	<5	<21	<5	<5	<5	<5	<5	<5	<5
TP-1A	2-2.5	6/10/99	VPSS-166	4.5 J	<5.3	<11	<5.3	<5.3	2.9 J	<5.3	<5.3	<5.3	<5.3
TP-1A	4.7-5.5	6/10/99	VPSS-167	4.5 J	<5.3	<11	<5.3	<5.3	2.8 J	<5.3	<5.3	<5.3	<5.3
TP-2A	1-1.5	6/10/99	VPSS-168	5.2 J	<5.6	<11	<5.6	<5.6	3.2 J	<5.6	<5.6	<5.6	<5.6
TP-2A	5-5.5	6/10/99	VPSS-169	<5.3	<5.3	<11	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3
TP-3A	1.5-2.5	6/10/99	VPSS-170	<5.2	<5.2	<10	<5.2	<5.2	<5.2	<5.2	<5.2	<5.2	<5.2
TP-3A	5-5.5	6/10/99	VPSS-171	<5.3	<5.3	<11	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3

Test Pit Number	Depth (feet)	Date	Sample Number	ETHYL-BENZENE	STYRENE	XYLENE (TOTAL)	VINYL ACETATE	FREON 11	FREON 113	TRANS-1,2-DICHLORO-ETHENE	1,2-DI-CHLORO-BENZENE	1,3-DI-CHLORO BENZENE	1,4-DI-CHLORO-BENZENE
TP-1	5-5.5	4/14/97	VPSS-160	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
TP-1	2.4	4/14/97	VPSS-161	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
TP-2	1-1.3	4/14/97	VPSS-162	<6	<6	<6	<6	<6	<6	<6	<6	<6	<6
TP-2	5-5.5	4/14/97	VPSS-163	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
TP-3	2.2-2.7	4/14/97	VPSS-164	<6	<6	<6	<6	<6	<6	<6	<6	<6	<6
TP-3	4.5-5.5	4/14/97	VPSS-165	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
TP-1A	2-2.5	6/10/99	VPSS-166	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3
TP-1A	4.7-5.5	6/10/99	VPSS-167	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3
TP-2A	1-1.5	6/10/99	VPSS-168	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6
TP-2A	5-5.5	6/10/99	VPSS-169	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3
TP-3A	1.5-2.5	6/10/99	VPSS-170	<5.2	<5.2	<5.2	<5.2	<5.2	<5.2	<5.2	<5.2	<5.2	<5.2
TP-3A	5-5.5	6/10/99	VPSS-171	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3

Notes:

B - Compound detected in method blank.

J - Estimated result; value is less than reporting

TP - Test pit.

APPENDIX G

SOIL VAPOR DATA EVALUATION REPORTS

SOIL VAPOR DATA EVALUATION REPORT
EVENT 1

I. INTRODUCTION

Summarized in this report is Foster Wheeler Environmental's review of the laboratory data package generated from gas-chromatographic analyses of the initial round of soil vapor samples collected January 14 through 18, 1994, from the JPL site, Pasadena, California. On-site analysis for volatile organic compounds (VOCs) was performed by Transglobal Environmental Geochemistry (TEG) in their DOHS-certified mobile laboratory by Mr. Scott Pieper (field chemist) with internal data review conducted by Dr. Blayne Hartman, both of TEG. The data package reported from the on-site analyses was carefully reviewed by Foster Wheeler Environmental's Principal Scientist/Project Chemist who prepared this summary report.

During early January of 1994, 48 vapor probe samples were extracted from the Operable Unit 2 (OU-2) soil investigation area (Event 1). One sample (SV-51) could not be collected due to failure (refusal) of the field sampling apparatus at the SV-51 location. In addition to these 48 primary depth-specific environmental vapor samples, nine collocated field duplicates, were successfully collected. These samples, along with five ambient-air system blanks collected within the on-site laboratory, were analyzed immediately for a predetermined list of target VOCs. The time between sample collection and analysis was only a few minutes. Five VOC compounds were found at a detectable level (greater than 1 μg/L-vapor) in one or more of the soil vapor samples. Those organic compounds positively detected at least once are:

- Trichloromethane ($CHCl_3$)
- Carbon tetrachloride (CCl_4)
- 1,1,1-Trichloroethane (TCA)
- Trichloroethylene (TCE)
- Tetrachloroethylene (PCE)

Laboratory results for all samples analyzed during Event 1 are included in Appendix B. Attached to this report is a summary of those results with the corresponding soil vapor well numbers and depths from which each identified vapor sample was collected during this sampling event. This table should provide the reader with sufficient information to determine where each sample was obtained and also to identify the collocated field duplicate samples (DUP).

II. GUIDELINES USED FOR THIS REVIEW

Soil vapor data review was performed to assess and evaluate adherence to the QA/QC and Reporting Requirements for Soil Gas Investigation, guidance published by the California Regional Water Quality Control Board - Los Angeles Region (RWQCB) for analyzing soil gas, and general quality control requirements and good laboratory practices contained in the current

reference methods (8000B & 8021) published in Test Methods for Evaluating Solid Wastes - Physical/Chemical Methods, SW-846, Office of Solid Waste and Emergency Response, USEPA, Washington, DC, 3rd Edition, September 1986 (including Update IIB, January 1995). It should also be noted that, from a contractual standpoint, TEG followed analytical protocols from the RWQCB preferentially over SW-846.

During this data review, there were some key areas that could not be evaluated because no information was supplied, and there are some constraints imposed by the nature of any vapor matrix that limit the types of control samples that can be run (e.g., matrix spikes). These areas, and their potential impact on data reliability, are discussed later in the report. In general, the data tables summarizing the laboratory's external calibration sample results contained a sufficient amount of data quality information to perform this review. Data packages also contained copies of individual chromatograms, which were scrutinized.

III. CHROMATOGRAPHIC PERFORMANCE

Lab analyses were performed using an external standard calibration method. During each analytical day, the environmental sample analyses were bracketed by check standards, which verified acceptable system performance for all target analytes detected in the soil vapor samples. Analytical system performance was checked at the beginning and end of each analytical day using a QC check standard of mid-range concentration (20 ηg; equivalent to a 20 μg/L soil vapor concentration). During Event 1, the laboratory was not required to analyze a "continuing standard" after the first 10 environmental samples, nor was the addition of surrogate compounds required at that time. Requirements for adding, analyzing and reporting surrogate recoveries were not incorporated into the RWQCB guidelines until March, 1994.

Data generated from initial calibration of the GC instrument was included in the data package, and served as the baseline against which data from daily QC check standards were compared in order to assure that the analytical systems remained within control limits. Analyte-specific response factors (RF) calculated from the pair of daily QC check standards were within ±15 percent of the corresponding mean calibration factors reported from initial calibration results. The QC report from TEG indicated that all concentrations of target analytes calculated for the daily QC check/calibration verification standards were within ±20 percent of their theoretical true concentration. After the first two days, most differences were below 10 percent.

A blank sample of laboratory air was analyzed before running any of the soil vapor samples collected that day. These blanks were clean in all cases. Indeed, most (60 percent) of all vapor samples analyzed showed no detectable contamination. This indicates that a contaminant-free analytical system was maintained in the field during sampling and in the laboratory during analysis. No results from matrix spikes, or laboratory replicates were included in the data package, and none was required under RWQCB guidelines.

In qualitative chromatographic terms such as peak shape, compound separation, stability of instrumental response, baseline appearance, drift and sensitivity, the quality of the chromatograms in the Event 1 data package compared favorably with the general criteria for single laboratory performance as published in the referenced methods.

IV. REQUIRED INSTRUMENT QC

Based on general evaluation criteria for GC analysis with non-MS detectors, RWQCB program guidance, and the method-specific guidance requirements in SW-846 - Method 8021, TEG's data packages were evaluated as follows:

- *Linearity of initial calibration curve*: Acceptable. Instrument response was demonstrated to be linear (r^2 greater than 0.990) for all target analytes.
- *Retention time (RT) windows*: Appeared stable and consistent. No data to check how absolute RT windows were established. NOTE: The RWQCB soil vapor guidelines do not require determination of RT windows. Therefore, setting of RT windows was performed according to the professional judgement of the analyst.
- *Establishment and verification of response factors (RF)*: Average RF values were correctly calculated. Verification checks indicated a stable analytical system with no more than 15 percent drift.

V. INITIAL DEMONSTRATION OF PROFICIENCY

It is assumed that, prior to performing environmental sample analysis, the TEG on-site lab, employing the current staff and instrumentation, successfully demonstrated proficiency by generating data of acceptable accuracy and precision using appropriate reference samples that contained the analytes of interest in a clean vapor-phase matrix. However, no data were presented to confirm that this requirement was completed. The lab should keep a current on-site file with copies of all proficiency data including data from analyzing external QC samples as part of any interlaboratory performance evaluation program. These records should be available for review at anytime during the course of the soil vapor investigation.

VI. LABORATORY CONTROL SAMPLES

Data on nine pairs of field duplicates were generated, and although the variability introduced in the process of sample extraction and collection is typically an order of magnitude greater than analytical and reporting variability within the laboratory, some general conclusions about the variability of the data set as a whole can be drawn. For that purpose, the mean relative percent difference (RPD) between individual field duplicate data pairs with detectable carbon tetrachloride, along with other statistical parameters, are shown in the table below. Only three of the nine sample pairs contained detectable carbon tetrachloride. The six remaining duplicate sample pairs contained no target analytes, a zero percent RPD.

	STATISTICAL PARAMETERS - Field Duplicates			
	average RPD	standard deviation σ	Variance σ^2	relative error $\sigma \div RPD$
Event 1: CCl_4	16.6 %	4.9×10^{-2}	2.4×10^{-3}	0.30

With only three sets of positive field duplicate results for carbon tetrachloride, the statistical data summarized in the above table demonstrate surprisingly good agreement between duplicate pairs. In every case, if any target contaminant was detected in a duplicated vapor sample, the same contaminants were also found in the corresponding field duplicate. This suggests that a reproducible field sampling procedure is being properly and consistently implemented.

The mixed-gas matrix collected from vapor monitoring wells was assumed to not significantly affect method performance in terms of detection limits, precision and accuracy (bias). No matrix spike data were reported to verify this assumption and no lab replicates were run for internal lab precision assessment. Although these types of control samples are not required by RWQCB guidelines, the lack of this type of control data means that the variability and bias of the results attributably solely to the analytical and reporting systems at the laboratory (handling and storage were negligible) cannot be quantified separately from the overall variability and bias which includes the sample collection activity.

VII. SURROGATE RECOVERIES

Prior to March, 1994, surrogates were not required.

VIII. PERFORMANCE CRITERIA

The detection limit was reported at 1 μg/L-vapor for all target compounds. Statistical data to support and confirm this limit were not provided (nor required), but an examination of the baseline noise and instrument sensitivity shown in the chromatograms provided in this data package indicates that setting the reporting limit at 1 ηg on-column (equivalent to 1 μg/L-vapor) was justified.

IX. SUMMARY OF FINDINGS & RECOMMENDATIONS

A. The following general comments are offered relative to these data packages:

1. The terminology used by the laboratory when referring to working standards and data calculation factors should be consistent. It is recommended that the terminology conventions contained in SW-846 Method 8000B - "Determinative Chromatographic Separations," be used. The appropriate units of measurement should be recorded next to all data or included as a footnote.

2. The TEG on-site gas chromatographs underwent an initial 3-point calibration. Although the published SW-846 method calls for a minimum of five calibration points, the RWQCB protocols allow for this modification to the standard method.

B. Based on a thorough review of the information contained in the January 19, 1994, Event 1 soil vapor data package, no added qualifications to TEG's final results are warranted.

SUMMARY

SOIL-VAPOR RESULTS – EVENT 1

(Concentrations in µg/L–vapor)

Soil Vapor Probe Number	Depth (ft bgs)	Date	Sample Number	1,1-DCE	CCl_4	TCE	Freon 113	Other Analytes Detected
Event 1								
SV-1	20	1/14/94	SV-1	ND	ND	ND	ND	
SV-2	20	1/14/94	SV-2	ND	ND	ND	ND	
SV-3	20	1/14/94	SV-3	ND	ND	ND	ND	
SV-4	20	1/14/94	SV-4	ND	ND	ND	ND	3.3 1,1,1-Trichloroethane
SV-5	22	1/14/94	SV-5	ND	ND	ND	ND	
SV-5	22	1/14/94	SV-6(DUP)	ND	ND	ND	ND	
SV-7	12	1/15/94	SV-7	ND	ND	ND	ND	
SV-8	12	1/15/94	SV-8	ND	ND	ND	ND	
SV-9	19	1/15/94	SV-9	ND	ND	ND	ND	1.9 Chloroform
SV-10	20	1/15/94	SV-10	ND	ND	ND	ND	
SV-11	20	1/15/94	SV-11	ND	ND	ND	ND	
SV-12	20	1/15/94	SV-12(DUP)	ND	ND	ND	ND	
SV-13	20	1/15/94	SV-13	ND	5	ND	ND	
SV-14	20	1/15/94	SV-14	ND	1.4	ND	ND	
SV-15	20	1/15/94	SV-15	ND	15.4	5.2	ND	1.0 Tetrachloroethene
SV-16	20	1/15/94	SV-16	ND	15.1	3	ND	
SV-17	11	1/15/94	SV-17	ND	9.5	51.9	ND	
SV-17	11	1/15/94	SV-18(DUP)	ND	11.5	53.3	ND	
SV-19	19	1/15/94	SV-19	ND	5.6	ND	ND	
SV-20	19	1/15/94	SV-20	ND	3.6	ND	ND	
SV-21	10	1/16/94	SV-21	ND	ND	ND	ND	
SV-22	20	1/16/94	SV-22	ND	ND	ND	ND	
SV-23	20	1/16/94	SV-23	ND	ND	ND	ND	
SV-23	20	1/16/94	SV-24(DUP)	ND	ND	ND	ND	
SV-25	20	1/16/94	SV-25	ND	ND	ND	ND	
SV-26	14	1/16/94	SV-26	ND	ND	ND	ND	

SUMMARY

SOIL-VAPOR RESULTS – EVENT 1

(Concentrations in µg/L–vapor)

Soil Vapor Probe Number	Depth (ft bgs)	Date	Sample Number	1,1-DCE	CCl_4	TCE	Freon 113	Other Analytes Detected
SV-27	16	1/16/94	SV-27	ND	ND	ND	ND	
SV-28	9	1/16/94	SV-28	ND	ND	ND	ND	
SV-29	13	1/16/94	SV-29	ND	ND	ND	ND	
SV-29	13	1/16/94	SV-30(DUP)	ND	ND	ND	ND	
SV-31	13	1/16/94	SV-31	ND	89.1	ND	ND	7.7 Chloroform
SV-32	16	1/16/94	SV-32	ND	51.6	ND	ND	10.8 Chloroform
SV-33	11	1/16/94	SV-33	ND	86.5	ND	ND	10.4 Chloroform
SV-34	8	1/16/94	SV-34	ND	ND	ND	ND	
SV-35	13	1/16/94	SV-35	ND	19.6	ND	ND	1.7 Chloroform
SV-35	13	1/16/94	SV-36(DUP)	ND	23.9	ND	ND	2.2 Chloroform
SV-37	18	1/17/94	SV-37	ND	ND	ND	ND	
SV-38	12	1/17/94	SV-38	ND	ND	ND	ND	
SV-39	19	1/17/94	SV-39	ND	ND	ND	ND	
SV-40	19	1/17/94	SV-40	ND	ND	ND	ND	
SV-41	15	1/17/94	SV-41	ND	ND	ND	ND	
SV-41	15	1/17/94	SV-42(DUP)	ND	ND	ND	ND	
SV-43	17	1/17/94	SV-43	ND	ND	ND	ND	
SV-44	11	1/17/94	SV-44	ND	ND	ND	ND	
SV-45	10	1/17/94	SV-45	ND	ND	ND	ND	
SV-46	12	1/17/94	SV-46	ND	ND	ND	ND	
SV-47	20	1/17/94	SV-47	ND	ND	ND	ND	
SV-47	20	1/17/94	SV-48(DUP)	ND	ND	ND	ND	
SV-49	20	1/18/94	SV-49	ND	ND	ND	ND	
SV-50	20	1/18/94	SV-50	ND	ND	ND	ND	
SV-52	15	1/18/94	SV-52	ND	ND	1.2	ND	
SV-53	11	1/18/94	SV-53	ND	ND	1.3	ND	
SV-54	8	1/18/94	SV-54	ND	ND	ND	ND	

SUMMARY

SOIL-VAPOR RESULTS – EVENT 1

(Concentrations in µg/L–vapor)

Soil Vapor Probe Number	Depth (ft bgs)	Date	Sample Number	1,1-DCE	CCl_4	TCE	Freon 113	Other Analytes Detected
SV-55	6	1/18/94	SV-55	ND	2.6	ND	ND	
SV-55	6	1/18/94	SV-56(DUP)	ND	2.9	ND	ND	
SV-57	17	1/18/94	SV-57	ND	ND	ND	ND	
SV-58	6	1/18/94	SV-58	ND	ND	ND	ND	

Notes:

bgs - Below ground surface.

DUP - Duplicate samples.

ND - Not detected.

SV-51 probe hit repeated refusals at depth of less than 1 foot and was not sampled.

SOIL VAPOR DATA EVALUATION REPORT
EVENTS 2 AND 3

I. INTRODUCTION

Summarized in this report is Foster Wheeler Environmental's review of the laboratory data package generated from gas-chromatographic analyses of the second and third rounds of soil vapor samples from the JPL site, Pasadena, California. Samples for Event 2 were collected and analyzed during December 1994. Event 3 samples were collected and analyzed in early March 1995. On-site analysis for volatile organic compounds (VOCs) was performed by Transglobal Environmental Geochemistry (TEG) in their DOHS-certified mobile laboratory by Mr. Paul Mosher (field chemist) with internal data review conducted by Dr. Blayne Hartman, both of TEG. Data packages generated from the on-site analyses were carefully reviewed by Foster Wheeler Environmental's Principal Scientist/Project Chemist who prepared this summary report.

During late December of 1994, Event 2 soil vapor sampling resulted in the successful collection of 111 vapor samples extracted from the Operable Unit 2 (OU-2) soil investigation area. During Event 2, a total of 93 primary depth-specific environmental vapor samples and 18 collocated field duplicates were successfully collected from 25 discreet soil vapor well locations. These samples, along with seven ambient-air system blanks collected within the on-site laboratory, were analyzed immediately for a predetermined list of target VOCs. Since performing the Event 1 initial round of soil vapor sampling, the list of target VOCs was expanded to include 19 compounds (counting ortho-, meta-, and para-xylene as one compound). However, only 14 of those target analytes were actually found at a detectable level (greater than 1 μg/L-vapor) in one or more of the soil vapor samples.

For Event 2 samples, those organic compounds positively detected at least once are:

- Chloroform
- Carbon tetrachloride
- 1,1,1-Trichloroethane
- Trichloroethylene
- Tetrachloroethylene
- Freon 113
- Benzene
- 1,1-Dichloroethane
- 1,1-Dichloroethylene
- 1,2-Dichloroethane
- cis-1,2-Dichloroethylene
- Toluene
- Ethylbenzene
- Xylenes

During early March 1995, Event 3 sampling was performed during which 92 soil vapor samples were successfully collected from the OU-2 soil investigation area. For Event 3, a total of 77 primary depth-specific environmental vapor samples and 15 collocated field duplicates were successfully collected from the same 25 discreet soil vapor well locations sampled during Event 2. The Event 3 samples, along with eight ambient-air system blanks collected within the on-site laboratory, were analyzed immediately for a predetermined list of target VOCs that

included 19 compounds. However, only 14 target analytes were actually found at a detectable level (greater than 1 μg/L-vapor) in one or more of the soil vapor samples.

For the Event 3 sample set, those target analytes positively detected at least once are:

- Chloroform
- Carbon tetrachloride
- 1,1,1-Trichloroethane
- Trichloroethene
- Tetrachloroethene
- Freon 113
- Benzene
- 1,1-Dichloroethane
- 1,1-Dichloroethene
- 1,2-Dichloroethane
- Dichloromethane
- Toluene
- Ethylbenzene
- Xylenes

Laboratory results for all samples analyzed during Events 2 and 3 are included in Appendices C1 and C2, respectively. Attached to this report is a summary of those results with the corresponding soil vapor well numbers and depths from which each identified vapor sample was collected. These tables should provide the reader with sufficient information to determine exactly where each sample was obtained and also to identify the collocated field duplicate samples (DUP).

II. GUIDELINES USED FOR THIS REVIEW

Soil vapor data review was performed to assess and evaluate adherence to the QA/QC and Reporting Requirements for Soil Gas Investigation, guidance published by the California Regional Water Quality Control Board - Los Angeles Region (RWQCB) for analyzing soil gas, and general quality control requirements and good laboratory practices contained in the current reference methods (8000B and 8021) published in Test Methods for Evaluating Solid Wastes - Physical/Chemical Methods, SW-846, Office of Solid Waste and Emergency Response, USEPA, Washington, DC, 3rd Edition, September 1986 (including Update IIB, January 1995). It should also be noted that, from a contractual standpoint, TEG preferentially followed the RWQCB guidelines over SW-846 analytical protocols.

The evaluation of TEG's results was performed by reviewing blanks, calibrations, and duplicate results reported with each delivery group of samples collected that day. During this data review, there were some key areas that could not be evaluated because no information was supplied, and there are some constraints imposed by the nature of any vapor matrix that limit the types of control samples that can be run (e.g., matrix spikes). These areas, and their potential impact on data reliability, are discussed later in the report. In general, the data tables summarizing the laboratory's external calibration sample results contained sufficient data quality information, including copies of individual chromatograms which were also reviewed. Chromatograms and quantitation reports were reviewed to verify the identification and quantitation processes used to generate and report concentrations of target analytes detected in the vapor samples.

III. CHROMATOGRAPHIC PERFORMANCE

On-site analyses were performed using an external standard calibration regimen. During each analytical day, the environmental sample analyses were bracketed by check standards in order to verify acceptable system performance for all target analytes detected in the soil vapor samples. All samples were quantified using a gas chromatograph outfitted with tandem photo-ionization (PID) and electrolytic conductivity (Hall) detectors. Analytical system performance was checked at the beginning of each analytical day by running a blank and an "AM QC Check Standard." At the end of the day, a "PM QC Check Standard" was analyzed. Each day during Events 2 and 3, the laboratory also analyzed a "Continuing Calibration Standard" to determine if instrumental drift was creating unacceptable (±20 percent) bias. Freon 113 and xylene QC check standards were prepared at a mid-range concentration of 20 ηg/μL (equivalent to a 20 μg/L soil vapor concentration). Calibration verification for the rest of the target analytes was performed at 10 ηg/μL (equivalent to a 10 μg/L soil vapor concentration). For most target analytes, the working calibration range of the on-site gas chromatograph was 1 to 38 μg/L-vapor (during Event 2) or 1 to 75 μg/L-vapor (during Event 3). A smaller aliquot of samples with analyte concentrations exceeding 1.5 times the highest calibration standard should have been reanalyzed so as to fall within this range.

The QC report from TEG indicated that most analyte-specific response factors (calculated as the ratio of the area counts from the daily QC check/calibration verification standards to the corresponding theoretical true concentration values for each target analyte in the standard mix) were within ±20 percent of the average RFs obtained from the original calibration curve used to generate final results. Discrepancies that require data qualification are discussed in Section VIII.

IV. REQUIRED INSTRUMENT QC

Based on general evaluation criteria for GC analysis with non-MS detectors, RWQCB program guidance, and the method-specific guidance requirements in SW-846 - Method 8021, TEG's data packages were evaluated as follows:

- *Linearity of initial calibration curve*: Initial 3-point calibration data were provided. Good linearity was clearly demonstrated with correlation coefficients greater than 0.990 as required by SW-846. Except for Freon and xylene, the linear working range of the instrument during Event 2 was 1 to 38 ηg on-column (2 to 75 ηg for Freon and xylene). During Event 3, the working range was expanded to 1 to 60 ηg on-column (2 to 120 ηg for Freon and xylene).
- *Retention time (RT) windows*: Appeared stable and consistent. The RWQCB soil gas guidelines do not require determination of RT windows. Therefore, establishment and adjustment of RT windows was performed according to the professional judgement of the on-site analytical chemist.
- *Establishment and verification of response factors*: Average RF values were correctly calculated.

In qualitative chromatographic terms such as peak shape, compound separation, stability of instrumental response, baseline appearance, drift and sensitivity, the quality of the chromatograms produced during Events 2 and 3 compared favorably with the general criteria for single laboratory performance as published in the referenced methods.

V. LABORATORY CONTROL SAMPLE RESULTS

A blank sample of laboratory air was analyzed before running any of the soil vapor samples collected that day. In all cases, these blanks were clean, indicating that a contaminant-free analytical system was established at the start of each daily analytical run.

Along with the analytical results, data on 33 pairs of field duplicates were reported by TEG. Freon 113 and carbon tetrachloride (CCl_4) were chosen as indicator compounds in assessing the precision of the data set. For that purpose, a data subset was complied from the relative percent differences (RPDs) between individual field duplicate data pairs with detectable carbon tetrachloride or Freon 113. Average RPDs, along with other statistical parameters, are shown in the table below. Of 33 duplicates, 10 contained neither carbon tetrachloride nor Freon 113, a perfect zero percent RPD. Data comparing detectable concentrations of carbon tetrachloride and Freon 113 between the other 23 field duplicate pairs were reviewed from which some general conclusions about the variability of the data set are drawn.

	STATISTICAL PARAMETERS - Field Duplicates			
	average RPD	standard deviation σ	Variance σ^2	relative error $\sigma \div$RPD
Event 2: CCl_4	32%	1.7×10^{-1}	2.8×10^{-2}	0.52
Event 3: CCl_4	29%	2.2×10^{-1}	4.9×10^{-2}	0.75
Event 2: FR113	30%	1.6×10^{-1}	2.7×10^{-2}	0.55
Event 3: FR113	20%	8.4×10^{-2}	7.1×10^{-3}	0.41

For demonstrating good agreement between field duplicate samples, it was generally expected that average RPDs would fall below 20 percent. Because they include variability introduced in the process of sample extraction and field collection, which is typically an order of magnitude greater than analytical and reporting variability within the laboratory, there are no hard and fast pass/fail criteria (as, for example, there are for MS/MSD pairs which do not include field sampling variability) and, therefore, no data were qualified based on these total variability parameters. As the work continues, both the field sampling team and the on-site laboratory staff will gain experience in performing their respective tasks. As a result, overall variability should decrease. These parameters will continue to be calculated and assessed as the data from successive sampling events are reported. At this time, it is recommended that current field sampling and analytical procedures be closely reviewed and standardized to the extent practicable in order to optimize overall precision.

The mixed-gas matrix collected from vapor monitoring wells was assumed to not significantly affect method performance in terms of detection limits, precision and accuracy (bias). No matrix spike data were reported to verify this assumption and no lab replicates were run for internal lab precision assessment. Although these types of control samples are not required under RWQCB guidelines, the lack of this type of control data means that the variability and bias of the results attributably solely to the analytical and reporting systems at the laboratory (handling and storage were negligible) could not be partitioned from the overall variability which includes field sampling variability.

VI. SURROGATE RECOVERIES

During Events 2 and 3, a chlorobenzene surrogate was spiked into standards and samples. Thepurpose for adding the surrogate was to monitor RT shifts between GC runs. No data were reported for evaluating the recovery of surrogate compounds. During future events, it is recommended that at least three appropriate compounds be analyzed as surrogates in accordance with recent changes in RWQCB guidance. Future data reports should include surrogate recovery data so that a quantitative evaluation can be made. Acceptable recoveries will fall within the range of 75 to 125 percent recovery. In addition, the laboratory should consider establishing their own specific in-house surrogate recovery limits and monitor trends. Upper and lower warning and control limit calculations are valuable indicators of system performance and are often the first sign of degrading analytical trends.

VII. PERFORMANCE CRITERIA

The detection limit was reported at 1 μg/L-vapor for all target compounds. Statistical data to support and confirm this limit were not provided, nor were such data required by the RWQCB. An examination of the baseline noise and instrument sensitivity shown in the chromatograms provided in this data package indicates that setting the reporting limit at 1 ηg on-column (equivalent to 1 μg/L-vapor) was justified.

VIII. SUMMARY OF FINDINGS & RECOMMENDATIONS

A. The following <u>general comments</u> are offered relative to these data packages:

1. The terminology used by the laboratory when referring to working standards and data calculation factors should be consistent. It is recommended that the terminology conventions contained in SW-846 Method 8000B ("Determinative Chromatographic Separations") be used. To avoid confusion, the laboratory should include all appropriate units of measure (e.g., volume injected, mass, RT, etc.) in the data tables, or present them as a footnote. Also, the time of sample collection should be included at the top of the data summary tables next to the analysis time.

2. The lab should consider establishing their own specific control limits for surrogate recoveries. Until lab-specific recovery limits are established, the 75 to 125 percent range called for in the RWQCB soil gas guidelines will apply. Although the principal purpose of adding surrogates to soil vapor samples is to monitor RT shifts between GC runs for better compound identification, these data could also be used for monitoring trends in accuracy and precision as the analytical work progresses from event to event.

B. Based on this review, the following data qualifications should be made when reporting these results:

1. If an analyte-specific response factor derived from any QC check standard (a.m./p.m., continuing calibration or LCS) was not within ±20 percent of the average RF used to calculate final results for that analyte (±30 percent for the Freons, chloroethane and vinyl chloride), the associated soil vapor data were subject to qualification as follows:

   - If the trend was toward decreasing sensitivity (check standard RF less than the average RF from the initial calibration curve), then detects and non-detects were qualified J, as estimated positive values or detection limits.
   - If the trend was toward increasing sensitivity (check standard RF greater than the average RF from initial calibration), then only positive results were qualified J, as estimated. In this case, non-detects were not qualified.

Based on this first set of criteria, the following 47 results should be qualified J to indicated estimated values:

Dichloromethane	VPSV-62,VPSV-63, VPSV-64, VPSV-65, VPSV-66, VPSV-67, VPSV-68, VPSV-69, VPSV-70, VPSV-71, VPSV-72, VPSV-73, VPSV-74, VPSV-75, VPSV-76, VPSV-77, VPSV-78, VPSV-79, VPSV-80, VPSV-81, VPSV-82, VPSV-83, VPSV-84, VPSV-85, VPSV-86, VPSV-88, VPSV-89, VPSV-90, VPSV-91, VPSV-92.
Xylenes	VPSV-28,VPSV-32, VPSV-33, VPSV-35, VPSV-37, VPSV-39, VPSV-41, VPSV-43, VPSV-45, VPSV-47, VPSV-49, VPSV-51, VPSV-52, VPSV-54, VPSV-56, VPSV-58, VPSV-60.

2. At the upper end of the initial/working calibration curve, any analyte whose concentration exceeded the highest calibration standard by more than 50 percent should have been reanalyzed using a smaller aliquot so that the raw instrumental result fell within the working calibration range. This was not done consistently during Event 2. The lab should not report extrapolated data results without qualification. Therefore, the following result should be qualified J to indicate an estimated value:

Trichloroethene	VPSV-8

3. There were a few instances in which one sample of a field duplicate pair had a small but detectable (greater than 1 μg/L-vapor) concentration of a target analyte, but that analyte was not detected in the other sample. In such cases, the positive result was qualified J as estimated. The following seven results received this qualification:

Trichloroethene	VPSV-17, VPSV-24, VPSV-71
Chloroform	VPSV-83, VPSV-165, VPSV-196
111-Trichloroethane	VPSV-201

SUMMARY

SOIL-VAPOR RESULTS– EVENTS 2 AND 3

(Concentrations in µg/L–vapor)

Soil Vapor Well Number	Depth (ft bgs)	Date	Sample Number	1,1-DCE	CCl_4	TCE	Freon 113	Other Analytes Detected
Event 2								
1	10	12/20/94	VPSV-1	ND	3.6	ND	ND	
1	21	12/20/94	VPSV-2	ND	3.3	ND	ND	
1	33	NS	NS	W	W	W	W	
2	10	12/20/94	VPSV-3	ND	ND	ND	ND	
2	22	12/20/94	VPSV-4	ND	ND	ND	ND	
2	37	12/20/94	VPSV-5	ND	ND	ND	ND	
2	37	12/20/94	VPSV-6(DUP)	ND	ND	ND	ND	
3	16	12/20/94	VPSV-7	ND	33	ND	ND	4.1 Chloroform
3	29	NS	NS	P	P	P	P	
3	40	NS	NS	W	W	W	W	
3	47	NS	NS	W	W	W	W	
4	11	12/20/94	VPSV-8	ND	3.7	52 J	ND	
4	20	12/20/94	VPSV-9	ND	4.9	36	ND	
4	35	12/20/94	VPSV-10	ND	6.1	33	ND	
4	56	NS	NS	W	W	W	W	
5	5	12/20/94	VPSV-11	ND	36	ND	ND	3.7 Chloroform
5	5	12/20/94	VPSV-12(DUP)	ND	31	ND	ND	2.8 Chloroform
5	9	12/20/94	VPSV-13	ND	27	2.6	ND	3.1 Chloroform
6	20	12/20/94	VPSV-22	ND	1.5	ND	1.6	
6	40	12/20/94	VPSV-23	ND	4.7	ND	6.1	
6	40	12/20/94	VPSV-24D	ND	3.2	1.4 J	3.5	
6	60	12/20/94	VPSV-25	ND	12	1.4	8.6	
6	77	12/20/94	VPSV-26	ND	11	ND	14	
6	96	12/20/94	VPSV-27	ND	14	ND	30	
7	20	12/20/94	VPSV-14	ND	ND	3.3	ND	
7	34	12/20/94	VPSV-15	ND	ND	1.6	ND	
8	20	12/20/94	VPSV-16	ND	ND	ND	ND	
8	30	12/20/94	VPSV-17	ND	ND	1.7 J	ND	
8	30	12/20/94	VPSV-18(DUP)	ND	ND	ND	ND	

SUMMARY

SOIL-VAPOR RESULTS– EVENTS 2 AND 3

(Concentrations in µg/L–vapor)

Soil Vapor Well Number	Depth (ft bgs)	Date	Sample Number	1,1-DCE	CCl_4	TCE	Freon 113	Other Analytes Detected
8	50	12/20/94	VPSV-19	1.8	13	ND	7.6	
8	70	12/20/94	VPSV-20	1.9	20	ND	4.7	
8	90	12/20/94	VPSV-21	2.6	23	ND	5.6	
9	20	12/21/94	VPSV-38	ND	ND	ND	5.1	
9	35	12/21/94	VPSV-39	ND	ND	ND	2.5	
9	50	12/21/94	VPSV-40	1.5	ND	ND	2.2	
9	70	12/21/94	VPSV-41	1.5	ND	ND	4.4	
9	70	12/21/94	VPSV-42(DUP)	1.8	ND	ND	3.1	
9	87	12/21/94	VPSV-43	3.4	ND	ND	5.8	
10	20	12/21/94	VPSV-28	ND	ND	1.3	1.5	
10	35	12/21/94	VPSV-29	ND	ND	ND	2.1	
10	35	12/21/94	VPSV-30(DUP)	ND	ND	ND	3.5	
10	50	12/21/94	VPSV-31	ND	ND	ND	3.9	
10	69	12/21/94	VPSV-32	ND	ND	ND	4.3	
11	20	12/21/94	VPSV-51	ND	ND	ND	2	
11	40	12/21/94	VPSV-52	ND	ND	ND	6	
11	60	12/21/94	VPSV-53	ND	ND	ND	5.9	
11	60	12/21/94	VPSV-54(DUP)	ND	ND	ND	7.4	
11	80	NS	NS	P	P	P	P	
11	96	12/21/94	VPSV-55	2.7	8.5	ND	29	
12	20	12/22/94	VPSV-65	ND	ND	ND	ND	
12	20	12/22/94	VPSV-66(DUP)	ND	ND	ND	ND	
12	40	12/22/94	VPSV-67	ND	ND	ND	ND	
12	60	12/22/94	VPSV-68	ND	ND	ND	ND	
12	76	12/22/94	VPSV-69	ND	ND	ND	ND	
13	10	12/21/94	VPSV-33	ND	ND	ND	4.7	
13	20	12/21/94	VPSV-34	ND	ND	ND	2.9	
13	30	12/21/94	VPSV-35	ND	ND	ND	ND	
13	30	12/21/94	VPSV-36(DUP)	ND	ND	ND	ND	
13	40	12/21/94	VPSV-37	ND	ND	ND	ND	

SUMMARY

SOIL-VAPOR RESULTS– EVENTS 2 AND 3

(Concentrations in µg/L–vapor)

Soil Vapor Well Number	Depth (ft bgs)	Date	Sample Number	1,1-DCE	CCl_4	TCE	Freon 113	Other Analytes Detected
14	5	12/21/94	VPSV-44	ND	ND	ND	ND	
14	10	12/21/94	VPSV-45	ND	ND	ND	ND	
14	13	12/21/94	VPSV-46	ND	ND	ND	ND	
15	20	12/22/94	VPSV-75	ND	ND	ND	ND	
15	40	12/22/94	VPSV-76	ND	ND	ND	1.3	
15	60	12/22/94	VPSV-77	ND	11	1.7	32	
15	60	12/22/94	VPSV-78(DUP)	ND	8.8	1.2	29	
15	75	12/22/94	VPSV-79	1.5	18	3	34	
15	90	12/22/94	VPSV-80	ND	8	1.8	16	
16	20	12/21/94	VPSV-56	ND	ND	ND	ND	
16	40	12/21/94	VPSV-57	ND	ND	ND	2.8	
16	60	12/21/94	VPSV-58	2.6	8.9	ND	23	
16	80	12/21/94	VPSV-59	2.7	176	1.2	14	
16	80	12/21/94	VPSV-60(DUP)	2.7	117	1.2	18	
16	95	12/21/94	VPSV-61	1.9	219	1.4	21	
17	12	12/21/94	VPSV-47	ND	ND	ND	ND	
17	12	12/21/94	VPSV-48(DUP)	ND	ND	ND	ND	
17	24	12/21/94	VPSV-49	ND	ND	ND	ND	
17	36	12/21/94	VPSV-50	ND	ND	ND	ND	1.4 Chloroform, 1.9 1,1-Dichloroethane, 4.2 1,2-Dichloroethane, 94 cis-1,2-Dichloroethene, 2.7 Tetrachloroethene, 3.8 1,1,1-Trichloroethane, 39 Benzene, 1.6 Ethylbenzene, 2.2 Toluene, 5.7 Total Xylenes
18	20	12/29/94	VPSV-106	ND	ND	ND	ND	
18	40	12/29/94	VPSV-107	ND	ND	1.2	ND	
18	40	12/29/94	VPSV-108(DUP)	ND	ND	1	ND	

SUMMARY

SOIL-VAPOR RESULTS– EVENTS 2 AND 3

(Concentrations in µg/L–vapor)

Soil Vapor Well Number	Depth (ft bgs)	Date	Sample Number	1,1-DCE	CCl_4	TCE	Freon 113	Other Analytes Detected
18	55	12/29/94	VPSV-109	ND	ND	2.2	1.7	
18	70	12/29/94	VPSV-110	ND	ND	2.1	2.3	1.0 1,1,1-Trichloroethane
18	85	12/29/94	VPSV-111	ND	ND	1.8	1	
19A	20	12/22/94	VPSV-70	ND	3.1	ND	2.5	
19A	40	12/22/94	VPSV-71	ND	10	1.3 J	4.8	
19A	40	12/22/94	VPSV-72(DUP)	ND	6.8	ND	3.5	
19A	60	12/22/94	VPSV-73	1.2	23	1.6	5	
19A	80	NS	NS	P	P	P	P	
19A	96	12/22/94	VPSV-74	ND	2.6	1.2	1.3	
20	10	12/29/94	VPSV-93	ND	ND	ND	ND	
20	20	NS	NS	P	P	P	P	
20	30	12/29/94	VPSV-94	ND	1.5	ND	1.3	
20	37	12/29/94	VPSV-95	ND	2	ND	ND	
20A	20	12/29/94	VPSV-96	ND	ND	ND	ND	
20A	20	12/29/94	VPSV-97(DUP)	ND	ND	ND	ND	
20A	30	12/29/94	VPSV-98	ND	ND	ND	ND	
20A	47	12/29/94	VPSV-99	ND	1	ND	ND	
20A	60	NS	NS	W	W	W	W	
21	20	12/22/94	VPSV-87	ND	ND	ND	ND	
21	40	12/22/94	VPSV-88	ND	ND	ND	1.4	
21	55	12/22/94	VPSV-89	ND	4.3	2.9	4.4	
21	55	12/22/94	VPSV-90(DUP)	ND	2.6	2.3	3.5	
21	70	12/22/94	VPSV-91	ND	4.1	4	2.8	
21	85	12/22/94	VPSV-92	ND	4.7	4.1	3.7	
22	20	12/22/94	VPSV-81	ND	8.9	2.8	9.1	
22	40	12/22/94	VPSV-82	ND	8.2	2.9	12	
22	60	12/22/94	VPSV-83	ND	19	4.8	20	1.4 J Chloroform
22	60	12/22/94	VPSV-84(DUP)	ND	11	4	13	
22	80	12/22/94	VPSV-85	ND	15	4.5	15	1.3 Chloroform
22	95	12/22/94	VPSV-86	ND	14	6.4	11	1.1 Chloroform

SUMMARY

SOIL-VAPOR RESULTS– EVENTS 2 AND 3

(Concentrations in µg/L–vapor)

Soil Vapor Well Number	Depth (ft bgs)	Date	Sample Number	1,1-DCE	CCl_4	TCE	Freon 113	Other Analytes Detected
23B	5	12/22/94	VPSV-62	ND	ND	ND	ND	
23B	11	12/22/94	VPSV-63	ND	ND	ND	ND	
23B	17	12/22/94	VPSV-64	ND	ND	ND	ND	
24	20	12/29/94	VPSV-100	ND	ND	ND	ND	
24	40	12/29/94	VPSV-101	ND	ND	ND	3.8	
24	60	12/29/94	VPSV-102	ND	7.8	1.7	17	
24	60	12/29/94	VPSV-103(DUP)	ND	7.5	1.6	16	
24	80	12/29/94	VPSV-104	ND	9.7	1.8	23	
24	95	12/29/94	VPSV-105	ND	3.8	ND	9.9	
Event 3								
1	10	3/7/95	VPSV-112	ND	1.9	ND	ND	
1	21	3/7/95	VPSV-113	ND	2.1	ND	ND	
1	33	NS	NS	W	W	W	W	
2	10	3/7/95	VPSV-114	ND	ND	ND	ND	
2	22	3/7/95	VPSV-115	ND	ND	ND	ND	
2	37	NS	NS	W	W	W	W	
3	16	3/7/95	VPSV-116	ND	40	ND	ND	7.3 Chloroform, 1.1 Tetrachloroethene
3	16	3/7/95	VPSV-117(DUP)	ND	26	ND	ND	3.7 Chloroform, 1.1 Tetrachloroethene
3	29	NS	NS	P	P	P	P	
3	40	NS	NS	W	W	W	W	
3	47	NS	NS	W	W	W	W	
4	11	3/7/95	VPSV-118	ND	7.5	46	1.5	
4	20	3/7/95	VPSV-119	ND	24	47	4.6	
4	35	3/7/95	VPSV-120	ND	41	40	3.1	
4	56	NS	NS	W	W	W	W	
5	5	3/7/95	VPSV-121	ND	29	ND	ND	2.7 Chloroform
5	9	3/7/95	VPSV-122	ND	29	ND	ND	4.3 Chloroform
5	9	3/7/95	VPSV-123(DUP)	ND	28	ND	ND	2.9 Chloroform

SUMMARY

SOIL-VAPOR RESULTS– EVENTS 2 AND 3

(Concentrations in µg/L–vapor)

Soil Vapor Well Number	Depth (ft bgs)	Date	Sample Number	1,1-DCE	CCl_4	TCE	Freon 113	Other Analytes Detected
6	20	3/7/95	VPSV-124	ND	7.4	ND	20	
6	40	3/7/95	VPSV-125	ND	44	ND	50	
6	60	3/7/95	VPSV-126	ND	29	2.4	19	
6	77	3/7/95	VPSV-127	ND	29	1.4	25	
6	96	3/7/95	VPSV-128	ND	6.1	ND	33	
6	96	3/7/95	VPSV-129(DUP)	ND	4.3	ND	29	
7	20	3/7/95	VPSV-130	ND	4.3	ND	ND	
7	34	NS	NS	W	W	W	W	
8	20	NS	NS	P	P	P	P	
8	30	3/9/95	VPSV-163	ND	ND	ND	2.1	
8	50	3/9/95	VPSV-164	ND	14	ND	6.6	
8	70	3/9/95	VPSV-165	ND	27	ND	9.7	1.1 J Chloroform
8	70	3/9/95	VPSV-166(DUP)	ND	27	ND	8.1	
8	90	3/9/95	VPSV-167	ND	28	ND	11	
9	20	3/9/95	VPSV-173	ND	ND	ND	3	
9	35	3/9/95	VPSV-174	ND	ND	ND	3.2	
9	50	3/9/95	VPSV-175	ND	ND	ND	8	
9	70	3/9/95	VPSV-176	ND	ND	ND	9.3	
9	87	3/9/95	VPSV-177	5.8	ND	ND	10	
9	87	3/9/95	VPSV-178(DUP)	6.5	ND	ND	9.3	
10	20	3/9/95	VPSV-168	ND	ND	ND	1.3	
10	35	NS	NS	W	W	W	W	
10	50	NS	NS	W	W	W	W	
10	69	NS	NS	P	P	P	P	
11	20	3/9/95	VPSV-179	ND	ND	ND	2.5	
11	40	3/9/95	VPSV-180	ND	ND	ND	6.5	
11	60	3/9/95	VPSV-181	ND	1.6	ND	15	
11	80	NS	NS	P	P	P	P	
11	96	3/9/95	VPSV-182	ND	7.1	ND	22	
12	20	3/9/95	VPSV-191	ND	ND	ND	ND	
12	40	3/9/95	VPSV-192	ND	ND	ND	ND	

SUMMARY

SOIL-VAPOR RESULTS– EVENTS 2 AND 3

(Concentrations in µg/L–vapor)

Soil Vapor Well Number	Depth (ft bgs)	Date	Sample Number	1,1-DCE	CCl_4	TCE	Freon 113	Other Analytes Detected
12	60	NS	NS	W	W	W	W	
12	76	NS	NS	W	W	W	W	
13	10	3/9/95	VPSV-169	ND	ND	ND	6.6	
13	20	NS	NS	W	W	W	W	
13	30	3/9/95	VPSV-170	ND	ND	ND	ND	
13	40	3/9/95	VPSV-171	ND	ND	ND	ND	
13	40	3/9/95	VPSV-172(DUP)	ND	ND	ND	ND	
14	5	3/9/95	VPSV-187	ND	ND	ND	ND	
14	10	3/9/95	VPSV-188	ND	ND	ND	ND	
14	13	3/9/95	VPSV-189	ND	ND	ND	ND	
14	13	3/9/95	VPSV-190(DUP)	ND	ND	ND	ND	
15	20	3/8/95	VPSV-146	ND	ND	ND	4.7	
15	40	3/8/95	VPSV-147	ND	3.6	ND	17	
15	40	3/8/95	VPSV-148(DUP)	ND	6.3	ND	22	
15	60	3/8/95	VPSV-149	ND	20	3	23	
15	75	NS	NS	P	P	P	P	
15	90	3/8/95	VPSV-150	ND	4.6	1.9	6.8	
16	20	3/10/95	VPSV-193	ND	ND	ND	ND	
16	40	3/10/95	VPSV-194	ND	ND	ND	ND	
16	60	3/10/95	VPSV-195	ND	6.8	ND	33	
16	60	3/10/95	VPSV-196(DUP)	ND	8	ND	25	1.0 J Chloroform
16	80	3/10/95	VPSV-197	ND	109	2.2	24	
16	95	3/10/95	VPSV-198	ND	240	ND	20	
17	12	3/9/95	VPSV-183	ND	ND	ND	ND	
17	12	3/9/95	VPSV-184(DUP)	ND	ND	ND	ND	
17	24	3/9/95	VPSV-185	ND	ND	ND	ND	1.9 1,1,1-Trichloroethane
17	36	3/9/95	VPSV-186	ND	ND	ND	1.8	1.9 Chloroform,
								3.3 1,1-Dichloroethane,
								6.1 1,2-Dichloroethane,
								2.2 cis-1,2-Dichloroethene,
								4.0 Tetrachloroethene,
								4.4 1,1,1-Trichloroethane,

SUMMARY

SOIL-VAPOR RESULTS– EVENTS 2 AND 3

(Concentrations in µg/L–vapor)

Soil Vapor Well Number	Depth (ft bgs)	Date	Sample Number	1,1-DCE	CCl_4	TCE	Freon 113	Other Analytes Detected
								54 Benzene, 1.9 Ethylbenzene, 3.6 Toluene, 12 Total Xylenes
18	20	NS	NS	P	P	P	P	
18	40	3/10/95	VPSV-199	ND	ND	2.9	1.7	
18	55	3/10/95	VPSV-200	ND	ND	2.9	ND	
18	70	3/10/95	VPSV-201	ND	2.2	3.7	2	1.6 J 1,1,1-Trichloroethane
18	70	3/10/95	VPSV-202(DUP)	ND	1.3	3.3	2.6	
18	85	3/10/95	VPSV-203	ND	ND	3.5	4.2	
19A	20	3/8/95	VPSV-138	ND	ND	ND	1.8	
19A	40	3/8/95	VPSV-139	ND	13	1.6	7.3	
19A	60	3/8/95	VPSV-140	ND	23	1.7	5.3	
19A	60	3/8/95	VPSV-141(DUP)	ND	25	1.8	5.6	
19A	80	NS	NS	P	P	P	P	
19A	96	3/8/95	VPSV-142	ND	9.2	2.8	8	
20	10	3/7/95	VPSV-134	ND	ND	ND	ND	
20	20	NS	NS	P	P	P	P	
20	30	3/7/95	VPSV-135	ND	17	ND	20	
20	30	3/7/95	VPSV-136(DUP)	ND	9.4	ND	16	
20	37	3/7/95	VPSV-137	ND	49	1.5	24	
20A	20	3/7/95	VPSV-131	ND	1.7	ND	6.3	
20A	30	3/7/95	VPSV-132	ND	ND	ND	ND	
20A	47	3/7/95	VPSV-133	ND	26	ND	20	
20A	60	NS	NS	W	W	W	W	
21	20	3/8/95	VPSV-151	ND	ND	ND	ND	
21	40	3/8/95	VPSV-152	ND	9.2	1.7	13	
21	55	3/8/95	VPSV-153	ND	19	10	15	1.4 Chloroform
21	55	3/8/95	VPSV-154(DUP)	ND	22	6.2	19	1.6 Chloroform
21	70	3/8/95	VPSV-155	ND	ND	5.7	ND	
21	85	3/8/95	VPSV-156	ND	14	4.7	15	

SUMMARY

SOIL-VAPOR RESULTS– EVENTS 2 AND 3

(Concentrations in µg/L–vapor)

Soil Vapor Well Number	Depth (ft bgs)	Date	Sample Number	1,1-DCE	CCl_4	TCE	Freon 113	Other Analytes Detected
22	20	3/8/95	VPSV-157	ND	28	9.6	27	
22	40	3/8/95	VPSV-158	ND	38	6.4	34	2.0 Chloroform
22	60	3/8/95	VPSV-159	ND	40	16	25	2.8 Chloroform
22	60	3/8/95	VPSV-160(DUP)	ND	35	7	29	2.5 Chloroform
22	80	3/8/95	VPSV-161	ND	29	16	23	2.3 Chloroform
22	95	3/8/95	VPSV-162	ND	28	6.2	28	2.0 Chloroform
23B	5	3/8/95	VPSV-143	ND	ND	ND	ND	
23B	11	NS	NS	W	W	W	W	
23B	17	NS	NS	W	W	W	W	
24	20	3/8/95	VPSV-144	ND	1.3	ND	8.4	
24	40	NS	NS	T	T	T	T	
24	60	3/8/95	VPSV-145	ND	17	5.3	16	
24	80	NS	NS	T	T	T	T	
24	95	NS	NS	T	T	T	T	

Notes:

bgs - Below ground surface.
DUP - Duplicate samples.
J - Estimated concentration.
ND - Not detected.
NS - Not sampled.
P - Sampling port plugged.
T - Sample tubing destroyed.
W - Sampling port inundated with water.

SOIL VAPOR DATA EVALUATION REPORT
EVENTS 4 AND 5

I. INTRODUCTION

Summarized in this report is Foster Wheeler Environmental's review of two analytical data packages generated from gas-chromatographic analyses of soil vapor samples collected during late June and July 1997 from the JPL site, Pasadena, California. On-site analysis for volatile organic compounds (VOCs) was performed by Transglobal Environmental Geochemistry (TEG) in their DOHS-certified mobile laboratory by Mr. Alan Glover (field chemist) with internal data review conducted by Mr. John Shepler (lab manager), both of TEG. The data packages generated from the on-site soil vapor analyses were carefully reviewed by Foster Wheeler Environmental's Principal Scientist/Project Chemist who prepared this summary report.

During June of 1997, seven Operable Unit 2 (OU-2) deep soil vapor wells (Well Nos. 25 through 31) were sampled (Event 4). Sixty-three depth-specific vapor samples, including 11 collocated field duplicates, were successfully collected. These samples, along with four field blanks were delivered to the on-site laboratory and immediately analyzed for a predetermined list of 25 target VOCs. According to sample custody records, the time between sample collection and analysis was less than 30 minutes.

In mid-July of 1997, the same set of seven deep soil vapor wells (Well Nos. 25 through 31) were sampled once again (Event 5). During this sampling round, a total of 63 depth-specific vapor samples, including 11 collocated field duplicates, were successfully collected. These samples, along with four ambient-air field blanks were collected within the on-site laboratory and immediately analyzed for the same predetermined list of 25 target VOCs. As was the case during sampling Event 4, the time between sample collection and analysis averaged only a few minutes.

Laboratory results for all samples analyzed during Events 4 and 5 are included in Appendices C3 and C4, respectively. Attached to this report is a summary of those results with the corresponding soil vapor well numbers and depths from which each identified vapor sample was collected during these two sampling events. This table should provide the reader with sufficient information to determine where each sample was obtained and also to identify the collocated field duplicate samples (DUP).

II. GUIDELINES USED FOR THIS REVIEW

Soil vapor data review was performed to assess and evaluate adherence to the QA/QC and Reporting Requirements for Soil Gas Investigation, protocols established by the California Regional Water Quality Control Board - Los Angeles Region, and general quality control requirements and good laboratory practices contained in the current reference methods (8000B and 8021) published in Test Methods for Evaluating Solid Wastes - Physical/Chemical Methods,

SW-846, Office of Solid Waste and Emergency Response, EPA, Washington, DC, 3rd Edition, September 1986 (including Update IIB, January 1995).

There were some key areas that could not be evaluated because no data were supplied, and there are some constraints imposed by the nature of any vapor matrix that limit the types of control samples that can be run. These areas, and their potential impact on data reliability, are discussed later in the report. In general, the data tables summarizing the laboratory's external calibration and internal control sample results contained only a minimal amount of information, but the package did contain copies of the individual chromatograms which were scrutinized.

III. CHROMATOGRAPHIC PERFORMANCE

All sample analyses were performed using an external standard calibration method. Analytical system performance was checked at the beginning of each analytical day with an "opening standard", a final "closing standard" (identified on the chromatograms as a Laboratory Control Standard or "LCS"), and a "continuing standard" run after the first 10 environmental samples. Because calibration of the analytical system was never altered, updated or otherwise adjusted based on these results, the term "continuing calibration" is misleading and should not be used when referring to these control samples. Instead, these control samples are, in essence, calibration verification standards. In future reports, the lab should label their check standards in accordance with SW-846 Method 8000B.

During each analytical day, the environmental sample analyses were bracketed by check standards which verified acceptable system performance for the limited number of analytes listed in the QA/QC - Calibration Data Summary Tables. With the exception of the ortho-xylene calibration of June 26, 1997, calibration factors (CF) calculated from the opening standard results were within ±15 percent of the mean calibration factors calculated from initial calibration results. Because none of the target analytes was detected in any environmental soil vapor samples, a closing standard was run at the reporting limit (1 μg/L) and CFs were within ±50 percent of initial calibration results as allowed under RWQCB guidelines. All of the calibration factors determined from the QA/QC-LCS results fell within the acceptable range of ±20 difference. The o-xylene data generated on June 26, 1997, were not qualified because the direction of drift was toward greater sensitivity and all results were non-detects.

The lab should refer to the ratio of instrument response (peak area) to mass of analyte as the Calibration Factor (CF) so that data reviewers will correctly infer that the system has been externally calibrated. The term "Response Factor" (RF) should not be used in conjunction with the lab's standardization protocol because it implies internal calibration.

Field blanks (lab air collected with the field probe) were analyzed immediately after the opening verification standard and were clean in all cases.

In qualitative chromatographic terms such as peak shape, compound separation, stability of instrumental response, baseline appearance, drift and sensitivity, the quality of the chromatograms in these data packages compared favorably with the general criteria for single laboratory performance as published in the method.

IV. REQUIRED INSTRUMENT QC

Based on general evaluation criteria for GC analysis with non-MS detectors and specific requirements in SW-846 Method 8021, TEG's data packages were evaluated as follows:

- *Linearity of initial calibration curve*: Initial 3-point calibration data were provided. Good linearity was clearly demonstrated with correlation coefficients greater than 0.990 as required by SW-846. The calibration range of the instrument was 2 to 100ηg on-column. The reporting range was 1 to 150 μg/L for a 1 μL injection volume.
- *Retention time (RT) windows*: Appeared stable and consistent. Data from a chlorobenzene surrogate was used to monitor relative RT drift and ensure precise compound identification.
- *Establishment and verification of calibration factors*: Average RF values were correctly calculated. Some key analytes (e.g., carbon tetrachloride) missing from QC data summary tables.

V. MATRIX SPIKE AND LABORATORY CONTROL SAMPLES

The mixed-gas matrix collected from vapor monitoring wells was assumed to not significantly affect method performance in terms of detection limits, precision and accuracy. No matrix spike data were reported to verify this assumption and no lab replicates were run for internal lab precision assessment. The lack of this type of control data means that the variability and bias of the results attributable solely to the analytical and reporting systems at the laboratory (handling and storage were negligible) cannot be quantified. However, data on 22 pairs of field duplicates were generated. Because variability introduced in the process of sample extraction and field collection is typically expected to be an order of magnitude greater than analytical and reporting variability within the laboratory, some general conclusions about sampling technique as well as variability of the data set as a whole can be drawn. For that purpose, the mean relative percent differences (RPD) between individual field duplicate data pairs with detectable carbon tetrachloride and Freon 113, along with other statistical parameters, are shown in the table on the next page.

	STATISTICAL PARAMETERS - Field Duplicates			
	average RPD	standard deviation σ	variance σ^2	relative error $\sigma \div RPD$
Event 4: CCl_4	13.6 %	1.5×10^{-1}	2.2×10^{-2}	1.1
Event 5: CCl_4	6.0 %	6.9×10^{-2}	4.7×10^{-3}	1.1
Event 4: FR113	5.8 %	7.8×10^{-2}	6.1×10^{-3}	1.4
Event 5: FR113	6.7 %	7.4×10^{-2}	5.5×10^{-3}	1.1

With the exception of the carbon tetrachloride results from Event 4, average RPDs are well below 10 percent. Some of the RPDs in Event 4 were high because the samples contained relatively high carbon tetrachloride concentrations, a smaller aliquot of which should have been reanalyzed to bring within the instrumental calibration range. For the rest of the data, there is very good general agreement between duplicate pairs and good consistency between sampling events. This suggests that a reproducibly consistent field sampling procedure is being properly implemented. But variability within the duplicate data set is relatively large (110 to 140 percent relative error). This variability arises, in this case, because there were a number of clean duplicates in which the RPD was zero (equal sample concentrations), contrasted with contaminated samples where laboratory precision was much lower. From these data, it is not possible to determine whether the laboratory or the field sampling procedures introduced the carbon tetrachloride variability, but agreement of the Freon® data among all sampling events suggests that the higher carbon tetrachloride variability, in this case, may arise from the laboratory's analytical system.

VI. SURROGATE RECOVERIES

During these sampling and on-site analysis events, 1,4-difluorobenzene, chlorobenzene, and 4-bromofluorobenzene were used as surrogates. The principal purpose of adding these surrogates is to monitor temporal drift in the chromatographic response from day to analytical day. The data are used to adjust RT windows and monitor absolute RT values for each analyte in order to precisely identify the compounds of interest. Calculating and assessing surrogate recovery percentages is also employed in assessing data accuracy and precision. A control range of 70 to 130 percent was applied. This is the RWQCB standard by which soil vapor data packages are to be judged. Both data packages satisfied this criterion by wide margins. Surrogate recoveries fell more typically within the 80 to 120 percent recovery range.

VII. PERFORMANCE CRITERIA

The reporting limit was 1 μg/L vapor (1 ηg on-column) for all 25 target compounds. Statistical data to support and confirm this limit was not provided (nor required). The low standard used for calibrating the GC was equivalent to 2 μg/L. An examination of the baseline noise and

instrument sensitivity shown in the chromatograms provided in this data package indicates that setting the reporting limit at 1 ηg on-column (equivalent to 1 μg/L-vapor) was justified.

VIII. SUMMARY OF FINDINGS & RECOMMENDATIONS

A. The following general comments are offered relative to these data packages:

1. It is requested that in future data reporting packages, the lab promptly supply a copy of the raw GC data from their initial three-point instrument calibration curve. Although the published SW-846 method calls for a minimum of five calibration points, the RWQCB protocols allow for this modification to the standard method of analysis.

2. System blanks should occasionally be run immediately after samples with high analyte concentrations (e.g., greater than 200 μg/L) to demonstrate that no analyte carry-over is occurring and the system is free of false positive signals.

3. "QA/QC Calibration Data" summary tables must include all organic compounds that have been detected on site. Carbon tetrachloride should be added to the lab's standard mix for preparing calibration verification and QC check standards.

4. Unidentified peaks are seen occasionally on the chromatograms. However, these unknown peaks are not listed in the data summary tables as called for in the RWQCB reporting requirements. There are peaks labeled "unknown" on the chromatograms, but none of the peaks that were listed on the chromatograms were thought to represent halogenated solvent compounds. All of the peaks listed as "unknown" were due to one of the following reasons:

   - They are due to interferences from oxygen and water vapor in clean outside air.
   - They were introduced by the surrogate mix.

   In the professional judgement of the laboratory analyst and the data reviewer at TEG, none of the unknown peaks listed on the chromatograms represent actual compounds in the soil vapor samples, and, thus, were not reported. Detailed discussion for this interpretation follows.

   Unknowns due to Interferences from Oxygen and Water Vapor in Clean Outside Air

   The PID and ElCD (Hall) detector responces are subject to interferences from the oxygen and water vapor normal found in air. This phenomenon is apparent in the blank sample results for all the sampling events. These interfering peaks (on the PID, it is typically a drop in signal rather than a peak) occur early in the analytical run (less than 5 minutes), and often before four minutes. They do not overlap the 4 early-eluting gaseous chlorinated compounds on the RWQCB list; therefore, they show up

on the chromatogram as "unknowns". There are not fugitive compounds and should not be considered as potential compounds of concern.

Unknowns Introduced by the Surrogate Standard

The surrogate mix is a liquid standard comprised of three compounds in methanol. Typically 1 μL of the liquid is injected for each analysis. With age, the methanol can become contaminated by small quantities of other compounds. This apparently happened in sampling Events 4 and 5.

In these events, the same "unknown peaks" were seen in every analysis at about the same magnitude (as shown by the area counts). The "unknowns" did not correspond to the expected time of any other compounds based upon a VOC chromatogram library. A summary of the peaks for each event is as follows:

Event	PID Unknowns	ElCD Unknowns
4	7.8 min, 12.1 min	6.2 min
5	7.8 min, 12.1 min	6.2 min

During Event 5, sample VPSV 269-60 was run twice, once with the surrogate and once without the surrogate. The above peaks did not show up in the analysis without the surrogate.

One Unknown on the PID - Sampling Event 4

There was one unknown peak observed on the PID at 14.6 to 14.8 minutes during Event 4. The peak was not confirmed on the ElCD detector and does not match any of the expected VOC compounds based upon a VOC chromatogram library (SW-846 Methods 8021 and 8260). Further, the magnitude of the unknown peak was about the same in every sample (as shown by the area counts). For these reasons, it was concluded that this peak represents a non-halogenated compound that is not a constituent of concern (COC) on any of the EPA's Volatile Organic Compound lists. Hence, it was not reported.

5. Second column confirmation data were not reported because, in accordance with the RWQCB guidelines, second column confirmation is not necessary if the compounds present have been confirmed from previous soil gas investigations. This is the case at the NASA JPL site. The same compounds are consistently detected in each sampling round.

   TEG's typical analytical configuration consists of sample analysis on 3 detectors:

   - Analysis on a 75 meter DB-624 column with PID and ElCD in series.
   - Analysis on a 30 meter DB-5 column with FID.

Using analytical arrangement, confirmation is available for every sample. However, the FID instrument was not operated during Events 4 and 5.

B. The following data qualifications should be made when reporting these results:

On the upper end of the initial/working calibration curve, any analyte whose concentration exceeded the highest calibration standard (100 µg/L) by 50 percent should have been reanalyzed using a smaller aliquot so that the raw instrumental result fell within the working calibration range. This was not done consistently. The lab should not report extrapolated data results without qualification. Therefore, the following three results should be qualified J to indicate an estimated value:

Carbon Tetrachloride	VPSV 209-100, VPSV 215-205, VPSV 221-100.

SUMMARY

SOIL-VAPOR RESULTS – EVENTS 4 AND 5

(Concentrations in µg/L–vapor)

Soil Vapor Well Number	Depth (ft bgs)	Date	Sample Number	1,1-DCE	CCl_4	TCE	Freon 113	Other Analytes Detected
Event 4								
25	20	6/23/97	VPSV-216	ND	7.9	ND	ND	
25	40	6/23/97	VPSV-217	ND	8.3	ND	5.7	
25	60	6/23/97	VPSV-218	ND	8.3	ND	59	2.7 Fluorotrichloromethane
25	85	6/24/97	VPSV-219	5.5	433	1.6	28	
25	100	6/24/97	VPSV-220	4.2	606	2	54	
25	100	6/24/97	VPSV-221(DUP)	4.4	378 J	2	53	
25	120	6/24/97	VPSV-222	3.2	424	2.5	49	
25	145	6/24/97	VPSV-223	2.8	295	2	36	
25	165	6/24/97	VPSV-224	2.4	267	2.1	38	
25	180	6/24/97	VPSV-225	3.1	255	2.6	43	
25	190	6/24/97	VPSV-226	4	181	2.7	38	
25	190	6/24/97	VPSV-227(DUP)	3.9	214	2.8	45	
26	20	6/24/97	VPSV-228	ND	ND	ND	ND	
26	35	6/24/97	VPSV-229	ND	3.7	ND	ND	
26	55	6/24/97	VPSV-230	10	2.5	ND	6.3	
26	80	6/24/97	VPSV-231	24	146	8.4	19	
26	100	6/24/97	VPSV-232	7.2	293	4.6	19	
26	100	6/24/97	VPSV-233(DUP)	8.2	276	3.4	15	
26	115	6/25/97	VPSV-234	5	261	2.2	11	
26	140	6/25/97	VPSV-235	3.3	244	1.3	20	
26	160	6/25/97	VPSV-236	3.5	297	1.6	29	
26	180	6/25/97	VPSV-237	3.2	225	1.4	22	
26	195	6/25/97	VPSV-238	3.5	136	2.1	23	
26	195	6/25/97	VPSV-239(DUP)	2.4	122	1.8	25	
27	20	6/23/97	VPSV-204	ND	ND	ND	ND	
27	35	6/23/97	VPSV-205	ND	ND	ND	1.6	
27	60	6/23/97	VPSV-206	ND	1.9	ND	33	
27	85	6/23/97	VPSV-207	9.8	57	ND	49	1.5 Fluorotrichloromethane
27	100	6/23/97	VPSV-208	6.3	288	1.1	61	
27	100	6/23/97	VPSV-209(DUP)	8.7	230 J	1	65	

SUMMARY

SOIL-VAPOR RESULTS – EVENTS 4 AND 5

(Concentrations in µg/L–vapor)

Soil Vapor Well Number	Depth (ft bgs)	Date	Sample Number	1,1-DCE	CCl_4	TCE	Freon 113	Other Analytes Detected
27	120	6/23/97	VPSV-210	6.6	409	ND	73	
27	140	6/23/97	VPSV-211	6.2	292	ND	67	
27	160	6/23/97	VPSV-212	6.3	299	ND	70	
27	180	6/23/97	VPSV-213	4.4	295	ND	71	
27	205	6/23/97	VPSV-214	5.5	577	ND	72	
27	205	6/23/97	VPSV-215(DUP)	3.3	436 J	ND	74	
28	20	6/25/97	VPSV-240	ND	ND	ND	2.5	1.4 1,1,1-Trichloroethane
28	45	6/25/97	VPSV-241	1.7	82	ND	30	
28	65	6/25/97	VPSV-242	3.7	160	1.7	33	
28	80	6/25/97	VPSV-243	3.7	257	2.3	42	
28	105	6/25/97	VPSV-244	3	296	2.4	56	
28	105	6/25/97	VPSV-245(DUP)	2.6	244	2.2	54	
28	120	6/25/97	VPSV-246	2.4	288	2.8	52	
28	140	NS	NS	P	P	P	P	
28	160	6/25/97	VPSV-247	3.6	121	2.9	26	
29	20	6/25/97	VPSV-248	ND	ND	ND	ND	
29	35	6/25/97	VPSV-249	ND	ND	ND	ND	
29	50	6/26/97	VPSV-250	ND	ND	ND	ND	
29	50	6/26/97	VPSV-251(DUP)	ND	ND	ND	ND	
29	60	6/26/97	VPSV-252	ND	ND	ND	ND	
29	78	6/26/97	VPSV-253	ND	ND	ND	ND	
30	17	6/26/97	VPSV-260	ND	ND	ND	ND	
30	30	6/26/97	VPSV-261	ND	ND	ND	ND	
30	40	6/26/97	VPSV-262	ND	ND	ND	ND	
30	40	6/26/97	VPSV-263(DUP)	ND	ND	ND	ND	
30	50	6/26/97	VPSV-264	ND	ND	ND	ND	
30	65	6/26/97	VPSV-265	ND	ND	ND	ND	
30	65	6/26/97	VPSV-266(DUP)	ND	ND	ND	ND	
31	20	6/26/97	VPSV-254	ND	ND	ND	ND	
31	35	6/26/97	VPSV-255	ND	ND	ND	ND	
31	45	6/26/97	VPSV-256	ND	ND	ND	ND	

SUMMARY

SOIL-VAPOR RESULTS – EVENTS 4 AND 5

(Concentrations in µg/L–vapor)

Soil Vapor Well Number	Depth (ft bgs)	Date	Sample Number	1,1-DCE	CCl_4	TCE	Freon 113	Other Analytes Detected
31	45	6/26/97	VPSV-257(DUP)	ND	ND	ND	ND	
31	55	6/26/97	VPSV-258	ND	ND	ND	ND	
31	65	6/26/97	VPSV-259	ND	ND	ND	ND	
Event 5								
25	20	7/21/97	VPSV-279	ND	2.2	ND	ND	
25	40	7/21/97	VPSV-280	ND	6.1	ND	3	
25	60	7/21/97	VPSV-281	3.1	7.7	ND	36	2.5 Fluorotrichloromethane
25	85	7/21/97	VPSV-282	8.2	368	5.2	75	
25	100	7/22/97	VPSV-283	6.2	582	3.9	61	
25	100	7/22/97	VPSV-284(DUP)	7.1	585	3.9	58	
25	120	7/22/97	VPSV-285	6.2	590	3.5	57	
25	145	7/22/97	VPSV-286	5.7	609	3	56	
25	165	7/22/97	VPSV-287	7	538	3.5	61	
25	180	7/22/97	VPSV-288	6.2	441	3.4	54	
25	190	7/22/97	VPSV-289	5.6	255	4.3	38	
25	190	7/22/97	VPSV-290(DUP)	6.6	308	5.3	49	
26	20	7/22/97	VPSV-291	ND	ND	ND	ND	
26	35	7/22/97	VPSV-292	1.5	6.1	ND	ND	
26	55	7/22/97	VPSV-293	7.7	3.5	ND	7	
26	80	7/22/97	VPSV-294	24	182	10	11	
26	100	7/22/97	VPSV-295	12	519	8.1	24	
26	100	7/22/97	VPSV-296(DUP)	11	447	6.8	22	
26	115	7/22/97	VPSV-297	9	448	5.6	27	
26	140	7/22/97	VPSV-298	6.3	527	3.6	49	
26	160	7/22/97	VPSV-299	6.1	330	3.8	24	
26	180	7/23/97	VPSV-300	2.8	164	1.3	26	
26	195	7/23/97	VPSV-301	3.1	111	1.9	23	
26	195	7/23/97	VPSV-302(DUP)	3	117	2.1	25	
27	20	7/21/97	VPSV-267	ND	ND	ND	ND	
27	35	7/21/97	VPSV-268	ND	ND	ND	1.5	
27	60	7/21/97	VPSV-269	ND	2.5	ND	31	

SUMMARY

SOIL-VAPOR RESULTS – EVENTS 4 AND 5
(Concentrations in µg/L–vapor)

Soil Vapor Well Number	Depth (ft bgs)	Date	Sample Number	1,1-DCE	CCl_4	TCE	Freon 113	Other Analytes Detected
27	85	7/21/97	VPSV-270	2.7	30	ND	27	1.2 Fluorotrichloromethane
27	100	7/21/97	VPSV-271	2.5	111	1.2	27	
27	100	7/21/97	VPSV-272(DUP)	3	117	1.5	29	
27	120	7/21/97	VPSV-273	2.5	82	ND	21	
27	140	7/21/97	VPSV-274	5.5	147	ND	67	
27	160	7/21/97	VPSV-275	3.7	228	ND	69	
27	180	7/21/97	VPSV-276	3.1	293	ND	68	
27	205	7/21/97	VPSV-277	6	472	ND	77	
27	205	7/21/97	VPSV-278(DUP)	7.5	435	ND	84	
28	20	7/23/97	VPSV-303	ND	1.9	ND	3.8	1.6 1,1,1-Trichloroethane
28	45	7/23/97	VPSV-304	1.7	66	ND	29	
28	65	7/23/97	VPSV-305	3	147	1.2	34	
28	80	7/23/97	VPSV-306	2.6	206	1.2	47	
28	105	7/23/97	VPSV-307	2.7	254	1.3	65	
28	105	7/23/97	VPSV-308(DUP)	3.1	289	1.6	72	
28	120	7/23/97	VPSV-309	2.7	297	1.4	71	
28	140	NS	NS	P	P	P	P	
28	160	7/23/97	VPSV-310	2.7	140	1.4	33	
29	20	7/23/97	VPSV-311	ND	ND	ND	ND	
29	35	7/23/97	VPSV-312	ND	ND	ND	ND	
29	50	7/23/97	VPSV-313	ND	ND	ND	ND	
29	50	7/23/97	VPSV-314(DUP)	ND	ND	ND	ND	
29	60	7/23/97	VPSV-315	ND	ND	ND	ND	
29	78	7/23/97	VPSV-316	ND	ND	ND	ND	
30	17	7/24/97	VPSV-317	ND	ND	ND	ND	
30	30	7/24/97	VPSV-318	ND	ND	ND	ND	
30	40	7/24/97	VPSV-319	ND	ND	ND	ND	
30	40	7/24/97	VPSV-320(DUP)	ND	ND	ND	ND	
30	50	7/24/97	VPSV-321	ND	ND	ND	ND	
30	65	7/24/97	VPSV-322	ND	ND	ND	ND	

SUMMARY

SOIL-VAPOR RESULTS – EVENTS 4 AND 5

(Concentrations in µg/L–vapor)

Soil Vapor Well Number	Depth (ft bgs)	Date	Sample Number	1,1-DCE	CCl_4	TCE	Freon 113	Other Analytes Detected
31	20	7/24/97	VPSV-323	ND	ND	ND	ND	
31	35	7/24/97	VPSV-324	ND	ND	ND	ND	
31	45	7/24/97	VPSV-325	ND	ND	ND	ND	
31	45	7/24/97	VPSV-326(DUP)	ND	ND	ND	ND	
31	55	7/24/97	VPSV-327	ND	ND	ND	ND	
31	65	7/24/97	VPSV-328	ND	ND	ND	ND	
31	65	7/24/97	VPSV-329D	ND	ND	ND	ND	

Notes:

bgs - Below ground surface.
DUP - Duplicate samples.
J - Estimated concentration.
ND - Not detected.
NS - Not sampled.
P - Sampling port plugged.

SOIL VAPOR DATA EVALUATION REPORT
EVENTS 6 AND 7

I. INTRODUCTION

Summarized in this report is Foster Wheeler Environmental's review of two analytical data packages generated from gas-chromatographic analyses of soil vapor samples collected during May and June 1998 from the JPL site, Pasadena, California. On-site analysis for volatile organic compounds (VOCs).was performed by Transglobal Environmental Geochemistry (TEG) in their DOHS-certified mobile laboratory by Mr. Alan Glover (field chemist) with internal data review conducted by Dr. Blayne Hartman, both of TEG. The data packages generated from the on-site analyses were carefully reviewed by Foster Wheeler Environmental's Principal Scientist/Project Chemist who prepared this summary report.

During May of 1998, 12 Operable Unit 2 (OU-2) deep soil vapor wells (Well Nos. 25 through 28 and Nos. 32 through 39) were sampled (Event 6). One hundred and fourteen depth-specific vapor samples, including 19 collocated field duplicates, were successfully collected. These samples, along with eight ambient-air field blanks were collected within the on-site laboratory and immediately analyzed for a predetermined list of 25 target VOCs. The time between sample collection and analysis was only a few minutes.

In mid-June of 1998, eight of the OU-2 deep soil vapor wells (Well Nos. 32 through 39) were sampled (Event 7). During this sampling event, 79 depth-specific vapor samples, including 13 collocated field duplicates, were successfully collected. These samples, along with five ambient-air field blanks were collected within the on-site laboratory and immediately analyzed for the same predetermined list of 25 target VOCs. As was the case during previous soil vapor sampling events, the time between sample collection and analysis was only a few minutes.

Laboratory results for all samples analyzed during Events 6 and 7 are included in Appendices C5 and C6, respectively. Attached to this report are summaries of those results with the corresponding soil vapor well numbers and depths from which each identified vapor sample was collected during these two sampling events. These tables should provide the reader with sufficient information to determine where each sample was obtained and also to identify the collocated field duplicate samples (DUP).

II. GUIDELINES USED FOR THIS REVIEW

Soil vapor data review was performed to assess and evaluate adherence to the Interim Guidance for Active Soil Gas Investigation, February 25, 1997, and QA/QC and Reporting Requirements for Soil Gas Investigation, protocols established by the California Regional Water Quality Control Board - Los Angeles Region, and general quality control requirements, and good laboratory practices contained in the current reference methods (8000B & 8021) published in Test Methods for Evaluating Solid Wastes - Physical/Chemical Methods, SW-846, Office of Solid

Waste and Emergency Response, EPA, Washington, DC, 3rd Edition, September 1986 (including Update IIB, January 1995).

There were some key areas that could not be evaluated because of constraints imposed by the nature of any vapor matrix that limit the types of control samples that can be run. These areas, and their potential impact on data quality, are discussed later in the report. In general, the data tables summarizing the laboratory's external calibration and internal control sample results contained sufficient information for this review, and included copies of the individual chromatograms which were scrutinized as part of this data quality assessment.

III. CHROMATOGRAPHIC PERFORMANCE

All sample analyses were performed using an external standard calibration method. Analytical system performance was checked at the beginning of each analytical day with an "opening standard", a final "closing standard" (identified on the chromato-grams as a Laboratory Control Standard or "LCS"), and a "continuing standard" run after the first 10 environmental samples. Because calibration of the analytical system was never altered, updated or otherwise adjusted based on these results, the term "continuing calibration" is misleading and should not be used when referring to these control samples. Instead, these are, in essence, calibration verification standards. In future reports, the lab should label their check standards in accordance with SW-846 Method 8000B.

During each analytical day, the environmental sample analyses were bracketed by check standards which verified acceptable system performance for the limited number of analytes listed in the QA/QC - Calibration Data Summary Tables. The calibration factors (CF) calculated from the opening standard results were within ±15 percent of the mean calibration factors calculated from initial calibration results. Closing standards and LCS results were within ±20 percent of initial calibration results. Again the laboratory used a term "Response Factor" (RF) that implies internal calibration. The lab should refer to the ratio of instrument response (peak area) to mass of analyte as the Calibration Factor (CF) so that data reviewers will correctly infer that the system has been externally calibrated.

Field blanks were analyzed immediately after the opening verification standard and were clean in all cases. No results from matrix spikes or laboratory replicates were included in these data packages, and none were required under current RWQCB guidelines.

In qualitative chromatographic terms such as peak shape, compound separation, stability of instrumental response, baseline appearance, drift and sensitivity, the quality of the chromatograms in these data packages compared favorably with the general criteria for single laboratory performance as published in the method.

IV. REQUIRED INSTRUMENT QC

Based on general evaluation criteria for GC analysis with non-MS detectors and -specific requirements in SW-846 - Method 8021, TEG's data packages were evaluated as follows:

- *Linearity of initial calibration curve*: Initial 3-point calibration data were provided. Good linearity was clearly demonstrated with correlation coefficients greater than 0.990 as required by SW-846. The calibration range of the instrument was 2 to 100 ηg on-column. The reporting range was 1 to 150 μg/L for a 1 μL injection volume.
- *Retention time (RT) windows*: Appeared to be stable and relatively consistent. Data from 3 surrogate compounds (1,4-Difluorobenzene, Chlorobenzene, and 4-Bromofluorobenzene) were used to monitor relative RT drift and ensure precise compound identification.
- *Establishment and verification of calibration factors*: Average RF values were correctly calculated. Carbon tetrachloride was missing from the QC data summary tables.

V. INITIAL DEMONSTRATION OF PROFICIENCY

It is assumed that, prior to performing environmental sample analysis, the TEG on-site lab, employing the current staff and instrumentation, successfully demonstrated proficiency by generating data of acceptable accuracy and precision using appropriate reference samples that contained the analytes of interest in a clean vapor-phase matrix. However, no data were presented to confirm that this requirement was completed. The lab should keep a current on-site file with copies of all proficiency data including data from analyzing external QC samples as part of any interlaboratory performance evaluation program.

VI. MATRIX SPIKE AND LABORATORY CONTROL SAMPLES

The mixed-gas matrix collected from vapor monitoring wells was assumed to not significantly affect method performance in terms of detection limits, precision and accuracy. No matrix spike data were reported to verify this assumption and no lab replicates were run for internal lab precision assessment. The lack of this type of control data means that the variability and bias of the results attributably solely to the analytical and reporting systems at the laboratory (handling and storage were negligible) cannot be quantified. However, data on 32 pairs of field duplicates were generated, and although the variability introduced in the process of sample extraction and collection is estimated to be an order of magnitude greater than analytical and reporting variability within the laboratory, some general conclusions about the variability of the data set as a whole can be drawn. For that purpose, the mean relative percent difference (RPD) between individual field duplicate data pairs with detectable carbon tetrachloride and Freon 113, along with other statistical parameters, are shown in the table on the next page.

	STATISTICAL PARAMETERS - Field Duplicates			
	average RPD	standard deviation σ	variance σ^2	relative error $\sigma \div RPD$
Event 6: CCl_4	9.0 %	9.3×10^{-2}	8.7×10^{-3}	1.03
Event 7: CCl_4	6.3 %	7.3×10^{-2}	5.4×10^{-3}	1.17
Event 6: FR113	8.0 %	7.2×10^{-2}	5.2×10^{-3}	0.90
Event 7: FR113	7.9 %	6.7×10^{-2}	4.5×10^{-3}	0.85

Average RPDs and other statistical parameters compare favorably with previous Event 4 and 5 precision data. With average RPDs consistently below 10 percent, there is very good general agreement between duplicate pairs and good consistency between sampling events. This suggests that a reproducibly consistent field sampling procedure is being properly implemented. But variability within the duplicate data set is relatively large (85 to 117 percent relative error). This variability arises from a number of cases in which the RPD was zero (equal sample concentrations), contrasted with instances where the absolute numerical difference was small but the average duplicate result was also very small. It is suspected that this variability is probably not introduced by the laboratory's analytical system, but by field collection technique design which varies the amount of vapor purged from a well as a function of sampling depth.

VII. SURROGATE RECOVERIES

During these sampling and on-site analysis events, 1,4-difluorobenzene, chlorobenzene, and 4-bromofluorobenzene were used as surrogates. The principal purpose of adding these surrogates is to monitor temporal drift in the chromatographic response from day to analytical day. The data are used to adjust RT windows and monitor absolute RT values for each analyte in order to precisely identify the compounds of interest. Calculating and assessing surrogate recovery percentages is also employed in assessing data accuracy and precision. A control range of 70 to 130 percent was applied. This is the RWQCB standard by which soil vapor data packages are to be judged. Both data packages satisfied this criterion by wide margins. Surrogate recoveries fell more typically within the 80 to 120 percent recovery range.

VIII. PERFORMANCE CRITERIA

The reporting limit was 1 μg/L vapor (1 ηg on-column) for all 25 target compounds. Statistical data to support and confirm this limit was not provided (nor required). The low standard used for calibrating the GC was equivalent to 2 μg/L. An examination of the baseline noise and instrument sensitivity shown in the chromatograms provided in this data package indicates that setting the reporting limit at 1 ηg on-column (equivalent to 1 μg/L-vapor) was justified.

IX. SUMMARY OF FINDINGS AND RECOMMENDATIONS

A. The following general comments are offered relative to these data packages:

1. The terminology used by the laboratory when referring to working standards and data calculation factors should be consistent and conform to SW-846 Method 8000B ("Determinative Chromatographic Separations"). The appropriate units of measurement should be recorded next to all data or included as a footnote.

2. System blanks should occasionally be run immediately after samples with high analyte concentrations (e.g., greater than 200 μg/L) to demonstrate that no analyte carry-over is occurring and the system is free of false positive signals.

3. "QA/QC Calibration Data" summary tables must include all organic compounds that have been detected on site. Carbon tetrachloride should be added to the lab's standard mix for preparing calibration verification and QC check standards.

4. Unidentified peaks are seen occasionally on the chromatograms. However, these unknown peaks are not listed in the data summary tables as called for in the RWQCB reporting requirements. There are peaks labeled "unknown" on the chromatograms, but none of the peaks that were listed on the chromatograms were thought to represent halogenated solvent compounds. All of the peaks listed as "unknown" were due to one of the following reasons:

   - They are due to interferences from oxygen and water vapor in clean outside air.
   - They were introduced by the surrogate mix.

   In the professional judgement of the laboratory analyst and the data reviewer at TEG, none of the unknown peaks listed on the chromatograms represent actual compounds in the soil vapor samples, and, thus, were not reported. Detailed discussion for this interpretation follows.

   Unknowns due to Interferences from Oxygen and Water Vapor in Clean Outside Air

   The PID and ElCD (Hall) detector responces are subject to interferences from the oxygen and water vapor normal found in air. This phenomenon is apparent in the blank sample results for all the sampling events. These interfering peaks (on the PID, it is typically a drop in signal rather than a peak) occur early in the analytical run (less than 5 minutes), and often before four minutes. They do not overlap the four early-eluting gaseous chlorinated compounds on the RWQCB list; therefore, they show up on the chromatogram as "unknowns". There are not fugitive compounds and should not be considered as potential compounds of concern.

One Unknown on the PID - Sampling Events 6 and 7

There was one unknown peak observed on the PID at 14.6 to 14.8 minutes during Events 6 and 7. The peak was not observed on the ElCD (Hall) detector and does not match any of the expected VOC compounds based upon a VOC chromatogram library (Methods 8021 and 8260). Further, the magnitude of the unknown peak was about the same in every sample (as shown by the area counts). For these reasons, it was concluded that this peak represents an unknown, non-halogenated compound that is not a constituent of concern (COC) on the EPA's Volatile Organic Compound lists. Therefore, this unknown peak was not included in the final data report summaries.

B. The following data qualifications should be made when reporting these results:

On the high end of the initial calibration curve, any analyte whose concentration exceeded the highest calibration standard (100 µg/L) by more than 150 percent, should have been reanalyzed using a smaller aliquot so that the raw instrumental result fell within the working calibration range. This was not done consistently. The lab should not report extrapolated data results without qualification. Therefore, the following 10 results should be qualified J to indicate an estimated value:

Carbon Tetrachloride	VPSV 375-108, VPSV 421-85, VPSV 433-115, VPSV 441-105, VPSV 442-120, VPSV 443-120, VPSV 464-85, VPSV 465-105, VPSV466-120, VPSV 467-120.

TABLE 1

SUMMARY OF SOIL-VAPOR RESULTS – EVENT 6

(Concentrations in µg/L–vapor)

Soil Vapor Well Number	Depth (ft bgs)	Date	Sample Number	1,1-DCE	CCl_4	TCE	Freon 113	Other Analytes Detected
Event 6								
25	20	5/26/98	VPSV-418	ND	ND	ND	ND	
25	40	5/26/98	VPSV-419	ND	ND	ND	ND	
25	40	5/26/98	VPSV-420(DUP)	ND	ND	ND	ND	
25	60	NS	NS	P	P	P	P	
25	85	5/26/98	VPSV-421	1.7	162 J	ND	31	
25	100	5/26/98	VPSV-422	ND	206	ND	41	
25	120	5/27/98	VPSV-423	ND	239	ND	36	
25	145	5/27/98	VPSV-424	ND	284	ND	48	
25	165	5/27/98	VPSV-425	ND	122	ND	29	
25	165	5/27/98	VPSV-426(DUP)	ND	109	ND	27	
25	180	NS	NS	W	W	W	W	
25	190	NS	NS	W	W	W	W	
26	20	5/27/98	VPSV-427	ND	ND	ND	ND	
26	35	5/27/98	VPSV-428	ND	ND	ND	ND	
26	55	5/27/98	VPSV-429	2.3	ND	ND	ND	
26	80	5/27/98	VPSV-430	7.6	48	5.1	4.7	
26	100	5/27/98	VPSV-431	1.4	49	ND	ND	
26	100	5/27/98	VPSV-432(DUP)	1.5	60	ND	ND	
26	115	5/27/98	VPSV-433	3.2	235 J	1.4	6.8	
26	140	5/27/98	VPSV-434	2.1	119	ND	3	
26	160	5/28/98	VPSV-435	1.9	107	ND	3.7	
26	180	5/28/98	VPSV-436	2.1	112	1.5	2.6	
26	195	NS	NS	W	W	W	W	
27	20	5/26/98	VPSV-409	ND	ND	ND	ND	
27	35	NS	NS	W	W	W	W	
27	60	5/26/98	VPSV-410	ND	ND	ND	ND	
27	85	5/26/98	VPSV-411	ND	13	ND	18	
27	100	5/26/98	VPSV-412	ND	147	ND	31	
27	120	5/26/98	VPSV-413	ND	182	ND	49	
27	120	5/26/98	VPSV-414(DUP)	ND	187	ND	51	

TABLE 1

SUMMARY OF SOIL-VAPOR RESULTS – EVENT 6

(Concentrations in µg/L–vapor)

Soil Vapor Well Number	Depth (ft bgs)	Date	Sample Number	1,1-DCE	CCl_4	TCE	Freon 113	Other Analytes Detected
27	140	5/26/98	VPSV-415	ND	96	ND	43	
27	160	5/26/98	VPSV-416	ND	105	ND	51	
27	180	5/26/98	VPSV-417	ND	80	ND	48	
27	205	NS	NS	W	W	W	W	
28	20	5/28/98	VPSV-437	ND	ND	ND	ND	
28	20	5/28/98	VPSV-438(DUP)	ND	ND	ND	ND	
28	45	5/28/98	VPSV-439	ND	ND	ND	ND	
28	65	NS	NS	P	P	P	P	
28	80	5/28/98	VPSV-440	ND	132	ND	38	
28	105	5/28/98	VPSV-441	ND	245 J	ND	93	
28	120	5/28/98	VPSV-442	ND	367 J	ND	81	
28	120	5/28/98	VPSV-443(DUP)	ND	404 J	ND	79	
28	140	NS	NS	P	P	P	P	
28	160	NS	NS	P	P	P	P	
32	25	5/18/98	VPSV-330	ND	ND	ND	ND	
32	40	5/18/98	VPSV-331	ND	ND	ND	ND	
32	55	5/18/98	VPSV-332	ND	ND	ND	ND	
32	70	5/18/98	VPSV-333	ND	ND	ND	14	
32	90	5/18/98	VPSV-334	ND	7.5	ND	42	
32	90	5/18/98	VPSV-335(DUP)	ND	9.9	ND	50	
32	115	5/18/98	VPSV-336	ND	ND	ND	ND	
32	135	5/18/98	VPSV-337	ND	16	ND	90	
32	155	5/18/98	VPSV-338	ND	96	ND	115	
32	180	5/18/98	VPSV-339	ND	72	ND	67	46 1,2-Dichloroethane, 25 Dichloromethane
32	195	NS	NS	W	W	W	W	
33	20	5/19/98	VPSV-346	ND	ND	ND	ND	
33	20	5/19/98	VPSV-347(DUP)	ND	ND	ND	ND	
33	40	5/19/98	VPSV-348	9.6	39	1.7	6.7	
33	60	5/19/98	VPSV-349	9.8	120	3.7	2.5	
33	85	5/19/98	VPSV-350	3	80	1.1	1.5	

TABLE 1

SUMMARY OF SOIL-VAPOR RESULTS – EVENT 6

(Concentrations in µg/L–vapor)

Soil Vapor Well Number	Depth (ft bgs)	Date	Sample Number	1,1-DCE	CCl_4	TCE	Freon 113	Other Analytes Detected
33	105	5/19/98	VPSV-351	4	88	1.4	2.1	
33	120	5/19/98	VPSV-352	3.9	115	ND	6.1	
33	120	5/19/98	VPSV-353(DUP)	3.6	105	ND	6.2	
33	140	5/19/98	VPSV-354	3.2	85	ND	ND	
33	160	5/19/98	VPSV-355	3.5	76	ND	ND	
33	180	5/19/98	VPSV-356	1.8	28	ND	ND	
33	200	NS	NS	W	W	W	W	
34	20	5/20/98	VPSV-368	ND	ND	ND	ND	
34	35	5/20/98	VPSV-369	ND	1.7	ND	ND	
34	50	5/20/98	VPSV-370	ND	30	ND	5.5	
34	50	5/20/98	VPSV-371(DUP)	ND	30	ND	6.9	
34	65	5/20/98	VPSV-372	ND	87	ND	11	
34	80	5/20/98	VPSV-373	ND	26	ND	9.1	
34	95	5/20/98	VPSV-374	ND	74	ND	10	1.7 Chloroform
34	108	5/20/98	VPSV-375	ND	246 J	ND	57	1.6 Chloroform
34	118	5/20/98	VPSV-376	ND	227	ND	49	
34	118	5/20/98	VPSV-377(DUP)	ND	234	ND	45	
35	20	5/22/98	VPSV-397	ND	ND	ND	ND	
35	35	5/22/98	VPSV-398	ND	ND	ND	ND	
35	50	5/22/98	VPSV-399	ND	1.5	ND	ND	
35	60	5/22/98	VPSV-400	ND	12	ND	9.9	
35	60	5/22/98	VPSV-401(DUP)	ND	12	ND	11	
35	80	5/22/98	VPSV-402	ND	29	ND	16	
35	95	5/22/98	VPSV-403	ND	43	ND	17	
35	110	5/22/98	VPSV-404	ND	97	ND	20	
35	125	5/22/98	VPSV-405	ND	91	ND	20	
35	140	5/22/98	VPSV-406	ND	114	1.1	20	
35	140	5/22/98	VPSV-407(DUP)	ND	112	1.1	19	
35	155	5/22/98	VPSV-408	ND	48	1.3	19	
36	20	5/18/98	VPSV-340	ND	ND	ND	ND	
36	20	5/18/98	VPSV-341(DUP)	ND	ND	ND	ND	

TABLE 1

SUMMARY OF SOIL-VAPOR RESULTS – EVENT 6

(Concentrations in µg/L–vapor)

Soil Vapor Well Number	Depth (ft bgs)	Date	Sample Number	1,1-DCE	CCl_4	TCE	Freon 113	Other Analytes Detected
36	35	5/18/98	VPSV-342	ND	15	ND	6.5	
36	55	5/18/98	VPSV-343	ND	11	ND	2	
36	75	5/18/98	VPSV-344	ND	12	ND	3.2	1.8 Chloroform
36	92	5/18/98	VPSV-345	ND	19	ND	6	4.4 Chloroform
37	25	5/19/98	VPSV-357	ND	3.1	ND	ND	
37	40	5/19/98	VPSV-358	ND	8.7	ND	1.8	
37	40	5/19/98	VPSV-359(DUP)	ND	7.4	ND	1.6	
37	60	5/19/98	VPSV-360	ND	2.8	ND	4	
37	80	5/19/98	VPSV-361	ND	24	1.2	6	
37	100	5/20/98	VPSV-362	ND	49	3	18	
37	120	5/20/98	VPSV-363	ND	32	3.6	17	1.1 Chloroform, 1.6 Fluorotrichloromethane
37	140	5/20/98	VPSV-364	ND	45	3.4	24	1.2 Chloroform, 1.3 Fluorotrichloromethane
37	140	5/20/98	VPSV-365(DUP)	ND	43	2.8	24	1.1 Chloroform, 1.2 Fluorotrichloromethane
37	155	5/20/98	VPSV-366	ND	42	2.6	9.4	
37	170	5/20/98	VPSV-367	ND	21	1.8	ND	
37	185	NS	NS	W	W	W	W	
38	25	5/21/98	VPSV-387	ND	7.1	ND	7.9	
38	45	5/21/98	VPSV-388	ND	19	1.9	23	
38	45	5/21/98	VPSV-389(DUP)	ND	19	1.8	23	
38	65	5/21/98	VPSV-390	ND	16	2.5	30	
38	80	5/21/98	VPSV-391	ND	15	1.9	33	1.3 Fluorotrichloromethane
38	95	NS	NS	W	W	W	W	
38	110	5/21/98	VPSV-392	ND	3.5	1.1	3	
38	125	5/21/98	VPSV-393	ND	22	2.1	38	
38	140	5/22/98	VPSV-394	ND	22	2.4	36	
38	140	5/22/98	VPSV-395(DUP)	ND	17	2	30	
38	155	5/22/98	VPSV-396	ND	17	2.1	32	
38	170	NS	NS	W	W	W	W	

TABLE 1

SUMMARY OF SOIL-VAPOR RESULTS – EVENT 6

(Concentrations in µg/L–vapor)

Soil Vapor Well Number	Depth (ft bgs)	Date	Sample Number	1,1-DCE	CCl_4	TCE	Freon 113	Other Analytes Detected
39	20	5/21/98	VPSV-378	ND	ND	ND	ND	
39	35	5/21/98	VPSV-379	ND	ND	ND	ND	
39	50	5/21/98	VPSV-380	ND	ND	ND	ND	
39	70	5/21/98	VPSV-381	ND	ND	ND	ND	
39	85	5/21/98	VPSV-382	ND	7.6	2.2	35	
39	85	5/21/98	VPSV-383(DUP)	ND	7.9	2.1	36	
39	100	5/21/98	VPSV-384	ND	9.1	3.8	18	
39	110	5/21/98	VPSV-385	ND	8.1	5.4	11	
39	120	5/21/98	VPSV-386	ND	2.7	19	7.5	
39	130	5/21/98	NS	W	W	W	W	

Notes:

bgs - Below ground surface.
DUP - Duplicate samples.
J - Estimated concentration.
ND - Not detected.
NS - Not sampled.
P - Sampling port plugged.
W - Sampling port inundated with water.

TABLE 2

SUMMARY OF SOIL-VAPOR RESULTS – EVENT 7

(Concentrations in µg/L–vapor)

Soil Vapor Well Number	Depth (ft bgs)	Date	Sample Number	1,1-DCE	CCl_4	TCE	Freon 113	Other Analytes Detected
Event 7								
32	25	6/15/98	VPSV-444	ND	ND	ND	ND	
32	40	6/15/98	VPSV-445	ND	ND	ND	ND	
32	55	6/15/98	VPSV-446	ND	ND	ND	14	
32	70	6/15/98	VPSV-447	ND	ND	ND	13	
32	90	6/15/98	VPSV-448	ND	4.6	ND	35	
32	90	6/15/98	VPSV-449(DUP)	ND	5	ND	35	
32	115	6/15/98	VPSV-450	ND	ND	ND	6.8	
32	135	6/15/98	VPSV-451	ND	18	ND	112	
32	155	6/15/98	VPSV-452	ND	66	1.9	101	
32	180	6/15/98	VPSV-453	ND	136	3.4	109	
32	195	NS	NS	W	W	W	W	
33	20	6/16/98	VPSV-460	ND	ND	ND	ND	
33	20	6/16/98	VPSV-461(DUP)	ND	ND	ND	ND	
33	40	6/16/98	VPSV-462	20	43	5.2	24	
33	60	6/16/98	VPSV-463	14	111	4.3	3	
33	85	6/16/98	VPSV-464	8.6	181 J	2.6	3.4	
33	105	6/16/98	VPSV-465	7.7	195 J	2.5	3.3	
33	120	6/16/98	VPSV-466	6.1	165 J	1	4.6	
33	120	6/16/98	VPSV-467(DUP)	6.2	165 J	1.1	4.4	
33	140	6/16/98	VPSV-468	11	126	ND	ND	
33	160	6/16/98	VPSV-469	9.6	53	ND	ND	
33	180	6/16/98	VPSV-470	7.4	47	ND	ND	
33	200	NS	NS	W	W	W	W	
34	20	6/17/98	VPSV-482	ND	ND	ND	ND	
34	35	6/17/98	VPSV-483	ND	ND	ND	ND	
34	50	6/17/98	VPSV-484	ND	4.9	ND	ND	
34	50	6/17/98	VPSV-485(DUP)	ND	4.9	ND	ND	
34	65	6/17/98	VPSV-486	ND	9.5	ND	ND	
34	80	6/17/98	VPSV-487	ND	7.1	ND	2	
34	95	6/17/98	VPSV-488	ND	61	ND	10	1.8 Chloroform
34	108	6/17/98	VPSV-489	ND	195	ND	43	

TABLE 2

SUMMARY OF SOIL-VAPOR RESULTS – EVENT 7

(Concentrations in µg/L–vapor)

Soil Vapor Well Number	Depth (ft bgs)	Date	Sample Number	1,1-DCE	CCl_4	TCE	Freon 113	Other Analytes Detected
34	118	6/17/98	VPSV-490	ND	235	ND	42	
34	118	6/17/98	VPSV-491(DUP)	ND	257	ND	43	
35	20	6/19/98	VPSV-511	ND	ND	ND	ND	
35	35	6/19/98	VPSV-512	ND	ND	ND	ND	
35	50	6/19/98	VPSV-513	ND	ND	ND	ND	
35	60	6/19/98	VPSV-514	ND	5	ND	3.7	
35	60	6/19/98	VPSV-515(DUP)	ND	6.5	ND	4.7	
35	80	6/19/98	VPSV-516	ND	23	ND	21	
35	95	6/19/98	VPSV-517	ND	42	ND	21	
35	110	6/19/98	VPSV-518	ND	86	ND	23	
35	125	6/19/98	VPSV-519	ND	83	ND	26	
35	140	6/19/98	VPSV-520	ND	104	ND	21	
35	140	6/19/98	VPSV-521(DUP)	ND	106	ND	24	
35	155	6/19/98	VPSV-522	ND	28	4.8	33	
36	20	6/15/98	VPSV-454	ND	ND	ND	ND	
36	20	6/15/98	VPSV-455(DUP)	ND	ND	ND	ND	
36	35	6/15/98	VPSV-456	ND	15	ND	12	
36	55	6/15/98	VPSV-457	ND	24	ND	12	2.0 Chloroform
36	75	6/15/98	VPSV-458	ND	30	ND	15	6.6 Chloroform
36	92	6/15/98	VPSV-459	ND	28	ND	14	6.9 Chloroform
37	25	6/16/98	VPSV-471	ND	2.4	ND	ND	
37	40	6/16/98	VPSV-472	ND	35	2.1	33	
37	40	6/16/98	VPSV-473(DUP)	ND	39	1.8	36	
37	60	6/16/98	VPSV-474	ND	73	1.7	15	
37	80	6/16/98	VPSV-475	ND	71	3.2	24	
37	100	6/17/98	VPSV-476	ND	36	5.5	25	
37	120	6/17/98	VPSV-477	ND	30	4.5	20	1.2 Chloroform. 1.5 Fluorotrichloromethane
37	140	6/17/98	VPSV-478	ND	42	4.7	25	1.3 Chloroform. 2.3 Fluorotrichloromethane
37	140	6/17/98	VPSV-479(DUP)	ND	41	5.2	24	1.4 Chloroform. 2.1 Fluorotrichloromethane
37	155	6/17/98	VPSV-480	ND	31	2.5	19	

TABLE 2

SUMMARY OF SOIL-VAPOR RESULTS – EVENT 7

(Concentrations in µg/L–vapor)

Soil Vapor Well Number	Depth (ft bgs)	Date	Sample Number	1,1-DCE	CCl_4	TCE	Freon 113	Other Analytes Detected
37	170	6/17/98	VPSV-481	ND	22	2.7	19	
37	185	NS	NS	W	W	W	W	
38	25	6/18/98	VPSV-501	ND	2.9	ND	1.5	
38	45	6/18/98	VPSV-502	ND	12	1.6	11	
38	45	6/18/98	VPSV-503(DUP)	ND	12	1.6	12	
38	65	6/18/98	VPSV-504	ND	12	1.9	22	1.3 Fluorotrichloromethane
38	80	6/18/98	VPSV-505	ND	8.4	1.3	21	1.0 Fluorotrichloromethane
38	95	NS	NS	W	W	W	W	
38	110	6/18/98	VPSV-506	ND	3	1.2	3.4	
38	125	6/18/98	VPSV-507	ND	11	1.6	17	1.4 Fluorotrichloromethane
38	140	6/19/98	VPSV-508	ND	17	2.1	37	
38	140	6/19/98	VPSV-509(DUP)	ND	16	2.1	34	
38	155	6/19/98	VPSV-510	ND	20	2.8	38	
38	170	NS	NS	W	W	W	W	
39	20	6/18/98	VPSV-492	ND	ND	ND	ND	
39	35	6/18/98	VPSV-493	ND	ND	ND	ND	
39	50	6/18/98	VPSV-494	ND	ND	ND	ND	
39	70	6/18/98	VPSV-495	ND	ND	ND	ND	
39	85	6/18/98	VPSV-496	ND	7.6	2	37	
39	85	6/18/98	VPSV-497(DUP)	ND	7.2	1.9	35	
39	100	6/18/98	VPSV-498	ND	11	6.2	21	
39	110	6/18/98	VPSV-499	ND	8.2	4.1	12	
39	120	6/18/98	VPSV-500	ND	2.2	8.2	8.7	
39	130	NS	NS	W	W	W	W	

Notes:

bgs - Below ground surface.
DUP - Duplicate samples.
J - Estimated concentration.
ND - Not detected.
NS - Not sampled.
W - Sampling port inundated with water.

APPENDIX H

LETTER FROM FOSTER WHEELER ENVIRONMENTAL CORPORATION TO JET PROPULSION LABORATORY DATED NOVEMBER 16, 1998

FOSTER WHEELER ENVIRONMENTAL CORPORATION

November 16, 1998

Mr. Chuck Buril
Jet Propulsion Laboratory
Environmental Affairs Office
Mail Stop 171-225
4800 Oak Grove Drive
Pasadena, California 91109

Subject: JPL OU2 Human Health Risk Assessment Approach and Methodology

Dear Mr. Buril,

Enclosed is a summary of the topics discussed with the California Department of Toxics and Substance Control (DTSC) and EPA Region IX concerning the human health risk assessment methodology and approach for Operable Unit 2 (OU2), On-Site Soil, at JPL.

Separate phone calls took place with Mark Ripperda and Dan Stralka of the Region IX EPA on 10/22/98 and 10/28/98, respectively. A conference call with Richard Gebert and Yugal Luthra of DTSC took place on 11/10/98. In these conversations we discussed the approach and methodology to be used in the human health risk assessment for OU2. Major topics of discussion included the use of soil and soil vapor data to assess exposure pathways and the application of screening levels derived from EPA Region IX Preliminary Remediation Goals (PRGs) and DTSC guidance. Additional topics included the selection of chemicals of concern, background geochemistry and metals in soil, and the calculation of location-specific risk at seepage pits, waste pits, and discharge points within the operable unit.

If you have any questions or comments related to the risk assessment portion of the OU2 remedial investigation report, please contact me at (303) 980-3506 or Carol Bieniulis at (303) 980-3526. Thank you.

Sincerely Yours,
FOSTER WHEELER
ENVIRONMENTAL CORPORATION

Samantha Hulme

Samantha Hulme
Project Risk Assessor

Attachment

143 UNION BOULEVARD, SUITE 1010, LAKEWOOD, CO 80228-1824
TEL: 303-988-2202 FAX: 303-980-3539

cc: B.G. Randolph/Costa Mesa
Tom Blaney/Costa Mesa
Gary Drendel/Denver
Carol Bieniulis/Denver
Mark Ripperda/EPA Region IX
Dan Stralka/EPA Region IX
Richard Gebert/California DTSC
Yugal Luthra/California DTSC

TO: Distribution DATE: November 17, 1998

FROM: Samantha Hulme–Foster Wheeler, Denver, CO

SUBJECT: Conference Call on November 10, 1996 Regarding the JPL OU2 Human Health Risk Assessment

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A conference call was held on November 10, 1998 to discuss the JPL OU2 human health risk assessment methodology. The purpose of the call was to obtain California Department of Toxics and Substance Control (DTSC) comments and suggestions on the proposed risk assessment methodology. Participants in the conference call included:

Richard Gebert	JPL RPM	DTSC	(818) 551-2859
Yugal Luthra	Program Toxicologist	DTSC	(916) 327-2512
Samantha Hulme	Project Risk Assessor	Foster Wheeler	(303) 980-3506
Gary Drendel	Risk Assessment Lead	Foster Wheeler	(303) 980-3546
Carol Bieniulis	Fate and Transport Lead/Risk Assessment Coordinator	Foster Wheeler	(303) 980-3526

The following items were discussed and agreed upon:

I. Chemicals of Concern (COCs) will be based on an Initial Screening Level Evaluation and Background Comparison
   A. Initial Screening Level Evaluation
      1. Soil Screening
         a) All chemicals detected in the first 30 feet of soil considered Chemicals of Potential Concern (COPCs)
         b) Compare maximum concentrations in soil to residential soil screening levels
      2. Soil Vapor Screening
         a) All chemicals detected in the first 30 feet of soil considered COPCs
         b) Quantitative exposure will be based on most recent sampling results (i.e. 1998)
         c) Data collected prior to 1998 will be included qualitatively in the risk assessment
         d) Compare maximum concentrations in soil vapor with ambient air screening levels and convert soil vapor concentrations to total soil concentration and compare to residential soil screening levels in consideration of all exposure pathways
      3. Screening levels determined by following the *Preliminary Endangerment Assessment Guidance Manual* (DTSC, 1994)

4. EPA Region IX PRGs will also be presented in the risk assessment for comparison
5. The screening level should be the most protective of human health will be used whether it is a DTSC calculated value or EPA PRG

B. Background Comparison
1. Completed for inorganics only
2. Comparison will be conducted following DTSC guidelines (provided by Yugal Luthra) or similar guidance as appropriate

II. Exposure Assessment
A. Based on geographical distribution of resulting COPCs, risk assessment will focus on specific areas such as seepage pits, waste pits, and discharge points
B. All potential receptors for which a complete exposure pathway exists will be presented in the risk assessment; rationale will be provided if any pathways are not quantitatively considered
1. Industrial receptors
a) Office worker
(1) Inhalation pathway (i.e., on-site fugitive dust and volatilization into indoor air)
(2) Maximum detection in first 15 feet of soil used as exposure point concentration
b) Construction worker
(1) Inhalation pathway (i.e., on-site fugitive dust and volatilization into ambient air)
(2) Ingestion pathway
(3) Dermal contact pathway
(4) Maximum detection in first 15 feet of soil used as exposure point concentration
2. Residential receptors
a) Off-site resident
(1) Qualitatively addressed; risk calculations for on-site receptors will be more conservative
b) On-site resident
(1) Anticipate qualitative assessment; need to confirm whether permit restrictions or site conditions exist that would preclude future residents on site
C. Exposure point concentration and exposure parameters based on the *Preliminary Endangerment Assessment Guidance Manual* (DTSC 1994)
D. Consider vapor modeling when handling the potential for inhalation in buildings without an adequate air circulation system
1. Information provided by Dan Stralka indicates the soil vapor samples were collected to locate source areas in soil and that high concentrations at depth are associated with contaminated groundwater contamination at JPL. He also stated that since the elevated detections of VOCs are primarily at depths greater than what would ordinarily be considered in a risk

assessment that vapor emission modeling was not warranted, and a risk assessment is not necessary for the indoor air pathway. Rationale for defining the inhalation pathway as incomplete will be presented

2. Qualitatively evaluate soil vapor data collected prior to 1998 to support the exposure assessment

III. Other considerations

A. Arsenic

1. Detected across the site at concentrations greater than EPA Region IX PRGs
2. Could be attributable to naturally-elevated arsenic minerals in weathered materials sourced from the San Gabriel mountains

B. Chromium IV (Cr^{+6})

1. Consider ratios of Cr^{+6} to total Chromium in soil samples
2. Cr^{+6} detected at one location (B-29) near Discharge Point 2
3. Address Cr^{+6} as location-specific risk
4. Discuss why Cr^{+6} was not detected in other samples (maybe include in Section 4, nature and extent, and Section 5, fate and transport)

IV. Toxicity information for each COC will be evaluated based on the following hierarchy:

A. California Office of Environmental Health Hazard Assessment Cancer Potency Factors

B. EPA's Integrated Risk Information System (IRIS)

C. EPA's Health Effects Assessment Summary Tables (HEAST)

D. Consultation with the Superfund Health Risk Technical Support Center (if applicable)

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APPENDIX I

METHODOLOGY FOR DERIVING PRELIMINARY REMEDIATION GOALS

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LIST OF ACRONYMS

COEHHA	California Office of Environmental Health Hazard Assessment
CSF	Cancer slope factor
CSF_i	Inhalation cancer slope factor
CSF_o	Oral cancer slope factor
DTSC	California Department of Toxic Substances Control
PEA	Preliminary endangerment assessment
PEF	Particulate emission factor
PM_{10}	Particulate matter less than 10 microns
PRG	Preliminary remediation goal
RfD	Non-cancer reference dose
RfD	Non-carcinogenic reference dose
RfD_i	Non-cancer inhalation reference dose
RfD_o	Non-cancer oral reference dose
EPA	U.S. Environmental Protection Agency
VF	Volatilization factor

1.0 INTRODUCTION

Explained in this appendix is the methodology used to derive preliminary remediation goals (PRGs) for use in the baseline risk assessment. Preliminary remediation goals were derived in accordance with the California Department of Toxic Substances Control's (DTSC) *Preliminary Endangerment Assessment* (PEA) *Guidance Manual* (DTSC, 1994) and United States Environmental Protection Agency (EPA) *Risk Assessment Guidance for Superfund* (EPA, 1989). PRGs were derived using the residential human receptor exposure parameters listed in Table I-1. Chemical-specific toxicity values used in developing the PRGs are shown in Tables I-2 and I-3. Potential exposure through direct ingestion of, dermal contact with, and inhalation of site-related soils was evaluated for residential land use.

1.1 TOXICITY VALUES

Toxicity values, chronic non-carcinogenic reference doses (RfDs) and carcinogenic slope factors (CSFs) were obtained from the California Office of Environmental Health Hazard Assessment (COEHHA, 1994), the Integrated Risk Information System (EPA, 1998a), and the Health Effects Assessment Summary Tables (EPA, 1997).

When no toxicity values were available for a given route of exposure, EPA Region IX's route-to-route extrapolations were used (EPA, 1998b). Oral cancer slope factors (CSF_o) and oral reference doses (RfD_o) were used for both oral and inhaled exposures for organic compounds lacking inhalation values. Inhalation cancer slope factors (CSF_i) and inhalation reference doses (RfD_i) were used for both inhaled and oral exposures for organic compounds lacking oral values. Oral toxicity values were used for evaluating dermal exposure (DTSC, 1994).

1.2 DERMAL ABSORPTION FRACTIONS

Screening level chemical-specific dermal absorption fractions for contaminants in soil and dust are shown in Table I-4 as recommended by DTSC (1994).

1.3 INHALATION OF VOLATILES AND FUGITIVE DUSTS

Soil PRGs have been developed to incorporate the inhalation pathway, as well as ingestion and dermal-contact pathways. To relate on-site soil-contaminant concentrations to air-contaminant concentrations that may be inhaled, the PRG calculations incorporate volatilization factors (VF) for volatile organic compounds and particulate emission factors (PEF) for nonvolatile organic compounds.

1.3.1 Volatilization Factor for Soils

Volatile organic compounds are defined as those chemicals having a Henry's Law constant greater than 10^{-5} atmospheres per cubic meter per mole and a vapor pressure of 0.001 millimeters of mercury or higher (DTSC, 1994). This screening considered acetone, bromodichloromethane, carbon tetrachloride, chloroform, methylene chloride, and trichlorotrifluoroethane (Freon 113) as volatile organic compounds. Specific VFs are given in Table I-5.

1.3.2 Particulate Emission Factor for Soils

Inhalation of chemicals adsorbed to respirable particles (PM_{10}) were assessed using a default PEF equal to 1.316×10^9 cubic meters per kilogram (Cowherd and others, 1985). This variable relates the contaminant concentration in soil with the concentration of respirable particles in the air as the result of fugitive dust emissions from contaminated soils.

1.4 EXPOSURE FACTORS

Default exposure factors were obtained primarily from the PEA manual (DTSC, 1994) and from *Supplemental Guidance: Standard Default Exposure Factors* (EPA, 1991). Because contact rates may be different for children and adults, carcinogenic risks were calculated for children to age 6 and adults from age 7 to 30. This approach approximates the integrated exposure from birth until age 30. Non-carcinogenic contaminants were evaluated for children only. The focus on children is considered protective of the higher daily intake rates of soil by children and their lower body weight.

1.5 PRG EQUATIONS

The equations used to calculate the PRGs for carcinogenic and non-carcinogenic chemicals are presented in Equations I-1 through I-4. The equations are based on DTSC equations contained in the PEA manual (DTSC, 1994) with the addition of the inhalation pathway. The methodology back-calculates a soil-concentration level that corresponds to a target risk of 1×10^{-6} for carcinogens or a hazard quotient of 1 for non-carcinogens.

1.6 DETERMINING THE APPROPRIATE PRG

PRGs were derived using available carcinogenic and non-carcinogenic toxicity values. Forexample, chronic RfDs and CSFs have been developed for bis(2-ethylhexyl)phthalate; therefore, two PRGs were derived for bis(2-ethylhexyl)phthalate—one reflecting its carcinogenic toxicity and one reflecting its non-carcinogenic toxicity. In cases where two PRGs were derived, the lower, more conservative PRG was used for the screening level comparison. The derived PRGs are shown in Table I-6.

Also shown in Table I-6 are the EPA Region IX PRGs (EPA, 1998b). The Region IX PRGs derived for butylbenzylphthalate and trichlorotrifluoroethane are set equal to the calculated soil saturation limit (EPA, 1998b). Soil saturation corresponds to the contaminant concentration in soil at which the adsorptive limits of the soil particles and the solubility limits of the available soil moisture have been reached. Above this point, pure liquid-phase contaminant is expected in soil. When the derived PRG is greater than the soil saturation limit, EPA Region IX sets the PRG equal to the soil saturation limit.

The two sets of PRGs were compared; the lower, more conservative PRG was used in the screening level comparison.

2.0 REFERENCES

COEHHA (California Office of Environmental Health Hazard Assessment). 1994. *California Cancer Potency Factors: Update,* November.

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EQUATIONS

EQUATION I-1

ESTINATED RISK IN SOILS

$$\text{Risk} = \left[CSF_o \times C_s \times \left(\frac{IRS_a \times EF \times ED_a \times 10^{-6} \frac{kg}{mg}}{BW_a \times AT_c \times 365 \frac{days}{year}} \right) \right] + \left[CSF_o \times C_s \times \left(\frac{IRS_c \times EF \times ED_c \times 10^{-6} \frac{kg}{mg}}{BW_c \times AT_c \times 365 \frac{days}{year}} \right) \right] + \left[CSF_o \times C_s \times \left(\frac{SA_a \times AF \times ABS \times EF_a \times ED_a \times 10^{-6} \frac{kg}{mg}}{BW_a \times AT_c \times 365 \frac{days}{year}} \right) \right] +$$

$$\left[CSF_o \times C_s \times \left(\frac{SA_c \times AF \times ABS \times EF_c \times ED_c \times 10^{-6} \frac{kg}{mg}}{BW_c \times AT_c \times 365 \frac{days}{year}} \right) \right] + \left[CSF_i \times C_s \times \left(\frac{ED_a \times EF_a \times IRA_a}{BW_a \times VF \times AT_c \times 365 \frac{days}{year}} \right) + CSF_i \times C_s \times \left(\frac{ED_c \times EF_c \times IRA_c}{BW_c \times VF \times AT_c \times 365 \frac{days}{year}} \right) \right]$$

EQUATION I-2

PRELIMINARY REMEDIATION GOALS FOR CARCINOGENIC CPOCs

$$C_s = \left(\frac{Risk \times AT_c \times 365 \frac{days}{year}}{\left[CSF_o \times 10^{-6} \frac{kg}{mg} \times \left[\left(\frac{IRS_a \times ED_a \times EF}{BW_a} \right) + \left(\frac{IRS_c \times ED_c \times EF}{BW_c} \right) + \left(\frac{SA_a \times AF \times ABS \times EF_a \times ED_a}{BW_a} \right) + \left(\frac{SA_c \times AF \times ABS \times EF_c \times ED_c}{BW_c} \right) \right] \right] + \left[CSF_i \times \left[\left(\frac{ED_a \times EF_a \times IRA_a}{BW_a \times VF} \right) + \left(\frac{ED_c \times EF_c \times IRA_c}{BW_c \times VF} \right) \right] \right]} \right)$$

EQUATION I-3

ESTINATION OF HAZARD IN SOILS

$$\text{Hazard} = \left((1/RfD_o) \times C_s \times \frac{IRS_c \times EF_c \times ED_c \times 10^{-6} \frac{kg}{mg}}{BW_c \times AT_n \times 365 \frac{days}{year}} \right) + \left((1/RfD_o) \times C_s \times \frac{SA_c \times AF \times ABS \times EF_c \times ED_c \times 10^{-6} \frac{kg}{mg}}{BW_c \times AT_n \times 365 \frac{days}{year}} \right) + \left(\frac{(1/RfD_i) \times C_s \times IRA_c}{BW_c \times VF} \right)$$

EQUATION I-4

PRELIMINARY REMEDIATION GOALS FOR NONCARCINOGENIC COPCs

$$C_s = \frac{\text{Hazard} \times BW_c \times AT_n \times 365 \frac{\text{days}}{\text{year}}}{EF_c \times ED_c \times \left[\left(\frac{IRS_c \times 10^{-6} \frac{kg}{mg}}{RfD_o} \right) + \left(\frac{SA_c \times AF \times ABS_c \times 10^{-6} \frac{kg}{mg}}{RfD_o} \right) + \left(\frac{IRA_c}{RfD_i \times VF} \right) \right]}$$

ABS	=	absorption fraction of chemical from soil
AF	=	soil to skin adherence factor
AT_c	=	averaging time for carcinogens
AT_n	=	averaging time for noncarcinogens
BW_a	=	body weight for adults
BW_c	=	body weight for children
C_s	=	chemical concentration in soil corresponding to the PRG
CSF_i	=	inhalation cancer slope factor
CSF_o	=	oral cancer slope factor
days/year	=	days per year
ED_a	=	exposure duration for dermal contact for adults
ED_c	=	exposure duration for dermal contact for children
EF	=	exposure frequency for soil ingestion
EF_a	=	exposure frequency for dermal contact for adults
EF_c	=	exposure frequency for dermal contact for children
Hazard	=	target hazard quotient
IRA_a	=	incidental soil inhalation rate for adults
IRA_c	=	incidental soil inhalation rate for children
IRS_a	=	incidental soil ingestion rate for adults
IRS_c	=	incidental soil ingestion rate for children
kg/mg	=	kilograms per milligram
RfD_i	=	reference dose for the inhalation pathway
RfD_o	=	reference does for the oral pathway
Risk	=	target risk level
SA_a	=	skin surface area exposed for adults
SA_c	=	skin surface area exposed for children
VF	=	volatilization factor used for volatile chemicals; particulate emission factor used for nonvolatile chemicals

TABLES

TABLE I-1

EXPOSURE PARAMETERS USED TO DERIVE PRELIMINARY REMEDIATION GOALS

Parameter	Definition (units)	Value	Reference
ABS	Skin absorption (unitless)	See Table I-4	
AF	Adherence factor (mg/cm^2)	1	EPA,1992
AT_c	Averaging time-carcinogens (years)	70	DTSC, 1994
AT_n	Averaging time-noncarcinogens (years)	6	DTSC, 1994
BW_a	Body weight, adult (kg)	70	EPA, 1991
BW_c	Body weight, child (kg)	15	EPA, 1991
C_s	Chemical concentration in soil corresponding to the PRG	See Table I-6	
ED_a	Exposure duration-adult (years)	24	DTSC, 1994
ED_c	Exposure duration-child (years)	6	DTSC, 1994
EF	Exposure frequency for soil ingestion (d/y)	350	EPA, 1991
EF_a	Exposure frequency for demal contact-adult (d/y)	100	EPA, 1991
EF_c	Exposure frequency for demal contact-child (d/y)	350	EPA, 1991
Hazard	Target hazard quotient	1	
IRA_a	Inhalation rate-adult (m^3/day)	20	EPA, 1991
IRA_c	Inhalation rate-child (m^3/day)	10	EPA, 1989
IRS_a	Soil ingestion-adult (mg/day)	100	EPA, 1991
IRS_c	Soil ingestion-child (mg/day)	200	EPA, 1991
PEF	Particulate emission factor (m^3/kg)	1.32E+09	Cowherd and others, 1985
RfD_i	Inhalation reference dose (mg/kg-day)	See Table I-3	
RfD_o	Oral reference dose (mg/kg-day)	See Table I-3	
Risk	Target cancer risk (unitless)	1.00E-06	
SA_a	Skin surface area exposed--adult (cm^2/day)	5,800	DTSC, 1992
SA_c	Skin surface area exposed--child (cm^2/day)	2,000	DTSC, 1992
CSF_i	Inhalation cancer slope factor (mg/kg-day)$^{-1}$	See Table I-2	
CSF_o	Oral cancer slope factor (mg/kg-day)$^{-1}$	See Table I-2	
VF	Volatilization factor (m^3/kg)	chemical-specific	EPA, 1998b

Notes:

kg	=	kilogram.
cm^2/day	=	square centimeters per day.
d/y	=	days per year.
m^3/day	=	cubic meters per day.
m^3/kg	=	cubic meters per kilogram.
mg/cm^2	=	milligrams per square centimeter.
mg/day	=	milligrams per day.
mg/kg-day	=	milligrams per kilogram per day.

References: Cowherd and others, 1985; DTSC, 1992 and 1994; EPA, 1989, 1991, 1992, and 1998b.

TABLE I-2

TOXICITY VALUES USED TO DERIVE CARCINOGENIC PRELIMINARY REMEDIATION GOALS

Constituent of Potential Concern	Oral Slope Factor (mg/kg-day)-1	Oral Slope Factor Source [a]	Inhalation Slope Factor (mg/kg-day)-1	Inhalation Slope Factor Source [a]
Acetone	--		--	
Antimony	--		--	
Arochlor-1232 [b]	2.0E-00		2.0E-00	
Arochlor-1254 [b]	2.0E-00		2.0E-00	
Arochlor-1260 [b]	2.0E-00		2.0E-00	
Arsenic	1.5E-00	EPA, 1998a	1.2E+01	
Barium	--		--	
Benzo(a)anthracene [c]	1.2E-00		3.9E-01	
Benzo(a)pyrene	1.2E+01		3.9E-00	
Benzo(b)fluoranthene [c]	1.2E-00		3.9E-01	
Benzo(g,h,i)perylene	--		--	
Beryllium	--		8.4E-00	EPA, 1998a
Bis(2-ethylhexyl)phthalate	8.4E-03		8.4E-03	
Bromodichloromethane	1.3E-01		1.3E-01	
Butylbenzyl phthalate	--		--	
Cadmium	--		1.5E+01	
Carbon tetrachloride	1.5E-01		1.5E-01	
Chloroform	3.1E-02		1.9E-02	
Chromium [d]	--		4.2E+01	EPA, 1998a
Chromium (VI)	4.2E-01		5.1E+02	
Chrysene	1.2E-01		3.9E-02	
Cobalt	--		--	
Copper	--		--	
Cyanide	--		--	
Di-n-butylphthalate	--		--	
Fluoranthene	--		--	
Indeno(1,2,3-cd)pyrene [c]	1.2E-00		3.9E-01	
Lead	--		--	
Mercury	--		--	
Methylene chloride	1.4E-02		3.5E-03	

TABLE I-2

TOXICITY VALUES USED TO DERIVE CARCINOGENIC PRELIMINARY REMEDIATION GOALS

Constituent of Potential Concern	Oral Slope Factor (mg/kg-day)-1	Oral Slope Factor Source [a]	Inhalation Slope Factor (mg/kg-day)-1	Inhalation Slope Factor Source [a]
Molybdenum	--		--	
Nickel	--		9.1E-01	
1,2,3,4,6,7,8,9-OCDD [e]	1.3E+01		1.3E+01	
Phenanthrene	--		--	
Pyrene	--		--	
Silver	--		--	
Strontium	--		--	
Thallium	--		--	
Trichlorotrifluoroethane	--		--	
Tributyltin [f]	--		--	
Vanadium	--		--	
Zinc	--		--	

Notes:

(a) Unless otherwise noted: California Office of Environmental Health Hazard Assessment (COEHHA, 1994).
(b) Based on toxicity of polychlorinated biphenyls.
(c) Cancer potency based on the weighting scheme for polyaromatic hydrocarbons developed by the Office of Environmental Health Hazard Assessment.
(d) Slope factor based on the cancer potency of total chromium (1/6 ratio Cr VI/Cr III).
(e) Slope factors based on the cancer potency of tetrachlorodibenzo-p-dioxin.
(f) Based on toxicity of tributyltin oxide.
-- Cancer potency factor not available.
$(mg/kg\text{-}day)^{-1}$ = $(\text{milligrams per kilogram per day})^{-1}$.
OCDD = octachlorodibenzo-p-dioxin.

References: COEHHA, 1994; EPA, 1998a.

TABLE I-3

TOXICITY VALUES USED TO DERIVE NON-CARCINOGENIC PRELIMINARY REMEDIATION GOALS

Constituent of Potential Concern	Oral Reference Dose (mg/kg-day)	Oral Reference Dose Source	Inhalation Reference Dose (mg/kg-day)	Inhalation Reference Dose Source
Acetone	1.0E-01	EPA 1998a	1.0E-01	EPA 1998b
Antimony	4.0E-04	EPA 1998a	--	NA
Arochlor-1232	--	NA	--	NA
Arochlor-1254	2.0E-05	EPA, 1998a	2.0E-05	EPA, 1998b
Arochlor-1260	--	NA	--	NA
Arsenic	3.0E-04	EPA, 1998a	--	NA
Barium	7.0E-02	EPA, 1998a	1.4E-04	EPA, 1997
Benzo(a)anthracene	--	NA	--	NA
Benzo(a)pyrene	--	NA	--	NA
Benzo(b)fluoranthene	--	NA	--	NA
Benzo(g,h,i)perylene	--	NA	--	NA
Beryllium	2.0E-03	EPA, 1998a	5.7E-06	EPA, 1998a
Bis(2-ethylhexyl)phthalate	2.0E-02	EPA, 1998a	2.2E-02	EPA, 1998b
Bromodichloromethane	2.0E-02	EPA, 1998a	2.0E-02	EPA, 1998b
Butylbenzyl phthalate	2.0E-01	EPA, 1998a	2.0E-01	EPA, 1998b
Cadmium	5.0E-04	EPA, 1998a	5.7E-05	EPA, 1998b
Carbon tetrachloride	7.0E-04	EPA, 1998a	5.7E-04	EPA, 1998b
Chloroform	1.0E-02	EPA, 1998a	1.0E-02	EPA, 1998b
Chromium [(a)]	--	NA	--	NA
Chromium (VI)	3.0E-03	EPA, 1998a	2.3E-06	EPA, 1998a
Chrysene	--	NA	--	NA
Cobalt	6.0E-02	EPA, 1998b	5.7E-06	EPA, 1998b
Copper	3.7E-02	EPA, 1997	--	NA
Cyanide [(b)]	2.0E-02	EPA, 1998a	--	NA
Di-n-butylphthalate	1.0E-01	EPA, 1998a	1.0E-01	EPA, 1998b
Fluoranthene	4.0E-02	EPA, 1998a	4.0E-02	EPA, 1998b
Indeno(1,2,3-cd)pyrene	--	NA	--	NA
Lead	--	NA	--	NA
Mercury	3.0E-04	EPA, 1998b	8.6E-05	EPA, 1998a
Methylene chloride	6.0E-02	EPA, 1998a	8.6E-01	EPA, 1997

TABLE I-3

TOXICITY VALUES USED TO DERIVE NON-CARCINOGENIC PRELIMINARY REMEDIATION GOALS

Constituent of Potential Concern	Oral Reference Dose (mg/kg-day)	Oral Reference Dose Source	Inhalation Reference Dose (mg/kg-day)	Inhalation Reference Dose Source
Molybdenum	5.0E-03	EPA, 1997	--	NA
Nickel	2.0E-02	EPA, 1998a	--	NA
1,2,3,4,6,7,8,9-OCDD [c]	--	NA	--	NA
Phenanthrene	--	NA	--	NA
Pyrene	3.0E-02	EPA, 1998a	3.0E-02	EPA, 1998b
Silver	5.0E-03	EPA, 1998a	--	NA
Strontium	6.0E-01	EPA, 1998a	--	NA
Thallium [d]	7.0E-05	EPA, 1997	--	NA
Trichlorotrifluoroethane	3.0E+01	EPA, 1998a	8.6E-00	EPA, 1997
Tributyltin [e]	3.0E-04	EPA, 1998a	--	NA
Vanadium	7.0E-03	EPA, 1997	--	NA
Zinc	3.0E-01	EPA, 1998a	--	NA

Notes:

(a) Based on toxicity of total chromium (1/6 ratio CrVI/CrIII).
(b) Based on toxicity of free cyanide.
(c) Reference dose based on the potency of tetrachlorodibenzo-p-dioxin.
(d) Reference dose based on toxicity of thallium oxide.
(e) Reference dose based on tributyltin oxide.
-- Reference dose not available.
$(mg/kg\text{-}day)^{-1}$ = milligrams per kilogram per day.
OCDD = octachlorodibenzo-p-dioxin.
NA Not Applicable.

References: EPA, 1997, 1998a, and 1998b.

TABLE I-4

SCREENING LEVEL DERMAL ABSORPTION FRACTIONS FROM SOIL

Constituent of Potential Concern	Absorption Fraction (DTSC, 1994)
Acetone	0.10
Antimony	0.01
Arochlor-1232	0.15
Arochlor-1254	0.15
Arochlor-1260	0.15
Arsenic	0.03
Barium	0.01
Benzo(a)anthracene	0.15
Benzo(a)pyrene	0.15
Benzo(b)fluoranthene	0.15
Benzo(g,h,i)perylene	0.15
Beryllium	0.01
Bis(2-ethylhexyl)phthalate	0.10
Bromodichloromethane	0.10
Butylbenzyl phthalate	0.10
Cadmium	0.001
Carbon tetrachloride	0.10
Chloroform	0.10
Chromium	0.01
Chromium (VI)	0
Chrysene	0.15
Cobalt	0.01
Copper	0.01
Cyanide [a]	0.10
Di-n-butylphthalate	0.10
Fluoranthene	0.15
Indeno(1,2,3-cd)pyrene	0.15
Lead	0.01
Mercury	0.01
Methylene chloride	0.10
Molybdenum	0.01

TABLE I-4

SCREENING LEVEL DERMAL ABSORPTION FRACTIONS FROM SOIL

Constituent of Potential Concern	Absorption Fraction (DTSC, 1994)
Nickel	0.01
1,2,3,4,6,7,8,9-OCDD [b]	0.03
Phenanthrene	0.15
Pyrene	0.15
Silver	0.01
Strontium	0.01
Thallium	0.01
Trichlorotrifluoroethane (Freon 113)	0.10
Tributyltin	0.10
Vanadium	0.01
Zinc	0.01

Notes:

(a) Adsorption fraction based on free cyanide.

(b) OCDD - octachlorodibenzo-p-dioxin.

Reference: DTSC, 1994.

TABLE I-5

SCREENING LEVEL VOLATILIZATION FACTORS FOR SOIL

Constituent of Potential Concern	Volatilization Factors (m^3/kg)	Reference
Carbon tetrachloride	2,000	EPA, 1998b
Acetone	13,000	EPA, 1998b
Bromodichloromethane	10,000	EPA, 1998b
Chloroform	2,900	EPA, 1998b
Methylene chloride	2,400	EPA, 1998b
Trichlorotrifluoroethane (Freon 113)	1,600	EPA, 1998b

Notes:

m^3/kg = cubic meters per kilogram.

TABLE I-6

COMPARISON OF RESIDENTIAL PRGs: DERIVED AND EPA REGION IX

Constituent of Potential Concern	CAS Number	Derived PRG (mg/kg)	EPA Region IX PRG (mg/kg)
Acetone	67-64-1	1.3E+03	1.4E+03
Antimony	7440-36-0	2.8E+01	3.0E+01
Arochlor-1232 [a]	11141-16-5	1.1E-01	2.0E-01
Arochlor-1254 [a]	11097-69-1	1.1E-01	9.7E-01
Arochlor-1260 [a]	11096-82-5	1.1E-01	2.0E-01
Arsenic	7440-38-2	3.1E-01	3.8E-01
Barium	7440-39-3	4.9E+03	5.2E+03
Benzo(a)anthracene	56-55-3	1.9E-01	5.6E-01
Benzo(a)pyrene	50-32-8	1.9E-02	5.6E-02
Benzo(b)fluoranthene	205-99-2	1.9E-01	5.6E-01
Benzo(g,h,i)perylene	191-24-2	--	--
Beryllium	7440-41-7	1.4E+02	1.5E+02
Bis(2-ethylhexyl)phthalate	117-81-7	3.5E+01	3.2E+01
Bromodichloromethane	75-27-4	1.7E-01	9.8E-01
Butylbenzyl phthalate [b]	85-68-7	7.8E+03	9.3E+02
Cadmium	7440-43-9	3.9E+01	9.0E+00 [c]
Carbon tetrachloride	56-23-5	5.5E-02	2.3E-01
Chloroform	67-66-3	1.6E+00	2.4E-01
Chromium	7440-47-3	5.7E+02	2.1E+02
Chromium (VI)	7440-47-3	1.5E-00	2.0E-01 [c]
Chrysene	218-01-9	1.9E-02	6.0E+00
Cobalt	7440-48-4	3.1E+03	3.3E+03
Copper	7440-50-8	2.6E+03	2.8E+03
Cyanide [d]	57-12-5	1.4E+03	1.1E+03
Di-n-butylphthalate	84-74-2	3.9E+03	5.5E+03
Fluoranthene	206-44-0	1.3E+03	2.0E+03
Indeno(1,2,3-cd)pyrene	193-39-5	1.9E-01	5.6E-01
Lead	7439-92-1	--	1.3E+02 [c]
Mercury	7487-94-7	2.1E+01	2.2E+01
Methylene chloride	75-09-2	6.0E+00	8.5E+00
Molybdenum	7439-98-7	3.6E+02	3.7E+02

TABLE I-6

COMPARISON OF RESIDENTIAL PRGs: DERIVED AND EPA REGION IX

Constituent of Potential Concern	CAS Number	Derived PRG (mg/kg)	EPA Region IX PRG (mg/kg)
Nickel	7440-02-0	1.4E+03	1.5E+02 [c]
1,2,3,4,6,7,8,9-OCDD [e]	3268-87-9	3.6E-02	3.8E-02
Phenanthrene	85-01-8	--	--
Pyrene	129-00-0	9.4E+02	1.5E+03
Silver	7440-22-4	3.6E+02	3.7E+02
Strontium	7440-24-6	4.3E+04	4.5E+04
Thallium [f]	7446-18-6	5.0E-00	5.2E-00
Trichlorotrifluoroethane (Freon 113) [b]	76-13-1	2.1E+04	5.6E+03
Tributyltin [g]	688-73-3	2.1E+01	1.6E+01
Vanadium	7440-62-2	5.0E+02	5.2E+02
Zinc	7440-66-6	2.1E+04	2.2E+04

Notes:

(a) Based on toxicity of polychlorinated biphenyls.
(b) EPA Region IX PRG used for screening level comparison based on derivation of soil saturation limit (EPA, 1998b).
(c) California modified PRG (EPA, 1998b).
(d) Based on the toxicity for free cyanide.
(e) OCDD =octachlorodibenzo-p-dioxin.
(f) Based on the toxicity of thallium oxide.
(g) Based on the toxicity of tributyltin oxide.

CAS Number = Chemical Abstract Service number.
mg/kg = milligrams per kilogram.
PRG = Preliminary remediation goal.
-- = No PRG derived because of lack of toxicity information.

Reference: EPA, 1998b.

APPENDIX J

TOXICOLOGICAL PROFILES

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LIST OF ACRONYMS

°C	Degrees centigrade
$\mu g/m^3$	Micrograms per cubic meter
atm-m^3/mol	Atmospheres per cubic meter/mole
cm^2/sec	Square centimeter per second
CSF	Cancer slope factor
EPA	U.S. Environmental Protection Agency
GI	Gastrointestinal
IARC	International Agency for Research on Cancer
L/kg	Liters per kilogram
mg/kg-day	Milligrams of chemical per kilogram of body weight per day
mg/L	Milligrams per liter
mg/m^3	Milligrams per cubic meter
ml/g	Milliliters per gram
NA	Not applicable
ng/m^3	Nanograms per cubic meter
ng/g	Nanograms per gram
ng/L	Nanograms per liter
NOAEL	No-observable-adverse-effect-level
OEHHA	Office of Environmental Health Hazard Assessment
PCB	Polychlorinated biphenyls
ppb	Parts per billion
RfD	Oral reference dose

ARSENIC

COMMON SYNONYMS:	CAS NUMBER: 7440-38-2 FORMULA: As MOLECULAR WEIGHT: 74.92	
PHYSICAL/CHEMICAL DATA	Physical State - metal (crystalline solid) Density - 5.727at 14°C Solubility in water (mg/L) - insoluble K_{OC} (ml/g) - NA Diffusivity in air (cm^2/sec) - NA Difusivity in water (cm^2/sec) - NA Henry's Law constant (atm-m^3/mol) - NA Bioconcentration factor (L/kg) - 4	EPA, 1999a EPA, 1999a EPA, 1999a ATSDR, 1993a
MAJOR USES	Used in arsenical pesticides; metallurgy for making alloys of copper or lead; making various types of glass.	EPA, 1999a

Arsenic occurs naturally in air, water, soil, plant, and in the tissues of living organisms. Occurrence of arsenic in the environment can be a result of industrial and agricultural activities. Arsenate (As^{+5}) is the main species of arsenic found in environments such as unflooded soils. Mildly reducing conditions favor the arsenite (As^{+3}) form (Goyer, 1991; Lewis, 1992; EPA, 1999a).

Toxicokinetics

Studies of tri- and pentavalent arsenic indicate almost complete absorption through the gastrointestinal tract in most laboratory animals and humans. Inhalation and absorption of arsenic is dependent upon the size of the particle inhaled. Large particles are quickly deposited in the upper airways and removed by ciliary action; therefore, there is only limited absorption across lung tissue. Small particles penetrate deep into the lungs into the alveoli and, dependent upon the chemical form of the arsenic, absorption across alveolar epithelium occurs. Data also indicate soluble forms (*e.g.*, tri- and pentavalent arsenic) are rapidly absorbed through the skin (ATSDR, 1993e; EPA, 1998a).

Once absorbed, all but a small fraction of systemic arsenic is cleared from tissues. Arsenic seems to distribute preferentially in the fingernails and toenails, skin, and hair. There is also general agreement that arsenic will initially accumulate in the kidney, liver, bile, brain, skeleton, and blood (ATSDR, 1993a).

Most of the absorbed arsenic is quickly cleared from tissue. The major metabolite is dimethylarsenate, which is found in the urine. Monomethylarsenate is often a secondary

metabolite, and can also appear in the urine. Arsenic is also known to be eliminated through the skin in sweat, particularly during periods of perfuse sweating (Goyer, 1991).

Toxicity

Noncarcinogenic Effects

Oral exposures of humans to arsenic can produce a large range of gastrointestinal disturbances, including nausea, vomiting, diarrhea, and thirst. Anemia, cardiovascular effects, seizures, and toxic delirium have also been noted. Inhalation exposures can cause all of the above, including pulmonary edema. Skin exposures have commonly caused hyper-pigmentation, keratosis, epidermoid carcinomas, and occasionally skin sensitization (Goyer, 1991; ATSDR, 1993a; EPA 1998a).

A no-observable-adverse-effect-level (NOAEL) of 0.009 milligrams per liter (mg/L) was established by the U.S. Environmental Protection Agency (EPA), based on hyper-pigmentation, keratosis and possible vascular complications. An oral reference dose (RfD) of 3×10^{-4} milligrams of chemical per kilogram of body weight per day (mg/kg-day) was also established by the EPA based on these effects (EPA, 1999b).

Carcinogenicity

Arsenic is a confirmed teratogen that can traverse placental barriers and cause fetal death and malformations in many species of mammals (Goyer, 1991; EPA, 1999a). It is carcinogenic in humans, and is classified by EPA as a Group A carcinogen. EPA (1998b) has established an inhalation unit risk of 4.3×10^{-3} per microgram per cubic meter $(\mu g/m^3)^{-1}$ and an oral cancer slope factor (CSF) of 1.5 $(mg/kg\text{-}day)^{-1}$. The California Office of Environmental Health Hazard Assessment (COEHHA) has set an inhalation CSFs of 12 $(mg/kg\text{-}day)^{-1}$ (COEHHA, 1994). COEHHA has not established an oral CSF for arsenic.

HEXAVALENT CHROMIUM

COMMON SYNONYMS:	CAS NUMBER: 7440-47-3 FORMULA: Cr^{6+} MOLECULAR WEIGHT: 51.996	
PHYSICAL/CHEMICAL DATA	Physical State - Metal Solubility in water (mg/L) - Insoluble K_{OC} (ml/g) - no data Diffusivity in air (cm^2/sec) - no data Difusivity in water (cm^2/sec) - no data Henry's Law constant (atm-m^3/mol) - no data Bioconcentration factor (L/kg) - no data	EPA, 1999a EPA, 1999a
MAJOR USES	It is commonly used in the manufacture of chrome steel or chrome-nickel steel, and for plating of other metals.	Budavari, 1989; ATSDR, 1993; Goyer, 1991

Toxicokinetics

Absorption via the gastrointestinal (GI) tract is relatively low, and is dependent on the water solubility of the compound and the GI transit time. Absorption following inhalation exposure is influenced by the particle size of the aerosols, as smaller sizes are able to penetrate more readily to the pulmonary regions of the respiratory tract (ATSDR, 1993). Chromium has been identified in the urine, serum, and red blood cells of humans following occupational exposure to chromium, indicating that it is absorbed via inhalation exposure (Gylseth and others., 1977). No data was found to indicate the rate of absorption. While no hexavalent chromium was identified in the urine, urinary chromium concentrations were highest when exposure was predominantly to hexavalent chromium compounds. Mali (1963) found that hexavalent chromium penetrated intact epidermis.

Chromium is distributed equally among human tissues with the exception of the lung, which may contain 2 to 3 times the concentration of other tissues (EPA, 1999a). In vitro studies indicate that hexavalent chromium is readily reduced to trivalent chromium (ATSDR, 1993b). Additionally, a study by Jennette (1982) provided evidence that a pentavalent chromium intermediate was formed during in vitro reduction of hexavalent chromium to trivalent chromium in rat liver microsomes, and suggested that the intermediate may be the form of chromium that interacts with cellular molecules (ATSDR, 1993b). Chromium is normally excreted through the kidneys and urine, with this route accounting for approximately 80 percent of absorbed chromium (EPA, 1999a). Other routes of excretion include the bile and feces, milk, sweat, hair, and nails (EPA, 1999a).

Toxicity

Noncarcinogenic Effects

Symptoms of chromium intoxication from prolonged inhalation of hexavalent chromate dust results in chronic irritation of the respiratory tract, congestion and hyperemia, chronic rhinitis, congestion of the larynx, chronic inflammation of the lungs, chronic bronchitis, emphysema, and adhesions of the diaphragm. Oral and inhalation exposure have also been linked to renal tubular necrosis. Hexavalent chromium compounds tend to be strong oxidizing agents, and are irritating and corrosive. Many of the toxic effects of these compounds, such as lesions of the nasal mucosa, result from these properties (ATSDR, 1993b). The respiratory tract seems to be the target organ of intermediate and chronic inhalation exposure to hexavalent chromium (ATSDR, 1993b). Hexavalent chromium is clearly a respiratory tract irritant, causing slight transient effects on pulmonary function. Impaired liver function has also been noted.

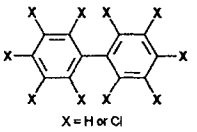
The EPA has established an oral reference dose (RfD) of 0.005 mg/kg-day, based on a no-observable-adverse-effect-level (NOAEL) of 2.4 mg/kg-day in a 1-year study in rats. The inhalation RfD is currently under review by an EPA work group (EPA, 1999b).

Carcinogenicity

Hexavalent chromium is an experimental mutagen, and is classified as a Class A carcinogen by the EPA (1999b), and Group 1 by the International Agency for Research on Cancer (IARC). Numerous epidemiological studies concerning the relationship between respiratory cancer and occupational exposure to chromium are available.

EPA has established an inhalation unit risk of 0.012 $(\mu g/m^3)^{-1}$ (EPA, 1999b). EPA does not list an oral cancer slope factor for hexavalent chromium. According to EPA (1999b), there are no studies indicating that hexavalent chromium is carcinogenic by oral administration.

POLYCHLORINATED BIPHENYLS

COMMON SYNONYMS:	CAS NUMBER: various	CHEMICAL STRUCTURE
• Aroclor-1260 • Aroclor-1254 • Aroclor-1248 • Aroclor-1242 • Aroclor-1232 • Aroclor-1221 • Aroclor-1016	FORMULA: various MOLECULAR WEIGHT: various	
PHYSICAL/CHEMICAL DATA	Physical State - Oil Solubility in water (mg/L) - various K_{oc} (ml/g) - various Diffusivity in air (cm^2/sec) - various Difusivity in water (cm^2/sec) - various Henry's Law constant (atm-m^3/mol) - various Bioconcentration factor (L/kg) - various	ATSDR, 1995
MAJOR USES	Used primarily in closed systems as heat transfer liquids, hydraulic fluids and lubricants, and in open systems as plasticizers, surface coatings, inks, adhesives, pesticide extenders, and in dyes for carbonless papers	ATSDR, 1995 EPA, 1999a

Polychlorinated biphenyls (PCBs) are produced by the progressive chlorination of biphenyls with anhydrous chlorine in the presence of a catalyst such as iron filings or ferric chloride. The degree of chlorination is controlled by the contact time of the anhydrous chlorine in the reactor. A total of 209 different biphenyl combinations are possible. PCB mixtures are thermally and chemically stable. After 1974, use of PCBs in the United States was limited to closed systems. As of January 1, 1979, manufacture and importation of PCBs in the United States was banned (ATSDR, 1995; EPA 1999a).

The persistence of PCBs makes them pervasive environmental contaminants, and they are found in body tissues and fluids of the general population. Results from the National Human Adipose Tissue Survey show that in 1981 greater than 99 percent of the U.S. population had measurable levels of PCBs (USAF, 1989). Ambient atmospheric concentrations of PCBs (measured in 1981) ranged from 0.1 nanograms per cubic meter (ng/m^3) in rural areas to a high of 30 ng/m^3 in urban areas. Concentrations in waters of the open oceans ranged from 0.02 to 0.59 nanograms per liter

(ng/L). The low water solubility of PCBs generally precludes them from reaching high concentrations in drinking water, and studies conducted by the EPA from 1975 to 1977 found PCBs in only 5 of 133 samples of finished surface water supplies at concentrations ranging from 0.1 to 1.4 parts per billion (ppb). Measured soil concentrations in the U.S. range from less than 1 to 33 ppb. An average Aroclor-1260 concentration of 120 nanograms per gram (ng/g) has been detected in sediment samples from eight locations along the coast of Maine (ATSDR, 1995).

Toxicokinetics

Inhalation and dermal absorption are the primary routes of occupational exposure to PCBs. The primary exposure route to humans not occupationally exposed is via the consumption of contaminated fish. Studies of 19 PCB congeners have shown greater than 90 percent absorption by the gastrointestinal tract in rats. Similar results were observed with a single administered dose of Aroclor-1248 in monkeys. One study, however, indicated that 59 percent to 87 percent of a single oral dose of hexachlorobiphenyl passed unabsorbed through the intestine of monkeys. European ferrets absorbed 85 percent of a single dose administered in food. There is no information regarding the extent of gastrointestinal absorption in humans. While PCBs appear to be readily absorbed by the lungs in both animals and humans, quantitative data are not available. Dermal absorption rates in animals range from 15 percent to 59 percent (ATSDR, 1995).

Following absorption, PCBs are readily cleared from the blood and initially partition in the liver and muscles. PCBs are highly lipophilic and bioconcentrate in adipose tissue and breast milk in humans. PCBs have also been detected in the brain and skin, are transported across the placental barrier, and are found in the placental tissues and fetus.

PCBs appear to undergo minimal metabolism in humans. Results of *in vitro* metabolism studies with human liver microsomes show little metabolism of 2,2',4,4',5,5'-hexachlorobiphenyl. Animal metabolism studies show that phenolic products are the primary metabolites, with methylsulfones, trans-dihydrodiols, polyhydroxylated-PCBs, and methyl ether derivatives also identified. As the rate of chlorination increases, the rate of metabolism decreases. The occurrence of *trans*-dihyrodiol metabolites suggests that metabolism of PCBs is via formation of arene oxide intermediates, which have been implicated in mutagenicity and carcinogenicity. While the toxicological significance of PCB metabolism is not known, evidence suggests that the parent compound is responsible for most of the toxic responses (ATSDR, 1995). Excretion of PCBs and metabolites is slow. Most metabolites are excreted in the feces, and to a lesser extent in the urine.

Toxicity

Noncarcinogenic Effects

Although there is considerable species variability in sensitivity to PCB toxicity, the most common pathological effects observed in mammalian species are pathological changes in the liver. Liver enlargement has been observed even where actual liver lesions were minimal or absent, and at doses below other effects (USAF, 1989). Reversible degenerative lesions of the

liver were observed in rats and mice exposed to 1.9 mg/m^3 Aroclor-1254 vapor 7 hours per day, 5 days per week over a 213-day period (ATSDR, 1995).

Epidemiological studies of persons occupationally exposed to Aroclor vapors ranging from 0.007 to 11.0 mg/m^3 for 8-hour periods provide inconsistent findings, with some increase in liver enzyme activity (ATSDR, 1995). Increased hepatic enzyme activity has been observed in workers occupationally exposed to PCBs (Emmett, 1985).

Exposure to Aroclor-1254 produced facial edema, alopecia, and a condition known as chloracne in rhesus monkeys fed 2.5 ppm in the diet for 1 to 6 months. Chloracne, skin rashes, and burning eyes and skin have been associated with human occupational exposure to PCBs at unspecified concentrations. Immunosuppression was observed in monkeys receiving Aroclor-1248 in the diet at doses as low as 5 ppm (USAF, 1989). Another noncarcinogenic effect noted was reduced thyroid activity in rats fed 5 ppm Aroclor-1254 in the diet for 4 weeks (ATSDR, 1995). Exposure to PCBs is associated with depressed reproductive capacity in animals. Exposure to high levels of PCBs was associated with reduced birth weight in children born to women employed at facilities engaged in producing capacitors using Aroclors-1016, -1254, and -1242 (USAF, 1989).

EPA has not established reference doses (RfDs) for PCBs as a class, but has established oral RfDs for Aroclor-1016 of 7.0×10^{-5} mg/kg-day, and Aroclor-1254 of 2.0×10^{-5} mg/kg-day (EPA, 1999b). These RfDs are based on reduced birth weights in a monkey reproductive bioassay for Aroclor-1016 and ocular exudate, distorted growth of nails and decreased antibody response in monkeys for Aroclor-1254. No inhalation RfDs have been established to date (EPA, 1999b).

Carcinogenicity

PCBs have generally tested negative using *in vitro* and *in vivo* systems; however, the results are inconclusive. Aroclor-1254 induced DNA breaks in freshly perfused rat hepatocytes treated for 3 hours at 0.3 MM, and Aroclor-1248 and Aroclor-1254 inhibited DNA and protein synthesis in CHO cells. Aroclor-1254 tested negative for mutagenicity in various *Salmonella typhimurium* strains and *Eschercia coli*, and did not show an increase in chromosomal abnormalities in rats fed 50 mg/kg for 7 days, or after a single dose of 5,000 mg/kg of Aroclor-1242. No dominant lethal effects were observed after male rats were exposed to single oral doses of Aroclor-1254 of up to 2,500 mg/kg or 250 mg/kg/day for 5 days.

Both Aroclor-1254 and Aroclor-1260 have been found to induce liver neoplasms in test animals (rats and mice). The primary evidence for carcinogenicity of Aroclor-1260 comes from a study by Kimbrough and others (1975), where the incidence of hepatocellular carcinomas in female Sherman rats showed a clear dose-response relationship to levels of Aroclor-1260 in the diet for 630 days. Additional animal studies have led to the conclusion that Aroclor-1260 is a complete liver carcinogen, acting as both an initiator and a promotor (USAF, 1989; EPA, 1999b). Kimbrough and Linder (1974) observed hepatomas in 41 percent of mice fed Aroclor-1254 in the diet for 11 months versus no hepatomas in control mice.

Brunner and others (1996) compared carcinogenicity across different Aroclors, dose levels, and sexes. Following a complete histopathologic evaluation, statistically significant increased incidences of liver adenomas or carcinomas were found in female rats for all Aroclors and in male rats for Aroclor-1260. Some of these tumors were hepatocholangiomas, a rare bile duct tumor seldom seen in control rats (EPA, 1999b). In a study by Norback and Weltman (1985), male and female Sprague-Dawley rats were fed Aroclor-1260 for 16 months and 24 months. Examinations demonstrated progression of liver lesions to carcinomas (EPA, 1999b).

Evidence in humans based on available epidemiological data do not indicate a consistent carcinogenic effect. Although there are many studies, EPA considers the data to be inadequate due to confounding exposures to known carcinogens or lack of exposure quantification. Occupational studies of workers exposed to PCBs in a New Jersey petrochemical plant and of employees in a capacitor-making plant in northern Italy are suggestive of carcinogenicity via the inhalation and dermal routes, although the results were not statistically significant (USAF, 1989; EPA, 1999b). Both of the Yusho and Ye-Cheng incidents, where rice oil contaminated by PCBs was consumed by residents, are cited as suggestive of carcinogenicity in humans via the oral route. In both cases however, the contaminated oils also contained polychlorinated dibenzofurans, which are known human carcinogens (USAF, 1989; EPA, 1999b). Based on the suggestive evidence of excess risk of liver cancer in humans by ingestion, inhalation, or dermal contact to PCBs, along with adequate evidence of carcinogenicity in animals, EPA (1998b) has concluded that PCBs are probable human carcinogens, and has listed the weight-of-evidence classification as B2, probable human carcinogen (EPA, 1999b).

The EPA has established a tiered approach for determining the cancer potency of PCB mixtures depending on the information available. For the ingestion of soil or sediments, dust or aerosol inhalation, and dermal and food chain exposures, an upper-bound slope factor of 2.0 per milligram per kilogram per day $(mg/kg\text{-}day)^{-1}$ and a central-estimate slope factor of 1.0 $(mg/kg\text{-}day)^{-1}$ have been established (EPA, 1999b). For the ingestion of water-soluble congeners, inhalation of evaporated congeners, or dermal contact when no absorption factor has been applied, an upper-bound slope factor of 0.4 $(mg/kg\text{-}day)^{-1}$ and a central-estimate slope factor of 0.3 $(mg/kg\text{-}day)^{-1}$ have been established (EPA, 1999b). Where analysis verifies that congeners with more than 4 chlorines comprise less than one-half percent of total PCBs, an upper-bound slope factor of 0.07 $(mg/kg\text{-}day)^{-1}$ and a central-estimate slope factor of 0.04 $(mg/kg\text{-}day)^{-1}$ have been established (EPA, 1999b).

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