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FINAL
REMEDIAL INVESTIGATION REPORT
VOLUME 2 OF 2
SUMMIT NATIONAL SITE
[redacted]DEERFIELD, OHIO

[redacted] EPA WA57-5L04
W64441

FEBRUARY 10, 1988

Appendix A

APPENDIX A - RI DATA SUMMARY TABLES

Table No.	Description
1	Onsite Soils
2	Offsite Soils
3	Surface Water
4	Sediment
5	Groundwater
6	Residential Wells
7	Drum/Tank Samples

TABLE 1
SUMMIT NATIONAL SITE
ONSITE SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Number:	SL001001	SL002001	SL003001	SL004001	SL005001	SL006001	SL007001	SL008001	SL009001	SL010001	RS000001	SL011001	SL012001	SL013001	SL014001	SL015001	SL016001	SL017001	SL018001
Sample Type:	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Blank	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Date Sampled:	11/06/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/08/84	11/08/84	11/08/84	11/08/84	11/08/84	11/08/84
DTR Number:	E9741	E9742	E9743	E9744	E9745	E9746	E9747	E9748	E9749	E9750	E9751	E9752	E9753	E9754	E9755	E9756	E9757	E9758	E9759
DTR Number:																			
ITR Number:	MEA249	MEA250	MEA251	MEA252	MEA253	MEA254	MEA255	MEA256	MEA257	MEA258	MEA259	MEA260	MEA261	MEA262	MEA263	MEA264	MEA265	MEA266	MEA267
ORGANIC COMPOUNDS (units-ug/kg)																			
VOLATILES																			
CHLOROMETHANE																			
VINYL CHLORIDE																			
METHYLENE CHLORIDE	60 B	4 J,B	5 J,B	4 B,J	7 B	2 J,B	6 B,J	6 B	4 B,J	5 J,B	3 J,B	13 B	14 B	16 B	8 B	68 B	7 B	13 B	6 B
ACETONE	95	81	96	51	30	56		24		10 J,B			120	.			6 J	7 J	7 J
CARBON DISULFIDE																			
1,1-DICHLOROETHENE																			
1,1-DICHLOROETHANE	14																		
TRANS-1,2-DICHLOROETHENE						31													
CHLOROFORM	16				42	2 J													
1,2-DICHLOROETHANE	2100 J	44																	
2-BUTANONE	610 J		220	34	62						5	5 J	150		8 J			6 J	6 J
1,1,1-TRICHLOROETHANE	240 J	4 J			7		6						4 J	4 J				3 J	
1,1,2,2-TETRACHLOROETHANE																			
TRICHLOROETHENE	1700 J	32		50	2 J	17	10												
1,1,2-TRICHLOROETHANE	29																		
BENZENE					3 J	1 J													
2-HEXANONE	58					29													
4-METHYL-2-PENTANONE	78																		
TETRACHLOROETHENE	5 J	1 J		1 J	1 J	1 J		1 J		5 J									
TOLUENE	53	3 J								5 J		3 J		4 J		3 J		6	
CHLOROBENZENE										4 J					18				
ETHYLBENZENE						3 J,B													
STYRENE																			
TOTAL XYLEMES						13 B													
TOTAL VOLATILES	5058	169	321	140	154	155	22	31	4	29	8	21	288	24	34	71	13	35	19
TOTAL TENTATIVELY IDENTIFIED VOLATILES	1500	0	0	0	0	0	52	0	0	89	0	72	49	11		9	0	6	0
BASE/NEUTRALS AND ACIDS																			
N-NITROSODIMETHYLAMINE																			
PHENOL												24000 **			290 J				
ANILINE																			
1,3-DICHLOROBENZENE																			
1,4-DICHLOROBENZENE																			
BENZYL ALCOHOL																			
1,2-DICHLOROBENZENE																			
2-METHYLPHENOL																			
BIS(2-CHLOROISOPROPYL)ETHER																			

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Sample Number:	SL001001	SL002001	SL003001	SL004001	SL005001	SL006001	SL007001	SL008001	SL009001	SL010001	RS000001	SL011001	SL012001	SL013001	SL014001	SL015001	SL016001	SL017001	SL018001
Sample Type:	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Blank	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Date Sampled:	11/06/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/08/84	11/08/84	11/08/84	11/08/84	11/08/84	11/08/84
OTR Number:	E9741	E9742	E9743	E9744	E9745	E9746	E9747	E9748	E9749	E9750	E9751	E9752	E9753	E9754	E9755	E9756	E9757	E9758	E9759
OTR Number:																			
ITR Number:	MEA249	MEA250	MEA251	MEA252	MEA253	MEA254	MEA255	MEA256	MEA257	MEA258	MEA259	MEA260	MEA261	MEA262	MEA263	MEA264	MEA265	MEA266	MEA267
4-METHYLPHENOL																			
HEXACHLOROETHANE																			
ISOPHORONE																			
2-NITROPHENOL																			
2,4-DIMETHYLPHENOL																			
BENZOIC ACID																			
1,2,4-TRICHLOROBENZENE																			
NAPHTHALENE															290 J	1000	830	1100	
4-CHLORO-3-METHYLPHENOL																			
2-METHYLNAPHTHALENE														590 J		2100	1300	1800	
HEXACHLOROCYCLOPENTADIENE																			
DIMETHYL PHTHALATE																			
ACENAPHTHYLENE																			
ACENAPHTHENE																			
4-NITROPHENOL																			
DIBENZOFURAN																490 J	290 J	460	
DIETHYLPHTHALATE																			
FLUORENE																			
N-NITROSODIPHENYLAMINE(1)																			
HEXACHLOROBENZENE																	280 J		
PENTACHLOROPHENOL																			
PHENANTHRENE																1500	730	2340	
ANTHRACENE																			
DI-N-BUTYLPHTHALATE																			
FLUORANTHENE																280 J	230 J	340 J	
PYRENE																		280 J	
BUTYLBENZYLPHTHALATE																			
BENZO(A)ANTHRACENE																		190 J	
BIS(2-ETHYLHEXYL)PHTHALATE										5900		26000 **		2600	2900	1900	5700	9000	48000
CHRYSENE																	250 J	250 J	
DI-N-OCTYL PHTHALATE													83000 **				530	1100	11000 J
BENZO(B)FLUORANTHENE																			
BENZO(K)FLUORANTHENE																			
BENZO(A)PYRENE																			
INDENO(1,2,3-CD)PYRENE																			
DIBENZ(A,H)ANTHRACENE																			
BENZO(G,H,I)PERYLENE																			
TOTAL BASE/NEUTRALS AND ACIDS										5900		50000	83000	3190	3480	7270	10140	16860	59000
TOTAL TENTATIVELY IDENTIFIED BASE/NEUTRALS AND ACIDS	0	0	0	0	49200	0	30100	25800	7180	7990	0	0	399900			106230	95410		60000

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Sample Type:	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Blank	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Date Sampled:	11/06/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/08/84	11/08/84	11/08/84	11/08/84	11/08/84	11/08/84
DTR Number:	E9741	E9742	E9743	E9744	E9745	E9746	E9747	E9748	E9749	E9750	E9751	E9752	E9753	E9754	E9755	E9756	E9757	E9758	E9759
DTR Number:																			
ITR Number:	MEA249	MEA250	MEA251	MEA252	MEA253	MEA254	MEA255	MEA256	MEA257	MEA258	MEA259	MEA260	MEA261	MEA262	MEA263	MEA264	MEA265	MEA266	MEA267
PESTICIDES and PCBs																			
ALPHA-BHC																			
BETA-BHC																			
DELTA-BHC																			
GAMMA-BHC (LINDANE)																			
HEPTACHLOR																			
ALDRIN																			
HEPTACHLOR EPOXIDE																			
ENDOSULFAN I																			
DIELDRIN																			
4,4-DDE																			
ENDRIN																			
4,4-DDT																			
TOXAPHENE																			
AROCHLOR-1232																			
AROCHLOR-1242																			
AROCHLOR-1248										7200 C		12300 C,**			2600	766	3200		
AROCHLOR-1254																			
MIREX																			
TOTAL PESTICIDES and PCBs										7200		12300			2600	766	3200		
PERCENT MOISTURE (VOLATILES)	16	14	20	16	18	14	22	23	18	17	0	16	15	23	16	17	14	13	13

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Sample Number:	SL001001	SL002001	SL003001	SL004001	SL005001	SL006001	SL007001	SL008001	SL009001	SL010001	RS000001	SL011001	SL012001	SL013001	SL014001	SL015001	SL016001	SL017001	SL018001
Sample Type:	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Blank	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Date Sampled:	11/06/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/08/84	11/08/84	11/08/84	11/08/84	11/08/84	11/08/84
DTR Number:	E9741	E9742	E9743	E9744	E9745	E9746	E9747	E9748	E9749	E9750	E9751	E9752	E9753	E9754	E9755	E9756	E9757	E9758	E9759
OTR Number:																			
ITR Number:	MEA249	MEA250	MEA251	MEA252	MEA253	MEA254	MEA255	MEA256	MEA257	MEA258	MEA259	MEA260	MEA261	MEA262	MEA263	MEA264	MEA265	MEA266	MEA267
INORGANIC COMPOUNDS (units) MG/KG DRY WEIGHT																			
ALUMINUM	7783	7205	9822	8652	6380	7377	8636	14808	7028	13028	184	10859	6029	13064	11696	3029	9965	4941	8726
ANTIMONY																			
ARSENIC	20 R	12 R	11 R	9.8 R			16 R		28 R	26 R		23 R	19 R			10 R	[35] R		[30] R
BARIUM	[74] R	[54] R	[91] R	[81] R	[112]	[111] R	134 R	[103] R	[67] R	[112] R		[109] R	[91] R	[87] R	158 R	[51] R	120 R	153 R	[83] R
BERYLLIUM																			
CADMIUM					7.8 R	3.0 R			3.5 R	3.2 R		3.0 R	4.3 R						
CALCIUM	[2586]	[1657]	[864]	[2134]	38029	5766	[2640]	[13873]	[2086]	4139	[492]	7910	7069	[2683]	10333	[2819]	15532	7845	25549
CHROMIUM	25 R	18 R	22 R	23 R	23 R	13 R	17 R	25 R	23 R	28 R	5.0 R	25 R	10 R	16 R	18 R	10 R	20 R	14 R	14 R
COBALT	[18] R		[15] R	[20] R	[15] R	[15] R	[20] R			[15] R		[15] R		[20] R	[15] R				
COPPER	34	31	18	14	26	25	31	24	22	28		23	19	[15]	29	[7]	18	[13]	[11]
IRON	43464	38752	29449	29251	39098	31072	26601	32586	37021	39557	122	38225	30058	28973	31560	11489	43649	38361	30178
LEAD	19 R	43 R	50 R	19 R	23 R	17 R	19 R	95 R	46 R	23 S+R		26 R	16 R	10 R	17 R	15 R	54 S+R	17 R	26 R
CYANIDE												.92	.78						
MAGNESIUM	[2869]	[1940]	[1897]	[2649]	[2892]	[2623]	[2406]	[2540]	[1889]	3887		4650	[2332]	4258	4471	[858]	[2665]	[1143]	[1208]
MANGANESE	247 R,E	155 R,E	612 R,E	483 R,E	683 R,E	386 R,E	217 R,E	194 R,E	207 R,E	543 R,E		553 R,E	193 R,E	847 R,E	435 R,E	68 R,E	263 R,E	88 R,E	116 R,E
MERCURY	.26	.47	.39	.17	.22	.33	0.5	.31	.19	.18		.17	.33	.16		.34	.27	.42	.34
NICKEL	27 R	[17] R	[17] R	[22] R	36 R	28 R	43 R	[22] R	[21] R	38 R		41 R	[21] R	42 R	40 R		24 R	[13] R	[12] R
POTASSIUM	[1539]	[1804]		[760]	[846]	[1007]	[970]	[1432]	[1874]	[2287]		[1664]	[1229]	[1133]	[1811]		[1260]	[1590]	[2140]
SELENIUM																	8.2 R	3.0 R	
SILVER																	5.8	[4.8]	
SODIUM											[1259]								
THALLIUM																			
TIN																			
VANADIUM	[31] R	[30] R	34 R	31 R	[25] R	[22] R	[28] R	38 R	[23] R	33 R	[14] R	30 R	[21] R	[25] R	[27] R	[16] R	30 R	[28] R	[24] R
ZINC	105 R	64 R	61 R	98 R	507 R	99 R	123 R	137 R	200 R	117 R	[5] R	152 R	127 R	67 R	145 R	32 R	107 R	50 R	52 R
PERCENT MOISTURE																			
PERCENT SOLIDS	77.8	80.5	81.6	86.8	83.7	83.5	78.1	75.4	79.4	84.7	99.6	87.3	86.5	80.3	84.0	84.3	85.5	83.3	84.0

FOOTNOTES:

B: Analyte has been found in the laboratory blank as well as the sample. Indicates possible/probable contamination.
C: Applies to pesticide parameters where the identification has been confirmed by GC/MS.
E: Value is estimated due to presence of interference.
J: An estimated value
R: Spike sample recovery is not within control limits.
S: Value is determined by standard addition.
*: Duplicate analysis is not within control limits.
**: Samples analyzed at medium concentrations.
[]: Positive values less than the contract required detection limit.

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SUMMIT NATIONAL SITE
ONSITE SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Number:	SL018001d	SL019001	SL020001	SL021001	SL022001	SR050001	SS024001	SS025001	SS026001	SS026001d	SS028001	SS029001	SS030001	SS031001	SS032001	SS033001	SS034001	SS035001	SS036001
Sample Type:	Surface	Surface	Surface	Surface	Surface	Blank	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Date Sampled:	11/08/84	11/09/84	11/09/84	11/09/84	11/09/84	11/15/84	11/13/84	11/13/84	11/13/84	11/13/84	11/13/84	11/13/84	11/13/84	11/13/84	11/13/84	11/14/84	11/15/84	11/15/84	11/14/84
OTR Number:	E9760	E9761	E9762	E9763	E9764	E9817	E9765	E9767	E9769	E9771	E9773	E9775	E9781	E9777	E9779	E9783	E9785	E9787	E9789
OTR Number:						E9818	E9766	E9768	E9770	E9772	E9774	E9776	E9782	E9778	E9780	E9784	E9786	E9788	E9790
ITR Number:	MEA268	MEA269	MEA270	MEA271	MEA272	MEA299	MEA273	MEA274	MEA275	MEA276	MEA277	MEA278	MEA281	MEA279	MEA280	MEA282	MEA283	MEA284	MEA285
ORGANIC COMPOUNDS (units-ug/kg)																			
VOLATILES																			
CHLOROMETHANE																			
VINYL CHLORIDE																			
METHYLENE CHLORIDE	7 B			910 J,B,**									6.2			29	4.1	5.8	8.4
ACETONE	9 J	8200 **		4800 **														16	
CARBON DISULFIDE																			
1,1-DICHLOROETHENE																			
1,1-DICHLOROETHANE																			
TRANS-1,2-DICHLOROETHENE																			
CHLOROFORM																2.6			
1,2-DICHLOROETHANE		1300 J,**	23000 **	6900 **	4300 **														
2-BUTANONE		3500 J,**	19000 **	5900 **															
1,1,1-TRICHLOROETHANE		19000 **	7400 **	5600 **	2400 J,**										4.5	81		55	6.0
1,1,2,2-TETRACHLOROETHANE			4400 J,**																
TRICHLOROETHENE		76000 **	9800 **		86000 **								8.2	49	46	112	99	51	4.6
1,1,2-TRICHLOROETHANE											14								
BENZENE						12.8 J,B	6.6 B	21 B	3.1	2.2	2.4 J,B	3.1	4.3 J,B	1.9 J,B	2.3	4.4	4.1	6.0	4.8
2-HEXANONE			4400 **		4400 J,**														
4-METHYL-2-PENTANONE			45000 **																
TETRACHLOROETHENE		1300 J,**	4600 J **													5.5			
TOLUENE	4 J	26000 **	260000 **	28000 **	13000 **			34 B	6.0	2.2			46			224	14	53	4.0
CHLOROBENZENE				3600 **															
ETHYLBENZENE			36000 **	4700 **	1900 J,**		36	6.8								22			
STYRENE																			2.9
TOTAL XYLENES			210000 **	18000 **	6700 J,**			13					9.5			244		9.6	
TOTAL VOLATILES	20	135300	623600	78410	118700	12.8	42.6	74.8	9.1	4.4	16.4	3.1	74.2	50.9	52.8	724	121	196	30.7
TOTAL TENTATIVELY IDENTIFIED VOLATILES	0	0	44200	11600	0	200	22B	603	200	200	200	200	200	200	200	444	200	200	204
BASE/NEUTRALS AND ACIDS																			
N-NITROSODIMETHYLAMINE																		8200 J,B	
PHENOL			44000 **	1900										960					
ANILINE																			
1,3-DICHLOROBENZENE									330 J	330 J									
1,4-DICHLOROBENZENE										330 J									
BENZYL ALCOHOL																			
1,2-DICHLOROBENZENE			13000 J,**	670					330 J										
2-METHYLPHENOL				310 J					330 J					4800		1600 J			
BIS(2-CHLOROISOPROPYL)ETHER																			800 J

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Sample Number:	SL018001d	SL019001	SL020001	SL021001	SL022001	SR050001	SS024001	SS025001	SS026001	SS026001d	SS028001	SS029001	SS030001	SS031001	SS032001	SS033001	SS034001	SS035001	SS036001
Sample Type:	Surface	Surface	Surface	Surface	Surface	Blank	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Date Sampled:	11/08/84	11/09/84	11/09/84	11/09/84	11/09/84	11/15/84	11/13/84	11/13/84	11/13/84	11/13/84	11/13/84	11/13/84	11/13/84	11/13/84	11/13/84	11/14/84	11/15/84	11/15/84	11/14/84
DTR Number:	E9760	E9761	E9762	E9763	E9764	E9817	E9765	E9767	E9769	E9771	E9773	E9775	E9781	E9777	E9779	E9783	E9785	E9787	E9789
QTR Number:						E9818	E9766	E9768	E9770	E9772	E9774	E9776	E9782	E9778	E9780	E9784	E9786	E9788	E9790
ITR Number:	MEA268	MEA269	MEA270	MEA271	MEA272	MEA299	MEA273	MEA274	MEA275	MEA276	MEA277	MEA278	MEA281	MEA279	MEA280	MEA282	MEA283	MEA284	MEA285
4-METHYLPHENOL				830															
HEXACHLOROETHANE																			
ISOPHORONE				3000												2900			800 J
2-NITROPHENOL																			
2,4-DIMETHYLPHENOL													800 J	7000		1600 J			
BENZOIC ACID				2900 J						1600 J				2100	8000 J		4000 J		4000 J
1,2,4-TRICHLOROBENZENE									330 J	330 J						14000			800 J
NAPHTHALENE			43000 **	1900			5500	6600	3100	2500	1200	470	9300	2400	1900	7000	980		2600
4-CHLORO-3-METHYLPHENOL																1600 J			
2-METHYLNAPHTHALENE			110000 **	1400			6100	12000	5300	4400	1800	660	14000	4000	3100	10000	1800		6500
HEXACHLOROCYCLOPENTADIENE			53000 **																
DIMETHYL PHTHALATE				280 J															
ACENAPHTHYLENE																			
ACENAPHTHENE								330 J	330 J	330 J			800 J			1600 J			800 J
4-NITROPHENOL																			
DIBENZOFURAN							890	2500	1600	1100	382		2800						
DIETHYLPHTHALATE										330 J	330 J	330 J	800 J	800 J		1600 J	800 J		800 J
FLUORENE				210 J				330 J	470	330 J			800 J			1600 J			800 J
N-NITROSODIPHENYLAMINE(1)										330 J B			800 J	800 J		1600 J	800 J		800 J
HEXACHLOROBENZENE			32000 **	1400					610	1000		3300		800 J	20000	1600 J	930		800 J
PENTACHLOROPHENOL																			
PHENANTHRENE			13000 J,**	2100			1800	5200	3800	2700	1100	580	4800	1900	1900	4000	820		3800
ANTHRACENE			13000 J,**													1600 J			
DI-N-BUTYLPHTHALATE				360 J			4100	1700	2800	3200	6900 B	4900 B	3700 B	5400	11000	11000 B	8200	8200 J	7700 B
FLUORANTHENE				350 J			740	1600	1200	840			1200	800 J		1600 J	800 J		1000
PYRENE				330 J			400	590	510	350	330	330 J	900	800 J	1600 J	1600 J	800 J		800 J
BUTYLBENZYLPHTHALATE			12000 J,**	1700				330		440					1600 J	6400	800 J		800 J
BENZO(A)ANTHRACENE								330 J	520	380			800 J	800 J		1600 J	800 J		800 J
BIS(2-ETHYLHEXYL)PHTHALATE	1400000 **	200000 **			81000 **	161 J,**	2800 B	550 B	2500 B	2200 B	760	2700	4400	11000	36000	20000	7700	46000	15000
CHRYSENE				230 J			520	910	700	540			830	800 J		1600 J	800 J		800 J
DI-N-OCTYL PHTHALATE				3100			330 J	330 J	2500	1600		330 J	800 J	3900	3800	4300	1900	64000	800 J
BENZO(B)FLUORANTHENE							360	990					800 J	800 J			800 J		800 J
BENZO(K)FLUORANTHENE									370	340			800 J						
BENZO(A)PYRENE								330 J	340	420			800 J	800 J					800 J
INDENO(1,2,3-CD)PYRENE								330 J		330 J									
DIBENZ(A,H)ANTHRACENE																			
BENZO(G,H,I)PERYLENE								330 J	330 J	330 J			800 J	800 J		1600 J			800 J
TOTAL BASE/NEUTRALS AND ACIDS		1400000	533000	22970	81000	161	23540	35280	28300	26580	12802	13600	50730	51460	88900	102000	32730	126400	53400
TOTAL TENTATIVELY IDENTIFIED BASE/NEUTRALS AND ACIDS	76000	0		27140	656400	5864	2538368	1921727	783459	686081	616359	896800	1755482	588268	2760000	1879915	767169	14048517	455294

TABLE I
SUMMIT NATIONAL SITE
ONSITE SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Number:	SL018001d	SL019001	SL020001	SL021001	SL022001	SR050001	SS024001	SS025001	SS026001	SS026001d	SS028001	SS029001	SS030001	SS031001	SS032001	SS033001	SS034001	SS035001	SS036001
Sample Type:	Surface	Surface	Surface	Surface	Surface	Blank	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Date Sampled:	11/08/84	11/09/84	11/09/84	11/09/84	11/09/84	11/15/84	11/13/84	11/13/84	11/13/84	11/13/84	11/13/84	11/13/84	11/13/84	11/13/84	11/13/84	11/14/84	11/15/84	11/15/84	11/14/84
OTR Number:	E9760	E9761	E9762	E9763	E9764	E9817	E9765	E9767	E9769	E9771	E9773	E9775	E9781	E9777	E9779	E9783	E9785	E9787	E9789
OTR Number:						E9818	E9766	E9768	E9770	E9772	E9774	E9776	E9782	E9778	E9780	E9784	E9786	E9788	E9790
ITR Number:	MEA268	MEA269	MEA270	MEA271	MEA272	MEA299	MEA273	MEA274	MEA275	MEA276	MEA277	MEA278	MEA281	MEA279	MEA280	MEA282	MEA283	MEA284	MEA285
PESTICIDES and PCBs																			
ALPHA-BHC																			
BETA-BHC																			
DELTA-BHC																			
GAMMA-BHC (LINDANE)																			
HEPTACHLOR																			
ALDRIN																			
HEPTACHLOR EPOXIDE							20 J												
ENDOSULFAN I																			
DIELDRIN																			
4,4-DDE																			
ENDRIN																			
4,4-DDT																			
TOXAPHENE																			
AROCHLOR-1232																			
AROCHLOR-1242																			
AROCHLOR-1248			21000 **	6900	590000 C,**				720	640				300	640	15000			680
AROCHLOR-1254											40 J								
MIREX																			
TOTAL PESTICIDES and PCBs			21000	6900	590000		20		720	640	40			300	640	15000			680
PERCENT MOISTURE (VOLATILES)	15	16	15	17	19	6	13	13	13	13	13	10	16	12	16	10	13	17	17

TABLE 1
SUMMIT NATIONAL SITE
ONSITE SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Number:	SL018001d	SL019001	SL020001	SL021001	SL022001	SR050001	SS024001	SS025001	SS026001	SS026001d	SS028001	SS029001	SS030001	SS031001	SS032001	SS033001	SS034001	SS035001	SS036001
Sample Type:	Surface	Surface	Surface	Surface	Surface	Blank	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Date Sampled:	11/08/84	11/09/84	11/09/84	11/09/84	11/09/84	11/15/84	11/13/84	11/13/84	11/13/84	11/13/84	11/13/84	11/13/84	11/13/84	11/13/84	11/13/84	11/14/84	11/15/84	11/15/84	11/14/84
DTR Number:	E9760	E9761	E9762	E9763	E9764	E9817	E9765	E9767	E9769	E9771	E9773	E9775	E9781	E9777	E9779	E9783	E9785	E9787	E9789
DTR Number:						E9818	E9766	E9768	E9770	E9772	E9774	E9776	E9782	E9778	E9780	E9784	E9786	E9788	E9790
ITR Number:	MEA268	MEA269	MEA270	MEA271	MEA272	MEA299	MEA273	MEA274	MEA275	MEA276	MEA277	MEA278	MEA281	MEA279	MEA280	MEA282	MEA283	MEA284	MEA285
INORGANIC COMPOUNDS (units) MG/KG DRY WEIGHT																			
ALUMINUM	7452	5530	6140	5610	5550	307	13200	2630	6030	4460	8740	9780	7810	7840	8790	7830	7600	7090	8480
ANTIMONY																			
ARSENIC		18 R	22 R	31 R	16 R			11 R	15 R	17 R	22 S R	17 R	13 R	16 R	17 R	16 S,R,+	18 R	15 R	14 R
BARIUM	[89] R	122	[58]	[77]	[83]	[3.9]	[47]	[54]	[109]	[93]	[55]	[52]	[58]	[54]	[65]	[78]	[46]	343	[68]
BERYLLIUM			[0.64]					[.83]	[.97]	[1.1]	[1.1]	[1.1]	[0.87]	[.94]	[1.1]	[0.98]	[0.74]	[1.0]	[1.1]
CADMIUM																		112	
CALCIUM	21258	[1630]	5520	13600	14900	[962]	[3130]	4840	18600	34200	3180	4240	[2520]	2870	3130	[2430]	[2020]	[1830]	13600
CHROMIUM	16 R	67	18	22	27	[2.3]	18	11	22	102	17	19	18	44	24	25	15	21	24
COBALT			[9.6]	[6.1]	[4.6]		[11]		[9.1]	[7.4]	[14]	[19]	[8.5]	[12]	[20]	[12]	[8.1]	[8.0]	[14]
COPPER	[12]	67	33	34	52		17	[10]	25	29	27	43	26	43	41	28	29	57	44
IRON	30820	33900	33400	33100	30900	233	31600	20900	28800	33400	34900	54600	38300	34000	39400	43400	34100	32700	39200
LEAD	25 R	65 *	49 *	28 *	57 *		69 *	25 *	103 *	116 *	33 *	17 *	16.5 *	31 *	28 *	27 *	70 *	39 *	37 S,*
CYANIDE		10.6 R	43.6	2.4 R	10.9 R		.4 R	.36 R	1.2 R	1.9 R	.34 R	.95 R	.6 R	.86 R	11.3 R	.6 R	.83 R	12.7 R	8.4 R
MAGNESIUM	[1375]	[19400]	[2590]	[1660]	[1690]	[78]	3590	[920]	[2750]	3400	3160	3750	[2720]		3160	[2670]	[2790]	[2750]	[2840]
MANGANESE	127 R,E	199	245	136	162	[2.6]	271	87	403	2620	527	477	236	365	642	292	268	281	300
MERCURY	.26			0.2	0.2			0.8								0.2			0.2
NICKEL	[14] R	[11]	28	[12]	[15]		[25]		29	[20]	29	28	[20]	26	33	24	24	[23]	24
POTASSIUM	[1021]	[1770]	[1530]	[1520]	[1130]		[862]	[969]	[1400]	[793]	[1890]	[1820]	[1030]	[1500]	[1660]	[1350]	[1520]	[1480]	[1560]
SELENIUM																			
SILVER																			
SODIUM		[166]	[247]	[178]	[157]	[2210]	[106]	[156]	[179]	[217]	[114]	[124]	[109]	[627]	[168]	[153]	[174]	[277]	[206]
THALLIUM																			
TIN				[18]						[15]						[15] R			
VANADIUM	[25] R	[15]	[20]	[23]	[22]	[25]	[25]	[14]	[20]	35	[22]	[29]	[25]	[25]	[26]	[27]	[19]	[20]	[24]
ZINC	110 R	67	103	192	120		65	40	483	803	100	113	85	89	130	112	89	347	194
PERCENT MOISTURE																			
PERCENT SOLIDS	86.8	84.4	81.1	88.2	80.5	78.1	79.7	79.7	82.5	86.2	83.7	82.9	82.3	88.4	82.0	85.2	85.2	81.9	84.8

FOOTNOTES:

B: Analyte has been found in the laboratory blank as well as the sample. Indicates possible/probable contamination.
C: Applies to pesticide parameters where the identification has been confirmed by GC/MS.
E: Value is estimated due to presence of interference.
J: An estimated value
R: Spike sample recovery is not within control limits.
S: Value is determined by standard addition.
*: Duplicate analysis is not within control limits.
**: Samples analyzed at medium concentrations.
[]: Positive values less than the contract required detection limit.

TABLE 1
SUMMIT NATIONAL SITE
ONSITE SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Number:	SS037001	SS038001	SS039001	SS040001	SS041001	SS042001	SS043001	SS044001	SS045001	SS046001	SS047001	SS048001	SS049001
Sample Type:	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Date Sampled:	11/14/84	11/14/84	11/14/84	11/14/84	11/14/84	11/14/84	11/14/84	11/15/84	11/15/84	11/15/84	11/15/84	11/15/84	11/15/84
OTR Number:	E9791	E9793	E9795	E9797	E9799	E9801	E9803	E9805	E9807	E9809	E9811	E9813	E9815
OTR Number:	E9792	E9794	E9796	E9798	E9800	E9802	E9804	E9806	E9808	E9810	E9812	E9814	E9816
ITR Number:	MEA286	MEA287	MEA288	MEA289	MEA290	MEA291	MEA292	MEA293	MEA294	MEA295	MEA296	MEA297	MEA298
ORGANIC COMPOUNDS (units-ug/kg)													
VOLATILES													
CHLOROMETHANE													
VINYL CHLORIDE													
METHYLENE CHLORIDE	6.0	6.1	18	11	13	15	11	13	3.8	17	8.4	13	6.2
ACETONE			153	309	24		38	52			72		
CARBON DISULFIDE													
1,1-DICHLOROETHENE			3.2										
1,1-DICHLOROETHANE			15										
TRANS-1,2-DICHLOROETHENE			381	4.9			14	2.4					
CHLOROFORM	19			2.4									
1,2-DICHLOROETHANE													
2-BUTANONE													
1,1,1-TRICHLOROETHANE	171		822	46			30		37	30			
1,1,2,2-TETRACHLOROETHANE													
TRICHLOROETHENE	2.7	3.8	1100	189	22	12	85	24	8.9	15	11	2.6	
1,1,2-TRICHLOROETHANE													
BENZENE	4.6	4.7	5.0	4.9	4.9	3.7	3.6	3.7	5.1	4.9	3.6	3.9	3.7
2-HEXANONE			19										
4-METHYL-2-PENTANONE													
TETRACHLOROETHENE			7.5										
TOLUENE	440	14	202	41	6.1		88	15	7.7	217	14		
CHLOROBENZENE	12						20	4.9		8.5			
ETHYLBENZENE	7.2		52	4.9			16	3.7		16			
STYRENE													
TOTAL XYLENES	38		394	68	15	7.3	103	28	14	206	26		
TOTAL VOLATILES	700	28.6	3172	681	85	38	409	147	76.5	514	135	19.5	9.9
TOTAL TENTATIVELY IDENTIFIED VOLATILES	200	200	200	212	200	200	200	282	200	347	200	200	200
BASE/NEUTRALS AND ACIDS													
N-NITROSODIMETHYLAMINE													
PHENOL													
ANILINE													
1,3-DICHLOROBENZENE													
1,4-DICHLOROBENZENE													
BENZYL ALCOHOL													
1,2-DICHLOROBENZENE				11200 J									
2-METHYLPHENOL													
BIS(2-CHLOROISOPROPYL)ETHER													

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ONSITE SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Number:	SS037001	SS038001	SS039001	SS040001	SS041001	SS042001	SS043001	SS044001	SS045001	SS046001	SS047001	SS048001	SS049001
Sample Type:	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Date Sampled:	11/14/84	11/14/84	11/14/84	11/14/84	11/14/84	11/14/84	11/14/84	11/15/84	11/15/84	11/15/84	11/15/84	11/15/84	11/15/84
DTR Number:	E9791	E9793	E9795	E9797	E9799	E9801	E9803	E9805	E9807	E9809	E9811	E9813	E9815
DTR Number:	E9792	E9794	E9796	E9798	E9800	E9802	E9804	E9806	E9808	E9810	E9812	E9814	E9816
ITR Number:	MEA286	MEA287	MEA288	MEA289	MEA290	MEA291	MEA292	MEA293	MEA294	MEA295	MEA296	MEA297	MEA298
4-METHYLPHENOL													
HEXACHLOROETHANE													
ISOPHORONE													
2-NITROPHENOL													
2,4-DIMETHYLPHENOL													
BENZOIC ACID													
1,2,4-TRICHLOROBENZENE													
NAPHTHALENE	6630 J,**												592 **
4-CHLORO-3-METHYLPHENOL													
2-METHYLNAPHTHALENE				2820 J,**									955 **
HEXACHLOROCYCLOPENTADIENE													
DIMETHYL PHTHALATE													
ACENAPHTHYLENE													
ACENAPHTHENE													
4-NITROPHENOL													
DIBENZOFURAN													258 **
DIETHYLPHTHALATE													
FLUORENE													
N-NITROSODIPHENYLAMINE(1)													
HEXACHLOROBENZENE	4860 J,**												
PENTACHLOROPHENOL													
PHENANTHRENE													662 **
ANTHRACENE													
DI-N-BUTYLPHTHALATE													
FLUORANTHENE													150 J,**
PYRENE													170 J,**
BUTYLBENZYLPHTHALATE													
BENZO(A)ANTHRACENE													
BIS(2-ETHYLHEXYL)PHTHALATE	16600 **	5210 J,B,**	52900 B,**	28000 B,**	5710 J,**	4400 J,B,**	29000 B,**	22800 B,**	7140 B,J,*	22700 B,**		49900 B,**	
CHRYSENE													
DI-N-OCTYL PHTHALATE				3620 J,**				2330 J,**		2300 J,**			
BENZO(B)FLUORANTHENE													
BENZO(K)FLUORANTHENE													
BENZO(A)PYRENE													
INDENO(1,2,3-CD)PYRENE													
DIBENZ(A,H)ANTHRACENE													
BENZO(G,H,I)PERYLENE													
TOTAL BASE/NEUTRALS AND ACIDS	28090	5210	52900	45640	5710	4400	29000	25130	7140	25000		49900	2787
TOTAL TENTATIVELY IDENTIFIED BASE/NEUTRALS AND ACIDS	171920	0	130200	40400	0	0	0	86400	11000	163300	142480	121000	17959

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SUMMIT NATIONAL SITE
ONSITE SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Number:	SS037001	SS038001	SS039001	SS040001	SS041001	SS042001	SS043001	SS044001	SS045001	SS046001	SS047001	SS048001	SS049001
Sample Type:	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Date Sampled:	11/14/84	11/14/84	11/14/84	11/14/84	11/14/84	11/14/84	11/14/84	11/15/84	11/15/84	11/15/84	11/15/84	11/15/84	11/15/84
OTR Number:	E9791	E9793	E9795	E9797	E9799	E9801	E9803	E9805	E9807	E9809	E9811	E9813	E9815
OTR Number:	E9792	E9794	E9796	E9798	E9800	E9802	E9804	E9806	E9808	E9810	E9812	E9814	E9816
ITR Number:	MEA286	MEA287	MEA288	MEA289	MEA290	MEA291	MEA292	MEA293	MEA294	MEA295	MEA296	MEA297	MEA298
PESTICIDES and PCBs													
ALPHA-BHC													
BETA-BHC													
DELTA-BHC													
GAMMA-BHC (LINDANE)								9.2 J					
HEPTACHLOR													
ALDRIN													
HEPTACHLOR EPOXIDE			19.8 J,**										
ENDOSULFAN I													
DIELDRIN		21.9 J,**											
4,4-DDE													
ENDRIN													
4,4-DDT													
TOXAPHENE													
AROCHLOR-1232													
AROCHLOR-1242		4809 **									50043		
AROCHLOR-1248	13700 **												
AROCHLOR-1254													
MIREX													
TOTAL PESTICIDES and PCBs	13700	4831	19.8					9.2			50043		
PERCENT MOISTURE (VOLATILES)	17	22	23	18	18	18	17	18	22	18	17	23	20

TABLE 1
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ONSITE SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Number:	SS037001	SS038001	SS039001	SS040001	SS041001	SS042001	SS043001	SS044001	SS045001	SS046001	SS047001	SS048001	SS049001
Sample Type:	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Date Sampled:	11/14/84	11/14/84	11/14/84	11/14/84	11/14/84	11/14/84	11/14/84	11/15/84	11/15/84	11/15/84	11/15/84	11/15/84	11/15/84
OTR Number:	E9791	E9793	E9795	E9797	E9799	E9801	E9803	E9805	E9807	E9809	E9811	E9813	E9815
DTR Number:	E9792	E9794	E9796	E9798	E9800	E9802	E9804	E9806	E9808	E9810	E9812	E9814	E9816
ITR Number:	MEA286	MEA287	MEA288	MEA289	MEA290	MEA291	MEA292	MEA293	MEA294	MEA295	MEA296	MEA297	MEA298
INORGANIC COMPOUNDS (units) MG/KG DRY WEIGHT													
ALUMINUM	7560	5600	5610	14600	15300	9900	18200	14900	18100	16600	14900	15900	14300
ANTIMONY				45 R	66 R	[16] R	46 R	46 R	67 R	76 R	545 R	57 R	42 R
ARSENIC	14 R	15 R	23 S,R	14 S	22	22 S	22 S	14	17	16	7.3 S	33	9.4
BARIUM	[83]	[50]	[108]	[123]	186	[92]	185	233	242	163	244	197	171
BERYLLIUM	[.65]	[0.74]	[1.1]		[1.6]		[1.5]	[1.5]	[1.6]	[0.97]	[1.9]	[1.6]	[1.2]
CADMIUM													
CALCIUM	12900	21400	4070	15200	11700	37000	10500	16200	30900	7420	19800	3570	[11400]
CHROMIUM	21	10	27	60	35	17	37	36	44	46	54	50	34
COBALT	[7.3]		[7.2]	[16]	[20]	[5.6]	[20]	[19]	[28]	[20]	[26]	[22]	[18]
COPPER	32	[12]	43	51	49	[12]	58	51	66	61	60	54	43
IRON	33500	12200	24300	72000	73300	33200	68500	77300	94500	80100	74300	95300	82900
LEAD	26 S,*	41 *	24 *	20	32	32	29 S	18 S	32	33	55	23 S	22 S
CYANIDE	8.6 R	1.2 R	3.7 R	.88 *	.57 *	1.7 *	3.0 *	.95 *	.63 *	2.7 *	2.4 *		.31 *
MAGNESIUM	[2700]	[326]	[1650]	4460	3990	[1670]	5880	4710	6120	5030	5590	5100	4340
MANGANESE	227	29	209	356	333	124	462	381	661	316	718	543	451
MERCURY		.2	.2	.1	.1				.1		.1		
NICKEL	[19]		[21]	41	37	[12]	40	42	53	30	56	46	45
POTASSIUM	[1560]	[1120]	[1420]	3310	[2800]	[2510]	3390	3230	3720	4250	3210	[3040]	3260
SELENIUM													
SILVER													
SODIUM	[145]	[132]	[212]	[231]	[464]	[283]	[241]	[294]	[1280]	[271]	[269]	[222]	[202]
THALLIUM													
TIN							[13] R		[15] R		[15] R		
VANADIUM	[23]	[14]	[22]	41	50	[24]	50	48	62	59	51	60	59
ZINC	120	26	74	132	130	51	272	255	304	196	626	231	327
PERCENT MOISTURE													
PERCENT SOLIDS	84.2	78.0	79.8	81.1	81.3	80.8	81.9	83.6			81.8	78.8	80.0

FOOTNOTES:

B: Analyte has been found in the laboratory blank as well as the sample. Indicates possible/probable contamination.
C: Applies to pesticide parameters where the identification has been confirmed by GC/MS.
E: Value is estimated due to presence of interference.
J: An estimated value
R: Spike sample recovery is not within control limits.
S: Value is determined by standard addition.
*: Duplicate analysis is not within control limits.
**: Samples analyzed at medium concentrations.
[]: Positive values less than the contract required detection limit.

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ONSITE SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Number:	SS1-3001	SS1-3001	SS1-4001	SS1-6001	SS1-8001	SS2-1001	SS2-2001	SS2-2001	SS2-2001	SS2-2002	SS2-4001	SS2-5001	SS2-5001	SS2-7001	SS2-7001	SS2-8001	SS3-1001	SS3-2001	SS3-4001
Sample Type:	At 4 Ft.	At 6 Ft.	At 4 Ft.	At 8 Ft.	At 8 Ft.	At 8 Ft.	At 2 Ft.	At 6 Ft.	At 8 Ft.	At 2 Ft.	At 4 Ft.	At 4 Ft.	At 8 Ft.	At 4 Ft.	At 8 Ft.	At 6 Ft.	At 8 Ft.	At 8 Ft.	At 8 Ft.
Date Sampled:	01/09/86	01/09/86	12/31/85	12/18/85	12/16/85	12/27/85	12/20/85	12/20/85	12/20/85	12/20/85	01/09/86	12/19/85	12/19/85	12/19/85	12/19/85	01/09/86	01/08/86	12/27/85	12/19/85
DTR Number:	E9875	E9876	E9877	E9878	E9879	E9880	E9881	E9883	E9884	E9882	E9885	E9886	E9887	E9888	E9889	E9890	E9891	E9892	E9893
QTR Number:																			
ITR Number:	ME4473	ME4474	ME4475	ME4476	ME4477	ME4478	ME4479	ME4481	ME4482	ME4480	ME4483	ME4484	ME4485	ME4486	ME4487	ME4488	ME4489	ME4490	ME4491
ORGANIC COMPOUNDS (units-ug/kg)																			
VOLATILES																			
CHLOROMETHANE																			
VINYL CHLORIDE																			
METHYLENE CHLORIDE	20 B	11 B	9 B	18 B	29 B	32 B	14 B	16 B	69 B	11 B	24 B	51 B	9 B	24 B	23 B	16 B	11 B	17 B	23 B
ACETONE	81 B	42 B	53 B	34 B	29 B	46 B	53 B	32 B	46 B	50 B	32 B	120 B	37 B	37 B	65 B	100 B	59 B	70 B	48 B
CARBON DISULFIDE	6		15			8						20					5	3 J	5
1,1-DICHLOROETHENE																			14
1,1-DICHLOROETHANE							7		3 J	10									42
TRANS-1,2-DICHLOROETHENE																			
CHLOROFORM																			
1,2-DICHLOROETHANE																			
2-BUTANONE	30 B	33 B	34 B	25 B	25 B	40 B	36 B	18 B	28 B	40 B	22 B	35 B	38 B	24 B	28 B	54 B	35 B	36 B	33 B
1,1,1-TRICHLOROETHANE				4 J	4 J	10	20	5		25		16		10					340
1,1,2,2-TETRACHLOROETHANE																			
TRICHLOROETHENE				75	4 J	5						5		5	4 J				4 J
1,1,2-TRICHLOROETHANE																			
BENZENE	29	11	30	12	38	110		4 J	4 J		12	110	5	23	28	29	10	39	29
2-HEXANONE																			
4-METHYL-2-PENTANONE	14	7 B														13	5 J	4 J	
TETRACHLOROETHENE				8										5					3 J
TOLUENE	290	82	120	70	180	270	5	36	17	4 J	17	410	18	61	100	140	54	130	110
CHLOROBENZENE			51	46				4 J				11		52	15				9
ETHYLBENZENE	14	4 J	27	15	16	31		7	3 J			52		7	14	7	8	18	17
STYRENE																			
TOTAL XYLENES	40	11	100	61	79	140		30	24		11	280	10	43	60	27	31	78	59
TOTAL VOLATILES	524	201	439	368	404	692	135	152	194	140	118	1110	117	291	337	386	218	395	736
TOTAL TENTATIVELY IDENTIFIED VOLATILES	365	29.3	378	70.3	126	318	0	117	16.3		321	726	0	107	41.9	69.2	165	198	214
BASE/NEUTRALS AND ACIDS																			
N-NITROSODIMETHYLAMINE																			
PHENOL	52 J																		
ANILINE																			
1,3-DICHLOROBENZENE																			
1,4-DICHLOROBENZENE							76 J			130 J				76 J					
BENZYL ALCOHOL																			
1,2-DICHLOROBENZENE							52 J			100 J									
2-METHYLPHENOL																			
BIS(2-CHLOROISOPROPYL)ETHER																			

TABLE 1
SUMMIT NATIONAL SITE
ONSITE SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Number:	SS1-3001	SS1-3001	SS1-4001	SS1-6001	SS1-8001	SS2-1001	SS2-2001	SS2-2001	SS2-2001	SS2-2002	SS2-4001	SS2-5001	SS2-5001	SS2-7001	SS2-7001	SS2-8001	SS3-1001	SS3-2001	SS3-4001
Sample Type:	At 4 Ft.	At 6 Ft.	At 4 Ft.	At 8 Ft.	At 8 Ft.	At 8 Ft.	At 2 Ft.	At 6 Ft.	At 8 Ft.	At 2 Ft.	At 4 Ft.	At 4 Ft.	At 8 Ft.	At 4 Ft.	At 8 Ft.	At 6 Ft.	At 8 Ft.	At 8 Ft.	At 8 Ft.
Date Sampled:	01/09/86	01/09/86	12/31/85	12/18/85	12/16/85	12/27/85	12/20/85	12/20/85	12/20/85	12/20/85	01/09/86	12/19/85	12/19/85	12/19/85	12/19/85	01/09/86	01/08/86	12/27/85	12/19/85
DTR Number:	E9875	E9876	E9877	E9878	E9879	E9880	E9881	E9883	E9884	E9882	E9885	E9886	E9887	E9888	E9889	E9890	E9891	E9892	E9893
QTR Number:																			
ITR Number:	ME4473	ME4474	ME4475	ME4476	ME4477	ME4478	ME4479	ME4481	ME4482	ME4480	ME4483	ME4484	ME4485	ME4486	ME4487	ME4488	ME4489	ME4490	ME4491
4-METHYLPHENOL	68 J																		
HEXACHLOROETHANE							66 J												
ISOPHORONE																			
2-NITROPHENOL																			
2,4-DIMETHYLPHENOL	190 J																		
BENZOIC ACID																			
1,2,4-TRICHLOROBENZENE																			
NAPHTHALENE	2600		27000 **	79 J	810	2300	1000	460	660	1600	200 J	6400	5100 J,**	850	240 J		830	2700	3900 J,**
4-CHLORO-3-METHYLPHENOL																			
2-METHYLNAPHTHALENE	4300		44000 **	130 J	1300	3700	1000	340	620	1200	310 J	8300	6800 **	1100	230 J		820	2300	3500 J,**
HEXACHLOROCYCLOPENTADIENE																			
DIMETHYL PHTHALATE																			
ACENAPHTHYLENE																			
ACENAPHTHENE	110 J					110 J	48 J										38 J	100 J	
4-NITROPHENOL																			
DIBENZOFURAN	910		6300 J,**	37 J	210 J	700	300 J	130 J	170 J	460	120 J	3100		310 J	70 J		200 J	460	
DIETHYLPHTHALATE																			
FLUORENE	290 J		2800 J,**			340	130 J	69 J	110 J	200 J	70 J	1000 J		59 J			130 J	340	
N-NITROSODIPHENYLAMINE(1)																			
HEXACHLOROBENZENE							48 J			180 J									
PENTACHLOROPHENOL									110 J										
PHENANTHRENE	1700		16000 **	110 J	470	1600	810	330	360	1000	290 J	6100	4700 J,**	660	140 J		510	1800	2000 J,**
ANTHRACENE									41 J										
DI-N-BUTYLPHTHALATE	51 B,J			49 B,J	38 B,J	53 B,J	350 B	380 B	180 B,J	460 B	92 J,B	1800 B		150 J,B	160 J,B	56 J,B	60 J,B	67 J,B	2400 J,**
FLUORANTHENE	590		2200 J,**	39 J	120 J	230 J	93 J	58 J	98 J	160 J	59 J	1200 J		130 J			62 J	240 J	
PYRENE	490		3600 J,**	42 J	400	280 J	260 J	120 J	190 J	350	160 J	1600 J		170 J	49 J		150 J	390	
BUTYLBENZYLPHTHALATE								59 J											
BENZO(A)ANTHRACENE	460		3000 J,**		130 J	150 J		56 J	72 J	170 J		1100 J		78 J			88 J	190 J	
BIS(2-ETHYLHEXYL)PHTHALATE	58 J	47 J		860	71 J	680	10000	4500	630	12000	200 J	1800	12000 **	570	190 J	82 J	75 J	110 J	370000 **
CHRYSENE	330		2700 J,**		150 J	200 J	110 J	60 J	90 J	190 J	76 J	980 J		87 J			59 J	140 J	
DI-N-OCTYL PHTHALATE						63 J													
BENZO(B)FLUORANTHENE	410				180 J	210 J	140 J	71 J	140 J	540	120 J	1100 J		110 J			80 J	200 J	
BENZO(K)FLUORANTHENE	410				180 J	210 J	140 J	71 J	140 J	540	120 J	1100 J		110 J			80 J	200 J	
BENZO(A)PYRENE	230 J				73 J	100 J	80 J	49 J	81 J	260 J	56 J			60 J			50 J	110 J	
INDENO(1,2,3-CD)PYRENE	80 J						77 J		100 J	180 J	68 J							85 J	
DIBENZ(A,H)ANTHRACENE	43 J								66 J										
BENZO(G,H,I)PERYLENE	140 J					82 J	150 J	75 J	160 J	600	240 J			73 J			110 J	290 J	
TOTAL BASE/NEUTRALS AND ACIDS	13512	47	107600	1346	4132	11008	14930	6828	4018	20320	2181	35580	28600	4593	1079	138	3342	9722	381800
TOTAL TENTATIVELY IDENTIFIED BASE/NEUTRALS AND ACIDS	43029	5091	495023	5507		35297	14333	12946	9688				76140	21328	5598	4005	10332	32209	8662

TABLE 1
SUMMIT NATIONAL SITE
ONSITE SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Number:	SS1-3001	SS1-3001	SS1-4001	SS1-6001	SS1-8001	SS2-1001	SS2-2001	SS2-2001	SS2-2001	SS2-2002	SS2-4001	SS2-5001	SS2-5001	SS2-7001	SS2-7001	SS2-8001	SS3-1001	SS3-2001	SS3-4001
Sample Type:	At 4 Ft.	At 6 Ft.	At 4 Ft.	At 8 Ft.	At 8 Ft.	At 8 Ft.	At 2 Ft.	At 6 Ft.	At 8 Ft.	At 2 Ft.	At 4 Ft.	At 4 Ft.	At 8 Ft.	At 4 Ft.	At 8 Ft.	At 6 Ft.	At 8 Ft.	At 8 Ft.	At 8 Ft.
Date Sampled:	01/09/86	01/09/86	12/31/85	12/18/85	12/16/85	12/27/85	12/20/85	12/20/85	12/20/85	12/20/85	01/09/86	12/19/85	12/19/85	12/19/85	12/19/85	01/09/86	01/08/86	12/27/85	12/19/85
DTR Number:	E9875	E9876	E9877	E9878	E9879	E9880	E9881	E9883	E9884	E9882	E9885	E9886	E9887	E9888	E9889	E9890	E9891	E9892	E9893
QTR Number:																			
ITR Number:	ME4473	ME4474	ME4475	ME4476	ME4477	ME4478	ME4479	ME4481	ME4482	ME4480	ME4483	ME4484	ME4485	ME4486	ME4487	ME4488	ME4489	ME4490	ME4491
PESTICIDES and PCBs																			
ALPHA-BHC																			
BETA-BHC																			
DELTA-BHC																			
GAMMA-BHC (LINDANE)																			
HEPTACHLOR																			
ALDRIN																			
HEPTACHLOR EPOXIDE																			
ENDOSULFAN I																			
DIELDRIN																			
4,4-DDE																			
ENDRIN																			
4,4-DDT																			
TOXAPHENE																			
AROCHLOR-1232																			
AROCHLOR-1242																			
AROCHLOR-1248													1000 J	6400 C					
AROCHLOR-1254																			
MIREX																			
TOTAL PESTICIDES and PCBs													1000	6400					
PERCENT MOISTURE (VOLATILES)	15	14	13	15	12	17	17	16	15	18	13	19	14	17	16	12	16	13	13

TABLE 1
SUMMIT NATIONAL SITE
ONSITE SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Number:	SS1-3001	SS1-3001	SS1-4001	SS1-6001	SS1-8001	SS2-1001	SS2-2001	SS2-2001	SS2-2001	SS2-2002	SS2-4001	SS2-5001	SS2-5001	SS2-7001	SS2-7001	SS2-8001	SS3-1001	SS3-2001	SS3-4001
Sample Type:	At 4 Ft.	At 6 Ft.	At 4 Ft.	At 8 Ft.	At 8 Ft.	At 8 Ft.	At 2 Ft.	At 6 Ft.	At 8 Ft.	At 2 Ft.	At 4 Ft.	At 4 Ft.	At 8 Ft.	At 4 Ft.	At 8 Ft.	At 6 Ft.	At 8 Ft.	At 8 Ft.	At 8 Ft.
Date Sampled:	01/09/86	01/09/86	12/31/85	12/18/85	12/16/85	12/27/85	12/20/85	12/20/85	12/20/85	12/20/85	01/09/86	12/19/85	12/19/85	12/19/85	12/19/85	01/09/86	01/08/86	12/27/85	12/19/85
OTR Number:	E9875	E9876	E9877	E9878	E9879	E9880	E9881	E9883	E9884	E9882	E9885	E9886	E9887	E9888	E9889	E9890	E9891	E9892	E9893
OTR Number:																			
ITR Number:	ME4473	ME4474	ME4475	ME4476	ME4477	ME4478	ME4479	ME4481	ME4482	ME4480	ME4483	ME4484	ME4485	ME4486	ME4487	ME4488	ME4489	ME4490	ME4491
INORGANIC COMPOUNDS (units) MG/KG DRY WEIGHT																			
ALUMINUM	2740	10900	2810	8080	10900	5740	5990	6120	8850	6870	4060	1110	5990	6290	6340	7110	10500	2850	5020
ANTIMONY				[16] J,R				[16] J,R											[22] J,R
ARSENIC	17 J	19 J	61 J	17 J	18 J	18 J	15 J	17 J	14 J	21 J	16 J	27 J	13 J	20 J	15 J	15 J	12 J	9.3 J	14 J
BARIUM	[61]	[53]	[81]	172	253	[49]	[75]	[107]	[65]	[80]	118	[96]	[109]	[84]	[56]	[53]	183	124	[78]
BERYLLIUM	[0.93]	[1.13]	[0.91]	[0.79]	[1.8]	[1]	[0.65]	[0.92]	[0.63]	[1.4]	[0.91]	[0.8]	[0.64]	[0.81]	[0.65]	[0.51]	[1.2]	[0.9]	[0.61]
CADMIUM		[2.6]	[2.7]																
CALCIUM	5020	5230	5640	3210	[10200]	6540	11300	7880	5880	9940	3440	6900	5540	[17100]	[12100]	[360]	3210	[22800]	10300
CHROMIUM	9	19	9.6	17	20	13	15	14	18	16	9.3	10	29	17	13	16	18	8.8	17
COBALT	[5]	[21]	[12]	[16]	51	[15]	[11]	[10]	[16]	[15]	[9.4]	[6.7]	[13]	[11]	[9.7]	[6.7]	[23]	[7]	[14]
COPPER	22	31	37	28	30	25	30	43	27	29	33	32	35	43	26	29	29	23	31
IRON	22000	32200	36400	29200	34700	27700	26900	24700	33100	29000	16100	16900	27400	33900	21500	33800	27500	20800	43100
LEAD	34	18	42	19	15	14	20	45	17	31	14	27	22	36	19	12	16	15	33
CYANIDE																			
MAGNESIUM	[681]	6020	[1290]	3620	4340	3650	3450	[2510]	5140	4220	[2490]	[373]	[2620]	[2330]	[2370]	[2000]	4760	[1360]	2960
MANGANESE	118	331	98	648	558	261	267	182	369	380	250	54	460	300	234	120	282	132	451
MERCURY			.28					.19	.13	.14		.32	.14	[.074]				[0.07]	
NICKEL	[10]	40	[24]	32	47	28	29	26	36	32	24	[12]	32	25	[23]	[15]	39	[14]	26
POTASSIUM	[814]	[1730]	[975]	[1390]	3450	[1320]	[1330]	[1040]	[1350]	[1480]	[1490]	[625]	[1370]	[1540]	[1180]	[1180]	[1360]	[1710]	[1290]
SELENIUM												5.1 S							
SILVER	[2.7] J,R					[3.4] J,R								[2.5] J,R					[2.9] J,R
SODIUM																			
THALLIUM			[5.9]																
TIN																			
VANADIUM	[17]	[24]	[24]	[21]	[24]	[18]	[17]	[16]	[21]	[19]	[11]	[17]	[18]	[21]	[20]	[22]	[20]	[12]	[20]
ZINC	34	79	222	97	88	64	190	359	90	141	84	54	171	88	77	51	74	42	103
PERCENT MOISTURE																			
PERCENT SOLIDS	83	85	85	83	84	88	82	84	84	84	85	82	83	81	81	80	83	86	87

FOOTNOTES:

B: Analyte has been found in the laboratory blank as well as the sample. Indicates possible/probable contamination.
C: Applies to pesticide parameters where the identification has been confirmed by GC/MS.
E: Value is estimated due to presence of interference.
J: An estimated value
R: Spike sample recovery is not within control limits.
S: Value is determined by standard addition.
*: Duplicate analysis is not within control limits.
**: Samples analyzed at medium concentrations.
[]: Positive values less than the contract required detection limit.

TABLE 1
SUMMIT NATIONAL SITE
ONSITE SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Number:	SS3-6001	SS3-8001	SS4-1001	SS4-4001	SS4-5001	SS4-6001	SS4-6001	SS4-8001	SS5-1001	SS5-2001	SS5-2001	SS5-3001	SS5-3001	SS5-4001	SS5-4001	SS5-4002	SS5-6001
Sample Type:	At 8 Ft.	At 8 Ft.	At 8 Ft.	At 8 Ft.	At 8 Ft.	At 2 Ft.	At 8 Ft.	At 8 Ft.	At 8 Ft.	At 2 Ft.	At 6 Ft.	At 4 Ft.	At 8 Ft.	At 2 Ft.	At 8 Ft.	At 2 Ft.	At 8 Ft.
Date Sampled:	12/30/85	12/31/85	12/28/85	01/08/86	01/07/86	01/07/86	01/07/86	01/07/86	01/08/86	12/28/85	12/28/85	12/30/85	12/30/85	12/30/85	12/30/85	12/30/85	01/07/86
DTR Number:	E9894	E9895	E9896	E9897	E9898	E9899	E9900	EA451	EA452	EA454	EA453	EB185	EB186	EB187	EB189	EB188	EB190
DTR Number:																	
ITR Number:	ME4492	ME4493	ME4494	ME4495	ME4496	ME4497	ME4498	ME4499	ME4500	MEB372	MEB371	MEB383	MEB384	MEB385	MEB387	MEB386	MEB388
ORGANIC COMPOUNDS (units-ug/kg)																	
VOLATILES																	
CHLOROMETHANE																	
VINYL CHLORIDE																	
METHYLENE CHLORIDE	190 J,**	68 B	23 B	350 J,**	1100 J,B**	290 B	4900 J,**	26 B	23 B	81 B	35 B		3300 J,**	18000 B,**	6000 B,J,**	5400 B,J,**	31 B
ACETONE	6000 B,**	62 B	87 B	3400 B,**	14000 B,**	100 B	35000 B,**	52 B	130 B	150 B	120 B	17000 B,**	17000 B,**	520000 B,**	42000 B,**	44000 B,**	290 B
CARBON DISULFIDE			6			10			4 J	8							10
1,1-DICHLOROETHENE			3 J			33									7600 J,**		3 J
1,1-DICHLOROETHANE	110 J,**			470 J,**		9	41000 **	16							13000 **		43
TRANS-1,2-DICHLOROETHENE												7700 **			5400 J,**		
CHLOROFORM						10				4 J				4300 J,**			
1,2-DICHLOROETHANE	11000 **	14		1000 **	8600 **	140		21					68000 **	76000 **	64000 **	80000 **	330
2-BUTANONE	9400 B,**	37 B	61 B	180 J,B,**	16000 B,**	130 B	33000 B,**	28 B	16 B	28 B	30 B	49000 B,**	25000 B,**	35000 B,**	40000 B,**	38000 B,**	66 B
1,1,1-TRICHLOROETHANE	710 **		12	7700 **	1600 J,**	1100	14000 **	34		19		43000 **	12000 **	47000 **	230000 **	51000 **	31
1,1,2,2-TETRACHLOROETHANE																	
TRICHLOROETHENE	400 J,**	10	9	880 **	1200 J,**	240	2500 J,**	19		220	4 J	140000 **	25000 **	150000 **	430000 **	160000 **	6
1,1,2-TRICHLOROETHANE						48											
BENZENE		27	30			14		39	42	24	31						10
2-HEXANONE																	
4-METHYL-2-PENTANONE	260 J,**							11	10			5600 J,**	2500 J,**		6400 J,**		6 J
TETRACHLOROETHENE				190 J,**	2300 J,**	12	2500 J,**					3800 J,**					
TOLUENE	5500 **	100	140	14000 **	40000 **	370	140000 **	130	110	66	91	9000 **	45000 **	62000 **	7100 J,**	36000 **	88 B
CHLOROBENZENE			5		5200 **	82											
ETHYLBENZENE	6800 **	10	21	20000 **	46000 **	18	76000 J,**	18	12	8	11	3400 J,**	58000 **	180000 **	45000 **	75000 **	11
STYRENE																	
TOTAL XYLENES	28000 **	44	200	70000 **	190000 **	700	270000 **	110	86	71	110	18000 **	210000 **	730000 **	260000 **	280000 **	32
TOTAL VOLATILES	68370	372	597	118170	326000	3306	618900	504	433	679	432	296500	465800	1822300	1156500	769400	957
TOTAL TENTATIVELY IDENTIFIED VOLATILES	0	37.7	70.8	18015.2	0	208	61872.9	29.7	152	56.4	56	0	0	101938.7	71648	36524.3	28.7
BASE/NEUTRALS AND ACIDS																	
N-NITROSODIMETHYLAMINE																	
PHENOL					740	7800 **		87 J				3300					
ANILINE																	
1,3-DICHLOROBENZENE																	
1,4-DICHLOROBENZENE												1500 J		18000 J,**	2300 J,**		
BENZYL ALCOHOL																	
1,2-DICHLOROBENZENE					1200					100 J	54 J	8300		140000 **	17000 **	67000 **	
2-METHYLPHENOL																	
BIS(2-CHLOROISOPROPYL)ETHER																	

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SUMMIT NATIONAL SITE
ONSITE SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Number:	SS3-6001	SS3-8001	SS4-1001	SS4-4001	SS4-5001	SS4-6001	SS4-6001	SS4-8001	SS5-1001	SS5-2001	SS5-2001	SS5-3001	SS5-3001	SS5-4001	SS5-4001	SS5-4002	SS5-6001
Sample Type:	At 8 Ft.	At 8 Ft.	At 8 Ft.	At 8 Ft.	At 8 Ft.	At 2 Ft.	At 8 Ft.	At 8 Ft.	At 8 Ft.	At 2 Ft.	At 6 Ft.	At 4 Ft.	At 8 Ft.	At 2 Ft.	At 8 Ft.	At 2 Ft.	At 8 Ft.
Date Sampled:	12/30/85	12/31/85	12/28/85	01/08/86	01/07/86	01/07/86	01/07/86	01/07/86	01/08/86	12/28/85	12/28/85	12/30/85	12/30/85	12/30/85	12/30/85	12/30/85	01/07/86
OTR Number:	E9894	E9895	E9896	E9897	E9898	E9899	E9900	EA451	EA452	EA454	EA453	EB185	EB186	EB187	EB189	EB188	EB190
OTR Number:																	
ITR Number:	ME4492	ME4493	ME4494	ME4495	ME4496	ME4497	ME4498	ME4499	ME4500	MEB372	MEB371	MEB383	MEB384	MEB385	MEB387	MEB386	MEB388
4-METHYLPHENOL																	
HEXACHLOROETHANE																	
ISOPHORONE					720					63 J							44 J
2-NITROPHENOL																	
2,4-DIMETHYLPHENOL					480												
BENZOIC ACID												9300					
1,2,4-TRICHLOROBENZENE					210 J							4200					
NAPHTHALENE	4000 J,**	560	1600	960 J	2700	14000 **	7000 **	360	2100	1300	850	3900	7800 **				1100
4-CHLORO-3-METHYLPHENOL																	
2-METHYLNAPHTHALENE	2000 J,**	620	2200	620 J	1800	13000 **	3500 J,**	290 J	2200	1800	850	5000	4600 J,**				1600
HEXACHLOROCYCLOPENTADIENE														2800000 **	130000 **	2300000 **	
DIMETHYL PHTHALATE																	
ACENAPHTHYLENE																	
ACENAPHTHENE			120 J		290 J				77 J								
4-NITROPHENOL									150 J								
DIBENZOFURAN		200 J	730		400			120 J	520	660	300 J	1000					160 J
DIETHYLPHTHALATE																	
FLUORENE			330		380				220 J	65 J	57 J						94 J
N-NITROSODIPHENYLAMINE(1)									40 J								
HEXACHLOROBENZENE					960	59000 **	2600 J,**					5800		250000 **	34000 **	160000 **	
PENTACHLOROPHENOL		58 J															
PHENANTHRENE	2300 J,**	440	1300	460 J	1200	8700 **	3100 J,**	340	1400	1200	670	3300	4100 J,**				440
ANTHRACENE			130 J		290 J												
DI-N-BUTYLPHTHALATE	2000 J,**	100 J,B	440 B	680 J,B	640 B			380 B	70 J,B	350 B	700 B	1100 J		12000 J,**			130 J
FLUORANTHENE		85 J	350		280 J			55 J	420	340	120 J	1900					80 J
PYRENE		92 J	330		140 J			88 J	310 J	350	210 J	1200 J					110 J
BUTYLBENZYLPHTHALATE	3400 J,**			450 J	1200	9000 **	4900 J,**					2200					
BENZO(A)ANTHRACENE		70 J	310 J					48 J	250 J	240 J	110 J		2500 J,**				38 J
BIS(2-ETHYLHEXYL)PHTHALATE	70000 **	220 J,B	130 J,B	12000 B	15000 B	330000 **	65000 **	600 B	100 J,B	3100 B	3600 B	130000	20000 **	3300000 **	160000 **	450000 **	67 J,B
CHRYSENE		60 J	170 J					48 J	150 J	220 J	130 J		2600 J,**				69 J
DI-N-OCTYL PHTHALATE	3100 J,**			920 J	990	8000 **	4300 J,**	200 J		1700	1300	13000	2200 J,**	170000 **	22000 **	110000 **	
BENZO(B)FLUORANTHENE		79 J	300 J	630 J				66 J	230 J	320 J	130 J		5500 J,**				70 J
BENZO(K)FLUORANTHENE		79 J	300 J	630 J				66 J	230 J	320 J	130 J		5500 J,**				70 J
BENZO(A)PYRENE			120 J	420 J					170 J	200 J	45 J		3000 J,**				
INDENO(1,2,3-CD)PYRENE				350 J						56 J		1400 J	2900 J,**				
DIBENZ(A,H)ANTHRACENE				410 J									2700 J,**				
BENZO(G,H,I)PERYLENE		53 J	200 J	400 J	210 J			82 J		130 J	84 J	1200 J	4500 J,**				110 J
TOTAL BASE/NEUTRALS AND ACIDS	86800	2716	9060	18930	29830	449500	90400	2830	8637	12514	9340	197600	67900	6690000	365300	3087000	4182
TOTAL TENTATIVELY IDENTIFIED BASE/NEUTRALS AND ACIDS	479274	13358	998	69723	234520	744623		10195	31829	27590	15058	322409	678260	3339342	481124	7398208	20686

TABLE 1
SUMMIT NATIONAL SITE
ONSITE SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Number:	SS3-6001	SS3-8001	SS4-1001	SS4-4001	SS4-5001	SS4-6001	SS4-6001	SS4-8001	SS5-1001	SS5-2001	SS5-2001	SS5-3001	SS5-3001	SS5-4001	SS5-4001	SS5-4002	SS5-6001
Sample Type:	At 8 Ft.	At 8 Ft.	At 8 Ft.	At 8 Ft.	At 8 Ft.	At 2 Ft.	At 8 Ft.	At 8 Ft.	At 8 Ft.	At 2 Ft.	At 6 Ft.	At 4 Ft.	At 8 Ft.	At 2 Ft.	At 8 Ft.	At 2 Ft.	At 8 Ft.
Date Sampled:	12/30/85	12/31/85	12/28/85	01/08/86	01/07/86	01/07/86	01/07/86	01/07/86	01/08/86	12/28/85	12/28/85	12/30/85	12/30/85	12/30/85	12/30/85	12/30/85	01/07/86
OTR Number:	E9894	E9895	E9896	E9897	E9898	E9899	E9900	EA451	EA452	EA454	EA453	EB185	EB186	EB187	EB189	EB188	EB190
OTR Number:																	
ITR Number:	ME4492	ME4493	ME4494	ME4495	ME4496	ME4497	ME4498	ME4499	ME4500	MEB372	MEB371	MEB383	MEB384	MEB385	MEB387	MEB386	MEB388
PESTICIDES and PCBs																	
ALPHA-BHC																	
BETA-BHC																	
DELTA-BHC																	
GAMMA-BHC (LINDANE)																	
HEPTACHLOR																	
ALDRIN																	
HEPTACHLOR EPOXIDE																	
ENDOSULFAN I																	
DIELDRIN																	
4,4-DDE																	
ENDRIN																	
4,4-DDT																	27
TOXAPHENE																	
AROCHLOR-1232													6800 **				
AROCHLOR-1242																	
AROCHLOR-1248	8300 **			1600	2300 C	310000 C,**	37000 **										
AROCHLOR-1254																	
MIREX																	
TOTAL PESTICIDES and PCBs	8300			1600	2300	310000	37000						6800				27
PERCENT MOISTURE (VOLATILES)	16	20	13	14	9	20	14	15	11	17	17	23	16	22	17	20	12

TABLE 1
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ONSITE SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Number:	SS3-6001	SS3-8001	SS4-1001	SS4-4001	SS4-5001	SS4-6001	SS4-6001	SS4-8001	SS5-1001	SS5-2001	SS5-2001	SS5-3001	SS5-3001	SS5-4001	SS5-4001	SS5-4002	SS5-6001
Sample Type:	At 8 Ft.	At 8 Ft.	At 8 Ft.	At 8 Ft.	At 8 Ft.	At 2 Ft.	At 8 Ft.	At 8 Ft.	At 8 Ft.	At 2 Ft.	At 6 Ft.	At 4 Ft.	At 8 Ft.	At 2 Ft.	At 8 Ft.	At 2 Ft.	At 8 Ft.
Date Sampled:	12/30/85	12/31/85	12/28/85	01/08/86	01/07/86	01/07/86	01/07/86	01/07/86	01/08/86	12/28/85	12/28/85	12/30/85	12/30/85	12/30/85	12/30/85	12/30/85	01/07/86
OTR Number:	E9894	E9895	E9896	E9897	E9898	E9899	E9900	EA451	EA452	EA454	EA453	EB185	EB186	EB187	EB189	EB188	EB190
OTR Number:																	
ITR Number:	ME4492	ME4493	ME4494	ME4495	ME4496	ME4497	ME4498	ME4499	ME4500	MEB372	MEB371	MEB383	MEB384	MEB385	MEB387	MEB386	MEB388
INORGANIC COMPOUNDS (units) MG/KG DRY WEIGHT																	
ALUMINUM	7120	5090	3940	6280	6820	4780	6880	9110	3800	1790	3920	1440	7270	4680	4530	3410	6140
ANTIMONY																[18] J,R	
ARSENIC	19 J	22 J	14 J	13 J	22 J	26 J	22 J	27 J	21 J	28 J	14 J	17 J	29 J	25 J	28 J	23 J	24 J
BARIUM	[78]	[46]	[36]	[93]	[100]	[84]	[57]	[53]	[74]	[70]	[64]	215	[86]	[110]	[55]	[119]	[35]
BERYLLIUM	[0.64]	[0.45]	[0.56]	[0.7]	[1.1]	[1.1]	[0.7]	[0.86]	[0.71]	[0.32]	[0.32]	[0.49]	[0.86]	[0.61]	[0.57]	[0.46]	[0.8]
CADMIUM			2.9			4.7					[2.9]	12	3.1	3.2	5	4.3	[2.7]
CALCIUM	3270	3420	4900	[1040]	3490	17600	3950	5480	3370	[2020]	[2070]	[980]	[1830]	[2920]	[12103]	[11603]	5660
CHROMIUM	19	12	15	13	16	36	16	19	15	8.7	11	13	20	24	21	89	17
COBALT	[14]	[9]	[11]	[9.1]	[17]	[8.8]	[13]	[16]	[9.6]		[8.5]	[4.7]	[13]	[9.4]	[13]	[6.3]	[18]
COPPER	29	19	23	22	31	51	25	28	22	22	29	31	39	148	66	175	39
IRON	24600	27600	30700	24800	31300	32300	23700	30900	39500	27800	28800	17000	34600	28800	39400	30400	48900
LEAD	35	17 R	17	13	21 R	48	19 R	24 R	35	19 R	22 R	35	17 R	64	42	147	32
CYANIDE						1.5						1.2	.81	22	9.4	67	
MAGNESIUM	3640	[1750]	[13403]	[1890]	4410	[19303]	3260	4410	[1730]	[407]	[1260]		3200	[17403]	[22603]	[13803]	4300
MANGANESE	436	142	73	244	495	131	347	521	150	33	105	23	293	153	324	115	458
MERCURY		[0.084]				0.65			.21	.52	0.25	0.29		0.15	[0.11]	0.15	[0.1]
NICKEL	29	[13]	[19]	[17]	37	[18]	30	35	[20]	[5.3]	[16]	[8.6]	29	[20]	25	[23]	37
POTASSIUM	[1220]	[2030]	[1300]	[1610]	[2460]	[1680]	[1540]	[2330]	[1790]	[1640]	[1790]	[1470]	[1600]	[1740]	[1640]	[1320]	[1680]
SELENIUM																	
SILVER		[2.6] J,R						[2.8] J,R	[3.3] J,R	[3.1] J,R		[2.8] J,R	[2.9] J,R		[4.1] J,R	[3] J	[4.2] J,R
SODIUM																	
THALLIUM																	
TIN												[15]				106	
VANADIUM	[18]	[20]	[18]	[18]	[22]	[18]	[18]	[23]	[22]	[16]	[16]	[15]	[24]	[18]	[19]	[18]	[23]
ZINC	90	42	41	71	111	448	95	85	49	24	59	28	93	104	112	421	103
PERCENT MOISTURE																	
PERCENT SOLIDS	83	83	87	85	86	84	86	83	84	83	83	76	83	79	85	82	89

FOOTNOTES:

B: Analyte has been found in the laboratory blank as well as the sample. Indicates possible/probable contamination.
C: Applies to pesticide parameters where the identification has been confirmed by GC/MS.
E: Value is estimated due to presence of interference.
J: An estimated value
R: Spike sample recovery is not within control limits.
S: Value is determined by standard addition.
*: Duplicate analysis is not within control limits.
**: Samples analyzed at medium concentrations.
[]: Positive values less than the contract required detection limit.

TABLE 1
SUMMIT NATIONAL SITE
ONSITE SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Number:	SS5-7001	SS5-7001	SS5-7002	SS5-8001	RS000005	SS6-2001	SS6-3001	SS6-5001	SS6-5001	SS6-5002	SS6-7001	SS6-7001	SS6-7002	RS000003	RS000004	SS0B1001	RS006001	SS0B2001	SS0B4001
Sample Type:	At 2 Ft.	At 8 Ft.	At 2 Ft.	At 8 Ft.	Blank	At 8 Ft.	At 8 Ft.	At 2 Ft.	At 8 Ft.	At 2 Ft.	At 2 Ft.	At 8 Ft.	At 2 Ft.	Blank	Blank	At 4 Ft.	Blank	At 6 Ft.	At 4 Ft.
Date Sampled:	01/06/86	01/06/86	01/06/86	01/07/86	01/09/86	01/08/86	12/30/85	01/06/86	01/06/86	01/06/86	01/06/86	01/06/86	01/06/86	01/09/86	01/09/86	07/03/86	09/12/86	07/03/86	07/03/86
OTR Number:	EB191	EB193	EB192	EB194	EB195	EA455	EA456	EA457	EA459	EA458	EA460	EB182	EB181	EB183	EB184	EC383	EC384	EC385	EC388
OTR Number:																EB532	EB538	EB533	EB536
ITR Number:	MEB389	MEB391	MEB390	MEB392	MEB394	MEB373	MEB374	MEB375	MEB377	MEB376	MEB378	MEB380	MEB379	MEB381	MEB382	ME6832	ME6833	ME6834	ME6837
ORGANIC COMPOUNDS (units-ug/kg)																			
VOLATILES																			
CHLOROMETHANE																			
VINYL CHLORIDE																			
METHYLENE CHLORIDE	81 B	70 B	53 B	13 B	8 B	16 B	38 B	16 B	5100	47 B	35 B	220 B	91 B	11 B	5 B	5 B	37 B	1700 J,B	470 J,B
ACETONE	74 B	260 B		37 B	63 B	35 B	37 B	28 B	19000 B	30 B	42 B	47 B	52 B	120 B	71 B	26 B	28 B	48000 B,J	980 J,B
CARBON DISULFIDE		3 J	5				4 J					5				3 J			
1,1-DICHLOROETHENE							5												430 J
1,1-DICHLOROETHANE				5			17									14			430 J
TRANS-1,2-DICHLOROETHENE		3 J					9	70	7100	51		30							1400 J
CHLOROFORM								6											
1,2-DICHLOROETHANE							100									81		8900 J	3200 J
2-BUTANONE	31 B	36 B		36 B	43 B	22 B	27 B		16000 B	25 B	34 B	39 B	30 B	28 B	52 B	21 B	4 J,B	190000 B,J	45000 B,J
1,1,1-TRICHLOROETHANE			3 J	9			100	19		6	12					100		2800 J	24000 J
1,1,2,2-TETRACHLOROETHANE																			
TRICHLOROETHENE	5	11	9	5			380	1600	99000	1400	59	130	18			6		1100 J	32000 J
1,1,2-TRICHLOROETHANE																			510 J
BENZENE	8	7		29		12	23	13		11	11	8	14			1 J			
2-HEXANONE																			
4-METHYL-2-PENTANONE					96									110	110				15000 J
TETRACHLOROETHENE							9									3 J			
TOLUENE	34 B	31 B	20 B	61	3 J	44	81	47	1900 J	34	72	24	72	5	3 J	22	1 J	26000 J	46000 J
CHLOROBENZENE										3 J									670 J
ETHYLBENZENE		4 J		6		5	10		2500 J	4 J			10			27		41000 J	3800 J
STYRENE																			
TOTAL XYLENES	12	11	9	24	5	33	72	11	9000	14	35	9	120	6	5	190		240000 J	30000 J
TOTAL VOLATILES	245	436	99	225	218	167	912	1810	159600	1625	300	512	407	280	246	499	70	559500	203890
TOTAL TENTATIVELY IDENTIFIED VOLATILES	42	39.5	59.7	0	255	18.5	47.5	27.6		0	133	13.2		239	457	337	0	0	3966
BASE/NEUTRALS AND ACIDS																			
N-NITROSODIMETHYLAMINE																			
PHENOL											330		290 J						
ANILINE																			
1,3-DICHLOROBENZENE																			
1,4-DICHLOROBENZENE							240 J												
BENZYL ALCOHOL															240 J				
1,2-DICHLOROBENZENE							1200		49 J										
2-METHYLPHENOL											1100		1900						
BIS(2-CHLOROISOPROPYL)ETHER																			

TABLE 1
SUMMIT NATIONAL SITE
ONSITE SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Number:	SS5-7001	SS5-7001	SS5-7002	SS5-8001	RS000005	SS6-2001	SS6-3001	SS6-5001	SS6-5001	SS6-5002	SS6-7001	SS6-7001	SS6-7002	RS000003	RS000004	SS0B1001	RS006001	SS0B2001	SS0B4001
Sample Type:	At 2 Ft.	At 8 Ft.	At 2 Ft.	At 8 Ft.	Blank	At 8 Ft.	At 8 Ft.	At 2 Ft.	At 8 Ft.	At 2 Ft.	At 2 Ft.	At 8 Ft.	At 2 Ft.	Blank	Blank	At 4 Ft.	Blank	At 6 Ft.	At 4 Ft.
Date Sampled:	01/06/86	01/06/86	01/06/86	01/07/86	01/09/86	01/08/86	12/30/85	01/06/86	01/06/86	01/06/86	01/06/86	01/06/86	01/06/86	01/09/86	01/09/86	07/03/86	09/12/86	07/03/86	07/03/86
OTR Number:	EB191	EB193	EB192	EB194	EB195	EA455	EA456	EA457	EA459	EA458	EA460	EB182	EB181	EB183	EB184	EC383	EC384	EC385	EC388
OTR Number:																EB532	EB538	EB533	EB536
ITR Number:	MEB389	MEB391	MEB390	MEB392	MEB394	MEB373	MEB374	MEB375	MEB377	MEB376	MEB378	MEB380	MEB379	MEB381	MEB382	MEG832	MEG833	MEG834	MEG837
4-METHYLPHENOL			45 J	110 J							270 J		640						
HEXACHLOROETHANE																			
ISOPHORONE																			
2-NITROPHENOL																			
2,4-DIMETHYLPHENOL											1100		2500						
BENZOIC ACID															190 J				
1,2,4-TRICHLOROBENZENE								1400	100 J	1000									
NAPHTHALENE	430	340	260 J	350		550	550	630		720	530	260 J	490						624
4-CHLORO-3-METHYLPHENOL									140 J										
2-METHYLNAPHTHALENE	540	480	370	410		580	800	1000	1100	1200	770	420	740						1226
HEXACHLOROCYCLOPENTADIENE																			
DIMETHYL PHTHALATE																			
ACENAPHTHYLENE																			
ACENAPHTHENE																			
4-NITROPHENOL																			
DIBENZOFURAN	120 J	110 J	85 J	110 J		180 J	180 J	190 J	150 J	220 J	93 J	110 J							
DIETHYLPHTHALATE																			
FLUORENE		67 J					74 J		63 J										
N-NITROSODIPHENYLAMINE(1)																			
HEXACHLOROBENZENE	180 J		96 J					220 J		140 J									
PENTACHLOROPHENOL																			
PHENANTHRENE	380	530	270 J	370		390	430	500	400	590	270 J	270 J	350						
ANTHRACENE																			
DI-N-BUTYLPHTHALATE	250 J	410	290 J	190 J	180 J	370 B	890 B	630 J,B	130 J,B	140 J,B	170 J,B	180 J		240 J	120 J	1124 B	3102 B	1095 B	1226 B
FLUORANTHENE	81 J	130 J	54 J	74 J		62 J	87 J	150 J	80 J	150 J		58 J							
PYRENE	110 J	200 J	82 J	120 J		170 J	240 J	120 J	150 J	170 J	200 J	140 J	220 J						
BUTYLBENZYLPHTHALATE											930		2100						
BENZO(A)ANTHRACENE	49 J		41 J				60 J	120 J	78 J	130 J									
BIS(2-ETHYLHEXYL)PHTHALATE	1000 B	310 J,B	630	130 J,B	54 J,B	430 B	690 B	16000 B	880 B	5200 B	3100 B	120 J,B	4200 B	44 J,B	82 J			707 B	346 J,B
CHRYSENE	68 J	95 J	53 J	87 J		86 J	93 J		70 J	140 J		83 J							
DI-N-OCTYL PHTHALATE	54 J	66 J	48 J			48 J	47 J	490	44 J	220 J	770		600						
BENZO(B)FLUORANTHENE	90 J	120 J		78 J		100 J	130 J	160 J	120 J	210 J									
BENZO(K)FLUORANTHENE	90 J	120 J				100 J	130 J		120 J	210 J									
BENZO(A)PYRENE						50 J	130 J		50 J	160 J									
INDENO(1,2,3-CD)PYRENE							54 J												
DIBENZ(A,H)ANTHRACENE																			
BENZO(G,H,I)PERYLENE	120 J		110 J			120 J	220 J	120 J	100 J	220 J									
TOTAL BASE/NEUTRALS AND ACIDS	3562	2978	2434	2029	234	3236	6245	21730	3824	10820	9633	1641	14030	284	632	1124	3102	1802	3422
TOTAL TENTATIVELY IDENTIFIED BASE/NEUTRALS AND ACIDS	24998	13892	21737	13838	7357	7195	14089	30289		18620	20294	9951	29973	2633	2638	1790	800	3960	9300

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REMEDIAL INVESTIGATION REPORT

Sample Number:	SS5-7001	SS5-7001	SS5-7002	SS5-8001	RS000005	SS6-2001	SS6-3001	SS6-5001	SS6-5001	SS6-5002	SS6-7001	SS6-7001	SS6-7002	RS000003	RS000004	SS081001	RS006001	SS082001	SS084001
Sample Type:	At 2 Ft.	At 8 Ft.	At 2 Ft.	At 8 Ft.	Blank	At 8 Ft.	At 8 Ft.	At 2 Ft.	At 8 Ft.	At 2 Ft.	At 2 Ft.	At 8 Ft.	At 2 Ft.	Blank	Blank	At 4 Ft.	Blank	At 6 Ft.	At 4 Ft.
Date Sampled:	01/06/86	01/06/86	01/06/86	01/07/86	01/09/86	01/08/86	12/30/85	01/06/86	01/06/86	01/06/86	01/06/86	01/06/86	01/06/86	01/09/86	01/09/86	07/03/86	09/12/86	07/03/86	07/03/86
DTR Number:	EB191	EB193	EB192	EB194	EB195	EA455	EA456	EA457	EA459	EA458	EA460	EB182	EB181	EB183	EB184	EC383	EC384	EC385	EC388
DTR Number:																EB532	EB538	EB533	EB536
ITR Number:	MEB389	MEB391	MEB390	MEB392	MEB394	MEB373	MEB374	MEB375	MEB377	MEB376	MEB378	MEB380	MEB379	MEB381	MEB382	MEB832	MEB833	MEB834	MEB837
PESTICIDES and PCBs																			
ALPHA-BHC																			
BETA-BHC																			
DELTA-BHC																			
GAMMA-BHC (LINDANE)																			
HEPTACHLOR																			
ALDRIN																			
HEPTACHLOR EPOXIDE																550 **		680 **	
ENDOSULFAN I																			
DIELDRIN																			
4,4-DDE																			
ENDRIN																			
4,4-DDT				36															
TOXAPHENE																			
AROCHLOR-1232																			
AROCHLOR-1242																			
AROCHLOR-1248		990																	
AROCHLOR-1254																			
MIREX																9000 **		12000 **	
TOTAL PESTICIDES and PCBs		990		36												9550		12680	
PERCENT MOISTURE (VOLATILES)	20	13	19	17	0	13	14	19	16	16	16	17	15	0	0	19	0	12	13

TABLE 1
SUMMIT NATIONAL SITE
ONSITE SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Number:	SS5-7001	SS5-7001	SS5-7002	SS5-8001	RS000005	SS6-2001	SS6-3001	SS6-5001	SS6-5001	SS6-5002	SS6-7001	SS6-7001	SS6-7002	RS000003	RS00004	SS081001	RS006001	SS082001	SS084001
Sample Type:	At 2 Ft.	At 8 Ft.	At 2 Ft.	At 8 Ft.	Blank	At 8 Ft.	At 8 Ft.	At 2 Ft.	At 8 Ft.	At 2 Ft.	At 2 Ft.	At 8 Ft.	At 2 Ft.	Blank	Blank		Blank		
Date Sampled:	01/06/86	01/06/86	01/06/86	01/07/86	01/09/86	01/08/86	12/30/85	01/06/86	01/06/86	01/06/86	01/06/86	01/06/86	01/06/86	01/09/86	01/09/86	07/03/86	09/12/86	07/03/86	07/03/86
OTR Number:	EB191	EB193	EB192	EB194	EB195	EA455	EA456	EA457	EA459	EA458	EA460	EB182	EB181	EB183	EB184	EC383	EC384	EC385	EC388
OTR Number:																EB532	EB538	EB533	EB536
ITR Number:	MEB389	MEB391	MEB390	MEB392	MEB394	MEB373	MEB374	MEB375	MEB377	MEB376	MEB378	MEB380	MEB379	MEB381	MEB382	MEG832	MEG833	MEG834	MEG837
INORGANIC COMPOUNDS (units) MG/KG DRY WEIGHT																			
ALUMINUM	6560	7080	6270	6720	138	8010	7550	6580	6660	6010	7030	8190	6640	139	139	3850	187	8070	6820
ANTIMONY		[17] J,R																	
ARSENIC	22 J	21 J	22 J	27 J		19 J	23 J	20 J	19 J	23 J	21 J	22 J	21 J			14		19	16
BARIUM	[57]	[46]	[39]	[50]		[48]	[65]	[45]	[50]	[52]	[51]	[51]	[69]			245	[3.6]	[60]	141
BERYLLIUM	[0.72]	[0.98]	[0.73]	[0.59]		[1.6]	[0.87]	[0.75]	[0.49]	[0.64]	[0.75]	[0.77]	[0.88]						
CADMIUM	3.7	[2.9]		[2.7]			[2.7]	[2.4]			3.4								13
CALCIUM	3470	[2550]	[988]	[2250]	[1870]	5680	5250	[2540]	[2530]	[1990]	4210	4670	3460	[1790]	[1900]	[2140] E	[2040] E	[1090] E	[1090] E
CHROMIUM	23	28	28	17	9.1	18	19	18	19	17	36	16	20	7.6	9.2	732	8.1	115	15
COBALT	[14]	[18]	[12]	[11]		[23]	[17]	[13]	[11]	[12]	[15]	[13]	[20]			[10]		[10]	[11]
COPPER	39	36	28	28	[3.2]	31	36	36	34	33	36	25	33	[4]	[5.1]	34	[4.9]	36	36
IRON	31600	47000	29700	33900	134	37700	41800	28100	31600	30300	33100	31000	35200	137	134	26100	164	50800	32800
LEAD	34	36	32	18 R		14	21	26	24	36	22	14	34			17		24	84
CYANIDE	1.1							8.8	3.9	1.4									
MAGNESIUM	[2650]	3400	[2540]	3050	[286]	4500	3890	3070	3190	[2750]	3190	3010	[2650]	[293]	[300]	[791]	[314]	[2980]	2900
MANGANESE	334	680	224	324	[2.6]	515	443	407	270	326	457	208	683	[2.1]	[2.9]	57		186	311
MERCURY	[.084]			[.096]				.81											
NICKEL	28	34	[21]	[23]		42	35	25	26	[24]	36	28	38			27	[3.8]	27	27
POTASSIUM	[1630]	[1770]	[1950]	[2320]		[1920]	[1760]	[1530]	[2170]	[1840]	[1610]	[1410]	[1880]			[1050]		[1720]	[1800]
SELENIUM																			
SILVER		[3.4] J,R	[2.6] J,R	[2.6] J,R															
SODIUM					[929]	[591]	[634]	[528]	[797]	[572]	[678]	[759]	[652]	[759]	[872]		[547]	[680]	
THALLIUM																			
TIN					[9.6]														[20]
VANADIUM	[20]	[26]	[21]	[22]	[16]	[24]	[22]	[18]	[19]	[19]	[19]	[19]	[20]	[15]	[15]	[14]	[15]	[16]	[14]
ZINC	162	100	85	58	[3.2]	195	120	109	91	88	112	69	115	[3.5]	21	126	[5.1]	97	110
PERCENT MOISTURE																			
PERCENT SOLIDS	83	84	82	83	100	83	87	86	84	83	86	83	86	100	100	81	100	84	89

FOOTNOTES:

B: Analyte has been found in the laboratory blank as well as the sample. Indicates possible/probable contamination.
C: Applies to pesticide parameters where the identification has been confirmed by GC/MS.
E: Value is estimated due to presence of interference.
J: An estimated value
R: Spike sample recovery is not within control limits.
S: Value is determined by standard addition.
*: Duplicate analysis is not within control limits.
**: Samples analyzed at medium concentrations.
[]: Positive values less than the contract required detection limit.

TABLE 2
SUMMIT NATIONAL SITE
OFFSITE SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Number:	SS1-9001	SS1-9002	SS2-9001	SS3-9001	SS4-9001	SS5-9001	SS5-9002	RS000002	SS051001	SS052001	SS053001	SS054001	SS055001	SS055002	SS056001	SS057001	SS058001	SS059001	SS060001
Sample Type:	Perimeter	Perimeter	Perimeter	Perimeter	Perimeter	Perimeter	Perimeter	Blank	Resident	Resident	Resident	Resident	Resident	Resident	Farm	Farm	Farm	Farm	Farm
Date Sampled:	12/12/85	12/12/85	12/12/85	12/12/85	12/12/85	12/12/85	12/12/85	01/08/86	12/12/85	12/11/85	12/11/85	12/13/85	12/11/85	12/11/85	12/11/85	12/11/85	12/11/85	12/11/85	12/11/85
DTR Number:	E9722	E9723	E9724	E9725	E9869	E9870	E9871	E9872	E8994	E8995	E8996	E8997	E8998	E9873	E9706	E9707	E9708	E9709	E9710
DTR Number:																			
ITR Number:	ME4463	ME4464	ME4465	ME4466	ME4467	ME4468	ME4469	ME4470	ME4441	ME4442	ME4443	ME4444	ME4445	ME4471	ME4447	ME4448	ME4449	ME4450	ME4451
ORGANIC COMPOUNDS (units-ug/kg)																			
VOLATILES																			
CHLOROMETHANE																			
VINYL CHLORIDE																			
METHYLENE CHLORIDE	15 B	27 B	19 B	19 B	9 B	47 B	26 B	13 B	40 B	45 B	99 B	11 B	17 B	26 B	8 B	97 B	46 B	54 B	40 B
ACETONE	25 B	27 B	34 B	41 B	25 B	110 B	81 B	70 B	30 B	19 B	110 B	32 B	24 B	110 B	18 B	25 B	24 B	30 B	19 B
CARBON DISULFIDE																			
1,1-DICHLOROETHENE																			
1,1-DICHLOROETHANE																			
TRANS-1,2-DICHLOROETHENE																			
CHLOROFORM																			
1,2-DICHLOROETHANE																			
2-BUTANONE	26 B	27 B	25 B	32 B	25 B	29 B	24 B	13 B	36 B	32 B	42 B	37 B	35 B	33 B	26 B	30 B	28 B	28 B	22 B
1,1,1-TRICHLOROETHANE																			
1,1,2,2-TETRACHLOROETHANE																			
TRICHLOROETHENE																			
1,1,2-TRICHLOROETHANE																			
BENZENE																			
2-HEXANONE																			
4-METHYL-2-PENTANONE								4 J											
TETRACHLOROETHENE																			
TOLUENE	20	16	16	5	4 J	28	14			6	12		10	7		11	11	4 J	9
CHLOROBENZENE																			
ETHYLBENZENE																			
STYRENE																			
TOTAL XYLENES																			
TOTAL VOLATILES	86	97	94	97	63	214	145	100	106	102	263	80	86	176	52	163	109	116	90
TOTAL TENTATIVELY IDENTIFIED VOLATILES	0	0	0	0	0	53.4	0	63.3	0	29.5	61.5	0	430	408	0	47.8	0	29.2	0
BASE/NEUTRALS AND ACIDS																			
N-NITROSODIMETHYLAMINE																			
PHENOL																			
ANILINE																			
1,3-DICHLOROBENZENE																			
1,4-DICHLOROBENZENE																			
BENZYL ALCOHOL								69 J											
1,2-DICHLOROBENZENE																			
2-METHYLPHENOL																			
BIS(2-CHLORDISOPROPYL)ETHER																			

TABLE 2
SUMMIT NATIONAL SITE
OFFSITE SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Number:	SS1-9001	SS1-9002	SS2-9001	SS3-9001	SS4-9001	SS5-9001	SS5-9002	RS000002	SS051001	SS052001	SS053001	SS054001	SS055001	SS055002	SS056001	SS057001	SS058001	SS059001	SS060001
Sample Type:	Perimeter	Perimeter	Perimeter	Perimeter	Perimeter	Perimeter	Perimeter	Blank	Resident	Resident	Resident	Resident	Resident	Resident	Farm	Farm	Farm	Farm	Farm
Date Sampled:	12/12/85	12/12/85	12/12/85	12/12/85	12/12/85	12/12/85	12/12/85	01/08/86	12/12/85	12/11/85	12/11/85	12/13/85	12/11/85	12/11/85	12/11/85	12/11/85	12/11/85	12/11/85	12/11/85
OTR Number:	E9722	E9723	E9724	E9725	E9869	E9870	E9871	E9872	E8994	E8995	E8996	E8997	E8998	E9873	E9706	E9707	E9708	E9709	E9710
OTR Number:																			
ITR Number:	ME4463	ME4464	ME4465	ME4466	ME4467	ME4468	ME4469	ME4470	ME4441	ME4442	ME4443	ME4444	ME4445	ME4471	ME4447	ME4448	ME4449	ME4450	ME4451
4-METHYLPHENOL																			
HEXACHLOROETHANE																			
ISOPHORONE																			
2-NITROPHENOL																			
2,4-DIMETHYLPHENOL																			
BENZOIC ACID						500 J			160 J	890 J			1100 J						
1,2,4-TRICHLOROBENZENE																			
NAPHTHALENE	2000	2000	1400 J,**	1200		750	370			1900		500	110 J	110 J					
4-CHLORO-3-METHYLPHENOL																			
2-METHYLNAPHTHALENE	2900	3200	2300 J,**	1700		1200	540		55 J	2600		990	150 J	130 J					
HEXACHLOROCYCLOPENTADIENE																			
DIMETHYL PHTHALATE																			
ACENAPHTHYLENE									83 J			150 J							
ACENAPHTHENE		240 J																	
4-NITROPHENOL																			
DIBENZOFURAN	700	870		340 J		310 J	120 J			500		230 J							
DIETHYLPHTHALATE																			
FLUORENE		480								94 J		65 J							
N-NITROSODIPHENYLAMINE(1)																			
HEXACHLOROBENZENE									330 J										
PENTACHLOROPHENOL									87 J										
PHENANTHRENE	1700	6500	1700 J,**	810		650	440		120 J	1300		1200	260 J	240 J	120 J	42 J	68 J	380	
ANTHRACENE		910							280 J			160 J						67 J	
DI-N-BUTYLPHTHALATE	110 J	130 J		320 J	45 J		60 J	45 J	84 B,J	160 B,J	510 B	270 J	190 J	88 J	91 B,J	76 B,J	110 B,J	180 B,J	150 B,J
FLUORANTHENE	890	7100				120 J	86 J		230 J	350		2100	300 J	300 J	220 J	70 J	140 J	570	69 J
PYRENE	690	4700		210 J		160 J	130 J		400	720		1500	230 J	190 J	120 J	54 J	87 J	540	73 J
BUTYLBENZYLPHTHALATE	67 J																		
BENZO(A)ANTHRACENE	660	3000				110 J	88 J		500	360		1000	200 J	140 J	97 J		59 J	300 J	
BIS(2-ETHYLHEXYL)PHTHALATE	97 J	140 J				45 J			91 J		51 J	120 J		73 J	49 J	40 J			
CHRYSENE	240 J	2400				110 J	83 J		940	340		1100	150 J	150 J	110 J	47 J	62 J	270 J	
DI-N-OCTYL PHTHALATE																			
BENZO(B)FLUORANTHENE	720	3200				120 J	120 J		1100	530		1900		250 J	190 J		49 J	490	66 J
BENZO(K)FLUORANTHENE	720	3200				120 J	120 J		1100	530		1900		250 J	190 J		49 J	490	66 J
BENZO(A)PYRENE	400	1700					41 J		430	280		1100		150 J	110 J		67 J	280 J	
INDENO(1,2,3-CD)PYRENE	320 J	1200							390			550		82 J				140 J	
DIBENZ(A,H)ANTHRACENE	89 J	410							97 J			120 J							
BENZO(G,H,I)PERYLENE	290 J	1200				140 J	120 J		310 J			470						150 J	
TOTAL BASE/NEUTRALS AND ACIDS	12593	42580	5400	4580	45	4335	2318	114	6787	10554	561	15425	2690	2153	1297	329	691	3857	424
TOTAL TENTATIVELY IDENTIFIED BASE/NEUTRALS AND ACIDS	34865	30523	20428	20479	4382	35993	8030	2995	5100	23441	9434	10673	19170	19390	7526	8631	2028	2892	1246

TABLE 2
SUMMIT NATIONAL SITE
OFFSITE SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Number:	SS1-9001	SS1-9002	SS2-9001	SS3-9001	SS4-9001	SS5-9001	SS5-9002	RS000002	SS051001	SS052001	SS053001	SS054001	SS055001	SS055002	SS056001	SS057001	SS058001	SS059001	SS060001
Sample Type:	Perimeter	Perimeter	Perimeter	Perimeter	Perimeter	Perimeter	Perimeter	Blank	Resident	Resident	Resident	Resident	Resident	Resident	Farm	Farm	Farm	Farm	Farm
Date Sampled:	12/12/85	12/12/85	12/12/85	12/12/85	12/12/85	12/12/85	12/12/85	01/08/86	12/12/85	12/11/85	12/11/85	12/13/85	12/11/85	12/11/85	12/11/85	12/11/85	12/11/85	12/11/85	12/11/85
DTR Number:	E9722	E9723	E9724	E9725	E9869	E9870	E9871	E9872	E8994	E8995	E8996	E8997	E8998	E9873	E9706	E9707	E9708	E9709	E9710
DTR Number:																			
ITR Number:	ME4463	ME4464	ME4465	ME4466	ME4467	ME4468	ME4469	ME4470	ME4441	ME4442	ME4443	ME4444	ME4445	ME4471	ME4447	ME4448	ME4449	ME4450	ME4451
PESTICIDES and PCBs																			
ALPHA-BHC																			
BETA-BHC																			
DELTA-BHC																			
GAMMA-BHC (LINDANE)																			
HEPTACHLOR																			
ALDRIN																			
HEPTACHLOR EPOXIDE																			
ENDOSULFAN I																			
DIELDRIN																			
4,4-DDE																			
ENDRIN																			
4,4-DDT																			
TOXAPHENE																			
AROCHLOR-1232																			
AROCHLOR-1242																			
AROCHLOR-1248																			
AROCHLOR-1254																			
MIREX																			
TOTAL PESTICIDES and PCBs																			
PERCENT MOISTURE (VOLATILES)	26	27	25	27	16	21	24	0.97	36	30	27	41	39	38	21	25	26	22	20

TABLE 2
SUMMIT NATIONAL SITE
OFFSITE SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Number:	SS1-9001	SS1-9002	SS2-9001	SS3-9001	SS4-9001	SS5-9001	SS5-9002	RS000002	SS051001	SS052001	SS053001	SS054001	SS055001	SS055002	SS056001	SS057001	SS058001	SS059001	SS060001
Sample Type:	Perimeter	Perimeter	Perimeter	Perimeter	Perimeter	Perimeter	Perimeter	Blank	Resident	Resident	Resident	Resident	Resident	Resident	Farm	Farm	Farm	Farm	Farm
Date Sampled:	12/12/85	12/12/85	12/12/85	12/12/85	12/12/85	12/12/85	12/12/85	01/08/86	12/12/85	12/11/85	12/11/85	12/13/85	12/11/85	12/11/85	12/11/85	12/11/85	12/11/85	12/11/85	12/11/85
OTR Number:	E9722	E9723	E9724	E9725	E9869	E9870	E9871	E9872	E8994	E8995	E8996	E8997	E8998	E9873	E9706	E9707	E9708	E9709	E9710
OTR Number:																			
ITR Number:	ME4463	ME4464	ME4465	ME4466	ME4467	ME4468	ME4469	ME4470	ME4441	ME4442	ME4443	ME4444	ME4445	ME4471	ME4447	ME4448	ME4449	ME4450	ME4451
INORGANIC COMPOUNDS (units) MG/KG DRY WEIGHT																			
ALUMINUM	7710	9650	2300	8290	12700	7180	9960	175	11800	8890	14500	18100	11800	9530	10400	13100	12200	11700	10900
ANTIMONY															[20] R				
ARSENIC	12	11	20	14	14	12	9.9		16	26	23	19	20	17	15	16	15	18	18
BARIUM	218	295	[53]	[66]	[71]	135	[130]		[109]	[123]	[90]	[145]	[74]	[68]	[104]	[83]	[80]	[78]	[56]
BERYLLIUM	[0.62]	[0.73]	[0.56]	[0.52]	[0.55]		[0.48]		[0.87]	[0.4]	[0.77]	[1.3]	[0.5]	[0.42]	[0.7]	[0.61]	[1.2]	[0.71]	[0.34]
CADMIUM	[2.8]	[2.9]		4			4.2			[3.3]		[3.8]			[2.8]	[3]	4.1	4	3.8
CALCIUM	7250	[9700]	[540]	[921]	[1670]	[392]	[402]	[1960]	[2430]	[2450]	[2930]	5510	[1350]	[978]	3340	[825]	[1340]	[1840]	[1330]
CHROMIUM	15	17	22	17	19	16	22	9	19	16	24	23	16	14	15	18	17	19	14
COBALT	[11]	[13]	[5]	[8.6]	[15]	[10]	[13]		[14]	[8.8]	[21]	[13]	[11]	[9.1]	[13]	[13]	[15]	[19]	[8.5]
COPPER	35	34	56	33	31	29	37	[8.9]	51	29	25	37	[20]	[18]	20	[16]	18	21	17
IRON	27800	25900	34300	30700	26100	30900	40600	164	22600	30300	31300	25700	19300	16600	18500	17900	21000	26900	17800
LEAD	164	175	50	20	17	22	21		123	391	31	215	52	50	26	24	26	62	19
CYANIDE									.83	.76	1.3	4.2	1.1			.69	1.2	.95	
MAGNESIUM	[1690]	[2300]	[515]	[2380]	3180	3280	4700	[332]	2360	[1790]	5340	[2960]	[2080]	[1720]	[2470]	[2000]	[2110]	[2050]	[2150]
MANGANESE	879 J	1350 J	54 J	145 J	655 J	170 J	239 J	[2] J	1550 J,R	472 J,R	1050 J,R	1160 J,R	865 J,R	693 J,R	1470 J,R	1120 J,R	916 J	1580 J,R	565 J,R
MERCURY	.55	.4	1.1						[.095]	.38		.25							
NICKEL	[19]	[21]	[18]	[22]	30	[19]	[25]	[5.2]	[15]	[13]	38	[23]	[13]	[13]	[15]	[16]	[14]	[16]	[12]
POTASSIUM	[1910]	[1810]	[2110]	[1740]	[1800]	[2190]	[2230]		[1860]	[1860]	[3100]	[2830]	[1390]	[905]	[1290]	[2040]	[1380]	[1400]	[1420]
SELENIUM			3.3																
SILVER	[3.5] J,R		[4.2] J,R			[2.7] J,R	[4.5] J,R		16 J,R	[3.4] J,R	[4.1] J,R					[2.8] J,R	[3.5] J,R	[2.8] J,R	
SODIUM	[674]	[850]	[759]	[1150]	[1090]	[707]		[1070]							[779]				
THALLIUM																			
TIN																			
VANADIUM	[21]	[25]	[20]	[20]	[25]	[16]	[22]	[16]	[27]	[21]	[27]	[36]	[25]	[20]	[23]	[28]	[30]	[29]	[22]
ZINC	124	139	36	75	100	89	109	25	187	127	91	227	87	70	61	69	75	64	60
PERCENT MOISTURE																			
PERCENT SOLIDS	74	75	82	71	84	77	76	100	63	68	71	57	55	66	78	75	74	77	80

FOOTNOTES:

B: Analyte has been found in the laboratory blank as well as the sample. Indicates possible/probable contamination.
C: Applies to pesticide parameters where the identification has been confirmed by GC/MS.
E: Value is estimated due to presence of interference.
J: An estimated value
R: Spike sample recovery is not within control limits.
**: Samples analyzed at medium concentrations.
[]: Positive values less than the contract required detection limit.

TABLE 2
SUMMIT NATIONAL SITE
OFFSITE SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Number:	SS061001	SS062001	SS063001	SS064001	SS065001	SS065002	SS066001	SS067001	SS068001	SS069001	SS070001	SS071001	SS072001	SS073001	SS073002	SS074001	SS075001	SS076001
Sample Type:	MineSoil	MineSoil	MineSoil	MineSoil	MineSoil	MineSoil	Industry	Industry	Industry	Industry	Industry	Per-4 Ft.	Per-6 Ft.	Perimeter	Perimeter	Per-2 Ft.	Per-6 Ft.	Per-2 Ft.
Date Sampled:	12/12/85	12/12/85	12/12/85	12/12/85	12/12/85	12/12/85	01/08/86	01/08/86	01/08/86	01/08/86	01/08/86	07/01/86	07/01/86	09/12/86	09/12/86	07/02/86	07/02/86	07/02/86
DTR Number:	E9711	E9712	E9713	E9714	E9715	E9874	E9717	E9718	E9719	E9720	E9721	EC371	EC372	EC373	EC374	EC375	EC376	EC377
DTR Number:												EB520	EB521	EB522	EB523	EB524	EB525	EB526
ITR Number:	ME4452	ME4453	ME4454	ME4455	ME4456	ME4472	ME4458	ME4459	ME4460	ME4461	ME4462	MEG820	MEG821	MEG822	MEG823	MEG824	MEG825	MEG826
ORGANIC COMPOUNDS (units-ug/kg)																		
VOLATILES																		
CHLOROMETHANE																		
VINYL CHLORIDE																		
METHYLENE CHLORIDE	52 B	64 B	59 B	52 B	36 B	10 B	21 B	45 B	20 B	25 B	10 B	15 B	97	18	5	6	2 J	2 J
ACETONE	140 B	84 B	32 B	81 B	27 B	58 B	58 B	60 B	26 B	23 B	30 B	8 J,B	25 B	16 B	17 B	22 B	12 B	13 B
CARBON DISULFIDE																		
1,1-DICHLOROETHENE																		
1,1-DICHLOROETHANE																		
TRANS-1,2-DICHLOROETHENE																		
CHLOROFORM																		
1,2-DICHLOROETHANE																		
2-BUTANONE	21 B	29 B	30 B	26 B	26 B	23 B	29 B	49 B	24 B	20 B	25 B	11 B	14 B	13 B	17 B	27 B	10 B	10 B
1,1,1-TRICHLOROETHANE																		
1,1,2,2-TETRACHLOROETHANE																		
TRICHLOROETHENE																		
1,1,2-TRICHLOROETHANE																		
BENZENE																		
2-HEXANONE																		
4-METHYL-2-PENTANONE																		
TETRACHLOROETHENE																		
TOLUENE	23	31	7	11	6	6	4 J		4 J				3 J					
CHLOROBENZENE																		
ETHYLBENZENE																		
STYRENE																		
TOTAL XYLENES	6	7																
TOTAL VOLATILES	242	215	128	170	95	97	112	154	74	68	65	34	139	47	39	55	24	25
TOTAL TENTATIVELY IDENTIFIED VOLATILES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE/NEUTRALS AND ACIDS																		
N-NITROSODIMETHYLAMINE																		
PHENOL																		
ANILINE																		
1,3-DICHLOROBENZENE																		
1,4-DICHLOROBENZENE																		
BENZYL ALCOHOL																		
1,2-DICHLOROBENZENE																		
2-METHYLPHENOL																		
BIS(2-CHLOROISOPROPYL)ETHER																		

TABLE 2
SUMMIT NATIONAL SITE
OFFSITE SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Number:	SS061001	SS062001	SS063001	SS064001	SS065001	SS065002	SS066001	SS067001	SS068001	SS069001	SS070001	SS071001	SS072001	SS073001	SS073002	SS074001	SS075001	SS076001
Sample Type:	MineSoil	MineSoil	MineSoil	MineSoil	MineSoil	MineSoil	Industry	Industry	Industry	Industry	Industry	Per-4 Ft.	Per-6 Ft.	Perimeter	Perimeter	Per-2 Ft.	Per-6 Ft.	Per-2 Ft.
Date Sampled:	12/12/85	12/12/85	12/12/85	12/12/85	12/12/85	12/12/85	01/08/86	01/08/86	01/08/86	01/08/86	01/08/86	07/01/86	07/01/86	09/12/86	09/12/86	07/02/86	07/02/86	07/02/86
DTR Number:	E9711	E9712	E9713	E9714	E9715	E9874	E9717	E9718	E9719	E9720	E9721	EC371	EC372	EC373	EC374	EC375	EC376	EC377
DTR Number:												EB520	EB521	EB522	EB523	EB524	EB525	EB526
ITR Number:	ME4452	ME4453	ME4454	ME4455	ME4456	ME4472	ME4458	ME4459	ME4460	ME4461	ME4462	MEGB20	MEGB21	MEGB22	MEGB23	MEGB24	MEGB25	MEGB26
4-METHYLPHENOL																		
HEXACHLOROETHANE																		
ISOPHORONE																	448	
2-NITROPHENOL																		
2,4-DIMETHYLPHENOL																		
BENZOIC ACID																		
1,2,4-TRICHLOROBENZENE																		
NAPHTHALENE	1900	1300	2900	3500	1400	990	36000 **		5500	2600	2300 J,**					249 J		
4-CHLORO-3-METHYLPHENOL																		
2-METHYLNAPHTHALENE	2200	1400	2700	3700	1300	1300	55000 **		6900	3700	2900 J,**			93 J	95 J	212 J	30 J	150 J
HEXACHLOROCYCLOPENTADIENE																		
DIMETHYL PHTHALATE																		
ACENAPHTHYLENE																		
ACENAPHTHENE																		
4-NITROPHENOL																		
DIBENZOFURAN	530	310 J	590 J	810	350	290 J	12000 **		1200	640								
DIETHYLPHTHALATE																		
FLUORENE										100 J								
N-NITROSODIPHENYLAMINE(1)																		
HEXACHLOROBENZENE																		
PENTACHLOROPHENOL																		
PHENANTHRENE	1400	1000	2400	1500	1200	1100	30000 **		2500	1600	8600 **			136 J		324 J		
ANTHRACENE							5500 J,**				2500 J,**							
DI-N-BUTYLPHTHALATE	62 B,J	100 B,J		88 J	82 J	49 J		410 J	220 J	82 J		806 B	831 B	294 J,B		286 J,B	460 B	313 J,B
FLUORANTHENE	240 J	200 J	400 J	270 J	280 J	260 J	20000 **		580 J	250 J	14000 **							
PYRENE	290 J	250 J	390 J	190 J	280 J	310 J	20000 **		460 J	330	11000 **				76 J			
BUTYLBENZYLPHTHALATE																	68 J	
BENZO(A)ANTHRACENE	140 J	150 J	300 J	200 J	160 J	160 J	16000 **		340 J	190 J	6700 **							
BIS(2-ETHYLHEXYL)PHTHALATE		70 J				52 J		330 J									59 J	
CHRYSENE	220 J	190 J	330 J	220 J	200 J	220 J	16000 **		470 J	250 J	9200 **					72 J		
DI-N-OCTYL PHTHALATE																		
BENZO(B)FLUORANTHENE	240 J	220 J	320 J	170 J	220 J	220 J	21000 **		390 J	250 J	11000 **							
BENZO(K)FLUORANTHENE	240 J	220 J	320 J	170 J	220 J	220 J	21000 **		390 J	250 J	11000 **							
BENZO(A)PYRENE	74 J	77 J		110 J		65 J	10000 **		200 J	150 J	6000 J,**							
INDENO(1,2,3-CD)PYRENE							5200 J,**											
DIBENZ(A,H)ANTHRACENE																		
BENZO(G,H,I)PERYLENE						170 J	3900 J,**											
TOTAL BASE/NEUTRALS AND ACIDS	7536	5487	10650	10928	5692	5406	271600	740	19150	10392	85200	806	831	523	171	1143	1065	463
TOTAL TENTATIVELY IDENTIFIED BASE/NEUTRALS AND ACIDS	21851	19132	38319	32914	19340	12260	418	19516	61804	29380	8805	7200	4400	3000	1600	5100	900	8500

TABLE 2
SUMMIT NATIONAL SITE
OFFSITE SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Number:	SS061001	SS062001	SS063001	SS064001	SS065001	SS065002	SS066001	SS067001	SS068001	SS069001	SS070001	SS071001	SS072001	SS073001	SS073002	SS074001	SS075001	SS076001
Sample Type:	MineSoil	MineSoil	MineSoil	MineSoil	MineSoil	MineSoil	Industry	Industry	Industry	Industry	Industry	Per-4 Ft.	Per-6 Ft.	Perimeter	Perimeter	Per-2 Ft.	Per-6 Ft.	Per-2 Ft.
Date Sampled:	12/12/85	12/12/85	12/12/85	12/12/85	12/12/85	12/12/85	01/08/86	01/08/86	01/08/86	01/08/86	01/08/86	07/01/86	07/01/86	09/12/86	09/12/86	07/02/86	07/02/86	07/02/86
OTR Number:	E9711	E9712	E9713	E9714	E9715	E9874	E9717	E9718	E9719	E9720	E9721	EC371	EC372	EC373	EC374	EC375	EC376	EC377
OTR Number:												EB520	EB521	EB522	EB523	EB524	EB525	EB526
ITR Number:	ME4452	ME4453	ME4454	ME4455	ME4456	ME4472	ME4458	ME4459	ME4460	ME4461	ME4462	MEG820	MEG821	MEG822	MEG823	MEG824	MEG825	MEG826
PESTICIDES and PCBs																		
ALPHA-BHC																		
BETA-BHC																		
DELTA-BHC																		
GAMMA-BHC (LINDANE)																		
HEPTACHLOR																		
ALDRIN																		
HEPTACHLOR EPOXIDE																		
ENDOSULFAN I																		
DIELDRIN																		
4,4-DDE																		
ENDRIN																		
4,4-DDT																		
TOXAPHENE																		
AROCHLOR-1232																		
AROCHLOR-1242																		
AROCHLOR-1248												1240	1190			1270	200	750
AROCHLOR-1254																		
MIREX																		
TOTAL PESTICIDES and PCBs												1240	1190			1270	200	750
PERCENT MOISTURE (VOLATILES)	15	15	17	15	15	15	36	74	19	16	22	18	13	10	12	19	17	12

TABLE 2
SUMMIT NATIONAL SITE
OFFSITE SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Number:	SS061001	SS062001	SS063001	SS064001	SS065001	SS065002	SS066001	SS067001	SS068001	SS069001	SS070001	SS071001	SS072001	SS073001	SS073002	SS074001	SS075001	SS076001
Sample Type:	MineSoil	MineSoil	MineSoil	MineSoil	MineSoil	MineSoil	Industry	Industry	Industry	Industry	Industry	Per-4 Ft.	Per-6 Ft.	Perimeter	Perimeter	Per-2 Ft.	Per-6 Ft.	Per-2 Ft.
Date Sampled:	12/12/85	12/12/85	12/12/85	12/12/85	12/12/85	12/12/85	01/08/86	01/08/86	01/08/86	01/08/86	01/08/86	07/01/86	07/01/86	09/12/86	09/12/86	07/02/86	07/02/86	07/02/86
DTR Number:	E9711	E9712	E9713	E9714	E9715	E9874	E9717	E9718	E9719	E9720	E9721	EC371	EC372	EC373	EC374	EC375	EC376	EC377
DTR Number:												EB520	EB521	EB522	EB523	EB524	EB525	EB526
ITR Number:	ME4452	ME4453	ME4454	ME4455	ME4456	ME4472	ME4458	ME4459	ME4460	ME4461	ME4462	ME6820	ME6821	ME6822	ME6823	ME6824	ME6825	ME6826
INORGANIC COMPOUNDS (units) MG/KG DRY WEIGHT																		
ALUMINUM	5100	4070	5180	4470	6100	6390	1450	7200	6140	8350	4310	8930	8180	9900	10300	9790	10800	7610
ANTIMONY																		
ARSENIC	13	[5.8]	19		15	14	8.7		19	8.9	78	14	14	17	18	12	15	9.2
BARIUM	[58]	[48]	[106]	[28]	[94]	[105]	299	578	[51]	[101]	384	[52]	[58]	[61]	[62]	[74]	[58]	[66]
BERYLLIUM	[0.33]	[0.32]		[0.43]		[0.32]	[.44]		[0.34]	[0.98]	[1.1]							
CADMIUM	3.6	[2.3]			[2.6]	[2.8]												
CALCIUM	[278]	[201]		[404]			[2620]	114000	[982]	3000	10500	[1800] E	[1200] E	6850 E	6560 E	28500 E	7120 E	[2850] E
CHROMIUM	15	12	16	12	18	17	9.7	[19]	16	19	14	15	12	15	15	14	14	12
COBALT	[6.6]	[5.9]	[7.1]	[6]	[8]	[8.7]			[7.8]	[19]	[13]	[14]	[14]	[13]	[15]	[7.3]	[23]	[13]
COPPER	23	23	26	17	28	30	[17]	[35]	26	31	24	28	27	28	28	30	30	28
IRON	31800	21300	36900	21900	37600	39400	15300	6620	35400	41100	47800	36600	24900	27500	30700	26300	26600	24400
LEAD	17	22	20	10	19	21	16	329	28	20	29	19	16	17	18	40	13	15
CYANIDE																		
MAGNESIUM	[2120]	[1820]	[2110]	[1990]	[2470]	[2520]		[1610]	[1740]	4700	[906]	3200	[2520]	4420	4760	[2540]	4890	[2690]
MANGANESE	118 J,R	105 J,R	124 J,R	120 J,R	171 J	322 J	19 J	282 J	109 J	924 J	406 J	532	338	457	496	174	315	376
MERCURY							0.52	[.32]	0.2		[0.1]			0.2	0.3			
NICKEL	[14]	[12]	[11]	[13]	[13]	[16]		[14]	[15]	32	[22]	33	[22]	32	36	[19]	33	32
POTASSIUM	[2130]	[1330]	[2670]	[1110]	[1970]	[2460]	[1190]	[2170]	[2100]	[1740]	[1240]	[1850]	[1760]	[1570]	[1670]	[1760]	[1850]	[1620]
SELENIUM																		
SILVER	[3.3] J,R			[3] J,R	[3] J,R	[2.5] J,R			[3.1] J,R	[2.9] J,R								
SODIUM							[847]	[5090]	[1120]	[971]	[766]						[723]	
THALLIUM																		
TIN																		
VANADIUM	[20]	[14]	[22]	[14]	[21]	[22]	[18]	[12]	[23]	[21]	35	[17]	[13]	[17]	[16]	[16]	[15]	[13]
ZINC	65	69	50	57	57	70	20	88	57	96	97	102	77	103	103	83	80	95
PERCENT MOISTURE																		
PERCENT SOLIDS	84	86	84	86	85	85	63	25	80	84	77	85	85	89	89	81	84	87

FOOTNOTES:

B: Analyte has been found in the laboratory blank as well as the sample. Indicates possible/probable contamination.
C: Applies to pesticide parameters where the identification has been confirmed by GC/MS.
E: Value is estimated due to presence of interference.
J: An estimated value
R: Spike sample recovery is not within control limits.
**: Samples analyzed at medium concentrations.
[]: Positive values less than the contract required detection limit.

TABLE 2
SUMMIT NATIONAL SITE
OFFSITE SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Number:	SS077001	SS078001	SS078002	SS079001	SS080001	SS083001	SS083002	SS085001	RS007001
Sample Type:	Per-4 Ft.	Perimeter	Perimeter	Per-2 Ft.	Per-4 Ft.	Resident	Resident	Perimeter	Blank
Date Sampled:	07/02/86	09/12/86	09/12/86	07/03/86	07/03/86	09/12/86	09/12/86	09/12/86	09/12/86
OTR Number:	EC378	EC379	EC380	EC381	EC382	EC386	EC387	EC389	EC390
OTR Number:	EB527	EB528	EB529	EB530	EB531	EB534	EB535	EB537	EB539
ITR Number:	ME6827	ME6828	ME6829	ME6830	ME6831	ME6835	ME6836	ME6838	ME6839
ORGANIC COMPOUNDS (units-ug/kg)									
VOLATILES									
CHLOROMETHANE									
VINYL CHLORIDE									
METHYLENE CHLORIDE	2 J	2 J	2 J	4 J,B	64 B	6 B	41 B	27 B	4 J
ACETONE	8 J,B	16 B	35 B	27 B,J	29 B,J	26 B,J	27 B,J	13 B	10 B,J
CARBON DISULFIDE									
1,1-DICHLOROETHENE									
1,1-DICHLOROETHANE									
TRANS-1,2-DICHLOROETHENE									
CHLOROFORM									
1,2-DICHLOROETHANE		16	4 J						
2-BUTANONE	6 J,B	12 B	26 B	22 B	17 B	15 B	18 B	14 B	4 J,B
1,1,1-TRICHLOROETHANE									
1,1,2,2-TETRACHLOROETHANE									
TRICHLOROETHENE									
1,1,2-TRICHLOROETHANE									
BENZENE									
2-HEXANONE									
4-METHYL-2-PENTANONE									
TETRACHLOROETHENE									
TOLUENE									
CHLOROBENZENE									
ETHYLBENZENE									
STYRENE									
TOTAL XYLENES									
TOTAL VOLATILES	16	46	67	53	110	47	86	54	18
TOTAL TENTATIVELY IDENTIFIED VOLATILES	0	0	0	0	0	0	0	0	0
BASE/NEUTRALS AND ACIDS									
N-NITROSODIMETHYLAMINE									
PHENOL									
ANILINE									
1,3-DICHLOROBENZENE									
1,4-DICHLOROBENZENE									
BENZYL ALCOHOL									
1,2-DICHLOROBENZENE									
2-METHYLPHENOL									
BIS(2-CHLOROISOPROPYL)ETHER									

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SUMMIT NATIONAL SITE
OFFSITE SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Number:	SS077001	SS078001	SS078002	SS079001	SS080001	SS083001	SS083002	SS085001	RS007001
Sample Type:	Per-4 Ft.	Perimeter	Perimeter	Per-2 Ft.	Per-4 Ft.	Resident	Resident	Perimeter	Blank
Date Sampled:	07/02/86	09/12/86	09/12/86	07/03/86	07/03/86	09/12/86	09/12/86	09/12/86	09/12/86
DTR Number:	EC378	EC379	EC380	EC381	EC382	EC386	EC387	EC389	EC390
DTR Number:	EB527	EB528	EB529	EB530	EB531	EB534	EB535	EB537	EB539
ITR Number:	MEG827	MEG828	MEG829	MEG830	MEG831	MEG835	MEG836	MEG838	MEG839
4-METHYLPHENOL									
HEXACHLOROETHANE									
ISOPHORONE									
2-NITROPHENOL									
2,4-DIMETHYLPHENOL									
BENZOIC ACID									
1,2,4-TRICHLOROBENZENE									
NAPHTHALENE	59 J	285 J	229 J			125 J			
4-CHLORO-3-METHYLPHENOL									
2-METHYLNAPHTHALENE	76 J	251 J	196 J	90 J		125 J			
HEXACHLOROCYCLOPENTADIENE									
DIMETHYL PHTHALATE									
ACENAPHTHYLENE									
ACENAPHTHENE									
4-NITROPHENOL									
DIBENZOFURAN		57 J							
DIETHYLPHTHALATE									
FLUORENE									
N-NITROSODIPHENYLAMINE(1)									
HEXACHLOROBENZENE									
PENTACHLOROPHENOL									
PHENANTHRENE		235 J				204 J			
ANTHRACENE									
DI-N-BUTYLPHTHALATE	303 J,B	1122 B	458 J,B	660 B	1313 B	759 B	1086 B	1677 B	3034 B
FLUORANTHENE				130 J		328 J			
PYRENE						272 J			
BUTYLBENZYLPHTHALATE									
BENZO(A)ANTHRACENE									
BIS(2-ETHYLHEXYL)PHTHALATE		469 J					206 J		
CHRYSENE									
DI-N-OCTYL PHTHALATE									
BENZO(B)FLUORANTHENE									
BENZO(K)FLUORANTHENE									
BENZO(A)PYRENE									
INDENO(1,2,3-CD)PYRENE									
DIBENZ(A,H)ANTHRACENE									
BENZO(G,H,I)PERYLENE									
TOTAL BASE/NEUTRALS AND ACIDS	438	2419	883	880	1313	1813	1292	1677	3034
TOTAL TENTATIVELY IDENTIFIED BASE/NEUTRALS AND ACIDS	3800	71600	1700	1700	4400	1500	2700	3500	1970

TABLE 2
SUMMIT NATIONAL SITE
OFFSITE SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Number:	SS077001	SS078001	SS078002	SS079001	SS080001	SS083001	SS083002	SS085001	RS007001
Sample Type:	Per-4 Ft.	Perimeter	Perimeter	Per-2 Ft.	Per-4 Ft.	Resident	Resident	Perimeter	Blank
Date Sampled:	07/02/86	09/12/86	09/12/86	07/03/86	07/03/86	09/12/86	09/12/86	09/12/86	09/12/86
OTR Number:	EC378	EC379	EC380	EC381	EC382	EC386	EC387	EC389	EC390
OTR Number:	EB527	EB528	EB529	EB530	EB531	EB534	EB535	EB537	EB539
ITR Number:	MEG827	MEG828	MEG829	MEG830	MEG831	MEG835	MEG836	MEG838	MEG839
PESTICIDES and PCBs									
ALPHA-BHC									
BETA-BHC									
DELTA-BHC									
GAMMA-BHC (LINDANE)									
HEPTACHLOR									
ALDRIN									
HEPTACHLOR EPOXIDE									
ENDOSULFAN I									
DIELDRIN									
4,4-DDE									
ENDRIN									
4,4-DDT									
TOXAPHENE									
AROCHLOR-1232									
AROCHLOR-1242									
AROCHLOR-1248	340	3050	3100	398	170	450	540	2960	
AROCHLOR-1254									
MIREX									
TOTAL PESTICIDES and PCBs	340	3050	3100	398	170	450	540	2960	
PERCENT MOISTURE (VOLATILES)	15	37	38	21	17	11	12	17	1

TABLE 2
SUMMIT NATIONAL SITE
OFFSITE SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Number:	SS077001	SS078001	SS078002	SS079001	SS080001	SS083001	SS083002	SS085001	RS007001
Sample Type:	Per-4 Ft.	Perimeter	Perimeter	Per-2 Ft.	Per-4 Ft.	Resident	Resident	Perimeter	Blank
Date Sampled:	07/02/86	09/12/86	09/12/86	07/03/86	07/03/86	09/12/86	09/12/86	09/12/86	09/12/86
OTR Number:	EC378	EC379	EC380	EC381	EC382	EC386	EC387	EC389	EC390
OTR Number:	EB527	EB528	EB529	EB530	EB531	EB534	EB535	EB537	EB539
ITR Number:	MEG827	MEG828	MEG829	MEG830	MEG831	MEG835	MEG836	MEG838	MEG839
INORGANIC COMPOUNDS (units) MG/KG DRY WEIGHT									
ALUMINUM	9870	10600	11400	8220	9190	10000	8920	7440	175
ANTIMONY									
ARSENIC	14	18	18	40	9.5	14	13	21	
BARIUM	[73]	[151]	171	[55]	[63]	119	119	[100]	[4.1]
BERYLLIUM						[1.3]			
CADMIUM									
CALCIUM	7260 E	32900 E	39800 E	4530 E	3860 E	5900 E	5580 E	5180 E	[2070] E
CHROMIUM	15	18	20	13	12	15	15	23	8.7
COBALT	[17]	[13]	[12]	[14]	[18]	[14]	[13]	[11]	
COPPER	28	38	44	26	26	35	37	119	[7]
IRON	27100	46200	51700	24700	24800	28000	27600	40700	169
LEAD	14	45	42	21	11	241	184	50	
CYANIDE									
MAGNESIUM	4270	[2910]	[3140]	3190	3160	3470	3240	[2330]	[327]
MANGANESE	645	580	513	388	493	595	518	280	[4.1]
MERCURY						0.2	0.2		
NICKEL	40	34	[31]	28	30	30	28	29	
POTASSIUM	[1470]	[1220]	[1670]	[1470]	[1630]	[1450]	[1190]	[1530]	
SELENIUM									
SILVER									
SODIUM									[795]
THALLIUM									
TIN						[22]	[16]		
VANADIUM	[15]	[18]	[20]	[14]	[15]	[18]	[17]	[17]	[15]
ZINC	97	135	135	104	75	341	380	114	[4.9]
PERCENT MOISTURE									
PERCENT SOLIDS	85	62	60	85	84	87	87	84	100

FOOTNOTES:

B: Analyte has been found in the laboratory blank as well as the sample. Indicates possible/probable contamination.
C: Applies to pesticide parameters where the identification has been confirmed by GC/MS.
E: Value is estimated due to presence of interference.
J: An estimated value
R: Spike sample recovery is not within control limits.
**: Samples analyzed at medium concentrations.
[]: Positive values less than the contract required detection limit.

TABLE 3
SUMMIT NATIONAL SITE
SURFACE WATER SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	N.Pond	E.Pond	E.Pond		West	South	S.East	East	East	1st Impd	2nd Impd		West	West	2nd Impd	E.Pond	E.Pond	S.East
Sample Number:	SW001001	SW002001	SW003001	SW097001	SW005001	SW006001	SW007001	SW008001	SW009001	SW010001	SW011001	SW096001	SW012001	SW013001	SW014001	SW015001	SW015002	SW016001
Sample Type:	Onsite	Onsite	Onsite	Blank	Upstream	Downstream	Downstream	Downstream	Downstream	Downstream	Downstream	Blank	Upstream	Upstream	Downstream	Onsite	Onsite	Downstream
Date Sampled:	11/28/84	11/28/84	11/28/84	11/28/84	11/28/84	11/28/84	11/28/84	11/28/84	11/28/84	11/29/84	11/29/84	11/29/84	09/15/86	09/15/86	09/15/86	09/16/86	09/16/86	09/16/86
OTR Number:	E9835	E9836	E9837	E9838	E9839	E9840	E9841	E9842	E9843	E9844	E9845	E9846	EC343	EC344	EC345	EC346	EC347	EC348
ITR Number:	ME4408	ME4409	ME4410	ME4411	ME4412	ME4413	ME4414	ME4415	ME4416	ME4417	ME4418	ME4419	ME6785	ME6786	ME6787	ME6788	ME6789	ME6790
ORGANIC COMPOUNDS (units-ppb)																		
VOLATILES																		
CHLOROMETHANE																		
VINYL CHLORIDE																		
METHYLENE CHLORIDE			51	5.6					15				1 J,B	1 J,B	2 J,B	2 J,B	3 J,B	2 J,B
ACETONE	45	4000	3900	23			3100	12	13		5.1	14	12 B	17 B	18 B	30 B,J	32 B,J	18 B,J
CARBON DISULFIDE																		
1,1-DICHLOROETHENE																		
1,1-DICHLOROETHANE																3 J	3 J	
TRANS-1,2-DICHLOROETHENE																		5
CHLOROFORM				13								13						
1,2-DICHLOROETHANE		860	830				500			16	11					38	41	44
2-BUTANONE				12									15 B	19 B	18 B	16 B	16 B	15 B
1,1,1-TRICHLOROETHANE			66													5	5	
1,1,2,2-TETRACHLOROETHANE																		
TRICHLOROETHENE																		
1,1,2-TRICHLOROETHANE																		
BENZENE																		
2-HEXANONE																		
4-METHYL-2-PENTANONE			78				58											
TETRACHLOROETHENE																		
TOLUENE			120												1 J	2 J	1 J	
CHLOROBENZENE																		
ETHYLBENZENE																		
STYRENE																		
TOTAL XYLENES			100													1 J	1 J	
TOTAL VOLATILES	45	4860	5145	53.6			3658	12	28	16	16.1	27	28	37	39	97	102	84
TOTAL TENTATIVELY IDENTIFIED VOLATILES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30.5	33.9	46.9
BASE/NEUTRALS AND ACIDS																		
N-NITROSODIMETHYLAMINE																		
PHENOL		8 J	12			107	7 J											
ANILINE		227	231				283											
1,3-DICHLOROBENZENE																		
1,4-DICHLOROBENZENE																		
BENZYL ALCOHOL																		
1,2-DICHLOROBENZENE																		

TABLE 3
SUMMIT NATIONAL SITE
SURFACE WATER SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	W.Pond	E.Pond	E.Pond		West	South	S.East	East	East	1st Impd	2nd Impd		West	West	2nd Impd	E.Pond	E.Pond	S.East
Sample Number:	SW001001	SW002001	SW003001	SW097001	SW005001	SW006001	SW007001	SW008001	SW009001	SW010001	SW011001	SW096001	SW012001	SW013001	SW014001	SW015001	SW015002	SW016001
Sample Type:	Onsite	Onsite	Onsite	Blank	Upstream	Downstream	Downstream	Downstream	Downstream	Downstream	Downstream	Blank	Upstream	Upstream	Downstream	Onsite	Onsite	Downstream
Date Sampled:	11/28/84	11/28/84	11/28/84	11/28/84	11/28/84	11/28/84	11/28/84	11/28/84	11/28/84	11/29/84	11/29/84	11/29/84	09/15/86	09/15/86	09/15/86	09/16/86	09/16/86	09/16/86
DTR Number:	E9835	E9836	E9837	E9838	E9839	E9840	E9841	E9842	E9843	E9844	E9845	E9846	EC343	EC344	EC345	EC346	EC347	EC348
ITR Number:	ME4408	ME4409	ME4410	ME4411	ME4412	ME4413	ME4414	ME4415	ME4416	ME4417	ME4418	ME4419	ME6785	ME6786	ME6787	ME6788	ME6789	ME6790
2-METHYLPHENOL																		
BIS(2-CHLORDISOPROPYL)ETHER																		
4-METHYLPHENOL																		
HEXACHLORDETHANE																		
ISOPHORONE		12	13				14											4 J
2-NITROPHENOL																		
2,4-DIMETHYLPHENOL																		
BENZOIC ACID		47 J					31 J											
1,2,4-TRICHLORDBENZENE																		
NAPHTHALENE																		
4-CHLORO-3-METHYLPHENOL																		
2-METHYLNAPHTHALENE																		
HEXACHLOROCYCLOPENTADIENE																		
DIMETHYL PHTHALATE																		
ACENAPHTHYLENE																		
ACENAPHTHENE																		
4-NITROPHENOL																		
DIBENZOFURAN																		
DIETHYLPHTHALATE																		
FLUORENE																		
N-NITROSODIPHENYLAMINE(1)																		
HEXACHLOROBENZENE																		
PENTACHLOROPHENOL																		
PHENANTHRENE																		
ANTHRACENE																		
DI-N-BUTYLPHTHALATE																		
FLUORANTHENE																		
PYRENE																		
BUTYLBENZYLPHTHALATE																		
BENZO(A)ANTHRACENE																		
BIS(2-ETHYLHEXYL)PHTHALATE	10B	25 B	20 B			5 J,B	10 B	6 J,B	25 B	13 B	10 B		6 J,B	6 J,B	4 J,B	7 J,B	10 B,J	14 B,J
CHRYSENE																		
DI-N-OCTYL PHTHALATE																		
BENZO(B)FLUORANTHENE																3 J		
BENZO(K)FLUORANTHENE																3 J		
BENZO(A)PYRENE																4 J		
INDENO(1,2,3-CD)PYRENE																3 J		
DIBENZ(A,H)ANTHRACENE																3 J		
BENZO(G,H,I)PERYLENE																3 J		
TOTAL BASE/NEUTRALS AND ACIDS	10	319	276			112	345	6	25	13	10		6	6	4	26	10	18
TOTAL TENTATIVELY IDENTIFIED BASE/NEUTRALS AND ACIDS	270	521	205	200	250	190	267	225	197	451	272	200	43.7	24.4	0	36	30.2	45.1

TABLE 3
SUMMIT NATIONAL SITE
SURFACE WATER SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	W.Pond	E.Pond	E.Pond		West	South	S.East	East	East	1st Impd	2nd Impd		West	West	2nd Impd	E.Pond	E.Pond	S.East
Sample Number:	SW001001	SW002001	SW003001	SW097001	SW005001	SW006001	SW007001	SW008001	SW009001	SW010001	SW011001	SW096001	SW012001	SW013001	SW014001	SW015001	SW015002	SW016001
Sample Type:	Onsite	Onsite	Onsite	Blank	Upstream	Downstream	Downstream	Downstream	Downstream	Downstream	Downstream	Blank	Upstream	Upstream	Downstream	Onsite	Onsite	Downstream
Date Sampled:	11/28/84	11/28/84	11/28/84	11/28/84	11/28/84	11/28/84	11/28/84	11/28/84	11/28/84	11/29/84	11/29/84	11/29/84	09/15/86	09/15/86	09/15/86	09/16/86	09/16/86	09/16/86
DTR Number:	E9835	E9836	E9837	E9838	E9839	E9840	E9841	E9842	E9843	E9844	E9845	E9846	EC343	EC344	EC345	EC346	EC347	EC348
ITR Number:	ME4408	ME4409	ME4410	ME4411	ME4412	ME4413	ME4414	ME4415	ME4416	ME4417	ME4418	ME4419	MEG785	MEG786	MEG787	MEG788	MEG789	MEG790
PESTICIDES and PCBs																		
ALPHA-BHC																		
BETA-BHC																		
DELTA-BHC																		
GAMMA-BHC (LINDANE)																		
HEPTACHLOR																		
ALDRIN																		
HEPTACHLOR EPOXIDE																		
ENDOSULFAN I																		
DIELDRIN																		
4,4-DDE																		
ENDRIN																		
4,4-DDT																		
TOXAPHENE																		
AROCHLOR-1232																		
AROCHLOR-1242																		
AROCHLOR-1248																		
AROCHLOR-1254																		
TOTAL PESTICIDES and PCBs																		

TABLE 3
SUMMIT NATIONAL SITE
SURFACE WATER SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	W.Pond	E.Pond	E.Pond		West	South	S.East	East	East	1st Impd	2nd Impd		West	West	2nd Impd	E.Pond	E.Pond	S.East
Sample Number:	SW001001	SW002001	SW003001	SW097001	SW005001	SW006001	SW007001	SW008001	SW009001	SW010001	SW011001	SW096001	SW012001	SW013001	SW014001	SW015001	SW015002	SW016001
Sample Type:	Onsite	Onsite	Onsite	Blank	Upstream	Downstream	Downstream	Downstream	Downstream	Downstream	Downstream	Blank	Upstream	Upstream	Downstream	Onsite	Onsite	Downstream
Date Sampled:	11/28/84	11/28/84	11/28/84	11/28/84	11/28/84	11/28/84	11/28/84	11/28/84	11/28/84	11/29/84	11/29/84	11/29/84	09/15/86	09/15/86	09/15/86	09/16/86	09/16/86	09/16/86
DTR Number:	E9835	E9836	E9837	E9838	E9839	E9840	E9841	E9842	E9843	E9844	E9845	E9846	EC343	EC344	EC345	EC346	EC347	EC348
ITR Number:	ME4408	ME4409	ME4410	ME4411	ME4412	ME4413	ME4414	ME4415	ME4416	ME4417	ME4418	ME4419	ME6785	ME6786	ME6787	ME6788	ME6789	ME6790
INORGANIC COMPOUNDS (units - ppb, except where noted otherwise)																		
ALUMINUM	17620		200			570	220	20150	18800				3430	218	243	1000	972	10400
ANTIMONY	121	62					94	139	178		87							[43]
ARSENIC			25 +,S				38 +,S											
BARIUM							220						[76]	[36]	[12]	[24]	[25]	[34]
BERYLLIUM	5																	
CADMIUM	35	9					9	6			5							
CALCIUM	139000	232600	171100		122900	107000	217800	206600	172400	105700	237300		361000 E	386000 E	171000 E	297000 E	296000 E	364000 E
CHROMIUM	28												11				[4.2]	22
COBALT	70							173	170				[8.7]			[15]	[13]	[15]
COPPER	102			148				70	60	100		143	[16]	[14]	[9.4]	[13]	[11]	28
IRON	5300	68500	51260		3200	4120	74600	13000	17560	1500	21100		17200	1410	657	3160	3030	131000
LEAD																		
CYANIDE																		
MAGNESIUM	32500	85580	63300		49650	36290	86400	67700	59550	32510	68810		106000	112000	45900	120000	120000	130000
MANGANESE	3740	8100	6000		370	427	8000	19000	1700	900	4700		5170	4080	212	7800	7880	5590
MERCURY																		
NICKEL	210	54	45				46	172	150				[9.9]			[20]	[20]	[30]
POTASSIUM	3670	8450	5730		3570	4510	9060	4510	3670	4040	9060		20400	13600	18900	12400	12400	11700
SELENIUM																		
SILVER																		
SODIUM	14700	55000	40500		15900	28500	59600	37300	31200	34400	64200		124000	130000	38600	71500	72100	312000
THALLIUM																		
TIN																		
VANADIUM													[5.6]					[8.3]
ZINC	1600	490	340	38	155		320	930	820	104	75	31	58	[20]	[15]	204	202	292
Total Alkalinity as CaCo3 (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	287	244	48			343
Ammonia, as N (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.3	2.1	0.9	4.6	4.5	13
Nitrate/Nitrite, as N (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA						
Chloride (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	293	213	79	123	85	242
Suspended Solids (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	486	35	21	7	7	456
Dissolved Solids (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2340	2410	1060	2210	2090	2900
Sulfate (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1050	1270	536	1300	1330	1490
Acidity (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NR	NR	NR	43	45	NR
FIELD PARAMETERS																		
pH (standard units)	3.4	6.2	6.5	8.0	6.2	6.8	6.0	3.0	3.0	5.6	5.8	6.6	6.0	7.0	5.5	4.0	4.0	6.0
SPECIFIC CONDUCTANCE (umhos/cm)	1160	1050	1130	0	620	800	1240	1640	1550	940	1430	0	2400	2400	1210	2000	2000	3000
TEMPERATURE (degrees F)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

FOOTNOTES:

B: Analyte has been found in the laboratory blank as well as the sample. Indicates possible/probable contamination.
E: Value is estimated due to presence of interference.
J: An estimated value
S: Value is determined by standard addition.
+: Correlation coefficient for method of standard addition is less than 0.995.

[]: Positive values less than the contract required detection limit.
NA: Not Analyzed

TABLE 3
SUMMIT NATIONAL SITE
SURFACE WATER SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	W.Pond	South	Berlin Res.	
Sample Number:	SW017001	SW018001	SW019001	SW098001
Sample Type:	Onsite	Downstream	Downstream	Blank
Date Sampled:	09/16/86	09/16/86	09/17/86	09/16/86
DTR Number:	EC349	EC350	EC351	EC353
ITR Number:	MEG791	MEG792	MEG801	MEG803
ORGANIC COMPOUNDS (units-ppb)				
VOLATILES				
CHLOROMETHANE				
VINYL CHLORIDE		7 J		
METHYLENE CHLORIDE	2 J,B	2 J,B		2 J,B
ACETONE	47 B,J	15 B,J	7 J,B	12 B
CARBON DISULFIDE				
1,1-DICHLOROETHENE				
1,1-DICHLOROETHANE		34		
TRANS-1,2-DICHLOROETHENE		78		
CHLOROFORM				
1,2-DICHLOROETHANE		78		
2-BUTANONE	11 B	13 B	15 B	16 B
1,1,1-TRICHLOROETHANE		29		
1,1,2,2-TETRACHLOROETHANE				
TRICHLOROETHENE		6		
1,1,2-TRICHLOROETHANE				
BENZENE				
2-HEXANONE				
4-METHYL-2-PENTANONE				
TETRACHLOROETHENE	24			
TOLUENE				
CHLOROBENZENE	59	2 J		
ETHYLBENZENE				
STYRENE				
TOTAL XYLENES				
TOTAL VOLATILES	143	264	22	30
TOTAL TENTATIVELY IDENTIFIED VOLATILES	29.6	0	0	0
BASE/NEUTRALS AND ACIDS				
N-NITROSODIMETHYLAMINE				
PHENOL				
ANILINE				
1,3-DICHLOROBENZENE				
1,4-DICHLOROBENZENE	49 J			
BENZYL ALCOHOL				
1,2-DICHLOROBENZENE	24 J			

TABLE 3
SUMMIT NATIONAL SITE
SURFACE WATER SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	W.Pond	South	Berlin Res.	
Sample Number:	SW017001	SW018001	SW019001	SW098001
Sample Type:	Onsite	Downstream	Downstream	Blank
Date Sampled:	09/16/86	09/16/86	09/17/86	09/16/86
OTR Number:	EC349	EC350	EC351	EC353
ITR Number:	ME6791	ME6792	ME6801	ME6803
2-METHYLPHENOL				
BIS(2-CHLOROISOPROPYL)ETHER				
4-METHYLPHENOL				
HEXACHLOROETHANE	14 J			
ISOPHORONE				
2-NITROPHENOL				
2,4-DIMETHYLPHENOL				
BENZOIC ACID				
1,2,4-TRICHLOROBENZENE				
NAPHTHALENE				
4-CHLORO-3-METHYLPHENOL				
2-METHYLNAPHTHALENE				
HEXACHLOROCYCLOPENTADIENE				
DIMETHYL PHTHALATE				
ACENAPHTHYLENE				
ACENAPHTHENE				
4-NITROPHENOL				
DIBENZOFURAN				
DIETHYLPHTHALATE				
FLUORENE				
N-NITROSODIPHENYLAMINE(1)				
HEXACHLOROBENZENE				
PENTACHLOROPHENOL				
PHENANTHRENE				
ANTHRACENE				
DI-N-BUTYLPHTHALATE				
FLUORANTHENE				
PYRENE				
BUTYLBENZYLPHTHALATE				
BENZO(A)ANTHRACENE				
BIS(2-ETHYLHEXYL)PHTHALATE	9 J,B	12 B,J		7 J,B
CHRYSENE				
DI-N-OCTYL PHTHALATE				
BENZO(B)FLUORANTHENE				
BENZO(K)FLUORANTHENE				
BENZO(A)PYRENE				
INDENO(1,2,3-CD)PYRENE				
DIBENZ(A,H)ANTHRACENE				
BENZO(G,H,I)PERYLENE				
TOTAL BASE/NEUTRALS AND ACIDS	96	12		7
TOTAL TENTATIVELY IDENTIFIED BASE/NEUTRALS AND ACIDS	95.2	27.9	23.2	0

TABLE 3
SUMMIT NATIONAL SITE
SURFACE WATER SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	W.Pond	South	Berlin Res.	
Sample Number:	SW017001	SW018001	SW019001	SW098001
Sample Type:	Onsite	Downstream	Downstream	Blank
Date Sampled:	09/16/86	09/16/86	09/17/86	09/16/86
OTR Number:	EC349	EC350	EC351	EC353
ITR Number:	ME6791	ME6792	ME6801	ME6803
PESTICIDES and PCBs				
ALPHA-BHC				
BETA-BHC				
DELTA-BHC				
GAMMA-BHC (LINDANE)				
HEPTACHLOR				
ALDRIN				
HEPTACHLOR EPOXIDE				
ENDOSULFAN I				
DIELDRIN				
4,4-DDE				
ENDRIN				
4,4-DDT				
TOXAPHENE				
AROCHLOR-1232				
AROCHLOR-1242				
AROCHLOR-1248				
AROCHLOR-1254				
TOTAL PESTICIDES and PCBs				

TABLE 3
SUMMIT NATIONAL SITE
SURFACE WATER SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	W.Pond	South	Berlin Res.	
Sample Number:	SW017001	SW018001	SW019001	SW098001
Sample Type:	Onsite	Downstream	Downstream	Blank
Date Sampled:	09/16/86	09/16/86	09/17/86	09/16/86
DTR Number:	EC349	EC350	EC351	EC353
ITR Number:	MEG791	MEG792	MEG801	MEG803
INORGANIC COMPOUNDS (units - ppb, except where noted otherwise)				
ALUMINUM	39800	[154]	843	[41]
ANTIMONY				
ARSENIC	27 S			
BARIUM	[9.9]		[46]	[5.1]
BERYLLIUM	[7.9]			
CADMIUM	23			
CALCIUM	162000 E	383000 E	94400 E	[526] E
CHROMIUM	21			
COBALT	123	[23]		
COPPER	122	[10]	[8.9]	[10]
IRON	8740	8520	1370	[18]
LEAD				
CYANIDE				
MAGNESIUM	44500	92900	30700	
MANGANESE	4760	3670	944	
MERCURY				
NICKEL	322	62	[9.9]	
POTASSIUM	6280	9700	6450	
SELENIUM	16 S			
SILVER				
SODIUM	15200	142000	30200	
THALLIUM				
TIN				
VANADIUM				
ZINC	1660	40	[14]	[7.1]
Total Alkalinity as CaCo3 (mg/l)		195	104	
Ammonia, as N (mg/l)		2.6		
Nitrate/Nitrite, as N (mg/l)				
Chloride (mg/l)	47	144	57	
Suspended Solids (mg/l)	41	33	24	
Dissolved Solids (mg/l)	1320	2320	591	
Sulfate (mg/l)	850	1200	295	
Acidity (mg/l)	320	NR	NR	4.2
FIELD PARAMETERS				
pH (standard units)	4.0	6.5	12.0	NA
SPECIFIC CONDUCTANCE (umhos/cm)	1440	1335	850	NA
TEMPERATURE (degrees F)	NA	NA	72	NA

FOOTNOTES:

B: Analyte has been found in the laboratory blank as well as the sample. Indicates possible/probable contamination.
E: Value is estimated due to presence of interference.
J: An estimated value
S: Value is determined by standard addition.
+: Correlation coefficient for method of standard addition is less than .995.

[]: Positive values less than the contract required detection limit.
NA: Not Analyzed

TABLE 4
SUMMIT NATIONAL SITE
SEDIMENT SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	E. Pond	E.Pond	E.Pond	E.Pond	W.Pond	W.Pond	W.Pond	W.Pond	W.Pond	West	West	West	South	South	South	East	East	East
Sample Number:	SD001001	SD002001	SD003001	SD004001	SD006001	SD007001	SD008001	SD009001	SD010001	SD011001	SD012001	SD013001	SD014001	SD015001	SD016001	SD017001	SD018001	SD019001
Sample Type:	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite	Upstream	Upstream	Upstream	Downstream	Downstream	Downstream	Downstream	Downstream	Downstream
Date Sampled:	11/26/84	11/26/84	11/26/84	11/26/84	11/26/84	11/26/84	11/26/84	11/26/84	11/26/84	11/26/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84
QTR Number:	E9726	E9727	E9728	E9729	E9731	E9732	E9733	E9734	E9735	E9736	E9737	E9738	E9739	E9740	E9819	E9820	E9821	E9822
ITR Number:	MEA234	MEA235	MEA236	MEA237	MEA239	MEA240	MEA241	MEA242	MEA243	MEA244	MEA245	MEA246	MEA247	MEA248	MEA300	MEA301	MEA302	MEA303
ORGANIC COMPOUNDS (units-ug/kg)																		
VOLATILES																		
CHLOROMETHANE																		
VINYL CHLORIDE																		
METHYLENE CHLORIDE	89.9	361	32 A	192	41000 **	2200 **	8300 A,**	4600 **	220	230	135	340	380	210	400	400	670	590
ACETONE	85	510 A		424		2600 **			300 A									
CARBON DISULFIDE																		
1,1-DICHLOROETHENE																		
1,1-DICHLOROETHANE									86									
TRANS-1,2-DICHLOROETHENE									9 A				290					
CHLOROFORM																		
1,2-DICHLOROETHANE						4800 **	8900 **	7400 **	690									
2-BUTANONE				156		12000 **	18000 **	15000 **										
1,1,1-TRICHLOROETHANE	30.5 A						2500 A,**	1200 A,**	50 A									
1,1,2,2-TETRACHLOROETHANE																		
TRICHLOROETHENE	15 A	18		23 A		500 **			12 A				110 A	66	15 A			
DIBROMOCHLOROMETHANE																		
1,1,2-TRICHLOROETHANE																		
BENZENE														33 A				
2-HEXANONE																		
4-METHYL-2-PENTANONE																		
TETRACHLOROETHENE																		
TOLUENE					174000 **		21000 **	15000 **	12 A									
CHLOROBENZENE	20 A			130		1000 **		610 A,**										
ETHYLBENZENE		24 A		146	16000 A,**	4300 **	28000 **	24000 **	16 A									
STYRENE																		
TOTAL XYLENES					78000 **	8200 **	92000 **	83000 **										
TOTAL VOLATILES	240	913	32	1071	309000	35600	178700	150810	1395	230	135	340	780	309	415	400	670	590
TOTAL TENTATIVELY IDENTIFIED VOLATILES	153	270	0	0	0	1800	0	2000	20	0	0	0	0	0	0	0	0	0
BASE/NEUTRALS AND ACIDS																		
N-NITROSODIMETHYLAMINE																		
PHENOL																		
ANILINE																		
1,3-DICHLOROBENZENE																		
1,4-DICHLOROBENZENE																		
BENZYL ALCOHOL																		
1,2-DICHLOROBENZENE													680 A					
2-METHYLPHENOL																		
BIS(2-CHLOROISOPROPYL)ETHER																		

TABLE 4
SUMMIT NATIONAL SITE
SEDIMENT SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	E. Pond	E.Pond	E.Pond	E.Pond	W.Pond	W.Pond	W.Pond	W.Pond	W.Pond	West	West	West	South	South	South	East	East	East
Sample Number:	SD001001	SD002001	SD003001	SD004001	SD006001	SD007001	SD008001	SD009001	SD010001	SD011001	SD012001	SD013001	SD014001	SD015001	SD016001	SD017001	SD018001	SD019001
Sample Type:	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite	Upstream	Upstream	Upstream	Downstream	Downstream	Downstream	Downstream	Downstream	Downstream
Date Sampled:	11/26/84	11/26/84	11/26/84	11/26/84	11/26/84	11/26/84	11/26/84	11/26/84	11/26/84	11/26/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84
DTR Number:	E9726	E9727	E9728	E9729	E9731	E9732	E9733	E9734	E9735	E9736	E9737	E9738	E9739	E9740	E9819	E9820	E9821	E9822
ITR Number:	MEA234	MEA235	MEA236	MEA237	MEA239	MEA240	MEA241	MEA242	MEA243	MEA244	MEA245	MEA246	MEA247	MEA248	MEA300	MEA301	MEA302	MEA303
4-METHYLPHENOL																		
HEXACHLOROETHANE																		
ISOPHORONE																		
2-NITROPHENOL																		
2,4-DIMETHYLPHENOL																		
BENZOIC ACID																		
1,2,4-TRICHLOROBENZENE																		
NAPHTHALENE	750 A					390 A	830 A		1100 A			1600	800 A					
4-CHLORO-3-METHYLPHENOL																		
2-METHYLNAPHTHALENE	1100 A								1200 A			630 A	1200 A	480 A	300			
HEXACHLOROCYCLOPENTADIENE																		
DIMETHYL PHTHALATE																		
ACENAPHTHYLENE												1100 A						
ACENAPHTHENE												1300 A						
4-NITROPHENOL																		
DIBENZOFURAN												2100 A						
DIETHYLPHTHALATE																		
FLUORENE												3100						
N-NITROSODIPHENYLAMINE(1)																		
HEXACHLOROBENZENE	1080 A						2700 A	2400										
PENTACHLOROPHENOL																		
PHENANTHRENE	490 A						1500	1000 A	620 A			6400	710 A					
ANTHRACENE												5500						
DI-N-BUTYLPHTHALATE																		
FLUORANTHENE												24000						670
PYRENE												16000						640 A
BUTYLBENZYLPHTHALATE																		
BENZO(A)ANTHRACENE												9000						
BIS(2-ETHYLHEXYL)PHTHALATE	52000	15000	18000	96000	71000	31000	87000	54000	24000				11000	15000	980			
CHRYSENE												16000	590 A					
DI-N-OCTYL PHTHALATE	5200	2500		14000		2300	9400	5700 A										
BENZO(B)FLUORANTHENE												13000						640 A
BENZO(K)FLUORANTHENE																		
BENZO(A)PYRENE												7300						
INDENO(1,2,3-CD)PYRENE												5200						
DIBENZ(A,H)ANTHRACENE												5400						
BENZO(G,H,I)PERYLENE												6900						
TOTAL BASE/NEUTRALS AND ACIDS	60620	17500	18000	110000	71000	33690	101430	63100	26920			124530	14980	15480	1280			1950
TOTAL TENTATIVELY IDENTIFIED BASE/NEUTRALS AND ACIDS	2000	7000	3000	49000	52600	23100	351300	229800	15800	0	0	13500	10800	28200	4700	0	213000	17000

TABLE 4
SUMMIT NATIONAL SITE
SEDIMENT SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	E. Pond	E.Pond	E.Pond	E.Pond	W.Pond	W.Pond	W.Pond	W.Pond	W.Pond	West	West	West	South	South	South	East	East	East
Sample Number:	SD001001	SD002001	SD003001	SD004001	SD006001	SD007001	SD008001	SD009001	SD010001	SD011001	SD012001	SD013001	SD014001	SD015001	SD016001	SD017001	SD018001	SD019001
Sample Type:	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite	Upstream	Upstream	Upstream	Downstream	Downstream	Downstream	Downstream	Downstream	Downstream
Date Sampled:	11/26/84	11/26/84	11/26/84	11/26/84	11/26/84	11/26/84	11/26/84	11/26/84	11/26/84	11/26/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84
DTR Number:	E9726	E9727	E9728	E9729	E9731	E9732	E9733	E9734	E9735	E9736	E9737	E9738	E9739	E9740	E9819	E9820	E9821	E9822
ITR Number:	MEA234	MEA235	MEA236	MEA237	MEA239	MEA240	MEA241	MEA242	MEA243	MEA244	MEA245	MEA246	MEA247	MEA248	MEA300	MEA301	MEA302	MEA303
PESTICIDES and PCBs																		
ALPHA-BHC																		
BETA-BHC																		
DELTA-BHC																		
GAMMA-BHC (LINDANE)																		
HEPTACHLOR																		
ALDRIN																		
HEPTACHLOR EPOXIDE																		
ENDOSULFAN I																		
DIELDRIN																		
4,4-DDE																		
ENDRIN																		
4,4-DDT																		
TOXAPHENE																		
AROCHLOR-1232																		
AROCHLOR-1242							6900 A	6100 A										
AROCHLOR-1248					35000 C	5100 A			1100 A				4200 A	290 A				
AROCHLOR-1254																		
TOTAL PESTICIDES and PCBs					35000	5100	6900	6100	1100				4200	290				
PERCENT MOISTURE (VOLATILES)																		
PERCENT MOISTURE (BNA)																		

TABLE 4
SUMMIT NATIONAL SITE
SEDIMENT SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	E. Pond	E.Pond	E.Pond	E.Pond	W.Pond	W.Pond	W.Pond	W.Pond	W.Pond	West	West	West	South	South	South	East	East	East
Sample Number:	SD001001	SD002001	SD003001	SD004001	SD006001	SD007001	SD008001	SD009001	SD010001	SD011001	SD012001	SD013001	SD014001	SD015001	SD016001	SD017001	SD018001	SD019001
Sample Type:	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite	Upstream	Upstream	Upstream	Downstream	Downstream	Downstream	Downstream	Downstream	Downstream
Date Sampled:	11/26/84	11/26/84	11/26/84	11/26/84	11/26/84	11/26/84	11/26/84	11/26/84	11/26/84	11/26/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84
QTR Number:	E9726	E9727	E9728	E9729	E9731	E9732	E9733	E9734	E9735	E9736	E9737	E9738	E9739	E9740	E9819	E9820	E9821	E9822
ITR Number:	MEA234	MEA235	MEA236	MEA237	MEA239	MEA240	MEA241	MEA242	MEA243	MEA244	MEA245	MEA246	MEA247	MEA248	MEA300	MEA301	MEA302	MEA303
INORGANIC COMPOUNDS (units) MG/KG DRY WEIGHT																		
ALUMINUM	7328	7527	7529	6453	7239	7454	4860	4947	5228	6803	5262	8925	8994	14905	13102	7109	3682	9689
ANTIMONY					148 R													
ARSENIC																		
BARIUM	[89] R	[87] R	[101] R	[82] R	[95] R	[88] R	[72] R	[64] R	[56] R	[59] R	[73] R	[87] R	[119] R	[135] R	[117] R	[65] R		[111] R
BERYLLIUM							4.3											
CADMIUM												4.6 R	11 R	11 R	14 R	11 R	16 R	18 R
CALCIUM	[812]	[940]	[848]	[1124]	6445	[2367]	[1044]	[916]	[692]	[2855]	[1373]	8112	17236	15026	5393	[975]	[1740]	[1683]
CHROMIUM	35 R	12 R	55 R	46 R	55 R	48 R	24 R	15 R	20 R		20 R		41 R	23 R	29 R	12 R		14 R
COBALT										[18] R	[15] R	[17] R		[21] R	[22] R			
COPPER	41 R	45 R	49 R	44 R	42 R	44 R	23 R	24 R	18 R	[17] R	[18] R	[14] R	38 R	79 R	89 R	28 R	57 R	66 R
IRON	38514	30728	36676	30921	60265	72667	47407	44309	34354	25682	26873	28380	49120	49132	61188	60960	92512	98360
LEAD		48	16	.47	62	43	33	23	24	20	23	40	47	64	41	68	69	134
CYANIDE																		
MAGNESIUM	[1878]	[1952]	[2153]	[1824]	[2447]	[2363]	[1691]	[1870]	[1886]	3247	[1798]	[2507]	[2941]	[4017]	[3847]	[1240]	[1015]	[1781]
MANGANESE	104 R	102 R	103 R	92 R	206 R	328 R	124 R	90 R	113 R	447 R	216 R	547 R	377 R	701 R	892 R	112 R	244 R	248 R
MERCURY	.26	.17	.29	.19	.3	.18	.16		.21						.15			
NICKEL		[24] R	[21] R	[21] R	[27] R	37 R	[23] R	[18] R	[19] R	30 R	29 R		[36] R	[34] R	46 R			[22] R
POTASSIUM	[767]			[1226]	[1301]	[1033]	[808]	[1006]	[780]					[1656]	[1330]		[1574]	
SELENIUM																		
SILVER																		
SODIUM																		
THALLIUM																		
TIN																		
VANADIUM	[26] R	[22] R	[23] R	[24] R	[34] R	[35] R	[27] R	[27] R	[27] R	[24] R	[20] R	[22] R	[25] R	[36] R	[33] R	[26] R		[30] R
ZINC	100 R,E	280 R,E	195 R,E	195 R,E	477 R,E	915 R,E	254 R,E	71 R,E	134 R,E	85 R,E	78 R,E	72 R,E	121 R,E	165 R,E	204 R,E	44 R,E	89 R,E	125 R,E
PERCENT MOISTURE																		
PERCENT SOLIDS	68.3	58.4	51.6	57.1	66.1	56.8	64.2	70.2	71.9	78.5	75.8	67.0	48.3	57.6	64.8	51.6	40.4	50.1

FOOTNOTES:

A: Detected below quantitation limit (Quantitation limit is 10 X DL)
B: Analyte has been found in the laboratory blank as well as the sample. Indicates possible/probable contamination.
C: Applies to pesticide parameters where the identification has been confirmed by GC/MS.
E: Value is estimated due to presence of interference.
J: An estimated value
R: Spike sample recovery is not within control limits.
**: Samples analyzed at medium concentrations.
[]: Positive values less than the contract required detection limit.

TABLE 4
SUMMIT NATIONAL SITE
SEDIMENT SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	East	S.East	S.East	S.East	1st Impd	1st Impd	1st Impd	1st Impd	2nd Impd	2nd Impd	2nd Impd			2nd Impd	West	E.Pond	W.Pond
Sample Number:	SD020001	SD021001	SD022001	SD023001	SD024001	SD025001	SD026001	SD027001	SD028001	SD029001	SD030001	SD098001	SD099001	SD031001	SD032001	SD033001	SD034001
Sample Type:	Downstream	Downstream	Downstream	Downstream	Downstream	Downstream	Downstream	Downstream	Downstream	Downstream	Downstream	Blank	Blank	Downstream	Upstream	Onsite	Onsite
Date Sampled:	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/26/84	09/15/86	09/16/86	09/16/86	09/17/86
DTR Number:	E9823	E9824	E9825	E9826	E9827	E9828	E9829	E9830	E9831	E9832	E9833	E9834	E9730	EC354	EC355	EC356	EC357
ITR Number:	MEA304	MEA305	MEA306	MEA307	MEA308	ME4401	ME4402	ME4403	ME4404	ME4405	ME4406	ME4407	MEA238	MEG804	MEG805	MEG806	MEG807
ORGANIC COMPOUNDS (units-ug/kg)																	
VOLATILES																	
CHLOROMETHANE																	
VINYL CHLORIDE																	
METHYLENE CHLORIDE	300	30 A	51 A	83	160 A	86 A	200	72	100 A	120	160	26 A	17 A	10 J	6 J,B	8 J,B	50
ACETONE					660 A	410	1400							15 J			
CARBON DISULFIDE																	
1,1-DICHLOROETHENE																13	14
1,1-DICHLOROETHANE																69	
TRANS-1,2-DICHLOROETHENE																	
CHLOROFORM																	
1,2-DICHLOROETHANE		220		240													14
2-BUTANONE																	
1,1,1-TRICHLOROETHANE														423	508 J	105	495
1,1,2,2-TETRACHLOROETHANE																	
TRICHLOROETHENE																10	
DIBROMOCHLOROMETHANE																	
1,1,2-TRICHLOROETHANE																	
BENZENE																	
2-HEXANONE																	
4-METHYL-2-PENTANONE																	
TETRACHLOROETHENE																	
TOLUENE																	
CHLOROBENZENE																	8 J
ETHYLBENZENE																	
STYRENE																	
TOTAL XYLENES																	
TOTAL VOLATILES	300	250	51	323	820	496	1600	72	100	120	160	26	17	448	514	205	581
TOTAL TENTATIVELY IDENTIFIED VOLATILES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	64
BASE/NEUTRALS AND ACIDS																	
N-NITROSODIMETHYLAMINE																	
PHENOL																	
ANILINE																	
[illegible]OBENZENE																	
[illegible]OBENZENE																	
[illegible]HOL																	
[illegible]ROBENZENE																	
[illegible]ENOL																	
[illegible]ROISOPROPYL)ETHER																	

TABLE 4
SUMMIT NATIONAL SITE
SEDIMENT SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	East	S.East	S.East	S.East	1st Impd	1st Impd	1st Impd	1st Impd	2nd Impd	2nd Impd	2nd Impd			2nd Impd	West	E.Pond	W.Pond
Sample Number:	SD020001	SD021001	SD022001	SD023001	SD024001	SD025001	SD026001	SD027001	SD028001	SD029001	SD030001	SD098001	SD099001	SD031001	SD032001	SD033001	SD034001
Sample Type:	Downstream	Downstream	Downstream	Downstream	Downstream	Downstream	Downstream	Downstream	Downstream	Downstream	Downstream	Blank	Blank	Downstream	Upstream	Onsite	Onsite
Date Sampled:	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/26/84	09/15/86	09/16/86	09/16/86	09/17/86
DTR Number:	E9823	E9824	E9825	E9826	E9827	E9828	E9829	E9830	E9831	E9832	E9833	E9834	E9730	EC354	EC355	EC356	EC357
ITR Number:	MEA304	MEA305	MEA306	MEA307	MEA308	ME4401	ME4402	ME4403	ME4404	ME4405	ME4406	ME4407	MEA238	MEG804	MEG805	MEG806	MEG807
4-METHYLPHENOL																	
HEXACHLOROETHANE																	
ISOPHORONE																	
2-NITROPHENOL																	
2,4-DIMETHYLPHENOL																	
BENZOIC ACID																	
1,2,4-TRICHLOROBENZENE																	
NAPHTHALENE								2100		470 A						210 J	
4-CHLORO-3-METHYLPHENOL																	
2-METHYLNAPHTHALENE	430 A							2400 A		580 A						182 J	
HEXACHLOROCYCLOPENTADIENE																	
DIMETHYL PHTHALATE																	
ACENAPHTHYLENE																	
ACENAPHTHENE																	
4-NITROPHENOL																	
DIBENZOFURAN								370 A									
DIETHYLPHTHALATE																	
FLUORENE																	
N-NITROSODIPHENYLAMINE(1)														809 J	409 J	490 J	
HEXACHLOROBENZENE											2800					518 J	
PENTACHLOROPHENOL																	
PHENANTHRENE								1700 A		470 A						168 J	
ANTHRACENE																	
DI-N-BUTYLPHTHALATE														4313 B	2398 B	2521 B	
FLUORANTHENE	630 A																
PYRENE	610 A																
BUTYLBENZYLPHTHALATE														296 J,B	124 J		
BENZO(A)ANTHRACENE																	
BIS(2-ETHYLHEXYL)PHTHALATE		780 A	26000	5700	950 A					1000 A	24000			997 J,B	197 J	9244	29703 J
CHRYSENE																	
DI-N-OCTYL PHTHALATE																	
BENZO(B)FLUORANTHENE	450 A																
BENZO(K)FLUORANTHENE																	
BENZO(A)PYRENE																	
INDENO(1,2,3-CD)PYRENE																	
DIBENZ(A,H)ANTHRACENE																	
BENZO(G,H,I)PERYLENE																	
TOTAL BASE/NEUTRALS AND ACIDS	2120	780	26000	5700	950			6570		2520	26800			6415	3128	13333	29703
TOTAL TENTATIVELY IDENTIFIED BASE/NEUTRALS AND ACIDS	3000	0	2000	0	4100	0	12900	21900	15000	20900	119000	0	0	4900	8200	20800	0

TABLE 4
SUMMIT NATIONAL SITE
SEDIMENT SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	East	S.East	S.East	S.East	1st Impd	1st Impd	1st Impd	1st Impd	2nd Impd	2nd Impd	2nd Impd			2nd Impd	West	E.Pond	W.Pond
Sample Number:	SD020001	SD021001	SD022001	SD023001	SD024001	SD025001	SD026001	SD027001	SD028001	SD029001	SD030001	SD098001	SD099001	SD031001	SD032001	SD033001	SD034001
Sample Type:	Downstream	Downstream	Downstream	Downstream	Downstream	Downstream	Downstream	Downstream	Downstream	Downstream	Downstream	Blank	Blank	Downstream	Upstream	Onsite	Onsite
Date Sampled:	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/26/84	09/15/86	09/16/86	09/16/86	09/17/86
OTR Number:	E9823	E9824	E9825	E9826	E9827	E9828	E9829	E9830	E9831	E9832	E9833	E9834	E9730	EC354	EC355	EC356	EC357
ITR Number:	MEA304	MEA305	MEA306	MEA307	MEA308	ME4401	ME4402	ME4403	ME4404	ME4405	ME4406	ME4407	MEA238	MEG804	MEG805	MEG806	MEG807
PESTICIDES and PCBs																	
ALPHA-BHC																	
BETA-BHC																	
DELTA-BHC																	
GAMMA-BHC (LINDANE)																	
HEPTACHLOR																	
ALDRIN																	
HEPTACHLOR EPOXIDE																	
ENDOSULFAN I																	
DIELDRIN																	
4,4-DDE																	
ENDRIN																	
4,4-DDT																	
TOXAPHENE																	
AROCHLOR-1232																	
AROCHLOR-1242																	
AROCHLOR-1248																8171	
AROCHLOR-1254																	
TOTAL PESTICIDES and PCBs																8171	
PERCENT MOISTURE (VOLATILES)														59.8	29.1	28.6	49.5
PERCENT MOISTURE (BNA)														62.9	29.1	28.6	49.5

TABLE 4
SUMMIT NATIONAL SITE
SEDIMENT SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	East	S.East	S.East	S.East	1st Impd	1st Impd	1st Impd	1st Impd	2nd Impd	2nd Impd	2nd Impd			2nd Impd	West	E.Pond	W.Pond
Sample Number:	SD020001	SD021001	SD022001	SD023001	SD024001	SD025001	SD026001	SD027001	SD028001	SD029001	SD030001	SD098001	SD099001	SD031001	SD032001	SD033001	SD034001
Sample Type:	Downstream	Downstream	Downstream	Downstream	Downstream	Downstream	Downstream	Downstream	Downstream	Downstream	Downstream	Blank	Blank	Downstream	Upstream	Onsite	Onsite
Date Sampled:	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/27/84	11/26/84	09/15/86	09/16/86	09/16/86	09/17/86
OTR Number:	E9823	E9824	E9825	E9826	E9827	E9828	E9829	E9830	E9831	E9832	E9833	E9834	E9730	EC354	EC355	EC356	EC357
ITR Number:	MEA304	MEA305	MEA306	MEA307	MEA308	ME4401	ME4402	ME4403	ME4404	ME4405	ME4406	ME4407	MEA238	MEG804	MEG805	MEG806	MEG807
INORGANIC COMPOUNDS (units) MG/KG DRY WEIGHT																	
ALUMINUM	10556	8337	7512	12899	12058	15431	10928	7286	20747	6675	15821	187	161	22300	9560	7310	8540
ANTIMONY																68	
ARSENIC														27		14	26
BARIUM	[118] R	[74]	[53]	[81]		[127]	[96]	[130]	[82]	[82]				[90]	[128]	[98]	[120]
BERYLLIUM																	
CADMIUM	14 R	19	11	12	8.1	7.0	6.4	5.9	9.9	7.3	17						
CALCIUM	[1569]	[1852]	[2055]	[3208]	79795	50010	39068	9365	[4176]	[1562]	[2803]	[602]	[304]	[5420]	[2840]	10500	[1240]
CHROMIUM	26 R	18 R	21 R	25 R	15 R	34 R	23 R	23 R	36 R	18 R	28 R			29	10	37	36
COBALT														[25]	[7]	[13]	[10]
COPPER	54 R	42	33	42	[31]	42	38	32	30	22	33			[35]	[17]	62	50
IRON	83716	92589	57588	67537	29295	39240	31042	40380	62602	50885	113877	166	170	76300	12400	31800	45300
LEAD	96	25	35	32	23	38	42	28	49	14				28	18	92	48
CYANIDE																	5.2 R
MAGNESIUM	[1943]	[1605]	[1767]	[3033]	18897	8039	7417	4326	6260	[2446]	[4546]			[8240]	[1790]	[2510]	[2410]
MANGANESE	215 R	183	192	369	1178	1708	1350	2014	342	107	463			542	109	390	141
MERCURY									.24	.23	.24						
NICKEL	[19] R	48	[26]	[34]		[37]	[26]	28	[39]		[31]			[65]	[16]	32	[23]
POTASSIUM	[1580]	[907]		[1314]	[6410]	[1076]	[1400]	[1555]	[3173]	[976]	[2042]			[3180]	[863]	[1310]	[2110]
SELENIUM																	
SILVER																	
SODIUM												[1562]	[747]	[1830]			[1310]
THALLIUM																	
TIN																	
VANADIUM	[34] R	[28]	[25]	[26]	[33]	[37]	[29]	[28]	[41]	[27]	[34]	[12]		[31]	[21]	[14]	[18]
ZINC	100 R,E	1254	452	566	81	172	134	279	117	60	124			200	52	413	167
PERCENT MOISTURE																	
PERCENT SOLIDS	52.2	56.0	53.7	53.8	38.9	48.7	45.6	72.4	41.5	64.4	41.4	99.9	99.9	30	72	71	50

FOOTNOTES:

A: Detected below quantitation limit (Quantitation limit is 10 X DL)
B: Analyte has been found in the laboratory blank as well as the sample. Indicates possible/probable contamination.
C: Applies to pesticide parameters where the identification has been confirmed by GC/MS.
E: Value is estimated due to presence of interference.
J: An estimated value
R: Spike sample recovery is not within control limits.
**: Samples analyzed at medium concentrations.
[]: Positive values less than the contract required detection limit.

TABLE 4
SUMMIT NATIONAL SITE
SEDIMENT SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	W.Pond	W.Pond	W.Pond	E.Pond	E.Pond	1st Impd	West	West	S.East	South	East	
Sample Number:	SD035001	SD035002	SD036001	SD037001	SD038001	SD039001	SD040001	SD040002	SD041001	SD042001	SD043001	SD097001
Sample Type:	Onsite	Onsite	Onsite	Onsite	Onsite	Downstream	Upstream	Upstream	Downstream	Downstream	Downstream	Blank
Date Sampled:	09/16/86	09/16/86	09/17/86	09/17/86	09/17/86	09/17/86	09/17/86	09/17/86	09/17/86	09/17/86	09/17/86	09/17/86
QTR Number:	EC358	EC359	EC360	EC361	EC362	EC363	EC364	EC365	EC366	EC367	EC368	EC369
ITR Number:	ME6808	ME6809	ME6810	ME6811	ME6812	ME6813	ME6814	ME6815	ME6816	ME6817	ME6818	ME6819
ORGANIC COMPOUNDS (units-ug/kg)												
VOLATILES												
CHLOROMETHANE												
VINYL CHLORIDE				102								
METHYLENE CHLORIDE	46 B	59 B	215 B	656 B	870 B	159 B	40	155 B	278 B	40 B	205 B	61 B
ACETONE	8 B	15 B	63 B	46 B	240 B	86	229				64 B	
CARBON DISULFIDE												
1,1-DICHLOROETHENE	16	13										
1,1-DICHLOROETHANE				1410	2261							
TRANS-1,2-DICHLOROETHENE												
CHLOROFORM												
1,2-DICHLOROETHANE	5 J	3 J	18	13115	16608				97			
2-BUTANONE												
1,1,1-TRICHLOROETHANE	738 J	633 J	411 J	787	777	27	863 J					
1,1,2,2-TETRACHLOROETHANE												
TRICHLOROETHENE			10	20								
DIBROMOCHLOROMETHANE												
1,1,2-TRICHLOROETHANE												
BENZENE				10 J	25							
2-HEXANONE					2792							
4-METHYL-2-PENTANONE												
TETRACHLOROETHENE												
TOLUENE				20	32		97	80				
CHLOROBENZENE			25	184	329							
ETHYLBENZENE			20		74							
STYRENE												
TOTAL XYLENES			4 J	43	67							
TOTAL VOLATILES	813	723	760	16393	24075	272	1229	235	375	40	269	61
TOTAL TENTATIVELY IDENTIFIED VOLATILES	20	0	84	2468	2680	9	0	220	36	0	0	0
BASE/NEUTRALS AND ACIDS												
N-NITROSODIMETHYLAMINE												
PHENOL								558 J				
ANILINE												
1,3-DICHLOROBENZENE												
1,4-DICHLOROBENZENE												
BENZYL ALCOHOL												
1,2-DICHLOROBENZENE												
2-METHYLPHENOL												
BIS(2-CHLOROISOPROPYL)ETHER												

TABLE 4
SUMMIT NATIONAL SITE
SEDIMENT SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	W.Pond	W.Pond	W.Pond	E.Pond	E.Pond	1st Impd	West	West	S.East	South	East	
Sample Number:	SD035001	SD035002	SD036001	SD037001	SD038001	SD039001	SD040001	SD040002	SD041001	SD042001	SD043001	SD097001
Sample Type:	Onsite	Onsite	Onsite	Onsite	Onsite	Downstream	Upstream	Upstream	Downstream	Downstream	Downstream	Blank
Date Sampled:	09/16/86	09/16/86	09/17/86	09/17/86	09/17/86	09/17/86	09/17/86	09/17/86	09/17/86	09/17/86	09/17/86	09/17/86
DTR Number:	EC358	EC359	EC360	EC361	EC362	EC363	EC364	EC365	EC366	EC367	EC368	EC369
ITR Number:	MEG808	MEG809	MEG810	MEG811	MEG812	MEG813	MEG814	MEG815	MEG816	MEG817	MEG818	MEG819
4-METHYLPHENOL							997 J	583 J				
HEXACHLOROETHANE												
ISOPHORONE												
2-NITROPHENOL												
2,4-DIMETHYLPHENOL												
BENZOIC ACID												
1,2,4-TRICHLOROBENZENE												
NAPHTHALENE						395 J				715 J		
4-CHLORO-3-METHYLPHENOL												
2-METHYLNAPHTHALENE						455 J		107 J		666 J	137 J	
HEXACHLOROCYCLOPENTADIENE												
DIMETHYL PHTHALATE												
ACENAPHTHYLENE												
ACENAPHTHENE												
4-NITROPHENOL												
DIBENZOFURAN										183 J		
DIETHYLPHTHALATE												
FLUORENE												
N-NITROSODIPHENYLAMINE(1)		8262 J	11546 J	22951 J	1095 J	1727 J	809 J					
HEXACHLOROBENZENE												
PENTACHLOROPHENOL												
PHENANTHRENE						682 J	377 J	267 J				
ANTHRACENE												
DI-N-BUTYLPHTHALATE					6714 B	8636 B	5121 J	4612	7336 B		2203 B	331 J,B
FLUORANTHENE						309 J	539 J	583 J				
PYRENE						359 J	485 J	510 J				
BUTYLBENZYLPHTHALATE												
BENZO(A)ANTHRACENE							270 J	243 J				
BIS(2-ETHYLHEXYL)PHTHALATE	16398 J	5128 J	12133 J	291808	8481	5909 J	701 J	704 J	1197 J	4825		
CHRYSENE								267 J				
DI-N-OCTYL PHTHALATE				55738 J	339 J	2045 J						
BENZO(B)FLUORANTHENE							243 J					
BENZO(K)FLUORANTHENE								413 J				
BENZO(A)PYRENE							197 J					
INDENO(1,2,3-CD)PYRENE												
DIBENZ(A,H)ANTHRACENE												
BENZO(G,H,I)PERYLENE												
TOTAL BASE/NEUTRALS AND ACIDS	16398	13390	23679	370497	16629	20517	9739	8847	8533	6389	2340	331
TOTAL TENTATIVELY IDENTIFIED BASE/NEUTRALS AND ACIDS	0	7000	0	25000	8400	9900	10600	2700	2900	6000	5400	2000

TABLE 4
SUMMIT NATIONAL SITE
SEDIMENT SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	W.Pond	W.Pond	W.Pond	E.Pond	E.Pond	Ist Impd	West	West	S.East	South	East	
Sample Number:	SD035001	SD035002	SD036001	SD037001	SD038001	SD039001	SD040001	SD040002	SD041001	SD042001	SD043001	SD097001
Sample Type:	Onsite	Onsite	Onsite	Onsite	Onsite	Downstream	Upstream	Upstream	Downstream	Downstream	Downstream	Blank
Date Sampled:	09/16/86	09/16/86	09/17/86	09/17/86	09/17/86	09/17/86	09/17/86	09/17/86	09/17/86	09/17/86	09/17/86	09/17/86
OTR Number:	EC358	EC359	EC360	EC361	EC362	EC363	EC364	EC365	EC366	EC367	EC368	EC369
ITR Number:	ME6808	ME6809	ME6810	ME6811	ME6812	ME6813	ME6814	ME6815	ME6816	ME6817	ME6818	ME6819
PESTICIDES and PCBs												
ALPHA-BHC												
BETA-BHC												
DELTA-BHC												
GAMMA-BHC (LINDANE)												
HEPTACHLOR												
ALDRIN												
HEPTACHLOR EPOXIDE						8.1						
ENDOSULFAN I												
DIELDRIN												
4,4-DDE												
ENDRIN												
4,4-DDT												
TOXAPHENE												
AROCHLOR-1232												
AROCHLOR-1242												
AROCHLOR-1248				21000	4063							
AROCHLOR-1254												
TOTAL PESTICIDES and PCBs				21000	40631	8.1						
PERCENT MOISTURE (VOLATILES)	26.8	28.9	48.9	69.5	71.7	78	62.9	58.8	74.1	39.9	54.6	0.2
PERCENT MOISTURE (BNA)	26.8	28.9	48.9	69.5	71.7	78	62.9	58.8	74.1	39.9	54.6	0.2

TABLE 4
SUMMIT NATIONAL SITE
SEDIMENT SOIL SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	W.Pond	W.Pond	W.Pond	E.Pond	E.Pond	1st Impd	West	West	S.East	South	East	
Sample Number:	SD035001	SD035002	SD036001	SD037001	SD038001	SD039001	SD040001	SD040002	SD041001	SD042001	SD043001	SD097001
Sample Type:	Onsite	Onsite	Onsite	Onsite	Onsite	Downstream	Upstream	Upstream	Downstream	Downstream	Downstream	Blank
Date Sampled:	09/16/86	09/16/86	09/17/86	09/17/86	09/17/86	09/17/86	09/17/86	09/17/86	09/17/86	09/17/86	09/17/86	09/17/86
QTR Number:	EC358	EC359	EC360	EC361	EC362	EC363	EC364	EC365	EC366	EC367	EC368	EC369
ITR Number:	ME6808	ME6809	ME6810	ME6811	ME6812	ME6813	ME6814	ME6815	ME6816	ME6817	ME6818	ME6819
INORGANIC COMPOUNDS (units) MG/KG DRY WEIGHT												
ALUMINUM	5490	7690	10900	11900	12000	13400	13800	13200	16700	17600	5930	209
ANTIMONY				[85] R					[143]		[52]	
ARSENIC	27	25	26		23		19	17	38	29	15	
BARIUM	[80]	[96]	[132]	[136]	[151]	[170]	[141]	[145]	[31]	[165]	[70]	[3.9]
BERYLLIUM												
CADMIUM												
CALCIUM	[6900]	[8650]	[14000]	[41700]	[49100]	84400	11200	11800	[105000]	14600	[20200]	[19700]
CHROMIUM	19	26	46	73	51	20	24	23	55	27	[10]	7.1
COBALT	[6.7]	[7.5]	[11]	[17]	[14]	[14]	[20]	[21]	[20]	[32]	[8.8]	
COPPER	34	43	57	65	56	[29]	46	48	74	42	32	[2.2]
IRON	36800	41100	47900	118000	118000	41600	49000	48100	48200	112000	166000	167
LEAD	36 S	55 S	56	59	85	23	121 S	131 S	29	71	29	
CYANIDE	2.1 R	25 R	7 R	74 R	3 R					2.4 R		
MAGNESIUM	[15900]	[20800]	[29400]	[32700]	[28200]	10500	[39800]	[38600]	[24900]	[50000]	[15900]	[301]
MANGANESE	112	132	166	621	598	1090	855	834	1500	2810	142	
MERCURY												
NICKEL	[15]	[19]	[26]	[38]	[29]	[40]	[29]	[36]	[49]	51	[15]	[4.5]
POTASSIUM	[1540]	[1910]	[2330]	[1680]	[1540]	[1630]	[1790]	[1950]	[2090]	[2450]	[1040]	[114]
SELENIUM												
SILVER												
SODIUM	[793]	[991]	[1240]	[1870]	[1960]	[3260]			[6720]	[1780]	[1520]	[935]
THALLIUM												
TIN												
VANADIUM	[14]	[17]	[21]	[18]	[17]	[19]	[24]	[23]		[22]	[13]	[16]
ZINC	82	102	162	1570	545	170	232	235	1070	355	134	[5.8]
PERCENT MOISTURE												
PERCENT SOLIDS	75	71	50	27	33	28	34	36	21	49	41	100

FOOTNOTES:

A: Detected below quantitation limit (Quantitation limit is 10 X DL)
B: Analyte has been found in the laboratory blank as well as the sample. Indicates possible/probable contamination.
C: Applies to pesticide parameters where the identification has been confirmed by GC/MS.
E: Value is estimated due to presence of interference.
J: An estimated value
R: Spike sample recovery is not within control limits.
**: Samples analyzed at medium concentrations.
[]: Positive values less than the contract required detection limit.

TABLE 5
SUMMIT NATIONAL SITE
GROUNDWATER SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10	MW-11	MW-12	MW-13	MW-13	MW-14	MW-15	MW-15
Sample Number:	GW002001	GW003001	GW004001	GW005001	GW006001	GW007001	GW008001	GW009001	GW010001	GW011001	GW012001	GW013001	GW013002	GW014001	GW015001	GW015002
Sample Type:	Onsite	Offsite	Offsite	Offsite	Offsite	Offsite	Offsite	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite	Offsite	Onsite	Onsite
Date Sampled:	12/07/84	12/06/84	12/05/84	12/05/84	12/06/84	12/06/84	12/06/84	12/05/84	12/05/84	12/05/84	12/05/84	12/07/84	12/07/84	12/06/84	12/05/84	12/05/84
DTR Number:	E9855	E9860	E9861	E9862	E9863	E9864	E9865	E9854	E9853	E9852	E9851	E9849	E9867	E9859	E9848	E9850
ITR Number:	ME4428	ME4433	ME4434	ME4435	ME4436	ME4437	ME4438	ME4427	ME4426	ME4425	ME4424	ME4422	ME4440	ME4432	ME4421	ME4423
ORGANIC COMPOUNDS (units-ppb)																
VOLATILES																
CHLOROMETHANE																
VINYL CHLORIDE																
METHYLENE CHLORIDE			1672	957				13160	5300							
ACETONE					9			109800	11700					638		
CARBON DISULFIDE																
1,1-DICHLOROETHENE																
1,1-DICHLOROETHANE		17								194						
TRANS-1,2-DICHLOROETHENE		25								51		46	35			
CHLOROFORM																
1,2-DICHLOROETHANE								31616	14800							
2-BUTANONE					30			152540						206		
1,1,1-TRICHLOROETHANE		22						3400	900	354						
1,1,2,2-TETRACHLOROETHANE																
TRICHLOROETHENE		2 J						2600		33		15	12			
1,1,2-TRICHLOROETHANE																
BENZENE	5 J,B	8 B	3 J,B	4 J,B	40 B	8 B	8 B	340 B	760 B	3 J,B	2 J,B	4 J,B	4 J,B	3 J,B	2 J,B	2 J,B
2-HEXANONE									3840							
4-METHYL-2-PENTANONE								8320								
TETRACHLOROETHENE								22320								
TOLUENE								1120								
CHLOROBENZENE																
ETHYLBENZENE																
STYRENE																
TOTAL XYLENES								196								
TOTAL VOLATILES	5	74	1675	961	79	8	8	345412	37300	635	2	65	51	847	2	2
TOTAL TENTATIVELY IDENTIFIED VOLATILES	200	200	200	200	265	206	200	45897	471130	220	202	200	200	230	230	225
BASE/NEUTRALS AND ACIDS																
N-NITROSODIMETHYLAMINE																
PHENOL									535							
ANILINE																
1,3-DICHLOROBENZENE																
1,4-DICHLOROBENZENE																
BENZYL ALCOHOL																
1,2-DICHLOROBENZENE																
2-METHYLPHENOL																
BIS(2-CHLOROISOPROPYL)ETHER																

TABLE 5
SUMMIT NATIONAL SITE
GROUNDWATER SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10	MW-11	MW-12	MW-13	MW-13	MW-14	MW-15	MW-15
Sample Number:	GW002001	GW003001	GW004001	GW005001	GW006001	GW007001	GW008001	GW009001	GW010001	GW011001	GW012001	GW013001	GW013002	GW014001	GW015001	GW015002
Sample Type:	Onsite	Offsite	Offsite	Offsite	Offsite	Offsite	Offsite	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite	Offsite	Onsite	Onsite
Date Sampled:	12/07/84	12/06/84	12/05/84	12/05/84	12/06/84	12/06/84	12/06/84	12/05/84	12/05/84	12/05/84	12/05/84	12/07/84	12/07/84	12/06/84	12/05/84	12/05/84
QTR Number:	E9855	E9860	E9861	E9862	E9863	E9864	E9865	E9854	E9853	E9852	E9851	E9849	E9867	E9859	E9848	E9850
ITR Number:	ME4428	ME4433	ME4434	ME4435	ME4436	ME4437	ME4438	ME4427	ME4426	ME4425	ME4424	ME4422	ME4440	ME4432	ME4421	ME4423
4-METHYLPHENOL																
HEXACHLOROETHANE																
ISOPHORONE		17						366	900	50		13	B J			
2-NITROPHENOL																
2,4-DIMETHYLPHENOL																
BENZOIC ACID									1425							
1,2,4-TRICHLOROBENZENE																
NAPHTHALENE					6 J											
4-CHLORO-3-METHYLPHENOL																
2-METHYLNAPHTHALENE					14											
HEXACHLOROCYCLOPENTADIENE																
DIMETHYL PHTHALATE																
ACENAPHTHYLENE																
ACENAPHTHENE																
4-NITROPHENOL																
DIBENZOFURAN																
DIETHYLPHTHALATE																
FLUORENE																
N-NITROSODIPHENYLAMINE(1)																
HEXACHLOROBENZENE																
PENTACHLOROPHENOL																
PHENANTHRENE																
ANTHRACENE																
DI-N-BUTYLPHTHALATE																
FLUORANTHENE																
PYRENE																
BUTYLBENZYLPHTHALATE																
BENZO(A)ANTHRACENE																
BIS(2-ETHYLHEXYL)PHTHALATE										13						
CHRYSENE																
DI-N-OCTYL PHTHALATE																
BENZO(B)FLUORANTHENE																
BENZO(K)FLUORANTHENE																
BENZO(A)PYRENE																
INDENO(1,2,3-CD)PYRENE																
DIBENZ(A,H)ANTHRACENE																
BENZO(G,H,I)PERYLENE																
TOTAL BASE/NEUTRALS AND ACIDS		17			20			366	2860	63		13	B			
TOTAL TENTATIVELY IDENTIFIED BASE/NEUTRALS AND ACIDS	0	0	0	0	10	0	0	38854	4405	0	4	29	20	0	7.5	6

TABLE 5
SUMMIT NATIONAL SITE
GROUNDWATER SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10	MW-11	MW-12	MW-13	MW-13	MW-14	MW-15	MW-15
Sample Number:	GW002001	GW003001	GW004001	GW005001	GW006001	GW007001	GW008001	GW009001	GW010001	GW011001	GW012001	GW013001	GW013002	GW014001	GW015001	GW015002
Sample Type:	Onsite	Offsite	Offsite	Offsite	Offsite	Offsite	Offsite	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite	Offsite	Onsite	Onsite
Date Sampled:	12/07/84	12/06/84	12/05/84	12/05/84	12/06/84	12/06/84	12/06/84	12/05/84	12/05/84	12/05/84	12/05/84	12/07/84	12/07/84	12/06/84	12/05/84	12/05/84
OTR Number:	E9855	E9860	E9861	E9862	E9863	E9864	E9865	E9854	E9853	E9852	E9851	E9849	E9867	E9859	E9848	E9850
ITR Number:	ME4428	ME4433	ME4434	ME4435	ME4436	ME4437	ME4438	ME4427	ME4426	ME4425	ME4424	ME4422	ME4440	ME4432	ME4421	ME4423
PESTICIDES and PCBs																
ALPHA-BHC									0.10	1.00			0.07			
BETA-BHC										0.30						
DELTA-BHC								17.4	2.10							
GAMMA-BHC (LINDANE)								2.2		0.20						0.25
HEPTACHLOR								6.50	0.60	0.40						
ALDRIN		0.05								0.60						
HEPTACHLOR EPOXIDE																
ENDOSULFAN I																
DIELDRIN																
4,4-DDE																
ENDRIN								0.20								
4,4-DDT					0.11							0.20	0.16	0.14		
TOXAPHENE							13.40									
AROCHLOR-1232																
AROCHLOR-1242																
AROCHLOR-1248																
AROCHLOR-1254																
TOTAL PESTICIDES and PCBs		0.05			0.11		13.4	26.3	2.8	2.5		0.2	0.23	0.14		0.25

TABLE 5
SUMMIT NATIONAL SITE
GROUNDWATER SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10	MW-11	MW-12	MW-13	MW-13	MW-14	MW-15	MW-15
Sample Number:	GW002001	GW003001	GW004001	GW005001	GW006001	GW007001	GW008001	GW009001	GW010001	GW011001	GW012001	GW013001	GW013002	GW014001	GW015001	GW015002
Sample Type:	Onsite	Offsite	Offsite	Offsite	Offsite	Offsite	Offsite	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite	Offsite	Onsite	Onsite
Date Sampled:	12/07/84	12/06/84	12/05/84	12/05/84	12/06/84	12/06/84	12/06/84	12/05/84	12/05/84	12/05/84	12/05/84	12/07/84	12/07/84	12/06/84	12/05/84	12/05/84
DTR Number:	E9855	E9860	E9861	E9862	E9863	E9864	E9865	E9854	E9853	E9852	E9851	E9849	E9867	E9859	E9848	E9850
ITR Number:	ME4428	ME4433	ME4434	ME4435	ME4436	ME4437	ME4438	ME4427	ME4426	ME4425	ME4424	ME4422	ME4440	ME4432	ME4421	ME4423
INORGANIC COMPOUNDS (units - ppb)																
ALUMINUM	[82]	[156]		572	1310	[129]	302	746			[153]	[51]	[76]	[161]	[103]	[58]
ANTIMONY																
ARSENIC					15		[6]	12	[9]		[5]		[8]	[9]	[5]	[6]
BARIUM				[52] R	[52] R		[50] R	[77] R								
BERYLLIUM																
CADMIUM	12	20						19	18							
CALCIUM	376300 R	473100 R	358100 R	[2180] R	[3604] R	393200 R	14080 R	858600 R	918000 R	469000 R	51590 R	111200 R	117100 R	5829 R	394900 R	357200 R
CHROMIUM		1079 E			33 E	10590 E		709 E	170 E			487 E			16 E	42 E
COBALT	[23] R					114 R		56 R	[38] R							
COPPER		28			[12]	162		27	[18]		[15]				[12]	
IRON	189100 R,E	244100 R,E	8731 R,E	454 R,E	1168 R,E	99410 R,E	2889 R,E	128800 R,E	97690 R,E	17300 R,E	[58] R,E	1746 R,E	176 R,E	198 R,E	14000 R,E	13480 R,E
LEAD		5 R							19 R							
CYANIDE						390		274	80	68			109		92	116
MAGNESIUM	168200 R,E	158900 R,E	197600 R,E	[635] R,E	[1279] R,E	122000 R,E	[4874] R,E	259300 R,E	245900 R,E	144200 R,E	20190 R,E	37450 R,E	40490 R,E	[4477] R,E	166600 R,E	151000 R,E
MANGANESE	8920	9635	734	16	35	6785	145	25540	20090	3581	293	898	878	[11]	9551	8489
MERCURY																
NICKEL	54 R	570 R			[22] R	5610 R		497 R	162 R	[21] R		254 R			46 R	133 R
POTASSIUM	8737	14686	15535	5720	5027	[2146]	15197	23350	38210	11421	19381	13504	14125	45580	12985	12165
SELENIUM					6											
SILVER											12 R					
SODIUM	37300 E	184700 E	45110 E	256400 E	284800 E	24480 E	341900 E	785500 E	715600 E	172300 E	460500 E	429700E	425600 E	415100 E	373100 E	341700 E
THALLIUM																
TIN																
VANADIUM	[41]	54				60		95	65	[26]	[26]	[23]	[20]		[37]	[33]
ZINC	118	45				130		50	74	32	[15]				24	
FIELD PARAMETERS																
pH (standard units)	6.6	6.2	8.5	8.1	10.4	6.4	9.3	5.5	6.3	6.5	8.9	8.2	8.1	9.4	6.5	6.4
SPECIFIC CONDUCTANCE (umhos/cm)	2700	3500	3000	1950	2500	2700	3000	7500	4000	1950	4250	4000	4200	2500	4500	4600
TEMPERATURE (degrees F)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

FOOTNOTES:

B: Analyte has been found in the laboratory blank as well as the sample. Indicates possible/probable contamination.
E: Value is estimated due to presence of interference.
J: An estimated value
R: Spike sample recovery is not within control limits.
[]: Positive values less than the contract required detection limit.
Note: All concentrations for metals are dissolved metals.
NA: Not Analyzed

TABLE 5
SUMMIT NATIONAL SITE
GROUNDWATER SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	MW-17	MW-17			MW-7	MW-4	MW-5	MW-5	MW-17	MW-8	MW-20	MW-18	MW-19	MW-2	2BB6	2BB7	2BB8	2BB5	2BB5
Sample Number:	GW017001	GW017002	GW098001	GW099001	GW018001	GW019001	GW020001	GW020002	GW021001	GW022001	GW023001	GW024001	GW025001	GW026001	GW027001	GW028001	GW029001	GW030001	GW030002
Sample Type:	Offsite	Offsite	Blank	Blank	Offsite	Offsite	Offsite	Offsite	Offsite	Offsite	Offsite	Offsite	Offsite	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite
Date Sampled:	12/06/84	12/06/84	12/07/84	12/06/84	09/9/86	09/9/86	09/9/86	09/9/86	09/9/86	09/9/86	09/10/86	09/10/86	09/10/86	09/10/86	09/11/86	09/11/86	09/11/86	09/11/86	09/11/86
DTR Number:	E9857	E9858	E9866	E9856	EB196	EB197	EB198	EB199	EB200	EC301	EC302	EC303	EC304	EC305	EC306	EC307	EC308	EC309	EC310
ITR Number:	ME4430	ME4431	ME4439	ME4429	MEB396	MEB397	MEB398	MEB399	MEB400	MEG743	MEG744	MEG745	MEG746	MEG747	MEG748	MEG749	MEG750	MEG751	MEG752
ORGANIC COMPOUNDS (units-ppb)																			
VOLATILES																			
CHLOROMETHANE																			
VINYL CHLORIDE																			
METHYLENE CHLORIDE					2 J	5	3 J	3 J	1 J	1 J	4 J	1 J	2 J	1 J	8100 J	6 J,B	2 J,B	5300 B	4900 J,B
ACETONE	245	150		2072	4 J,B	3 J,B	3 J,B	4 J,B	6 J,B	13 B,J	8 J,B	5 J,B	2 J,B	8 J,B	59000 B,J	79 B	17 B	85000 B	76000 B
CARBON DISULFIDE																			
1,1-DICHLOROETHENE															2600 J				
1,1-DICHLOROETHANE															12000 J	40	5	2400 J	2100 J
TRANS-1,2-DICHLOROETHENE															4600 J				
CHLOROFORM																			
1,2-DICHLOROETHANE	8											2 J				630	170	130000	100000
2-BUTANONE	124	72		711	14 B	16 B	15 B	16 B	15 B	13 B	21 B	14 B	14 B	20 B	290000 B,J	74 B	15 B	67000	56000 B
1,1,1-TRICHLOROETHANE															53000 J			9000	7100
1,1,2,2-TETRACHLOROETHANE																			
TRICHLOROETHENE															27000 J			1000 J	
1,1,2-TRICHLOROETHANE																			
BENZENE	2 J,B	2 J,B	4 J,B	2 J,B												38			
2-HEXANONE																			
4-METHYL-2-PENTANONE															62000 J			5300 J	4500 J
TETRACHLOROETHENE																			
TOLUENE					16		4 J	3 J		1 J	2 J		12	2 J	7100 J	10 J	3 J	20000	16000
CHLOROBENZENE																			
ETHYLBENZENE																36	1 J	11000	6100
STYRENE																			
TOTAL XYLENES																		52000	26000
TOTAL VOLATILES	379	224	4	2785	36	24	25	26	22	28	35	22	30	31	525400	913	213	388000	298700
TOTAL TENTATIVELY IDENTIFIED VOLATILES	262	232	200	1183	0	0	0	0	0	0	0	0	0	3.3	0	551	0	0	0
BASE/NEUTRALS AND ACIDS																			
N-NITROSODIMETHYLAMINE																			
PHENOL															7000				1100
ANILINE																			
1,3-DICHLOROBENZENE																			
1,4-DICHLOROBENZENE																			
BENZYL ALCOHOL																			
1,2-DICHLOROBENZENE																			
2-METHYLPHENOL																			210
BIS(2-CHLOROISOPROPYL)ETHER																			

TABLE 5
SUMMIT NATIONAL SITE
GROUNDWATER SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	MW-17	MW-17			MW-7	MW-4	MW-5	MW-5	MW-17	MW-8	MW-20	MW-18	MW-19	MW-2	2BB6	2BB7	2BB8	2BB5	2BB5
Sample Number:	GW017001	GW017002	GW098001	GW099001	GW018001	GW019001	GW020001	GW020002	GW021001	GW022001	GW023001	GW024001	GW025001	GW026001	GW027001	GW028001	GW029001	GW030001	GW030002
Sample Type:	Offsite	Offsite	Blank	Blank	Offsite	Offsite	Offsite	Offsite	Offsite	Offsite	Offsite	Offsite	Offsite	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite
Date Sampled:	12/06/84	12/06/84	12/07/84	12/06/84	09/9/86	09/9/86	09/9/86	09/9/86	09/9/86	09/9/86	09/10/86	09/10/86	09/10/86	09/10/86	09/11/86	09/11/86	09/11/86	09/11/86	09/11/86
DTR Number:	E9857	E9858	E9866	E9856	EB196	EB197	EB198	EB199	EB200	EC301	EC302	EC303	EC304	EC305	EC306	EC307	EC308	EC309	EC310
ITR Number:	ME4430	ME4431	ME4439	ME4429	MEB396	MEB397	MEB398	MEB399	MEB400	MEG743	MEG744	MEG745	MEG746	MEG747	MEG748	MEG749	MEG750	MEG751	MEG752
4-METHYLPHENOL																			510
HEXACHLOROETHANE																			
ISOPHORONE																3 J		920	1100
2-NITROPHENOL																			
2,4-DIMETHYLPHENOL																		120	140
BENZOIC ACID																		2700	2600
1,2,4-TRICHLOROBENZENE																			35 J
NAPHTHALENE															82			620	510
4-CHLORO-3-METHYLPHENOL																			130
2-METHYLNAPHTHALENE															60			370	350
HEXACHLOROCYCLOPENTADIENE																		2800	1100
DIMETHYL PHTHALATE															10				22 J
ACENAPHTHYLENE																			
ACENAPHTHENE																		110	78 J
4-NITROPHENOL																			
DIBENZOFURAN																		59 J	48 J
DIETHYLPHTHALATE																			53 J
FLUORENE																		75 J	57 J
N-NITROSODIPHENYLAMINE(1)																			
HEXACHLOROBENZENE																		630	430
PENTACHLOROPHENOL																			
PHENANTHRENE																		200	120
ANTHRACENE																		41 J	24 J
DI-N-BUTYLPHTHALATE						3 J,B	2 J,B	3 J,B		4 J,B	2 J	2 J	3 J		2 J,B			130 B	72 J,B
FLUORANTHENE																		77 J	41 J
PYRENE																		79 J	
BUTYLBENZYLPHTHALATE																		950	360
BENZO(A)ANTHRACENE																			
BIS(2-ETHYLHEXYL)PHTHALATE			12		5 J,B	8 J,B	6 J,B	5 J,B	3 J,B	6 J,B	12 B	3 J,B	3 J,B	8 J,B	10 B	8 J,B	8 J,B	8600 B	5900 B
CHRYSENE																			
DI-N-OCTYL PHTHALATE																		1600	860
BENZO(B)FLUORANTHENE																			
BENZO(K)FLUORANTHENE																			
BENZO(A)PYRENE																			
INDENO(1,2,3-CD)PYRENE																			
DIBENZ(A,H)ANTHRACENE																			
BENZO(G,H,I)PERYLENE																			
TOTAL BASE/NEUTRALS AND ACIDS			12		5	11	8	8	3	10	14	5	6	8	7164	11	8	20081	15850
TOTAL TENTATIVELY IDENTIFIED BASE/NEUTRALS AND ACIDS	0	0	0	0	40.1	35.4	103	72.2	62.5	81.5	182	45.7	75.7	0	1983	327	231	58775	40606

TABLE 5
SUMMIT NATIONAL SITE
GROUNDWATER SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	MW-17	MW-17			MW-7	MW-4	MW-5	MW-5	MW-17	MW-8	MW-20	MW-18	MW-19	MW-2	2BB6	2BB7	2BB8	2BB5	2BB5
Sample Number:	GW017001	GW017002	GW098001	GW099001	GW018001	GW019001	GW020001	GW020002	GW021001	GW022001	GW023001	GW024001	GW025001	GW026001	GW027001	GW028001	GW029001	GW030001	GW030002
Sample Type:	Offsite	Offsite	Blank	Blank	Offsite	Offsite	Offsite	Offsite	Offsite	Offsite	Offsite	Offsite	Offsite	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite
Date Sampled:	12/06/84	12/06/84	12/07/84	12/06/84	09/9/86	09/9/86	09/9/86	09/9/86	09/9/86	09/9/86	09/10/86	09/10/86	09/10/86	09/10/86	09/11/86	09/11/86	09/11/86	09/11/86	09/11/86
DTR Number:	E9857	E9858	E9866	E9856	EB196	EB197	EB198	EB199	EB200	EC301	EC302	EC303	EC304	EC305	EC306	EC307	EC308	EC309	EC310
ITR Number:	ME4430	ME4431	ME4439	ME4429	MEB396	MEB397	MEB398	MEB399	MEB400	MEG743	MEG744	MEG745	MEG746	MEG747	MEG748	MEG749	MEG750	MEG751	MEG752
PESTICIDES and PCBs																			
ALPHA-BHC																			
BETA-BHC																			
DELTA-BHC																			
GAMMA-BHC (LINDANE)																			
HEPTACHLOR																			
ALDRIN																			
HEPTACHLOR EPOXIDE																			
ENDOSULFAN I																			
DIELDRIN																			
4,4-DDE																			
ENDRIN																			
4,4-DDT																			
TOXAPHENE																			
AROCHLOR-1232																			
AROCHLOR-1242																			
AROCHLOR-1248																			
AROCHLOR-1254																			
TOTAL PESTICIDES and PCBs																			

TABLE 5
SUMMIT NATIONAL SITE
GROUNDWATER SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	MW-17	MW-17			MW-7	MW-4	MW-5	MW-5	MW-17	MW-8	MW-20	MW-18	MW-19	MW-2	2BB6	2BB7	2BB8	2BB5	2BB5
Sample Number:	GW017001	GW017002	GW098001	GW099001	GW018001	GW019001	GW020001	GW020002	GW021001	GW022001	GW023001	GW024001	GW025001	GW026001	GW027001	GW028001	GW029001	GW030001	GW030002
Sample Type:	Offsite	Offsite	Blank	Blank	Offsite	Offsite	Offsite	Offsite	Offsite	Offsite	Offsite	Offsite	Offsite	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite
Date Sampled:	12/06/84	12/06/84	12/07/84	12/06/84	09/9/86	09/9/86	09/9/86	09/9/86	09/9/86	09/9/86	09/10/86	09/10/86	09/10/86	09/10/86	09/11/86	09/11/86	09/11/86	09/11/86	09/11/86
DTR Number:	E9857	E9858	E9866	E9856	EB196	EB197	EB198	EB199	EB200	EC301	EC302	EC303	EC304	EC305	EC306	EC307	EC308	EC309	EC310
ITR Number:	ME4430	ME4431	ME4439	ME4429	MEB396	MEB397	MEB398	MEB399	MEB400	ME6743	ME6744	ME6745	ME6746	ME6747	ME6748	ME6749	ME6750	ME6751	ME6752
INORGANIC COMPOUNDS (units - ppb)																			
ALUMINUM	[105]	[100]		[68]	801	[47]		[170]	304	200	[130]	[129]	725	419	4840			1630	1620
ANTIMONY																		149	134
ARSENIC															16 S			12	18 S
BARIUM	[62] R	[60] R					[59]	[64]	[17]	[30]	[14]					[17]	[12]		
BERYLLIUM																			
CADMIUM	5.3	7.2													58				
CALCIUM	296200 R	310200 R	[734] R	[942] R	430000	505000	[1560]	[1780]	373000	[3080]	[1860]	432000	653000	384000	648000	194000	139000	607000	616000
CHROMIUM			36 E						[8.2]					[5]				[19]	[11]
COBALT	87 R	92 R			[24]				325				[36]	[36]	896			120	116
COPPER				[13]						[3.3]	[20]								
IRON	32970 R,E	34800 R,E	129 R,E		77900	19800	[97]	[86]	80600	[90]	650	4990	222000	183000	982000	2960	2480	539000	614000
LEAD																			
CYANIDE																			
MAGNESIUM	210000 R,E	213900 R,E			117000	228000	[504]	[604]	295000	[1050]	[245]	161000	298000	173000	309000	45000	35400	184000	189000
MANGANESE	26100	27420			5290	1530		[7.8]	40100	27		4280	14100	10600	72200	2340	1350	25600	26100
MERCURY																			
NICKEL	61 R	62 R			[31]				169				58	67	1120			198	182
POTASSIUM	8665	9039			[4840]	18300	[3680]	[3740]	8750	19200	[3560]	9040	18200	12300	[20100]	7140	7720	19200	20500
SELENIUM																			
SILVER				[8.7] R			10												
SODIUM	37060 E	28980 E	[1701] E	[1450] E	21700	94800	434000	435000	43000	570000	465000	96400	409000	50600	350000	384000	950000	272000	289000
THALLIUM																			
TIN											3120								
VANADIUM	[23]	[25]									[7.1]								
ZINC	119	129			133	34	[3.8]	[6.4]	248	[8.6]	76	88	350	292	3750	[17]	[17]	295	324
FIELD PARAMETERS																			
pH (standard units)	6.6	6.5	NA	NA	NA	6.9	7.2	7.2	NA	6.0	NA	6.9	6.2	5.1	5.1	6.2	7.0	6.0	6.0
SPECIFIC CONDUCTANCE (umhos/cm)	2500	2500	NA	NA	1150	3000	1500	1500	3100	2000	2500	1500	2200	1700	850	300	500	250	250
TEMPERATURE (degrees F)	NA	NA	NA	NA	57	58	58	52	68	64	59	55	58	56	68	64	68	64	64

FOOTNOTES:

B: Analyte has been found in the laboratory blank as well as the sample. Indicates possible/probable contamination.
E: Value is estimated due to presence of interference.
J: An estimated value
R: Spike sample recovery is not within control limits.
[]: Positive values less than the contract required detection limit.
Note: All concentrations for metals are dissolved metals.
NA: Not Analyzed

TABLE 5
SUMMIT NATIONAL SITE
GROUNDWATER SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	MW-15	Tipple	MW-24	MW-11	MW-22	MW-9	MW-10	MW-26	MW-25	MW-14	MW-14	MW-23	MW-3	MW-6	MW-13	MW-12	MW-16	MW-21	
Sample Number:	GW031001	GW032001	GW033001	GW034001	GW035001	GW036001	GW037001	GW038001	GW039001	GW040001	GW040002	GW041001	GW042001	GW043001	GW044001	GW045001	GW046001	GW047001	GW097001
Sample Type:	Onsite	Onsite	Onsite	Onsite	Offsite	Onsite	Onsite	Onsite	Onsite	Offsite	Offsite	Offsite	Offsite	Offsite	Onsite	Onsite	Onsite	Offsite	Blank
Date Sampled:	09/11/86	09/11/86	09/12/86	09/11/86	09/10/86	09/12/86	09/12/86	09/12/86	09/12/86	09/12/86	09/12/86	09/12/86	09/11/86	09/12/86	09/12/86	09/12/86	09/16/86	09/17/86	09/10/86
DTR Number:	EC311	EC312	EC313	EC314	EC315	EC316	EC317	EC318	EC319	EC320	EC321	EC322	EC323	EC324	EC325	EC326	EC327	EC328	EC330
ITR Number:	MEG753	MEG754	MEG755	MEG756	MEG757	MEG758	MEG759	MEG760	MEG761	MEG762	MEG763	MEG764	MEG765	MEG766	MEG767	MEG768	MEG769	MEG770	MEG772
ORGANIC COMPOUNDS (units-ppb)																			
VOLATILES																			
CHLOROMETHANE																			
VINYL CHLORIDE																			
METHYLENE CHLORIDE	1 J,B	2 J,B	180 J,B	6 J,B	1 J	10000 J,B	24000 J,B	1 J,B	3 J	5 B,J	2 J,B	2 J	2 J,B	2 J,B	1 J	1 J	2 J,B	5	2 J
ACETONE	16 B	5 J,B	2700 B,J	51 B	9 J,B	890000 B,J	1300000 B,J	18 B,J	13 B	14 B,J	19 B,J	11 B	7 J,B	7 J,B	11 B	15 B	9 J,B	8 J,B	6 J,B
CARBON DISULFIDE																			
1,1-DICHLOROETHENE				16 J									1 J		7				
1,1-DICHLOROETHANE	3 J		820 J	140					5				14				2 J		
TRANS-1,2-DICHLOROETHENE				12 J									32		32				
CHLOROFORM																			
1,2-DICHLOROETHANE	4 J		5800 J			110000 J			100				13				5		
2-BUTANONE	16 B	14 B	1800 B,J	100 B	15 B	430000 B,J	650000 B,J	15 B,J	15 B	19 B,J	19 B,J	11 B	15 B	16 B,J	13 B	14 B	12 B	17 B	13 B
1,1,1-TRICHLOROETHANE	19		360 J	650					3 J				23		3 J				
1,1,2,2-TETRACHLOROETHANE																			
TRICHLOROETHENE			55 J			6200 J							4 J		46				
1,1,2-TRICHLOROETHANE																			
BENZENE															1 J				
2-HEXANONE			96 J							6 J,B									
4-METHYL-2-PENTANONE			250 J							2 J,B				2 J,B					
TETRACHLOROETHENE						20000 J													
TOLUENE	1 J	7	3200 J					1 J	9	5 J	4 J		3 J	5 J					7
CHLOROBENZENE																			
ETHYLBENZENE			590 J																
STYRENE																			
TOTAL XYLENES			2100 J							1 J									
TOTAL VOLATILES	60	28	17951	975	25	1466200	1974000	35	148	52	44	24	114	32	114	30	30	30	28
TOTAL TENTATIVELY IDENTIFIED VOLATILES	23.4	0	221	53.7	0	166	0	0	0	207	0	0	12.3	54	0	0	0	0	0
BASE/NEUTRALS AND ACIDS																			
N-NITROSODIMETHYLAMINE																			
PHENOL			260			1800 J	910	6 J		3 J	3 J			3 J					
ANILINE																			
1,3-DICHLOROBENZENE																			
1,4-DICHLOROBENZENE																			
BENZYL ALCOHOL			90																
1,2-DICHLOROBENZENE																			
2-METHYLPHENOL			16																
BIS(2-CHLOROISOPROPYL)ETHER																			

TABLE 5
SUMMIT NATIONAL SITE
GROUNDWATER SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	MW-15	Tipple	MW-24	MW-11	MW-22	MW-9	MW-10	MW-26	MW-25	MW-14	MW-14	MW-23	MW-3	MW-6	MW-13	MW-12	MW-16	MW-21	
Sample Number:	GW031001	GW032001	GW033001	GW034001	GW035001	GW036001	GW037001	GW038001	GW039001	GW040001	GW040002	GW041001	GW042001	GW043001	GW044001	GW045001	GW046001	GW047001	GW097001
Sample Type:	Onsite	Onsite	Onsite	Onsite	Offsite	Onsite	Onsite	Onsite	Onsite	Offsite	Offsite	Offsite	Offsite	Offsite	Onsite	Onsite	Onsite	Offsite	Blank
Date Sampled:	09/11/86	09/11/86	09/12/86	09/11/86	09/10/86	09/12/86	09/12/86	09/12/86	09/12/86	09/12/86	09/12/86	09/12/86	09/11/86	09/12/86	09/12/86	09/12/86	09/16/86	09/17/86	09/10/86
QTR Number:	EC311	EC312	EC313	EC314	EC315	EC316	EC317	EC318	EC319	EC320	EC321	EC322	EC323	EC324	EC325	EC326	EC327	EC328	EC330
ITR Number:	ME6753	ME6754	ME6755	ME6756	ME6757	ME6758	ME6759	ME6760	ME6761	ME6762	ME6763	ME6764	ME6765	ME6766	ME6767	ME6768	ME6769	ME6770	ME6772
4-METHYLPHENOL			140			310 J	12 J												
HEXACHLOROETHANE																			
ISOPHORONE			41	18 J		2600 J	1600						4 J						
2-NITROPHENOL							140												
2,4-DIMETHYLPHENOL			16				32 J												
BENZOIC ACID	4 J		110																
1,2,4-TRICHLOROBENZENE																			
NAPHTHALENE			11		3 J														
4-CHLORO-3-METHYLPHENOL			14																
2-METHYLNAPHTHALENE			5 J		3 J														
HEXACHLOROCYCLOPENTADIENE																			
DIMETHYL PHTHALATE																			
ACENAPHTHYLENE																			
ACENAPHTHENE																			
4-NITROPHENOL																			
DIBENZOFURAN																			
DIETHYLPHTHALATE																			
FLUORENE																			
N-NITROSODIPHENYLAMINE(1)																			
HEXACHLOROBENZENE																			
PENTACHLOROPHENOL	7 J												6 J						
PHENANTHRENE																			
ANTHRACENE																			
DI-N-BUTYLPHTHALATE	2 J,B				3 J								2 J,B						3 J
FLUORANTHENE																			
PYRENE																			
BUTYLBENZYLPHTHALATE																			
BENZO(A)ANTHRACENE																			
BIS(2-ETHYLHEXYL)PHTHALATE	16 B,J	4 J,B	4 B,J	3 J	6 J,B	170 B,J	28 B,J	4 J	2 B,J			4 J	4 J,B						5 J,B
CHRYSENE																			
DI-N-OCTYL PHTHALATE																			
BENZO(B)FLUORANTHENE																			
BENZO(K)FLUORANTHENE																			
BENZO(A)PYRENE																			
INDENO(1,2,3-CD)PYRENE																			
DIBENZ(A,H)ANTHRACENE																			
BENZO(G,H,I)PERYLENE																			
TOTAL BASE/NEUTRALS AND ACIDS	29	4	707	21	15	4880	2722	10	2	3	3	4	16	3	0	0	0	0	8
TOTAL TENTATIVELY IDENTIFIED BASE/NEUTRALS AND ACIDS	230	69	1469	147	70.7	12559	5400	7.7	5.4	18.8	0	0	22.9	0	36.9	0	2060	0	49.9

TABLE 5
SUMMIT NATIONAL SITE
GROUNDWATER SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	MW-15	Tipple	MW-24	MW-11	MW-22	MW-9	MW-10	MW-26	MW-25	MW-14	MW-14	MW-23	MW-3	MW-6	MW-13	MW-12	MW-16	MW-21	
Sample Number:	GW031001	GW032001	GW033001	GW034001	GW035001	GW036001	GW037001	GW03B001	GW039001	GW040001	GW040002	GW041001	GW042001	GW043001	GW044001	GW045001	GW046001	GW047001	GW097001
Sample Type:	Onsite	Onsite	Onsite	Onsite	Offsite	Onsite	Onsite	Onsite	Onsite	Offsite	Offsite	Offsite	Offsite	Offsite	Onsite	Onsite	Onsite	Offsite	Blank
Date Sampled:	09/11/86	09/11/86	09/12/86	09/11/86	09/10/86	09/12/86	09/12/86	09/12/86	09/12/86	09/12/86	09/12/86	09/12/86	09/11/86	09/12/86	09/12/86	09/12/86	09/16/86	09/17/86	09/10/86
OTR Number:	EC311	EC312	EC313	EC314	EC315	EC316	EC317	EC318	EC319	EC320	EC321	EC322	EC323	EC324	EC325	EC326	EC327	EC328	EC330
ITR Number:	ME6753	ME6754	ME6755	ME6756	ME6757	ME6758	ME6759	ME6760	ME6761	ME6762	ME6763	ME6764	ME6765	ME6766	ME6767	ME6768	ME6769	ME6770	ME6772
PESTICIDES and PCBs																			
ALPHA-BHC																			
BETA-BHC																			
DELTA-BHC																			
GAMMA-BHC (LINDANE)																			
HEPTACHLOR																			
ALDRIN																			
HEPTACHLOR EPOXIDE																			
ENDOSULFAN I																			
DIELDRIN																			
4,4-DDE																			
ENDRIN																			
4,4-DDT																			
TOXAPHENE																			
AROCHLOR-1232																			
AROCHLOR-1242																			
AROCHLOR-1248																			
AROCHLOR-1254																			
TOTAL PESTICIDES and PCBs																			

TABLE 5
SUMMIT NATIONAL SITE
GROUNDWATER SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	MW-15	Tipple	MW-24	MW-11	MW-22	MW-9	MW-10	MW-26	MW-25	MW-14	MW-14	MW-23	MW-3	MW-6	MW-13	MW-12	MW-16	MW-21	
Sample Number:	GW031001	GW032001	GW033001	GW034001	GW035001	GW036001	GW037001	GW038001	GW039001	GW040001	GW040002	GW041001	GW042001	GW043001	GW044001	GW045001	GW046001	GW047001	GW097001
Sample Type:	Onsite	Onsite	Onsite	Onsite	Offsite	Onsite	Onsite	Onsite	Onsite	Offsite	Offsite	Offsite	Offsite	Offsite	Onsite	Onsite	Onsite	Offsite	Blank
Date Sampled:	09/11/86	09/11/86	09/12/86	09/11/86	09/10/86	09/12/86	09/12/86	09/12/86	09/12/86	09/12/86	09/12/86	09/12/86	09/11/86	09/12/86	09/12/86	09/12/86	09/16/86	09/17/86	09/10/86
DTR Number:	EC311	EC312	EC313	EC314	EC315	EC316	EC317	EC318	EC319	EC320	EC321	EC322	EC323	EC324	EC325	EC326	EC327	EC328	EC330
ITR Number:	ME6753	ME6754	ME6755	ME6756	ME6757	ME6758	ME6759	ME6760	ME6761	ME6762	ME6763	ME6764	ME6765	ME6766	ME6767	ME6768	ME6769	ME6770	ME6772
INORGANIC COMPOUNDS (units - ppb)																			
ALUMINUM		627		[83]	[46]	1100		2580		1410	257	[37]	785	816		[57]			[35]
ANTIMONY		[43]											67						
ARSENIC						19 S	14												
BARIUM			[48]		[27]	[284]	1550	[4.8]	[22]	[84]	[80]	[27]		[22]	[24]	[36]	[6.8]		[3.7]
BERYLLIUM																			
CADMIUM																			
CALCIUM	493000	461000	23400	627000	40300	775000	782000	[845]	46500	[3850]	[3310]	14000	551000	[2060]	268000	12000	54500		[337]
CHROMIUM		11		[4.2]		55	20						[6.8]						
COBALT	[7.5]	[33]				[40]	[26]						[11]						
COPPER		[6.7]				[6.1]													
IRON	13100	273000	[62]	38300	[42]	68800	806	[48]		371	[72]	[24]	296000	130	402	159			
LEAD																			
CYANIDE																			
MAGNESIUM	176000	181000	[408]	216000	11200	282000	254000	[102]	22300	[1810]	[1620]	5180	176000	[255]	127000	[4510]	19300		[52]
MANGANESE	10100	8030		2710	90	14200	15700		78	50	39	[14]	11200		3690	157	124		
MERCURY																			
NICKEL	[12]	[27]	[12]	[11]		161	120						[14]						
POTASSIUM	9630	8420	158000	10800	12400	18800	37600	5870	11200	10400	10200	6410	11500	5470	15600	9010	11800		
SELENIUM																			
SILVER																			
SODIUM	514000	52500	483000	295000	551000	1560000	1210000	462000	701000	609000	615000	640000	242000	355000	369000	690000	534000		[1680]
THALLIUM																			
TIN						122	113										[28]		
VANADIUM						[47]	[16]	[13]											
ZINC	[17]	1670	[7.6]	30	[6.3]	41	[6.3]	[13]	[7]	40	21	[5.5]	142	[11]	[6.1]	[9.9]	[19]		[5.6]
FIELD PARAMETERS																			
pH (standard units)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPECIFIC CONDUCTANCE (umhos/cm)	3500	2600	3800	4000	3250	11000	8000	4600	4600	2500	2500	3250	4000	1625	4300	4100	1500	1625	NA
TEMPERATURE (degrees F)	62	60	60	64	66	64	60	60	59	58	58	64	60	58	58	60	55	56	NA

FOOTNOTES:

B: Analyte has been found in the laboratory blank as well as the sample. Indicates possible/probable contamination.
E: Value is estimated due to presence of interference.
J: An estimated value
N: Spike sample recovery is not within control limits.
[]: Positive values less than the contract required detection limit.
Note: All concentrations for metals are dissolved metals.
NA: Not Analyzed

TABLE 5
SUMMIT NATIONAL SITE
GROUNDWATER SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	---
Sample Number:	GW096001
Sample Type:	Blank
Date Sampled:	09/9/86
QTR Number:	EC331
ITR Number:	ME6773

****
ORGANIC COMPOUNDS (units-ppb)
****

VOLATILES	
CHLOROMETHANE	
VINYL CHLORIDE	
METHYLENE CHLORIDE	2 J
ACETONE	11 B
CARBON DISULFIDE	
1,1-DICHLOROETHENE	
1,1-DICHLOROETHANE	
TRANS-1,2-DICHLOROETHENE	
CHLOROFORM	
1,2-DICHLOROETHANE	
2-BUTANONE	13 B
1,1,1-TRICHLOROETHANE	
1,1,2,2-TETRACHLOROETHANE	
TRICHLOROETHENE	
1,1,2-TRICHLOROETHANE	
BENZENE	
2-HEXANONE	
4-METHYL-2-PENTANONE	
TETRACHLOROETHENE	
TOLUENE	1 J
CHLOROBENZENE	
ETHYLBENZENE	
STYRENE	
TOTAL XYLENES	
TOTAL VOLATILES	27
TOTAL TENTATIVELY IDENTIFIED VOLATILES	0

BASE/NEUTRALS AND ACIDS	
N-NITROSODIMETHYLAMINE	
PHENOL	3 J
ANILINE	
1,3-DICHLOROBENZENE	
1,4-DICHLOROBENZENE	
BENZYL ALCOHOL	
1,2-DICHLOROBENZENE	
2-METHYLPHENOL	
BIS(2-CHLOROISOPROPYL)ETHER	

TABLE 5
SUMMIT NATIONAL SITE
GROUNDWATER SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:

Sample Number: GW096001
Sample Type: Blank
Date Sampled: 09/9/86
DTR Number: EC331
ITR Number: ME6773

****

4-METHYLPHENOL
HEXACHLOROETHANE
ISOPHORONE
2-NITROPHENOL
2,4-DIMETHYLPHENOL
BENZOIC ACID
1,2,4-TRICHLOROBENZENE
NAPHTHALENE
4-CHLORO-3-METHYLPHENOL
2-METHYLNAPHTHALENE
HEXACHLOROCYCLOPENTADIENE
DIMETHYL PHTHALATE
ACENAPHTHYLENE
ACENAPHTHENE
4-NITROPHENOL
DIBENZOFURAN
DIETHYLPHTHALATE
FLUORENE
N-NITROSODIPHENYLAMINE(1)
HEXACHLOROBENZENE
PENTACHLOROPHENOL
PHENANTHRENE
ANTHRACENE
DI-N-BUTYLPHTHALATE
FLUORANTHENE
PYRENE
BUTYLBENZYLPHTHALATE
BENZO(A)ANTHRACENE
BIS(2-ETHYLHEXYL)PHTHALATE
CHRYSENE
DI-N-OCTYL PHTHALATE
BENZO(B)FLUORANTHENE
BENZO(K)FLUORANTHENE
BENZO(A)PYRENE
INDENO(1,2,3-CD)PYRENE
DIBENZ(A,H)ANTHRACENE
BENZO(G,H,I)PERYLENE

==========

TOTAL BASE/NEUTRALS AND ACIDS	3
TOTAL TENTATIVELY IDENTIFIED BASE/NEUTRALS AND ACIDS	11.2

==========

TABLE 5
SUMMIT NATIONAL SITE
GROUNDWATER SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	---
Sample Number:	GW096001
Sample Type:	Blank
Date Sampled:	09/9/86
OTR Number:	EC331
ITR Number:	ME6773

****

PESTICIDES and PCBs	
ALPHA-BHC	
BETA-BHC	
DELTA-BHC	
GAMMA-BHC (LINDANE)	
HEPTACHLOR	
ALDRIN	
HEPTACHLOR EPOXIDE	
ENDOSULFAN I	
DIELDRIN	
4,4-DDE	
ENDRIN	
4,4-DDT	
TOXAPHENE	
AROCHLOR-1232	
AROCHLOR-1242	
AROCHLOR-1248	
AROCHLOR-1254	
TOTAL PESTICIDES and PCBs	

TABLE 5
SUMMIT NATIONAL SITE
GROUNDWATER SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	---
Sample Number:	GW096001
Sample Type:	Blank
Date Sampled:	09/9/86
DTR Number:	EC331
ITR Number:	ME6773

INORGANIC COMPOUNDS (units - ppb)	
ALUMINUM	[97]
ANTIMONY	
ARSENIC	
BARIUM	[5.9]
BERYLLIUM	
CADMIUM	
CALCIUM	[1510]
CHROMIUM	
COBALT	
COPPER	
IRON	[90]
LEAD	
CYANIDE	
MAGNESIUM	[115]
MANGANESE	[6.2]
MERCURY	
NICKEL	
POTASSIUM	
SELENIUM	
SILVER	
SODIUM	[2700]
THALLIUM	
TIN	
VANADIUM	
ZINC	[2.4]

FIELD PARAMETERS	
pH (standard units)	NA
SPECIFIC CONDUCTANCE (umhos/cm)	NA
TEMPERATURE (degrees F)	NA

FOOTNOTES:

B: Analyte has been found in the laboratory blank as well as the sample. Indicates possible/probable contamination.
E: Value is estimated due to presence of interference.
J: An estimated value
R: Spike sample recovery is not within control limits.
[]: Positive values less than the contract required detection limit.
Note: All concentrations for metals are dissolved metals.
NA: Not Analyzed

TABLE 5
SUMMIT NATIONAL SITE
GROUNDWATER SAMPLE RESULTS (Total Metals)
REMEDIAL INVESTIGATION REPORT

Sample Location:	MW-7	MW-4	MW-5	MW-5	MW-17	MW-8	MW-20	MW-18	MW-19	MW-2	2BB6	2BB7	2BB8	2BB5	2BB5	MW-15	Tipple	MW-24	MW-11	MW-22
Sample Number:	GW018001	GW019001	GW020001	GW020002	GW021001	GW022001	GW023001	GW024001	GW025001	GW026001	GW027001	GW028001	GW029001	GW030001	GW030002	GW031001	GW032001	GW033001	GW034001	GW035001
Sample Type:	Offsite	Offsite	Offsite	Offsite	Offsite	Offsite	Offsite	Offsite	Offsite	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite	Offsite
Date Sampled:	09/9/86	09/9/86	09/9/86	09/9/86	09/9/86	09/9/86	09/10/86	09/10/86	09/10/86	09/10/86	09/11/86	09/11/86	09/11/86	09/11/86	09/11/86	09/11/86	09/11/86	09/12/86	09/11/86	09/10/86
OTR Number:	EB196	EB197	EB198	EB199	EB200	EC301	EC302	EC303	EC304	EC305	EC306	EC307	EC308	EC309	EC310	EC311	EC312	EC313	EC314	EC315
ITR Number:	MEB396	MEB397	MEB398	MEB399	MEB400	MEG743	MEG744	MEG745	MEG746	MEG747	MEG748	MEG749	MEG750	MEG751	MEG752	MEG753	MEG754	MEG755	MEG756	MEG757
INORGANIC COMPOUNDS (units - ppb, except where noted otherwise)																				
ALUMINUM	4850	994	3350	3920	19400	736	3110	25300	38800	12300	29000	10100	12600	14200	12200	221	853	255	[126]	11000
ANTIMONY									64	69	240			110	121		[50]			
ARSENIC					13			18 S	30 S		62 S,+	72 S		30 S	28 S					
BARIUM	[14]	[154]	[137]	[149]	[180]	[45]	[118]	[146]	[139]	[80]	186]	[65]	[80]	[28]	[23]			209		242
BERYLLIUM					[2.9]			[3.4]	[4.3]		[6.8]			[3.2]	[2.5]		[2.1]			
CADMIUM		5.4								7.5	175			5.1	8.7				5.1	
CALCIUM	407000	448000	11200	11800	312000	5610	50400	455000	62300	365000	540000	193000	141000	515000	554000	442000	437000	31100	570000	49400
CHROMIUM	[5.3]	[6.3]	[6.1]	[5.6]	38		[4.9]	42	58	25	32	13	21	44	45	[6.4]	11			16
COBALT	[27]				356			[45]	74	66	938	[16]	[18]	119	127		[34]			[15]
COPPER	[12]	[12]	[20]	[23]	40	[16]	[23]	63	89	40	[43]	28	33	[22]	[22]	[16]	47	[23]	[11]	37
IRON	80400	25900	5660	5750	148000	1180	3320	88300	288000	280000	1020000	36200	48700	534000	555000	31500	276000	497	37100	26200
LEAD													15 S,R							21 S,R
CYANIDE														16	18	26				
MAGNESIUM	109000	203000	[1580]	[1590]	270000	[1230]	[1510]	171000	296000	169000	267000	44700	40800	165000	177000	158000	171000	[646]	202000	15100
MANGANESE	5030	1380	101	104	37300	63	125	6490	14100	11000	69500	2760	1870	22800	24100	9080	7910	21	2520	616
MERCURY					0.9	0.3	0.5	0.7	0.5	0.3		0.3	0.3							
NICKEL	[37]	[7.5]	[8.3]		255		[8.8]	87	149	137	1210	[33]	43	216	224	[15]	[32]	[12]	[24]	[35]
POTASSIUM	[4790] E	16500 E	[3700] E	[4030] E	10200 E	17700 E	[4850] E	13300 E	22200 E	14500 E	23600 E	8060 E	8800 E	18700 E	19200 E	8630	7780	144000	9940 E	13300 E
SELENIUM																				
SILVER																				
SODIUM	20100	81600	353000	376000	38900	513000	428000	95100	380000	41900	344000	383000	902000	240000	256000	472000	49900	446000	273000	539000
THALLIUM																				
TIN	[27]					[29]													[36]	
VANADIUM	[4]	[5.4]	[9.2]	[7.3]	[38]		[15]	[48]	54	[18]		[20]	[25]	[7.3]					[5.2]	[22]
ZINC	139	46	32	33	609	37	33	228	586	631	4360	121	128	703	615	63	1590	43	34	142
Total Alkalinity, as CaCO3 (mg/l)	143	245	842	830	100	1080	938	316	174	4.0	NR	677	947	248	271	778	157	231	713	380
Ammonia, as N (mg/l)	0.7	2.8	0.8	0.85	0.50	1.2	1.1	1.0	3.8	3.6	2.5	48	45	22	24	27	1.3	5.0	3.0	1.5
Nitrate/Nitrite, as N (mg/l)											0.11			0.14	0.15					
Chloride (mg/l)	15	109	12	13	39	42	107	95	1420	31	925	121	140	350	64	189	60	48	311	17
Suspended Solids (mg/l)	139	119	126	87	28400	47	201	10800	3640	1310	4240	4710	2400	6080	10900	85	162	30	49	932
Dissolved Solids (mg/l)	2400	3060	938	926	3150	1350	1100	2620	6080	3210	8420	1960	3320	5500	5660	3920	3270	1840	3900	1840
Sulfate (mg/l)	1500	1650	8.8	10	1920	1020	34	1380	2230	1870	3320	730	1240	2370	2400	2040	1950	800	1530	670
Acidity (mg/l)	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	2330	NR	NR	NR	NR	NR	NR	NR	NR	NR
FIELD PARAMETERS																				
pH (standard units)	NA	6.9	7.2	7.2	NA	6.0	NA	6.9	6.2	5.1	5.1	6.2	7.0	6.0	6.0	NA	NA	NA	NA	NA
SPECIFIC CONDUCTANCE (umhos/cm)	1150	3000	1500	1500	3100	2000	2500	1500	2200	1700	850	300	500	250	250	3500	2600	3800	4000	3250
TEMPERATURE (degrees F)	57	58	58	52	68	64	59	55	58	56	68	64	68	64	64	62	60	60	64	66

FOOTNOTES:
E: Value is estimated due to presence of interference.
R: Spike sample recovery is not within control limits.
S: Value is determined by standard addition.
+: Correlation coefficient for method of standard addition is less than 0.995

[]: Positive values less than the contract required detection limit.
Note: All concentrations for metals are dissolved metals.
NA: Not Analyzed
NR: Not Reported

TABLE 5
SUMMIT NATIONAL SITE
GROUNDWATER SAMPLE RESULTS (Total Metals)
REMEDIAL INVESTIGATION REPORT

Sample Location:	MW-9	MW-10	MW-26	MW-25	MW-14	MW-14	MW-23	MW-3	MW-6	MW-13	MW-12	MW-16	MW-21		
Sample Number:	GW036001	GW037001	GW038001	GW039001	GW040001	GW040002	GW041001	GW042001	GW043001	GW044001	GW045001	GW046001	GW047001	GW097001	GW096001
Sample Type:	Onsite	Onsite	Onsite	Onsite	Offsite	Offsite	Offsite	Offsite	Offsite	Onsite	Onsite	Onsite	Offsite	Blank	Blank
Date Sampled:	09/12/86	09/12/86	09/12/86	09/12/86	09/12/86	09/12/86	09/12/86	09/11/86	09/12/86	09/12/86	09/12/86	09/16/86	09/17/86	09/10/86	09/9/86
OTR Number:	EC316	EC317	EC318	EC319	EC320	EC321	EC322	EC323	EC324	EC325	EC326	EC327	EC328	EC330	EC331
ITR Number:	ME6758	ME6759	ME6760	ME6761	ME6762	ME6763	ME6764	ME6765	ME6766	ME6767	ME6768	ME6769	ME6770	ME6772	ME6773
INORGANIC COMPOUNDS (units - ppb, except where noted otherwise)															
ALUMINUM	1330	4140	2600	926	44800	37500	4200	649	14000	356	2950	1240	212000	[35]	[45]
ANTIMONY								[55]					[114]		
ARSENIC	35 S,R	22 R			18 R	17 R			10 R				39		
BARIUM	[320]	2230	[12]	[36]	1720	1610	[52]		248	[33]	230	[21]	3520	[6.8]	[5.1]
BERYLLIUM					[3.1]	[2.9]							22		
CADMIUM															
CALCIUM	750000	665000	7700	51500	17800	17100	16200	532000	11200	270000	14300	49500 E	135000 E	[501]	[510]
CHROMIUM	52	30			68	60	[6.4]		19		[5.1]	[4.1]	318		
COBALT	[37]	[38]			52	[50]		[7.6]	[16]				343		
COPPER	[6.8]	[38]	[20]	[16]	91	90	[18]		42	[13]	25	28	502	[5.1]	[8.9]
IRON	69100	325000	160	1800	101000	90800	2450	286000	29000	2970	5540	6510	608000	[79]	[34]
LEAD		64			37	32			18			16 S,+	220		
CYANIDE	239	37								35					
MAGNESIUM	303000	252000	[94]	22900	19300	17400	5580	172000	[4800]	129000	5270	16900	98000	[84]	[112]
MANGANESE	13800	10800		122	2860	2630	53	11000	529	3680	300	586	10700		
MERCURY								0.7					0.4		
NICKEL	156	138			98	93	[8.4]	[11]	[36]			[10]	678		
POTASSIUM	20700	40000	5850	10100	16400	15000	6660	11100 E	8000	16400	9170	11400	34000		
SELENIUM															
SILVER															
SODIUM	1600000	1140000	462000	703000	565000	550000	634000	232000	331000	377000	684000	477000	320000	[1060]	
THALLIUM															
TIN												[28]			
VANADIUM	[52]	[19]	[14]		75	64	[6]		[26]		[9.2]		321		
ZINC	50	319	24	24	292	264	28	132	106	22	56	54	2000	[8.2]	[9.3]
Total Alkalinity, as CaCO3 (mg/l)	2330	2490	991	466	1220	1220	433	150	678	646	457	480	460		62
Ammonia, as N (mg/l)	11	4.6	2.5	2.4	1.3	1.3	1.2	3.0	4.4	1.4	1.3	2.4	2.0		
Nitrate/Nitrite, as N (mg/l)											0.2				
Chloride (mg/l)	918	799	61	24	179	166	79	316	94	122	27	46	149		
Suspended Solids (mg/l)	90	462	31	51	2810	3340	172	46	510	27	144	172	37000		
Dissolved Solids (mg/l)	10800	9230	1150	2400	1820	1630	2030	4290	1100	2690	2180	1700	1280	14	22
Sulfate (mg/l)	650	33	75	1060	39	42	800	2100	49	950	1040	716	395		
Acidity (mg/l)	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	14	NR
FIELD PARAMETERS															
pH (standard units)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPECIFIC CONDUCTANCE (umhos/cm)	11000	8000	4600	4600	2500	2500	3250	4000	1625	4300	4100	1500	1625	NA	NA
TEMPERATURE (degrees F)	64	60	60	59	58	58	64	60	58	58	60	55	56	NA	NA

FOOTNOTES:

E: Value is estimated due to presence of interference.
R: Spike sample recovery is not within control limits.
S: Value is determined by standard addition.
+: Correlation coefficient for method of standard addition is less than 0.995

[]: Positive values less than the contract required detection limit.
Note: All concentrations for metals are dissolved metals.
NA: Not Analyzed
NR: Not Reported

TABLE 6
SUMMIT NATIONAL SITE
RESIDENTIAL WELLS SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	Lemon	Watson	Watson	Martin	Carver		Lemon	Lockridge	Watson	D'Neil	Meyers	Meyers	Jones	Dreher	Kays	Weese	
Sample Number:	RW001001	RW002001	RW002002	RW004001	RW005001	RW099001	RW006001	RW007001	RW008001	RW009001	RW010001	RW010002	RW011001	RW012001	RW013001	RW014001	RW099001
Sample Type:	Residntl	Residntl	Residntl	Residntl	Residntl	Blank	Residntl	Residntl	Residntl	Residntl	Residntl	Residntl	Residntl	Residntl	Residntl	Residntl	Blank
Date Sampled:	12/04/84	12/04/84	12/04/84	12/04/84	12/04/84	12/04/84	09/15/86	09/15/86	09/15/86	09/15/86	09/15/86	09/15/86	09/16/86	09/16/86	09/16/86	09/16/86	09/16/86
DTR Number:	DRG08	DRG09	DRG10	DRG11	DRG12	DRGR02	E01	E02	E06	E03	E04	E05	E08	E09	E10	E07	E11
ITR Number:	INDRG08	INDRG09	INDRG10	INDRG11	INDRG12	INDRR02	MEG774	MEG775	MEG776	MEG777	MEG778	MEG779	MEG780	MEG781	MEG782	MEG783	MEG784
ORGANIC COMPOUNDS (units-ppb)																	
VOLATILES																	
CHLOROMETHANE																	
VINYL CHLORIDE																	
METHYLENE CHLORIDE	0.7 SC	0.7 SC		0.7 SC		0.6 SC							5.5 B	0.9 B,J			0.7 B,J
ACETONE							5.0 B,J	9.3 B,J	10 B,J	11 B,J					10 B,J	9.3 B,J	
CARBON DISULFIDE																	
1,1-DICHLOROETHENE																	
1,1-DICHLOROETHANE																	
TRANS-1,2-DICHLOROETHENE																	
CHLOROFORM						0.6	0.4 B,J	0.3 B,J	0.2 B,J	0.3 B,J	0.3 B,J	0.2 B,J	0.3 B,J	0.3 B,J	0.3 B,J	0.1 B,J	0.4 B,J
1,2-DICHLOROETHANE																	
2-BUTANONE														0.6 B,J			
1,1,1-TRICHLOROETHANE																	
1,1,2,2-TETRACHLOROETHANE																	
TRICHLOROETHENE																	
1,1,2-TRICHLOROETHANE																	
BENZENE																	
2-HEXANONE																	
4-METHYL-2-PENTANONE																	
TETRACHLOROETHENE																	
TOLUENE							5.3 B	1.7 B	1 B,J	1.5 B	0.9 B,J	0.8 B,J	0.9 B,J	0.9 B,J	0.9 B,J	0.9 B,J	0.9 B,J
CHLOROBENZENE																	
ETHYLBENZENE															0.1		0.1 J
STYRENE																	
TOTAL XYLENES																	
TOTAL VOLATILES	0.7	0.7		0.7		1.2	10.7	11.3	11.2	12.8	1.2	1.0	6.7	2.7	11.3	10.3	2.1
TOTAL TENTATIVELY IDENTIFIED VOLATILES	3.6	3.7	0.8	0	1.4	9	0	0	0	0	0	0	0	0	0	0	0
BASE/NEUTRALS AND ACIDS																	
N-NITROSODIMETHYLAMINE																	
PHENOL																	
ANILINE																	
1,3-DICHLOROBENZENE																	
1,4-DICHLOROBENZENE																	
BENZYL ALCOHOL																	
1,2-DICHLOROBENZENE																	
2-METHYLPHENOL																	
BIS(2-CHLOROISOPROPYL)ETHER																	

TABLE 6
SUMMIT NATIONAL SITE
RESIDENTIAL WELLS SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
Sample Number:	RW001001	RW002001	RW002002	RW004001	RW005001	RW099001	RW006001	RW007001	RW008001	RW009001	RW010001	RW010002	RW011001	RW012001	RW013001	RW014001	RW099001
Sample Type:	Residntl	Residntl	Residntl	Residntl	Residntl	Blank	Residntl	Residntl	Residntl	Residntl	Residntl	Residntl	Residntl	Residntl	Residntl	Residntl	Blank
Date Sampled:	12/04/84	12/04/84	12/04/84	12/04/84	12/04/84	12/04/84	09/15/86	09/15/86	09/15/86	09/15/86	09/15/86	09/15/86	09/16/86	09/16/86	09/16/86	09/16/86	09/16/86
DTR Number:	DRG08	DRG09	DRG10	DRG11	DRG12	DRGR02	ED1	ED2	ED6	ED3	ED4	ED5	ED8	ED9	E10	ED7	E11
ITR Number:	INDRG08	INDRG09	INDRG10	INDRG11	INDRG12	INDRR02	MEG774	MEG775	MEG776	MEG777	MEG778	MEG779	MEG780	MEG781	MEG782	MEG783	MEG784
4-METHYLPHENOL																	
HEXACHLOROETHANE																	
ISOPHORONE																	
2-NITROPHENOL																	
2,4-DIMETHYLPHENOL																	
BENZOIC ACID																	
1,2,4-TRICHLOROBENZENE																	
NAPHTHALENE																	
4-CHLORO-3-METHYLPHENOL																	
2-METHYLNAPHTHALENE																	
HEXACHLOROCYCLOPENTADIENE																	
DIMETHYL PHTHALATE																	
ACENAPHTHYLENE																	
ACENAPHTHENE																	
4-NITROPHENOL																	
DIBENZOFURAN																	
DIETHYLPHTHALATE							0.2 B,J	0.2 B,J	0.2 B,J	0.3 B,J	0.1 B,J	0.2 B,J	0.1 B,J	0.1 B,J	0.1 B,J	0.1 B,J	0.1 B,J
FLUORENE																	
N-NITROSODIPHENYLAMINE(1)																	
HEXACHLOROBENZENE																	
PENTACHLOROPHENOL																	
PHENANTHRENE																	
ANTHRACENE																	
DI-N-BUTYLPHTHALATE							1 B,J	0.3 B,J	0.2 B,J	0.8 B,J	0.1 B,J	0.2 B,J	0.1 B,J	0.1 B,J	0.2 B,J	0.1 B,J	0.3 B,J
FLUORANTHENE																	
PYRENE																	
BUTYLBENZYLPHTHALATE										0.1 B,J							
BENZO(A)ANTHRACENE																	
BIS(2-ETHYLHEXYL)PHTHALATE							0.7 B,J	0.8 B,J	0.6 B,J	1.1 B,J	0.7 B,J	0.1 B,J	0.2 B,J	0.2 B,J	0.3 B,J	0.4 B,J	0.3 B,J
CHRYSENE																	
DI-N-OETYL PHTHALATE																	
BENZO(B)FLUORANTHENE																	
BENZO(K)FLUORANTHENE																	
BENZO(A)PYRENE																	
INDENO(1,2,3-CD)PYRENE																	
DIBENZ(A,H)ANTHRACENE																	
BENZO(G,H,I)PERYLENE																	
TOTAL BASE/NEUTRALS AND ACIDS							1.9	1.3	1.0	2.3	0.9	0.5	0.4	0.4	0.6	0.6	0.7
TOTAL TENTATIVELY IDENTIFIED BASE/NEUTRALS AND ACIDS	0.4	0.8	4.2	0.4	1.4	0.1	3.1	1.1	11.4	1.8	13.2	10.9	2	5.9	25.9	9.2	0

TABLE 6
SUMMIT NATIONAL SITE
RESIDENTIAL WELLS SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Sample Number:	RW001001	RW002001	RW002002	RW004001	RW005001	RW099001	RW006001	RW007001	RW008001	RW009001	RW010001	RW010002	RW011001	RW012001	RW013001	RW014001	RW099001
Sample Type:	Residntl	Residntl	Residntl	Residntl	Residntl	Blank	Residntl	Residntl	Residntl	Residntl	Residntl	Residntl	Residntl	Residntl	Residntl	Residntl	Blank
Date Sampled:	12/04/84	12/04/84	12/04/84	12/04/84	12/04/84	12/04/84	09/15/86	09/15/86	09/15/86	09/15/86	09/15/86	09/15/86	09/16/86	09/16/86	09/16/86	09/16/86	09/16/86
OTR Number:	ORG08	ORG09	ORG10	ORG11	ORG12	ORGR02	E01	E02	E06	E03	E04	E05	E08	E09	E10	E07	E11
ITR Number:	INORG08	INORG09	INORG10	INORG11	INORG12	INORR02	ME6774	ME6775	ME6776	ME6777	ME6778	ME6779	ME6780	ME6781	ME6782	ME6783	ME6784
PESTICIDES and PCBs																	
ALPHA-BHC																	
BETA-BHC																	
DELTA-BHC																	
GAMMA-BHC (LINDANE)																	
HEPTACHLOR																	
ALDRIN																	
HEPTACHLOR EPOXIDE																	
ENDOSULFAN I																	
DIELDRIN																	
4,4-DDE																	
ENDRIN																	
4,4-DDT																	
TOXAPHENE																	
AROCHLOR-1232																	
AROCHLOR-1242																	
AROCHLOR-1248																	
AROCHLOR-1254																	
TOTAL PESTICIDES and PCBs																	

TABLE 6
SUMMIT NATIONAL SITE
RESIDENTIAL WELLS SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Sample Number:	RW001001	RW002001	RW002002	RW004001	RW005001	RW099001	RW006001	RW007001	RW008001	RW009001	RW010001	RW010002	RW011001	RW012001	RW013001	RW014001	RW099001
Sample Type:	Residntl	Residntl	Residntl	Residntl	Residntl	Blank	Residntl	Residntl	Residntl	Residntl	Residntl	Residntl	Residntl	Residntl	Residntl	Residntl	Blank
Date Sampled:	12/04/84	12/04/84	12/04/84	12/04/84	12/04/84	12/04/84	09/15/86	09/15/86	09/15/86	09/15/86	09/15/86	09/15/86	09/16/86	09/16/86	09/16/86	09/16/86	09/16/86
OTR Number:	DR608	DR609	DR610	DR611	DR612	DRBR02	ED1	ED2	ED6	ED3	ED4	ED5	ED8	ED9	E10	ED7	E11
ITR Number:	INDR608	INDR609	INDR610	INDR611	INDR612	INDRR02	NE6774	NE6775	NE6776	NE6777	NE6778	NE6779	NE6780	NE6781	NE6782	NE6783	NE6784
INORGANIC COMPOUNDS (units - ppb, except where noted otherwise)																	
ALUMINUM									[127]	[36]				[30]		[129]	[38]
ANTIMONY									3.3 B		17 B	14 B	15 B	10 B		135	
ARSENIC																	
BARIUM	22	121	126	70.6	15		[11]	[86]	[184]	[28]					[26]		[5.8]
BERYLLIUM																	
BORON	521	564	560	725	450												
CADMIUM	2.79																
CALCIUM	47800	3040	2070	7090	81200		93600	9080	[2840]	[3840]	338000	339000	522000	529000	9970	346000	[352]
CHROMIUM	10.1													[4]			
COBALT																	
COPPER		6.07					[7.8]	[6.9]	74	[7.1]	32	41	[17]	[18]	[7]	[12]	[5.8]
IRON	206						1090 J	470 J	370 J	349 J	6030 J	6610 J	10700 J	10900 J	[55] J	9620 J	[18] J
LEAD																	
LITHIUM	14.6			42.6	19.4												
CYANIDE																	
MAGNESIUM	18800	1050	932	2800	34800		44000	[3590]	[960]	[1450]	131000	135000	250000	254000	[4900]	141000	
MANGANESE	36.9			6.2	46.9		48	[14]			199	209	928	942		134	
MERCURY												0.5					
MOLYBDENUM																	
NICKEL	47.6												[7.5]	[7]			
POTASSIUM	4250			4520	7190		7090 E	[4340] E	[1560] E	[2740] E	13400 E	13600 E	18400 E	18600 E	[3470] E	15000 E	
SELENIUM																	
SILVER																	
SODIUM	399000	335000	341000	783000	274000		508000 E	835000 E	351000 E	544000 E	292000 E	274000 E	286000 E	289000 E	526000 E	281000 E	
STRONTIUM	740	58.8	55.6	241	1330												
THALLIUM																	
TIN																	
TITANIUM																	
VANADIUM																	
YTTRIDIUM																	
ZINC	62.2			42.4			[17]	[11]	29	[9.8]	23	24	[19]	[19]	[6.1]	[18]	[6.7]
Total Alkalinity, as CaCO3 (mg/l)							489	609	664	531	430	432	552	558	466	467	
Ammonia, as N (mg/l)																	
Nitrate/Nitrite, as N (mg/l)																	
Chloride (mg/l)							26	941	8.9	504	26	25	97	146	9.5	18	
Suspended Solids (mg/l)																	
Dissolved Solids (mg/l)							1940	2215	857	1380	2720	2730	4020	2600	1520	2850	
Sulfate (mg/l)																	
Acidity (mg/l)							NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	3.2
FIELD PARAMETERS																	
pH (standard units)	7.6	8.7	8.7	7.8	7.3	NA	6.5	6.5	7.0	6.5	6.5	6.5	NA	6.5	7.0	6.0	NA
Specific Conductance (umhos/cm)	2500	1250	1350	4500	2000	NA	200	650	375	820	400	400	NA	300	450	315	NA

TABLE 6
SUMMIT NATIONAL SITE
RESIDENTIAL WELLS SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
Sample Number:	RW001001	RW002001	RW002002	RW004001	RW005001	RW099001	RW006001	RW007001	RW008001	RW009001	RW010001	RW010002	RW011001	RW012001	RW013001	RW014001	RW099001
Sample Type:	Residntl	Residntl	Residntl	Residntl	Residntl	Blank	Residntl	Residntl	Residntl	Residntl	Residntl	Residntl	Residntl	Residntl	Residntl	Residntl	Blank
Date Sampled:	12/04/84	12/04/84	12/04/84	12/04/84	12/04/84	12/04/84	09/15/86	09/15/86	09/15/86	09/15/86	09/15/86	09/15/86	09/16/86	09/16/86	09/16/86	09/16/86	09/16/86
OTR Number:	ORG08	ORG09	ORG10	ORG11	ORG12	ORGR02	ED1	ED2	ED6	ED3	ED4	ED5	ED8	ED9	E10	ED7	E11
ITR Number:	INORG08	INORG09	INORG10	INORG11	INORG12	INORR02	MEG774	MEG775	MEG776	MEG777	MEG778	MEG779	MEG780	MEG781	MEG782	MEG783	MEG784
Temperature (degrees F)	NA	NA	NA	NA	NA	NA	58	60	62	62	60	60	NA	64	62	56	NA

FOOTNOTES:

B: Analyte has been found in the laboratory blank as well as the sample. Indicates possible/probable contamination.
C: Applies to pesticide parameters where the identification has been confirmed by GC/MS.
E: Value is estimated due to presence of interference.
J: An estimated value
S: Value is determined by standard addition.
SC: Suspected contaminant
( ): Positive values less than the contract required detection limit.
NA: Not Analyzed

TABLE 7
SUMMIT NATIONAL SITE
DRUM/TANK SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	Incin.	Incin.	TP-1S	TP-1S	TP-1S	TP-1S	Zone I	Zone I	TP-1W	TP-9W	TP-2W	TP-2W	TP-3S	Tank A	Tank A	Tank A
Sample Number:	TK001001	TK001002	DR001001	DR001001	DR002001	DR002001	DR003001	DR003001	DR004001	DR005001	DR006001	DR007001	DR008001	TK002001	TK002001	TK002001
Sample Type:	Tank	Tank	Drum	Drum	Drum	Drum	Drum	Drum	Drum	Drum	Drum	Drum	Drum	Tank	Tank	Tank
Date Sampled:	11/14/84	11/14/84	12/11/85	12/11/85	12/11/85	12/11/85	12/11/85	12/11/85	12/11/85	12/12/85	12/12/85	12/12/85	12/12/85	01/09/86	01/09/86	01/09/86
QTR Number:	E5801	E5802	E5804		E5805-11	E5805-13	E5806		E5807	E5808	E5809	E5810	E5811	E5803-11	E5803-12	E5803-13
ITR Number:	ME5801	ME5802	ME5813-11	ME5813-12	ME5814-11	ME5814-12	ME5815-11	ME5815-12	ME5348-13	ME5349-13	ME5350-11	ME5352-12	ME5353-13	ME5812-11	ME5812-12	
ORGANIC COMPOUNDS (units-ug/kg)																
VOLATILES																
CHLOROMETHANE									20000							
VINYL CHLORIDE																
METHYLENE CHLORIDE	110000 B	110000 B	9500 B		34000 J,B	1800000 J,B	6100 B		14000 B	8900 B,**	100000 B	5700 B,**	20000 J,B	1200000 J,B	6300 B	1100000 J,B
ACETONE			3300 J,B		61000 J,B	4800000 B	4100 B			1600 B,**	180000 B	2300 B,**	160000 B		36000 B	9500000 B
CARBON DISULFIDE																
1,1-DICHLOROETHENE	50000 J															
1,1-DICHLOROETHANE																
TRANS-1,2-DICHLOROETHENE										370 J,**			72000			
CHLOROFORM							620 J,B			770 B,**		690 J,B				
1,2-DICHLOROETHANE										3100 **						
2-BUTANONE	270000	250000	8600 B				5800 B			5400 B,**	84000 J,B	7000 B **	37000 J,B		72000 B	
1,1,1-TRICHLOROETHANE	3550000	3120000	19000				1500 J			1700 **			19000 J			
1,1,2,2-TETRACHLOROETHANE																
TRICHLOROETHENE			13000				1400 J			1500 **			140000			
1,1,2-TRICHLOROETHANE																
BENZENE							1200 J							1100000 J	43000	13000000
2-HEXANONE																
4-METHYL-2-PENTANONE																
TETRACHLOROETHENE																
TOLUENE	260000	240000	62000		26000 J		21000		2000 J	3200 **	340000	6100 **	31000 J	9100000	64000	54000000
CHLOROBENZENE					15000 J				110000							
ETHYLBENZENE	160000	140000	13000				570 J			2100 **	23000 J		190000	1300000 J	6000	10000000
STYRENE			370000													
TOTAL XYLENES	250000		10000				4400			8700 **	140000	650 J,**	840000	8400000	32000	55000000
TOTAL VOLATILES	4650000	3860000	508400		136000	6600000	46690		146000	37340	867000	22440	1509000	21100000	259300	142600000
TOTAL TENTATIVELY IDENTIFIED VOLATILES	3842000	4317000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE/NEUTRALS AND ACIDS																
N-NITROSODIMETHYLAMINE																
PHENOL		67000 J	8200 J,**													
ANILINE																
1,3-DICHLOROBENZENE																
1,4-DICHLOROBENZENE																
BENZYL ALCOHOL																
1,2-DICHLOROBENZENE																
2-METHYLPHENOL																
BIS(2-CHLOROISOPROPYL)ETHER																
4-METHYLPHENOL	525000	664000														

TABLE 7
SUMMIT NATIONAL SITE
DRUM/TANK SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	Incin.	Incin.	TP-1S	TP-1S	TP-1S	TP-1S	Zone I	Zone I	TP-1W	TP-9W	TP-2W	TP-2W	TP-3S	Tank A	Tank A	Tank A
Sample Number:	TK001001	TK001002	DR001001	DR001001	DR002001	DR002001	DR003001	DR003001	DR004001	DR005001	DR006001	DR007001	DR008001	TK002001	TK002001	TK002001
Sample Type:	Tank	Tank	Drum	Drum	Drum	Drum	Drum	Drum	Drum	Drum	Drum	Drum	Drum	Tank	Tank	Tank
Date Sampled:	11/14/84	11/14/84	12/11/85	12/11/85	12/11/85	12/11/85	12/11/85	12/11/85	12/11/85	12/12/85	12/12/85	12/12/85	12/12/85	01/09/86	01/09/86	01/09/86
DTR Number:	E5801	E5802	E5804		E5805-11	E5805-13	E5806		E5807	E5808	E5809	E5810	E5811	E5803-11	E5803-12	E5803-13
ITR Number:	ME5801	ME5802	ME5813-11	ME5813-12	ME5814-11	ME5814-12	ME5815-11	ME5815-12	ME5348-13	ME5349-13	ME5350-11	ME5352-12	ME5353-13	ME5812-11	ME5812-12	
HEXACHLOROETHANE																
ISOPHORONE																
2-NITROPHENOL																
2,4-DIMETHYLPHENOL	101000	109000														
BENZOIC ACID																
1,2,4-TRICHLOROBENZENE																
NAPHTHALENE	23000 J	24000 J											85000 J	360000 **	12000 J,**	
4-CHLORO-3-METHYLPHENOL																
2-METHYLNAPHTHALENE														470000 **	11000 J,**	
HEXACHLOROCYCLOPENTADIENE																
DIMETHYL PHTHALATE																
ACENAPHTHYLENE																
ACENAPHTHENE														28000 J,**		
4-NITROPHENOL																
DIBENZOFURAN																
DIETHYLPHTHALATE																
FLUORENE														4200 J, **		
N-NITROSODIPHENYLAMINE(1)																
HEXACHLOROBENZENE																
PENTACHLOROPHENOL																34000 J,**
PHENANTHRENE	25000 J															34000 **
ANTHRACENE	25000 J	28000 J														4000 J,**
DI-N-BUTYLPHTHALATE	16000 J	112000			5700 J,**	14000 J,**							28000 J	28000 J,**		
FLUORANTHENE																
PYRENE			2900 J,**													4700 J,**
BUTYLBENZYLPHTHALATE																
BENZO(A)ANTHRACENE																2000 J,**
BIS(2-ETHYLHEXYL)PHTHALATE	281000	298000			21000 **											
CHRYSENE																2800 J,**
DIN-N-OCTYL PHTHALATE					43000 **	100000 **										
BENZO(B)FLUORANTHENE																2300 J,**
BENZO(K)FLUORANTHENE																1600 J,**
BENZO(A)PYRENE																
INDENO(1,2,3-CD)PYRENE																
DIBENZ(A,H)ANTHRACENE																
BENZO(G,H,I)PERYLENE																
TOTAL BASE/NEUTRALS AND ACIDS	996000	1302000	11100		69700	114000							113000	890200	23000	85400
TOTAL TENTATIVELY IDENTIFIED BASE/NEUTRALS AND ACIDS	10973000	18235000	33000	0	32000	28000	0	0	0	170000	18000	0	0	10700000	209000	0

PESTICIDES AND PCBs

ALPHA-BHC																

TABLE 7
SUMMIT NATIONAL SITE
DRUM/TANK SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	Incin.	Incin.	TP-1S	TP-1S	TP-1S	TP-1S	Zone I	Zone I	TP-1W	TP-9W	TP-2W	TP-2W	TP-3S	Tank A	Tank A	Tank A
Sample Number:	TK001001	TK001002	DR001001	DR001001	DR002001	DR002001	DR003001	DR003001	DR004001	DR005001	DR006001	DR007001	DR008001	TK002001	TK002001	TK002001
Sample Type:	Tank	Tank	Drum	Drum	Drum	Drum	Drum	Drum	Drum	Drum	Drum	Drum	Drum	Tank	Tank	Tank
Date Sampled:	11/14/84	11/14/84	12/11/85	12/11/85	12/11/85	12/11/85	12/11/85	12/11/85	12/11/85	12/12/85	12/12/85	12/12/85	12/12/85	01/09/86	01/09/86	01/09/86
OTR Number:	E5801	E5802	E5804		E5805-11	E5805-13	E5806		E5807	E5808	E5809	E5810	E5811	E5803-11	E5803-12	E5803-13
ITR Number:	ME5801	ME5802	ME5813-11	ME5813-12	ME5814-11	ME5814-12	ME5815-11	ME5815-12	ME5348-13	ME5349-13	ME5350-11	ME5352-12	ME5353-13	ME5812-11	ME5812-12	
BETA-BHC																
DELTA-BHC	6250 **															
GAMMA-BHC(LINDANE)																
HEPTACHLOR																
ALDRIN	4750 **															
HEPTACHLOR EPOXIDE																
ENDOSULFAN I	1700 **															
DIELDRIN																
4,4-DDE	1800 **															
ENDRIN																
4,4-DDT																
TOXAPHENE																
AROCHLOR-1232																
AROCHLOR-1242																
AROCHLOR-1248																
AROCHLOR-1254																
TOTAL PESTICIDES and PCBs	14500															

TABLE 7
SUMMIT NATIONAL SITE
DRUM/TANK SAMPLE RESULTS
REMEDIAL INVESTIGATION REPORT

Sample Location:	Incin.	Incin.	TP-1S	TP-1S	TP-1S	TP-1S	Zone I	Zone I	TP-1W	TP-9W	TP-2W	TP-2W	TP-3S	Tank A	Tank A	Tank A
Sample Number:	TK001001	TK001002	DR001001	DR001001	DR002001	DR002001	DR003001	DR003001	DR004001	DR005001	DR006001	DR007001	DR008001	TK002001	TK002001	TK002001
Sample Type:	Tank	Tank	Drum	Drum	Drum	Drum	Drum	Drum	Drum	Drum	Drum	Drum	Drum	Tank	Tank	Tank
Date Sampled:	11/14/84	11/14/84	12/11/85	12/11/85	12/11/85	12/11/85	12/11/85	12/11/85	12/11/85	12/12/85	12/12/85	12/12/85	12/12/85	01/09/86	01/09/86	01/09/86
OTR Number:	E5801	E5802	E5804		E5805-11	E5805-13	E5806		E5807	E5808	E5809	E5810	E5811	E5803-11	E5803-12	E5803-13
ITR Number:	ME5801	ME5802	ME5813-11	ME5813-12	ME5814-11	ME5814-12	ME5815-11	ME5815-12	ME5348-13	ME5349-13	ME5350-11	ME5352-12	ME5353-13	ME5812-11	ME5812-12	
INORGANIC COMPOUNDS (units) MG/KG DRY WEIGHT																
ALUMINUM	699	803			7810		2790				16500			6210		
ANTIMONY																
ARSENIC																
BARIUM	[89]	88														
BERYLLIUM																
CADMIUM	2.4	7.9									139 R		88 R			
CALCIUM			3130	2830	3800	2700	4010	3040	6240		4090	2800		1680	2680	
CHROMIUM	202 R	189 R									68					
COBALT																
COPPER	28	28									527		69.7	120		
IRON	2050	2050	226		5360		14900		404		25700 F	710		162000 F		
LEAD	168	195												460		
CYANIDE											768	1330 F				
MAGNESIUM					1440		809		1410		2340			871		
MANGANESE	14	17			77		60.6				982			331		
MERCURY																
NICKEL			64	55	117	70.9	86.7	99.8	241	142	57.9	74	189			
POTASSIUM																
SELENIUM																
SILICON			1400 E	897	31100 E		2710 E		2900		49700 E			21900 E	2160	
SILVER																
SODIUM	4800	4760														
THALLIUM		[2.3]														
TIN		18 R														
TITANIUM					602						979			428		
VANADIUM																
ZINC	67	71			203		150				198000		111	629		

FOOTNOTES:

B: Analyte has been found in the laboratory blank as well as the sample. Indicates possible/probable contamination.
E: Value is estimated due to presence of interference.
F: Sample Concentration is greater than 4 times the spike value.
J: An estimated value
R: Spike sample recovery is not within control limits.
**: Samples analysed at medium concentrations.
[]: Positive values less than the contract required detection limit.
11: Top Liquid Phase
12: Middle Liquid Phase
13: Solid Phase

Appendix B

APPENDIX B - LABORATORY AND EPA QA PROTOCOL

CHAPTER V
PROGRAM QUALITY ASSURANCE

The purpose of this chapter is to present a summary of the different aspects of quality assurance (QA) and to show their interrelationship within the overall structure of the program. This information is included to familiarize users with the program's basic QA principles and their application, and to facilitate a more complete understanding of the quality of CLP analytical data in terms of potential utilization.

A. Interface with Agency Quality Assurance

The primary role of the CLP is to support the Agency's Superfund investigation and cleanup efforts by producing analytical data of known and documented quality useable for Agency enforcement actions keyed to identification of pollutant sources and recovery of cleanup costs. Therefore, a comprehensive quality assurance program that reflects Agency QA objectives has been incorporated into all aspects of CLP operations. The CLP links two primary aspects of quality assurance (QA): field QA, which includes field sampling operations and QA project planning; and laboratory QA, which is comprised of analytical method QC and external or program QA.

Field operations include sampling activities performed by the EPA Regions and National Remedial Action/Field Investigation Team (REM/FIT) and Technical Assistance Team (TAT) contractors, which result in samples being processed through the CLP for analysis. The CLP NPO coordinates closely with these and other Agency sampling groups and Agency QA teams, in the development and application of quality-controlled Program Plans and site-specific Project Plans. These plans include the consistent use of Agency-specified containers, sampling techniques, sample preservation, sample tags and chain-of-custody documents, and adherence to DOT regulations in sample shipment. The CLP strongly supports the use of consistent field sampling, and sample packaging and shipment

techniques, and specifies types of sample containers and required sample volumes for appropriate target analyses. Through its Sample Bottle Repository system, the CLP provides Superfund samplers with the precleaned sampling bottles for use in the field.

The CLP is directly involved in all aspects of laboratory QA. Analytical methods require extensive Agency-specified quality control (QC) procedures and documentation to ensure a complete data product that will withstand legal scrutiny. The CLP operates an extensive external QA program, which includes: pre-award and post-award laboratory performance evaluation sample analyses and laboratory facility evaluations, required submission of laboratory Standard Operating Procedures (SOPs) for analytical operations and documentation, continuous monitoring of lab performance by Headquarters contract POs and Regional DPOs, and a multi-level data review process to evaluate the validity of the data product.

The CLP, through a variety of mechanisms, continuously strives to improve the quality of program data by maintaining state-of-the-art analytical methods, refining the structure and requirements of analytical contracts, and strengthening lab operations. CLP QA activities are coordinated through the NPO QA Officer, to ensure that the CLP is operating in accordance with overall Agency QA mandates.

The application of field QA is addressed in Chapters II and III, where sample volume, container, preservation, packaging, shipment and documentation requirements are discussed. Analysis or method QC is addressed for each analytical program in Chapter II, which contains a description of contract analytical methods and QC requirements for each program. The following sections of this chapter describe the program's external laboratory QA activities.

B. Laboratory Selection Process

1. Bid Price

The first criterion for laboratory selection is bid price. Following bid opening, bid abstracts are reviewed and evaluated by NPO and EPA contract officials. The lowest competitive bidders are selected to participate in pre-award bid confirmation, the process through which bidder responsiveness and responsibility for award are demonstrated and evaluated.

2. Pre-Award Bid Confirmation

Pre-award bid confirmation may include three activities: (1) bidder analysis of performance evaluation (PE) samples; (2) bidder submission of Standard Operating Procedures (SOPs); and (3) site evaluation of the bidder's facility, performed by EPA program management and contracts personnel.

a. Performance Evaluation Sample Analysis

Laboratories chosen to participate in the pre-award process are sent a set of PE samples for analysis. The PE samples are prepared by EMSL/LV and are representative of the types of field samples that the contractor would routinely be analyzing under the subject procurement. The laboratory is required to analyze PE samples according to contract procedures set forth in the IFB, and to report PE sample data according to IFB requirements, within a time period of 21 days. Bidders' PE sample data are evaluated by NPO and EMSL/LV personnel, in terms of compliance with contract requirements and accuracy of determination of compounds at the levels

known to be in the PE samples. Analysis results are rated by a scoresheet developed by EMSL/LV. The PE sample score is a primary consideration in determining bidder responsiveness/responsibility for contract award.

b. Standard Operating Procedures

Bidders are required to submit copies of all laboratory Standard Operating Procedures (SOPs) at the time of submission of PE sample data. SOPs are not required to coincide with each specific detail of the contract requirement, but must be representative of good laboratory practices and must demonstrate that the laboratory has a facility-wide quality assurance program in place and operating. Bidder SOPs are reviewed by NPO and EMSL/LV personnel and are utilized by EPA in performance of the site evaluation.

c. Laboratory Evaluation

EPA NPO and EMSL/LV personnel participate in site evaluations of laboratory facilities of bidders which scored acceptably on the PE sample analyses. EPA personnel perform a walk-through of the facility and complete a site evaluation questionnaire. The results of the site evaluation are considered in final determination of bidder responsiveness/responsibility for contract award.

C. Laboratory Start-Up Process

Laboratories entering the program undergo a learning curve process during which they become fully familiarized and obtain expertise in application of program methodologies and quality control procedures. To reduce the learning curve period and bring laboratories "up to speed" in a timely manner, CLP management employs a series of laboratory start-up procedures which are utilized during the laboratory's initial contract operations and whenever laboratory problems are identified during contract performance.

1. Provision of Standards to Laboratory

Immediately following contract award, EMSL/LV arranges for the provision of standard materials (SMs) to the contractor, through the Agency's contractor-operated QA Materials Bank. These SMs are utilized by the laboratory in performing initial instrument calibrations and as reference standards throughout contract performance.

2. PO Review of First Data Packages

Initial data packages are targeted for immediate review and evaluation by the NPO Project Officer (PO), EMSL/LV and the Region. This review is intensive and focuses on any problems the laboratory has, either in applying methodologies or in reporting the data. The PO then supplies feedback to the laboratory concerning the status of the data and works with the laboratory in identifying and remedying problems.

3. PO/DPO Laboratory Visits

Depending on the extent of the problems found during the review of an initial data package, the PO may visit the laboratory facility and work on-site with laboratory personnel in rectifying problems. This process also

occurs on an ongoing basis during the life of the contract. Site evaluations are performed yearly by EPA staff, and the PO and/or Deputy Project Officer (DPO) visit the laboratory on an as-needed basis to resolve performance problems.

4. PO/DPO/SMO/Laboratory Communication

Telephone communication is the most widely applied method for problem solving and maintaining efficient laboratory operations, both during the laboratory start-up phase and throughout the performance of the contract. During the start-up period, communication links are established and the laboratory becomes familiarized with the communication process. In general, the laboratory notifies SMO immediately upon identification of any problem regarding the samples (e.g., insufficient sample volume) or any difficulties encountered in analysis. SMO routinely resolves sample-related problems in coordination with the Regional client, and refers technical problems to the contract PO, who contacts the laboratory and resolves the problem. The resolution and any specific actions taken are reported to SMO which records this information as part of the permanent Case record. The laboratory also records the problem and resolution on the sample data report, so that the Region considers this information in association with evaluating and using the data. With the appointment of Regional DPOs to assist in the monitoring of contractor performance, the DPO will play a major role in ongoing laboratory problem resolution in coordination with the PO.

D. Laboratory Performance Evaluation

1. Performance Evaluation Sample Analysis

Performance Evaluation (PE) samples are prepared by ORD EMSL/LV and sent to contractor laboratories for analysis, normally on a quarterly basis. PE samples are typically shipped as "double blind" samples, i.e., the PE samples are not discernable from routine field samples, to ensure that the laboratory processes the samples in a routine manner. Evalution of PE sample data is performed by EMSL/LV and is used by the NPO in formally evaluating laboratory contract performance. Additionally, PE sample QC data are entered by EMSL/LV into the program's QA Data Base, and are utilized, along with other laboratory data, in trend analyses, and evaluation and revision of contract QC criteria.

2. Laboratory Site Evaluation

At least once a year, EPA NPO, Regional and EMSL/LV personnel visit each laboratory facility and evaluate laboratory procedures. The evaluation reports which result from these site visits are utilized by the NPO in identifying and remedying laboratory performance problems. Repeat site visits by EPA NPO, Regional and EMSL/LV personnel are made on an as-needed basis throughout the year, to resolve laboratory problems.

3. Corrective Action

Upon identification of laboratory performance problems, the PO and DPO work closely with the laboratory to effect correction of the problems. Depending on the scope of the problems, the laboratory may be placed on temporary hold, whereby the laboratory does not receive additional samples for analysis until the problem has been corrected.

Should the contractor's non-compliance to contract performance or deliverable requirements continue, the EPA Contracting Officer is requested by the NPO to issue a Show Cause Notice to the contractor. This document requires the contractor, within a ten-day period of time, to present the government with any facts bearing on the issue, to be used in the government's determination regarding whether the contractor's failure to perform arose out of causes beyond the laboratory's control and without fault or negligence on the part of the contractor. The contractor, in response, must submit substantial evidence to demonstrate that the contract should not be terminated for default.

A recovery plan is generally included as part of the contractor's response to the Show Cause Notice. EPA Contracts and NPO officials review the contractor's response and proposed recovery plan, and determine whether the contractor has presented sufficient evidence to demonstrate timely remedy of the noncompliance. Following this review, if the contractor has presented acceptable evidence toward recovery, the government issues a Cure Notice to the contractor which delineates the government-accepted recovery plan that the contractor must follow to avoid contract termination. The government's recovery plan includes actions and time schedules for completion of each step of the recovery process, and specifies an overall time period acceptable for completion of recovery.

Should the contractor not comply with the recovery schedule, the next and final step may be contract termination by the government for default. In addition to terminating the laboratory's contract, this action impacts on evaluation of the contractor's responsiveness/responsibility for award under future CLP solicitations.

E. Sample Data Evaluation

1. Intercomparison Check Sample Studies

Intercomparison check sample studies are initiated by the EPA Regions on a periodic basis and involve simultaneous shipment of known samples to two or more CLP and/or Regional laboratories for analysis. Check samples are routinely shipped as "single blind" sample, i.e., the laboratory is aware samples are check samples but does not know sample composition. Analytical data from study participants are compiled by the Region and used in comparative data evaluation. The Region provides intercomparison sample study results to the NPO and EMSL/LV for use in programmatic applications. These studies differ from the PE sample program in that check sample data do not result in contractual evaluation of individual laboratory performance.

2. Regional Sample Split/Spike Programs

This Regionally-directed program involves simultaneous sample analysis by two or more CLP and/or Regional laboratory facilities, and provides the Region with comparative data utilized in evaluating application of methods. In the sample split program, the Regions arrange to have field samples split and sent to different contractor and Regional laboratories for analysis. In the sample spike program, a known sample volume is prepared and divided into two or more equivalent portions. Each sample portion is then spiked with known levels of contaminants, and sent to different contractor and/or Regional laboratories for analysis. Results of split/spike sample analyses performed by CLP laboratories are provided to the NPO and EMSL/LV by the Region.

F. Analytical Data Review

Upon completion of analysis and data reporting, the laboratory simultaneously sends a copy of the complete data package to the CLP SMO, EMSL/LV and the Regional client. Each of these groups performs complementary aspects of data review.

1. EMSL/LV Data Review

On a routine basis, EMSL/LV performs a comprehensive QA audit on CLP sample data packages using Mil. Standard 105D. Based on this review, EMSL/LV prepares a detailed report on the data packages, which is provided to the NPO and to Regional clients by SMO. This review package is valuable to both program management and users in evaluating the suitability of the contract methods to the types of samples analyzed, the quality of the analytical data, and the performance of the contractor laboratories.

In addition, EMSL/LV enters surrogate and spike recovery information into the program's QA Data Base. These data are then statistically evaluated and utilized to determine and revise contract QC acceptance windows for CLP-generated data and to characterize laboratory performance.

2. Regional Data Review

The Regional client reviews all data packages resulting from Regional sampling efforts. It is the responsibility of the Region, as the data user, to determine the applicability of each data package to its intended use, e.g., site investigation support, cleanup activities and/or enforcement actions. In this review, the Region applies its standard CLP data review procedures and references the requirements of the contract Statement of Work under which the analyses were performed.

3. SMO Data Check for Completeness

Each CLP-generated data package is checked for completeness by SMO upon receipt. SMO reviews the data package verifying that all contractually-required forms are included and that forms are completed according to contract specifications. Should SMO identify any missing information, incomplete forms or other problems with the data package, SMO immediately notifies the NPO PO, EMSL/LV and the Regional client. At this time, the laboratory is contacted and instructed to submit the missing or incorrect portions of the data package.

4. SMO Data Review Services

Under direction of CLP management, SMO may perform additional data review, checking the data for compliance to contract QC procedures and parameters and for applicability to its intended uses. This review is provided on a limited basis in response to specific Regional request. Consult Chapter IV, Section E, for a complete description of the data review services provided and appropriate request procedures.

G. Analytical Methodology Improvement/Development

1. Protocol Standardization and Improvement

Refining and improving analytical protocols to maintain state-of-the-art status and to reflect newly-defined or changed requirements of the Superfund effort, is an ongoing activity for all CLP participants. This effort is accomplished through an established system of information transfer coordinated through the NPO. All program participants submit comments or recommendations to the NPO on an ongoing basis. The NPO reviews all submitted information and considers recommendations for program application, on a periodic basis.

Since 1982, input on protocol improvements has come primarily through the CLP Technical Caucuses which involve NPO, EMSL/LV, EMSL/Cincinnati, EPA Region, SMO, laboratory and other program support contractor personnel. Analytical methods and data reporting formats are reviewed and discussed in detail at the caucus sessions. EPA personnel then review caucus discussions and compile concensus recommendations for protocol changes. Following NPO approval of recommended changes, laboratory contracts are modified by the Contracting Officer to include recommended revisions, through contract change order actions. All laboratory contracts within an analytical program are changed concurrently to maintain consistency across the program.

2. Method Development

Development of new analytical methods may be initiated by a newly identified or redefined Agency analysis requirement, such as dioxin analysis. Analytical methods utilized in the CLP are based on EPA-developed and approved methodologies. The NPO, EMSL/LV, EMSL/Cincinnati, and/or EPA Regions have historically contributed to development of new program analytical methodologies. Regardless of the group responsible for method development, methods are reviewed by several sources and are tested prior to implementation, to the extent possible to meet program requirements.

A. Organic Routine Analytical Services (RAS)

1. Sample Matrices, Concentration Levels and Volumes Required

The organic RAS contract methods apply to analysis of water (aqueous) and soil/sediment samples. Samples for analysis should be single-phase, homogeneous samples of a similar matrix. Sample matrices other than water, sediment or soil are processed through the SAS program.

Organic RAS contract methods determine concentrations of organic compounds ranging from low or environmental levels of concentration to medium levels, where a compound may comprise as much as 15 percent of the total sample, at the lowest appropriate detection limits. Low level samples are considered to be those collected off-site, around the perimeter of a waste site, or in areas where hazards are thought to be significantly reduced by normal environmental processes. Medium level samples are most often those collected on-site, in areas of moderate dilution by normal environmental processes. Low and medium level designations are made in the field by the sampler to determine packaging and shipment procedures. Low and medium level analysis designations are performed within the laboratory to determine the appropriate analytical protocol to be used.

Samples collected on-site where high levels of contamination are suspected (i.e., drum samples) are routinely shipped to a Hazardous Substances Laboratory for sample preparation prior to analysis. High hazard sample preparation is discussed in Section D of this chapter. Alternatively, HH sample preparation and analysis can be obtained through SAS as described in Section E.

The sample volume and container types required for RAS organic analysis vary according to the matrix and estimated concentration level of the sample. For RAS organic analysis of a water sample estimated as low level, one gallon sample volume is required for extractables (B/N/A), and 80 ml for volatiles (VOA). The sample should be collected in two ½-gallon

or four 1-liter amber glass bottles, and two 40-ml glass vials. For RAS organics analysis of a water sample estimated as medium level, a four liter volume is required for extractables and 80 ml for volatiles. The sample should be collected in four 1-liter amber glass bottles or four 32-ounce glass jars, and two 40-ml glass vials. For RAS analysis of a soil/sediment sample estimated as low or medium level, a six ounce volume is required. The sample should be collected in one 8-ounce glass jar for extractables and two 120-ml glass vials for volatiles.

Each sample estimated as medium level (both water and soil) must be enclosed and sealed in a metal paint can for shipment. If it is not certain whether a sample should be categorized as low or medium level, volume should be collected as specified for low level samples, however shipping procedures must be followed as designated for medium level samples. Sample portions for volatile analysis (water and soil) should be collected so that the containers are completely filled, leaving no headspace.

Water samples for duplicate analyses must be collected at double the volume specified for extractables, and triple the volume specified for volatiles. Additionally, for water samples one field blank should be supplied per Case, and one volatile trip blank should be supplied per shipment. No additional volume is required for soil sample duplicate analyses, and no blanks are currently required for soil samples. Soil blanks will be used in the future and will be supplied to Regions by EMSL/LV.

If sufficient sample volume is not provided, complete analysis may not be possible. If this occurs, SMO will contact the RSCC to determine appropriate adjustments in analysis.

Required sample volumes and container types for RAS organic analysis of water and soil samples are illustrated in Appendix C. Pre-cleaned sample bottles are available through the Sample Bottle Repository, as detailed in Chapter IV.

2. Compounds Identified and Quantified

The organic RAS program provides identification and quantification of EPA Hazardous Substances List (HSList) organic compounds in water and soil/sediment samples. These compounds, which include priority pollutant compounds and other organics of interest, are identified on the organic data reporting sheets in Appendix B.

In addition, the laboratory is required to execute a maximum of 30 EPA/NIH Mass Spectral Library searches for compounds not identified on the HSL. The 10 peaks of greatest apparent concentration in the volatile fraction and the 20 peaks in the base/neutral/acid fraction are tentatively identified and the concentration estimated, following a visual comparison of sample spectra with the nearest library matches. The tentative identification of non-HSL organic compounds provides information on potential organic contaminants outside of the analytical parameters of the RAS program.

3. Contract Deliverable Requirements

The organic RAS program specifies contractually-required deliverables for sample extraction, volatile analysis and data reporting. These requirements include: completion of sample extraction within five days of sample receipt by the laboratory, completion of volatile analysis within seven days of sample receipt, and completion of extractable analysis and reporting of data within 30 days of sample receipt. Laboratories are subject to financial penalties for late delivery in meeting these deadlines and incentives for early delivery of the final data package. Illegible data reports are considered unacceptable, and the laboratory is required to resubmit readable versions of any illegible pages.

The organic RAS data package supports independent sample data review by the client user. Through review of data package components, the client can determine the quality of the analytical data.

Each organic RAS data package includes the following components:

- o Narrative report, describing analytical problems encountered and internal decision tree processes applied.
- o Copies of sample Traffic Reports.
- o Quality control summary, containing surrogate, reagent blank and duplicate matrix spike analyses recoveries and instrument tuning and performance information.
- o Sample data, including tabulated results of the organic HSL compounds identified and quantified, and the tentative identification and estimated concentration of up to 30 non-HSL organic compounds in greatest apparent concentration, reported in ug/l or mg/kg.
- o Raw sample analytical data, including sample chromatograms, spectra, quantitation reports, and calculations.
- o Standards data package (for each Case of samples), including chromatograms, spectra and data system printouts.
- o QC data package, documenting instrument tuning and analytical QC criteria.

The organic RAS deliverables index and copies of organic data reporting sheets are contained in Appendix B.

4. Analytical Protocols

The standardized organic analytical methods are based on Federal Register (FR) Methods 625, 608, and 624 modified for CLP use in the analysis of both water and soil samples. Analysis for the organic HSL compounds includes a GC and GC/MS analysis to achieve the lowest appropriate detection limits for each sample fraction.

a. Water Method

Water samples for full organic analysis (base/neutral/acid, volatile and pesticide/PCB compounds) are first prepared and/or solvent extracted, resulting in three individual sample fractions: extractable or semivolatile (B/N/A); volatile (VOA); and pesticide/PCB. Extracts are cleaned up when necessary, using optional column chromatography techniques.

The identification and quantification of the organic HSL compounds in water samples is performed by GC/MS for B/N/A and VOA fractions, and by GC/EC for the pesticide/PCB fractions.

In addition, the 20 highest non-HSL base/neutral/acid compound peaks and the 10 highest non-HSL volatile peaks are tentatively identified and their concentration estimated, using a forward search of the EPA/NIH Mass Spectral Library.

b. Soil Method

Soil samples for full organic analysis (base/neutral/acid, volatile and pesticide/PCB compounds) are prepared by sonification prior to solvent extraction. Extracts are cleaned up using optional column chromatography techniques when necessary.

The identification and quantification of the organic HSL compounds in soil samples is performed by GC/MS for B/N/A and VOA fractions, and by GC/EC for the pesticide/PCB fraction.

In addition, the 20 highest non-HSL base/neutral, acid peaks and the 10 highest non-HSL volatile peaks are tentatively identified and their concentration estimated, using a forward search of the EPA/NIH Mass Spectral Library.

c. Method Detection Limits

Low level analysis method detection limits (MDLs) for water samples are based on MDLs for each organic compound using FR Methods 624, 625, and 608, and are at the part-per-billion (ppb) level. Approximate achievable MDLs for low and medium level water and soil samples can be calculated based on the sample size and on concentration/dilution factors.

MDLs are provided for analytical guidance, as the limits are highly matrix dependent. Matrix interferences vary considerably depending on the nature and homogeneity of the sample, on the interferent contaminants which coextract from the sample, and on the sample volume taken for analysis. The list of contract-specified MDLs for low level water samples is included in Appendix B.

5. Contract Quality Control Requirements

The CLP quality control (QC) program for organic RAS laboratory analysis is structured to provide consistent results of known and documented quality. The program therefore places stringent quality control requirements on all laboratories performing sample analyses. Sample data packages contain documentation of a series of QC operations that allow an experienced chemist to determine the quality of the data and its applicability to each sampling effort. In addition, laboratory contracts contain provisions for sample re-analysis if and when specified QC criteria are not met by the contract laboratory. Each CLP laboratory is also encouraged to develop additional internal QA/QC procedures.

The minimum QC requirements of the organic RAS program consist of both an initial and ongoing demonstration of laboratory capability to generate acceptable precision and accuracy with the contract methods in the

analysis of water and soil samples. CLP contracts define extensive QC procedures that must be performed and documented, and criteria that must be met. These include, but are not limited to, the following:

- o GC/MS instrument tunes for both volatile and semi-volatile compound analyses.
- o Initial multi-level calibration for each HSL compound.
- o Continuing calibration for each HSL compound.
- o Addition of surrogate compounds to each sample and blank for determining percent recovery information.
- o Duplicate matrix spike analyses.
- o Reagent blank analyses.

Certain of the above-listed QC procedures demonstrate that the instrument is operating within contract specifications. These include: a demonstration that the two tuning compounds (DFTPP for extractables and BFB for volatiles) meet the defined ion abundance criteria; determination of an average response factor ($\overline{RF}$) based on a calibration using several concentrations of each HSL compound that must meet a defined relative standard deviation (RSD) and minimum RF; and, a continuing calibration at a single concentration for each HSL compound for which specified compounds are flagged as controls which must meet defined percent difference (%D) from the initial RF or a new initial calibration must be performed.

Other QC procedures are required to demonstrate the quality of the analytical data generated. These include: addition of surrogate spikes to all samples and blanks to monitor sample preparation and analysis and to provide percent recovery information for each sample, so that the suitability of the method for each sample (regardless of matrix) may be established; analysis of duplicate matrix spiked samples to display the

precision of the method for the particular Case and also to provide percent recovery information for defined HSL compounds (specified matrix spikes) as for surrogates; analysis of reagent blanks for each Case or each set of 20 samples (whichever is less) and for each matrix within a Case, to assure that laboratory contaminants are not reflected in data results.

It is the responsibility of the contractor laboratory to document, in each data package submitted, that both initial and ongoing instrument and analytical QC criteria have been met. The laboratory must demonstrate that instrument tuning and calibration criteria have been met, that interferences from the analytical system are under control, and that surrogate spike, matrix spike and matrix spike duplicate recoveries falling outside contract acceptance windows are attributable to sample matrix interferences and not to laboratory analytical errors. Any samples analyzed when contract QC criteria have not been met are re-analyzed by the laboratory when sufficient sample volume is available.

B. Inorganic Routine Analytical Services (RAS)

1. Sample Matrices, Concentration Levels, Volumes Required and Preservation Techniques

The inorganic RAS contract methods apply to analysis of water and soil/sediment samples. Samples for analysis should be single-phase, homogeneous samples of a similar matrix. Sample matrices other than water, sediment or soil are processed through the SAS program.

Inorganic RAS contract methods determine concentrations of inorganic priority pollutant (PP) constituents ranging from low or background levels of concentration to medium levels, where a compound may comprise up to 15 percent of the total sample. Low level samples are generally those collected off-site, around the perimeters of a waste site, or in areas where hazards are thought to be significantly reduced by normal environmental processes. Low level samples are estimated to contain less than 10 ppm of the inorganic PP contaminants. Medium level samples are most often those collected on-site, in areas of moderate dilution by normal environmental processes. Medium level samples are estimated to contain concentrations of inorganic PP contaminants up to 15 percent. Low and medium level designations are made for sample collection volume and shipment purposes, and for determination of appropriate analytical methods and QA/QC requirements. Samples estimated to contain concentrations of inorganic contaminants higher than 15 percent of the sample must be sent to a Hazardous Substances Laboratory for sample preparation prior to analysis. High hazard sample preparation is discussed in section D of this chapter.

The sample volume and container types required for inorganic analysis vary according to the matrix and estimated concentration level of the sample. For RAS inorganic analysis of a water sample estimated as low level, one

liter volume is required for metals analysis and one liter volume for cyanide analysis. The sample should be collected in two 1-liter polyethylene bottles. For RAS inorganic analysis of a water sample estimated as medium level, sixteen ounce volume is required for metals and sixteen ounce volume for cyanide. The sample should be collected in two 16-ounce glass jars. For RAS inorganic analysis of a soil sample estimated as low or medium level, six ounce sample volume is required for both metals and cyanide analyses. The sample should be collected in one 8-ounce glass jar.

For the inorganics RAS program only, it is recommended that a Case of samples be collected over no more than a three-day period and samples shipped collectively when the Case is completed.

When collecting low level water samples, a sample aliquot for cyanide analysis must be collected separately, and different preservation techniques applied to the metals and cyanide portions, as follows. For the metals analysis aliquot, the sample should be filtered, then acidified to pH ≤ 2 with HNO_3. (If filtration is not possible, the sample should not be acidified.) For the cyanide aliquot, the preservation techniques specified in Methods for Chemical Analysis of Water and Waste should be applied. (Consult Appendix E for complete reference.) No preservation is required for medium level water samples or low or medium level soil samples.

Each medium level sample (water and soil) must be enclosed and sealed in a metal paint can for shipment. If it is not certain whether a sample should be categorized as low or medium concentration, volume should be collected and the sample preserved as specified for low level samples, however shipping procedures must be followed as designated for medium level samples. For water samples, one field blank should be supplied for each Case. No blanks are currently required for soil samples. No additional volume is required for duplicate analyses of either water or soil samples.

If sufficient sample volume is not provided, analysis of all required parameters and/or complete QA/QC determination may not be possible. If this occurs, SMO will contact the RSCC to determine appropriate adjustments in analysis.

Required sample volume and container types for inorganic RAS analysis of water and soil samples are illustrated in Appendix C. Pre-cleaned sample bottles are available through the Sample Bottle Repository, as detailed in Chapter IV.

2. Constituents Identified and Quantified

The inorganic RAS program provides identification and quantification of metals and cyanide in water and soil/sediment samples. These compounds are listed on the inorganic data reporting form included in Appendix B.

3. Contract Deliverable Requirements

The inorganic RAS program specifies contractually-required deliverables for completion of metals and cyanide analysis and submission of the final data package within 30 days of sample receipt at the laboratory. Laboratories are subject to financial penalties for late delivery and incentives for early delivery of the final data package. Illegible data reports are considered unacceptable and the laboratory is required to resubmit readable versions of any illegible pages.

The inorganic RAS data package supports independent sample data review by the client user. Through review of data package components, the client can determine the quality of the analytical data.

Each inorganic RAS data package includes the following components:

- Cover sheet, listing the samples included in the report and narrative comments describing problems encountered in analysis.
- Tabulated results of inorganic compounds identified and quantified, reported in ug/l or mg/kg.

- Analytical results for QC spikes, duplicates, standards, preparation blanks calibration verification and interference checks.
- Tabulation of instrument detection limits determined in pure water solutions.
- Raw data system printouts, identifying calibration standards, calibration blanks, preparation blanks, samples and any atypical dilution, duplicates, spikes, interference checks and any instrument adjustments or apparent anomalies on the measurement record.

A summary of RAS inorganic contract deliverables and copies of data reporting forms are contained in Appendix B.

4. Analytical Protocols

The standardized inorganic analytical methods are based on Federal Register (FR) methods, EPA Methods for Chemical Analysis of Water and Wastes (MCAWW), and Test Methods for Evaluating Solid Waste (SW-846), for the analysis of water and soil samples. Analysis for specified metals and cyanide is performed by flame, furnace and cold vapor atomic absorption (AA), colorimetric, distillation, and inductively coupled argon plasma (ICP) methods.

a. Water Method

Water samples for metals analysis are prepared, acid digested and the digestate filtered to remove insoluble materials prior to analysis. Samples are analyzed by AA or ICP methods, and dilutions are performed where any analyte concentration exceeds the calibrated range.

For water samples, a quantitative determination for cyanide is made by midi-distillation and automated colorimetric analysis by MCAWW Method 335.2.

b. Soil/Sediment Method

Soil samples for metals analysis are prepared and acid digested and the digestate filtered to remove insoluble materials prior to analysis. Samples are analyzed by AA or ICP methods, and dilutions are performed where any analyte concentration exceeds the calibrated range.

For soil samples, a quantitative determination for cyanide is made by midi-distillation and automated colorimetric analysis by MCAWW Method 335.2.

c. Detection Limits

The detection limits listed on the inorganic data sheets (see Appendix B) are based on analysis of analytes in pure water. Detection limits for the sample analyses will be higher, depending on the sample matrix.

Detection limits for low level water samples can be achieved in the part-per-billion (ppb) to low part-per-million (ppm) range; detection limits for medium water and soil samples can be achieved in the low-ppm to mid-ppm range. Detection limits are significantly affected by matrix interferences and other sample parameters that vary considerably depending on the nature and homogeneity of the sample, interferent contaminants that coextract from the sample, and analytical method. Lowest detection limits are achieved on low level water samples in the ppb range, where sample matrix interferences are minimal.

Exhibit C of the Statement of Work of inorganics IFB contracts contains minimum contract-required instrument detection levels (IDLs) that must be met by all laboratories for each of the metals and cyanide in pure water.

Extrapolations from the "pure water" IDLs must be made to estimate the detection limits for low and medium water and soil samples, since the detection levels achievable for these samples will be highly dependent on the inorganic species and matrix of each sample. Although data is reported down to the "pure water" IDL, results below the contract-required detection levels should be used with caution.

5. Contract Quality Control Requirements

The CLP quality control (QC) program for inorganic RAS laboratory analysis is structured to provide consistent results of known and documented quality. The program therefore places stringent quality control requirements on all laboratories performing sample analysis. Sample data packages contain documentation of a series of QC operations that allow an experienced chemist to determine the quality of the data and its applicability to each investigation. In addition, laboratory contracts contain provisions for sample re-analysis if and when specified QC criteria are not met by the contract laboratory. Each CLP laboratory is also encouraged to develop additional internal QA/QC procedures.

The minimum QC requirements of the inorganic RAS program consist of both an initial and ongoing demonstration of laboratory capability to generate acceptable precision and accuracy with the contract methods in the analysis of water and soil samples. CLP contracts define extensive QA

procedures that must be performed and documented, and criteria that must be met. These include, but are not limited to, the following:

- Initial calibration and calibration verification.
- Continuing calibration verification.
- ICP interference check sample analysis.
- Preparation blank analysis.
- Matrix spike analysis.
- Duplicate sample analysis.
- Laboratory control sample analysis.

The instrument QC operations include initial and continuing calibration checks, which are performed daily and/or every ten samples. These checks determine that the analytical system is meeting contract-required criteria.

Analytical QC operations include: ICP interference check sample, preparation blank, spiked sample, and duplicate sample analyses. ICP interference check sample analyses are performed at least twice per eight-hour shift, to verify interelement and background correction factors. Preparation blank analyses are performed for each batch of samples or for each set of 20 samples, to ascertain whether sample concentrations reflect contamination. Spiked sample analyses and duplicate sample analyses are performed for each matrix within a Case of samples or for each set of 20 samples of a similar matrix within a Case, to provide information concerning sample homogeneity, analytical precision and accuracy, the effect of the sample matrix on the analytical methodology, and to enable the Agency to evaluate the long-term precision of the method. The laboratory control sample is a standard carried through sample preparation and analysis procedures to document the performance of the entire sample process.

It is the responsibility of the contractor laboratory to document, in each data package submitted, that both initial and ongoing instrument and analytical QC criteria have been met. The laboratory must demonstrate that instrument calibration criteria have been met, that interferences from the analytical system are under control, and that spike recoveries falling outside contract acceptance windows are attributable to sample matrix interferences and not to laboratory analytical errors. Any samples analyzed when contract QC criteria have not been met are re-analyzed by the laboratory.

Appendix C

APPENDIX C - CONTRACT REQUIRED DETECTION LIMITS

EXHIBIT C

Hazardous Substance List (HSL) and Contract Required Detection Limits (CRDL)**

Volatiles	CAS Number	Detection Limits* Low Water[a] ug/L	Low Soil/Sediment[b] ug/Kg
1. Chloromethane	74-87-3	10	10
2. Bromomethane	74-83-9	10	10
3. Vinyl Chloride	75-01-4	10	10
4. Chloroethane	75-00-3	10	10
5. Methylene Chloride	75-09-2	5	5
6. Acetone	67-64-1	10	10
7. Carbon Disulfide	75-15-0	5	5
8. 1,1-Dichloroethene	75-35-4	5	5
9. 1,1-Dichloroethane	75-35-3	5	5
10. trans-1,2-Dichloroethene	156-60-5	5	5
11. Chloroform	67-66-3	5	5
12. 1,2-Dichloroethane	107-06-2	5	5
13. 2-Butanone	78-93-3	10	10
14. 1,1,1-Trichloroethane	71-55-6	5	5
15. Carbon Tetrachloride	56-23-5	5	5
16. Vinyl Acetate	108-05-4	10	10
17. Bromodichloromethane	75-27-4	5	5
18. 1,1,2,2-Tetrachloroethane	79-34-5	5	5
19. 1,2-Dichloropropane	78-87-5	5	5
20. trans-1,3-Dichloropropene	10061-02-6	5	5
21. Trichloroethene	79-01-6	5	5
22. Dibromochloromethane	124-48-1	5	5
23. 1,1,2-Trichloroethane	79-00-5	5	5
24. Benzene	71-43-2	5	5
25. cis-1,3-Dichloropropene	10061-01-5	5	5

(continued)

Volatiles	CAS Number	Detection Limits* Low Water[a] ug/L	Low Soil/Sediment[b] ug/Kg
26. 2-Chloroethyl Vinyl Ether	110-75-8	10	10
27. Bromoform	75-25-2	5	5
28. 2-Hexanone	591-78-6	10	10
29. 4-Methyl-2-pentanone	108-10-1	10	10
30. Tetrachloroethene	127-18-4	5	5
31. Toluene	108-88-3	5	5
32. Chlorobenzene	108-90-7	5	5
33. Ethyl Benzene	100-41-4	5	5
34. Styrene	100-42-5	5	5
35. Total Xylenes		5	5

[a]Medium Water Contract Required Detection Limits (CRDL) for Volatile HSL Compounds are 100 times the individual Low Water CRDL.

[b]Medium Soil/Sediment Contract Required Detection Limits (CRDL) for Volatile HSL Compounds are 100 times the individual Low Soil/Sediment CRDL.

Semi-Volatiles	CAS Number	Detection Limits[a] Low Water[c] ug/l	Low Soil/Sediment[d] ug/Kg
36. Phenol	108-95-2	10	330
37. bis(2-Chloroethyl) ether	111-44-4	10	330
38. 2-Chlorophenol	95-57-8	10	330
39. 1,3-Dichlorobenzene	541-73-1	10	330
40. 1,4-Dichlorobenzene	106-46-7	10	330
41. Benzyl Alcohol	100-51-6	10	330
42. 1,2-Dichlorobenzene	95-50-1	10	330
43. 2-Methylphenol	95-48-7	10	330
44. bis(2-Chloroisopropyl) ether	39638-32-9	10	330
45. 4-Methylphenol	106-44-5	10	330
46. N-Nitroso-Dipropylamine	621-64-7	10	330
47. Hexachloroethane	67-72-1	10	330
48. Nitrobenzene	98-95-3	10	330
49. Isophorone	78-59-1	10	330
50. 2-Nitrophenol	88-75-5	10	330
51. 2,4-Dimethylphenol	105-67-9	10	330
52. Benzoic Acid	65-85-0	50	1600
53. bis(2-Chloroethoxy) methane	111-91-1	10	330
54 2,4-Dichlorophenol	120-83-2	10	330
55. 1,2,4-Trichlorobenzene	120-82-1	10	330
56. Naphthalene	91-20-3	10	330
57. 4-Chloroaniline	106-47-8	10	330
58. Hexachlorobutadiene	87-68-3	10	330
59. 4-Chloro-3-methylphenol (para-chloro-meta-cresol)	59-50-7	10	330
60. 2-Methylnaphthalene	91-57-6	10	330
61. Hexachlorocyclopentadiene	77-47-4	10	330
62. 2,4,6-Trichlorophenol	88-06-2	10	330
63. 2,4,5-Trichlorophenol	95-95-4	50	1600

(continued

Semi-Volatiles	CAS Number	Detection Limits[a] Low Water[c] ug/L	Low Soil/Sediment[d] ug/Kg
64. 2-Chloronaphthalene	91-58-7	10	330
65. 2-Nitroaniline	88-74-4	50	1600
66. Dimethyl Phthalate	131-11-3	10	330
67. Acenaphthylene	208-96-8	10	330
68. 3-Nitroaniline	99-09-2	50	1600
69. Acenaphthene	83-32-9	10	330
70. 2,4-Dinitrophenol	51-28-5	50	1600
71. 4-Nitrophenol	100-02-7	50	1600
72. Dibenzofuran	132-64-9	10	330
73. 2,4-Dinitrotoluene	121-14-2	10	330
74. 2,6-Dinitrotoluene	606-20-2	10	330
75. Diethylphthalate	84-66-2	10	330
76. 4-Chlorophenyl Phenyl ether	7005-72-3	10	330
77. Fluorene	86-73-7	10	330
78. 4-Nitroaniline	100-01-6	50	1600
79. 4,6-Dinitro-2-methylphenol	534-52-1	50	1600
80. N-nitrosodiphenylamine	86-30-6	10	330
81. 4-Bromophenyl Phenyl ether	101-55-3	10	330
82. Hexachlorobenzene	118-74-1	10	330
83. Pentachlorophenol	87-86-5	50	1600
84. Phenanthrene	85-01-8	10	330
85. Anthracene	120-12-7	10	330
86. Di-n-butylphthalate	84-74-2	10	330
87. Fluoranthene	206-44-0	10	330
88. Pyrene	129-00-0	10	330
89. Butyl Benzyl Phthalate	85-68-7	10	330
90. 3,3'-Dichlorobenzidine	91-94-1	20	660
91. Benzo(a)anthracene	56-55-3	10	330
92. bis(2-ethylhexyl)phthalate	117-81-7	10	330
93. Chrysene	218-01-9	10	330
94. Di-n-octyl Phthalate	117-84-0	10	330
95. Benzo(b)fluoranthene	205-99-2	10	330
96. Benzo(k)fluoranthene	207-08-9	10	330
97. Benzo(a)pyrene	50-32-8	10	330

(continued)

Semi-Volatiles	CAS Number	Detection Limits[a] Low Water[c] ug/L	Low Soil/Sediment[d] ug/Kg
98. Indeno(1,2,3-cd)pyrene	193-39-5	10	330
99. Dibenz(a,h)anthracene	53-70-3	10	330
100. Benzo(g,h,i)perylene	191-24-2	10	330

[c]Medium Water Contract Required Detection Limits (CRDL) for Semi-Volatile HSL Compounds are 100 times the individual Low Water CRDL.

[d]Medium Soil/Sediment Contract Required Detection Limits (CRDL) for Semi-Volatile HSL Compounds are 60 times the individual Low Soil/Sediment CRDL.

Pesticides	CAS Number	Detection Limits* Low Water[e] ug/L	Low Soil/Sediment[f] ug/Kg
101. alpha-BHC	319-84-6	0.05	8.0
102. beta-BHC	319-85-7	0.05	8.0
103. delta-BHC	319-86-8	0.05	8.0
104. gamma-BHC (Lindane)	58-89-9	0.05	8.0
105. Heptachlor	76-44-8	0.05	8.0
106. Aldrin	309-00-2	0.05	8.0
107. Heptachlor Epoxide	1024-57-3	0.05	8.0
108. Endosulfan I	959-98-8	0.05	8.0
109. Dieldrin	60-57-1	0.10	16.0
110. 4,4'-DDE	72-55-9	0.10	16.0
111. Endrin	72-20-8	0.10	16.0
112. Endosulfan II	33213-65-9	0.10	16.0
113. 4,4'-DDD	72-54-8	0.10	16.0
114. Endosulfan Sulfate	1031-07-8	0.10	16.0
115. 4,4'-DDT	50-29-3	0.10	16.0
116. Endrin Ketone	53494-70-5	0.10	16.0
117. Methoxychlor	72-43-5	0.5	80.0
118. Chlordane	57-74-9	0.5	80.0
119. Toxaphene	8001-35-2	1.0	160.0
120. AROCLOR-1016	12674-11-2	0.5	80.0
121. AROCLOR-1221	11104-28-2	0.5	80.0
122. AROCLOR-1232	11141-16-5	0.5	80.0
123. AROCLOR-1242	53469-21-9	0.5	80.0
124. AROCLOR-1248	12672-29-6	0.5	80.0
125. AROCLOR-1254	11097-69-1	1.0	160.0
126. AROCLOR-1260	11096-82-5	1.0	160.0

[e]Medium Water Contract Required Detection Limits (CRDL) for Pesticide HSL Compounds are 100 times the individual Low Water CRDL.

[f]Medium Soil/Sediment Contract Required Detection Limits (CRDL) for Pesticide HSL compounds are 15 times the individual Low Soil/Sediment CRDL.

*Detection limits listed for soil/sediment are based on wet weight. The detection limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, as required by the contract, will be higher.

** Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable.

Table 1. Elements Determined by Inductively Coupled Plasma Emission or Atomic Absorption Spectroscopy

Element	Contract Required Detection Level[1,2] (ug/L)
Aluminum	200
Antimony	60
Arsenic	10
Barium	200
Beryllium	5
Cadmium	5
Calcium	5000
Chromium	10
Cobalt	50
Copper	25
Iron	100
Lead	5
Magnesium	5000
Manganese	15
Mercury	0.2
Nickel	40
Potassium	5000
Selenium	5
Silver	10
Sodium	5000
Thallium	10
Vanadium	50
Zinc	20

Appendix D

APPENDIX D - BORING LOGS AND WELL CONSTRUCTIONS

PROJECT NUMBER	BORING NUMBER SHEET OF

SOIL BORING LOG

PROJECT _____ LOCATION MW7 MW8

ELEVATION _____ DRILLING CONTRACTOR _____

DRILLING METHOD AND EQUIPMENT _____

WATER LEVEL AND DATE _____ START _____ FINISH _____ LOGGER _____

ELEVATION	DEPTH BELOW SURFACE	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	HEAD SPACE OVA (HNu)	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	5					Till, tan-brown silt w/coarse and fine sand			
	10								
	15								
						Coal (Bedford)			
						Carbonaceous Shale			
	20					Brown-gray Claystone, Broken			BOH @ 20'
	25					Gray shale, interlaminated w/light-gray sandstone, tr bituminous fossils			
	30								

PROJECT NUMBER	BORING NUMBER SHEET OF

SOIL BORING LOG

PROJECT _____ LOCATION MW7 MW8

ELEVATION _____ DRILLING CONTRACTOR _____

DRILLING METHOD AND EQUIPMENT _____

WATER LEVEL AND DATE _____ START _____ FINISH _____ LOGGER _____

ELEVATION	DEPTH BELOW SURFACE	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	HEAD SPACE OVA (HNu)	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	35					Gray shale, interlaminated w/light-gray sandstone, tr bituminous fossils			
	40								
	45					Coal (lower mercer?) interbedded claystone and shale			
	50					Brown-gray limestone			
						Dark-gray claystone			
	55					Dark-gray shale and claystone w/some soft seams and carbonaceous intervals			
	60								

PROJECT NUMBER	BORING NUMBER SHEET OF

SOIL BORING LOG

PROJECT _____ LOCATION _____

ELEVATION _____ DRILLING CONTRACTOR _____

DRILLING METHOD AND EQUIPMENT _____

WATER LEVEL AND DATE _____ START _____ FINISH _____ LOGGER _____

ELEVATION	DEPTH BELOW SURFACE	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	HEAD SPACE OVA (HNu)	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS TESTS AND INSTRUMENTATION
	65								
	70					Dark-gray shale and claystone w/some soft seams and carbonaceous intervals			
	75								
	80								
						Coal (unknown) w/tr-pyrite			
						Light-gray sandstone, fine			
	85					Gray siltstone and silty shale, occasional silty sandstone laminate and bands of dark-gray clayey siltstone			
	90					Carbonaceous shale and coal			

PROJECT NUMBER	BORING NUMBER SHEET OF

SOIL BORING LOG

PROJECT _____ LOCATION _____

ELEVATION _____ DRILLING CONTRACTOR _____

DRILLING METHOD AND EQUIPMENT _____

WATER LEVEL AND DATE _____ START _____ FINISH _____ LOGGER _____

ELEVATION	DEPTH BELOW SURFACE	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	HEAD SPACE OVA (HNu)	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
						Carbonaceous shale and coal			
	95								
						Silty shale			
	100								
						Gray siltstone and silty shale, occasional silty sandstone laminate and bands of dark-gray clayey siltstone			
						Silty sandstone			
	105								
	110								
						Black - carbonaceous			
	115								
	120								

PROJECT NUMBER	BORING NUMBER SHEET OF

SOIL BORING LOG

PROJECT _____ LOCATION MW7 MW8

ELEVATION _____ DRILLING CONTRACTOR _____

DRILLING METHOD AND EQUIPMENT _____

WATER LEVEL AND DATE _____ START _____ FINISH _____ LOGGER _____

ELEVATION	DEPTH BELOW SURFACE	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	HEAD SPACE OVA (HNu)	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	125					Gray siltstone and silty shale, occasional silty sandstone laminate and bands of dark-gray clayey siltstone			
	130								
	135								
						Green-gray siltstone, sandy			
	140					BOH 140' Elev. 966.84			BOH @ 140'

PROJECT NUMBER	BORING NUMBER SHEET OF

SOIL BORING LOG

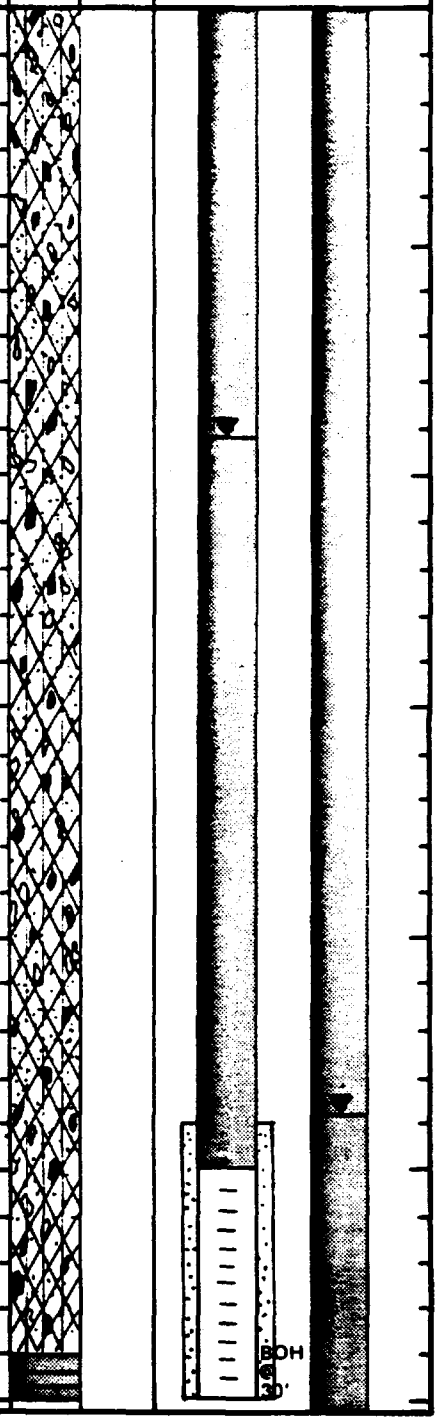
PROJECT _____ LOCATION MW9 MW10

ELEVATION _____ DRILLING CONTRACTOR _____

DRILLING METHOD AND EQUIPMENT _____

WATER LEVEL AND DATE _____ START _____ FINISH _____ LOGGER _____

ELEVATION	DEPTH BELOW SURFACE	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	HEAD SPACE OVA (HNu)	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	5					Fill, tan-brown silt, some sandy, w/rock frags and fine coal refuse			
	10								
	15								
	20								
	25								BOH @ 30'
	30					Black carbonaceous shale, weathered			



PROJECT NUMBER	BORING NUMBER SHEET OF

SOIL BORING LOG

PROJECT _____ LOCATION MW9 MW10

ELEVATION _____ DRILLING CONTRACTOR _____

DRILLING METHOD AND EQUIPMENT _____

WATER LEVEL AND DATE _____ START _____ FINISH _____ LOGGER _____

ELEVATION	DEPTH BELOW SURFACE	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	HEAD SPACE OVA (HNu)	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	35					??(Inadequate recovery and logging)			
	40					Coal (lower mercer)			
						BOH @ 40' Elev. 1057.07			BOH @ 40'

PROJECT NUMBER	BORING NUMBER SHEET OF

SOIL BORING LOG

PROJECT _____ LOCATION MW13 MW12 MW11

ELEVATION _____ DRILLING CONTRACTOR _____

DRILLING METHOD AND EQUIPMENT _____

WATER LEVEL AND DATE _____ START _____ FINISH _____ LOGGER _____

ELEVATION	DEPTH BELOW SURFACE	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	HEAD SPACE OVA (HNu)	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	5					Fill, dark-brown silt, w/rock frags, coarse sand, and crushed limestone			
	10								
	15					Till, medium-brown silt, some sandy, w/coal and rock frags			
	20								
	25					Tan sandy silt and clay w/tr sand			BOH @ 25'
	30								

PROJECT NUMBER	BORING NUMBER SHEET OF

SOIL BORING LOG

PROJECT _____ LOCATION MW13 MW12 MW11

ELEVATION _____ DRILLING CONTRACTOR _____

DRILLING METHOD AND EQUIPMENT _____

WATER LEVEL AND DATE _____ START _____ FINISH _____ LOGGER _____

ELEVATION	DEPTH BELOW SURFACE	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	HEAD SPACE OVA (HNu)	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
						Tan sandy silt and clay w/tr sand			
						Gray siltstone, sandy			
	35					Limestone			
	40					Dark-gray shale, silty some limestone			
	45								
	50								
						Coal (lower mercer?)			
	55					Silty SS Light to dark-gray siltstone and interbedded silty sandstone and shale, some limestone			
	60								

PROJECT NUMBER	BORING NUMBER SHEET OF

SOIL BORING LOG

PROJECT _____ LOCATION _____

ELEVATION _____ DRILLING CONTRACTOR _____

DRILLING METHOD AND EQUIPMENT _____

WATER LEVEL AND DATE _____ START _____ FINISH _____ LOGGER _____

ELEVATION	DEPTH BELOW SURFACE	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	HEAD SPACE OVA (HNu)	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS TESTS AND INSTRUMENTATION
	65					Siltstone Limestone Shale			
	70					Light to dark-gray siltstone and interbedded silty sandstone and shale, some limestone			
	75					Siltstone Silty SS			
	80								
	85					Siltstone			BOH @ 87'
	90								

PROJECT NUMBER	BORING NUMBER SHEET OF

SOIL BORING LOG

PROJECT _____ LOCATION MW13 MW12 MW11

ELEVATION _____ DRILLING CONTRACTOR _____

DRILLING METHOD AND EQUIPMENT _____

WATER LEVEL AND DATE _____ START _____ FINISH _____ LOGGER _____

ELEVATION	DEPTH BELOW SURFACE	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	HEAD SPACE OVA (HNu)	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
						Siltstone			
	95					Interbedded SS & Shale			
	100					Light-gray sandstone, fine, some silty sandstone grading to sandy siltstone			
						Siltstone			
	105					Shale			
	110					Silty SS			
	115								
						BOH @ 117' Elev. 979.43			BOH @ 117'

PROJECT NUMBER	BORING NUMBER SHEET OF

SOIL BORING LOG

PROJECT _____ LOCATION MW14

ELEVATION _____ DRILLING CONTRACTOR _____

DRILLING METHOD AND EQUIPMENT _____

WATER LEVEL AND DATE _____ START _____ FINISH _____ LOGGER _____

ELEVATION	DEPTH BELOW SURFACE	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	HEAD SPACE OVA (HNu)	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	5								
	10					Fill, tan silt, some sandy, w/rock frags and sand			
	15								
	20								
	25								
						Coal (unknown)			
						Dark-gray siltstone			
	30								

PROJECT NUMBER	BORING NUMBER SHEET OF

SOIL BORING LOG

PROJECT _____ LOCATION MW14

ELEVATION _____ DRILLING CONTRACTOR _____

DRILLING METHOD AND EQUIPMENT _____

WATER LEVEL AND DATE _____ START _____ FINISH _____ LOGGER _____

ELEVATION	DEPTH BELOW SURFACE	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	HEAD SPACE OVA (HNu)	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
						Dark-gray siltstone			
						Medium-gray silty sandstone			
	35								
	40								
						Siltstone			
						Dark-gray to gray siltstone w/interbedded silty shale and limestone			
	45								
	50								
						Limestone			
	55					Shale			
						Siltstone			
	60								

PROJECT NUMBER	BORING NUMBER SHEET OF

SOIL BORING LOG

PROJECT _____ LOCATION MW14

ELEVATION _____ DRILLING CONTRACTOR _____

DRILLING METHOD AND EQUIPMENT _____

WATER LEVEL AND DATE _____ START _____ FINISH _____ LOGGER _____

ELEVATION	DEPTH BELOW SURFACE	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	HEAD SPACE OVA (HNu)	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
						Siltstone			
						Coal (lower mercer?) and carbonaceous shale			
	65								
	70								
	75					Green-gray siltstone w/interbedded silty claystone and shale, some carbonaceous shale and sandstone			
	80								
	85								
	90								

PROJECT NUMBER	BORING NUMBER SHEET OF

SOIL BORING LOG

PROJECT _____ LOCATION _____

ELEVATION _____ DRILLING CONTRACTOR _____

DRILLING METHOD AND EQUIPMENT _____

WATER LEVEL AND DATE _____ START _____ FINISH _____ LOGGER _____

ELEVATION	DEPTH BELOW SURFACE	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	HEAD SPACE OVA (HNu)	COMMENTS: DEPTH OF CASING DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	95					Green-gray siltstone w/interbedded silty claystone and shale, some carbonaceous shale and sandstone			
	100								
	105								
	110					Medium to dark-gray silty sandstone w/interbedded black shale			
	115								
	120					Medium to dark-gray siltstone, some silty sandstone, little fine sand			

PROJECT NUMBER	BORING NUMBER SHEET OF

SOIL BORING LOG

PROJECT _____ LOCATION _____

ELEVATION _____ DRILLING CONTRACTOR _____

DRILLING METHOD AND EQUIPMENT _____

WATER LEVEL AND DATE _____ START _____ FINISH _____ LOGGER _____

ELEVATION	DEPTH BELOW SURFACE	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	HEAD SPACE OVA (HNu)	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
						Medium to dark-gray siltstone, some silty sandstone, little fine sand			
	125								
						Light-gray sandstone, fine, some silty sandstone grading to sandy siltstone			
	130								
						BOH @ 132' Elev. 967.34			BOH @ 132'

PROJECT NUMBER	BORING NUMBER SHEET OF

SOIL BORING LOG

PROJECT _____ LOCATION MW16 MW15

ELEVATION _____ DRILLING CONTRACTOR _____

DRILLING METHOD AND EQUIPMENT _____

WATER LEVEL AND DATE _____ START _____ FINISH _____ LOGGER _____

ELEVATION	DEPTH BELOW SURFACE	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	HEAD SPACE OVA (HNu)	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	5					Fill, brown and tan silt, some sandy w/rock and coal frags and sand			
	10								
	15								
	20					Till, light to medium-brown silt and fine sand			BOH @ 19'
						Coal (bedford)			
	25					Gray siltstone, weathered and broken			
	30								

PROJECT NUMBER	BORING NUMBER SHEET OF

SOIL BORING LOG

PROJECT _____ LOCATION MW16 MW15

ELEVATION _____ DRILLING CONTRACTOR _____

DRILLING METHOD AND EQUIPMENT _____

WATER LEVEL AND DATE _____ START _____ FINISH _____ LOGGER _____

ELEVATION	DEPTH BELOW SURFACE	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	HEAD SPACE OVA (HNu)	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	35					Gray siltstone, weathered and broken			
						Coal (lower mercer)			
	40					BOH @ 40.9 Elev. 1056.22			BOH @ 40.9'

PROJECT NUMBER	BORING NUMBER SHEET OF

SOIL BORING LOG

PROJECT _____ LOCATION MW17

ELEVATION _____ DRILLING CONTRACTOR _____

DRILLING METHOD AND EQUIPMENT _____

WATER LEVEL AND DATE _____ START _____ FINISH _____ LOGGER _____

ELEVATION	DEPTH BELOW SURFACE	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	HEAD SPACE OVA (HNu)	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
						Fill, brown silt w/decomposed rock and coal, tr wood			
	5					Tan and gray clay, mottled			
	10					Medium-gray silty shale, weathered and iron stained			
						BOH @ 10.4' Elev. 1073.85			BOH @ 10.4'

WELL / BORING NO.: MW 18 BY: DS

DATE COMPLETED: 6/30/85 JOB NO.: 86301

JOB NAME: SUMMIT NATIONAL

LOCATION: DEERFIELD, OHIO

DRILLING COMPANY: BOWSER MORNER BORING DIAMETER: 6¼"

DRILLING METHOD: HOLLOW STEM AUGER DEVELOPMENT:

ELEVATION: GROUND SURFACE: OUTER CASING:

INNER CASING: 2" PVC SCALE: 1" = 10 FT

DEPTH	LITHOLOGY	RECOVERY	% RECOVERY	BLOWS/RQD	RUN	PROFILE	DEPTH	WELL CONSTRUCTION	COMMENTS
	BLACK TO BROWN SILTY CLAY TO SAND WITH ROCK FRAGMENTS AND COAL FRAGMENTS — MINE SPOIL —			3,4,3,4				FROST COVER; CEMENT APRON	
				3,3,3,3				CEMENT BENTONITE GROUT	
10	— FILL —			3,3,4,5				2" ϕ SCHD 80 PVC RISER PIPE	
				6,6,6,7				BENTONITE PELLETS	
25				8,8,10,12				FINE GRAVEL FILTER PACK	
				20,10,12,10					
30	TOP OF ROCK			7,10,12,15				2" ϕ SCHD 80 PVC WELL SCREEN	
33'	BOTTOM OF BORING								

WELL / BORING NO.: MW-19 BY: [illegible]

DATE COMPLETED: 11/9/86 JOB NO.: 84110

JOB NAME: Summit National Site

LOCATION: Deerfield, Ohio

DRILLING COMPANY: Pennsylvania Drilling (Hand) BORING DIAMETER ____

DRILLING METHOD: Auger and carbide bit DEVELOPMENT: ____

ELEVATION: GROUND SURFACE: ____ OUTER CASING: ____

INNER CASING: ____ SCALE: 1" = 10 FT

SRW

DEPTH	LITHOLOGY	RECOVERY	% RECOVERY	BLOWS/RQD	RUN	PROFILE	DEPTH	WELL CONSTRUCTION	COMMENTS
1.5	Black shale fragments, fine coal dust, occasional silt (MINE SPOIL)	0.6		3,7,7	1			Boring grouted and abandoned	
5.0									
6.5		1.3		6,8,15	2				
10.0									
11.5		0.2		3,4,6	3				
15.0									
16.5		0.8		10,4,6	4				approx water table
20.0									
21.5		0.9		6,7,8	5				
25.0									
26.5	Medium-brown silt and sand, some gravel, fines at top (TILL)	1.0		5,7,12	6				
30.0									
31.5		1.0		7,10,11	7				
35.0									
36.5		1.5		8,10,4	8				
40.0									
41.5	Shale, very-dark-gray, highly weathered.	0.2		50/4	9				probable bedrock

WELL / BORING NO.: MW 19 BY: DS

DATE COMPLETED: 6-25-86 JOB NO.: 86301

JOB NAME: SUMMIT NATIONAL

LOCATION: DEERFIELD OHIO

DRILLING COMPANY: PARKER MORNER BORING DIAMETER: 6 1/4"

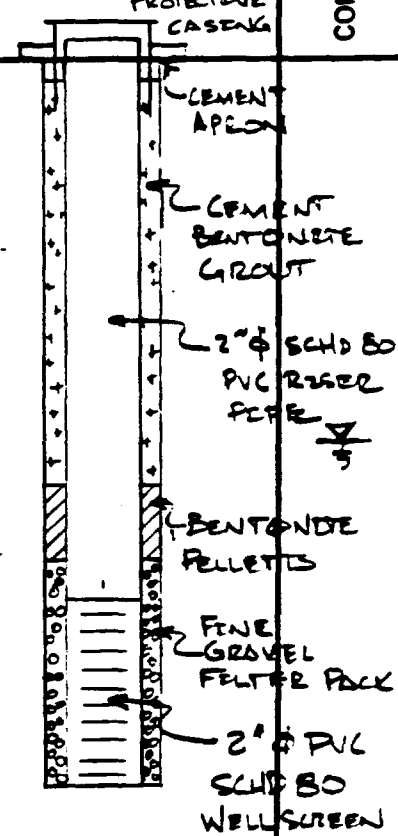
DRILLING METHOD: HOLLOW STEM AUGER DEVELOPMENT:

ELEVATION: GROUND SURFACE: OUTER CASING:

INNER CASING: 2" PVC SCALE: 1" = 10 FT

SRW

DEPTH	LITHOLOGY	RECOVERY	% RECOVERY	BLOWS/RQD	RUN	PROFILE	DEPTH	WELL CONSTRUCTION	COMMENTS
	BLACK SHALE AND COAL REFUSE FRAGMENTS WITH OCCASIONAL ZONES OF BROWN SILTY CLAY (MINE SPOIL)								
10									
20									
	MEDIUM BROWN SILT AND SAND, SOME GRAVEL (TILL)								
30									
35'	BOTTOM OF HOLE								



WELL / BORING NO.: MW-20 BY: [illegible]

DATE COMPLETED: 12/19/85 JOB NO.: 84110

JOB NAME: Summit National Site

LOCATION: Deerfield Ohio

DRILLING COMPANY: [illegible] BORING DIAMETER: ____

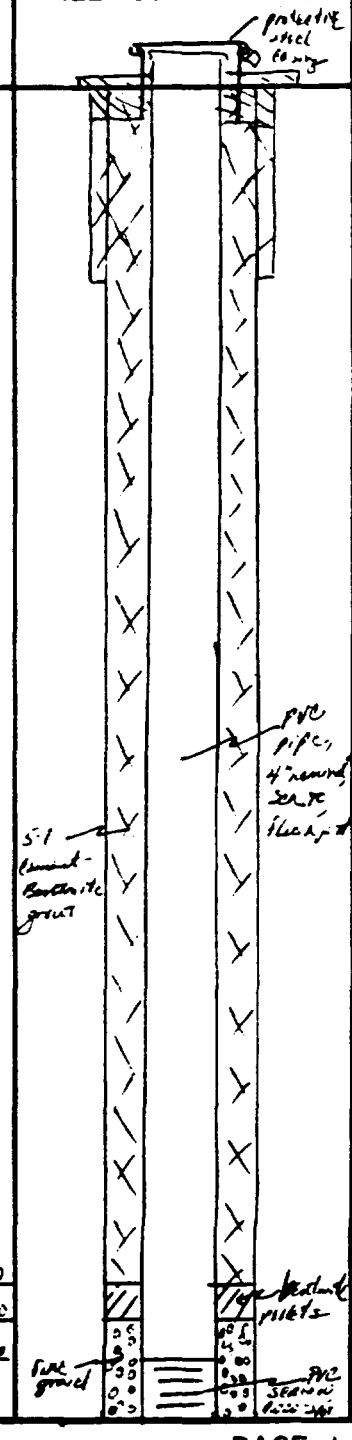
DRILLING METHOD: [illegible] DEVELOPMENT: ____

ELEVATION: GROUND SURFACE: ____ OUTER CASING: ____

INNER CASING: ____ SCALE: 1" = 10 FT

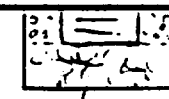
SRW

DEPTH	LITHOLOGY	RECOVERY	% RECOVERY	BLOWS/RQD	RUN	PROFILE	DEPTH	WELL CONSTRUCTION	COMMENTS
1.5	SILT w/ SAND, ROCK FRAGMENTS, ROOTS, GLEY (FILL)	1.5	100	1,3,6	1				
5.0	GRAVEL SANDY SILT w/ SUBANGULAR COARSE SAND & GRAVEL, ROCK FRAGMENTS, WET (TILL)								
6.5		1.1		6,12,17	2				
10.0									
11.5	SILTSTONE, GREEN-GRAY, FINING DOWNWARD, VERY WEATHERED AT TOP FINING DOWNWARD	1.2		8,46,102	3				STARTING CORING
15.0		0.8		0%	1				
	SILTY SHALE, GREEN-GRAY TO DARK-GRAY, HARD CONCRETIONS, TRACE PYRITE, FINING DOWNWARD	9.4	94	0%	2				WATER BLOWN OUT OF MW-20 & MW-20 IS ADVANCED
25.0	CARBONACEOUS SHALE AND BONE COAL								
25.9									
27.4	CLAYSTONE, VERY DARK-GRAY UNDULAR LAMINAE, GRADING DOWNWARD TO BROWN CLAYSTONE WITH CARBONACEOUS LAMINAE								
29.5	SILTSTONE, LIGHT-GREEN-GRAY, WITH SANDY BEDS, SLIGHTLY FOSSILIFEROUS	9.3	93	15%	3				
35.0	MUDSTONE DARK-GRAY, OCCASIONAL SANDSTONE LAMINAE, HARD SILTSTONE CONCRETIONS RARE, TRACE PYRITE								
37.7									
41.1	SHALE, DARK-GRAY, HARD SILTSTONE CONCRETIONS, CALCITE VEINS IN LOWER HALF	9.4	94	31%	4			5:1 cement-bentonite grout	
44.2	LIMESTONE, GRAY, FOSSILIFEROUS, SOMETIMES CLASTIC								
45.0	CLAYSTONE GRADING DOWNWARD TO SHALE, DARK-GRAY								
	SILTSTONE, MEDIUM-GRAY, SOMETIMES FISSILE								
	SILTSTONE, DARK-GRAY, TRACE PYRITE	4.7	47	Ø	5				CONTACTS APPROXIMATE DUE TO POOR RECOVERY
55.0	BROWN-GRAY ~~SILTSTONE TO~~ MUDSTONE, FOSSILIFEROUS, TO CLAYSTONE								
	SILTSTONE, DARK GREEN-GRAY, SLIGHTLY SANDY THINBEDDED	5.2	52	35%	6				
	LIMESTONE, DARK-GRAY, SLIGHTLY CRYSTALLINE FOSSILIFEROUS								
65.0	FINE-TO-MEDIUM SANDSTONE, ARGILLACEOUS MATRIX, VERY SOFT						64.0		
[illegible]	SILTY SHALE, VERY DARK-GRAY, FOSSILIFEROUS						66.0		
71.0	BY SILTSTONE, DARK-GREEN-GRAY, MICACEOUS, SHALEY PARTINGS,	5.7		46%	7		67.70	fine gravel	



WELL/BORING NO.: MW-20 JOB NO.: 84110 1" = 10 FT.

SRW

DEPTH	LITHOLOGY	RECOVERY	% RECOVERY	BLOWS/RQD	RUN	PROFILE	DEPTH	WELL CONSTRUCTION	COMMENTS
73.0'	SAME	28		40	6		70		
74.0	BLACK SHALE TO CARBONACEOUS SHALE								
	LAST 2" OF RUN YIELDED LIGHT-COLORED DUST BUT NO RECOVERY							CALIBRATE CUTTINGS	

WELL / BORING NO.: MW-01 BY: TFF

DATE COMPLETED: 6/27/86 JOB NO.: 86301

JOB NAME: SUMMIT NATIONAL

LOCATION: DEERFIELD OHIO

DRILLING COMPANY: DUNCAN BROS BORING DIAMETER 8"

DRILLING METHOD: AIR ROTARY DEVELOPMENT:

ELEVATION: GROUND SURFACE: OUTER CASING:

INNER CASING: 4" PVC SCALE: 1" = 10 FT

SRW

DEPTH	LITHOLOGY	RECOVERY	% RECOVERY	BLOWS/ROD	RUN	PROFILE	DEPTH	WELL CONSTRUCTION	COMMENTS
10	SEE LOG OF MW-20 FOR DESCRIPTION OF SOIL AND BEDROCK						1.4'	PROTECTIVE CASING	
20							2.0	CAP; NEAT CEMENT GROUT	
30									BENTONITE CEMENT GROUT
40									4" PVC RISER SCH. 80 PIPE
50							46.3'		BENTONITE PELLETS
60							55.1'		5 FT. SCREEN SCH. 80 4" ϕ PVC PIPE
70							62.9'		
							63.3	BENTONITE	END PLUG
							65'	SAND	
							69'		

WELL / BORING NO.: MW-22 BY: [illegible]
DATE COMPLETED: 12/19/85 JOB NO.: 5110
JOB NAME: Summit Normal Site
LOCATION: Deerfield Ohio
DRILLING COMPANY: [illegible] BORING DIAMETER: 10"/5"
DRILLING METHOD: Angle/air coring/flushing DEVELOPMENT:
ELEVATION: GROUND SURFACE: OUTER CASING:
INNER CASING: SCALE: 1" = 10 FT

SRW

DEPTH	LITHOLOGY	RECOVERY, ft	% RECOVERY	BLOWS/RQD	RUN	PROFILE	DEPTH	WELL CONSTRUCTION	COMMENTS
1.5	Dark-brown silt + sand, moist	3.1	53	2,3,4	1			Protective steel casing; PVC riser	
5.0	SILTY SHALE FRAGMENTS, SILT, SAND, TRACE COAL (NIRC SPOIL)								
6.5		0.6	86	3,3/6,5	2				
10.0									
11.5		0.7	47	2,6,7	3				
15.0									
16.5		0.5	53	4,4,5	4				
20.0									
21.5		0.6	40	4,5,5	5			Cement-bentonite slurry	
25.0									
26.5		1.1	73	6,9,7	6				
30.0									
31.5	Medium-brown SILT, ABUNDANT SAND, TRACE GRAVEL	0.2	13	6,9,7	7				30-34 ft screen b.t.l.
34	START CORING RIGHT TO SET CASING								
40.0									
41.5	SILTSTONE, VERY DARK-GRAY, VERY BROKEN AND WEATHERED, FOSSILIFEROUS	5.5	55	7%	1			4" b PVC pipe, filled gravel sch 80.	
45	MUDSTONE, BROWN-GRAY, FOSSILIFEROUS								
49.2	SILTSTONE, MEDIUM-GRAY, SOMETIMES SHALY								
50.0	LIMESTONE, MEDIUM-GRAY, MICRITIC, FOSSILIFEROUS						50.3	Bentonite pellets	Calcite-filled joint
53.3									
54.4	SILTY SHALE, BLACK								
	SILTSTONE, MEDIUM- TO DARK-GRAY, SOMETIMES SHALEY	10	100%	35%	2		56.6	PVC screen, 4" b, 0.020 slot	
60.0									
61.2	CARBONACEOUS SHALE, TRACE COAL								
	MUDSTONE, LIGHT-GRAY, FOSSILIFEROUS	3.1	51%	3%	3		63.1	Bentonite pellets	Due to poor core recovery contacts are approximate
70.0									

WELL/BORING NO.: MW-22 JOB NO.: 84110 1" = 10 FT. **SRW**

DEPTH	LITHOLOGY	RECOVERY	% RECOVERY	BLOWS/RQD	RUN	PROFILE	DEPTH	WELL CONSTRUCTION	COMMENTS
74.2									
71.3	SHALE, BLACK, SLIGHTLY CARBONACEOUS								
75.6	SILTSTONE, MEDIUM-GRAY	6.0	60%		4		76		
80.0	SILTSTONE, MEDIUM-GRAY, SOFTER THAN ABOVE, VERY BROKEN, UNDULATE PARTINGS								
81.2	CARBONACEOUS SHALE								
84.1	CLAYSTONE, DARK-GRAY, FOSSILIFEROUS NEAR TOP, SLICKENSIDES AT BASE	3.0	60%	6%	5			BENTONITE AND GROUT	
87.2	SILTSTONE AND CLAYSTONE, GRAY-BROWN, FOSSILIFEROUS						87.2		← OVERBURDEN

WELL / BORING NO.: MW-23 BY: TFF

DATE COMPLETED: 7/2/86 JOB NO.: 86301

JOB NAME: SUMMIT NATIONAL

LOCATION: DEERFIELD OHIO

DRILLING COMPANY: DUNCAN BORING DIAMETER 8"

DRILLING METHOD: AIR ROTARY DEVELOPMENT:

ELEVATION: GROUND SURFACE: OUTER CASING:

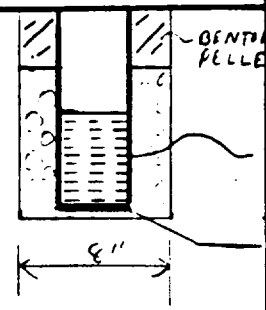
INNER CASING: SCALE: 1" = 10' FT

SRW

DEPTH	LITHOLOGY	RECOVERY	% RECOVERY	BLOWS/ROD	RUN	PROFILE	DEPTH	WELL CONSTRUCTION	COMMENTS
	SEE LOG OF MW-23 FOR DESCRIPTION OF SOIL AND BEDROCK MATERIALS						0.7' 2'	VENT CAP; NEAT CEMENT; PROTECTIVE CASING; BENTONITE-CEMENT GROUT; 4" ϕ SCH 40 PVC PIPE RISER	
10									
20									
30									
40									
50									
60									
70									

WELL/BORING NO.: MW-23 JOB NO.: 86301 1" = 10 FT.

SRW

DEPTH	LITHOLOGY	RECOVERY	% RECOVERY	BLOWS/RQD	RUN	PROFILE	DEPTH	WELL CONSTRUCTION	COMMENTS
	SEE LOG OF MW-23 FOR DESCRIPTION OF						70.2'		
							73'		
							75.5		5 FT. SCREEN SCH. 80 4" ϕ PVC
							81'		END PLUG

WELL / BORING NO.: MW-24 BY: TFF
DATE COMPLETED: 7/10/86 JOB NO.: 86301
JOB NAME: SUMMIT NATIONAL
LOCATION: DEERFIELD OHIO
DRILLING COMPANY: DUNCAN BROS. BORING DIAMETER 8"
DRILLING METHOD: AIR ROTARY DEVELOPMENT:
ELEVATION: GROUND SURFACE: OUTER CASING:
INNER CASING: SCALE: 1" = 10 FT

SRW

DEPTH	LITHOLOGY	RECOVERY	% RECOVERY	BLOWS/RQD	RUN	PROFILE	DEPTH	WELL CONSTRUCTION	COMMENTS
	SEE LOG OF MW-26 FOR DESCRIPTION OF SOIL & BEDROCK MATERIALS						1'	VENT CAP	
10							8'		
20								4" ϕ SCH. 80 PVC PIPE RISER; BENTONITE CEMENT GROUT	
30									
40									
50							57'		
60							54'7"		
							68'	END PLUG	5 FT. SCREEN SCH. 80 4" ϕ PVC
70								B.O.H. 68'	

WELL / BORING NO.: MW-25 BY: TFF

DATE COMPLETED: 7/7/86 JOB NO.: 86301

JOB NAME: SUMMIT NATIONAL

LOCATION: DEERFIELD, OHIO

DRILLING COMPANY: DUNCAN BROS BORING DIAMETER 8"

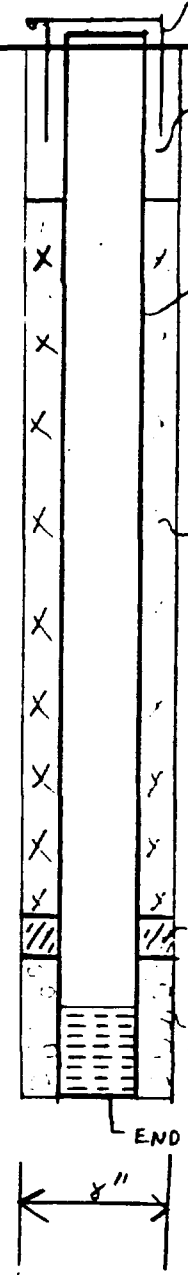
DRILLING METHOD: AIR ROTARY DEVELOPMENT:

ELEVATION: GROUND SURFACE: OUTER CASING:

INNER CASING: SCALE: 1" = FT

SRW

DEPTH	LITHOLOGY	RECOVERY	% RECOVERY	BLOWS/RQD	RUN	PROFILE	DEPTH	WELL CONSTRUCTION	COMMENTS
	SEE LOG OF MW-26 FOR DESCRIPTION OF SOILS AND BEDROCK						1'2" 8"	VENT CAP; PROTECTIVE CASING	
							8'	CONCRETE	
10								4" ϕ SCH. 80 PVC. PIPE RISER	
20									
								BENTONITE CEMENT GROUT	
30									
40									
							44' 10"	BENTONITE PELLETS	
							47' 6"		
50								WELL PACK	5 FT SCREEN SCH 80 PVC. PIPE
							55	END PLUG	
60								8"	
								B.O.H = 55'	



SRW ASSOCIATES, INC. PITTSBURGH, PA

WELL / BORING NO.: [illegible] BY: [illegible]

DATE COMPLETED: [illegible] JOB NO.: 84.10

JOB NAME: Summit National Site

LOCATION: Deerfield, Ohio

DRILLING COMPANY: [illegible] BORING DIAMETER ____

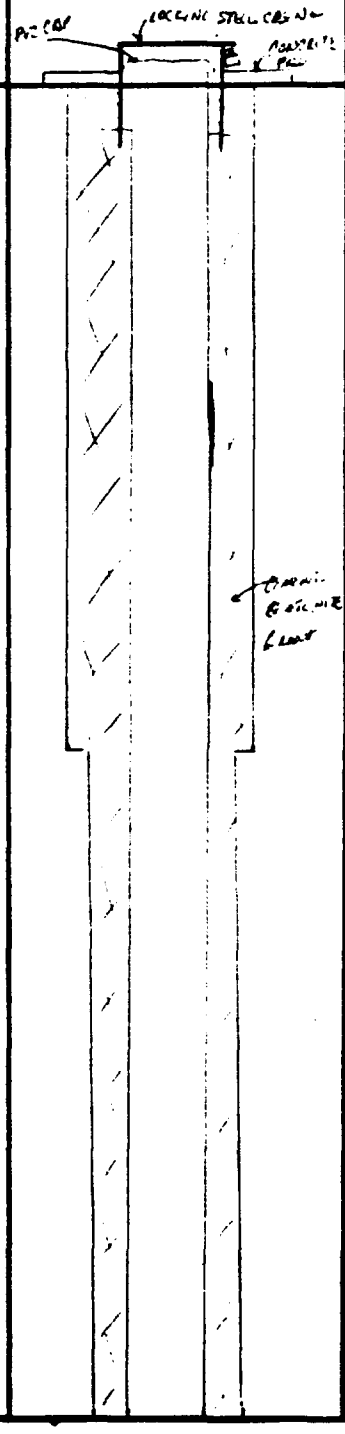
DRILLING METHOD: [illegible] DEVELOPMENT: ____

ELEVATION: GROUND SURFACE: ____ OUTER CASING: ____

INNER CASING: ____ SCALE: 1" = 11 FT

SRW

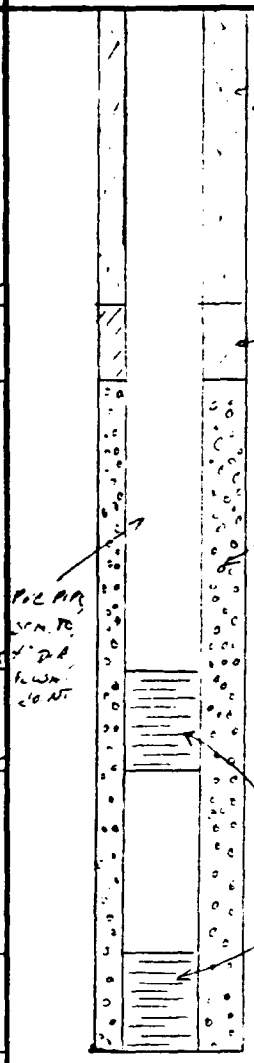
DEPTH	LITHOLOGY	RECOVERY	% RECOVERY	BLOWS/RQD	RUN	PROFILE	DEPTH	WELL CONSTRUCTION	COMMENTS
2.0	Mine spoil & fill	0.4		6,12,12,15	1				Lab sample S-1
4.0		1.6		6,12,22,15	2				
6.0		1.6		6,8,22,17	3				Lab sample S-2
8.0		1.4		2,5,6,7	4				Lab sample S-3
10.0									
11.5				1,2,3	5				
15.0									
16.5				3,4,6	6				
20.0									
21.5				4,6,9	7				
25.0									
26.5				9/10	8				
30.0									
31.0	CLAYSTONE, BROWN-GRAY, CONTORTED BEDDING (UNDERCLAY)	0.85	85	43.7%	9				Bedrock surface
35.0		0	0	0.6%	10				
38.5	SILTY SHALE, VERY DARK-GRAY								START CORING
40.0	SILTSTONE, DARK-GRAY, CONTORTED BEDDING	8.9	89	27%	1				
42.0	MUDSTONE, MEDIUM GRAY, HARD CONCRETIONS, RARE SHALE								
44.0	CLAYSTONE, MEDIUM-GRAY, SLICKENSIDES, AND MEDIUM-GRAY MUDSTONE								
50.6	SILTY SHALE, VERY DARK-GRAY, BECOMING BLACK & CARBONACEOUS @ BASE	8.5	85	25%	2				
55.0	LIMESTONE, MEDIUM-GRAY, FOSSILIFEROUS								
61.7	SILTY SHALE, VERY DARK-GRAY, TRACE PYRITE	7.4	74	9%	3				
65.0	SILTSTONE, MEDIUM-GRAY, LAMINAR, SLIGHTLY SANDY								
67.9	COAL & CARBONACEOUS SHALE	7.8	78	8%	4				
70.0	SILTSTONE, GRAY & BROWN-GRAY, FOSSILIFEROUS, CONTORTED BEDDING @ TOP								



WELL/BORING NO.: [illegible] JOB NO.: [illegible] 1" = 10 FT.

SRW

DEPTH	LITHOLOGY	RECOVERY	% RECOVERY	BLOWS/RQD	RUN	PROFILE	DEPTH	WELL CONSTRUCTION	COMMENTS
70.2	SANDY SILTSTONE TO SILTY SANDSTONE, HARD FOSSILIFEROUS				4				
75.0	SANDY SHALE TO SHALEY SANDSTONE, GRAY, BLACK & CARBONACEOUS BANDS RARE, CROSS BEDDED				Cont				
	SILTY SHALE, VERY DARK GRAY, MICACEOUS								
	CORE + CARBONACEOUS SHALE	2.4	24	0%	5				
85.0	SILTSTONE + MUDSTONE, GRAY, FOSSILIFEROUS						85.5		
	BECOMING SHALEY + LESS FOSSILIFEROUS								
89.5							90.0		
	VERY FINE SANDSTONE, LIGHT-GRAY, DARK GRAY SHALE LAMINAE	6.1	61	10%	6				
95.0									
98.2									
	SHALE TO SILTY SHALE, MEDIUM GRAY, MICACEOUS	7.9	79	12%	7				
105.0	- SLIGHTLY CARB. LAMINAE BAND -						105.5		
	SANDY SILTSTONE, LIGHT-GRAY, MICACEOUS	2.3	23	0%	8		110.5		
115.0									
115.6	SILTSTONE LAMINAE, DARK-GREEN GRAY	4.2	84%						
116.0	INTERBEDDED SANDY SILTSTONE, SILTSTONE, MUDSTONE, MICACEOUS, VARYING FROM LAMINATE TO MASSIVE			12%	9		120.0		
122.1									
125.0	SILTY SANDSTONE TO SANDY SILTSTONE, LIGHT-GRAY TO GREEN GRAY, MICACEOUS, HARD, CARB. LAMINAE STRINGERS	5.0	100%	27%	10		125.0		



WELL / BORING NO.: 2B-B5 BY: DS

DATE COMPLETED: 7-3-86 JOB NO.: 86301

JOB NAME: SUMMIT NATIONAL

LOCATION: DEERFIELD, OHIO

DRILLING COMPANY: BOWKER MORNER BORING DIAMETER: 3 1/4

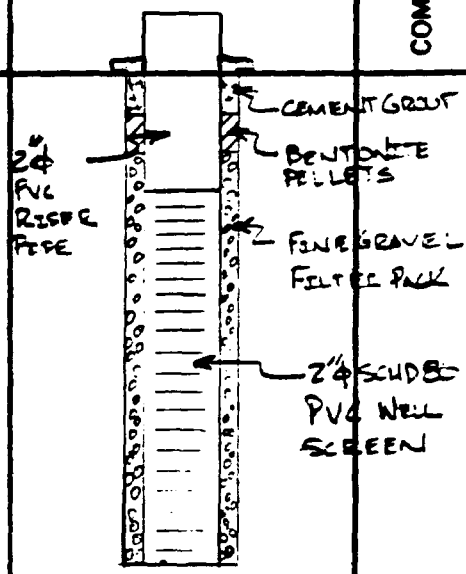
DRILLING METHOD: HOLLOW STEM AUGER DEVELOPMENT:

ELEVATION: GROUND SURFACE: OUTER CASING:

INNER CASING: SCALE: 1" = 5 FT

SRW

DEPTH	LITHOLOGY	RECOVERY	% RECOVERY	BLOWS/RQD	RUN	PROFILE	DEPTH	WELL CONSTRUCTION	COMMENTS
	BROWN TO BLACK SILTY CLAY WITH ROCK FRAGMENTS AND FOREIGN MATERIALS SUCH AS TAR AND OIL. -FILL-			2,3,3,5 5,5,5,5 5,6,8,8 7,8,10,10					
	(NOT SAMPLED)								
10									
13	BOTTOM OF WELL								



WELL / BORING NO.: 2B-86 BY: DS

DATE COMPLETED: 7-3-86 JOB NO.: 86301

JOB NAME: SUMMIT NATIONAL

LOCATION: DEERFIELD OHIO

DRILLING COMPANY: BOWSER MORNER BORING DIAMETER: 3¼

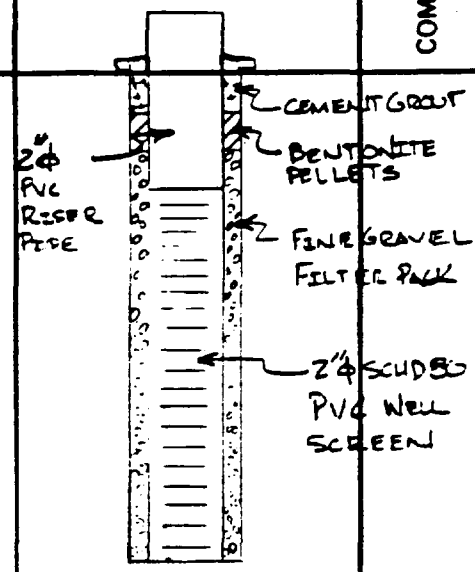
DRILLING METHOD: HOLLOW STEM AUGER DEVELOPMENT:

ELEVATION: GROUND SURFACE: OUTER CASING:

INNER CASING: SCALE: 1" = 5 FT

SRW

DEPTH	LITHOLOGY	RECOVERY	% RECOVERY	BLOWS/RQD	RUN	PROFILE	DEPTH	WELL CONSTRUCTION	COMMENTS
	BROWN TO BLACK SILTY CLAY WITH ROCK FRAGMENTS AND FOREIGN MATERIALS SUCH AS TAR AND OIL.			3,4,6,6					
				5,5,6,7					
				6,6,9,9					
	- FILL -			2,4,6,6					
10	NOT SAMPLED								
13	BOTTOM OF WELL								



WELL / BORING NO.: 2B-B7 BY: DS

DATE COMPLETED: 7-8-86 JOB NO.: 86301

JOB NAME: SUMMIT NATIONAL

LOCATION: DEERFIELD OHIO

DRILLING COMPANY: BOWSER MORNER BORING DIAMETER ≥1/4"

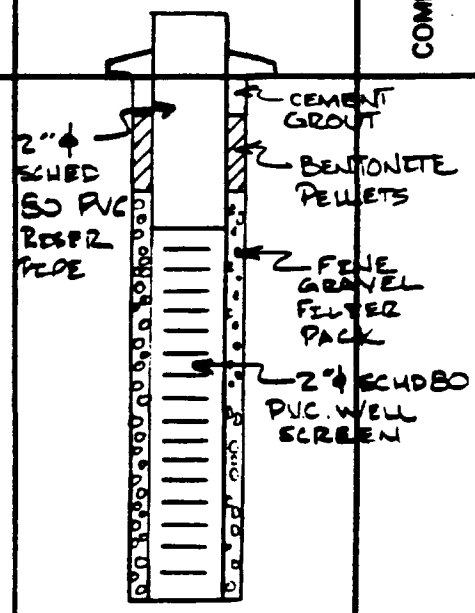
DRILLING METHOD: HOLLOW STEM AUGER DEVELOPMENT:

ELEVATION: GROUND SURFACE: OUTER CASING:

INNER CASING: SCALE: 1" = 5 FT

SRW

DEPTH	LITHOLOGY	RECOVERY	% RECOVERY	BLOWS/RQD	RUN	PROFILE	DEPTH	WELL CONSTRUCTION	COMMENTS
	BROWN AND BLACK SILTY CLAY WITH ROCK AND COAL FRAGMENTS, LEADING INTO BLACK SAND WITH ROCK FRAGMENTS			4,4,4,5					
				4,5,6,8					
5				3,4,4,3					
	— FILL —			1,1,1,3					
				3,4,4,3					
10	NOT SAMPLED								
14	BOTTOM OF WELL								



WELL / BORING NO.: 28-BS BY: DS

DATE COMPLETED: 7-7-86 JOB NO.: 86301

JOB NAME: SUMMIT NATIONAL

LOCATION: DEERFIELD OHIO

DRILLING COMPANY: BOWSER MORNER BORING DIAMETER: 3 1/4"

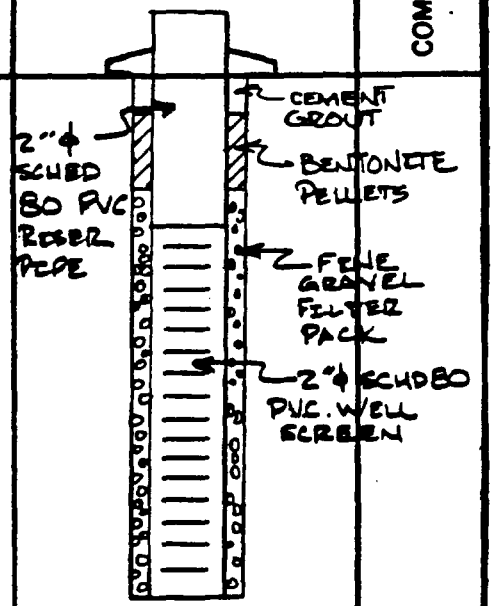
DRILLING METHOD: HOLLOW STEM AUGER DEVELOPMENT:

ELEVATION: GROUND SURFACE: OUTER CASING:

INNER CASING: SCALE: 1" = 5 FT

SRW

DEPTH	LITHOLOGY	RECOVERY	% RECOVERY	BLOWS/RQD	RUN	PROFILE	DEPTH	WELL CONSTRUCTION	COMMENTS
	BROWN AND BLACK SILTY CLAY WITH ROCK FRAGMENTS			3,4,5,5					
				3,3,3,4					
5	TARRY SUBSTANCE IN FIRST SAMPLE			3,4,4,5					
				3,5,10,11					
			14	17,17,17					
10	NOT SAMPLED								
14	BOTTOM OF WELL								



BORING LOGS FROM
PENN ENVIRONMENTAL CONSULTANTS

B-2 Sheet 1 of 3
Date Started June 24,
Date Finished June 26,

SUBSURFACE LOG

Project Name NUS - Deerfield
Project Number 396-01
Location Deerfield, Ohio
Datum
Geologist/Engineer R. T. Petrus
Drilling Contractor Lake Drilling
Drill ATV Penn Drill
Driller R. Valera
Drilling Method Spoon, Auger, Core
Core Size NX
Surface Elevation 1100.2
Boring Depth 32.5 feet
Well Screen Interval 26-31 feet
Johnson 0.010 slot PVC screen

CASING INFORMATION		GROUNDWATER LEVEL DATA			
Size	Depth	Date	Depth	Date	Depth
4" PVC	26.0 feet	July 3, 1980	14'11"		
		July 7, 1980	9'0"		
		July 17, 1980	9'0"		

depth ft	samples	sample no.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	Blows on Casing C	SOIL OR ROCK CLASSIFICATION
		1	4	3	3	4			Fill, olive gray (5 Y 4/1) clay and rock fragment some gravel, dry
0									
		2	5	6	6	12			Black (N1) coal and carbonaceous shale fragments (coal refuse) with dark yellowish orange (10 YR 6 sandstone rock fragments.
4.0									
		3	52	36	16	19			
.0									
		4	5	3	5	4			Dark gray (N4) CLAY and SILT, little sand (topsoi
8.0									Moderate brown (5 YR 4/4) silt and clay, damp
		5	2	4	5	8			Medium gray (N4) and moderate yellowish brown (10 YR 5/4) mottled clay and silt, few gravel, thin sand lense (2 cm), dry, slightly calcareous.
0.4									

depth-ft	samples	sample no.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	Blows on Casing C	SOIL OR ROCK CLASSIFICATION
		6	5	4	7	10			Same as above.
.0									
		7	8	9	10	14			Dark yellowish brown (10 YR 4/2) silt, some fine little clay trace gravel, calcareous, dry.
.0									
		8	5	8	17	12			
.0									Dark gray (N3) SILT and GRAVEL, some sand, trace dry, carbonaceous shale fragments.
		9	6	15	40				Dusky yellowish brown (10 YR 4/2) SILT, some clay gravel, little sand, damp
0.0		10	23	60					Brownish black (5 YR 2/1) SILT, little clay and gravel, weathered
		11	31	62					Dark gray (N3) weathered SHALE, carbonaceous, iron-stained, moist
.0									Augered
		12	32	65					Medium dark gray (N4) clay shale; iron stained.
22.0									
		13	70						Medium dark gray (N4) clay shale, micaceous.
									Proceed with core boring sheet.

" = Number blows to drive 2.0 " spoon 6 " with 140 lb. pin weight falling 30 " per blow.

Classification manual-visual USCS

= Number blows to drive _____ " casing _____ " with _____ lb. weight falling _____ " per blow.

METHOD OF INVESTIGATION _____

6-2 Date June 24, 1980

VISUAL CLASSIFICATION OF ROCK

Project Name _____ Project No. _____
Location _____ Coordinates _____
Geologist/Engineer _____ Drilling Contractor _____
Drill _____ Driller _____
Drilling Method _____ Core Size _____ Elevation _____
Plunge from Horiz. _____ Bearing Azimuth _____

Casing Information		Groundwater Level Data			
Size	Depth	Actual Time	Depth	Actual Time	Depth

Run Number	Depth (feet)	Recovery	% Recovery	RQD	Profile	Description
#1	27.5	30"	50%	0%		Dark gray (N3) siltstone, slightly micaceous, plant fossils.
#2	32.5	54"	90%	0%		Grayish black coal, pyritic with carbonaceous shale. (Bedford Coal) Light olive gray (5 Y 6/1) underclay, very hard, fractured, rooted End of Boring

B-3 Sheet 1 of
Date Started July
Date Finished July

SUBSURFACE LOG

Project Name NUS - Deerfield
Project Number 396-01
Location Deerfield, Ohio
Datum
Geologist/Engineer R. T. Petrus
Drilling Contractor Lake Drilling Comp
Drill ATV Penn Drill
Driller R. Valega
Drilling Method Spoon, Auger, Core
Core Size NX
Surface Elevation 109
Boring Depth 48 feet
Well Screen Interval 33.5-38.0 feet
Johnson slot 0.010 PVC screen

CASING INFORMATION		GROUNDWATER LEVEL DATA			
Size	Depth	Date	Depth	Date	Depth
4" PVC	33.5 feet	July 7, 1980	12'3"		
		July 10, 1980	11'10"		
		July 17, 1980	12'0"		

depth-ft	samples	sample no.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	Blows on Casing C	SOIL OR ROCK CLASSIFICATION
2.0									Augered to 2.0 feet, FILL from septic tank manufacturer.
3.5		1	1	3	4				FILL, dark gray (N3) SILT, some sand and gravel
5.0									Augered to 5.0 feet.
6.5		2	3	3	3				Mottled dark gray (N3) to moderate yellowish br (10 YR 5/4) CLAY, some silt and rock fragments turbed).
8.5									Augered to 8.5 feet.
10.		3	3	4	6				Mottled dark gray (N3) to moderate yellowish br CLAY, some silt and rock fragments moist (distu

depth-ft	samples	sample no.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	Blows on Casing C	SOIL OR ROCK CLASSIFICATION
		4	3	3	4	4			Dark gray (N3) to dark yellowish brown (10 YR 4 CLAY and ROCK fragments, some silt moist (disti
2.0									
		5	3	4	4	3			Dark gray (N3) to dark yellowish brown (10 YR 4 CLAY, some silt and rock fragments (disturbed).
		6	2	3	4	5			Medium dark gray (N4) SILT and CLAY, some grave trace sand wet at 15 feet.
6.0									
		7	5	5	10	3			Dark gray (N3) ROCK fragments, some clay and si (disturbed) rock fragments have Fe-oxide coatir
8.0									
		8	1	2	3	3			Mottled CLAY some silt and shale rock fragments (angular), damp (disturbed).
		9	4	7	6	4			Dark gray (N3) ROCK fragments, some clay and si moist (disturbed) rock fragments are siltstone.
12.0									
		10	3	5	5	5			Olive gray (5 Y 3/2) CLAY and ROCK fragments, s silt (disturbed).

N = Number blows to drive 2 " spoon 6 " with 140 lb. pin weight falling 30 " per blow.

Classification manual visual l

C = Number blows to drive _____ " casing _____ " with _____ lb. weight falling _____ " per blow.

METHOD OF INVESTIGATION _____

Boring No. B-3

Sheet 3 of

depth-ft	samples	sample no.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	Blows on Casing C	SOIL OR ROCK CLASSIFICATION
		11	3	5	5	7			Weathered dark gray rock fragments (siltstone) disturbed.
6.0									
		12	5	6	5	7			Dark yellowish brown (10 YR 4/2), CLAY, some si little gray mudstone rock fragments, moist (dis
8.0									
		13	4	3	6	8			Medium dark gray (N4) to brownish gray (5 YR 4/ siltstone rock fragments, some clay, little silt (disturbed).
0.0									
		14	5	5	11	11			Medium gray (N5) CLAY, some silt and rock fragme damp, (disturbed) coal fragments.
2.0									
		15	16	17	49				Gray siltstone rock fragments little clay and si (disturbed).
3.5									
									Bedrock at 35 feet, augered to 39.0 feet, predon light gray siltstone.
.0									
									Go to core sheets

N = Number blows to drive 2 " spoon 6 " with 140 lb. pin weight falling 30 " per blow.

Classification manual-visual US

C = Number blows to drive _____ " casing _____ " with _____ lb. weight falling _____ " per blow.

METHOD OF INVESTIGATION _____

Date July 3, 1981

VISUAL CLASSIFICATION OF ROCK

Project Name NUS - Deerfield Site Project No. 396-01
Location Deerfield, Ohio Coordinates
Geologist/Engineer Drilling Contractor
Drill Driller
Drilling Method Core Size Elevation
Plunge from Horiz. Bearing Azimuth

Casing Information		Groundwater Level Data			
Size	Depth	Actual Time	Depth	Actual Time	Depth

Run Number	Depth (feet)	Recovery	% Recovery	RQD	Profile	Description
#1		18"	37.5%	0%		Light gray claystone, no recovery.
						Light gray (N7) fine grained sandstone and siltstone carbonaceous plant fossils, oolitic-like grains.
	43					Light gray (N7) claystone.
#2		54"	90%	10%		Dark gray (N7) siltstone, pyritic in places.
	48					

Sheet 1 of
Date Started June 30
Date Finished July 1,

SUBSURFACE LOG

Project Name NUS - Deerfield Site
Project Number 396-01
Location Deerfield, Ohio
Datum
Geologist/Engineer R. T. Petrus
Drilling Contractor Lake Drilling
Drill ATU Penn Drill
Driller R. Valega
Drilling Method Spoon, auger, core
Core Size NX
Surface Elevation 1088.
Boring Depth 30.0'
Well Screen Interval 19.0-24.0 feet
Johnson 0.010 slot PVC screen

CASING INFORMATION		GROUNDWATER LEVEL DATA			
Size	Depth	Date	Depth	Date	Depth
4" PVC	19.0 feet	July 7, 1980	6'11"		
		July 10, 1980	6'11"		
		July 17, 1980	6'11"		

depth-ft	samples	sample no.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	Blows on Casing C	SOIL OR ROCK CLASSIFICATION
2.0									Augered to 2.0 feet, black (N4) carbonaceous sha (spoil).
3.5		1	3	8	9				Black (N4) carbonaceous shale, silty clay and co moist, spoil.
5.0									Augered to 5.0 feet, spoil as above, water at 4. feet.
5.5		2	3	3	3				Coal, sandstone and shale fragments, wet (spoil)
.0									Augered to 8.0 feet, same as above.
0.0		3	1	1	2				Medium light gray (N6) to moderate brown (5 YR 4 mottled CLAY, little silt and gravel, damp calca

Boring No. 1-4

Sheet 2 of

Depth	Samples	Sample no.	Blows on Sampler 0/6	6/12	12/18	18/24	N	Blows on Casing C	Soil or Rock Classification
		4	5	15	25				Medium light gray (N6) iron stained clay shale.
5									
									Augered to 15 feet, interbedded claystone and muds
10									
		5	52						Dark gray (N3) shale.
									Augered to 20.0 feet, same as above.
20		6	50/4						
									Dark gray (N3) clayey shale.
									Augered to 25.0 feet coal brought up in augers at 2 feet.
30									
									Go to core sheets.

N = Number blows to drive 2 " spoon 6 " with 140 lb. pin weight falling 30 " per blow.

Classification manual-visual USCS

C = Number blows to drive _____ " casing _____ " with _____ lb. weight falling _____ " per blow.

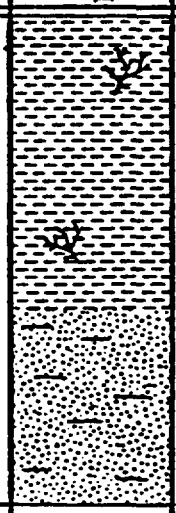
METHOD OF INVESTIGATION _____

B-4 Boring No. _____
Sheet 3 of 3
Date _____

VISUAL CLASSIFICATION OF ROCK

Project Name NUS-Deerfield Project No. 396-01
Location Deerfield, Ohio Coordinates _____
Geologist/Engineer _____ Drilling Contractor _____
Drill _____ Driller _____
Drilling Method _____ Core Size _____ Elevation _____
Plunge from Horiz. _____ Bearing Azimuth _____

Casing Information		Groundwater Level Data			
Size	Depth	Actual Time	Depth	Actual Time	Depth

Run Number	Depth (feet)	Recovery	% Recovery	RQD	Profile	Description
#1	25.0 30.0	24"	40%	10%		Upper 3.0 feet is probably claystone (not recovered) light gray (N7) very fine grained sandstone, carbonaceous plant fossils, high clay content in places micaceous. End of Boring

Date June 30, 1980

VISUAL CLASSIFICATION OF ROCK

Project Name NUS-Deerfield Site Project No. 396-01
Location Deerfield, Ohio Coordinates Datum arbitrary
Geologist/Engineer R.T. Petrus Drilling Contractor Lake Drilling Co.
Drill Truck Mounted Penn Drill Driller R. Valero
Drilling Method Auger, Cone, Roller bit Core Size NX Elevation 1087.7
Plunge from Horiz. N/A Bearing Azimuth N/A

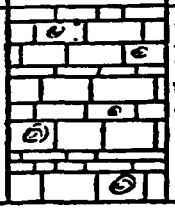
Casing Information		Groundwater Level Data			
Size	Depth	Actual Time	Depth	Actual Time	Depth
* 4" PVC	102 feet	July 9	21'6"		
		July 17	20'11"		

* Bottom 10 feet is 4" PVC Johnson 0.020 slot screen.

Run Number	Depth (feet)	Recovery	% Recovery	RQD	Profile	Description
						Boring was advanced by augers to 38 feet. Profile may be inferred from adjacent hole (B4).

Run Number	Depth (feet)	Recovery	% Recovery	RQD	Profile	Description
	25.0					

Boring No. _____
Sheet 3 of 6
Date June 30, 1980

Run Number	Depth (feet)	Recovery	% Recovery	RQD	Profile	Description
	38.0					
#1		118"	98%	59%		Brownish black (5 YR 2/1). Fossiliferous limestone with thin laminations of argillaceous material, carbonaceous with pyritic replacement of some fossils.

Boring No. B-5
Sheet 4 of 8
Date June 30, 1983

Run Number	Depth (feet)	Recovery	% Recovery	RQD	Profile	Description
#1		118"	98%	59%		Medium dark gray (N4) siltstone and shales. Carbonaceous plant fragments, non-calcareous with 1 inch coal bed at base.
	48					Medium dark gray siltstone (N4) interbedded with brownish gray (5 YR 4/1) irregularly laminated claystone.
						Light gray (N7) claystone with irregular bedding.
#2		113"	94%	29%		Medium dark gray (N4) siltstone with varying clay content. Middle of unit is shaly. Slightly micaceous. Carbonaceous rich fragments are present.
						Dark gray (N3) to black (N1) carbonaceous shale and coal pyritic.

Drilling No. 1-5
Sheet 5 of 8
Date June 30, 1980

Run Number	Depth (feet)	Recovery	% Recovery	RQD	Profile	Description
#2	58	113"	94%	29%		Light gray (N7) underclay rooted and irregular structure.
						Medium gray (N5) siltstone.
						Medium gray (N5) claystone, contorted.
#3	68	116"	97%	30%		Dark gray (N3) siltstone increasing clay content toward base.
						Brownish black (5 YR 2/1) fossiliferous limestone with interbedded argillaceous material.
						Light olive gray (5 Y 6/1) sandstone fine grained. Contains cavities with pyrite coatings. Approximately 10 percent of rock has 1.0 mm non-calcareous oolite-like grains.
						Dark gray (N5) shale with variable amounts of sand, pyritic, carbonaceous.
#4		109"	91%			Medium dark gray (N6) siltstone. Variable amounts of carbonaceous material slightly micaceous and shaly in places.

Boring No. B-5
Sheet 6 of 8
Date June 30, 1980

Run Number	Depth (feet)	Recovery	% Recovery	RQD	Profile	Description
#4		109"	91%	50%		Grayish black (N2) shale, coal beds in places gradational lower contact.
	78					Light olive gray (5 Y 6/1) sandstone fine grained mostly quartz, slightly micaceous increasing clay content towards base.
#5		120"	100%	40%		Medium gray (N5) clay shale.
						Medium gray (N5) sandstone fine grained, iron stained, micaceous.
						Medium dark gray (N4) siltstone with lenses of clay and sand.

Boring No. 1-5
Sheet 7 of 8
Date June 30, 1980

Run Number	Depth (feet)	Recovery	% Recovery	RQD	Profile	Description
#5	88	120"	100%	40%		
#6	98	116"	97%	42%		Medium dark gray (N4) siltstone increasing in grain size towards base. Slightly micaceous, iron stained.
						Medium dark gray (N4) sandy shale, carbonaceous, micaceous.
						Medium light gray (N6) argillaceous sandstone with planar to wavy bedding, porous, carbonaceous, iron stained and micaceous.
						Black (N1) coal, pyritic
#7		113"	94%	65%		Light gray (N7) argillaceous sandstone planar to wavy bedded, carbonaceous.

Run Number	Depth (feet)	Recovery	% Recovery	RQD	Profile	Description
#7		113"	94%	65%		Dark gray (N3) siltstone/mudstone, slightly micaceous, carbonaceous.
	108					End of Boring

Boring No. E-6
Sheet 1 of 10
Date July 9, 1980

VISUAL CLASSIFICATION OF ROCK

Project Name NUS - Deerfield Project No. 396-01
Location Deerfield, Ohio Coordinates
Geologist/Engineer R. T. Petrus Drilling Contractor Lake Drilling Co.
Drill ATV - Penn Drill Driller R. Valega
Drilling Method Auger, Roller Bit, Core Core Size NX Elevation 1100.9
Plunge from Horiz. -- Bearing Azimuth --

Casing Information		Groundwater Level Data			
Size	Depth	Actual Time	Depth	Actual Time	Depth
* 4" PVC	136 feet	July 17, 1980	25.0'		

* Bottom 10 feet is 4" PVC Johnson 0.020 slot screen.

Run Number	Depth (feet)	Recovery	% Recovery	RQD	Profile	Description
						Augered to 45 feet geologic profile may be inferred from adjacent hole (B-3). Water encountered at 29.0 feet.

Run Number	Depth (feet)	Recovery	% Recovery	RQD	Profile	Description
	25.0					

Boring No. B-6
Sheet 3 of 10
Date June 30, 1980

Run Number	Depth (feet)	Recovery	% Recovery	RQD	Profile	Description
	40.0					

Boring No. B-6
Sheet 4 of 10
Date July 9, 1980

Run Number	Depth (feet)	Recovery	% Recovery	RQD	Profile	Description
	45.0					
#1	50.5	45.6"	69%	0		Dark gray (N3) mudstone, with calcite filling fractures, slightly pyritic shaley in places claystone at base.
#2		57"	95%	73%		Dark gray (N3) limestone fossiliferous, dense, slightly pyritic, very argillaceous.
						Black (N1) carbonaceous shale slightly fossiliferous and pyritic.
						Dark gray (N3) siltstone.

Boring No. B-6
Sheet 5 of 10
Date July 9, 1980

Run Number	Depth (feet)	Recovery	% Recovery	RQD	Profile	Description
	55.5					Dark gray (N3) clay shale.
#3		54"	90%	25%		Dark gray (N3) claystone to mudstone. Shaly in places, carbonaceous.
	60.5					Dark gray (N3) siltstone, very carbonaceous at base, slightly fossiliferous.
#4		58"	96%	0		Black coal (N1), pyritic.
	65.5					Olive gray (5 Y 4/1) claystone and siltstone rooted at top, carbonaceous plant fossils, slightly micaceous.
#5		109"	96%	48%		Olive gray (5 Y 4/1) to light olive gray (5 Y 6/1) fine grained sandstone and siltstone, ferruginous non-calcareous oolite-like grains, calcite fracture fillings.
						Olive gray (5 Y 4/1) sandstone, fine-grained, oolite-like grains, chert and ferruginous clasts.
	70					Medium light gray (N6) arenaceous shale increasing carbonaceous material towards bottom.

Boring No. B-6
Sheet 6 of 10
Date July 9, 1980

Run Number	Depth (feet)	Recovery	% Recovery	RQD	Profile	Description
#5	75.0	109"	96%	48%		Dark gray (N3) siltstone with a few arenaceous laminations, slightly micaceous, increasing carbonaceous material towards base.
#6	85.0	113.5"	95%	46%		Black (N1) coal and carbonaceous shale.
						Dark gray (N3) claystone.
						Medium gray (N5) siltstone and fine grained sandstone, clay lenses present.

Boring No. B-6
Sheet 7 of 10
Date July 9, 1980

Run Number	Depth (feet)	Recovery	% Recovery	RQD	Profile	Description
#7		116.5"	97%	88%		Medium dark gray (N4) mudstone to siltstone thinly laminated with some iron-stained units.
	95					Medium dark gray (N4) interbedded siltstone and fine grained sandstone, carbonaceous, planar to wavy laminations.
#8		115"	96%	51%		

Boring No. 1-6
Sheet 8 of 10
Date July 9, 1980

Run Number	Depth (feet)	Recovery	% Recovery	RQD	Profile	Description
#8	105.0	115"	96%	51%		Dark gray (N3) mudstone slightly micaceous, some carbonaceous plant fossils.
						Dark gray (N3) carbonaceous, shale.
#9	115.0	118"	94%	41%		Dark gray (N3) siltstone with thin clay laminations, iron stained in places.

Boring No. B-6
Sheet 9 of 10
Date July 9, 1980

Run Number	Depth (Feet)	Recovery	% Recovery	RQD	Profile	Description
	115.0					Medium dark gray (N4) claystone.
#10		117.5"	98%	70%		Medium gray (N5) fine grained sandstone and siltstone (wavy and flat laminations) cleaner at base, pyrite grains. Lost water at 117.0 feet
	125.0					
#11		96.2"	80%	23%		Medium light gray (N6) fine to medium grained sandstone with localized siltstone beds.

Boring No. L-6
Sheet 10 of 10
Date July 9, 1980

Run Number	Depth (feet)	Recovery	% Recovery	RQD	Profile	Description
	135.5	96.2"	80%	23%		Wavy and planar laminations.
#12	140.5	57"	95%	20%		Medium light gray siltstone (N6).
						Grayish black (N2) clay shale carbonaceous.
						Medium gray argillaceous sandstone fine to medium grained, micaceous.

LOGS FOR
SAMPLED RESIDENTIAL WELLS

DEPARTMENT OF NATURAL RESOURCES
Division of Water
Columbus, Ohio

№ 160810

County Portage Township Atwater Deerfield Section of Township or Lot Number —

Owner [redacted]

Location of property [redacted]

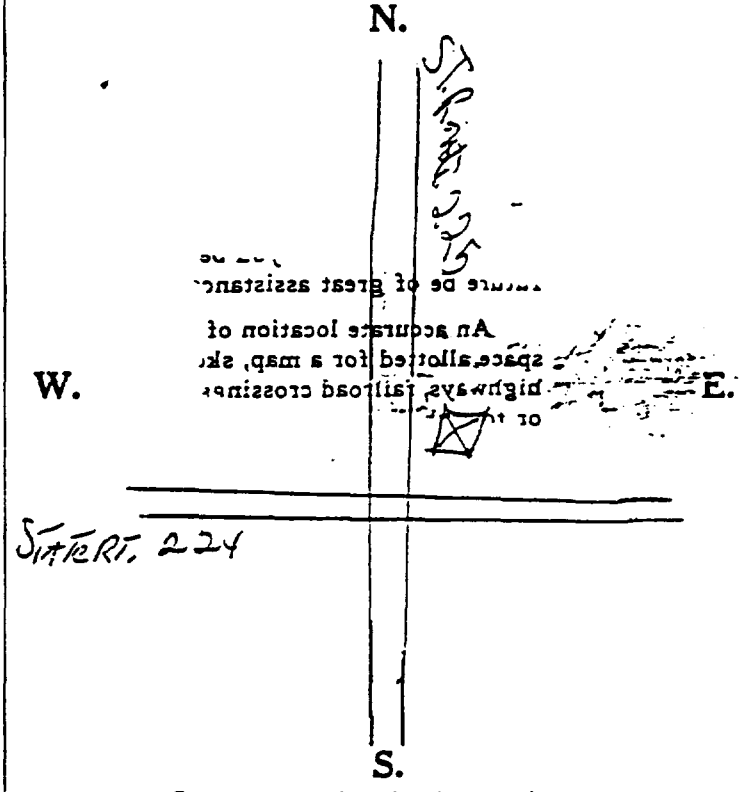
CONSTRUCTION DETAILS	PUMPING TEST
Casing diameter 6" Length of casing 34'	Pumping rate ..... G.P.M. Duration of test ..... hrs.
Type of screen ..... Length of screen	Drawdown ..... ft. Date .....
Type of pump	Developed capacity .....
Capacity of pump	Static level—depth to water ..... ft.
Depth of pump setting	Pump installed by .....

WELL LOG

Formations Sandstone, shale, limestone, gravel and clay	From	To
Clay, yellow	0 Feet	6 Ft.
Sand, yellow	6'	20'
Clay	20'	34'
Rock	34'	40'
Shale	40'	61'
Water at 55'		

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



See reverse side for instructions

[redacted] Domestic Well
RW011001
Source: Pinzon, 1986

Date 11/29/58

Signed [illegible]

LOCATED 113

OR TYPEWRITER
DO NOT USE INK.

Division of Water
1562 W. First Avenue
Columbus, Ohio 43212

County Portage Township Deerfield Section of Township

Owner [redacted]

Locati[redacted]

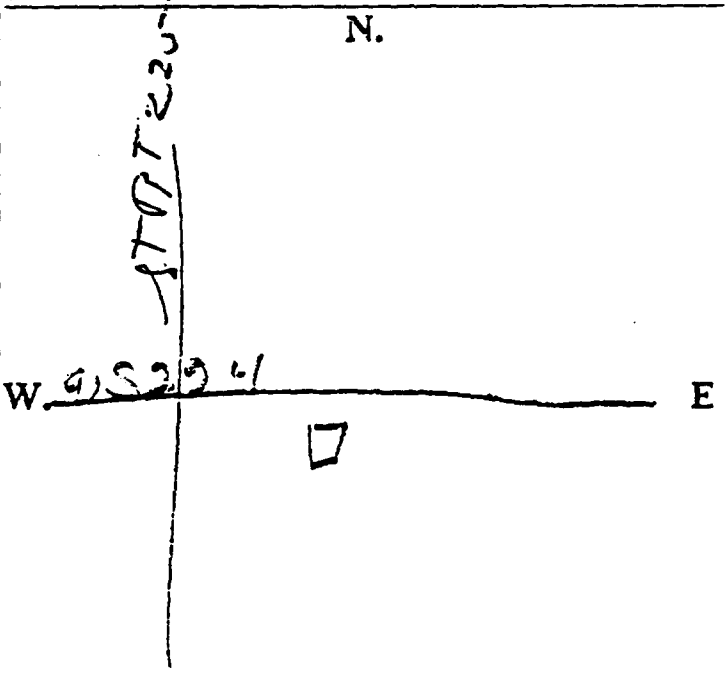
CONSTRUCTION DETAILS Martin	BAILING OR PUMPING TEST
Casing diameter 62 ft 4 in Length of casing 100	Pumping Rate 2 G.P.M. Duration of test ___ hrs.
Type of screen ___ Length of screen ___	Drawdown 140 ft. Date April 1965
Type of pump Deep well	Static level-depth to water 140 ft
Capacity of pump ___	Quality (clear, cloudy, taste, odor) Clear
Depth of pump setting 190	[illegible]
Date of completion April 1 1965	Pump installed by [illegible]

WELL LOG*

Formations Sandstone, shale, limestone, gravel and clay	From	To
Clay	0 Feet	15 Ft.
Fine Clay	15	20
Shale	20	30
Fine stone	30	36
Shale	36	90
Fine stone	90	[illegible]
Shale	101	215
Sand stone	215	225
1 Gal Pressure at 210		
Shale	225	258
Sandstone shale	258	276
Sand stone	276	281
Shale 9 Gal at 281	281	290

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



See reverse side for instructions

[redacted] Domestic Well
RW007001
Source: Pinzon, 1986

Date April 1, 1965

Signed [illegible]

*If additional space is needed to complete well log, use next consecutive numbered form

LOCAT
118

[redacted]

OR TYPEWRITER
DO NOT USE INK.

Division of Water
1562 W. First Avenue
Columbus 12, Ohio

N. 321720

County PORTAGE Township DEERFIELD Section of Township S. E.

Owner [redacted]

Location of prope[redacted]

CONSTRUCTION DETAILS

183

Casing diameter 6" 4" Length of casing 33

Type of screen Length of screen

Type of pump SUBMERSIBLE

Capacity of pump 15

Depth of pump setting 186

Date of completion 7-8-65

BAILING OR PUMPING TEST

Pumping Rate 10 G.P.M. Duration of test 3 hrs.

Drawdown 100 ft. Date 7-6-65

Static level-depth to water 85 ft.

Quality (clear, cloudy, taste, odor) Cloudy

Pump installed by O R Scott Jr

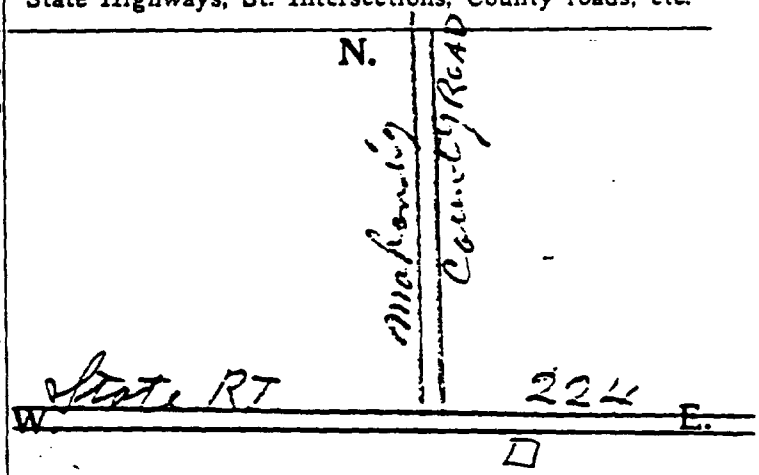
WELL LOG

Formations Sandstone, shale, limestone, gravel and clay	From	To
	0 Feet	Ft.
CLAY YELLOW	0	24
Clay Blue	24	30
Shale Gray	30	70
Sand Rock	70	177
Cal mine open	177	183
Clay Blue	183	187
Blue Lime HARD	187	198
Shale DARK	198	225

WATER 198

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



S.

See reverse side for instructions

[redacted] Domestic Well
RW009001
Source: Pinzon, 1986

Date 7-9-65

Signed O R Scott

LOCATED 119

PLEASE USE PENCIL
OR TYPEWRITER.
DO NOT USE INK.

DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus, Ohio

No. 234652

County Portage Township Deerfield Section of Township

Owner [redacted]

Location [redacted]

CONSTRUCTION DETAILS

Casing diameter 4 Length of casing 53
Type of screen none Length of screen
Type of pump
Capacity of pump
Depth of pump setting 75
Date of completion

BAILING OR PUMPING TEST

Pumping rate 10 G.P.M. Duration of test hrs.
Drawdown 45 ft. Date
Developed capacity
Static level—depth to water 24 ft.
Pump installed by

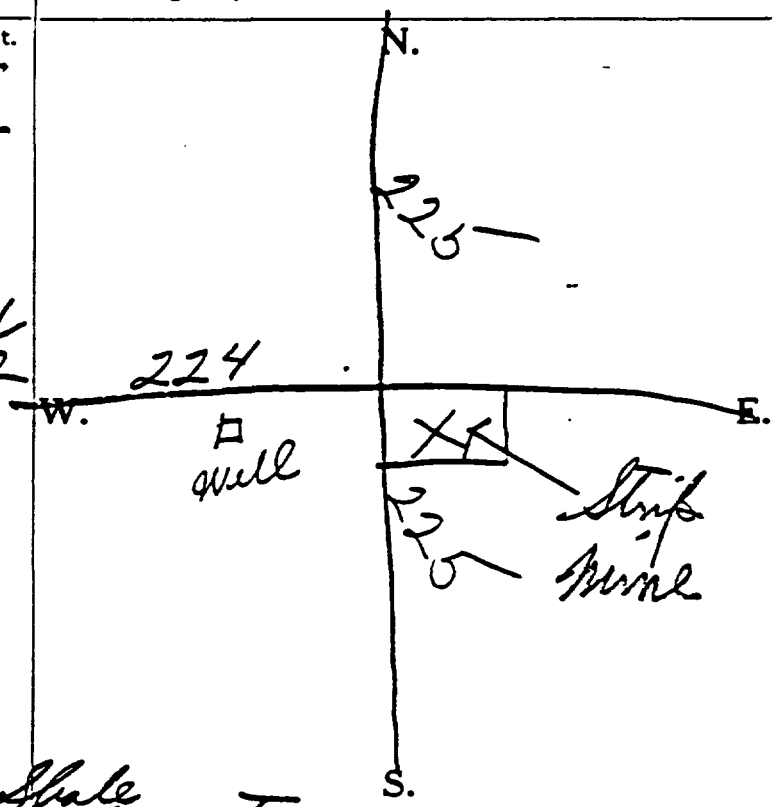
WELL LOG

Formations Sandstone, shale, limestone, gravel and clay	From	To
	0 Feet	Ft.
Clay	0	15
Sandstone	15	25
Shale	25	51
Limestone	51	52 1/2
Shale	52	91

Water at 81
Drilled pocket for settling
6" hole drilled open to Shale under limestone

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



See reverse side for instructions

Date June 1 1959

Signed K. I. Wolverton

[redacted] Domestic Well
RW008001
Source: Pinzon, 1986

LOCATED
112

NO CARBON PAPER
NECESSARY—
SELF-TRANSCRIBING

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
Fountain Square
Columbus, Ohio 43224

500980

COUNTY PORTAGE TOWNSHIP DEERFIELD SECTION OF TOWNSHIP

OWNER SUMMIT HOMES [redacted] ADDRESS HARTVILLE, OHIO

LOCATION OF PROPERTY [redacted]

CONSTRUCTION DETAILS

Casing diameter 5" Length of casing 31'8"

Type of screen Length of screen

Type of pump

Capacity of pump

Depth of pump setting

Date of completion

BAILING OR PUMPING TEST
(specify one by circling)

Test rate 15 gpm Duration of test 1 hrs

Drawdown 25 ft Date 4-21-77

Static level (depth to water) 10 ft

Quality (clear, cloudy, taste, odor)

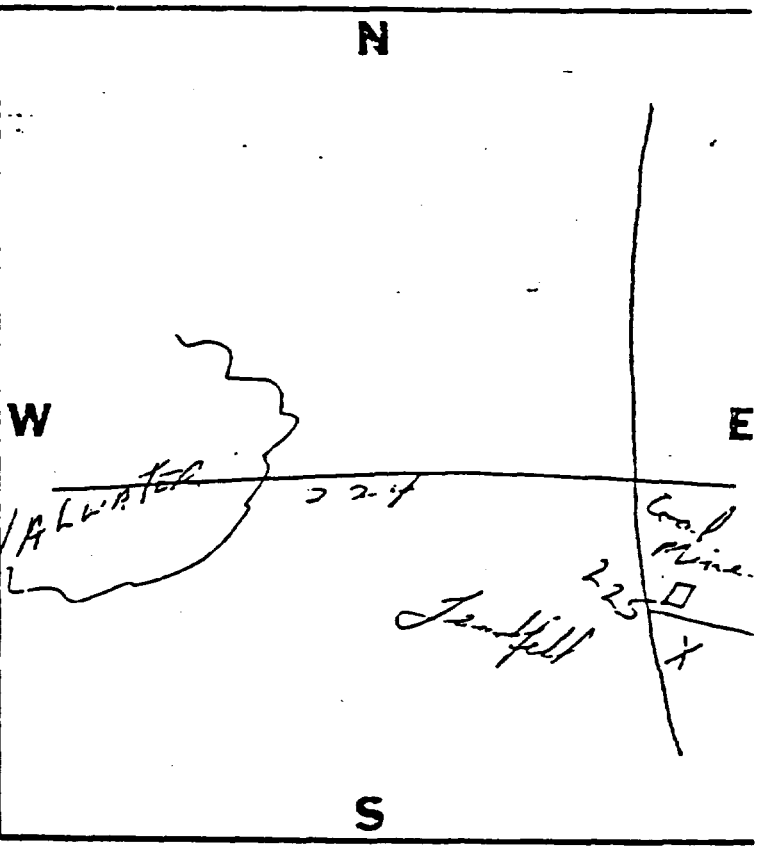
Pump installed by

WELL LOG*

Formations: sandstone, shale, limestone, gravel, clay	From	To
SAND & GRAVEL	0 ft	20 ft
GRAY SHALE	20	26
LIMESTONE	26	30'6"
GRAY SANDY SHALE	30'6"	45
LIMESTONE	45	47'6"
LIGHT GRAY SHALE	47'6"	55
COAL	55	56
CLAY	56	58
GRAY SHALE	58	62

SKETCH SHOWING LOCATION

Locate in reference to numbered state highways, street intersections, county roads, etc.



[redacted] Domestic Well
RW012001
Source: Pinzan, 1986

DATE May 3, 1977

SIGNED M. P. Greenwalt Sec

*If additional space is needed to complete well log, use next consecutive numbered form.

cher

Appendix E

APPENDIX E - HYDROGEOLOGIC CALCULATIONS

NOTES ON HYDRAULIC-CONDUCTIVITY TESTS
SUMMIT NATIONAL SITE

ZONE DESIGNATION	WELL #	HYDRAULIC CONDUCTIVITY	COMMENTS ON TEST	LITHOLOGIES MONITORED
Bedford Coal	MW- 4	1E-4	Very good.	shale, coal
Fill	2BB5		NONE PERFORMED	Fill
	2BB6		NONE PERFORMED	Fill
	2BB7		NONE PERFORMED	Fill
	2BB8		NONE PERFORMED	Fill
	MW- 3	3E-3	Good.	fill, siltstone
	MW- 9	2E-4	Good until time=10 minutes.	fill, weathered carbonaceous shale
	MW-15	1E-4	Fair; some tailing-off on both ends.	fill, till
	MW-18	8E-5	Poor; recovery ceased at 50%.	Fill
Till	MW- 7	2E-3	Linear recovery is of very short duration.	till, coal, carbonaceous shale
	MW-11	3E-3	Poor linear trend, very short duration until recovery.	till, outwash
	MW-17	6E-5	Very good.	clay, weathered silty shale
	MW-19	6E-4	Fair; very short duration for linear trend.	till
Unnamed Coal #1	MW- 2	1E-5	Slow recovery, but good linear trend	carbonaceous shale, coal, siltstone, underclay
Unnamed Coal #1a	MW-10	2E-5	Very good.	poor recovery, but some coal apparent
	MW-16	6E-7	Good linear trend, but very little recovery during test.	siltstone, coal
Unnamed Coal #2	MW-22	3E-6	Good linear trend, but very little recovery during test.	siltstone, mudstone, carbonaceous shale, sandstone
	MW-25	5E-6	Fair linear trend; very little recovery during test.	limestone, silty shale
Unnamed Coal #3	MW-12	6E-6	Very good.	siltstone, silty sandstone
	MW-20	9E-6	Good linear trend, but little recovery during test.	siltstone, black to carbonaceous shale
	MW-23	1E-5	Good linear trend, but little recovery during test.	Siltstone, carbonaceous shale
	MW-24	6E-5	Good.	siltstone, coal, carbonaceous shale, silty shale
Unnamed Limestone	MW-21	2E-8	Unacceptable. No recovery during test.	mudstone, sandstone, siltstone, limestone
Upper Sharon	MW- 5	3E-4	Fair. Low regression coefficient.	siltstone, sandstone
	MW- 6	5E-6	Good test, but field observations indicate that well is damaged.	sandstone, siltstone
	MW- 8	1E-5	Very good.	siltstone, sandy siltstone
	MW-13	2E-7	Poor linear trend, very slow recovery	sandstone, shale, siltstone, silty sandstone
	MW-14	5E-5	Poor linear trend, irregular recovery.	siltstone, black shale, silty sandstone, sandy siltstone, sandstone
	MW-26	2E-4	Good for time < 10 minutes.	sandstone, silty shale, sandy siltstone, silty sandstone

NOTE: All values are cm/sec.
Fill includes mine spoil

COMMENTS ON METHODOLOGY

1. All data collected are shown on the plots, but only data selected for calculations are presented in tables.

2. Calculations performed by a computer program (Thompson, in press) which uses the methods of Cedergren (1977).

3. Data for calculations were selected to maximize the regression coefficient.

SUMMIT NATIONAL SITE -- MW-2

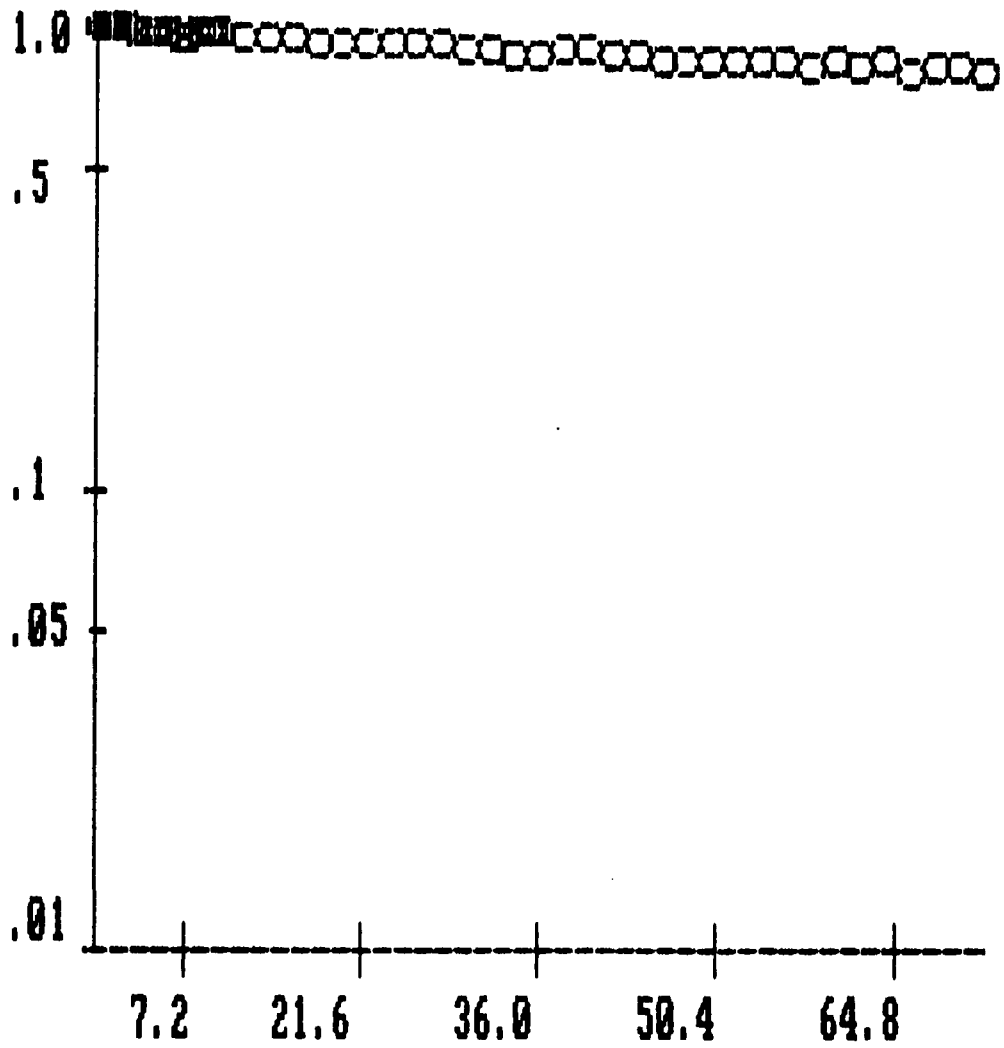
TIME (seconds)	WATER LEVEL (feet)	DRAWDOWN (feet)	H/HO
7.998	3.64	3.64	.9972603
9	3.64	3.64	.9972603
9.996	3.64	3.64	.9972603
10.998	3.64	3.64	.9972603
12	3.64	3.64	.9972603
12.996	3.64	3.64	.9972603
13.998	3.64	3.64	.9972603
15	3.65	3.65	1
15.996	3.64	3.64	.9972603
16.998	3.64	3.64	.9972603
18	3.65	3.65	1
18.996	3.65	3.65	1
19.998	3.65	3.65	1
25.002	3.65	3.65	1
30	3.65	3.65	1
34.998	3.65	3.65	1
40.002	3.65	3.65	1
45	3.65	3.65	1
49.998	3.65	3.65	1
55.002	3.65	3.65	1
60	3.64	3.64	.9972603
64.998	3.64	3.64	.9972603
70.002	3.64	3.64	.9972603
75	3.63	3.63	.9945207
79.998	3.63	3.63	.9945207
84.996	3.63	3.63	.9945207
90	3.62	3.62	.9917808
94.998	3.62	3.62	.9917808
100.002	3.62	3.62	.9917808
105	3.62	3.62	.9917808
109.998	3.61	3.61	.9890411
115.002	3.61	3.61	.9890411
120	3.61	3.61	.9890411
150	3.6	3.60	.9863014
180	3.59	3.59	.9835616
210	3.58	3.58	.9808219
240	3.57	3.57	.9780822
270	3.56	3.56	.9753425
300	3.55	3.55	.9726028
330	3.54	3.54	.9698631
360	3.52	3.52	.9643836
390	3.45	3.45	.9452055
420	3.45	3.45	.9452055
450	3.47	3.47	.9506849
480	3.49	3.49	.9561645
510	3.52	3.52	.9643836
540	3.53	3.53	.9671232

570	3.52	3.52	.9643836
600	3.51	3.51	.9616439
720	3.45	3.45	.9452055
840	3.42	3.42	.9369864
960	3.39	3.39	.9287671
1080	3.34	3.34	.9150684
1200	3.36	3.36	.9205479
1320	3.37	3.37	.9232876
1440	3.34	3.34	.9150684
1560	3.32	3.32	.909589
1680	3.29	3.29	.9013699
1800	3.27	3.27	.8958904
1920	3.2	3.20	.8767124
2040	3.17	3.17	.8684932
2160	3.17	3.17	.8684932
2280	3.25	3.25	.8904109
2400	3.2	3.20	.8767124
2520	3.12	3.12	.8547945
2640	3.11	3.11	.8520548
2760	3.07	3.07	.8410959
2880	3.06	3.06	.8383562
3000	3.04	3.04	.8328768
3120	3.03	3.03	.830137
3240	3.03	3.03	.830137
3360	3.04	3.04	.8328768
3480	2.97	2.97	.8136986
3600	3.01	3.01	.8246576
3720	2.95	2.95	.8082192
3840	2.99	2.99	.8191781
3960	2.86	2.86	.7835616
4080	2.94	2.94	.8054795
4200	2.92	2.92	.8

UNCONFINED AQUIFER

K = 0.1E-04 cm/sec
= 0.3 gpd/ft2
= 0.4E-06 ft/sec
= 0.0 ft/day

REGRESSION COEFFICIENT = -.990636



X AXIS:
TIME, min

Y AXIS:
LOG (H/H0)

EXAMINE PLOT.
STRIKE ANY KEY WHEN READY.

MW-2 (con't.)

SUMMIT NATIONAL SITE -- MW-3

TIME (seconds)	WATER LEVEL (feet)	DRAWDOWN (feet)	H/HO
4.998	3.6	3.60	1
6	3.59	3.59	.9972222
6.996	3.54	3.54	.9833333
7.998	3.53	3.53	.9805555
9	3.51	3.51	.975
9.996	3.48	3.48	.9666666
10.998	3.44	3.44	.9555555
12	3.44	3.44	.9555555
12.996	3.39	3.39	.9416667
13.998	3.36	3.36	.9333332
15	3.33	3.33	.925
15.996	3.3	3.30	.9166666
16.998	3.27	3.27	.9083333
18	3.24	3.24	.9
18.996	3.21	3.21	.8916667
19.998	3.19	3.19	.8861111
25.002	3.03	3.03	.8416666
30	2.88	2.88	.8000001
34.998	2.75	2.75	.7638889
40.002	2.62	2.62	.7277778
45	2.48	2.48	.688889
49.998	2.35	2.35	.6527778
55.002	2.23	2.23	.6194445
60	2.11	2.11	.5861111
64.998	2	2.00	.5555555
70.002	1.9	1.90	.5277778
75	1.79	1.79	.4972222
79.998	1.7	1.70	.4722222
84.996	1.6	1.60	.4444445
90	1.51	1.51	.4194445
94.998	1.42	1.42	.3944444
100.002	1.34	1.34	.3722222
105	1.26	1.26	.35
109.998	1.18	1.18	.3277778
115.002	1.11	1.11	.3083333
120	1.04	1.04	.2888889
150	.69	0.69	.1916667
180	.44	0.44	.1222222
210	.28	0.28	7.777778E-02
240	.19	0.19	5.277778E-02
270	.13	0.13	3.611111E-02
300	.1	0.10	2.777778E-02
330	.08	0.08	2.222222E-02
360	.06	0.06	1.666667E-02

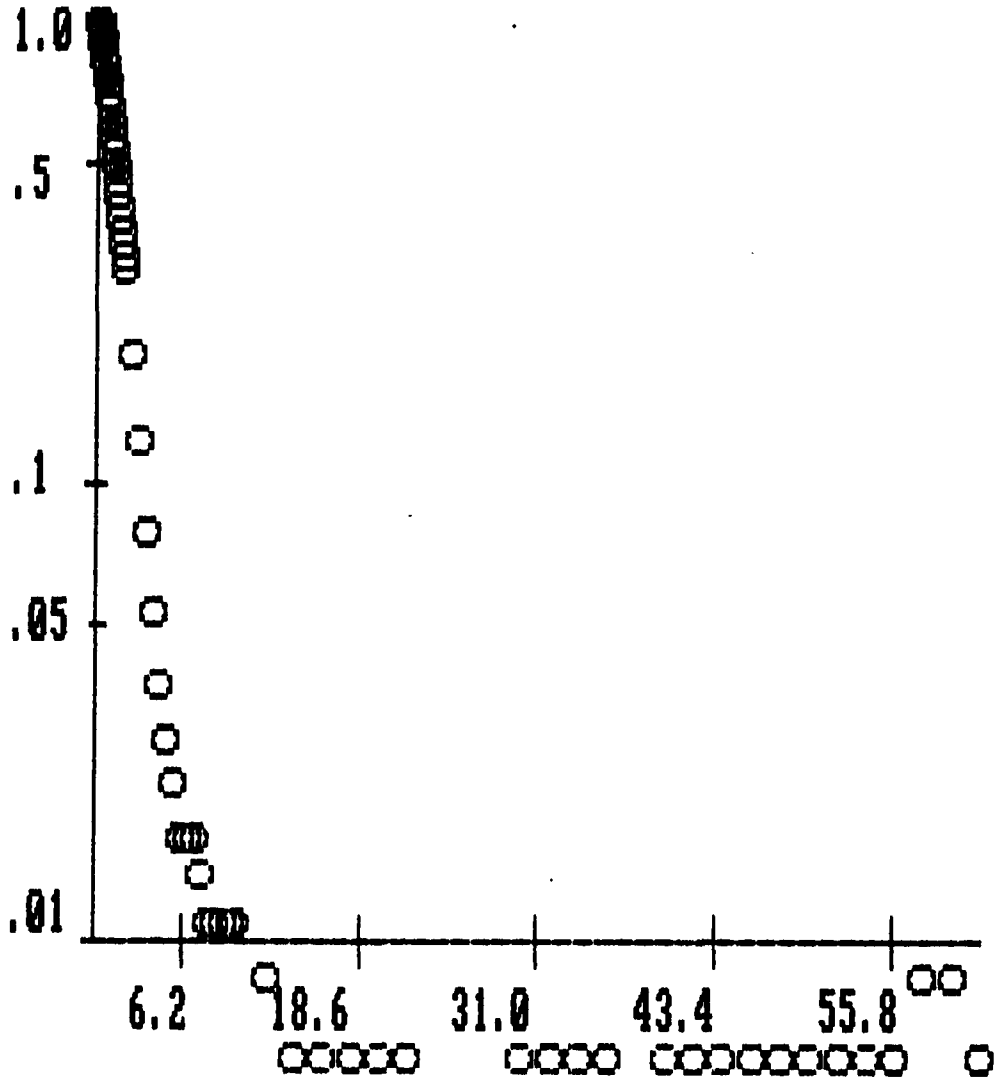
UNCONFINED AQUIFER

K = 0.3E-02 cm/sec

MW-3 (con't.)

= 62.9 gpd/ft2
= 0.1E-03 ft/sec
= 8.4 ft/day

REGRESSION COEFFICIENT = -.9978448



X AXIS:
TIME, min

Y AXIS:
LOG (H/H0)

EXAMINE PLOT.
STRIKE ANY KEY WHEN READY.

MW-3 (con't.)

SUMMIT NATIONAL SITE -- MW-4

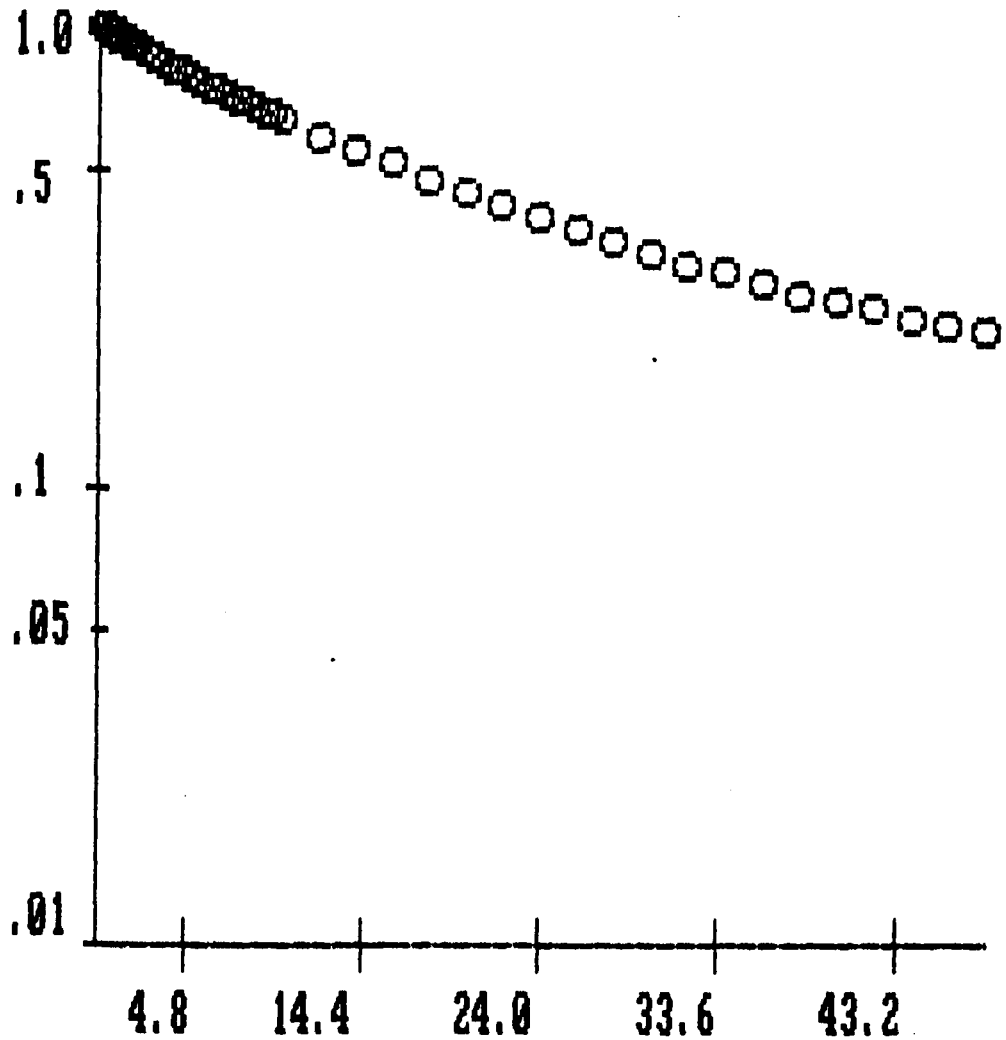
TIME (seconds)	WATER LEVEL (feet)	DRAWDOWN (feet)	H/H0
6.996	3.62	3.62	1
7.998	3.61	3.61	.9972376
9	3.61	3.61	.9972376
9.996	3.61	3.61	.9972376
10.998	3.61	3.61	.9972376
12	3.61	3.61	.9972376
12.996	3.61	3.61	.9972376
13.998	3.6	3.60	.9944752
15	3.6	3.60	.9944752
15.996	3.6	3.60	.9944752
16.998	3.6	3.60	.9944752
18	3.6	3.60	.9944752
18.996	3.59	3.59	.9917128
19.998	3.59	3.59	.9917128
25.002	3.57	3.57	.9861879
30	3.55	3.55	.980663
34.998	3.53	3.53	.9751381
40.002	3.52	3.52	.9723758
45	3.5	3.50	.9668509
49.998	3.48	3.48	.9613261
55.002	3.46	3.46	.9558012
60	3.45	3.45	.9530388
64.998	3.43	3.43	.9475139
70.002	3.41	3.41	.9419891
75	3.4	3.40	.9392266
79.998	3.38	3.38	.9337018
84.996	3.37	3.37	.9309392
90	3.36	3.36	.9281768
94.998	3.34	3.34	.9226519
100.002	3.33	3.33	.9198896
105	3.31	3.31	.9143647
109.998	3.3	3.30	.9116022
115.002	3.28	3.28	.9060774
120	3.27	3.27	.903315
150	3.19	3.19	.8812156
180	3.11	3.11	.859116
210	3.03	3.03	.8370166
240	2.96	2.96	.8176796
270	2.89	2.89	.7983426
300	2.82	2.82	.7790056
330	2.76	2.76	.762431
360	2.7	2.70	.7458564
390	2.64	2.64	.7292819
420	2.59	2.59	.7154697
450	2.53	2.53	.6988951
480	2.49	2.49	.6878454
510	2.44	2.44	.6740333
540	2.38	2.38	.6574587

570	2.34	2.34	.6464089
600	2.29	2.29	.6325968
720	2.11	2.11	.582873
840	1.96	1.96	.5414365
960	1.82	1.82	.5027625
1080	1.7	1.70	.4696133
1200	1.59	1.59	.4392266
1320	1.49	1.49	.4116023
1440	1.41	1.41	.3895028
1560	1.32	1.32	.364641
1680	1.24	1.24	.3425415
1800	1.16	1.16	.320442
1920	1.11	1.11	.3066299
2040	1.05	1.05	.2900553
2160	1	1.00	.2762431
2280	.95	0.95	.262431
2400	.91	0.91	.2513813
2520	.87	0.87	.2403315
2640	.83	0.83	.2292818

UNCONFINED AQUIFER

K = 0.1E-03 cm/sec
= 2.9 gpd/ft2
= 0.4E-05 ft/sec
= 0.4 ft/day

REGRESSION COEFFICIENT = -.9945094



X AXIS:
TIME, min

Y AXIS:
LOG (H/H0)

EXAMINE PLOT.
STRIKE ANY KEY WHEN READY.

MW-4 (con't.)

SUMMIT NATIONAL SITE -- MW-5

TIME (seconds)	WATER LEVEL (feet)	DRAWDOWN (feet)	H/H0
12	8.21	8.21	.7383094
12.996	8.21	8.21	.7383094
13.998	8.21	8.21	.7383094
15	8.2	8.20	.7374101
15.996	8.2	8.20	.7374101
16.998	8.18	8.18	.7356116
18	8.18	8.18	.7356116
18.996	8.17	8.17	.7347123
19.998	8.17	8.17	.7347123
25.002	8.15	8.15	.7329137
30	8.12	8.12	.7302159
34.998	8.100001	8.10	.7284173
40.002	8.08	8.08	.7266187
45	8.05	8.05	.7239209
49.998	8.020001	8.02	.7212231
55.002	8	8.00	.7194245
60	7.98	7.98	.717626
64.998	7.95	7.95	.7149281
70.002	7.93	7.93	.7131295
75	7.91	7.91	.711331
79.998	7.89	7.89	.7095324
84.996	7.87	7.87	.7077339
90	7.85	7.85	.7059353
94.998	7.83	7.83	.7041368
100.002	7.81	7.81	.7023381
105	7.79	7.79	.7005396
109.998	7.77	7.77	.698741
115.002	7.75	7.75	.6969425
120	7.73	7.73	.6951439
150	7.62	7.62	.6852518
180	7.51	7.51	.6753598
210	7.42	7.42	.6672662
240	7.33	7.33	.6591727
270	7.24	7.24	.6510791
300	7.16	7.16	.6438849

CONFINED AQUIFER, FULLY PENETRATING CONDITION

K = 0.1E-03 cm/sec
= 2.3 gpd/ft2
= 0.4E-05 ft/sec
= 0.3 ft/day

REGRESSION COEFFICIENT = -.9963438

SUMMIT NATIONAL SITE -- MW-5

TIME (seconds)	WATER LEVEL (feet)	DRAWDOWN (feet)	r/r0
240	7.33	7.33	.6591727
270	7.24	7.24	.6510791
300	7.16	7.16	.6438849
330	7.08	7.08	.6366907
360	7.01	7.01	.6303958
390	6.94	6.94	.6241008
420	6.87	6.87	.6178058
450	6.8	6.80	.6115108
480	6.75	6.75	.6070145
510	6.69	6.69	.6016188
540	6.64	6.64	.5971223
570	6.59	6.59	.592626
600	6.53	6.53	.5872303
720	6.35	6.35	.5710432
840	6.2	6.20	.557554
960	6.08	6.08	.5467626
1080	5.97	5.97	.5368705
1200	5.87	5.87	.5278777
1320	5.8	5.80	.5215828
1440	5.72	5.72	.5143885
1560	5.66	5.66	.5089928
1680	5.6	5.60	.5035972
1800	5.55	5.55	.4991008
1920	5.5	5.50	.4946044
2040	5.46	5.46	.4910072
2160	5.42	5.42	.4874101
2280	5.4	5.40	.4856116
2400	5.35	5.35	.4811151
2520	5.33	5.33	.4793166
2640	5.3	5.30	.4766188

CONFINED AQUIFER, FULLY PENETRATING CONDITION

K = 0.3E-04 cm/sec
= 0.6 gpd/ft2
= 0.1E-05 ft/sec
= 0.1 ft/day

REGRESSION COEFFICIENT = -.9636249

SUMMIT NATIONAL SITE -- MW-5

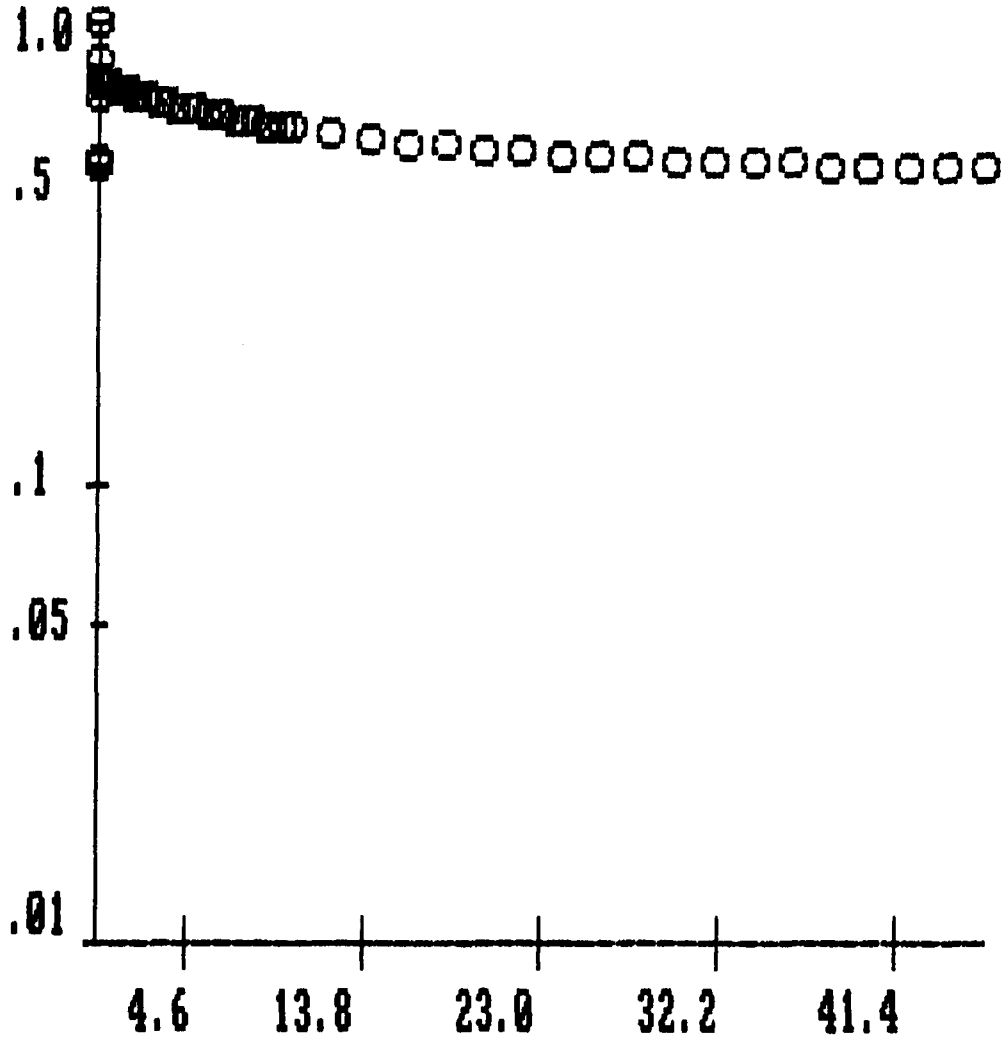
TIME (seconds)	WATER LEVEL (feet)	DRAWDOWN (feet)	H/HO
30	8.12	8.12	.7302159
34.998	8.100001	8.10	.7284173
40.002	8.08	8.08	.7266187
45	8.05	8.05	.7239209
49.998	8.020001	8.02	.7212231
55.002	8	8.00	.7194245
60	7.98	7.98	.717626
64.998	7.95	7.95	.7149281
70.002	7.93	7.93	.7131295
75	7.91	7.91	.711331
79.998	7.89	7.89	.7095324
84.996	7.87	7.87	.7077339
90	7.85	7.85	.7059353
94.998	7.83	7.83	.7041368
100.002	7.81	7.81	.7023381
105	7.79	7.79	.7005396
109.998	7.77	7.77	.698741
115.002	7.75	7.75	.6969425
120	7.73	7.73	.6951439
150	7.62	7.62	.6852518
180	7.51	7.51	.6753598
210	7.42	7.42	.6672662
240	7.33	7.33	.6591727
270	7.24	7.24	.6510791
300	7.16	7.16	.6438849
330	7.08	7.08	.6366907
360	7.01	7.01	.6303958
390	6.94	6.94	.6241008
420	6.87	6.87	.6178058
450	6.8	6.80	.6115108
480	6.75	6.75	.6070145
510	6.69	6.69	.6016188
540	6.64	6.64	.5971223
570	6.59	6.59	.592626
600	6.53	6.53	.5872303
720	6.35	6.35	.5710432
840	6.2	6.20	.557554
960	6.08	6.08	.5467626
1080	5.97	5.97	.5368705
1200	5.87	5.87	.5278777
1320	5.8	5.80	.5215828
1440	5.72	5.72	.5143885
1560	5.66	5.66	.5089928
1680	5.6	5.60	.5035972
1800	5.55	5.55	.4991008
1920	5.5	5.50	.4946044
2040	5.46	5.46	.4910072
2160	5.42	5.42	.4874101

2280	5.4	5.40	.4856116
2400	5.35	5.35	.4811151
2520	5.33	5.33	.4793166
2640	5.3	5.30	.4766188

CONFINED AQUIFER, FULLY PENETRATING CONDITION

K = 0.4E-04 cm/sec
= 0.8 gpd/ft2
= 0.1E-05 ft/sec
= 0.1 ft/day

REGRESSION COEFFICIENT = -.9519105



X AXIS:
TIME, min

Y AXIS:
LOG (H/H0)

EXAMINE PLOT.
STRIKE ANY KEY WHEN READY.

MW-5 (con't.)

SUMMIT NATIONAL SITE -- MW-6

TIME (seconds)	WATER LEVEL (feet)	DRAWDOWN (feet)	H/HO
7.998	3.65	3.65	1
9	3.64	3.64	.9972603
9.996	3.64	3.64	.9972603
10.998	3.64	3.64	.9972603
12	3.65	3.65	1
12.996	3.65	3.65	1
13.998	3.65	3.65	1
15	3.65	3.65	1
15.996	3.65	3.65	1
16.998	3.65	3.65	1
18	3.64	3.64	.9972603
18.996	3.65	3.65	1
19.998	3.65	3.65	1
25.002	3.65	3.65	1
30	3.65	3.65	1
34.998	3.65	3.65	1
40.002	3.65	3.65	1
45	3.65	3.65	1
49.998	3.65	3.65	1
55.002	3.64	3.64	.9972603
60	3.66	3.66	1.00274
64.998	3.64	3.64	.9972603
70.002	3.64	3.64	.9972603
75	3.64	3.64	.9972603
79.998	3.64	3.64	.9972603
84.996	3.64	3.64	.9972603
90	3.64	3.64	.9972603
94.998	3.64	3.64	.9972603
100.002	3.63	3.63	.9945207
105	3.63	3.63	.9945207
109.998	3.63	3.63	.9945207
115.002	3.63	3.63	.9945207
120	3.63	3.63	.9945207
150	3.62	3.62	.9917808
180	3.62	3.62	.9917808
210	3.61	3.61	.9890411
240	3.62	3.62	.9917808
270	3.59	3.59	.9835616
300	3.58	3.58	.9808219
330	3.58	3.58	.9808219
360	3.57	3.57	.9780822
390	3.57	3.57	.9780822
420	3.56	3.56	.9753425
450	3.55	3.55	.9726028
480	3.55	3.55	.9726028
510	3.56	3.56	.9753425
540	3.53	3.53	.9671232
570	3.52	3.52	.9643836

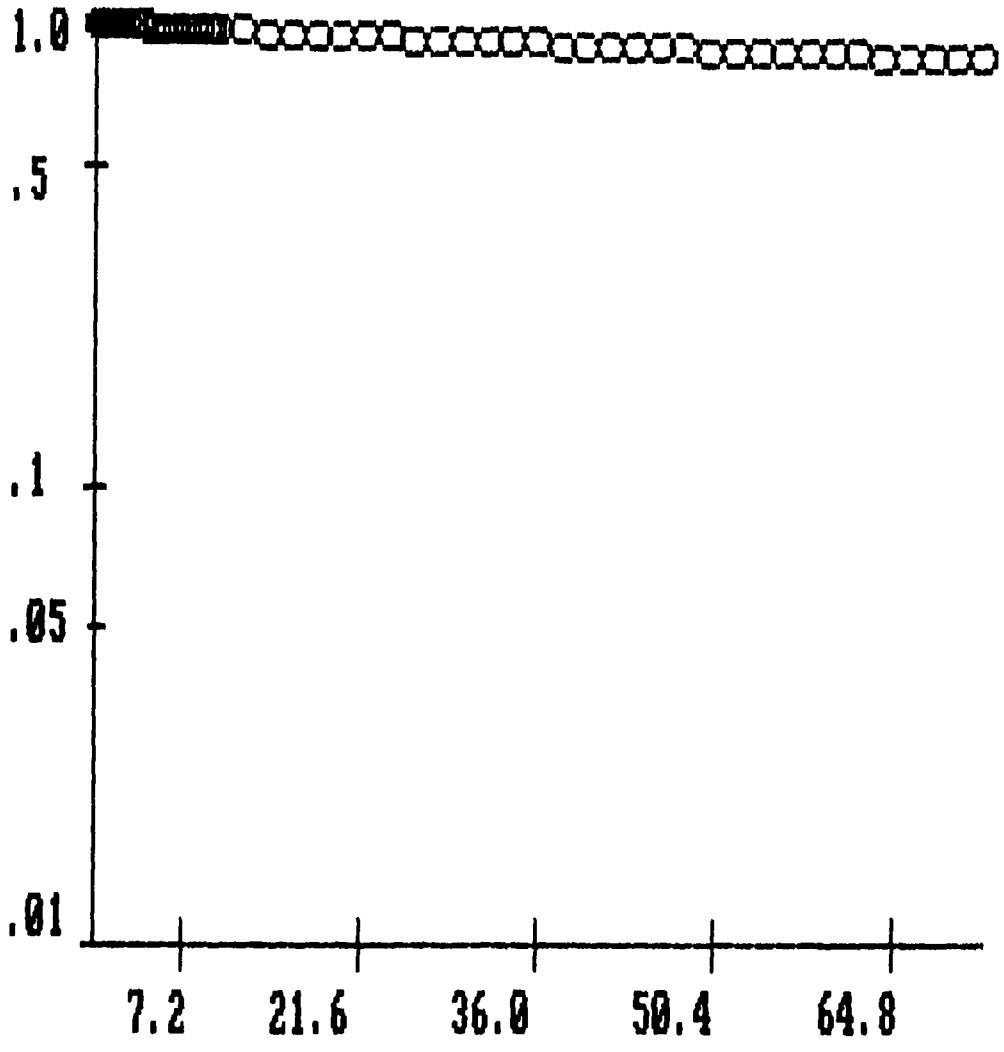
MW-6 (con't.)

600	3.52	3.52	.9643836
720	3.51	3.51	.9616439
840	3.48	3.48	.9534247
960	3.46	3.46	.9479452
1080	3.44	3.44	.9424658
1200	3.42	3.42	.9369864
1320	3.41	3.41	.9342466
1440	3.39	3.39	.9287671
1560	3.37	3.37	.9232876
1680	3.35	3.35	.9178082
1800	3.33	3.33	.9123288
1920	3.32	3.32	.909589
2040	3.3	3.30	.9041096
2160	3.29	3.29	.9013699
2280	3.27	3.27	.8958904
2400	3.25	3.25	.8904109
2520	3.24	3.24	.8876712
2640	3.22	3.22	.8821918
2760	3.21	3.21	.8794521
2880	3.19	3.19	.8739726
3000	3.17	3.17	.8684932
3120	3.16	3.16	.8657535
3240	3.16	3.16	.8657535
3360	3.14	3.14	.860274
3480	3.12	3.12	.8547945
3600	3.1	3.10	.8493151
3720	3.1	3.10	.8493151
3840	3.08	3.08	.8438356
3960	3.06	3.06	.8383562
4080	3.05	3.05	.8356165
4200	3.04	3.04	.8328768
4320	3.02	3.02	.8273973

CONFINED AQUIFER, FULLY PENETRATING CONDITION

K = 0.5E-05 cm/sec
= 0.1 gpd/ft2
= 0.2E-06 ft/sec
= 0.0 ft/day

REGRESSION COEFFICIENT = -.9971494



X AXIS:
TIME, min

Y AXIS:
LOG (H/H0)

EXAMINE PLOT.
STRIKE ANY KEY WHEN READY.

MM-6 (con't.)

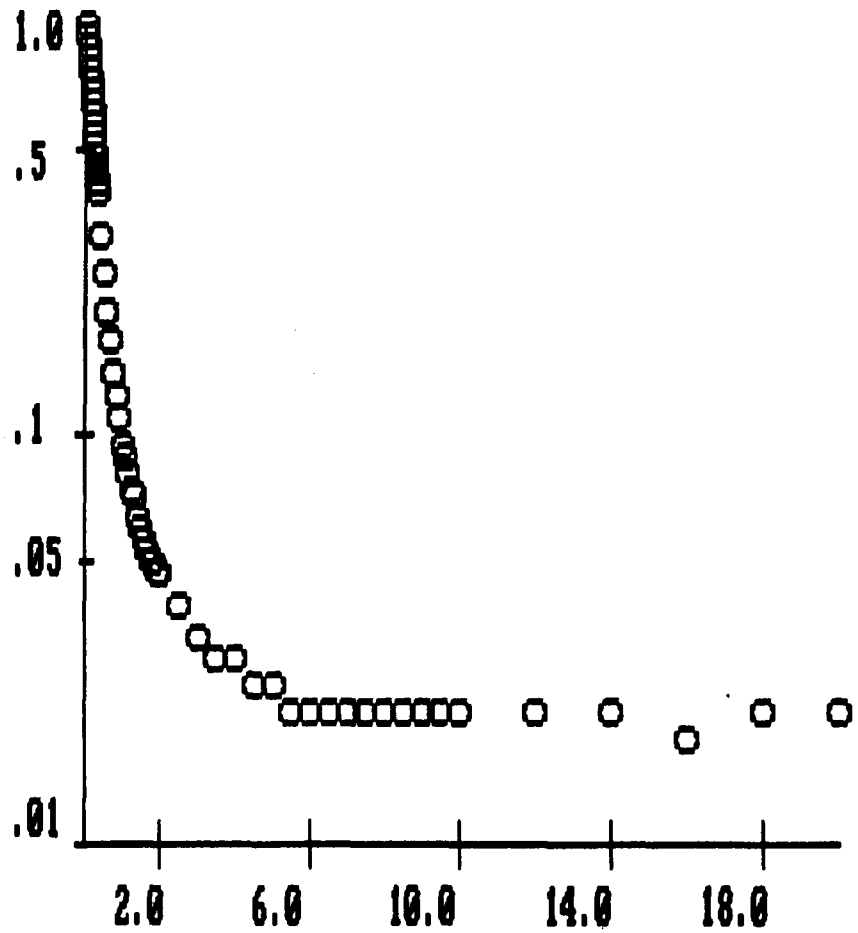
Summit National Site -- MW-7

TIME (seconds)	WATER LEVEL (feet)	DRAWDOWN (feet)	H/H0
3.996	2.83	2.83	1
4.998	2.67	2.67	.9434629
6	2.51	2.51	.8869258
6.996	2.35	2.35	.8303887
7.998	2.2	2.20	.7773852
9	2.07	2.07	.7314487
9.996	1.94	1.94	.6855125
10.998	1.83	1.83	.6466432
12	1.72	1.72	.6077738
12.996	1.62	1.62	.5724382
13.998	1.52	1.52	.5371025
15	1.44	1.44	.508834
15.996	1.36	1.36	.4805654
16.998	1.29	1.29	.4558304
18	1.22	1.22	.4310954
18.996	1.15	1.15	.4063604
19.998	1.09	1.09	.385159
25.002	.86	0.86	.3038869
30	.69	0.69	.2438163
34.998	.56	0.56	.1978799
40.002	.47	0.47	.1660778
45	.4	0.40	.1413428
49.998	.35	0.35	.1236749
55.002	.31	0.31	.1095406
60	.27	0.27	9.540637E-02
64.998	.25	0.25	8.833922E-02
70.002	.23	0.23	8.127209E-02
75	.21	0.21	7.420495E-02
79.998	.2	0.20	7.067138E-02
84.996	.18	0.18	6.360425E-02
90	.17	0.17	6.007068E-02

UNCONFINED AQUIFER

K = 0.2E-02 cm/sec
= 40.4 gpd/ft2
= 0.6E-04 ft/sec
= 5.4 ft/day

REGRESSION COEFFICIENT = -.978916



X AXIS:
TIME, min

Y AXIS:
LOG (H/H0)

EXAMINE PLOT.
STRIKE ANY KEY WHEN READY.

MW-7 (con't.)

Summit National Site -- MW-8

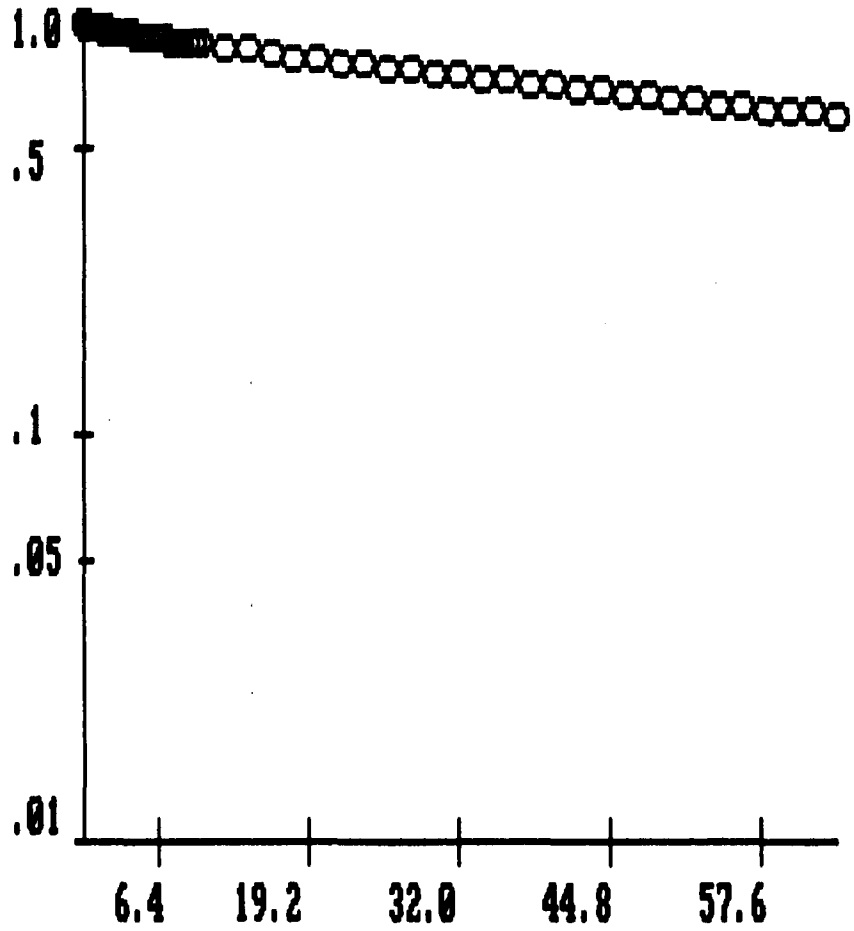
TIME (seconds)	WATER LEVEL (feet)	DRAWDOWN (feet)	H/H0
3.996	3.57	3.57	1
4.998	3.54	3.54	.9915967
6	3.46	3.46	.9691877
6.996	3.45	3.45	.9663866
7.998	3.46	3.46	.9691877
9	3.46	3.46	.9691877
9.996	3.46	3.46	.9691877
10.998	3.46	3.46	.9691877
12	3.46	3.46	.9691877
12.996	3.46	3.46	.9691877
13.998	3.46	3.46	.9691877
15	3.46	3.46	.9691877
15.996	3.46	3.46	.9691877
16.998	3.45	3.45	.9663866
18	3.45	3.45	.9663866
18.996	3.45	3.45	.9663866
19.998	3.45	3.45	.9663866
25.002	3.45	3.45	.9663866
30	3.45	3.45	.9663866
34.998	3.45	3.45	.9663866
40.002	3.45	3.45	.9663866
45	3.44	3.44	.9635854
49.998	3.44	3.44	.9635854
55.002	3.44	3.44	.9635854
60	3.44	3.44	.9635854
64.998	3.43	3.43	.9607844
70.002	3.43	3.43	.9607844
75	3.44	3.44	.9635854
79.998	3.42	3.42	.9579833
84.996	3.42	3.42	.9579833
90	3.42	3.42	.9579833
94.998	3.41	3.41	.9551821
100.002	3.41	3.41	.9551821
105	3.41	3.41	.9551821
109.998	3.4	3.40	.9523809
115.002	3.4	3.40	.9523809
120	3.4	3.40	.9523809
150	3.38	3.38	.9467788
180	3.36	3.36	.9411765
210	3.34	3.34	.9355742
240	3.32	3.32	.929972
270	3.3	3.30	.9243698
300	3.28	3.28	.9187675
330	3.26	3.26	.9131652
360	3.25	3.25	.9103641
390	3.23	3.23	.9047619
420	3.22	3.22	.9019609
450	3.2	3.20	.8963586
480	3.19	3.19	.8935575
510	3.18	3.18	.8907564
540	3.17	3.17	.8879552
570	3.16	3.16	.8851541
600	3.14	3.14	.8795519

720	3.09	3.09	.8655463
840	3.04	3.04	.8515406
960	2.99	2.99	.8375351
1080	2.92	2.92	.8179273
1200	2.86	2.86	.8011204
1320	2.82	2.82	.789916
1440	2.77	2.77	.7759104
1560	2.73	2.73	.764706
1680	2.68	2.68	.7507003
1800	2.64	2.64	.7394959
1920	2.6	2.60	.7282913
2040	2.55	2.55	.7142858
2160	2.52	2.52	.7058824
2280	2.49	2.49	.697479
2400	2.44	2.44	.6834735
2520	2.4	2.40	.672269
2640	2.37	2.37	.6638656
2760	2.34	2.34	.6554622
2880	2.3	2.30	.6442578
3000	2.28	2.28	.6386555
3120	2.24	2.24	.627451
3240	2.21	2.21	.6190476
3360	2.18	2.18	.6106443
3480	2.15	2.15	.602241
3600	2.12	2.12	.5938376
3720	2.1	2.10	.5882353
3840	2.07	2.07	.5798319

CONFINED AQUIFER, FULLY PENETRATING CONDITION

K = 0.1E-04 cm/sec
= 0.2 gpd/ft2
= 0.4E-06 ft/sec
= 0.0 ft/day

REGRESSION COEFFICIENT = -.9978846



X AXIS:
TIME, min

Y AXIS:
LOG (H/H0)

EXAMINE PLOT.
STRIKE ANY KEY WHEN READY.

MW-8 (con't.)

SUMMIT NATIONAL SITE -- MW-9

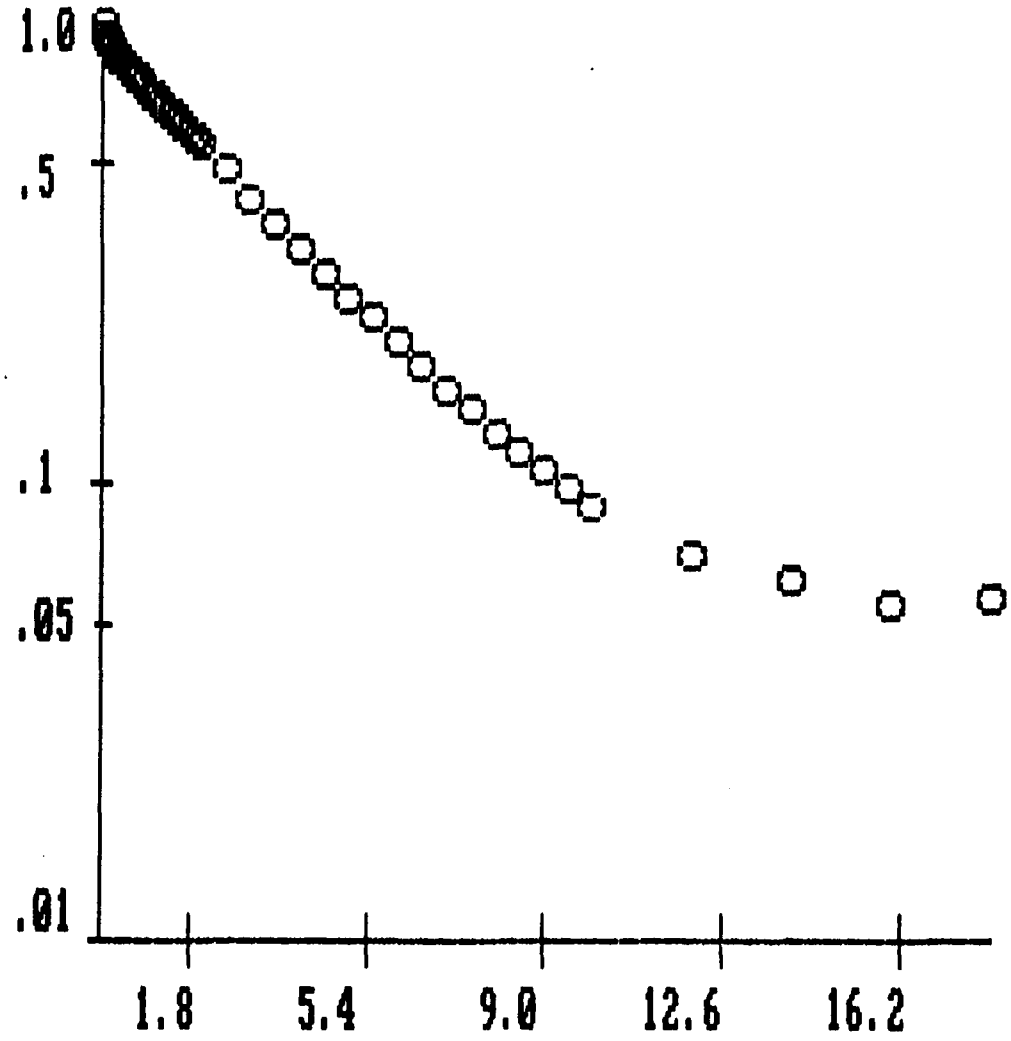
TIME (seconds)	WATER LEVEL (feet)	DRAWDOWN (feet)	H/HO
3	4.25	4.25	1
3.996	3.99	3.99	.9388234
4.998	3.94	3.94	.9270588
6	3.94	3.94	.9270588
6.996	3.9	3.90	.917647
7.998	3.86	3.86	.9082352
9	3.83	3.83	.9011764
9.996	3.81	3.81	.8964706
10.998	3.77	3.77	.8870588
12	3.75	3.75	.8823529
12.996	3.73	3.73	.8776471
13.998	3.7	3.70	.8705882
15	3.68	3.68	.8658824
15.996	3.66	3.66	.8611765
16.998	3.64	3.64	.8564706
18	3.61	3.61	.8494118
18.996	3.6	3.60	.8470588
19.998	3.58	3.58	.8423529
25.002	3.49	3.49	.8211765
30	3.4	3.40	.8
34.998	3.33	3.33	.7835294
40.002	3.26	3.26	.7670588
45	3.18	3.18	.7482353
49.998	3.11	3.11	.7317647
55.002	3.03	3.03	.7129412
60	2.97	2.97	.6988236
64.998	2.9	2.90	.682353
70.002	2.84	2.84	.6682353
75	2.78	2.78	.6541176
79.998	2.72	2.72	.64
84.996	2.66	2.66	.6258823
90	2.6	2.60	.6117647
94.998	2.54	2.54	.597647
100.002	2.49	2.49	.5858824
105	2.44	2.44	.5741177
109.998	2.39	2.39	.562353
115.002	2.34	2.34	.5505882
120	2.29	2.29	.5388235
150	2.01	2.01	.4729412
180	1.76	1.76	.4141176
210	1.55	1.55	.3647059
240	1.37	1.37	.322353
270	1.22	1.22	.2870588
300	1.08	1.08	.2541177
330	.96	0.96	.2258823
360	.85	0.85	.2
390	.76	0.76	.1788235
420	.67	0.67	.1576471

450	.61	0.61	.1435294
480	.54	0.54	.1270588
510	.49	0.49	.1152941
540	.45	0.45	.1058824
570	.41	0.41	9.647059E-02
600	.38	0.38	8.941176E-02

UNCONFINED AQUIFER

K = 0.2E-03 cm/sec
= 4.8 gpd/ft2
= 0.7E-05 ft/sec
= 0.6 ft/day

REGRESSION COEFFICIENT = -.9984327



X AXIS:
TIME, min

Y AXIS:
LOG (H/H0)

EXAMINE PLOT.
STRIKE ANY KEY WHEN READY.

MW-9 (cont'd.)

Summit National Site -- MW-10

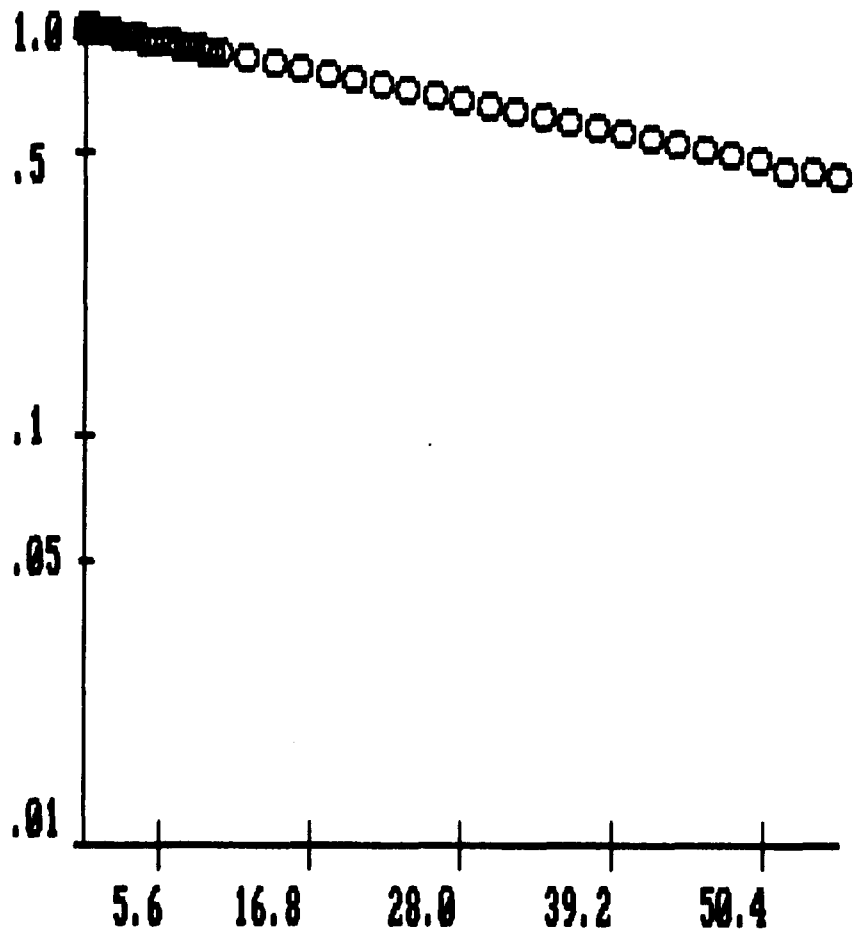
TIME (seconds)	WATER LEVEL (feet)	DRAWDOWN (feet)	H/H0
3	4.58	4.58	1
3.996	4.5	4.50	.9825328
4.998	4.45	4.45	.9716158
6	4.58	4.58	1
6.996	4.5	4.50	.9825328
7.998	4.52	4.52	.9868996
9	4.51	4.51	.9847163
9.996	4.52	4.52	.9868996
10.998	4.52	4.52	.9868996
12	4.52	4.52	.9868996
12.996	4.52	4.52	.9868996
13.998	4.52	4.52	.9868996
15	4.52	4.52	.9868996
15.996	4.52	4.52	.9868996
16.998	4.52	4.52	.9868996
18	4.52	4.52	.9868996
18.996	4.52	4.52	.9868996
19.998	4.52	4.52	.9868996
25.002	4.52	4.52	.9868996
30	4.52	4.52	.9868996
34.998	4.51	4.51	.9847163
40.002	4.5	4.50	.9825328
45	4.5	4.50	.9825328
49.998	4.49	4.49	.9803494
55.002	4.48	4.48	.978166
60	4.48	4.48	.978166
64.998	4.47	4.47	.9759826
70.002	4.46	4.46	.9737992
75	4.45	4.45	.9716158
79.998	4.45	4.45	.9716158
84.996	4.44	4.44	.9694324
90	4.44	4.44	.9694324
94.998	4.43	4.43	.9672489
100.002	4.43	4.43	.9672489
105	4.42	4.42	.9650656
109.998	4.41	4.41	.9628821
115.002	4.4	4.40	.9606988
120	4.4	4.40	.9606988
150	4.36	4.36	.9519651
180	4.34	4.34	.9475984
210	4.31	4.31	.9410481
240	4.28	4.28	.9344979
270	4.24	4.24	.9257642
300	4.21	4.21	.919214
330	4.19	4.19	.9148472
360	4.17	4.17	.9104804
390	4.14	4.14	.9039301
420	4.1	4.10	.8951966
450	4.08	4.08	.8908297
480	4.04	4.04	.8820961
510	4.01	4.01	.8755459

540	3.98	3.98	.8689957
570	3.95	3.95	.8624455
600	3.93	3.93	.8580787
720	3.81	3.81	.8318778
840	3.69	3.69	.8056769
960	3.58	3.58	.7816595
1080	3.47	3.47	.757642
1200	3.36	3.36	.7336245
1320	3.28	3.28	.7161573
1440	3.18	3.18	.6943232
1560	3.1	3.10	.676856
1680	2.99	2.99	.6528385
1800	2.91	2.91	.6353712
1920	2.8	2.80	.6113538
2040	2.7	2.70	.5895197
2160	2.64	2.64	.5764193
2280	2.54	2.54	.5545852
2400	2.47	2.47	.5393013
2520	2.4	2.40	.5240175
2640	2.32	2.32	.5065503
2760	2.24	2.24	.489083
2880	2.16	2.16	.4716158
3000	2.1	2.10	.4585153
3120	2.03	2.03	.4432315
3240	1.97	1.97	.430131
3360	1.91	1.91	.4170306

CONFINED AQUIFER, FULLY PENETRATING CONDITION

K = 0.2E-04 cm/sec
= 0.5 gpd/ft2
= 0.8E-06 ft/sec
= 0.1 ft/day

REGRESSION COEFFICIENT = -.9997384



X AXIS:
TIME, min

Y AXIS:
LOG (H/H0)

EXAMINE PLOT.
STRIKE ANY KEY WHEN READY.

MW-10 (con't.)

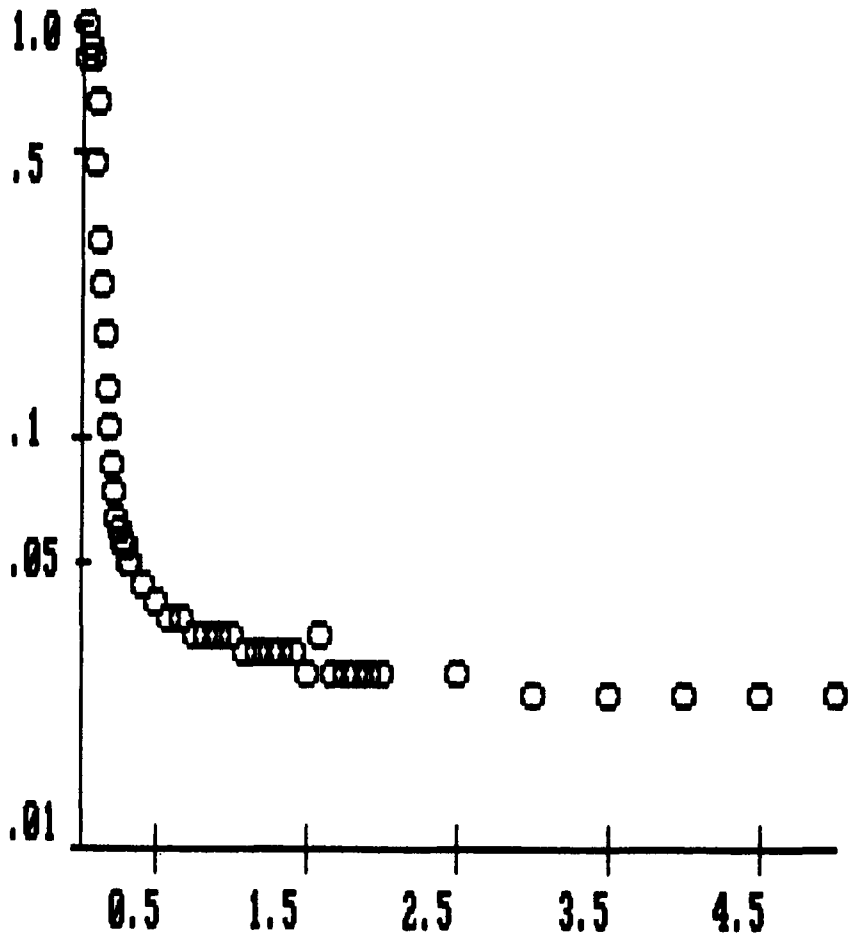
Summit National Site -- MW-11

TIME (seconds)	WATER LEVEL (feet)	DRAWDOWN (feet)	H/H0
1.8	3	3.00	1
1.998	2.49	2.49	.8300001
3	2.63	2.63	.8766668
3.996	2.47	2.47	.8233334
4.998	1.39	1.39	.4633334
6	1.97	1.97	.6566667
6.996	.92	0.92	.3066667
7.998	.71	0.71	.2366667
9	.53	0.53	.1766667
9.996	.4	0.40	.1333333
10.998	.32	0.32	.1066667
12	.26	0.26	8.666667E-02
12.996	.22	0.22	7.333334E-02
13.998	.19	0.19	6.333333E-02
15	.18	0.18	6.000001E-02
15.996	.17	0.17	5.666667E-02
16.998	.16	0.16	5.333334E-02
18	.16	0.16	5.333334E-02
18.996	.15	0.15	5.000001E-02
19.998	.15	0.15	5.000001E-02
25.002	.13	0.13	4.333334E-02
30	.12	0.12	.04
34.998	.11	0.11	3.666667E-02
40.002	.11	0.11	3.666667E-02
45	.1	0.10	3.333334E-02

UNCONFINED AQUIFER

K = 0.3E-02 cm/sec
= 67.9 gpd/ft2
= 0.1E-03 ft/sec
= 9.1 ft/day

REGRESSION COEFFICIENT = -.8152988



X AXIS:
TIME, min

Y AXIS:
LOG (H/H0)

EXAMINE PLOT.
STRIKE ANY KEY WHEN READY.

MW-11 (con't.)

960	3.5	3.50	.9615384
1080	3.48	3.48	.9560439
1200	3.46	3.46	.9505494
1320	3.45	3.45	.9478022
1440	3.43	3.43	.9423077
1560	3.41	3.41	.9368132
1680	3.4	3.40	.9340659
1800	3.38	3.38	.9285714
1920	3.35	3.35	.9203296
2040	3.34	3.34	.9175823
2160	3.33	3.33	.9148351
2280	3.31	3.31	.9093406
2400	3.3	3.30	.9065933
2520	3.28	3.28	.9010989
2640	3.26	3.26	.8956044
2760	3.25	3.25	.8928571
2880	3.23	3.23	.8873626
3000	3.22	3.22	.8846154
3120	3.2	3.20	.8791209
3240	3.19	3.19	.8763736
3360	3.17	3.17	.8708791
3480	3.15	3.15	.8653846
3600	3.13	3.13	.8598902
3720	3.12	3.12	.8571428
3840	3.1	3.10	.8516483
3960	3.09	3.09	.8489011
4080	3.07	3.07	.8434066
4200	3.06	3.06	.8406593

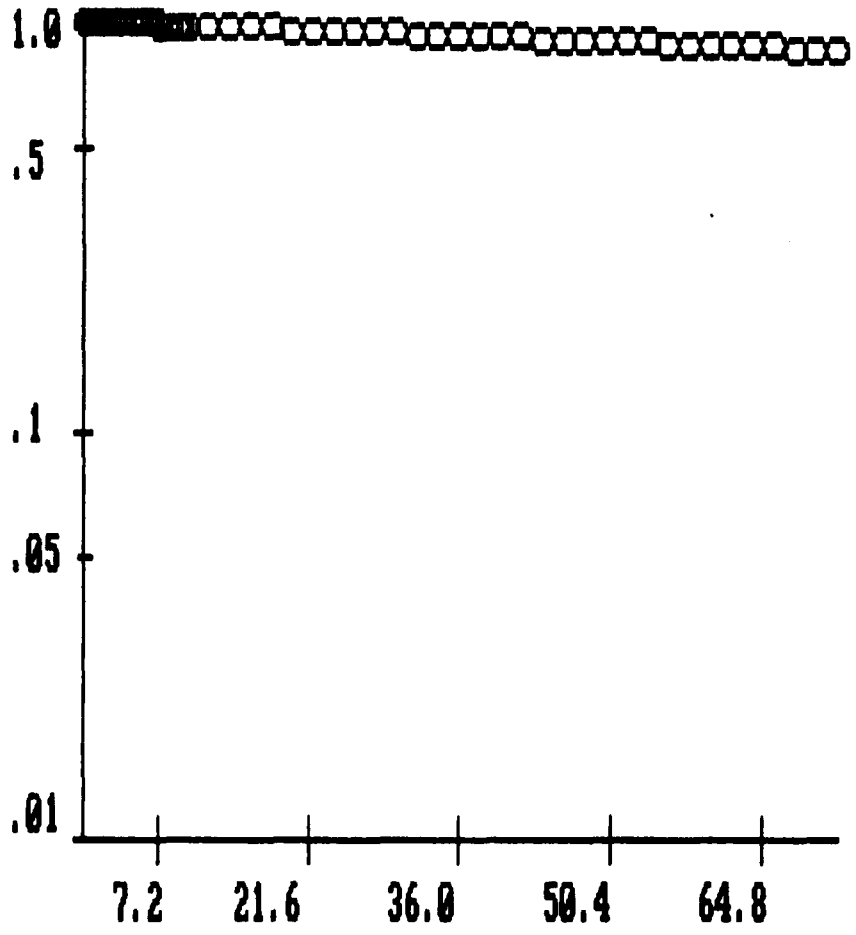
CONFINED AQUIFER, FULLY PENETRATING CONDITION

K = 0.6E-05 cm/sec
= 0.1 gpd/ft2
= 0.2E-06 ft/sec
= 0.0 ft/day

REGRESSION COEFFICIENT = -.9996982

Summit National Site -- MW-12

TIME (seconds)	WATER LEVEL (feet)	DRAWDOWN (feet)	H/H0
7.998	3.64	3.64	1
9	3.64	3.64	1
9.996	3.64	3.64	1
10.998	3.64	3.64	1
12	3.64	3.64	1
12.996	3.64	3.64	1
13.998	3.64	3.64	1
15	3.64	3.64	1
15.996	3.64	3.64	1
16.998	3.64	3.64	1
18	3.64	3.64	1
18.996	3.64	3.64	1
19.998	3.64	3.64	1
25.002	3.64	3.64	1
30	3.64	3.64	1
34.998	3.64	3.64	1
40.002	3.64	3.64	1
45	3.64	3.64	1
49.998	3.64	3.64	1
55.002	3.64	3.64	1
60	3.64	3.64	1
64.998	3.64	3.64	1
70.002	3.64	3.64	1
75	3.64	3.64	1
79.998	3.64	3.64	1
84.996	3.64	3.64	1
90	3.64	3.64	1
94.998	3.64	3.64	1
100.002	3.64	3.64	1
105	3.64	3.64	1
109.998	3.64	3.64	1
115.002	3.64	3.64	1
120	3.63	3.63	.9972528
150	3.63	3.63	.9972528
180	3.62	3.62	.9945054
210	3.62	3.62	.9945054
240	3.61	3.61	.9917582
270	3.61	3.61	.9917582
300	3.6	3.60	.989011
330	3.6	3.60	.989011
360	3.6	3.60	.989011
390	3.59	3.59	.9862637
420	3.59	3.59	.9862637
450	3.58	3.58	.9835164
480	3.58	3.58	.9835164
510	3.57	3.57	.9807692
540	3.57	3.57	.9807692
570	3.56	3.56	.978022
600	3.56	3.56	.978022
720	3.54	3.54	.9725274
840	3.52	3.52	.9670329



X AXIS:
TIME, min

Y AXIS:
LOG (H/H0)

EXAMINE PLOT.
STRIKE ANY KEY WHEN READY.

MW-12 (con't.)

Summit National Site -- MW-13

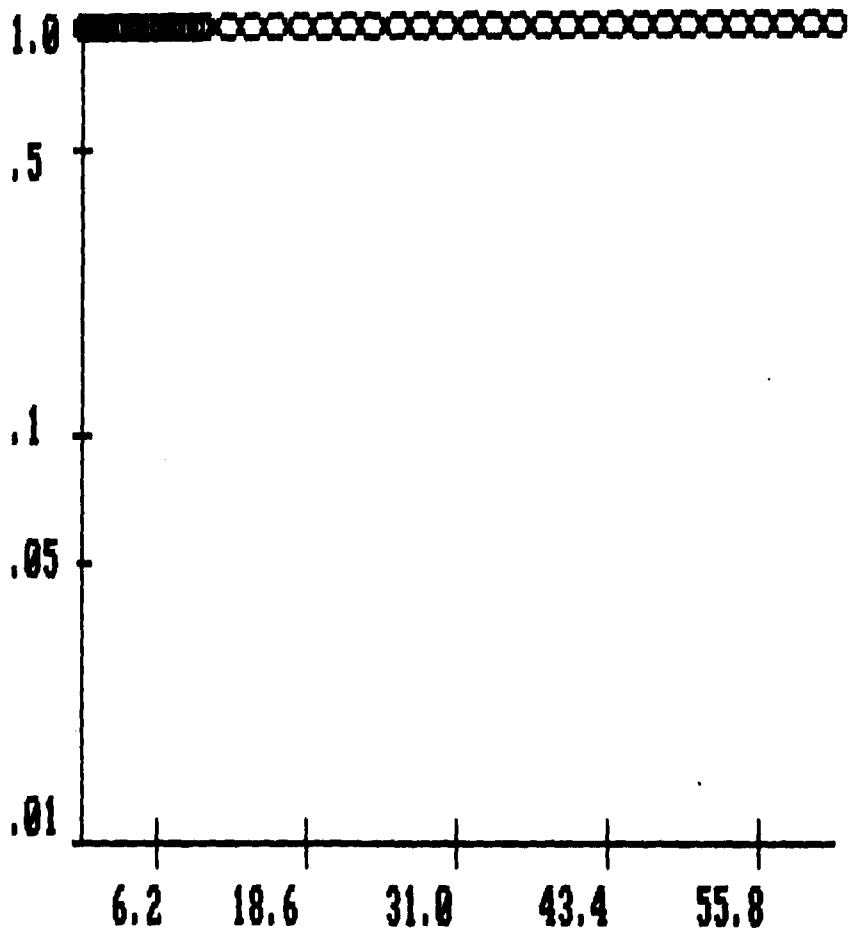
TIME (seconds)	WATER LEVEL (feet)	DRAWDOWN (feet)	H/H0
6.996	3.61	3.61	1
7.998	3.6	3.60	.99723
9	3.6	3.60	.99723
9.996	3.61	3.61	1
10.998	3.61	3.61	1
12	3.61	3.61	1
12.996	3.61	3.61	1
13.998	3.61	3.61	1
15	3.61	3.61	1
15.996	3.61	3.61	1
16.998	3.61	3.61	1
18	3.61	3.61	1
18.996	3.61	3.61	1
19.998	3.61	3.61	1
25.002	3.61	3.61	1
30	3.61	3.61	1
34.998	3.61	3.61	1
40.002	3.61	3.61	1
45	3.61	3.61	1
49.998	3.61	3.61	1
55.002	3.61	3.61	1
60	3.61	3.61	1
64.998	3.61	3.61	1
70.002	3.61	3.61	1
75	3.61	3.61	1
79.998	3.61	3.61	1
84.996	3.61	3.61	1
90	3.61	3.61	1
94.998	3.61	3.61	1
100.002	3.61	3.61	1
105	3.61	3.61	1
109.998	3.61	3.61	1
115.002	3.61	3.61	1
120	3.61	3.61	1
150	3.61	3.61	1
180	3.61	3.61	1
210	3.61	3.61	1
240	3.61	3.61	1
270	3.61	3.61	1
300	3.61	3.61	1
330	3.61	3.61	1
360	3.61	3.61	1
390	3.61	3.61	1
420	3.61	3.61	1
450	3.6	3.60	.99723
480	3.6	3.60	.99723
510	3.6	3.60	.99723
540	3.6	3.60	.99723
570	3.6	3.60	.99723
600	3.6	3.60	.99723
720	3.6	3.60	.99723

840	3.6	3.60	.99723
960	3.6	3.60	.99723
1080	3.6	3.60	.99723
1200	3.6	3.60	.99723
1320	3.6	3.60	.99723
1440	3.6	3.60	.99723
1560	3.6	3.60	.99723
1680	3.6	3.60	.99723
1800	3.6	3.60	.99723
1920	3.6	3.60	.99723
2040	3.6	3.60	.99723
2160	3.6	3.60	.99723
2280	3.6	3.60	.99723
2400	3.59	3.59	.9944598
2520	3.59	3.59	.9944598
2640	3.6	3.60	.99723
2760	3.59	3.59	.9944598
2880	3.59	3.59	.9944598
3000	3.59	3.59	.9944598
3120	3.59	3.59	.9944598
3240	3.6	3.60	.99723
3360	3.58	3.58	.9916898
3480	3.57	3.57	.9889197
3600	3.59	3.59	.9944598
3720	3.6	3.60	.99723

CONFINED AQUIFER, FULLY PENETRATING CONDITION

K = 0.2E-06 cm/sec
= 0.0 gpd/ft2
= 0.6E-08 ft/sec
= 0.0 ft/day

REGRESSION COEFFICIENT = -.8481028



X AXIS:
TIME, min

Y AXIS:
LOG (H/H0)

EXAMINE PLOT.
STRIKE ANY KEY WHEN READY.

MW-13 (con't.)

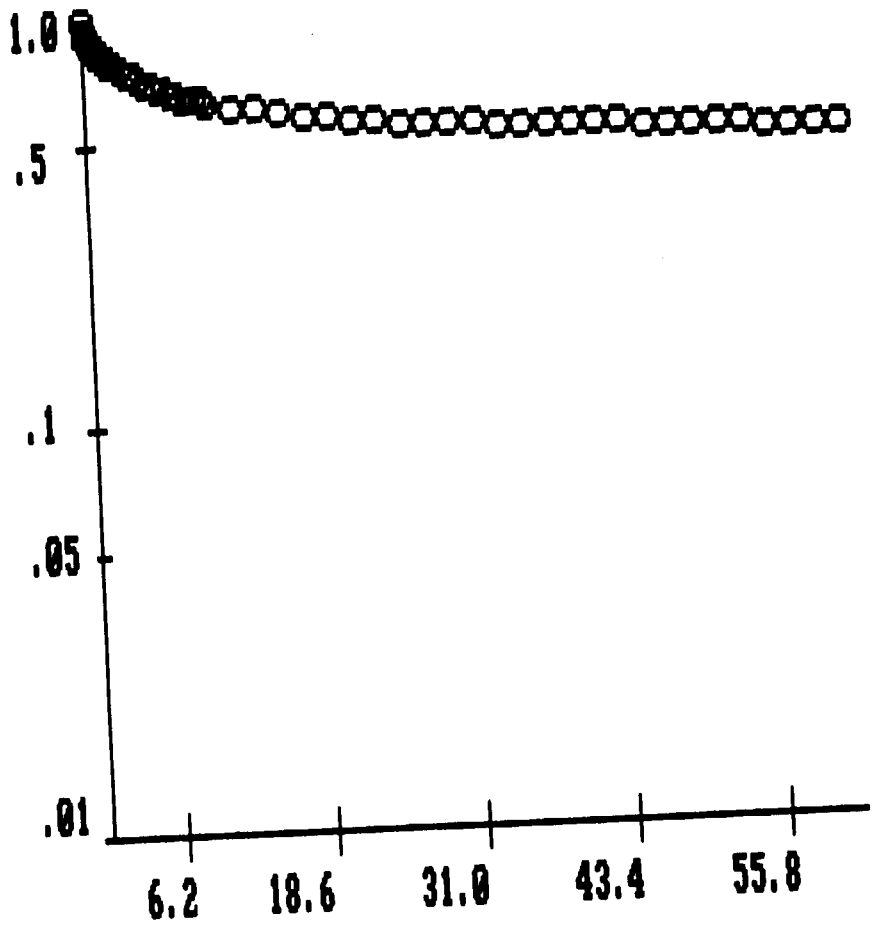
Summit National Site -- MW-14

TIME (seconds)	WATER LEVEL (feet)	DRAWDOWN (feet)	H/H0
60	3.21	3.21	.8492064
64.998	3.19	3.19	.8439154
70.002	3.17	3.17	.8386245
75	3.16	3.16	.8359789
79.998	3.13	3.13	.8280425
84.996	3.12	3.12	.8253968
90	3.1	3.10	.8201059
94.998	3.08	3.08	.8148149
100.002	3.06	3.06	.8095238
105	3.05	3.05	.8068783
109.998	3.03	3.03	.8015873
115.002	3.02	3.02	.7989418
120	3	3.00	.7936508
150	2.93	2.93	.7751323
180	2.86	2.86	.7566138
210	2.8	2.80	.7407408
240	2.74	2.74	.7248678
270	2.69	2.69	.7116403
300	2.64	2.64	.6984128
330	2.6	2.60	.6878307
360	2.55	2.55	.6746032
390	2.51	2.51	.6640212
420	2.48	2.48	.6560847
450	2.45	2.45	.6481482
480	2.42	2.42	.6402117
510	2.4	2.40	.6349207
540	2.38	2.38	.6296297
570	2.36	2.36	.6243386
600	2.34	2.34	.6190476

CONFINED AQUIFER, FULLY PENETRATING CONDITION

K = 0.5E-04 cm/sec
= 1.2 gpd/ft2
= 0.2E-05 ft/sec
= 0.2 ft/day

REGRESSION COEFFICIENT = -.9867078



X AXIS:
TIME, min

Y AXIS:
LOG (H/H0)

EXAMINE PLOT.
STRIKE ANY KEY WHEN READY.

MW-14 (con't.)

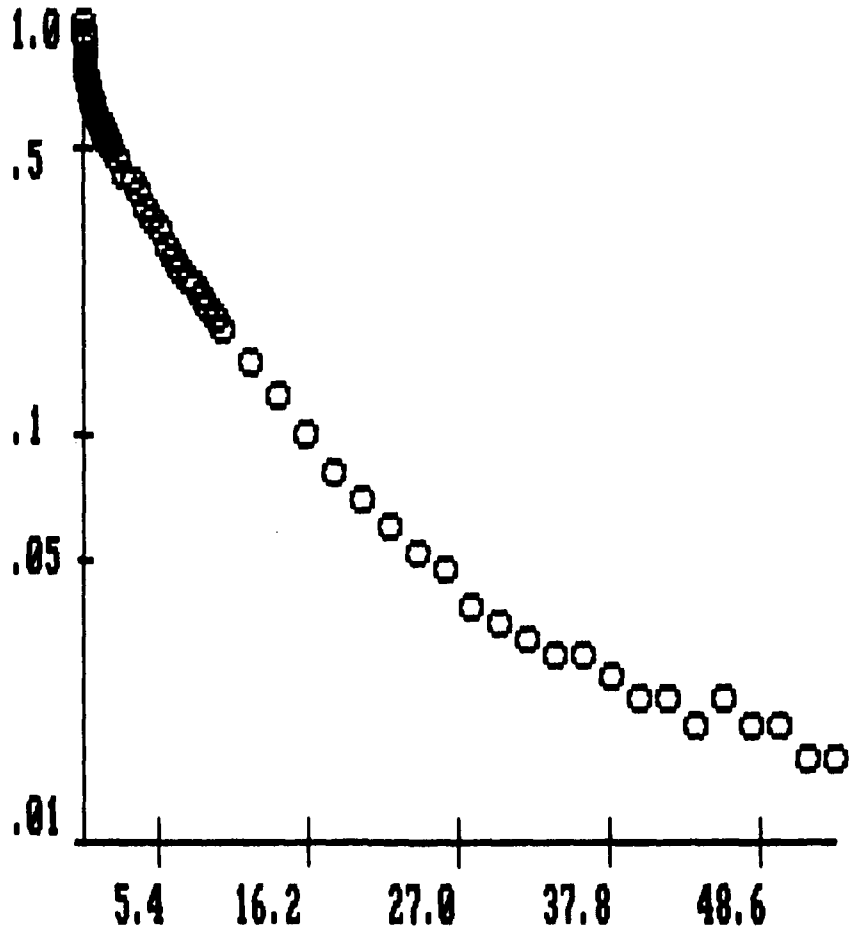
Summit National Site -- MW-15

TIME (seconds)	WATER LEVEL (feet)	DRAWDOWN (feet)	H/H0
60	1.88	1.88	.5893417
64.998	1.85	1.85	.5799373
70.002	1.82	1.82	.570533
75	1.79	1.79	.5611285
79.998	1.76	1.76	.5517241
84.996	1.74	1.74	.5454545
90	1.71	1.71	.5360502
94.998	1.69	1.69	.5297806
100.002	1.66	1.66	.5203762
105	1.64	1.64	.5141066
109.998	1.62	1.62	.507837
115.002	1.6	1.60	.5015675
120	1.57	1.57	.492163
150	1.47	1.47	.4608151
180	1.37	1.37	.4294671
210	1.29	1.29	.4043887
240	1.22	1.22	.3824451
270	1.13	1.13	.354232
300	1.05	1.05	.3291536
330	.98	0.98	.30721
360	.92	0.92	.2884013
390	.86	0.86	.2695925
420	.81	0.81	.2539185
450	.76	0.76	.2382445
480	.72	0.72	.2257054
510	.68	0.68	.2131662
540	.64	0.64	.200627
570	.61	0.61	.1912226
600	.58	0.58	.1818182
720	.47	0.47	.1473354
840	.39	0.39	.1222571
960	.32	0.32	.1003135

UNCONFINED AQUIFER

K = 0.1E-03 cm/sec
= 2.3 gpd/ft2
= 0.4E-05 ft/sec
= 0.3 ft/day

REGRESSION COEFFICIENT = -.9965199



X AXIS:
TIME, min

Y AXIS:
LOG (H/H0)

EXAMINE PLOT.
STRIKE ANY KEY WHEN READY.

MW-15 (con't.)

Summit National Site -- MW-16

TIME (seconds)	WATER LEVEL (feet)	DRAWDOWN (feet)	H/HO
4.998	4.63	4.63	1
6	4.61	4.61	.9956803
6.996	4.61	4.61	.9956803
7.998	4.61	4.61	.9956803
9	4.61	4.61	.9956803
9.996	4.61	4.61	.9956803
10.998	4.61	4.61	.9956803
12	4.61	4.61	.9956803
12.996	4.61	4.61	.9956803
13.998	4.61	4.61	.9956803
15	4.61	4.61	.9956803
15.996	4.62	4.62	.9978401
16.998	4.61	4.61	.9956803
18	4.61	4.61	.9956803
18.996	4.61	4.61	.9956803
19.998	4.61	4.61	.9956803
25.002	4.61	4.61	.9956803
30	4.62	4.62	.9978401
34.998	4.62	4.62	.9978401
40.002	4.62	4.62	.9978401
45	4.62	4.62	.9978401
49.998	4.62	4.62	.9978401
55.002	4.62	4.62	.9978401
60	4.62	4.62	.9978401
64.998	4.62	4.62	.9978401
70.002	4.62	4.62	.9978401
75	4.62	4.62	.9978401
79.998	4.62	4.62	.9978401
84.996	4.62	4.62	.9978401
90	4.62	4.62	.9978401
94.998	4.62	4.62	.9978401
100.002	4.62	4.62	.9978401
105	4.61	4.61	.9956803
109.998	4.62	4.62	.9978401
115.002	4.62	4.62	.9978401
120	4.62	4.62	.9978401
150	4.61	4.61	.9956803
180	4.61	4.61	.9956803
210	4.61	4.61	.9956803
240	4.6	4.60	.9935205
270	4.6	4.60	.9935205
300	4.6	4.60	.9935205
330	4.6	4.60	.9935205
360	4.6	4.60	.9935205
390	4.59	4.59	.9913608
420	4.59	4.59	.9913608
450	4.59	4.59	.9913608
480	4.58	4.58	.9892008
510	4.58	4.58	.9892008
540	4.58	4.58	.9892008
570	4.58	4.58	.9892008
600	4.58	4.58	.9892008
720	4.57	4.57	.9870411

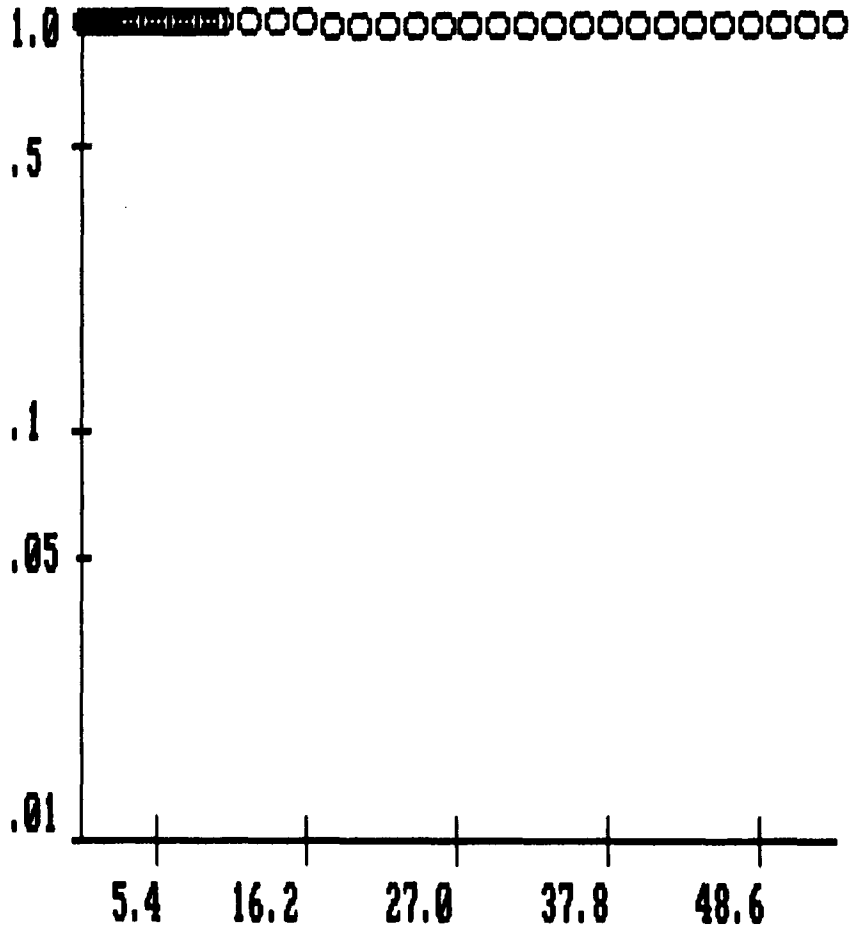
MW-16 (con't.)

840	4.56	4.56	.9848812
960	4.56	4.56	.9848812
1080	4.55	4.55	.9827214
1200	4.55	4.55	.9827214
1320	4.54	4.54	.9805616
1440	4.53	4.53	.9784018
1560	4.52	4.52	.9762419
1680	4.52	4.52	.9762419
1800	4.51	4.51	.9740821
1920	4.51	4.51	.9740821
2040	4.5	4.50	.9719222
2160	4.49	4.49	.9697624
2280	4.49	4.49	.9697624
2400	4.48	4.48	.9676026
2520	4.48	4.48	.9676026
2640	4.47	4.47	.9654427
2760	4.47	4.47	.9654427
2880	4.46	4.46	.9632829
3000	4.45	4.45	.9611231
3120	4.45	4.45	.9611231
3240	4.44	4.44	.9589632

CONFINED AQUIFER, FULLY PENETRATING CONDITION

K = 0.6E-06 cm/sec
= 0.0 gpd/ft2
= 0.2E-07 ft/sec
= 0.0 ft/day

REGRESSION COEFFICIENT = -.9939054



X AXIS:
TIME, min

Y AXIS:
LOG (H/H0)

EXAMINE PLOT.
STRIKE ANY KEY WHEN READY.

MW-16 (con't.)

Summit National Site -- MW-17

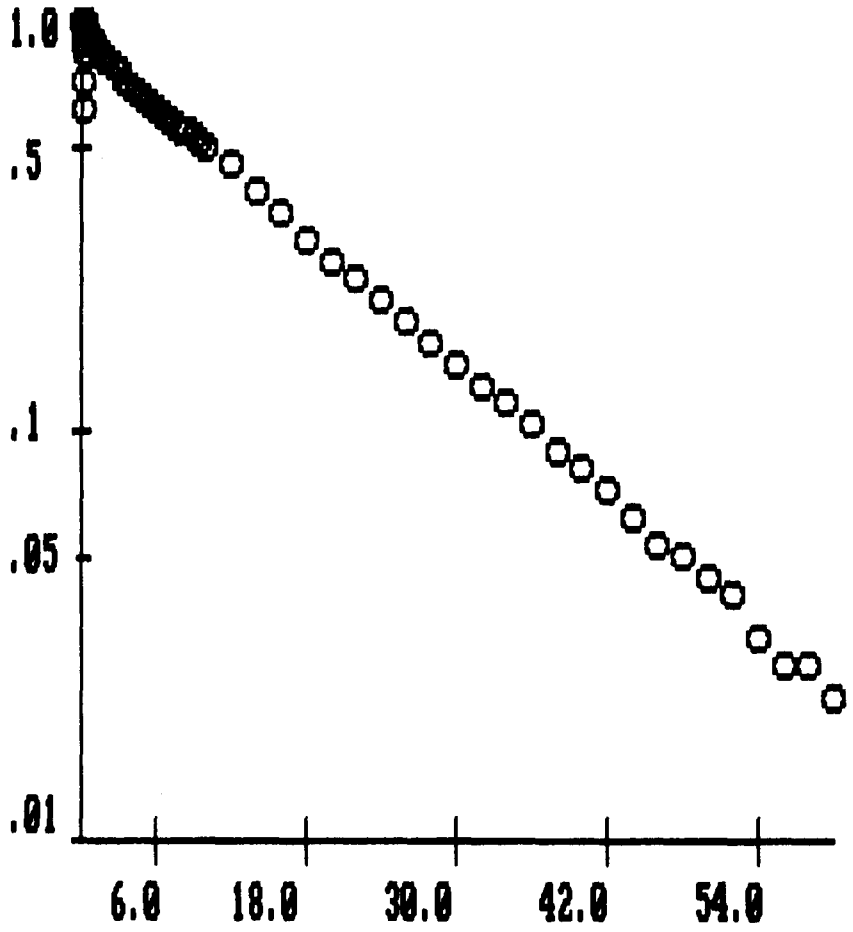
TIME (seconds)	WATER LEVEL (feet)	DRAWDOWN (feet)	H/H0
30	2.11	2.11	.9336282
34.998	2.09	2.09	.9247787
40.002	2.08	2.08	.9203539
45	2.06	2.06	.9115043
49.998	2.04	2.04	.9026548
55.002	2.02	2.02	.8938053
60	2	2.00	.8849558
64.998	1.98	1.98	.8761062
70.002	1.96	1.96	.8672566
75	1.95	1.95	.8628318
79.998	1.93	1.93	.8539822
84.996	1.91	1.91	.8451327
90	1.9	1.90	.8407079
94.998	1.89	1.89	.8362831
100.002	1.87	1.87	.8274336
105	1.86	1.86	.8230089
109.998	1.85	1.85	.8185841
115.002	1.83	1.83	.8097345
120	1.82	1.82	.8053097
150	1.75	1.75	.7743363
180	1.69	1.69	.7477876
210	1.63	1.63	.721239
240	1.58	1.58	.6991151
270	1.52	1.52	.6725664
300	1.48	1.48	.6548673
330	1.43	1.43	.6327433
360	1.39	1.39	.6150443
390	1.35	1.35	.5973451
420	1.31	1.31	.579646
450	1.28	1.28	.5663717
480	1.24	1.24	.5486726
510	1.23	1.23	.5442478
540	1.18	1.18	.5221239
570	1.15	1.15	.5088495
600	1.12	1.12	.4955752
720	1.02	1.02	.4513274
840	.88	0.88	.3893805
960	.76	0.76	.3362832
1080	.67	0.67	.2964602
1200	.59	0.59	.2610619
1320	.53	0.53	.2345133
1440	.47	0.47	.2079646
1560	.42	0.42	.1858407
1680	.37	0.37	.1637168
1800	.33	0.33	.1460177
1920	.29	0.29	.1283186
2040	.26	0.26	.1150442

2160	.23	0.23	.1017699
2280	.2	0.20	8.849558E-02
2400	.18	0.18	7.964602E-02
2520	.16	0.16	7.079646E-02
2640	.14	0.14	.0619469
2760	.12	0.12	5.309734E-02
2880	.11	0.11	4.867257E-02
3000	.1	0.10	4.424779E-02
3120	9.000001E-02		
		0.09	3.982301E-02
3240	.07	0.07	3.097345E-02
3360	.06	0.06	2.654867E-02
3480	.06	0.06	2.654867E-02
3600	.05	0.05	2.212389E-02

UNCONFINED AQUIFER

K = 0.6E-04 cm/sec
= 1.2 gpd/ft2
= 0.2E-05 ft/sec
= 0.2 ft/day

REGRESSION COEFFICIENT = -.9997093



X AXIS:
TIME, min

Y AXIS:
LOG (H/H0)

EXAMINE PLOT.
STRIKE ANY KEY WHEN READY.

MW-17 (con't.)

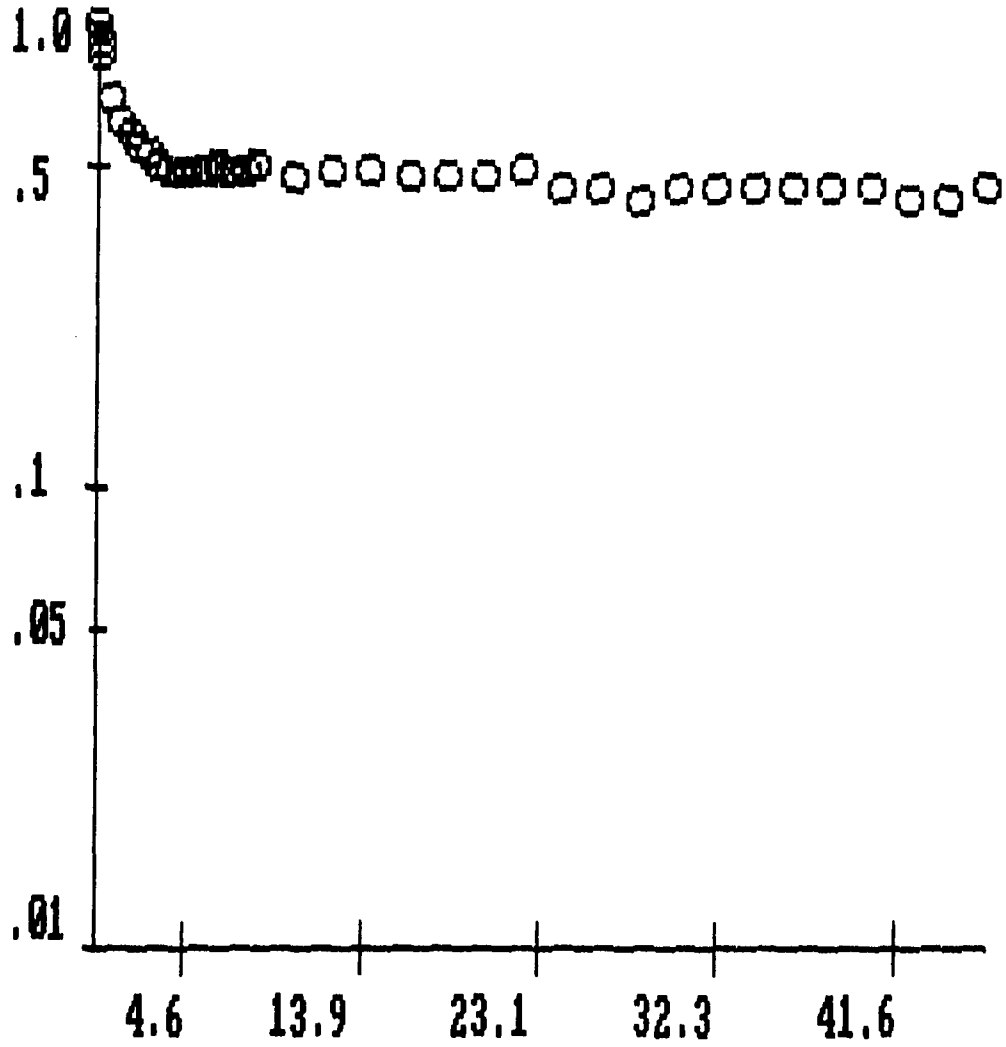
Summit National Site -- MW-18

TIME (seconds)	WATER LEVEL (feet)	DRAWDOWN (feet)	H/HO
10.002	.41	0.41	.6841667
40.002	.33	0.33	.6875001
70.002	.29	0.29	.6041666
100.002	.28	0.28	.5833334
130.002	.26	0.26	.5416666
160.002	.25	0.25	.5208334
190.002	.24	0.24	.5
220.002	.23	0.23	.4791667

UNCONFINED AQUIFER

K = 0.8E-04 cm/sec
= 1.7 gpd/ft2
= 0.3E-05 ft/sec
= 0.2 ft/day

REGRESSION COEFFICIENT = -.9422798



X AXIS:
TIME, min

Y AXIS:
LOG (H/H0)

EXAMINE PLOT.
STRIKE ANY KEY WHEN READY.

MW-18 (cont'd.)

1LIST 2RUN← 3LOAD" 4SAVE" 5CONT← 6,"LPT1 7TRON← 8TROFF← 9KEY 0SCREEN

Summit National Site -- MW-19

TIME (seconds)	WATER LEVEL (feet)	DRAWDOWN (feet)	H/H0
3	3.16	3.16	1
3.996	2.88	2.88	.9113924
4.998	2.75	2.75	.8702532
6	2.62	2.62	.8291139
6.996	2.5	2.50	.7911392
7.998	2.38	2.38	.7531646
9	2.26	2.26	.7151899
9.996	2.16	2.16	.6835443
10.998	2.06	2.06	.6518987
12	1.97	1.97	.6234177
12.996	1.88	1.88	.5949368
13.998	1.79	1.79	.5664557
15	1.71	1.71	.5411393
15.996	1.64	1.64	.5189873
16.998	1.57	1.57	.4968355
18	1.51	1.51	.4778481
18.996	1.46	1.46	.4620253
19.998	1.41	1.41	.4462025
25.002	1.21	1.21	.3829114
30	1.08	1.08	.3417722
34.998	.98	0.98	.3101266
40.002	.9	0.90	.2848101
45	.83	0.83	.2626582
49.998	.77	0.77	.2436709
55.002	.71	0.71	.2246836
60	.66	0.66	.2088608
64.998	.61	0.61	.193038
70.002	.57	0.57	.1803798
75	.53	0.53	.1677215
79.998	.5	0.50	.1582279
84.996	.47	0.47	.1487342
90	.45	0.45	.1424051
94.998	.43	0.43	.1360759
100.002	.4	0.40	.1265823
105	.39	0.39	.1234177
109.998	.37	0.37	.1170886
115.002	.36	0.36	.1139241
120	.34	0.34	.1075949

UNCONFINED AQUIFER

K = 0.6E-03 cm/sec
= 13.3 gpd/ft2
= 0.2E-04 ft/sec
= 1.8 ft/day

REGRESSION COEFFICIENT = -.9713761

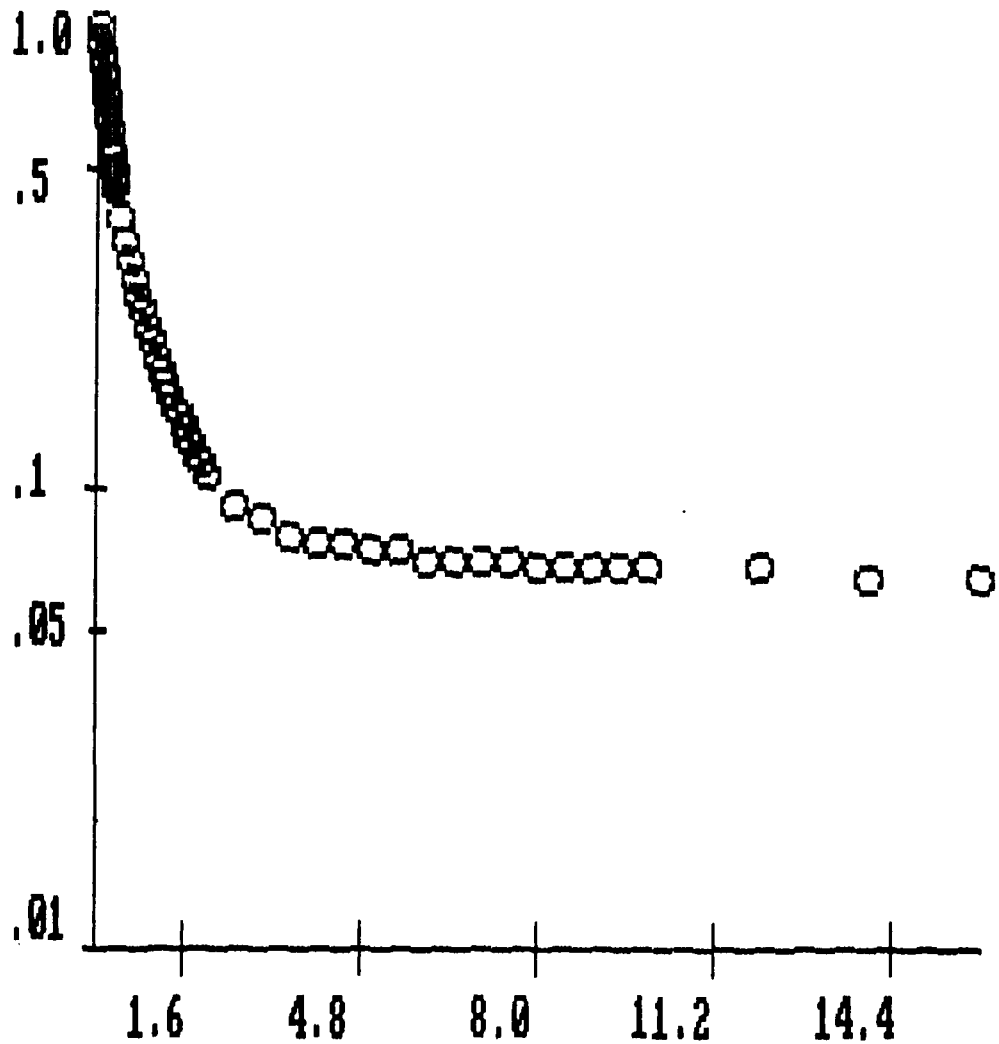
Summit National Site -- MW-19

TIME (seconds)	WATER LEVEL (feet)	DRAWDOWN (feet)	H/HO
19.998	1.41	1.41	.4462025
25.002	1.21	1.21	.3829114
30	1.08	1.08	.3417722
34.998	.98	0.98	.3101266
40.002	.9	0.90	.2848101
45	.83	0.83	.2626582
49.998	.77	0.77	.2436709
55.002	.71	0.71	.2246836
60	.66	0.66	.2088608
64.998	.61	0.61	.193038
70.002	.57	0.57	.1803798
75	.53	0.53	.1677215
79.998	.5	0.50	.1582279
84.996	.47	0.47	.1487342
90	.45	0.45	.1424051
94.998	.43	0.43	.1360759
100.002	.4	0.40	.1265823
105	.39	0.39	.1234177
109.998	.37	0.37	.1170886
115.002	.36	0.36	.1139241
120	.34	0.34	.1075949

UNCONFINED AQUIFER

K = 0.5E-03 cm/sec
= 9.8 gpd/ft2
= 0.2E-04 ft/sec
= 1.3 ft/day

REGRESSION COEFFICIENT = -.9887367



X AXIS:
TIME, min

Y AXIS:
LOG (H/H0)

EXAMINE PLOT.
STRIKE ANY KEY WHEN READY.

1LIST 2RUN← 3LOAD" 4SAVE" 5CONT← 6,"LPT1 7TRON← 8TROFF← 9KEY 0SCREEN

MW-19 (con't.)

SUMMIT NATIONAL SITE -- MW-20

TIME (seconds)	WATER LEVEL (feet)	DRAWDOWN (feet)	H/HO
40.002	4.4	4.40	1
45	4.4	4.40	1
49.998	4.4	4.40	1
55.002	4.39	4.39	.9977272
60	4.39	4.39	.9977272
64.998	4.39	4.39	.9977272
70.002	4.39	4.39	.9977272
75	4.39	4.39	.9977272
79.998	4.39	4.39	.9977272
84.996	4.39	4.39	.9977272
90	4.39	4.39	.9977272
94.998	4.39	4.39	.9977272
100.002	4.39	4.39	.9977272
105	4.38	4.38	.9954546
109.998	4.38	4.38	.9954546
115.002	4.38	4.38	.9954546
120	4.38	4.38	.9954546
150	4.38	4.38	.9954546
180	4.37	4.37	.9931818
210	4.36	4.36	.9909091
240	4.36	4.36	.9909091
270	4.36	4.36	.9909091
300	4.35	4.35	.9886363
330	4.35	4.35	.9886363
360	4.34	4.34	.9863637
390	4.34	4.34	.9863637
420	4.33	4.33	.9840909
450	4.33	4.33	.9840909
480	4.33	4.33	.9840909
510	4.32	4.32	.9818182
540	4.32	4.32	.9818182
570	4.31	4.31	.9795455
600	4.31	4.31	.9795455
720	4.29	4.29	.975
840	4.28	4.28	.9727274
960	4.26	4.26	.9681819
1080	4.25	4.25	.9659091
1200	4.23	4.23	.9613637
1320	4.22	4.22	.9590909
1440	4.21	4.21	.9568182
1560	4.19	4.19	.9522727
1680	4.18	4.18	.9499999
1800	4.17	4.17	.9477272
1920	4.15	4.15	.9431818
2040	4.14	4.14	.940909
2160	4.13	4.13	.9386364
2280	4.11	4.11	.9340909
2400	4.1	4.10	.9318182

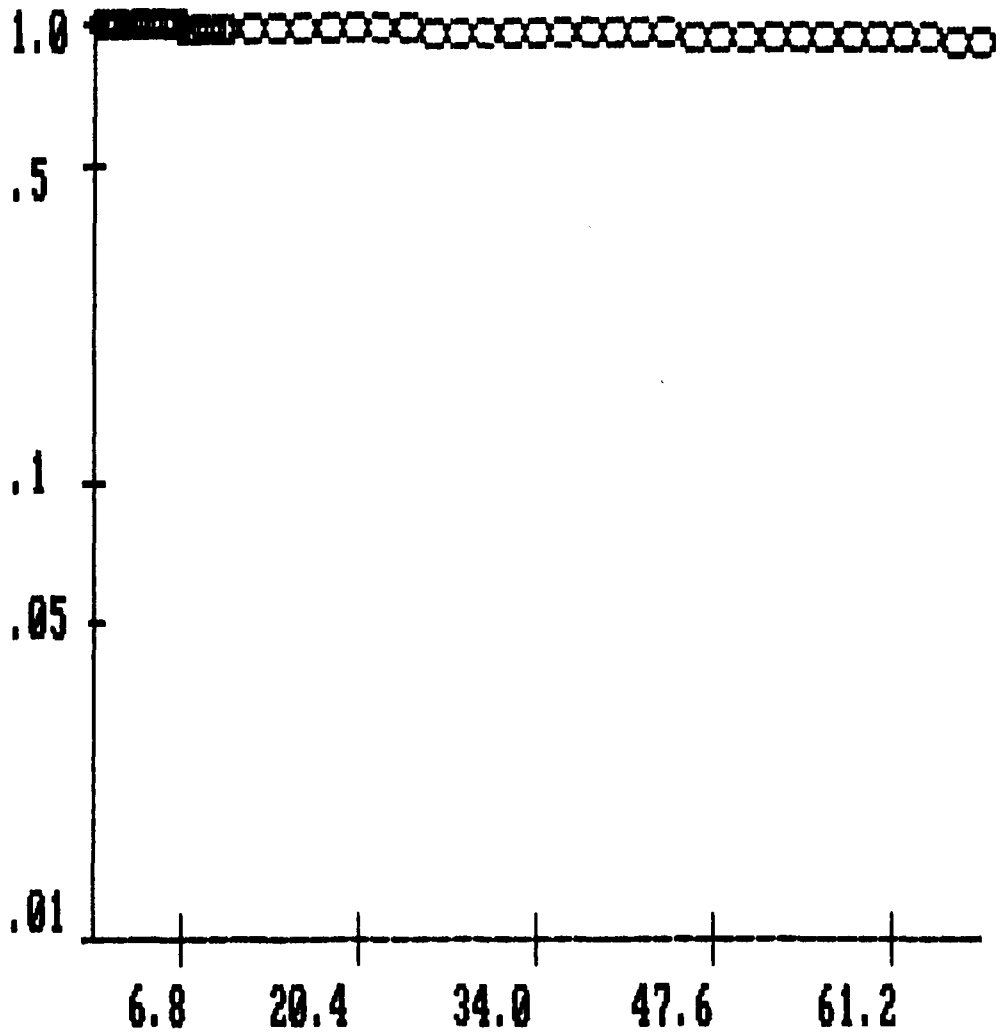
MW-20 (con't.)

2520	4.09	4.09	.9295455
2640	4.08	4.08	.9272727
2760	4.07	4.07	.9250001
2880	4.05	4.05	.9204546
3000	4.04	4.04	.9181818
3120	4.03	4.03	.9159092
3240	4.02	4.02	.9136364
3360	4	4.00	.9090909
3480	3.99	3.99	.9068181
3600	3.98	3.98	.9045455
3720	3.97	3.97	.9022728
3840	3.96	3.96	.9
3960	3.95	3.95	.8977273
4080	3.94	3.94	.8954545

CONFINED AQUIFER, FULLY PENETRATING CONDITION

K = 0.9E-05 cm/sec
= 0.2 gpd/ft2
= 0.3E-06 ft/sec
= 0.0 ft/day

REGRESSION COEFFICIENT = -.9981674



X AXIS:
TIME, min

Y AXIS:
LOG (H/H0)

EXAMINE PLOT.
STRIKE ANY KEY WHEN READY.

MW-20 (con't.)

SUMMIT NATIONAL SITE -- MW-21

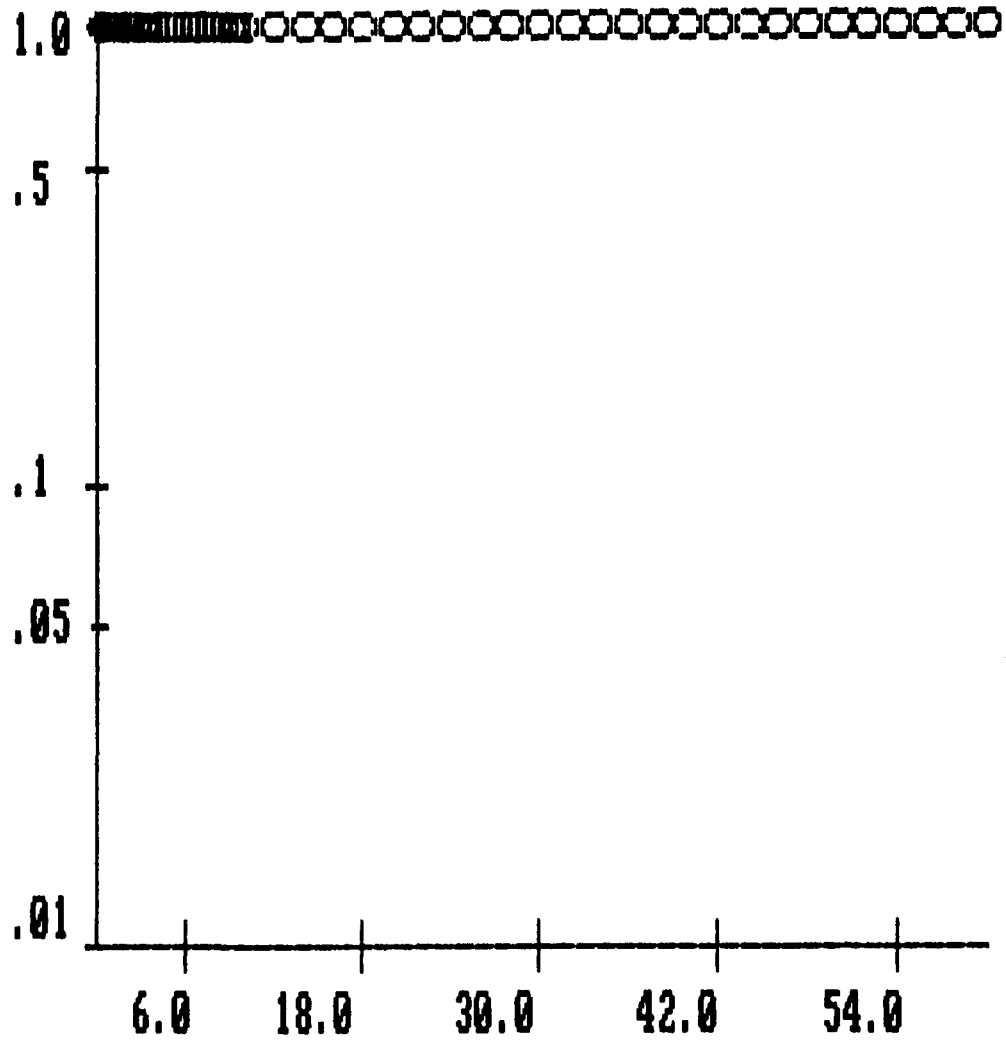
TIME (seconds)	WATER LEVEL (feet)	DRAWDOWN (feet)	H/HO
30	3.61	3.61	1
34.998	3.61	3.61	1
40.002	3.61	3.61	1
45	3.61	3.61	1
49.998	3.61	3.61	1
55.002	3.61	3.61	1
60	3.61	3.61	1
64.998	3.61	3.61	1
70.002	3.61	3.61	1
75	3.61	3.61	1
79.998	3.61	3.61	1
84.996	3.61	3.61	1
90	3.61	3.61	1
94.998	3.61	3.61	1
100.002	3.61	3.61	1
105	3.61	3.61	1
109.998	3.61	3.61	1
115.002	3.61	3.61	1
120	3.61	3.61	1
150	3.61	3.61	1
180	3.61	3.61	1
210	3.61	3.61	1
240	3.61	3.61	1
270	3.61	3.61	1
300	3.61	3.61	1
330	3.61	3.61	1
360	3.61	3.61	1
390	3.61	3.61	1
420	3.61	3.61	1
450	3.61	3.61	1
480	3.61	3.61	1
510	3.61	3.61	1
540	3.61	3.61	1
570	3.61	3.61	1
600	3.61	3.61	1
720	3.61	3.61	1
840	3.61	3.61	1
960	3.61	3.61	1
1080	3.61	3.61	1
1200	3.61	3.61	1
1320	3.61	3.61	1
1440	3.61	3.61	1
1560	3.61	3.61	1
1680	3.61	3.61	1
1800	3.61	3.61	1
1920	3.61	3.61	1
2040	3.61	3.61	1
2160	3.61	3.61	1
		3.61	1

2280	3.61	3.61	1
2400	3.61	3.61	1
2520	3.61	3.61	1
2640	3.6	3.60	.99723
2760	3.61	3.61	1
2880	3.61	3.61	1
3000	3.61	3.61	1
3120	3.61	3.61	1
3240	3.61	3.61	1
3360	3.61	3.61	1
3480	3.61	3.61	1
3600	3.61	3.61	1

CONFINED AQUIFER, PARTIALLY PENETRATING CONDITION

K = 0.2E-07 cm/sec
= 0.0 gpd/ft2
= 0.5E-09 ft/sec
= 0.0 ft/day

REGRESSION COEFFICIENT = -.1880114



X AXIS:
TIME, min

Y AXIS:
LOG (H/H0)

EXAMINE PLOT.
STRIKE ANY KEY WHEN READY.

MW-31 (con't.)

SUMMIT NATIONAL SITE -- MW-22

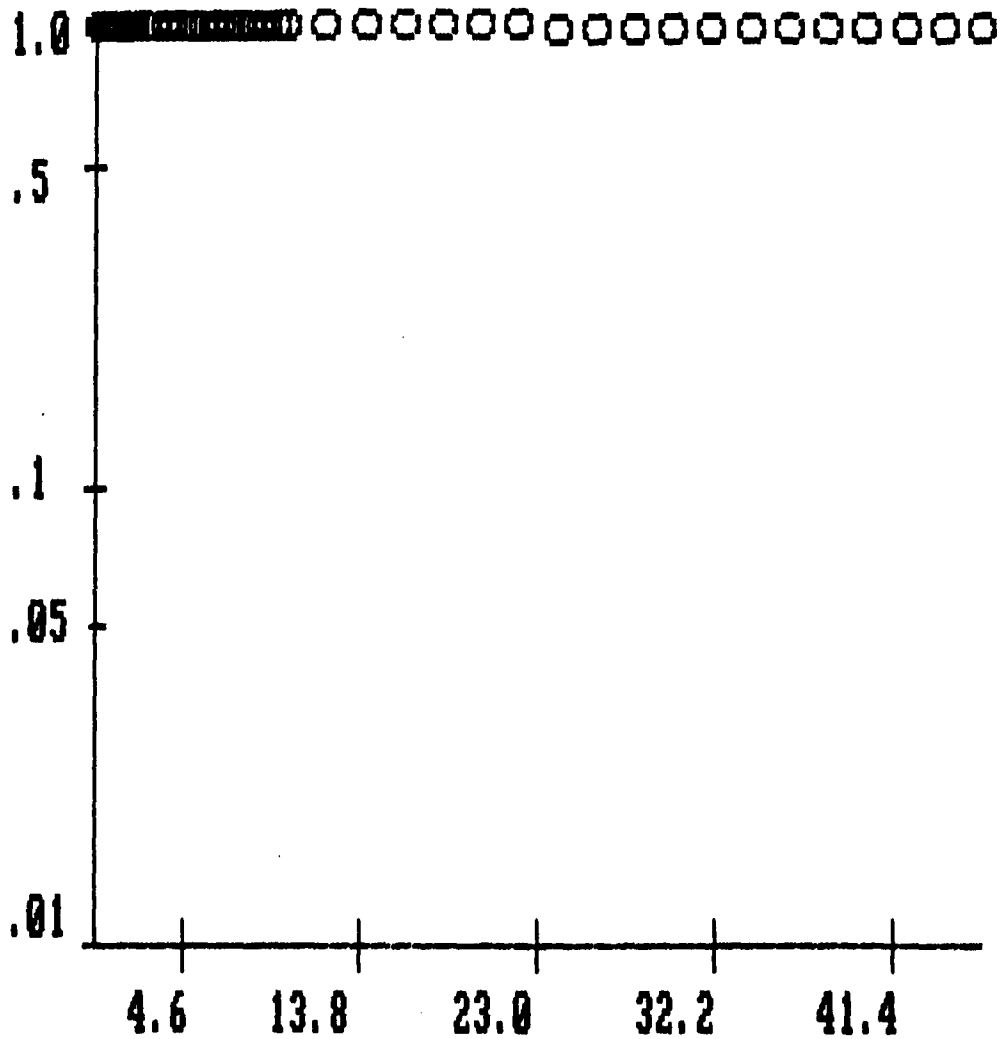
TIME (seconds)	WATER LEVEL (feet)	DRAWDOWN (feet)	H/HO
9.996	3.66	3.66	.9972752
10.998	3.66	3.66	.9972752
12	3.66	3.66	.9972752
12.996	3.66	3.66	.9972752
13.998	3.67	3.67	1
15	3.67	3.67	1
15.996	3.67	3.67	1
16.998	3.67	3.67	1
18	3.67	3.67	1
18.996	3.67	3.67	1
19.998	3.67	3.67	1
25.002	3.67	3.67	1
30	3.67	3.67	1
34.998	3.67	3.67	1
40.002	3.67	3.67	1
45	3.66	3.66	.9972752
49.998	3.66	3.66	.9972752
55.002	3.66	3.66	.9972752
60	3.66	3.66	.9972752
64.998	3.66	3.66	.9972752
70.002	3.66	3.66	.9972752
75	3.66	3.66	.9972752
79.998	3.66	3.66	.9972752
84.996	3.66	3.66	.9972752
90	3.66	3.66	.9972752
94.998	3.66	3.66	.9972752
100.002	3.66	3.66	.9972752
105	3.66	3.66	.9972752
109.998	3.66	3.66	.9972752
115.002	3.66	3.66	.9972752
120	3.66	3.66	.9972752
150	3.66	3.66	.9972752
180	3.66	3.66	.9972752
210	3.66	3.66	.9972752
240	3.66	3.66	.9972752
270	3.65	3.65	.9945504
300	3.65	3.65	.9945504
330	3.65	3.65	.9945504
360	3.65	3.65	.9945504
390	3.65	3.65	.9945504
420	3.65	3.65	.9945504
450	3.65	3.65	.9945504
480	3.65	3.65	.9945504
510	3.65	3.65	.9945504
540	3.65	3.65	.9945504
570	3.65	3.65	.9945504
600	3.64	3.64	.9918256
720	3.64	3.64	.9918256

840	3.64	3.64	.9918256
960	3.63	3.63	.9891009
1080	3.63	3.63	.9891009
1200	3.63	3.63	.9891009
1320	3.62	3.62	.9863759
1440	3.61	3.61	.9836512
1560	3.6	3.60	.9809264
1680	3.6	3.60	.9809264
1800	3.6	3.60	.9809264
1920	3.59	3.59	.9782016
2040	3.59	3.59	.9782016
2160	3.59	3.59	.9782016
2280	3.58	3.58	.9754769
2400	3.58	3.58	.9754769
2520	3.57	3.57	.9727521
2640	3.57	3.57	.9727521
2760	3.56	3.56	.9700272

CONFINED AQUIFER, FULLY PENETRATING CONDITION

K = 0.3E-05 cm/sec
= 0.1 gpd/ft2
= 0.1E-06 ft/sec
= 0.0 ft/day

REGRESSION COEFFICIENT = -.9914401



X AXIS:
TIME, min

Y AXIS:
LOG (H/H0)

EXAMINE PLOT.
STRIKE ANY KEY WHEN READY.

MW-22 (con't.)

SUMMIT NATIONAL SITE -- MW-23

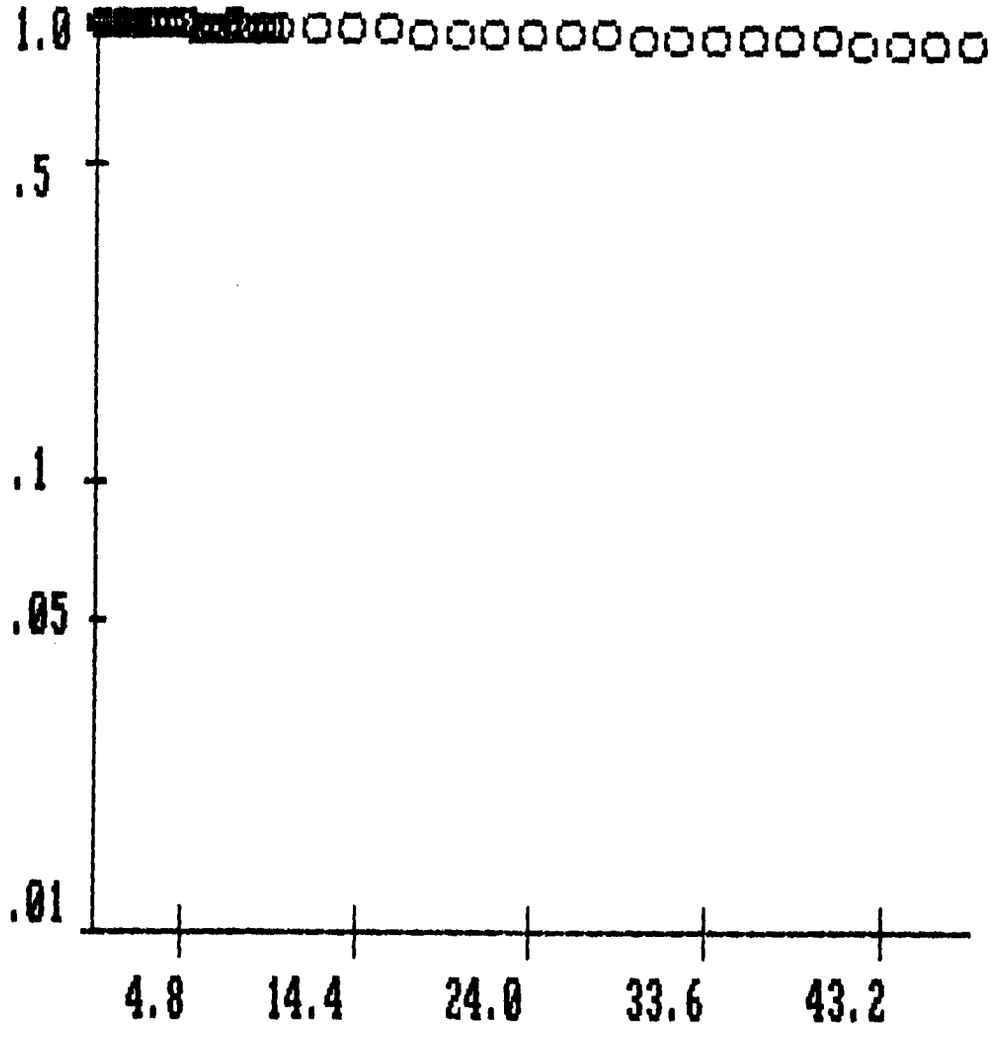
TIME (seconds)	WATER LEVEL (feet)	DRAWDOWN (feet)	H/HO
6.996	3.65	3.65	1
7.998	3.65	3.65	1
9	3.64	3.64	.9972603
9.996	3.64	3.64	.9972603
10.998	3.64	3.64	.9972603
12	3.64	3.64	.9972603
12.996	3.64	3.64	.9972603
13.998	3.64	3.64	.9972603
15	3.64	3.64	.9972603
15.996	3.64	3.64	.9972603
16.998	3.64	3.64	.9972603
18	3.64	3.64	.9972603
18.996	3.64	3.64	.9972603
19.998	3.64	3.64	.9972603
25.002	3.64	3.64	.9972603
30	3.64	3.64	.9972603
34.998	3.64	3.64	.9972603
40.002	3.64	3.64	.9972603
45	3.64	3.64	.9972603
49.998	3.64	3.64	.9972603
55.002	3.64	3.64	.9972603
60	3.63	3.63	.9945207
64.998	3.64	3.64	.9972603
70.002	3.64	3.64	.9972603
75	3.64	3.64	.9972603
79.998	3.63	3.63	.9945207
84.996	3.63	3.63	.9945207
90	3.63	3.63	.9945207
94.998	3.64	3.64	.9972603
100.002	3.63	3.63	.9945207
105	3.63	3.63	.9945207
109.998	3.63	3.63	.9945207
115.002	3.63	3.63	.9945207
120	3.63	3.63	.9945207
150	3.62	3.62	.9917808
180	3.62	3.62	.9917808
210	3.62	3.62	.9917808
240	3.61	3.61	.9890411
270	3.6	3.60	.9863014
300	3.6	3.60	.9863014
330	3.59	3.59	.9835616
360	3.59	3.59	.9835616
390	3.59	3.59	.9835616
420	3.58	3.58	.9808219
450	3.6	3.60	.9863014
480	3.58	3.58	.9808219
510	3.58	3.58	.9808219
540	3.57	3.57	.9780822

570	3.57	3.57	.9780822
600	3.56	3.56	.9753425
720	3.53	3.53	.9671232
840	3.52	3.52	.9643836
960	3.5	3.50	.9589041
1080	3.48	3.48	.9534247
1200	3.46	3.46	.9479452
1320	3.45	3.45	.9452055
1440	3.43	3.43	.9397261
1560	3.41	3.41	.9342466
1680	3.39	3.39	.9287671
1800	3.37	3.37	.9232876
1920	3.36	3.36	.9205479
2040	3.34	3.34	.9150684
2160	3.33	3.33	.9123288
2280	3.33	3.33	.9123288
2400	3.3	3.30	.9041096
2520	3.27	3.27	.8958904
2640	3.26	3.26	.8931507
2760	3.24	3.24	.8876712
2880	3.22	3.22	.8821918

CONFINED AQUIFER, FULLY PENETRATING CONDITION

K = 0.1E-04 cm/sec
= 0.3 gpd/ft2
= 0.4E-06 ft/sec
= 0.0 ft/day

REGRESSION COEFFICIENT = -.9989186



X AXIS:
TIME, min

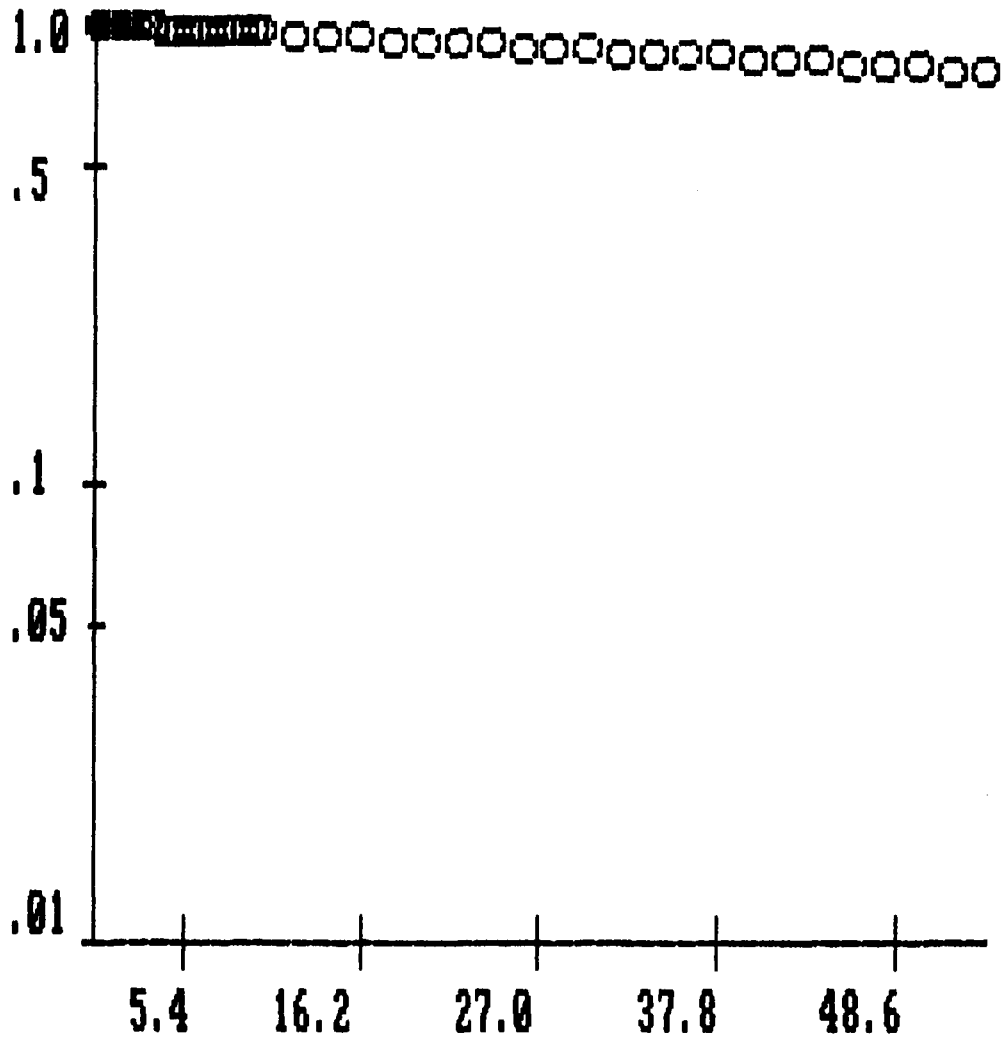
Y AXIS:
LOG (H/H0)

EXAMINE PLOT.
STRIKE ANY KEY WHEN READY.

MW-23 (con't.)

SUMMIT NATIONAL SITE -- MW-24

TIME (seconds)	WATER LEVEL (feet)	DRAWDOWN (feet)	H/HO
6	3.67	3.67	1
6.996	3.67	3.67	1
7.998	3.67	3.67	1
9	3.67	3.67	1
9.996	3.67	3.67	1
10.998	3.67	3.67	1
12	3.67	3.67	1
12.996	3.67	3.67	1
13.998	3.67	3.67	1
15	3.67	3.67	1
15.996	3.67	3.67	1
16.998	3.67	3.67	1
18	3.67	3.67	1
18.996	3.67	3.67	1
19.998	3.67	3.67	1
25.002	3.67	3.67	1
30	3.67	3.67	1
34.998	3.67	3.67	1
40.002	3.67	3.67	1
45	3.67	3.67	1
49.998	3.67	3.67	1
55.002	3.66	3.66	.9972752
60	3.66	3.66	.9972752
64.998	3.66	3.66	.9972752
70.002	3.66	3.66	.9972752
75	3.66	3.66	.9972752
79.998	3.66	3.66	.9972752
84.996	3.65	3.65	.9945504
90	3.65	3.65	.9945504
94.998	3.65	3.65	.9945504
100.002	3.65	3.65	.9945504
105	3.65	3.65	.9945504
109.998	3.65	3.65	.9945504
115.002	3.65	3.65	.9945504
120	3.65	3.65	.9945504
150	3.64	3.64	.9918256
180	3.63	3.63	.9891009
210	3.62	3.62	.9863759
240	3.61	3.61	.9836512
270	3.61	3.61	.9836512
300	3.6	3.60	.9809264
330	3.59	3.59	.9782016
360	3.58	3.58	.9754769
390	3.58	3.58	.9754769
420	3.57	3.57	.9727521
450	3.56	3.56	.9700272
480	3.55	3.55	.9673024
510	3.54	3.54	.9645777



X AXIS:
TIME, min

Y AXIS:
LOG (H/H0)

EXAMINE PLOT.
STRIKE ANY KEY WHEN READY.

MW-24 (con't.)

SUMMIT NATIONAL SITE -- MW-25

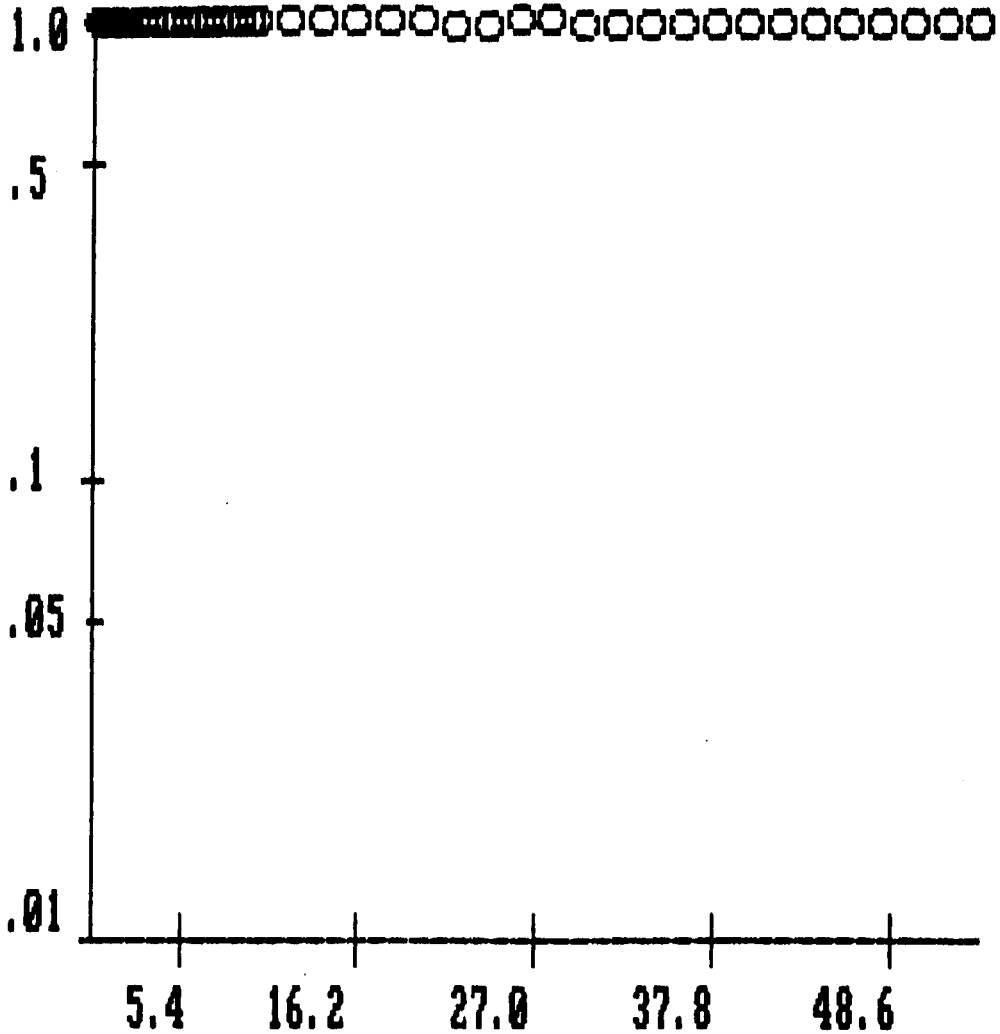
TIME (seconds)	WATER LEVEL (feet)	DRAWDOWN (feet)	H/HO
18	3.6	3.60	1
18.996	3.6	3.60	1
19.998	3.6	3.60	1
25.002	3.6	3.60	1
30	3.6	3.60	1
34.998	3.6	3.60	1
40.002	3.6	3.60	1
45	3.6	3.60	1
49.998	3.6	3.60	1
55.002	3.6	3.60	1
60	3.6	3.60	1
64.998	3.6	3.60	1
70.002	3.6	3.60	1
75	3.6	3.60	1
79.998	3.6	3.60	1
84.996	3.6	3.60	1
90	3.59	3.59	.9972222
94.998	3.59	3.59	.9972222
100.002	3.6	3.60	1
105	3.6	3.60	1
109.998	3.6	3.60	1
115.002	3.6	3.60	1
120	3.59	3.59	.9972222
150	3.6	3.60	1
180	3.59	3.59	.9972222
210	3.59	3.59	.9972222
240	3.59	3.59	.9972222
270	3.59	3.59	.9972222
300	3.58	3.58	.9944444
330	3.58	3.58	.9944444
360	3.58	3.58	.9944444
390	3.58	3.58	.9944444
420	3.58	3.58	.9944444
450	3.58	3.58	.9944444
480	3.57	3.57	.9916666
510	3.57	3.57	.9916666
540	3.57	3.57	.9916666
570	3.57	3.57	.9916666
600	3.57	3.57	.9916666
720	3.58	3.58	.9944444
840	3.58	3.58	.9944444
960	3.55	3.55	.9861111
1080	3.56	3.56	.9888889
1200	3.55	3.55	.9861111
1320	3.54	3.54	.9833333
1440	3.54	3.54	.9833333
1560	3.55	3.55	.9861111
1680	3.55	3.55	.9861111

1800	3.54	3.54	.9833333
1920	3.53	3.53	.9805555
2040	3.53	3.53	.9805555
2160	3.53	3.53	.9805555
2280	3.52	3.52	.9777778
2400	3.52	3.52	.9777778
2520	3.52	3.52	.9777778
2640	3.51	3.51	.975
2760	3.51	3.51	.975
2880	3.51	3.51	.975
3000	3.5	3.50	.9722222
3120	3.5	3.50	.9722222
3240	3.5	3.50	.9722222

CONFINED AQUIFER, NEARLY FULL PENETRATION WITH EQUATION FOR FULL PENETRATION
D

K = 0.5E-05 cm/sec
= 0.1 gpd/ft2
= 0.1E-06 ft/sec
= 0.0 ft/day

REGRESSION COEFFICIENT = -.9827466



X AXIS:
TIME, min

Y AXIS:
LOG (H/H0)

EXAMINE PLOT.
STRIKE ANY KEY WHEN READY.

MW-25 (con't.)

SUMMIT NATIONAL SITE -- MW-26

TIME (seconds)	WATER LEVEL (feet)	DRAWDOWN (feet)	H/HO
6.996	3.41	3.41	1
7.998	3.35	3.35	.9824046
9	3.36	3.36	.9853372
9.996	3.38	3.38	.9912024
10.998	3.36	3.36	.9853372
12	3.37	3.37	.9882697
12.996	3.37	3.37	.9882697
13.998	3.37	3.37	.9882697
15	3.33	3.33	.9765396
15.996	3.33	3.33	.9765396
16.998	3.35	3.35	.9824046
18	3.32	3.32	.9736069
18.996	3.3	3.30	.9677419
19.998	3.29	3.29	.9648094
25.002	3.21	3.21	.941349
30	3.14	3.14	.9208211
34.998	3.08	3.08	.9032258
40.002	3.01	3.01	.8826979
45	2.95	2.95	.8651026
49.998	2.89	2.89	.8475073
55.002	2.83	2.83	.829912
60	2.77	2.77	.8123166
64.998	2.72	2.72	.797654
70.002	2.66	2.66	.7800586
75	2.61	2.61	.7653959
79.998	2.56	2.56	.7507331
84.996	2.51	2.51	.7360704
90	2.46	2.46	.7214076
94.998	2.41	2.41	.7067449
100.002	2.36	2.36	.6920821
105	2.31	2.31	.6774193
109.998	2.27	2.27	.6656892
115.002	2.23	2.23	.653959
120	2.18	2.18	.6392962
150	1.94	1.94	.568915
180	1.74	1.74	.5102639
210	1.56	1.56	.457478
240	1.4	1.40	.4105572
270	1.27	1.27	.372434
300	1.15	1.15	.3372434
330	1.05	1.05	.3079179
360	.96	0.96	.2815249
390	.87	0.87	.255132
420	.8	0.80	.2346041
450	.74	0.74	.2170088
480	.69	0.69	.202346
510	.65	0.65	.1906158
540	.61	0.61	.1788856

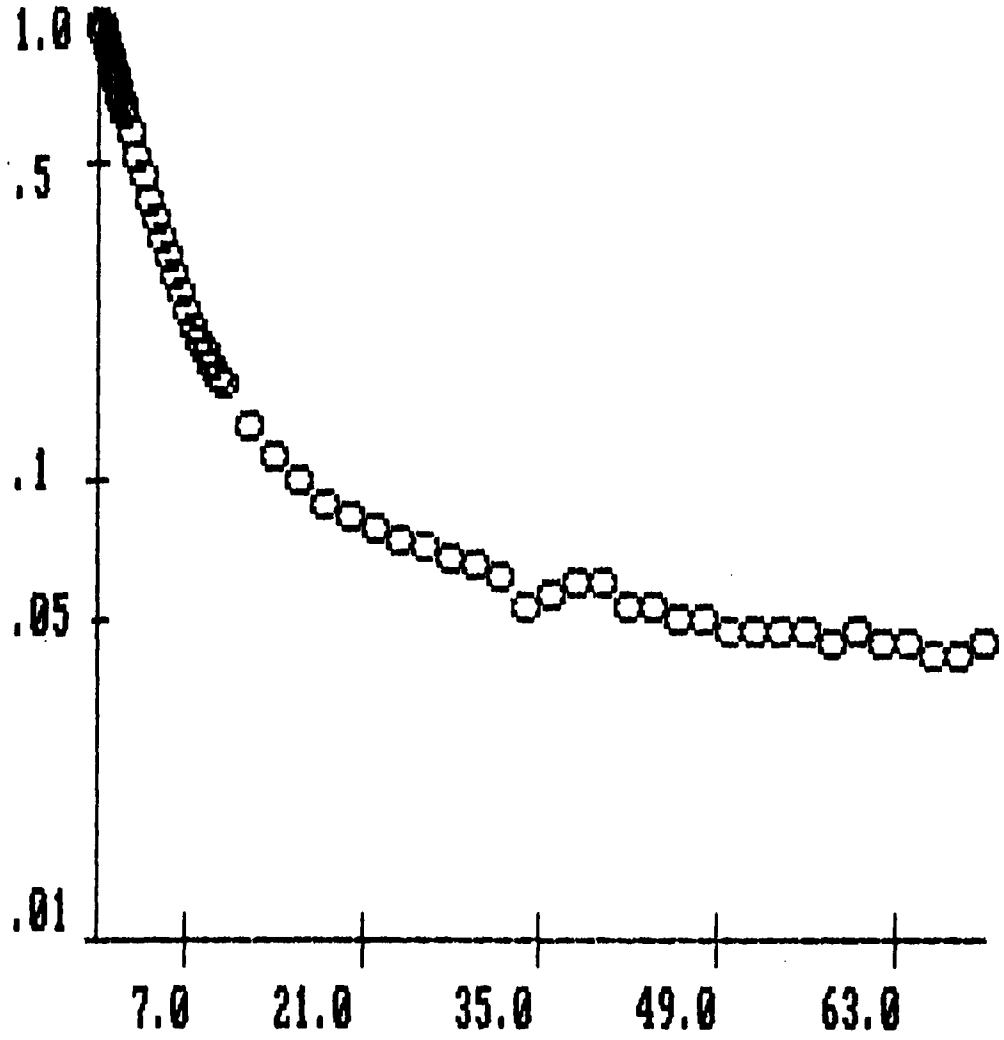
MW-26 (con't.)

570	.58	0.58	.170088
600	.55	0.55	.1612903

CONFINED AQUIFER, FULLY PENETRATING CONDITION

K = 0.2E-03 cm/sec
= 4.5 gpd/ft2
= 0.7E-05 ft/sec
= 0.6 ft/day

REGRESSION COEFFICIENT = -.9959606



X AXIS:
TIME, min

Y AXIS:
LOG (H/H0)

EXAMINE PLOT.
STRIKE ANY KEY WHEN READY.

MW-26 (con't.)

SRW ASSOCIATES INC.

PROJECT Summit National Site PROJECT NO. 8616

Vertical flow from water table aquifer

PAGE 1 OF 1

MADE BY [illegible] DATE 2/20/87 CHECKED BY _____ DATE _____

Heads at nests with wells in shallowest portion of the intermediate units

Well	head g/R	K (est)	Z
MW-9	1087.11 ft	2×10^{-5} cm/sec	10 ft
MW-10	1086.93		
MW-15	1084.80	6×10^{-7} cm/sec	20 ft
MW-16	1068.35		

Z = vertical distance between midpoints of screened zones

Area of ~~water table~~ contamination in water-table aquifer

$A \approx 700\,ft \times 350\,ft = 245{,}000\ ft^2$

$Q = KIA$

for wells MW-9 & MW-10:

$$Q = \left(2\times10^{-5}\,cm/sec \times \frac{1\,gpd/ft^2}{4.7\times10^{-5}\,cm/sec}\right)\left(\frac{1087.11\,ft - 1086.93\,ft}{10\,ft}\right)(245{,}000\,ft^2)$$

$$= 4\times10^{-1}\,gpd/ft^2 \times 0.018 \times 245000\,ft^2$$

$$= 1{,}764\,gpd$$

for wells MW-15 & MW-16

$$Q = \left(6\times10^{-7}\,cm/sec \times \frac{1\,gpd/ft^2}{4.7\times10^{-5}\,cm/sec}\right)\left(\frac{1084.80\,ft - 1068.35\,ft}{20\,ft}\right)(245000\,ft^2)$$

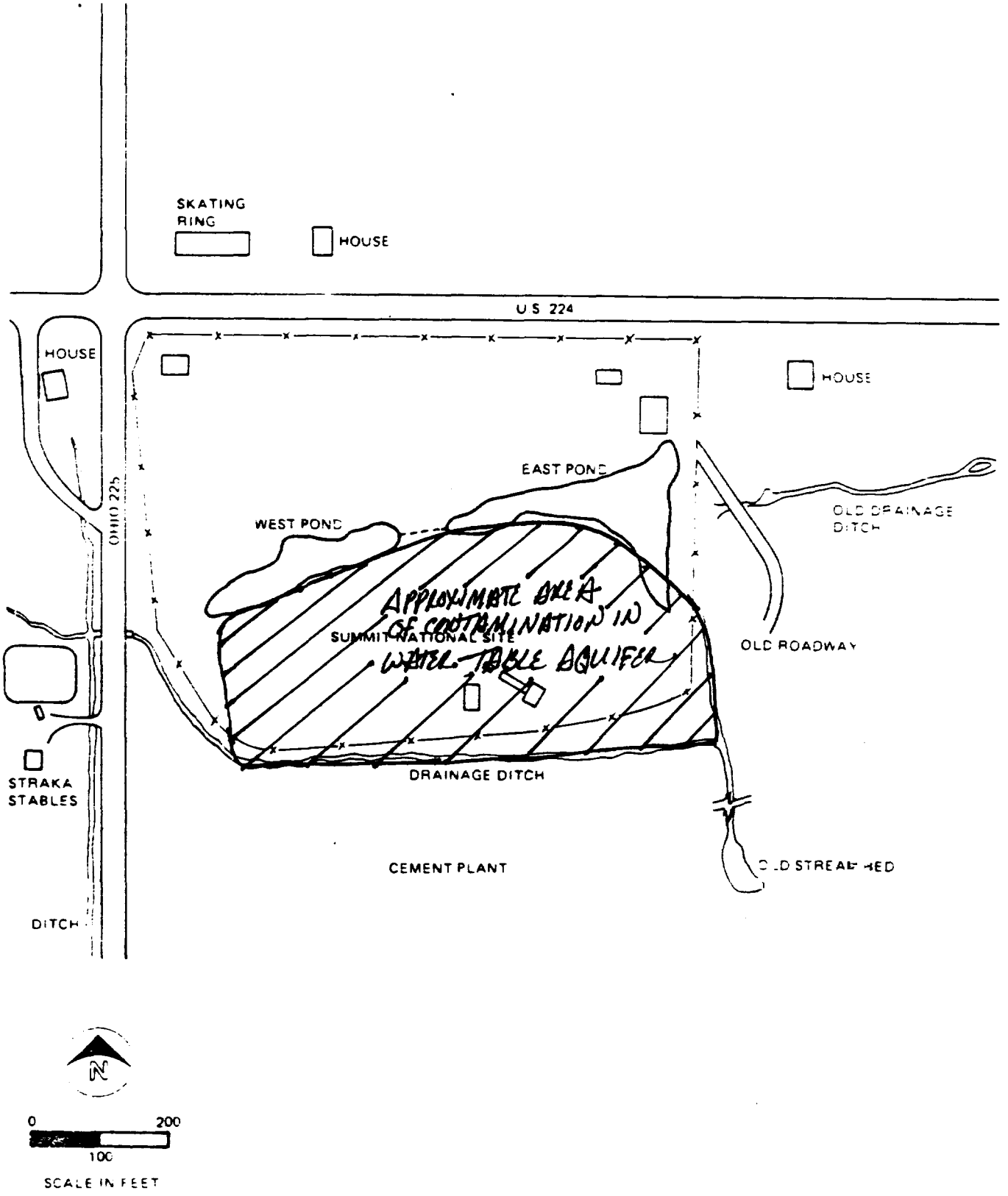
$$= (1\times10^{-2}\,gpd/ft^2)(0.685)(245000\,ft^2)$$

$$= 1{,}612\,gpd$$

$V = KI/n$ assuming 10% porosity

$$V_{min} = \frac{(6\times10^{-7}\,cm/sec \,/\, 3.5\times10^{-4}\,ft/day) \times 0.7}{0.1} = 0.01\,ft/day$$

$$V_{max} = \frac{(2\times10^{-5}\,cm/sec \,/\, 3.5\times10^{-4}\,ft/day) \times 0.02}{.1} = 0.01\,ft/day$$



NOTE: All locations of structures and physical features are approximate

SOURCE: [illegible] USEPA

2

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PROJECT Summit National Site PROJECT NO. 5316

PAGE 1 OF 1

Calculation of downward flow in intermediate units

MADE BY [illegible] DATE 2/28/87 CHECKED BY _____ DATE _____

$Q = KIA$ $\quad V = \frac{KI}{n}$

$K_{min} = 3\times10^{-6}$ cm/sec
$K_{max} = 1\times10^{-5}$ cm/sec
} min & max for wells in intermediate units below burned coal #1a

$A = 245000\ ft^2 \Rightarrow$ area of contamination from calcs for downward flow from water-table aquifer

	MW-25	MW-24	Δ
head	1076.07 ft	1064.68	11.39
depth (mid-point of monitored zone)	51 ft	64	13

$I = \frac{\Delta h}{\Delta l} = \frac{11.39\ ft}{13\ ft} = 0.9$

$Q_{min} = (3\times10^{-6}\ cm/sec / 4.7\times10^{-5}\ gpd/ft^2) \times 0.9 \times 245000\ ft^2 = 14{,}074\ gpd$

$Q_{max} = (1\times10^{-5}\ cm/sec / 4.7\times10^{-5}\ gpd/ft^2) \times 0.9 \times 245000\ ft^2 = 46{,}915\ gpd$

assuming $n = 10\%$

$V_{min} = \frac{(3\times10^{-6} / \cancel{4.7\times10^{-5}}\ 3.5\times10^{-4}) \times 0.9}{0.1} = \cancel{0.6}\ 0.08\ ft/day$

$V_{max} = \frac{(1\times10^{-5} / \cancel{4.7\times10^{-5}}\ 3.5\times10^{-4}) \times 0.9}{0.1} = \cancel{0.03}\ \cancel{2\ ft/day}\ 0.3\ ft/day$

weighting for $\frac{K_h}{K_v} = 1.5$ (Freeze & Cherry 1979) $\quad Q = 9400 - 31000\ gpd$

~~$V = 0.4 - 13\ ft/day$~~ 0.2

$V = 0.05 - 0.2\ ft/day$

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PROJECT Summit National PROJECT NO. 86318

Lateral Flow in Upper Intermediate Units PAGE 1 OF 2

MADE BY [signature] DATE 2/20/87 CHECKED BY _____ DATE _____

$Q = KIA = T_w I$

$\bar{I}$ between 1075 & 1080-ft contour lines

$$\bar{I} = \frac{5\,ft}{(132+100+50)/3}$$

width between contours @ north, middle, south of contaminated area.

$\bar{w} = 380\,ft$

$T = Kb$

$\bar{b}$ along xsection between MW-13 and MW-26 ≈ 25 ft, to top of Unnamed Limestone

About 1 ft coal, average 4 ft ss. ~~Trace~~ Remainder is sltst & sh.

$T = T_{coal} + T_{ss} + T_{sltst}$

$K_{coal} = 6\times10^{-7} - 6\times10^{-5}$ cm/sec (MW-10 & MW-24)

$K_{ss} = 3\times10^{-6} - 6\times10^{-6}$ cm/sec (MW-22 & MW-12)

$K_{sltst} = 9\times10^{-6} - 1\times10^{-5}$ cm/sec (MW-20 & MW-23)

using all K's measured for intermediate units

$T_{coal} = 1\,ft \times 6\times10^{-7}\,cm/sec \times \frac{1\,gpd/ft^2}{4.7\times10^{-5}\,cm/sec} = 1\times10^{-2}\,gpd/ft$ min

$= 1 \times 6\times10^{-5} \times \frac{1}{4.7\times10^{-5}} = 1\,gpd/ft$ max

$T_{ss} = 4 \times 3\times10^{-6} \times \frac{1}{4.7\times10^{-5}} = 3\times10^{-1}\,gpd/ft$ min

$4 \times 6\times10^{-6} \times \frac{1}{4.7\times10^{-5}} = 5\times10^{-1}\,gpd/ft$ max

$T_{sltst} = 20 \times 9\times10^{-6} \times \frac{1}{4.7\times10^{-5}} = 4\,gpd/ft$ min

$20 \times 1\times10^{-5} \times \frac{1}{4.7\times10^{-5}} = 4\,gpd/ft$ max

$T_{max} = 1 + 5\times10^{-1} + 4 = 5\,gpd/ft$

$T_{min} = 1\times10^{-2} + 3\times10^{-1} + 4 = 4\,gpd/ft$

$Q_{min} = 4\,gpd/ft \times 380\,ft \times 0.05 = 76\,gpd$

$Q_{max} = 5\,gpd/ft \times 380\,ft \times 0.05 = 95\,gpd$

SRW ASSOCIATES INC.

PROJECT Lateral Flow in Intermediate Units PROJECT NO. 7316

PAGE 2 OF 2

MADE BY DJT DATE 2/20/87 CHECKED BY _____ DATE _____

$$V = \frac{KI}{n}$$

assuming $n = 10\%$

$K = 6\times10^{-7}$ cm/sec (in coal, MW-14) to 6×10^{-5} cm/sec (in sa., MW-10)

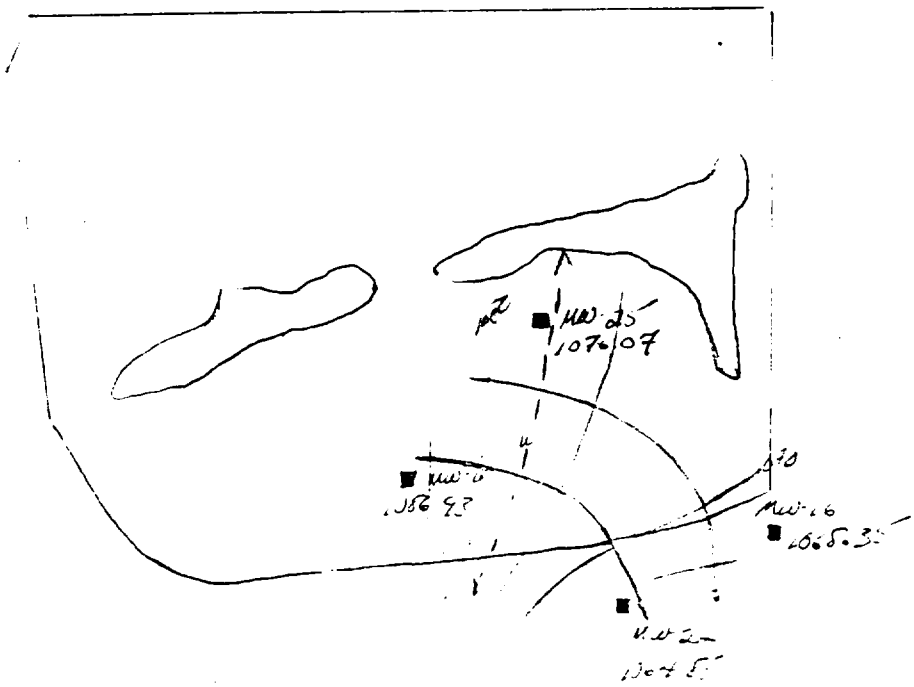
$$V_{min} = \frac{\left(6\times10^{-7}\,\text{cm/sec} \cdot \frac{1\ \text{ft/day}}{3.5\times10^{-4}\,\text{cm/sec}}\right)\times 0.05}{10\%}$$

$$= 9\times10^{-4}\ \text{ft/day} = 0.3\ \text{ft/yr}$$

$$V_{max} = \frac{\left(6\times10^{-5}\,\text{cm/sec} \times \frac{1\ \text{ft/day}}{3.5\times10^{-4}\,\text{cm/sec}}\right)\times 0.05}{10\%} =$$

$$= 9\times10^{-2}\ \text{ft/day} = 31\ \text{ft/yr}$$

4



[illegible]
[illegible]
recovery & very low water
level indicates that head
may not be valid

Flow in upper intermediate
units

SRW ASSOCIATES INC.

PROJECT Summit National Site — PROJECT NO. 8638

Lateral Flow in Lower Intermediate Units — PAGE 1 OF 2

MADE BY [signature] DATE 2/20/87 CHECKED BY _____ DATE _____

$Q = KIA = TwI$

I between 1064 and 1065 ft contour lines

$I = \frac{1ft}{75ft} = 1\times10^{-2}$

$w = 340\,ft$

$T = Kb$

b along xsection MW-13 to MW-26 ≈ 32ft. Average ~2ft coal, ~5ft ss. Remainder is sltst/sh

$T = T_{coal} + T_{ss} + T_{sltst}$

$K_{coal} = 6\times10^{-7} - 6\times10^{-5}$ cm/sec (MW-10 + MW-24)
$K_{ss} = 3\times10^{-6} - 6\times10^{-6}$ cm/sec (MW-22 + MW-12)
$K_{sltst} = 9\times10^{-6} - 1\times10^{-5}$ cm/sec (MW-20 + MW-23)
} using all K_s measured for intermediate units

$T_{coal} = 2ft \times 6\times10^{-7}$ cm/sec $\times \frac{1\,gpd/ft^2}{4.7\times10^{-5}\,cm/sec} = 3\times10^{-2}$ gpd/ft min

$2ft \times 6\times10^{-5}$ cm/sec $\times \frac{1\,gpd/ft^2}{4.7\times10^{-5}\,cm/sec} = 3$ gpd/ft max

$T_{ss} = 3 \times 3\times10^{-6} \times \frac{1}{4.7\times10^{-5}} = 2\times10^{-1}$ gpd/ft min

$3 \times 6\times10^{-6} \times \frac{1}{4.7\times10^{-5}} = 4\times10^{-1}$ gpd/ft max

$T_{sltst} = 27 \times 9\times10^{-6} \times \frac{1}{4.7\times10^{-5}} = 5$ gpd/ft min

$27 \times 1\times10^{-5} \times \frac{1}{4.7\times10^{-5}} = 6$ gpd/ft max

$T_{min} = 3\times10^{-2} + 2\times10^{-1} + 5 = 5$ gpd/ft

$T_{max} = 3 + 4\times10^{-1} + 6 = 9$ gpd/ft

$Q_{min} = 5\,gpd/ft \times 340\,ft \times 0.01 = 17$ gpd

$Q_{max} = 9\,gpd/ft \times 340\,ft \times 0.01 = 31$ gpd

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PROJECT Summit PROJECT NO. 8315

Lateral Flow in Lower Intermediate Units PAGE 2 OF 2

MADE BY [illegible] DATE 2/20/89 CHECKED BY _____ DATE _____

$$V = \frac{KI}{n}$$

assuming $n = 10\%$

$K_{min} = 6 \times 10^{-7}$ cm/sec

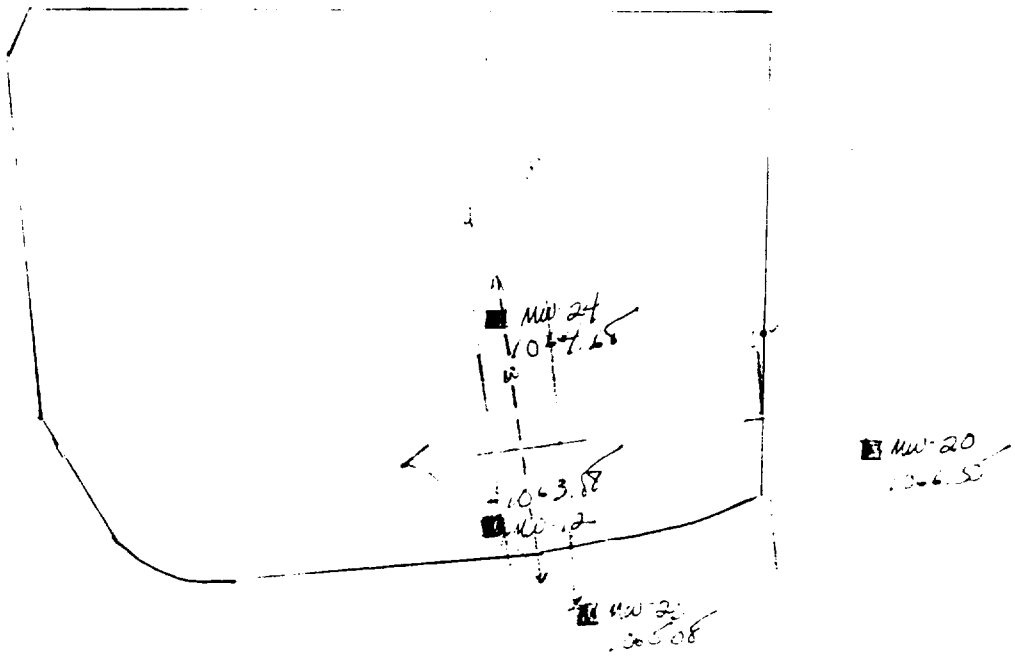
$K_{max} = 6 \times 10^{-5}$ cm/sec

$$V_{min} = \frac{\left(6 \times 10^{-7}\ \text{cm/sec} \times \frac{1\ \text{ft/day}}{3.5 \times 10^{-4}\ \text{cm/sec}}\right) \times 0.01}{10\%}$$

$= 2 \times 10^{-1}$ ft/day $= 6 \times 10^{-2}$ ft/yr

$$V_{max} = \frac{\left(6 \times 10^{-5}\ \text{cm/sec} \times \frac{1\ \text{ft/day}}{3.5 \times 10^{-4}\ \text{cm/sec}}\right) \times 0.01}{10\%}$$

$= 2 \times 10^{-2}$ ft/day $= 6$ ft/yr



Flow in base, intermediate limits

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PROJECT Summit National Site PROJECT NO. 8638

PAGE 1 OF 1

Calculation of Flow in Upper Zone

MADE BY [illegible] DATE 12/24/87 CHECKED BY _____ DATE _____

$Q = KIA$

$I = \frac{2ft}{(250+240+250)/3} = \frac{2}{252} = 8\times10^{-3}$ (see attached

average flow length

$A = w \times b$

$b = 45 ft$

$w = 710'$

$A = 45ft \times 710ft = 31{,}950 ft^2$

$K_{min} = 5\times10^{-5} cm/sec = 1 gpd/ft^2$ (MW-14)

$K_{max} = 3\times10^{-4} cm/sec = 6 gpd/ft^2$ (MW-5)

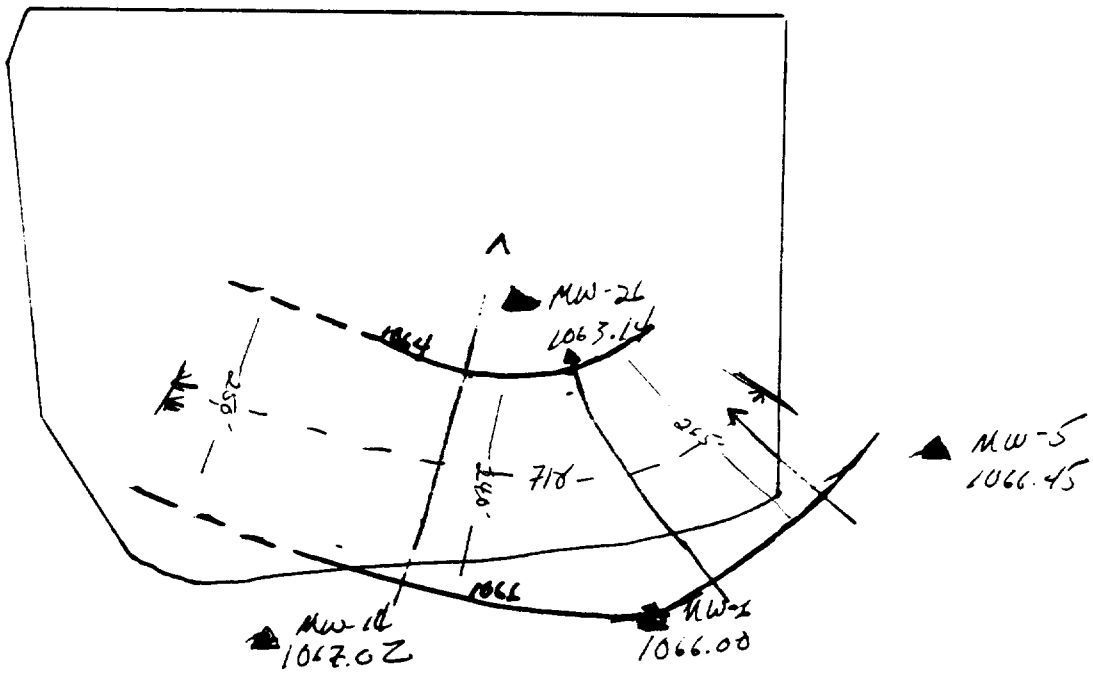
$Q_{min} = 1 gpd/ft^2 \times (8\times10^{-3}) \times 31{,}950 ft^2 = 251$ gpd

$Q_{max} = 6 gpd/ft^2 \times (8\times10^{-3}) \times 31{,}950 ft^2 = 1534$ gpd

$V = \frac{KI}{n}$ assuming $n = 10\%$

$V_{min} = \frac{1 gpd/ft (8\times10^{-3})}{7.48 \frac{gal}{ft^3}\ 10\%} = 1\times10^{-2}$ ft/day

$V_{max} = \frac{6 gpd/ft (8\times10^{-3})}{7.48 \frac{gal}{ft^3}\ 10\%} = 0.06$ ft/day



LEGEND:

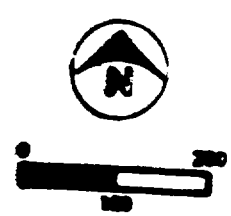
▲ MONITORING WELL

1069.21 HYDRAULIC HEAD (FT.)

EQUIPOTENTIAL LINE, DASHED WHERE TENTATIVE (CONTOUR INTERVAL = 2 FT.)

FLOW LINE

~~MW-8 has been omitted due to st~~



SCALE IN FEET APPROXIMATE

NOTE: All locations of structures and physical features approximate.

SOURCE: Modified from USEPA.

FIGURE 4-~~28~~ 6
PIEZOMETRIC SURFACE ON THE UPPER SHARON AQUIFER
SUMMIT NATIONAL RI

1/3

CALCULATION OF GROUNDWATER FLOW QUANTITIES IN WATER-TABLE AQUIFER
SUMMIT NATIONAL SITE DBT
27-Feb-87

Q = KIA = K (dh/hl) x w x b
v = KI/n

Q = total flow q = flow in single cell
dh = change in head dl = flow length
w = width of flow cell b = aquifer thickness
I = dh/dl n = porosity
K = hydraulic conductivity (assumed from typical values for these materials)

CALCUALTION FOR HIGH-END HYDRAULIC CONDUCTIVITY
Using K(fill) = 3E-3 cm/sec. (MW-3 - maximum valid slug test for fill)
K(till) = 2E-3 cm/sec (MW-7 - maximum valid slug test for till)
K(rock) = 1E-5 from MW-2, closest bedrock well to area used for calculation.
Performing calculations between 1084 and 1086 water-table contour lines

Calculated val:

CELL	w (ft)	dl (ft)	b (ft)	* I = 2/dl	K (cm/sec)	K (gpd/ft2)	K (ft/d)	* q (gpd)	n	* v (ft/d)
A	150	25	23	0.08	3E-03	64	9	17542	40%	1.71
B	135	30	24	0.066666	3E-03	64	9	13729	40%	1.43
C	70	50	21	0.04	3E-03	64	9	3737	40%	0.86
D	45	90	22	0.022222	3E-03	64	9	1398	40%	0.48
E	80	65	22	0.030769	3E-03	64	9	3442	40%	0.66
F	80	50	22	0.04	3E-03	64	9	4475	40%	0.86
G	120	70	14	0.028571	3E-03	64	9	3051	40%	0.61
H	75	60	10	0.033333	3E-03	64	9	1589	40%	0.71
I	85	20	10	0.1	3E-03	64	9	5403	40%	2.14
J	125	25	15	0.08	3E-03	64	9	9534	40%	1.71
K(till)	100	35	8	0.057142	2E-03	42	6	1937	30%	1.09
K(rock)	100	35	12	0.057142	1E-05	0.2	0.03	15	20%	0.01
L(till)	110	50	13	0.04	2E-03	42	6	2424	30%	0.76
L(rock)	110	50	12	0.04	1E-05	0.2	0.03	11	20%	0.01
								=========		=========

TOTAL FLOW (gpd) 68,286
(gpm) 47

AVERAGE FLOW RATE 0.93

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CALCULATION FOR LOW-END HYDRAULIC CONDUCTIVITY

Using K(fill) = 1E-4 cm/sec. (MW-15 - minimum valid slug test for fill)
K(till) = 6E-5 cm/sec (MW-17 - minimum valid slug test for till)
K(rock) = 1E-5 from MW-2, closest bedrock well to area used for calculation.
Performing calculations between 1084 and 1086 water-table contour lines

Calculated val:

CELL	w (ft)	dl (ft)	b (ft)	* I = 2/dl	K (cm/sec)	K (gpd/ft2)	K (ft/d)	* q (gpd)	n	* v (ft/d)
A	150	25	23	0.08	1E-04	2	0.3	585	40%	0.06
B	135	30	24	0.066666	1E-04	2	0.3	458	40%	0.05
C	70	50	21	0.04	1E-04	2	0.3	125	40%	0.03
D	45	90	22	0.022222	1E-04	2	0.3	47	40%	0.02
E	80	65	22	0.030769	1E-04	2	0.3	115	40%	0.02
F	80	50	22	0.04	1E-04	2	0.3	149	40%	0.03
G	120	70	14	0.028571	1E-04	2	0.3	102	40%	0.02
H	75	60	10	0.033333	1E-04	2	0.3	53	40%	0.02
I	85	20	10	0.1	1E-04	2	0.3	180	40%	0.07
J	125	25	15	0.08	1E-04	2	0.3	318	40%	0.06
K(till)	100	35	8	0.057142	6E-05	1	0.2	58	30%	0.02
K(rock)	100	35	12	0.057142	1E-05	0.2	0.03	15	20%	0.00
L(till)	110	50	13	0.04	6E-05	1	0.2	73	30%	0.02
L(rock)	110	50	12	0.04	1E-05	0.2	0.03	11	20%	0.00
								=========		=========
						TOTAL FLOW	(gpd)	2,287		
							(gpm)	2		
								AVERAGE FLOW RATE		0.03

Summit

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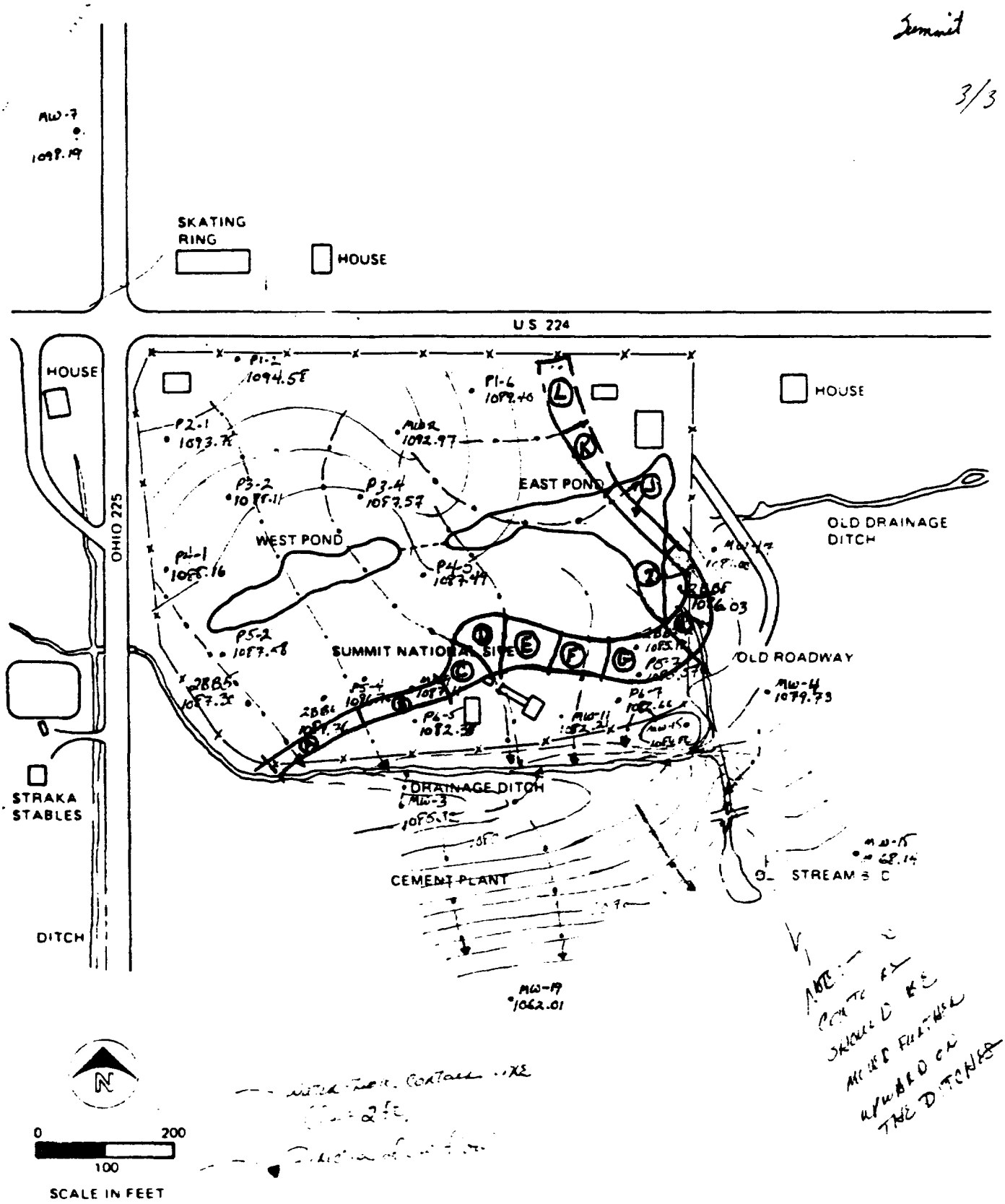

NOTE All locations of structures and physical features approximate

SOURCE Modified from USEPA

Water-Table Map
Sept., 1986

Project: Summit National Site
Flow and transport calculations for water-table aquifer
By: DBT Date: 26-Feb-87
Checked: _____ Date: _____
Filename: WTTRANS2.WK1

1/5

Retardation coefficients and adjusted times for previous concentrations:
Assuming 40% porosity, 1% organic carbon, density of 100 lb/ft3 (2 g/cm3)
References: Practical Aspects of Groundwater Modeling, W.C. Walton, 1984.
Handbook of Env. Data on Organic Chemicals, 2nd ed, K. Verschueren, 1983.
(Kow not available for all compounds)
Kd = 6.3E-1 x f x Kow (distribution coefficient ml/g)
f = organic carbon content
Kow = octanol-water partitioning coefficient
Rd = 1 +(ps/n x Kd) (retardation factor, dimensionless)
ps = dry bulk density
n = porosity

COMPOUND	Kow (molar)	Kd (ml/g)	Rd
Methylene chloride	8.12	0.05	1.3
1,1-Dichloroethane	61.7	0.39	2.9
1,2-Dichloroethane	30.2	0.19	2.0
2-Butanone	-0.039	-0.00	1.0
1,1,1-Trichloroethane	148	0.93	5.7
Trichloroethene	195	1.23	7.1
Toluene	490	3.09	16.4
Ethylbenzene	3.15	0.02	1.1
Phenol	28.8	0.18	1.9
Isophorone	0.23	0.001	1.0
2,4-Dimethylphenol	2.5	0.02	1.1
Naphthalene	34.4	0.22	2.1
Bis(2-ethylhexyl)phthalate	540000000	3.40E+06	1.70E+07

HIGH-VELOCITY CASE

x =	20	ft
n =	0.4	
V =	0.9	ft/day
ax =	60	ft (Walton, 1984)
ay =	10	ft (Walton, 1984)
az =	10	ft (Walton, 1984)

Dx assumed as 0

Dx =	54	ft2/d
Dy =	9	ft2/d
Dz =	9	ft2/d

References: Domenico and Robbins, 1985
Gilham, 1982

Source dimensions: X = 110 ft
Y = 440 ft
Z = 20 ft

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for location x=100, y=0, z=0 (edit)(abs)(down)
time = 10 years

CONTAMINANT	Rd	v'	Dx'	Dy'	Dz'	A	erfc(A)	B	erf(B)	C	erf(C)	D	erf(D)	E	erf(E)	Co ppb	C ppb
Methylene chloride	1.25578	0.71668604	43.0011626	7.17E+00	7.1668604	-3.1752472	2	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	24,000	4,080
1,1-Dichloroethane	2.94355	0.30575325	18.3451954	3.06E+00	3.0575325	-1.9631606	2	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	12,000	2,040
1,2-Dichloroethane	1.9513	0.46123097	27.6738584	4.61E+00	4.6123097	-2.4911786	2	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	115,000	19,550
2-Butanone	0.9981415	0.90167576	54.1005458	9.02E+00	9.0167576	-3.5905866	2	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	650,000	110,500
1,1,1-Trichloroethane	5.662	0.15895443	9.53726598	1.59E+00	1.5895443	-1.2868236	1.93	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	53,000	8,695
Trichloroethene	7.1425	0.12600630	7.56037801	1.26E+00	1.2600630	-1.0833316	1.88	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	18,000	2,876
Toluene	16.435	0.05476118	3.28567082	5.48E-01	0.5476118	-0.4560187	1.48	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	27,000	3,397
Ethylbenzene	1.099225	0.81875867	49.1255202	8.19E+00	8.1875867	-3.4106544	2	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	11,000	1,870
Phenol	1.9072	0.47189597	28.3137583	4.72E+00	4.7189597	-2.5234121	2	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	7,000	1,190
Isophorone	1.007245	0.89352640	53.6115840	8.94E+00	8.9352640	-3.5733023	2	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	26,000	4,420
2,4-Dimethylphenol	1.07875	0.83429895	50.0579374	8.34E+00	8.3429895	-3.4450901	2	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	140	24
Naphthalene	2.0836	0.43194471	25.9166826	4.32E+00	4.3194471	-2.4004695	2	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	620	105
Bis(2-ethylhexyl)phthalate	17010001	5.29E-08	3.17E-06	5.29E-07	5.29E-07	464.491769	0	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	7,250	0

for location x=100, y=0, z=0
time = 50 years

CONTAMINANT	Rd	v'	Dx'	Dy'	Dz'	A	erfc(A)	B	erf(B)	C	erf(C)	D	erf(D)	E	erf(E)	Co ppb	C ppb
Methylene chloride	1.25578	0.71668604	43.0011626	7.17E+00	7.1668604	-7.3258346	2	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	24,000	4,080
1,1-Dichloroethane	2.94355	0.30575325	18.3451954	3.06E+00	3.0575325	-4.7354113	2	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	12,000	2,040
1,2-Dichloroethane	1.9513	0.46123097	27.6738584	4.61E+00	4.6123097	-5.8518705	2	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	115,000	19,550
2-Butanone	0.9981415	0.90167576	54.1005458	9.02E+00	9.0167576	-8.2300745	2	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	650,000	110,500
1,1,1-Trichloroethane	5.662	0.15895443	9.53726598	1.59E+00	1.5895443	-3.3568124	2	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	53,000	9,010
Trichloroethene	7.1425	0.12600630	7.56037801	1.26E+00	1.2600630	-2.9608300	2	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	18,000	3,060
Toluene	16.435	0.05476118	3.28567082	5.48E-01	0.5476118	-1.8364340	1.99	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	27,000	4,567
Ethylbenzene	1.099225	0.81875867	49.1255202	8.19E+00	8.1875867	-7.8376800	2	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	11,000	1,870
Phenol	1.9072	0.47189597	28.3137583	4.72E+00	4.7189597	-5.9207483	2	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	7,000	1,190
Isophorone	1.007245	0.89352640	53.6115840	8.94E+00	8.9352640	-8.1923414	2	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	26,000	4,420
2,4-Dimethylphenol	1.07875	0.83429895	50.0579374	8.34E+00	8.3429895	-7.9127041	2	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	140	24
Naphthalene	2.0836	0.43194471	25.9166826	4.32E+00	4.3194471	-5.6584227	2	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	620	105
Bis(2-ethylhexyl)phthalate	17010001	5.29E-08	3.17E-06	5.29E-07	5.29E-07	207.725429	0	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	7,250	0

for location x=100, y=0, z=0
time = 100 years

CONTAMINANT	Rd	v'	Dx'	Dy'	Dz'	A	erfc(A)	B	erf(B)	C	erf(C)	D	erf(D)	E	erf(E)	Co ppb	C ppb
Methylene chloride	1.25578	0.71668604	43.0011626	7.17E+00	7.1668604	-10.400204	2	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	24,000	4,080
1,1-Dichloroethane	2.94355	0.30575325	18.3451954	3.06E+00	3.0575325	-6.7579859	2	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	12,000	2,040
1,2-Dichloroethane	1.9513	0.46123097	27.6738584	4.61E+00	4.6123097	-8.3255441	2	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	115,000	19,550
2-Butanone	0.9981415	0.90167576	54.1005458	9.02E+00	9.0167576	-11.674664	2	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	650,000	110,500
1,1,1-Trichloroethane	5.662	0.15895443	9.53726598	1.59E+00	1.5895443	-4.8319942	2	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	53,000	9,010
Trichloroethene	7.1425	0.12600630	7.56037801	1.26E+00	1.2600630	-4.2824273	2	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	18,000	3,060
Toluene	16.435	0.05476118	3.28567082	5.48E-01	0.5476118	-2.7414914	2	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	27,000	4,590
Ethylbenzene	1.099225	0.81875867	49.1255202	8.19E+00	8.1875867	-11.121493	2	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	11,000	1,870
Phenol	1.9072	0.47189597	28.3137583	4.72E+00	4.7189597	-8.4223867	2	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	7,000	1,190
Isophorone	1.007245	0.89352640	53.6115840	8.94E+00	8.9352640	-11.621463	2	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	26,000	4,420

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2,4-Dimethylphenol	1.07875	0.83429895	50.0579374	8.34E+00	8.3429895	-11.227243	2	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	140	24
Naphthalene	2.0836	0.43194471	25.9166826	4.32E+00	4.3194471	-8.0536265	2	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	620	105
Bis(2-ethylhexyl)phthalate	17010001	5.29E-08	3.17E-06	5.29E-07	5.29E-07	146.882641	0	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	7,250	0

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Retardation coefficients and adjusted times for previous concentrations:
Assuming 40% porosity, 1% organic carbon, density of 100 lb/ft3 (2 g/cm3)
References: Practical Aspects of Groundwater Modeling, W.C. Walton, 1984.
Handbook of Env. Data on Organic Chemicals, 2nd ed, K. Verschueren, 1983.

(Kow not available for all compounds)
Kd = 6.3E-1 x f x Kow (distribution coefficient ml/g)
f = organic carbon content
Kow = octanol-water partitioning coefficient
Rd = 1 +(ps/n x Kd) (retardation factor, dimensionless)
ps = dry bulk density
n = porosity

COMPOUND	Kow (molar)	Kd (ml/g)	Rd
Methylene chloride	8.12	0.05	1.3
1,1-Dichloroethane	61.7	0.39	2.9
1,2-Dichloroethane	30.2	0.19	2.0
2-Butanone	-0.059	-0.00	1.0
1,1,1-Trichloroethane	148	0.93	5.7
Trichloroethene	195	1.23	7.1
Toluene	490	3.09	16.4
Ethylbenzene	3.15	0.02	1.1
Phenol	28.8	0.18	1.9
Isophorone	0.23	0.001	1.0
2,4-Dimethylphenol	2.5	0.02	1.1
Naphthalene	34.4	0.22	2.1
Bis(2-ethylhexyl)phthalate	540000000	3.40E+06	1.70E+07

LOW-VELOCITY CASE

a = 20 ft
n = 0.4
V = 0.03 ft/day
ax = 60 ft (Walton, 1984)
ay = 10 ft (Walton, 1984)
az = 10 ft (Walton, 1984)
D0 assumed as 0

Dx = 1.8 ft2/d
Dy = 0.3 ft2/d
Dz = 0.3 ft2/d

References: Domenico and Robbins, 1985
Gilham, 1982

Source dimensions: X = 110 ft
Y = 440 ft
Z = 20 ft

for location x=100, y=0, z=0 (edit)(abs)(down)
time = 10 years

CONTAMINANT	Rd	v'	Dx'	Dy'	Dz'	A	erfc(A)	B	erf(B)	C	erf(C)	D	erf(D)	E	erf(E)	Co ppb	C ppb
Methylene chloride	1.25578	0.02388953	1.43337208	2.39E-01	0.2388953	0.08850393	0.89	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	24,000	1,816

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1,1-Dichloroethane	2.94355	0.01019177	0.61150651	1.02E-01	0.1019177	0.66463439	0.36	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	12,000	367
1,2-Dichloroethane	1.9513	0.01537436	0.92246194	1.54E-01	0.1537436	0.37813879	0.57	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	115,000	5,572
2-Butanone	0.9981415	0.03005585	1.80335152	3.01E-01	0.3005585	-0.0598038	1.06	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	650,000	58,565
1,1,1-Trichloroethane	5.662	0.00529848	0.31790886	5.30E-02	0.0529848	1.18395010	0.09	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	53,000	405
Trichloroethene	7.1425	0.00420021	0.25201260	4.20E-02	0.0420021	1.39584781	0.05	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	18,000	77
Toluene	16.435	0.00182537	0.10952236	1.83E-02	0.0182537	2.33414496	0.001	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	27,000	2
Ethylbenzene	1.099225	0.02729195	1.63751734	2.73E-01	0.2729195	0.00248582	1	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	11,000	935
Phenol	1.9072	0.01572986	0.94379194	1.57E-01	0.1572986	0.36278739	0.62	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	7,000	369
Isophorone	1.007245	0.02978421	1.78705280	2.98E-01	0.2978421	-0.0539376	1.06	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	26,000	2,343
2,4-Dimethylphenol	1.07875	0.02780996	1.66859791	2.78E-01	0.2780996	-0.0096511	1	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	140	12
Naphthalene	2.0836	0.01439815	0.86388942	1.44E-01	0.1439815	0.42247474	0.57	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	620	30
Bis(2-ethylhexyl)phthalate	17010001	1.76E-09	1.06E-07	1.76E-08	1.76E-08	2544.13094	0	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	7,250	0

for location x=100, y=0, z=0
time = 50 years

CONTAMINANT	Rd	v'	Dx'	Dy'	Dz'	A	erfc(A)	B	erf(B)	C	erf(C)	D	erf(D)	E	erf(E)	Co ppb	C ppb
Methylene chloride	1.25578	0.02388953	1.43337208	2.39E-01	0.2388953	-1.0386702	1.84	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	24,000	3,754
1,1-Dichloroethane	2.94355	0.01019177	0.61150651	1.02E-01	0.1019177	-0.4070389	1.43	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	12,000	1,459
1,2-Dichloroethane	1.9513	0.01537436	0.92246194	1.54E-01	0.1537436	-0.6958877	1.68	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	115,000	16,422
2-Butanone	0.9981415	0.03005585	1.80335152	3.01E-01	0.3005585	-1.2361740	1.91	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	650,000	105,528
1,1,1-Trichloroethane	5.662	0.00529848	0.31790886	5.30E-02	0.0529848	0.02167998	1	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	53,000	4,505
Trichloroethene	7.1425	0.00420021	0.25201260	4.20E-02	0.0420021	0.17212463	0.83	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	18,000	1,270
Toluene	16.435	0.00182537	0.10952236	1.83E-02	0.0182537	0.74580968	0.29	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	27,000	666
Ethylbenzene	1.099225	0.02729195	1.63751734	2.73E-01	0.2729195	-1.1513675	1.91	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	11,000	1,786
Phenol	1.9072	0.01572986	0.94379194	1.57E-01	0.1572986	-0.7126966	1.68	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	7,000	1,000
Isophorone	1.007245	0.02978421	1.78705280	2.98E-01	0.2978421	-1.2280727	1.91	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	26,000	4,221
2,4-Dimethylphenol	1.07875	0.02780996	1.66859791	2.78E-01	0.2780996	-1.1676812	1.91	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	140	23
Naphthalene	2.0836	0.01439815	0.86388942	1.44E-01	0.1439815	-0.6481479	1.64	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	620	86
Bis(2-ethylhexyl)phthalate	17010001	1.76E-09	1.06E-07	1.76E-08	1.76E-08	1137.76965	0	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	7,250	0

for location x=100, y=0, z=0
time = 100 years

CONTAMINANT	Rd	v'	Dx'	Dy'	Dz'	A	erfc(A)	B	erf(B)	C	erf(C)	D	erf(D)	E	erf(E)	Co ppb	C ppb
Methylene chloride	1.25578	0.02388953	1.43337208	2.39E-01	0.2388953	-1.6874985	1.98	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	24,000	4,039
1,1-Dichloroethane	2.94355	0.01019177	0.61150651	1.02E-01	0.1019177	-0.9103148	1.8	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	12,000	1,836
1,2-Dichloroethane	1.9513	0.01537436	0.92246194	1.54E-01	0.1537436	-1.2566231	1.93	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	115,000	18,866
2-Butanone	0.9981415	0.03005585	1.80335152	3.01E-01	0.3005585	-1.9431013	1.99	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	650,000	109,948
1,1,1-Trichloroethane	5.662	0.00529848	0.31790886	5.30E-02	0.0529848	-0.4335047	1.48	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	53,000	6,667
Trichloroethene	7.1425	0.00420021	0.25201260	4.20E-02	0.0420021	-0.2779086	1.33	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	18,000	2,035
Toluene	16.435	0.00182537	0.10952236	1.83E-02	0.0182537	0.26392412	0.72	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	27,000	1,652
Ethylbenzene	1.099225	0.02729195	1.63751734	2.73E-01	0.2729195	-1.8327972	1.99	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	11,000	1,861
Phenol	1.9072	0.01572986	0.94379194	1.57E-01	0.1572986	-1.2772976	1.93	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	7,000	1,148
Isophorone	1.007245	0.02978421	1.78705280	2.98E-01	0.2978421	-1.9325311	1.99	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	26,000	4,398
2,4-Dimethylphenol	1.07875	0.02780996	1.66859791	2.78E-01	0.2780996	-1.8539544	1.99	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	140	24
Naphthalene	2.0836	0.01439815	0.86388942	1.44E-01	0.1439815	-1.1981948	1.91	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	620	101
Bis(2-ethylhexyl)phthalate	17010001	1.76E-09	1.06E-07	1.76E-08	1.76E-08	804.524380	0	3.47850542	1	-3.4785054	-1	0.15811388	0.17	-0.1581138	-0.17	7,250	0

v= 0.9 ft/day
time= 36500 days
x= 1450 feet

CONTAMINANT	Rd	v'	Dx'	Dy'	Dz'	A	erfc(A)	B	erf(B)	C	erf(C)	D	erf(D)	E	erf(E)	Co ppb	C ppb
Methylene Chloride	1.25578	0.7166860	43.00116	7.166860	7.166860	-9.86141	2	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	24,000	1,079
1,1-Dichloroethane	2.94355	0.3057532	18.34519	3.057532	3.057532	-5.93309	2	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	12,000	539
1,2-Dichloroethane	1.9513	0.4612309	27.67385	4.612309	4.612309	-7.65392	2	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	115,000	5,169
2-Butanone	0.998141	0.9016757	54.10054	9.016757	9.016757	-11.1943	2	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	650,000	29,214
1,1,1-Trichloroethane	5.662	0.1589544	9.537265	1.589544	1.589544	-3.68794	2	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	53,000	2,382
Trichloroethene	7.1425	0.1260063	7.560378	1.260063	1.260063	-2.99747	1.9999	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	18,000	809
Toluene	16.435	0.0547611	3.285670	0.547611	0.547611	-0.79234	1.7421	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	27,000	1,057
Ethyl Benzene	1.099225	0.8187586	49.12552	8.187586	8.187586	-10.6174	2	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	11,000	494
Phenol	1.9072	0.4718959	28.31375	4.718959	4.718959	-7.75840	2	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	7,000	315
Isophorone	1.007245	0.8935264	53.61158	8.935264	8.935264	-11.1389	2	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	26,000	1,169
2,4-Dimethylphenol	1.07875	0.8342989	50.05793	8.342989	8.342989	-10.7278	2	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	140	6
Naphthalene	2.0836	0.4319447	25.91668	4.319447	4.319447	-7.35961	2	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	620	28
Bis(2-ethylhexyl)phthalat	17010001	0.0000000	0.000003	0.000000	0.000000	2129.836	0	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	7,250	0

Project: Summit National Site
Contaminant-Transport Calculations for Water-Table Aquifer

By: DBT Date: 10-Dec-87

SEE TRANSPORT CALCULATIONS OF 2/26/87 FOR TERMS, EQUATIONS AND REFERENCES

HIGH-VELOCITY CASE

v= 0.9 ft/day
time= 3650 days
x= 1450 feet

CONTAMINANT	Rd	v'	Dx'	Dy'	Dz'	A	erfc(A)	B	erf(B)	C	erf(C)	D	erf(D)	E	erf(E)	Co ppb	C ppb
Methylene Chloride	1.25578	0.7166860	43.00116	7.166860	7.166860	-1.47145	1.966	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	24,000	1,060
1,1-Dichloroethane	2.94355	0.3057532	18.34519	3.057532	3.057532	0.645371	0.3579	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	12,000	97
1,2-Dichloroethane	1.9513	0.4612309	27.67385	4.612309	4.612309	-0.36733	1.3794	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	115,000	3,565
2-Butanone	0.998141	0.9016757	54.10054	9.016757	9.016757	-2.07159	1.997	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	650,000	29,171
1,1,1-Trichloroethane	5.662	0.1589544	9.537265	1.589544	1.589544	2.330983	0.00114	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	53,000	1
Trichloroethene	7.1425	0.1260063	7.560378	1.260063	1.260063	2.980031	0.000022	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	18,000	0
Toluene	16.435	0.0547611	3.285670	0.547611	0.547611	5.707735	0	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	27,000	0
Ethyl Benzene	1.099225	0.8187586	49.12552	8.187586	8.187586	-1.81659	1.9891	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	11,000	492
Phenol	1.9072	0.4718959	28.31375	4.718959	4.718959	-0.42370	1.4284	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	7,000	225
Isophorone	1.007245	0.8935264	53.61158	8.935264	8.935264	-2.04739	1.9953	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	26,000	1,166
2,4-Dimethylphenol	1.07875	0.8342989	50.05793	8.342989	8.342989	-1.86594	1.9928	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	140	6
Naphthalene	2.0836	0.4319447	25.91668	4.319447	4.319447	-0.20580	1.2227	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	620	17
Bis(2-ethylhexyl)phthalat	17010001	0.0000000	0.000003	0.000000	0.000000	6735.142	0	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	7,250	0

v= 0.9 ft/day
time= 18250 days
x= 1450 feet

CONTAMINANT	Rd	v'	Dx'	Dy'	Dz'	A	erfc(A)	B	erf(B)	C	erf(C)	D	erf(D)	E	erf(E)	Co ppb	C ppb
Methylene Chloride	1.25578	0.7166860	43.00116	7.166860	7.166860	-6.56387	2	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	24,000	1,079
1,1-Dichloroethane	2.94355	0.3057532	18.34519	3.057532	3.057532	-3.56884	2	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	12,000	539
1,2-Dichloroethane	1.9513	0.4612309	27.67385	4.612309	4.612309	-4.90205	2	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	115,000	5,169
2-Butanone	0.998141	0.9016757	54.10054	9.016757	9.016757	-7.55075	2	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	650,000	29,214
1,1,1-Trichloroethane	5.662	0.1589544	9.537265	1.589544	1.589544	-1.73887	1.9838	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	53,000	2,363
Trichloroethene	7.1425	0.1260063	7.560378	1.260063	1.260063	-1.14363	1.8802	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	18,000	761
Toluene	16.435	0.0547611	3.285670	0.547611	0.547611	0.920080	0.2021	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	27,000	123
Ethyl Benzene	1.099225	0.8187586	49.12552	8.187586	8.187586	-7.12479	2	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	11,000	494
Phenol	1.9072	0.4718959	28.31375	4.718959	4.718959	-4.98173	2	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	7,000	315
Isophorone	1.007245	0.8935264	53.61158	8.935264	8.935264	-7.50993	2	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	26,000	1,169
2,4-Dimethylphenol	1.07875	0.8342989	50.05793	8.342989	8.342989	-7.20649	2	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	140	6
Naphthalene	2.0836	0.4319447	25.91668	4.319447	4.319447	-4.67694	2	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	620	28
Bis(2-ethylhexyl)phthalat	17010001	0.0000000	0.000003	0.000000	0.000000	3012.045	0	0.913500	0.7969	-0.91350	-0.7969	0.041522	0.0564	-0.04152	-0.0564	7,250	0

Project: Summit National Site
Contaminant-Transport Calculations for Water-Table Aquifer

By: DBT Date: 10-Dec-87

SEE TRANSPORT CALCULATIONS OF 2/26/87 FOR TERMS, EQUATIONS AND REFERENCES

HIGH-VELOCITY CASE

v= 0.9 ft/day
time= 3650 days
x= 4500 feet

CONTAMINANT	Rd	v'	Dx'	Dy'	Dz'	A	erfc(A)	B	erf(B)	C	erf(C)	D	erf(D)	E	erf(E)	Co ppb	C ppb
Methylene Chloride	1.25578	0.7166860	43.00116	7.166860	7.166860	2.377861	0.0011	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	24,000	0
1,1-Dichloroethane	2.94355	0.3057532	18.34519	3.057532	3.057532	6.538721	0	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	12,000	0
1,2-Dichloroethane	1.9513	0.4612309	27.67385	4.612309	4.612309	4.430977	0	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	115,000	0
2-Butanone	0.998141	0.9016757	54.10054	9.016757	9.016757	1.360213	0.0477	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	650,000	209
1,1,1-Trichloroethane	5.662	0.1589544	9.537265	1.589544	1.589544	10.50454	0	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	53,000	0
Trichloroethene	7.1425	0.1260063	7.560378	1.260063	1.260063	12.16022	0	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	18,000	0
Toluene	16.435	0.0547611	3.285670	0.547611	0.547611	19.63325	0	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	27,000	0
Ethyl Benzene	1.099225	0.8187586	49.12552	8.187586	8.187586	1.784789	0.0109	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	11,000	1
Phenol	1.9072	0.4718959	28.31375	4.718959	4.718959	4.320075	0	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	7,000	0
Isophorone	1.007245	0.8935264	53.61158	8.935264	8.935264	1.400023	0.0047	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	26,000	1
2,4-Dimethylphenol	1.07875	0.8342989	50.05793	8.342989	8.342989	1.701739	0.0162	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	140	0
Naphthalene	2.0836	0.4319447	25.91668	4.319447	4.319447	4.752502	0	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	620	0
Bis(2-ethylhexyl)phthalat	17010001	0.0000000	0.000003	0.000000	0.000000	20902.16	0	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	7,250	0

v= 0.9 ft/day
time= 18250 days
x= 4500 feet

CONTAMINANT	Rd	v'	Dx'	Dy'	Dz'	A	erfc(A)	B	erf(B)	C	erf(C)	D	erf(D)	E	erf(E)	Co ppb	C ppb
Methylene Chloride	1.25578	0.7166860	43.00116	7.166860	7.166860	-4.84240	2	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	24,000	324
1,1-Dichloroethane	2.94355	0.3057532	18.34519	3.057532	3.057532	-0.93325	1.7969	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	12,000	145
1,2-Dichloroethane	1.9513	0.4612309	27.67385	4.612309	4.612309	-2.75618	1.9999	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	115,000	1,550
2-Butanone	0.998141	0.9016757	54.10054	9.016757	9.016757	-6.01600	2	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	650,000	8,762
1,1,1-Trichloroethane	5.662	0.1589544	9.537265	1.589544	1.589544	1.916448	0.0072	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	53,000	3
Trichloroethene	7.1425	0.1260063	7.560378	1.260063	1.260063	2.961866	0.000022	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	18,000	0
Toluene	16.435	0.0547611	3.285670	0.547611	0.547611	7.147761	0	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	27,000	0
Ethyl Benzene	1.099225	0.8187586	49.12552	8.187586	8.187586	-5.51420	2	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	11,000	148
Phenol	1.9072	0.4718959	28.31375	4.718959	4.718959	-2.86024	1.9999	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	7,000	94
Isophorone	1.007245	0.8935264	53.61158	8.935264	8.935264	-5.96820	2	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	26,000	350
2,4-Dimethylphenol	1.07875	0.8342989	50.05793	8.342989	8.342989	-5.61097	2	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	140	2
Naphthalene	2.0836	0.4319447	25.91668	4.319447	4.319447	-2.45951	1.9993	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	620	8
Bis(2-ethylhexyl)phthalat	17010001	0.0000000	0.000003	0.000000	0.000000	9347.732	0	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	7,250	0

v= 0.9 ft/day
time= 36500 days
x= 4500 feet

CONTAMINANT	Rd	v'	Dx'	Dy'	Dz'	A	erfc(A)	B	erf(B)	C	erf(C)	D	erf(D)	E	erf(E)	Co ppb	C ppb
Methylene Chloride	1.25578	0.7166860	43.00116	7.166860	7.166860	-8.64415	2	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	24,000	324
1,1-Dichloroethane	2.94355	0.3057532	18.34519	3.057532	3.057532	-4.06945	2	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	12,000	162
1,2-Dichloroethane	1.9513	0.4612309	27.67385	4.612309	4.612309	-6.13656	2	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	115,000	1,550
2-Butanone	0.998141	0.9016757	54.10054	9.016757	9.016757	-10.1090	2	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	650,000	8,762
1,1,1-Trichloroethane	5.662	0.1589544	9.537265	1.589544	1.589544	-1.10323	2	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	53,000	714
Trichloroethene	7.1425	0.1260063	7.560378	1.260063	1.260063	-0.09444	1.1125	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	18,000	135
Toluene	16.435	0.0547611	3.285670	0.547611	0.547611	3.611294	0	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	27,000	0
Ethyl Benzene	1.099225	0.8187586	49.12552	8.187586	8.187586	-9.47854	2	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	11,000	148
Phenol	1.9072	0.4718959	28.31375	4.718959	4.718959	-6.25828	2	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	7,000	94
Isophorone	1.007245	0.8935264	53.61158	8.935264	8.935264	-10.0487	2	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	26,000	350
2,4-Dimethylphenol	1.07875	0.8342989	50.05793	8.342989	8.342989	-9.59967	2	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	140	2
Naphthalene	2.0836	0.4319447	25.91668	4.319447	4.319447	-5.79165	2	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	620	8
Bis(2-ethylhexyl)phthalat	17010001	0.0000000	0.000003	0.000000	0.000000	6609.843	0	0.518544	0.5205	-0.51854	-0.5205	0.023570	0.025898	-0.02357	-0.02589	7,250	0

Project: Summit National Site
Contaminant-Transport Calculations for Water-Table Aquifer

By: DBT Date: 10-Dec-87

SEE TRANSPORT CALCULATIONS OF 2/26/87 FOR TERMS, EQUATIONS AND REFERENCES

LOW-VELOCITY CASE

v= 0.03 ft/day
time= 3650 days
x= 1450 feet

CONTAMINANT	Rd	v'	Dx'	Dy'	Dz'	A	erfc(A)	B	erf(B)	C	erf(C)	D	erf(D)	E	erf(E)	Co ppb	C ppb
Methylene Chloride	1.25578	0.0238895	43.00116	7.166860	7.166860	1.719953	0.0162	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	24,000	0
1,1-Dichloroethane	2.94355	0.0101917	18.34519	3.057532	3.057532	2.729877	0.0001	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	12,000	0
1,2-Dichloroethane	1.9513	0.0153743	27.67385	4.612309	4.612309	2.192881	0.0019	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	115,000	0
2-Butanone	0.998141	0.0300558	54.10054	9.016757	9.016757	1.508076	0.0339	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	650,000	15
1,1,1-Trichloroethane	5.662	0.0052984	9.537265	1.589544	1.589544	3.833965	0	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	53,000	0
Trichloroethene	7.1425	0.0042002	7.560378	1.260063	1.260063	4.318208	0	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	18,000	0
Toluene	16.435	0.0018253	3.285670	0.547611	0.547611	6.589908	0	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	27,000	0
Ethyl Benzene	1.099225	0.0272919	49.12552	8.187586	8.187586	1.594510	0.0237	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	11,000	0
Phenol	1.9072	0.0157298	28.31375	4.718959	4.718959	2.165942	0.0019	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	7,000	0
Isophorone	1.007245	0.0297842	53.61158	8.935264	8.935264	1.516059	0.0339	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	26,000	1
2,4-Dimethylphenol	1.07875	0.0278099	50.05793	8.342989	8.342989	1.577378	0.0339	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	140	0
Naphthalene	2.0836	0.0143981	25.91668	4.319447	4.319447	2.271794	0.0011	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	620	0
Bis(2-ethylhexyl)phthalat	17010001	0.0000000	0.000003	0.000000	0.000000	6735.143	0	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	7,250	0

v= 0.03 ft/day
time= 18250 days
x= 1450 feet

CONTAMINANT	Rd	v'	Dx'	Dy'	Dz'	A	erfc(A)	B	erf(B)	C	erf(C)	D	erf(D)	E	erf(E)	Co ppb	C ppb
Methylene Chloride	1.25578	0.0238895	43.00116	7.166860	7.166860	0.572325	0.4367	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	24,000	7
1,1-Dichloroethane	2.94355	0.0101917	18.34519	3.057532	3.057532	1.092256	0.1198	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	12,000	1
1,2-Dichloroethane	1.9513	0.0153743	27.67385	4.612309	4.612309	0.822760	0.2579	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	115,000	20
2-Butanone	0.998141	0.0300558	54.10054	9.016757	9.016757	0.453622	0.5245	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	650,000	229
1,1,1-Trichloroethane	5.662	0.0052984	9.537265	1.589544	1.589544	1.621890	0.0237	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	53,000	1
Trichloroethene	7.1425	0.0042002	7.560378	1.260063	1.260063	1.848616	0.0109	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	18,000	0
Toluene	16.435	0.0018253	3.285670	0.547611	0.547611	2.892680	0.00041	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	27,000	0
Ethyl Benzene	1.099225	0.0272919	49.12552	8.187586	8.187586	0.502673	0.4795	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	11,000	4
Phenol	1.9072	0.0157298	28.31375	4.718959	4.718959	0.808897	0.2579	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	7,000	1
Isophorone	1.007245	0.0297842	53.61158	8.935264	8.935264	0.458191	0.5245	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	26,000	9
2,4-Dimethylphenol	1.07875	0.0278099	50.05793	8.342989	8.342989	0.493024	0.4795	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	140	0
Naphthalene	2.0836	0.0143981	25.91668	4.319447	4.319447	0.863147	0.2293	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	620	0
Bis(2-ethylhexyl)phthalat	17010001	0.0000000	0.000003	0.000000	0.000000	3012.047	0	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	7,250	0

v= 0.03 ft/day
time= 36500 days
x= 1450 feet

CONTAMINANT	Rd	v'	Dx'	Dy'	Dz'	A	erfc(A)	B	erf(B)	C	erf(C)	D	erf(D)	E	erf(E)	Co ppb	C ppb
Methylene Chloride	1.25578	0.0238895	43.00116	7.166860	7.166860	0.230693	0.7237	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	24,000	12
1,1-Dichloroethane	2.94355	0.0101917	18.34519	3.057532	3.057532	0.658690	0.358	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	12,000	3
1,2-Dichloroethane	1.9513	0.0153743	27.67385	4.612309	4.612309	0.442191	0.5245	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	115,000	41
2-Butanone	0.998141	0.0300558	54.10054	9.016757	9.016757	0.125588	0.832	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	650,000	363
1,1,1-Trichloroethane	5.662	0.0052984	9.537265	1.589544	1.589544	1.064904	0.1198	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	53,000	4
Trichloroethene	7.1425	0.0042002	7.560378	1.260063	1.260063	1.234209	0.0897	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	18,000	1
Toluene	16.435	0.0018253	3.285670	0.547611	0.547611	1.997335	0.0047	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	27,000	0
Ethyl Benzene	1.099225	0.0272919	49.12552	8.187586	8.187586	0.169463	0.832	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	11,000	6
Phenol	1.9072	0.0157298	28.31375	4.718959	4.718959	0.430783	0.5245	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	7,000	2
Isophorone	1.007245	0.0297842	53.61158	8.935264	8.935264	0.129703	0.832	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	26,000	15
2,4-Dimethylphenol	1.07875	0.0278099	50.05793	8.342989	8.342989	0.160883	0.832	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	140	0
Naphthalene	2.0836	0.0143981	25.91668	4.319447	4.319447	0.475253	0.4795	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	620	0
Bis(2-ethylhexyl)phthalat	17010001	0.0000000	0.000003	0.000000	0.000000	2129.839	0	0.166781	0.168	-0.16678	-0.168	0.007580	0.008	-0.00758	-0.008	7,250	0

v= 0.03 ft/day
time= 16500 days
x= 4500 feet

CONTAMINANT	Rd	v'	Dx'	Dy'	Dz'	A	erfc(A)	B	erf(B)	C	erf(C)	D	erf(D)	E	erf(E)	Co ppb	C ppb
Methylene Chloride	1.25578	0.0238895	43.00116	7.166860	7.166860	1.447953	0.0477	0.094672	0.5205	-0.09467	-0.5205	0.004303	0.005	-0.00430	-0.005	24,000	1
1,1-Dichloroethane	2.94355	0.0101917	18.34519	3.057532	3.057532	2.522331	0.0004	0.094672	0.5205	-0.09467	-0.5205	0.004303	0.005	-0.00430	-0.005	12,000	0
1,2-Dichloroethane	1.9513	0.0153743	27.67385	4.612309	4.612309	1.959551	0.0047	0.094672	0.5205	-0.09467	-0.5205	0.004303	0.005	-0.00430	-0.005	115,000	1
2-Butanone	0.998141	0.0300558	54.10054	9.016757	9.016757	1.210820	0.0897	0.094672	0.5205	-0.09467	-0.5205	0.004303	0.005	-0.00430	-0.005	650,000	76
1,1,1-Trichloroethane	5.662	0.0052984	9.537265	1.589544	1.589544	3.649612	0	0.094672	0.5205	-0.09467	-0.5205	0.004303	0.005	-0.00430	-0.005	53,000	0
Trichloroethene	7.1425	0.0042002	7.560378	1.260063	1.260063	4.137240	0	0.094672	0.5205	-0.09467	-0.5205	0.004303	0.005	-0.00430	-0.005	18,000	0
Toluene	16.435	0.0018253	3.285670	0.547611	0.547611	6.400971	0	0.094672	0.5205	-0.09467	-0.5205	0.004303	0.005	-0.00430	-0.005	27,000	0
Ethyl Benzene	1.099225	0.0272919	49.12552	8.187586	8.187586	1.308322	0.066	0.094672	0.5205	-0.09467	-0.5205	0.004303	0.005	-0.00430	-0.005	11,000	1
Phenol	1.9072	0.0157298	28.31375	4.718959	4.718959	1.930899	0.0072	0.094672	0.5205	-0.09467	-0.5205	0.004303	0.005	-0.00430	-0.005	7,000	0
Isophorone	1.007245	0.0297842	53.61158	8.935264	8.935264	1.219873	0.0897	0.094672	0.5205	-0.09467	-0.5205	0.004303	0.005	-0.00430	-0.005	26,000	3
2,4-Dimethylphenol	1.07875	0.0278099	50.05793	8.342989	8.342989	1.289086	0.066	0.094672	0.5205	-0.09467	-0.5205	0.004303	0.005	-0.00430	-0.005	140	0
Naphthalene	2.0836	0.0143981	25.91668	4.319447	4.319447	2.043208	0.0047	0.094672	0.5205	-0.09467	-0.5205	0.004303	0.005	-0.00430	-0.005	620	0
Bis(2-ethylhexyl)phthalat	17010001	0.0000000	0.000003	0.000000	0.000000	6609.846	0	0.094672	0.5205	-0.09467	-0.5205	0.004303	0.005	-0.00430	-0.005	7,250	0

Project: Summit National Site
Contaminant-Transport Calculations for Water-Table Aquifer

By: DBT Date: 10-Dec-87

SEE TRANSPORT CALCULATIONS OF 2/26/87 FOR TERMS, EQUATIONS AND REFERENCES

LOW-VELOCITY CASE

v= 0.03 ft/day
time= 3650 days
x= 4500 feet

CONTAMINANT	Rd	v'	Dx'	Dy'	Dz'	A	erfc(A)	B	erf(B)	C	erf(C)	D	erf(D)	E	erf(E)	Co ppb	C ppb
Methylene Chloride	1.25578	0.0238895	43.00116	7.166860	7.166860	5.569266	0	0.094672	0.1124	-0.09467	-0.1124	0.004303	0.005	-0.00430	-0.005	24,000	0
1,1-Dichloroethane	2.94355	0.0101917	18.34519	3.057532	3.057532	8.623227	0	0.094672	0.1124	-0.09467	-0.1124	0.004303	0.005	-0.00430	-0.005	12,000	0
1,2-Dichloroethane	1.9513	0.0153743	27.67385	4.612309	4.612309	6.991194	0	0.094672	0.1124	-0.09467	-0.1124	0.004303	0.005	-0.00430	-0.005	115,000	0
2-Butanone	0.998141	0.0300558	54.10054	9.016757	9.016757	4.939881	0	0.094672	0.1124	-0.09467	-0.1124	0.004303	0.005	-0.00430	-0.005	650,000	0
1,1,1-Trichloroethane	5.662	0.0052984	9.537265	1.589544	1.589544	12.00752	0	0.094672	0.1124	-0.09467	-0.1124	0.004303	0.005	-0.00430	-0.005	53,000	0
Trichloroethene	7.1425	0.0042002	7.560378	1.260063	1.260063	13.49839	0	0.094672	0.1124	-0.09467	-0.1124	0.004303	0.005	-0.00430	-0.005	18,000	0
Toluene	16.435	0.0018253	3.285670	0.547611	0.547611	20.51542	0	0.094672	0.1124	-0.09467	-0.1124	0.004303	0.005	-0.00430	-0.005	27,000	0
Ethyl Benzene	1.099225	0.0272919	49.12552	8.187586	8.187586	5.195897	0	0.094672	0.1124	-0.09467	-0.1124	0.004303	0.005	-0.00430	-0.005	11,000	0
Phenol	1.9072	0.0157298	28.31375	4.718959	4.718959	6.909723	0	0.094672	0.1124	-0.09467	-0.1124	0.004303	0.005	-0.00430	-0.005	7,000	0
Isophorone	1.007245	0.0297842	53.61158	8.935264	8.935264	4.963478	0	0.094672	0.1124	-0.09467	-0.1124	0.004303	0.005	-0.00430	-0.005	26,000	0
2,4-Dimethylphenol	1.07875	0.0278099	50.05793	8.342989	8.342989	5.145067	0	0.094672	0.1124	-0.09467	-0.1124	0.004303	0.005	-0.00430	-0.005	140	0
Naphthalene	2.0836	0.0143981	25.91668	4.319447	4.319447	7.230105	0	0.094672	0.1124	-0.09467	-0.1124	0.004303	0.005	-0.00430	-0.005	620	0
Bis(2-ethylhexyl)phthalat	17010001	0.0000000	0.000003	0.000000	0.000000	20902.16	0	0.094672	0.1124	-0.09467	-0.1124	0.004303	0.005	-0.00430	-0.005	7,250	0

v= 0.03 ft/day
time= 18250 days
x= 4500 feet

CONTAMINANT	Rd	v'	Dx'	Dy'	Dz'	A	erfc(A)	B	erf(B)	C	erf(C)	D	erf(D)	E	erf(E)	Co ppb	C ppb
Methylene Chloride	1.25578	0.0238895	43.00116	7.166860	7.166860	2.293791	0.0011	0.094672	0.1124	-0.09467	-0.1124	0.004303	0.005	-0.00430	-0.005	24,000	0
1,1-Dichloroethane	2.94355	0.0101917	18.34519	3.057532	3.057532	3.727842	0	0.094672	0.1124	-0.09467	-0.1124	0.004303	0.005	-0.00430	-0.005	12,000	0
1,2-Dichloroethane	1.9513	0.0153743	27.67385	4.612309	4.612309	2.968631	0.000041	0.094672	0.1124	-0.09467	-0.1124	0.004303	0.005	-0.00430	-0.005	115,000	0
2-Butanone	0.998141	0.0300558	54.10054	9.016757	9.016757	1.988371	0.0047	0.094672	0.1124	-0.09467	-0.1124	0.004303	0.005	-0.00430	-0.005	650,000	1
1,1,1-Trichloroethane	5.662	0.0052984	9.537265	1.589544	1.589544	5.277219	0	0.094672	0.1124	-0.09467	-0.1124	0.004303	0.005	-0.00430	-0.005	53,000	0
Trichloroethene	7.1425	0.0042002	7.560378	1.260063	1.260063	5.954122	0	0.094672	0.1124	-0.09467	-0.1124	0.004303	0.005	-0.00430	-0.005	18,000	0
Toluene	16.435	0.0018253	3.285670	0.547611	0.547611	9.120361	0	0.094672	0.1124	-0.09467	-0.1124	0.004303	0.005	-0.00430	-0.005	27,000	0
Ethyl Benzene	1.099225	0.0272919	49.12552	8.187586	8.187586	2.113263	0.003	0.094672	0.1124	-0.09467	-0.1124	0.004303	0.005	-0.00430	-0.005	11,000	0
Phenol	1.9072	0.0157298	28.31375	4.718959	4.718959	2.930380	0.000041	0.094672	0.1124	-0.09467	-0.1124	0.004303	0.005	-0.00430	-0.005	7,000	0
Isophorone	1.007245	0.0297842	53.61158	8.935264	8.935264	1.999924	0.0047	0.094672	0.1124	-0.09467	-0.1124	0.004303	0.005	-0.00430	-0.005	26,000	0
2,4-Dimethylphenol	1.07875	0.0278099	50.05793	8.342989	8.342989	2.088543	0.003	0.094672	0.1124	-0.09467	-0.1124	0.004303	0.005	-0.00430	-0.005	140	0
Naphthalene	2.0836	0.0143981	25.91668	4.319447	4.319447	3.080571	0	0.094672	0.1124	-0.09467	-0.1124	0.004303	0.005	-0.00430	-0.005	620	0
Bis(2-ethylhexyl)phthalat	17010001	0.0000000	0.000003	0.000000	0.000000	9347.734	0	0.094672	0.1124	-0.09467	-0.1124	0.004303	0.005	-0.00430	-0.005	7,250	0

Appendix F

APPENDIX F - RADIOLOGICAL MONITORING DATA

Eberline Thermo Electron Corporation

Post Office Box 2108
Santa Fe, New Mexico 87501
(505) 471-3232 TWX 910-985-0678

CURRENT TLD OCCUPATIONAL RADIATION EXPOSURE REPORT

APPROVED FOR USE IN LIEU OF NRC FORMS

5617 1 /

DATE 02/06/85

DOSIMETRY SERVICES

Facility	Name	Dose Recorded	Type	Date	Location	Neutron Reading	Total Dose Recorded	Gamma	Beta	Neutron	Whole Body	Skin	Extremity	Total	Test	Rate
0000	CONTROL		T	11/01/84			28									
			M	02/04/85			28									
0025			T	11/01/84			2	0	0		0	0	0	1.250		5
			M	02/04/85			2	0	0		0	0	0	0.000		
0026			T	11/01/84			7	0	0		0	0	0	1.250		5
			M	02/04/85			7	0	0		0	0	0	0.000		
0027			T	11/01/84			7	0	0		0	0	0	1.250		5
			M	02/04/85			7	0	0		0	0	0	0.000		
0028			T	11/01/84			11	0	11		0	11	0	1.250		5
			M	02/04/85			0	0	11		0	11	0	0.000		
0029			T	11/01/84			19	0	19		0	19	0	1.250		5
			M	02/04/85			0	0	19		0	19	0	0.000		
0030			T	11/01/84			0	0	0		0	0	0	1.250		5
			M	02/04/85			0	0	0		0	0	0	0.000		
0031			T	11/01/84			0	0	0		0	0	0	1.250		5
			M	02/04/85			5	0	0		0	0	0	0.000		
0032			T	11/01/84			2	0	0		0	0	0	1.250		5
			M	02/04/85			2	0	0		0	0	0	0.000		
0033			T	11/01/84			0	0	0		0	0	0	1.250		5
			M	02/04/85			0	0	0		0	0	0	0.000		
0034			T	11/01/84			0	0	0		0	0	0	1.250		5
			M	02/04/85			0	0	0		0	0	0	0.000		
0035			T	11/01/84			0	0	0		0	0	0	1.250		5
			M	02/04/85			0	0	0		0	0	0	0.000		

PHOENIX SAFETY ASSOC. LIM
LORI EHRENFRIED
P.O. BOX 545
PHOENIXVILLE PA 19[illegible]

Note: Any net counts listed under (Total TLD Net counts), < 10 are recorded as 0 mrem for total dose because background readings are taken into consideration.

Badge # 0028 and 0029 have readings of 11 + 19 for total TLD net counts which is beta + GAMMA and listed as the skin dose in mrem.

Data Documents 10 163102

EXPLANATION AND REMARKS CONCERNING THE REPORT

1. ABOUT THE REPORT

This report lists the deep and shallow dose equivalents for each participant based on the amount of radiation to which the badge or dosimeter was exposed. The premise is that the radiation which exposed the badge is closely related in both quality and quantity to that radiation which exposed that part of the body on which the dosimeter was worn.

2. USE OF CONTROL DOSIMETER

A control dosimeter is included with the shipment of dosimeters as a means to determine radiation doses received during transit. The control dosimeter reading is subtracted from the dosimeter reading of each participant. Failure to include a control dosimeter with your return shipment of dosimeters will not allow us to assess transit exposure to radiation and such transit doses will be reflected in the participant dose.

3. MINIMUM DOSE EQUIVALENT REPORTED

Dose equivalents for the current monitoring period below the minimum measurable quantity are recorded as "M". The minimum measurable quantity depends on the dosimeter type and quality of radiation. GARDRAY® film and TLD dosimeters have a minimum reporting value of 10mrem for x and gamma rays and 40mrem for energetic beta particles. DEX-RAY® film dosimeters have a minimum reporting value of 5mrem. All fast and moderate energy neutron dosimeters have a minimum reporting dose of 20mrem. Film dosimeters for thermal neutrons have a minimum reporting dose of 10mrem.

4. CUMULATIVE TOTAL DATA

Cumulative totals equal the sum of the readings of dosimeters returned for processing and reported to date. Minimal exposures are added as zero. Calendar quarters are selected to most nearly conform to NRC and state recording requirements considering starting date and length of monitoring periods chosen.

5. ADJUSTMENTS TO CUMULATIVE DATA

To aid in proper presentation of information for records required by the NRC and other regulatory bodies, amendments to the cumulative totals may have been made increasing or decreasing the totals from those originally reported. Such amendments are made at the request of an authorized representative of the client and are only to reflect supplementary data demonstrating that the dosimeter exposure originally occurred in such a manner as to either overstate or understate the true dosage to the badge assignee. (Refer to adjustment column.) Addition of previous exposure prior to commencement of use of the particular dosimeter assignment reported may also be reflected in the cumulative totals.

6. DEEP AND SHALLOW DOSE EQUIVALENTS

The deep dose is the dose equivalent from all radiations at a depth of 1cm (1000mg/cm²) in soft tissue. Considered are the effects of build up and attenuation of radiation in the body as estimated using the 30cm diameter sphere of tissue equivalent material specified by the International Commission on Radiation Units and Measurements. The shallow dose equivalent is the dose equivalent from all radiations at approximately 0.007cm depth (7mg/cm²) in soft tissue. Similar to deep dose, the contribution to the shallow dose equivalent from radiation scattered within the body is considered. The deep dose should be considered equivalent to the whole body dose and the shallow dose as equivalent to the dose to the skin of the whole body.

Dose equivalents arising from exposures to x or gamma rays will have a deep and shallow value reported. Depending on the energy of the x or gamma rays, the deep and shallow values may or may not be equal. For neutron exposures, the same value is reported *for the deep and shallow dose equivalent. Beta* exposures are only reported as a shallow dose equivalent.

When the lens of the eyes are not sufficiently protected from radiation, NRC Form 5 states that doses at 300mg/cm² or less should be measured. When dosimeter data indicate that reporting the dose at 1cm depth would not reflect the appropriate dose at 0.3cm depth (300mg/cm²) the deep dose reported will be the dose at 0.3cm depth rather than at 1.0cm depth.

7. RING BADGE READINGS

Ring badge readings are reported as a shallow dose as if due to gamma rays. If produced by low energy x-rays or beta particles, the reported value may be incorrect. Calibration factors for x-rays and beta particles are available so that a more accurate interpretation is possible.

8. GENERAL RADIATION EXPOSURE GUIDES*

TYPE OF EXPOSURE	GUIDE VALUE
Whole body, head & trunk, blood forming organs, lens of eye, or gonads	1250 millirems per quarter, 5000 millirems per year. Up to 3000 millirems is permitted in a calendar quarter as long as the accumulated occupational dose to the whole body does not exceed 5000 millirems x (age-18)
Skin of whole body	7,500 millirems per quarter
Hand, forearms, feet and ankles	18,750 millirems per quarter

*U.S.N.R.C. regulations, Title 10, Part 20, Code of Federal Regulations (9-1-78). NOTE: Certain states and other regulatory agencies may follow guides that are different from the above.

COLUMN REFERENCES

NOTES (COLUMN 4)

A ABSENT

B-1 This film appears to have been damaged by light. The accuracy of any reading given would be affected thereby.

B-2 This film appears to have been damaged by moisture. The accuracy of any reading given would be affected thereby.

B-3 This film appears to have been damaged by chemical fogging. The accuracy of any reading given would be affected thereby.

B-4 This dosimeter appears to have been manufactured faultily. The accuracy of any reading given would be affected thereby.

B-5 This film appears to have been damaged by heat or pressure. The accuracy of any reading given would be affected thereby.

C Evidence of contamination.

DA This film packet appears to have been exposed out of the badge, therefore, the value given is based on a high energy gamma calibration and is valid only if the exposure were due to high energy gamma. If it were due to beta particles, or lower energy x or gamma rays, the value reported may be inaccurate.

DC This film packet is partially lightstruck. There is apparently a dose recorded, however, no exact quantitative determination can be made. The reported dose is the maximum received.

DD This film badge appears to have been shielded during exposure. The dose *reported is not an exact quantitative determination, but only an indication that the* badge was exposed.

DE This film badge appears to have been shielded during exposure. There is a dose recorded, however, no exact quantitative determination can be made.

DF This film packet appears to have been misplaced in the badge. The dose reported is not an exact quantitative determination, but is only an indication that the badge was exposed.

DG Although this film packet was slightly lightstruck, there seems to be no apparent effect on the reading.

DH The beta-gamma background on this film badge was too high to give a valid fast neutron reading.

DI This reading is based on 50-150KV x-ray. This film badge appears to be defective; please return badge for replacement.

DJ This film packet is too old to process.

DL This control packet appears to have been placed in a film badge indicating possible misuse. May we remind you that the value of the control films is lost if used for personnel monitoring or other radiation measurement purposes.

DR This film appears to have been exposed from the rear of the badge.

DS Amounts shown in columns 8 & 9 have been permanently subtracted from cumulative totals at customer's request.

DT Amounts shown in columns 8 & 9 have been permanently added to cumulative totals at customer's request.

DU Amounts shown in columns 8 & 9 have been supplied by customer for period prior to inception of Landauer service and have been permanently added to cumulative totals.

DV Amounts shown in columns 8 & 9 are previous lifetime exposures supplied by customer and have been permanently added to cumulative totals.

DY Other comment - See attached note.

DZ Other comment - See attached note.

E Irregular exposure.

E-1 Due to the irregular exposure the effective energy cannot be properly determined and the dosage is estimated arbitrarily based on 50 to 150 PKV x-rays as probable source of exposure. If different energy the value reported will not be the actual dosage.

E-2 Due to the irregular exposure the effective energy cannot be properly determined and the dosage is estimated arbitrarily based on gamma or x-ray over 400KeV as probable source of exposure. If different energy, the value reported will not be the actual dosage.

H Unused.

QC Dosimeter received and processed. Quality control has not authorized reporting of doses. A separate report containing the doses for this dosimeter will be forthcoming.

DOSIMETER TYPE USED (COLUMN 6)

A X, GAMMA, BETA, FAST NEUTRON (NEUTRAK® 8)
B X, GAMMA, BETA, FAST NEUTRON (NEUTRAK 144)
C X, GAMMA, BETA, FAST NEUTRON (NEUTRAK 144), THERMAL NEUTRON
D REACTOR TLD
E NEUTRAK®
F REACTOR TLD, FAST NEUTRON (NEUTRAK 144)
G X, GAMMA, BETA
H X, GAMMA, BETA, FAST NEUTRON (BETA FILM), THERMAL NEUTRON
I NEUTRAK ER (TLD CARD & NEUTRAK 144)
J X, GAMMA, BETA, FAST NEUTRON (NEUTRAK 8), THERMAL NEUTRON
K TLD (3 CHIPS)
L TLD (4 CHIPS)
M TLD (2 CHIPS), FAST NEUTRON (NEUTRAK 144)
N FAST NEUTRON (NEUTRAK 144)
O TLD (1 CHIP), FAST NEUTRON (NEUTRAK 8)
P X, GAMMA, BETA, FAST NEUTRON (BETA FILM)
Q DEX-RAY®
R X, BETA, GAMMA, NEUTRON (NEUTRAK-ER) (FILM)
S X, BETA, GAMMA, NEUTRON (NEUTRAK-ER) (TLD [illegible])
T TLD (2 CHIPS)
U TLD (1 CHIP RING)
V ALBEDO ONLY (TLD CARD ONLY)
W ESCORT® TLD
X SPECIAL TLD
Y X, GAMMA, BETA, THERMAL NEUTRON
Z TLD (3 CHIPS), FAST NEUTRON (NEUTRAK 144)

OPTION CODE (WHEN USED)
1 ADDITIONAL BETA CALC. & COMBINATION HOLDER
2 ADDITIONAL BETA CALC.
3 COMBINATION HOLDER
4 X CALCULATION FOR RING

RADIATION QUALITY (COLUMN 7)

The following codes are provided to identify the types and in some cases energies of radiation contributing to the dose equivalent.

P - x or gamma ray exposure. P may be followed by an H for high energy x or gamma rays (greater than 250 keV effective), M for moderate energies (between 100 and 250 keV effective) or L for low energies (less than 100 keV effective).

B - Beta particle exposure.

N - Neutron exposure. N may be followed by an F for fast and intermediate energy neutrons or a T for thermal neutrons.

CPB - Combined exposure due to both x or gamma rays and beta particles. The beta particle dose will be printed as a second line in the shallow dose column and coded as B, indicating that the second line is the beta dose component of the combined shallow dose.

CPN - Combined exposure due to x or gamma rays and neutrons. The neutron dose will be printed as a second line in the deep dose column. This line will be coded as NF or NT, indicating that the second line is the dose due to fast and intermediate energy neutrons or thermal neutrons, respectively.

ADJUSTMENTS (COLUMN 16)

Adjustments made to cumulative totals with this or previous report at customer request.

A - Additions
B - Subtractions
C - Additions & Subtractions
D - Dosage data supplied by customer for period prior to inception of Landauer service.
E - Dosage data supplied by customer for period prior to inception of Landauer service, additional changes have also been made.
F - Previous lifetime exposure supplied by customer.
G - Previous lifetime exposure supplied by customer, additional changes have also been made.

UNUSED PERMISSIBLE ACCUMULATED DOSE (COLUMN 17)

Unless birth date and lifetime exposure records are supplied by the customer, no values are reported in column 17. If this data is supplied, the difference between the participant's age (in years) and 18 (if age greater than 18) is multiplied by 5000. From this we subtract the value shown in column 15. The result is that value given in column 17. [5000 (Age-18)-column 15]. The value in column 17 is computed monthly. Permissible values are based on January 8, 1957 recommendations of the National Committee on Radiation Protection and Measurements. These values are given for total body exposures only.

INCEPTION DATE OF PERMANENT TOTAL (COLUMN 21)

Available to client modification to meet specific administrative requirements and may not reflect actual beginning date of accumulated totals.

LANDAUER DOSIMETRY SERVICES ARE TESTED BY PRINCIPAL TESTING ORGANIZATIONS AGAINST CURRENT CONSENSUS INDUSTRY STANDARDS.

SRW ASSOCIATES INC
ATTN L LADD
2793 NOBLESTOWN RD
PITTSBURGH PA 15205

ACCOUNT NO	SERIES CODE
35394	

PROCESS NO	REPORT DATE	DOSIMETER RECEIVED	REPORTING TIME IN WORK DAYS	PAGE NO
T6290M	11/06/86	10/17/86	14	1

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(312) 756-7000

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National Bureau of Standards
through [illegible]

RADIATION DOSIMETRY REPORT

Summit 86301

1 - PR 3484 - 64752

PARTICIPANT ID NUMBER	NAME	SOCIAL SECURITY NUMBER	NOTE (SEE REVERSE SIDE)	DOSIMETER TYPE	DOSIMETER USE	RADIATION QUALITY	EXPOSURE TO BADGE (MILLIREMS) FOR PERIOD(S) INDICATED BELOW: DEEP	EXPOSURE TO BADGE (MILLIREMS) FOR PERIOD(S) INDICATED BELOW: SHALLOW	CUMULATIVE TOTALS (MILLIREMS) CALENDAR QUARTER: DEEP	CALENDAR QUARTER: SHALLOW	YEAR TO DATE: DEEP	YEAR TO DATE: SHALLOW	PERMANENT: DEEP	PERMANENT: SHALLOW	ADJUSTMENTS	PREVIOUS PART OF PERMANENTLY ACCUMULATED DOSE (MILLIREMS)	SEX	BIRTH DATE MO	BIRTH DATE DA	BIRTH DATE YR	NUMBER BADGE REPORTS TO DATE	NUMBER BADGE REPORTS QTR	RECEPTION DATE OF PERMA DOSE TOTAL MO	RECEPTION DATE OF PERMA DOSE TOTAL YR
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Appendix G

APPENDIX G - WESTON GEOPHYSICAL SURVEY

Weston Geophysical
CORPORATION

May 28, 1985
WGC R588-92

SRW ASSOCIATES INC.
Attn: Mr. Earl Brown
2793 Noblestown Road
Pittsburg PA 15205

Dear Mr. Brown:

In accordance with your authorization, a geophysical survey program was conducted at the Summit National Site in Deerfield Township, Ohio.

Preliminary data and a draft report have been previously submitted.

This submission is the final report presenting the results and findings of the geophysical investigation.

Very truly yours,

WESTON GEOPHYSICAL CORPORATION

Paul Fisk

Paul Fisk

PF/rf-2009R2

Post Office Box 550 • Westboro, Massachusetts 01581 • (617) 366-9191 • Telex No. 920491

GEOPHYSICAL SURVEY

SUMMIT NATIONAL SITE
DEERFIELD TOWNSHIP
PORTAGE COUNTY, OHIO

Prepared for

SRW ASSOCIATES, INC.

MAY 1985

Weston Geophysical
CORPORATION

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1.0 EXECUTIVE SUMMARY

A multiple-technique geophysical survey was conducted at the Summit National Site in Deerfield Township, Portage County, Ohio to evaluate overall site conditions.

Magnetic data obtained along a 25-foot grid within the site identified seven possible waste container burial sites. Ground penetrating radar [GPR] surveying had limited penetration due to highly conductive surface materials. GPR test lines identified buried point targets, possibly barrels, within two of the magnetic anomalies [anomalous zones IV and VI].

Electromagnetic surveying along selected profile lines, both within and adjacent to the site, indicate higher conductivity values associated with near surface materials and the upper aquifer and lower conductivity values associated with an aquitard at depth. The high conductivity values indicative of contaminants within the upper aquifer appear to be migrating eastward more or less along the path of a stream. Lower conductivity values at depth indicate that the aquitard is slowing the vertical migration of contaminants. Contoured conductivity values indicate an eastward migration of contaminants along the top or possibly within the upper portion of the aquitard.

2.0 INTRODUCTION & PURPOSE

A geophysical survey was conducted for SRW Associates, Inc., at the U.S. EPA Summit National Site located in Deerfield Township, Portage County, Ohio during the period of October 31 through November 7, 1984. The multiple-technique geophysical program consisted of magnetometer, electromagnetic terrain conductivity [EM], ground penetrating radar [GPR] and borehole logging surveys.

The general purpose of the multiple-technique survey was to evaluate the overall site condition in terms of total field magnetics, surface and subsurface conductivity and stratigraphy. The specific objective

of the magnetometer survey was to determine those locations within the site where waste containers, drums, barrels, tanks, were buried. One of the specific objectives of the EM survey was to define a relationship between the general site stratigraphy and conductivity. The general site stratigraphy consists of surface soils, upper aquifer, aquitard and lower aquifer. The other objective of the EM survey was to evaluate the extent of groundwater contamination and the direction of contaminant migration. The specific objective of the GPR survey was to evaluate the source of the magnetic anomalies. The borehole logging survey was conducted to define various parameters; resistivty, conductivity, porosity, temperature, self potential, density and temperature related to the stratigraphy.

3.0 LOCATION & SURVEY CONTROL

The area of investigation is shown on Figure 1, a segment of the Deerfield, Ohio United States Geological Survey Quadrangle Map. The specific locations of magnetic, EM and GPR survey lines are shown on Figures 2 and 2A. The base map and horizontal control for this survey were provided by SRW Associates, Inc.

4.0 METHOD OF INVESTIGATION

The geophysical field program utilized magnetic, electromagnetic terrain conductivity and ground penetrating radar and borehole logging techniques. The method of investigation for each technique is described is the following sections.

4.1 Magnetometer Survey

Total field magnetic measurements were made using a Geometrics model G-816 Portable Proton Magnetometer. Total field magnetic readings were recorded every 10 feet on a 25-foot survey grid in the on-site area. Base station data used to correct the survey data for local diurnal variation was obtained on Line F at Station 6+75. The locations of metal debris scattered throughout the survey area were noted in field

data books, since this debris will effect magnetic measurements. A discussion of the magnetic survey technique is included as Appendix A to this report.

4.2 Electromagnetic Terrain Conductivity [EM] Survey

Conductivity measurements were made on each survey line using both the EM31 and EM34-3. Measurements were made at 12.5-foot intervals with the EM31. The data intervals for the EM34-3 survey were 25-foot and 50-foot, respectively, for the 10 and 20 meter coil spacings. A complete set of data showing the variation of conductivity with depth was obtained by making multiple traverses over each survey line. The EM31 provided information on the conductivity of the near surface material. EM34-3 data obtained with the 10- and 20-meter coil spacing, vertical coil configuration, provided information on subsurface conductivity with increasing depth. The EM34-3 20-meter coil spacing, horizontal coil configuration, provided the maximum depth of penetration achieved during this survey. The EM34-3 40-meter coil spacing, vertical coil configuration, survey originally proposed for this site could not be accomplished due to high levels of electromagnetic background noise. The 20-meter coil spacing, horizontal coil configuration, survey was used to complete the data set.

Table 1 summarizes the exploration depths of the EM31 and EM34-3 for the various coil spacings and configurations used for the survey.

TABLE 1

		Approximate Exploration Depth [feet]	
Type	Intercoil Spacing [meters]	Vertical Coils	Horizontal Coils
EM31	3.7	-	8 - 18
EM34-3	10	20 - 25	40 - 50
EM34-3	20	40 - 50	90 - 100

A discussion of the electromagnetic conductivity technique is included as Appendix B to this report.

4.3 Ground Penetrating Radar [GPR] Survey

GPR data were obtained using a Geophysical Survey Systems, Inc. Subsurface Interface Radar [SIR] System coupled with a 300 MHz transducer. Results of the earlier EM31 survey showed high surface conductivity indicating the GPR depth of penetration would be limited. However, a test program was conducted in several areas of the site. These test lines were located in areas of magnetic anomalies and other areas of primary interest. A discussion of the ground penetrating radar survey technique is included as Appendix C to this report.

4.4 Borehole Logging Survey

Spontaneous Potential [SP], resistivity, Natural Gamma Ray, Neutron-Neutron, Density, Caliper, and Fluid temperature and conductivity geophysical logging techniques were used in borings MW-8 and MW-14.

5.0 DISCUSSION OF RESULTS

5.1 On-Site Area

5.1.1 Magnetometer Survey

Contoured magnetometer survey data [Figure 3] obtained in the on-site area defined several anomalous zones. These zones are indicated as I-VII on the Magnetic Anomaly Map [Figure 4]. Metal debris observed on the surface was noted in the field records and has been accounted for in the interpretation of magnetic data described below.

Zone I is a relatively broad area centered near the intersection of Lines H+50 and 8+50. The anomalous zone consists of several magnetic highs and lows in an area approximately 125 x 125 feet. The amplitude, 800+ gammas, of the anomaly and extent of this zone indicate a relatively large amount of buried magnetic material scattered throughout

this area. The type of material suspected to be buried is probably similar to that observed at the surface; drums, barrels, cans and general debris.

Zone II is a relatively small area centered near the intersection of Lines G+75 and 9+50. The location, size and amplitude of this magnetic anomaly appears to confirm the suspicion of a buried tank in this area, an area which coincides with seepage of a tar like material from a subsurface source.

Zone III is a relatively small area centered near the intersection of Lines F+50 and 9+00. The low amplitude, approximately 250 gammas, signature of this anomaly is indicative of a relatively small amount of magnetic material. The anomaly is probably the result of magnetic debris, barrel covers and rings, observed on the surface at this location rather than a concentration of buried material such as barrels or drums. However, there is a possibility of buried material at this location.

Zone IV is a broad area, approximately 100 x 100 feet, centered near the intersection of Lines E+30 and 9+30. Two anomalies consisting of paired magnetic highs and lows were detected in this area. The measured amplitude of the anomaly on the west side of the zone is greater than 2000 gammas, indicative of a large amounts of magnetic material concentrated in a small area, possibly a nest of buried barrels. The source of the anomaly appears to be on Line E near Station 9+30. The magnetic field at this station was very erratic and resulted in highly anomalous, nonrepeatable, data.

The anomaly on the east side of the zone has a measured amplitude of approximately 800 gammas. Although smaller in measured amplitude, the magnetic signature is indicative of a concentration of material in a small area. The location of the source of this anomaly is probably defined by the magnetic high.

The anomaly at Zone V consisted of a paired high/low magnetic signature of relatively low amplitude, approximately 500 gammas, covering a small area centered near the intersection of Lines D and 8+00. Magnetic material including barrels, steel cable and general debris was observed on the ground surface in this area. The magnetic material observed in this area contributes to the anomalous magnetic condition, however, it is considered probable that more magnetic material is present, buried in the mounds of dirt and debris at this location.

The anomalous condition in Zone VI, centered near Lines F+50 and 7+00, consisted of a low amplitude, approximately 350 gammas, magnetic high. The source of the anomaly appears to be an isolated buried magnetic object located by ground penetrating radar on Line 6+50 at F+78. The depth of burial, based on GPR data, is estimated to be two feet.

The anomalous condition in Zone VII, centered near Lines H+75 and 6+50, consisted of a paired high/low magnetic signature with an amplitude of approximately 300 gammas. Although some steel debris was observed in this area, it is considered likely that the anomaly is due to magnetic material buried at this location.

5.1.2 EM Survey

The data obtained during the electromagnetic terrain conductivity survey in the on-site area are shown as composite plots [Figures 5 and 6]. Data obtained on Line 9+00 indicates conductive surface and subsurface conditions. A zone of high conductivity was detected from approximately Line D+50 to Line G with the highest values occurring near Line F. High conductivity values, particularly near Line F, were measured with all the EM coil configurations and coil spacing utilized on this site. This conductive zone generally coincides with the magnetic anomalies, Zones III and IV, previously discussed. The data indicates a highly conductive subsurface condition extending to depth. On Line F, the EM31 data, indicates conductive subsurface condition. The anomalous, low conductivity values measured on Line F, with the 20-meter coil

spacing horizontal coil configuration, are probably the result of orientation of the instrumentation with respect to the conductive zone rather than the presence of a true low conductivity subsurface condition in this area.

Anomalous EM data were obtained on Line 7+00 at D+75. This location is adjacent to the reinforced concrete coal tipple structure. The anomalous EM condition is probably related to the influence of this structure.

In addition to the specific anomalous conditions previously discussed, several general observations of conditions in the on-site area are important. The composite plots of EM data obtained with the various coil spacings and configuration indicate that terrain conductivity generally high, 40 to 60 mmhos/m for the near surface material, decreasing to less than 40 mmhos/m at depth. The lowest conductivity values were measured with the EM34-3, 20-meter coil spacing, horizontal coil configuration. This configuration and coil spacing provided the maximum depth of penetration achieved for this survey. The composite data plots also indicate a similarity in the trend of the data obtained with the EM31 and EM34-3 [10- and 20-meter coil spacing, vertical coil configuration]. The EM31 data show the conductive nature of the near-surface materials. The EM34-3 data show relatively high conductivity conditions indicative of contamination extending to a depth which includes the upper aquifer. Due to the variation in conductivity across the site and the limited coverage, contaminant migration pathways could not be identified. Data obtained with the EM34-3, 20-meter spacing horizontal coil configuration, indicates the materials at greater depth, within the aquitard, have lower conductivity than that of the near surface material. In addition, the variation in conditions in the aquitard vary somewhat from the trends established in the shallower data. This may indicate that vertical migration of contaminants in the upper layers is variable or variation in the depth or stratigraphy of the aquitard layer.

5.1.3 GPR Survey

Due to the conductive nature of the surface materials at this site, the depth of penetration achieved by the GPR on test lines conducted in several areas was limited to approximately 2 to 3 feet. For this reason the GPR survey was determined to be inapproproate for this site. However, GPR test data did locate shallow point targets, possibly barrels, in magnetic anomaly zones IV and VI. The location of the test lines and anomalous conditions are shown on Figure 2A. Test lines conducted in the area of the scale house showed a large buried tank adjacent to the scale house on the west side and two smaller tanks buried side by side adjacent to the scale house on the east side. The depth to the top of these tanks is estimated to be less than three feet.

GPR test lines in the vicinity of the coal tipple ruins, incinerator and incinerator stacks were run to determine if tanks were buried at these locations. Several small shallow targets were detected at these locations, but signal penetration was very limited. Buried tanks, if present, were not detected within the depth range of the GPR.

5.2 Off-Site Area

5.2.1 EM Survey

The off-site electromagnetic terrain conductivity survey was conducted in an area approximately 300 by 400 feet located directly east of the on-site area. The survey coverage was established to investigate surface and subsurface conductivity in the vicinity of a small swampy area and an eastward flowing stream.

The results of the off-site EM survey are shown as data plots on Figures 6 and 7 and contour maps, Figures 8, 9, 10, and 11. Composite plots of EM data obtained with the various equipment configurations are shown for Line B and the extension of Line J+75 on Figures 6 and 7, respectively. The order in which the contour maps are presented is

consistent with increasing depth of penetration for the various EM equipment configurations. Figure 8 shows the near surface conditions, while Figure 11 shows conditions at the maximum depth of penetration. In general, this set of data shows that conductivity decreases with depth and significant variations in contour trends for the various coil spacings and configurations.

The EM31 data indicate relatively conductive, 25 to 50 mmhos/m, surface soils. The highest values were measured in the swampy area and in the vicinity of the stream channel. Surface soil conductivity values are high in the west decreasing to the north, south and east. Although the near surface soil conductivity decreases to the east, no specific trend related to the eastward flowing stream was evident in the contours. The EM34-3 data obtained with the 10- and 20-meter coil spacing, vertical coil configuration, are indicative of the conductivity in the upper aquifer. Available geologic information indicates an upper aquifer in the overall site area at a depth of approximately 22 to 30 feet. The contour maps [Figure 10 and 11] developed from 10 and 20 meter spacings, vertical coil, data indicate subsurface conductivity is relatively high, 25 to 40 mmhos/m. The measured values are high in the west, decreasing to the north, south and east. This general trend is the same as that established by the EM31 data for the near surface soils. However, unlike the near surface data, the deeper penetration EM34-3 data defined a trend evident in the contours, which may indicate a concentration of relatively high conductivity in the upper aquifer following the surface path of the eastward flowing stream. At several locations along Line 7+00, the upper aquifer conductivity is higher than the values measured for the near surface soils.

Data obtained with EM34-3 20-meter coil spacing, horizontal coil configuration, are indicative of the subsurface condition at the maximum depth of penetration achieved during the survey. These data indicate lower conductivity at depth. This decrease in conductivity with depth is probably the result of the influence of the material below the upper aquifer. Available geologic information indicates a low permeability layer, identified as an aquitard, in the site area at

a depth of 30 to 95 feet. Due to the low permeability of this layer, the vertical and horizontal migration rate of contaminants into and through the layer would be expected to be very low. However, the contours of the deep EM34-3 data, Figure 11, show conductivity values decreasing from west to east, indicating a possible migration of conductive contaminants in this layer or that the depth to the aquitard is shallower to the east. There is no indication in these data of any specific trend associated with the eastward flowing stream as was the case in the upper aquifer.

5.2.2 Borehole Logging

No direct correlation can be drawn between the stratigraphic sections and surface electromagnetic measurements because boring MW-14 is several hundred feet from the nearest EM survey line and MW-8 is located near electromagnetic Line B whose measured condutivity profile is generally characterless. These boring logs may have information which will contribute to the overall project and have been included as Figures 12 and 13.

6.0 CONCLUSIONS & RECOMMENDATIONS

The multiple-technique geophysical survey conducted for SRW Associates, Inc. at the Summit National Site obtained magnetic, electromagnetic, ground penetrating radar and borehole logging data to evaluate the overall site conditions. Geophysical data were obtained on 25-foot spaced grid lines within the on-site area and along selected survey lines in the off-site area. The 25-foot magnetic data acquisition grid provided sufficient data density to locate specific areas where barrels may be burried; and the wider spacing of EM survey lines is cost effective in evaluating the overall site conductivity conditions.

Magnetic survey results indicate seven anomalous zones where waste containers may be buried. Point targets, possibly barrels, were identified within two of the anomalous zones by the GPR survey. The electromagnetic survey results indicate that the surface materials and

upper aquifer are more conductive than the aquitard at depth. Contoured conductivity values indicate that contaminants in the upper aquifer are following the surface path of an eastwardly flowing stream and that the aquitard is limiting the vertical migration of contaminants.

It is recommended that the results of this geophysical investigation be verified with trenching of magnetic anomalies and drilling and sample analysis of possibly contaminated ground water along the migration path identified by contoured conductivity data [EM results]. It is also recommended that the geophysical survey be extended to include all of the geophysically logged boreholes to allow for direct correlation and a better overall understanding of site conditions.

FIGURES

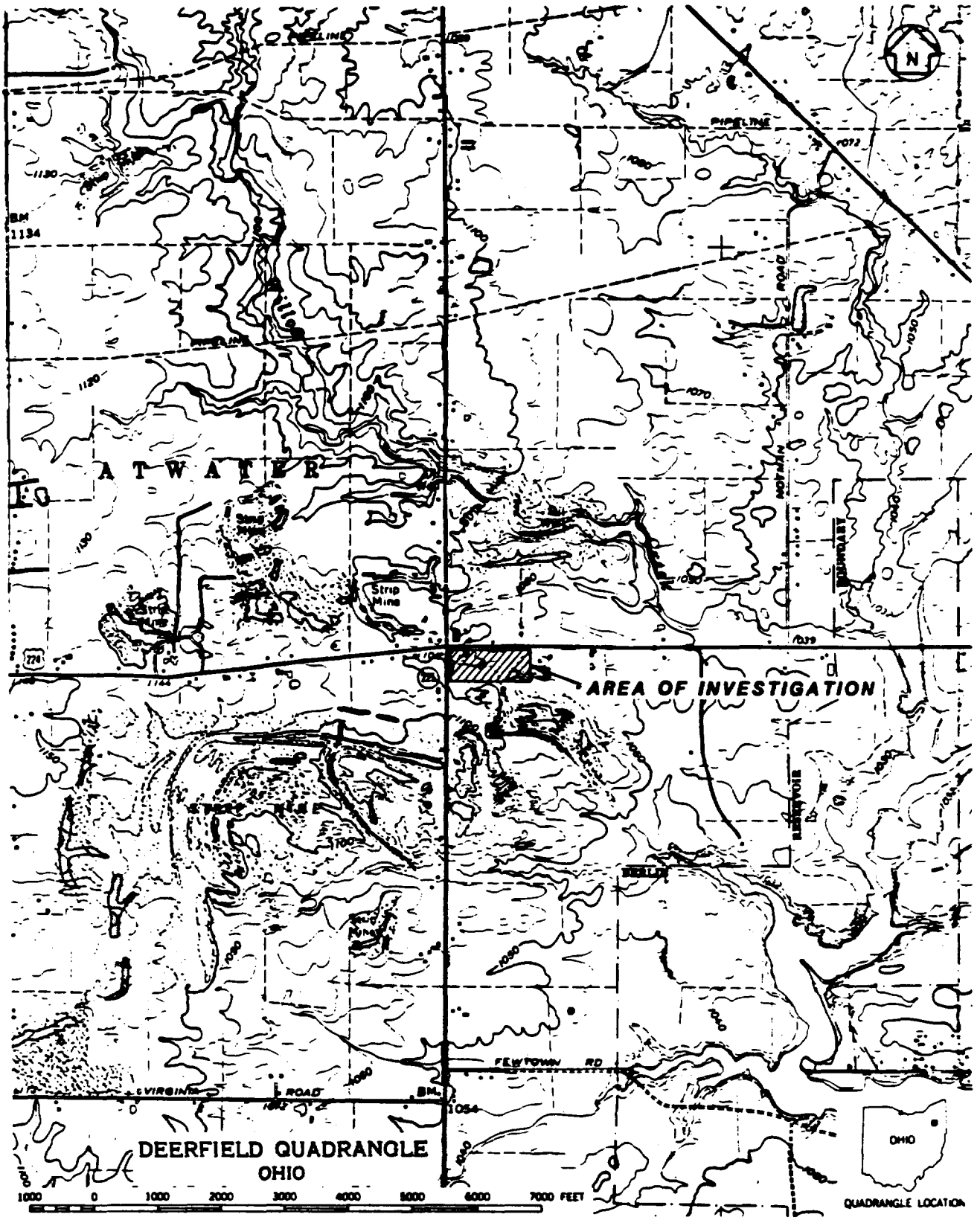


FIGURE 1
AREA OF INVESTIGATION
SUMMIT NATIONAL SITE

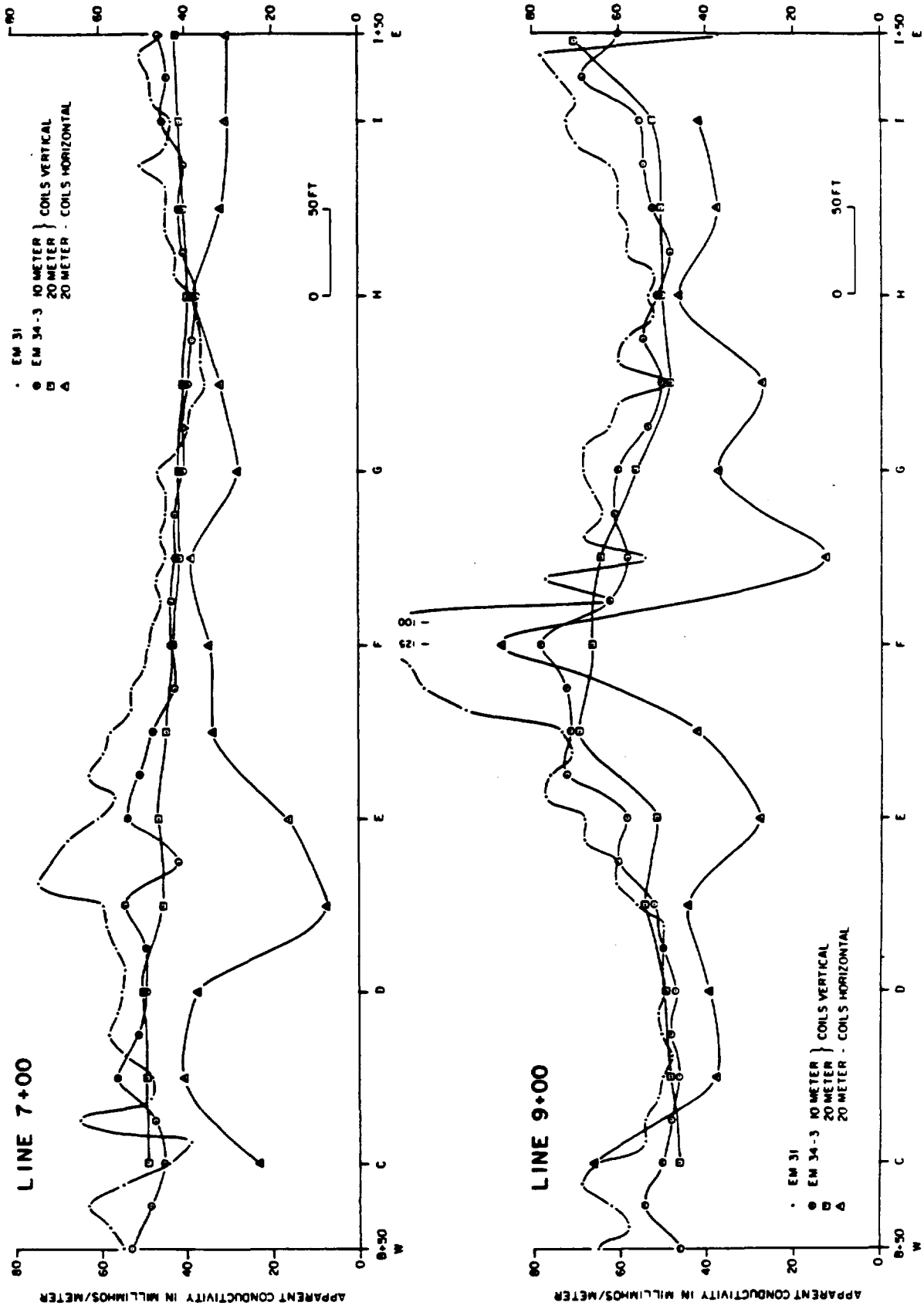
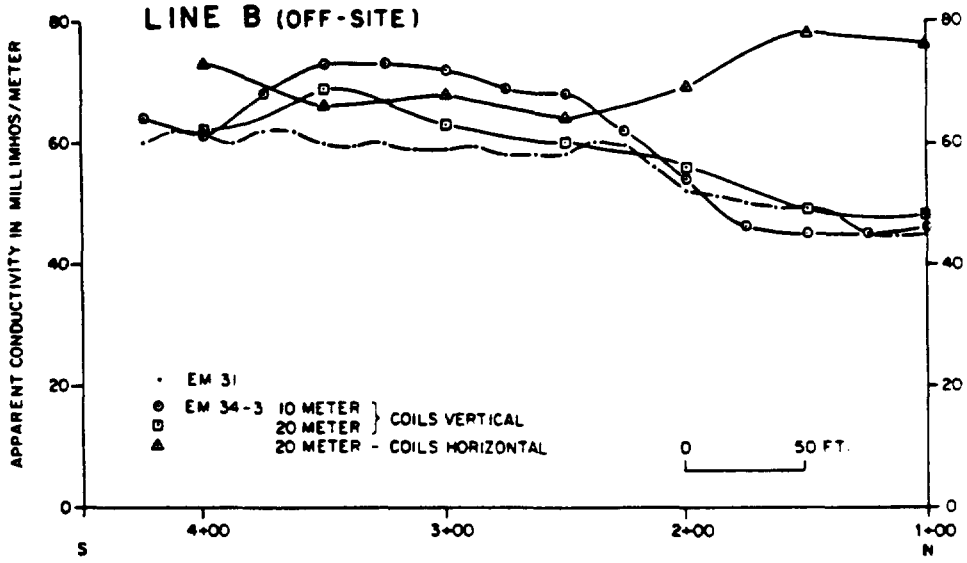


FIGURE 5
TERRAIN CONDUCTIVITY DATA
LINES 7+00 AND 9+00 (ON-SITE)
SUMMIT NATIONAL SITE



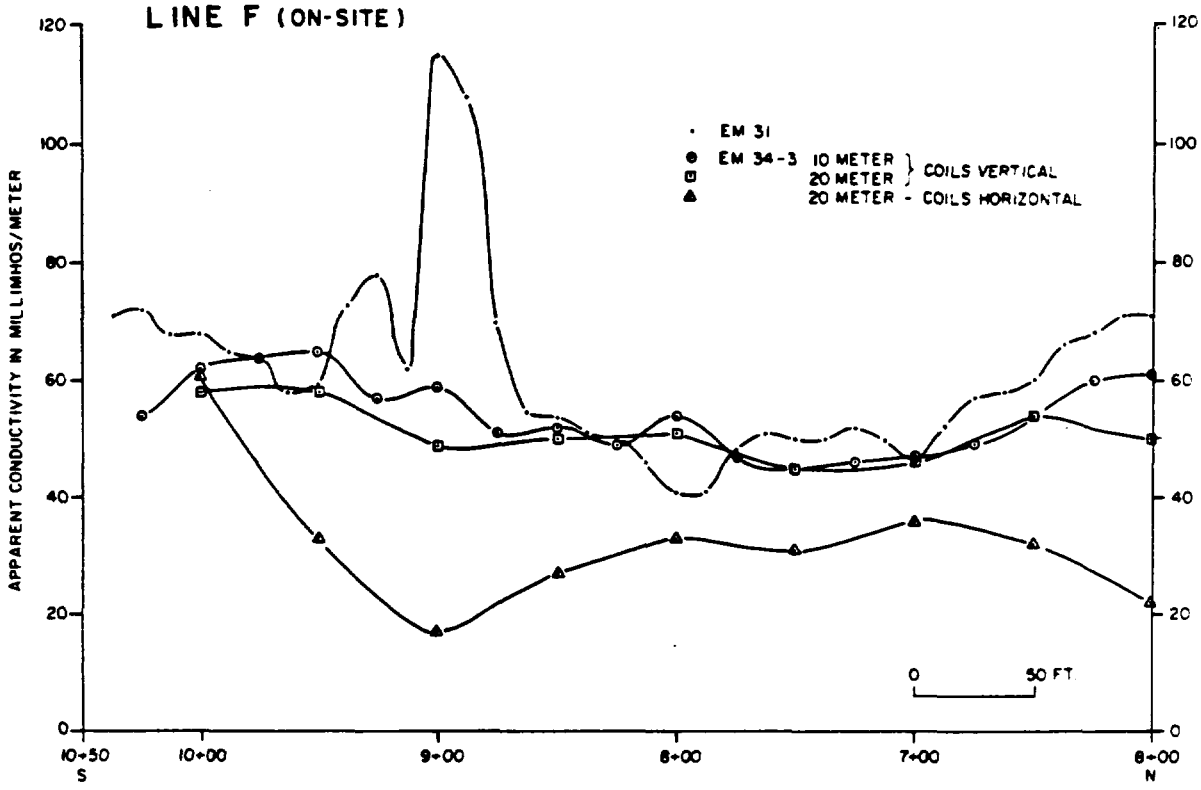


FIGURE 6
TERRAIN CONDUCTIVITY DATA
LINES F AND B (ON/OFF-SITE)
SUMMIT NATIONAL SITE

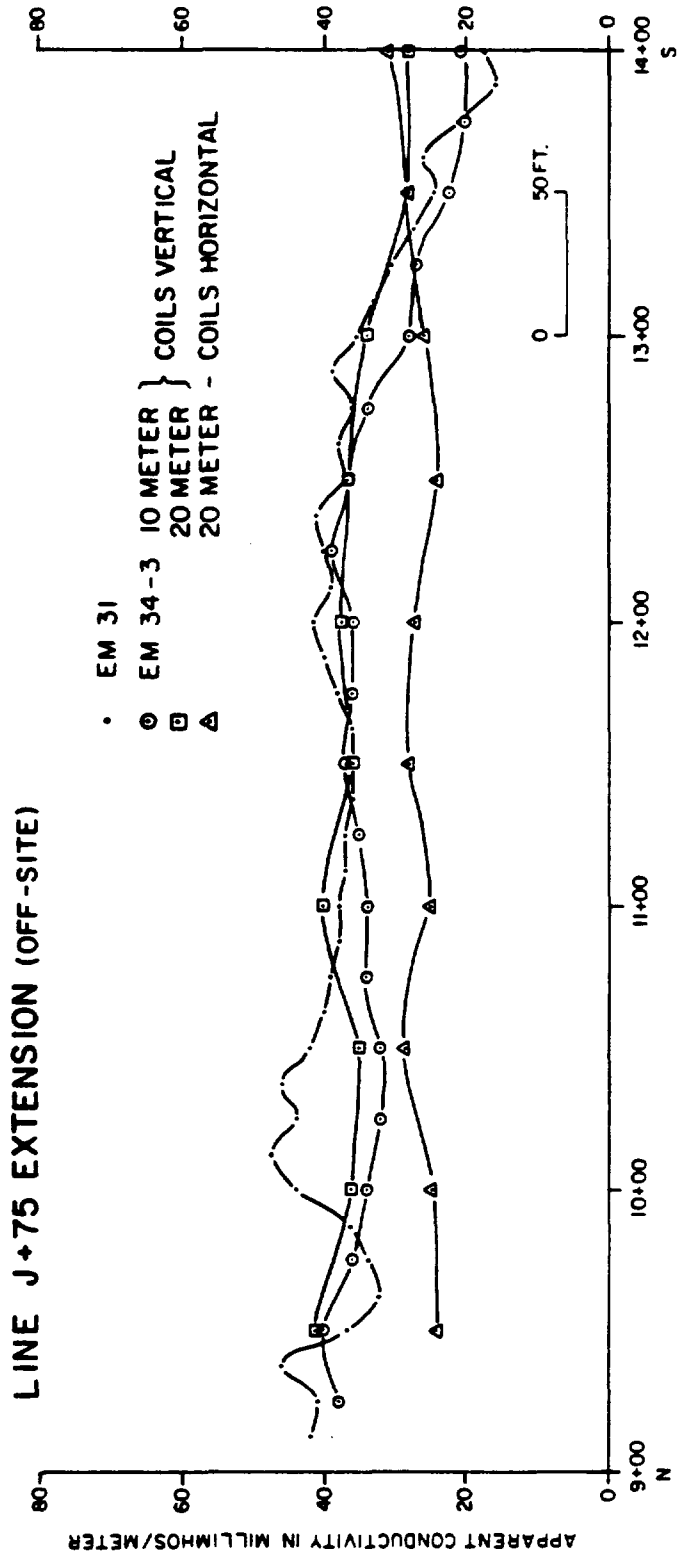
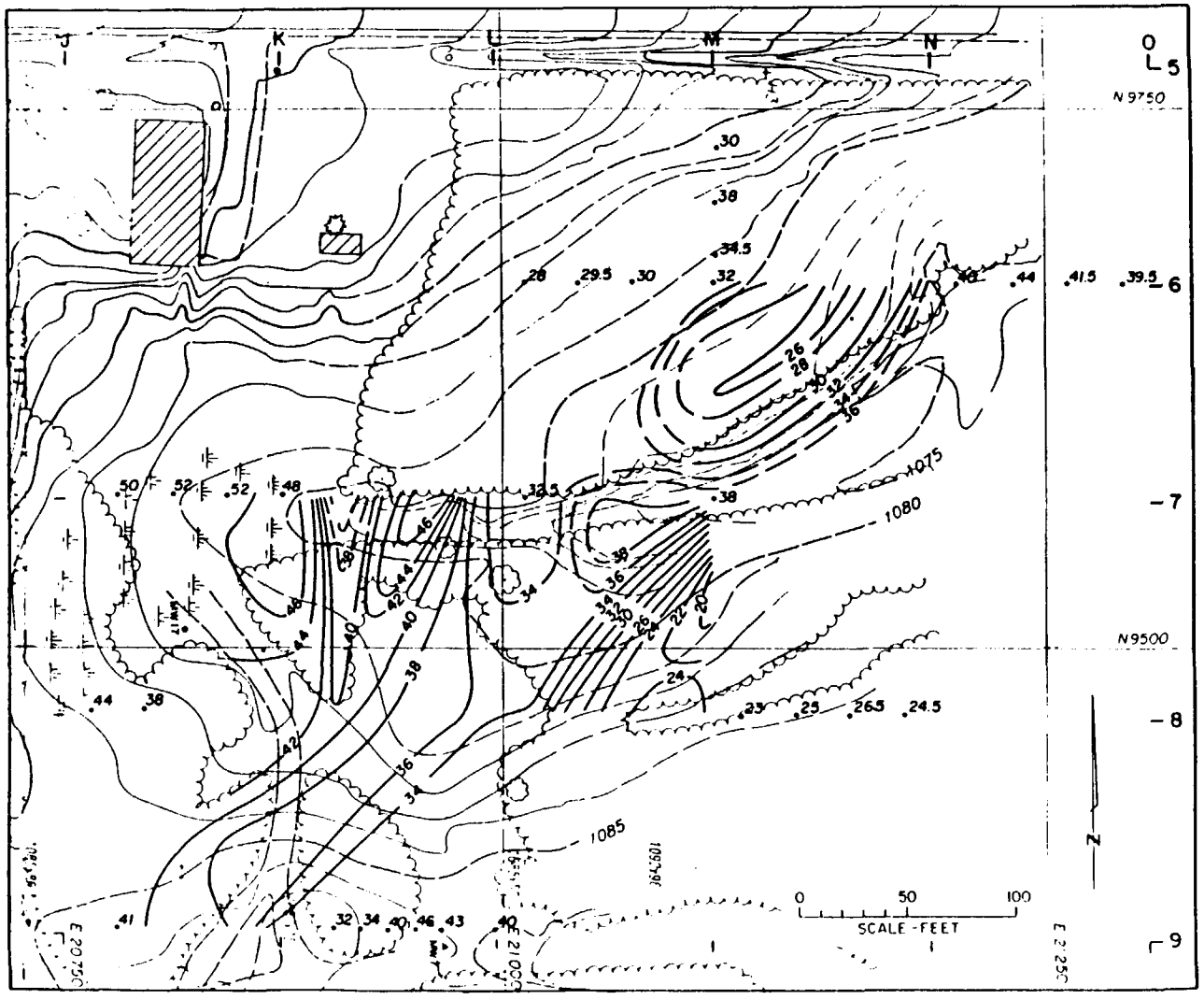


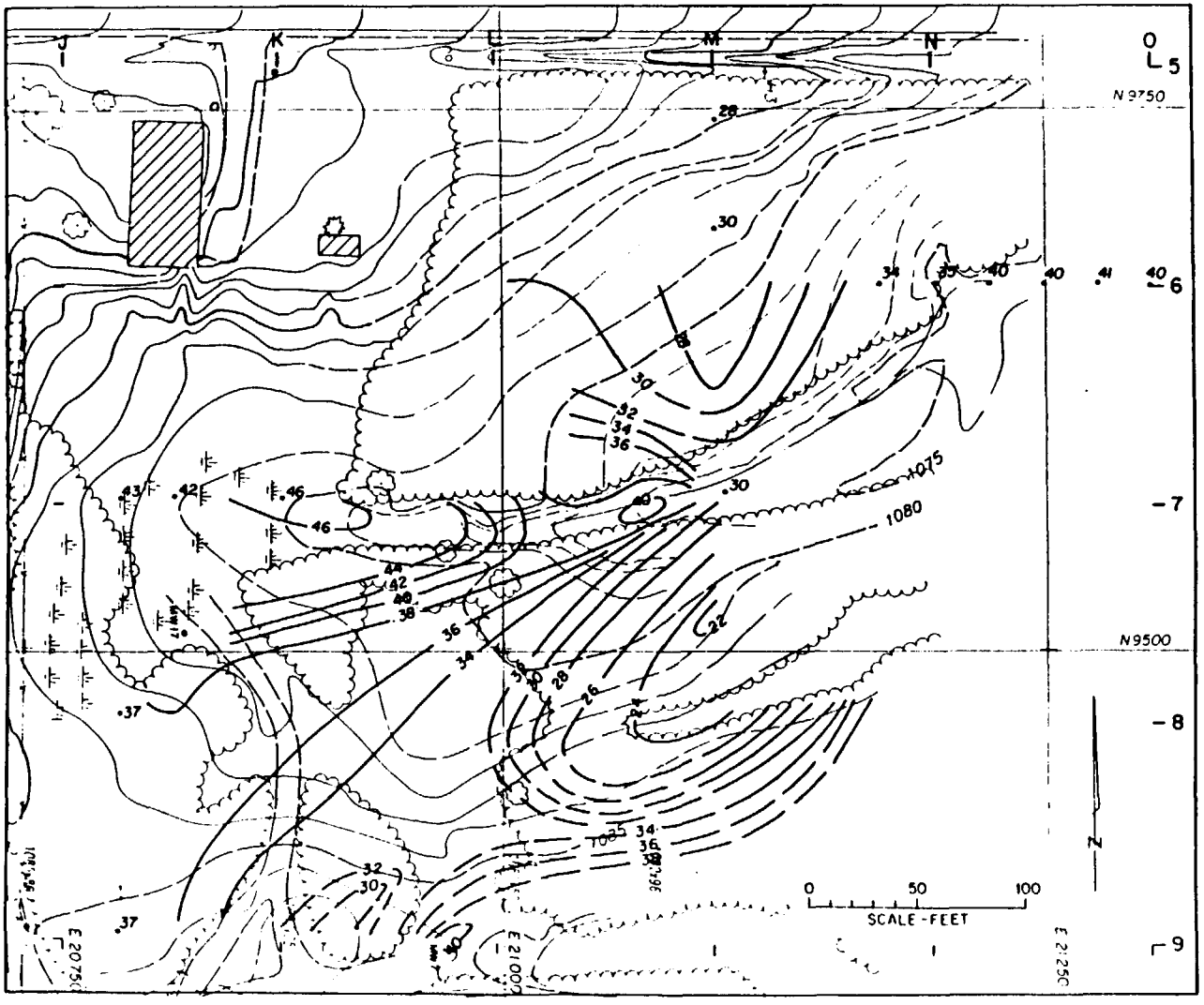
FIGURE 7
TERRAIN CONDUCTIVITY DATA
LINE J+75 EXTENSION (OFF-SITE)
SUMMIT NATIONAL SITE



NOTES:

1. Apparent conductivity in millimhos/meter.
2. Data from EM 31.
   Coil spacing 3.7M

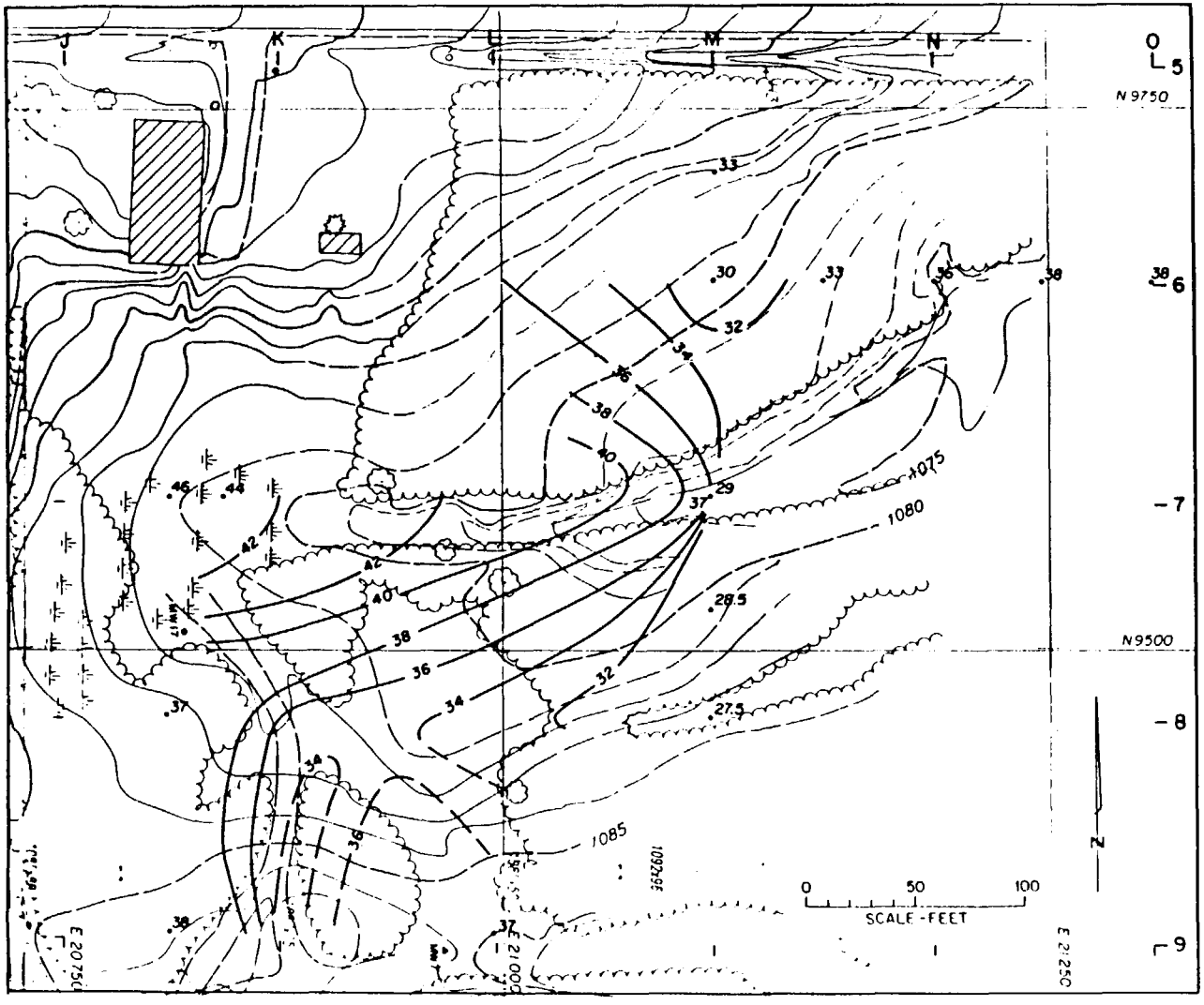
FIGURE 8
CONTOUR MAP
EM-31 (OFF-SITE)
SUMMIT NATIONAL SITE



NOTES:

1. Apparent conductivity in millimhos/meter.
2. Data from EM 34-3.
   Coil spacing 10M.
   Coils vertical.

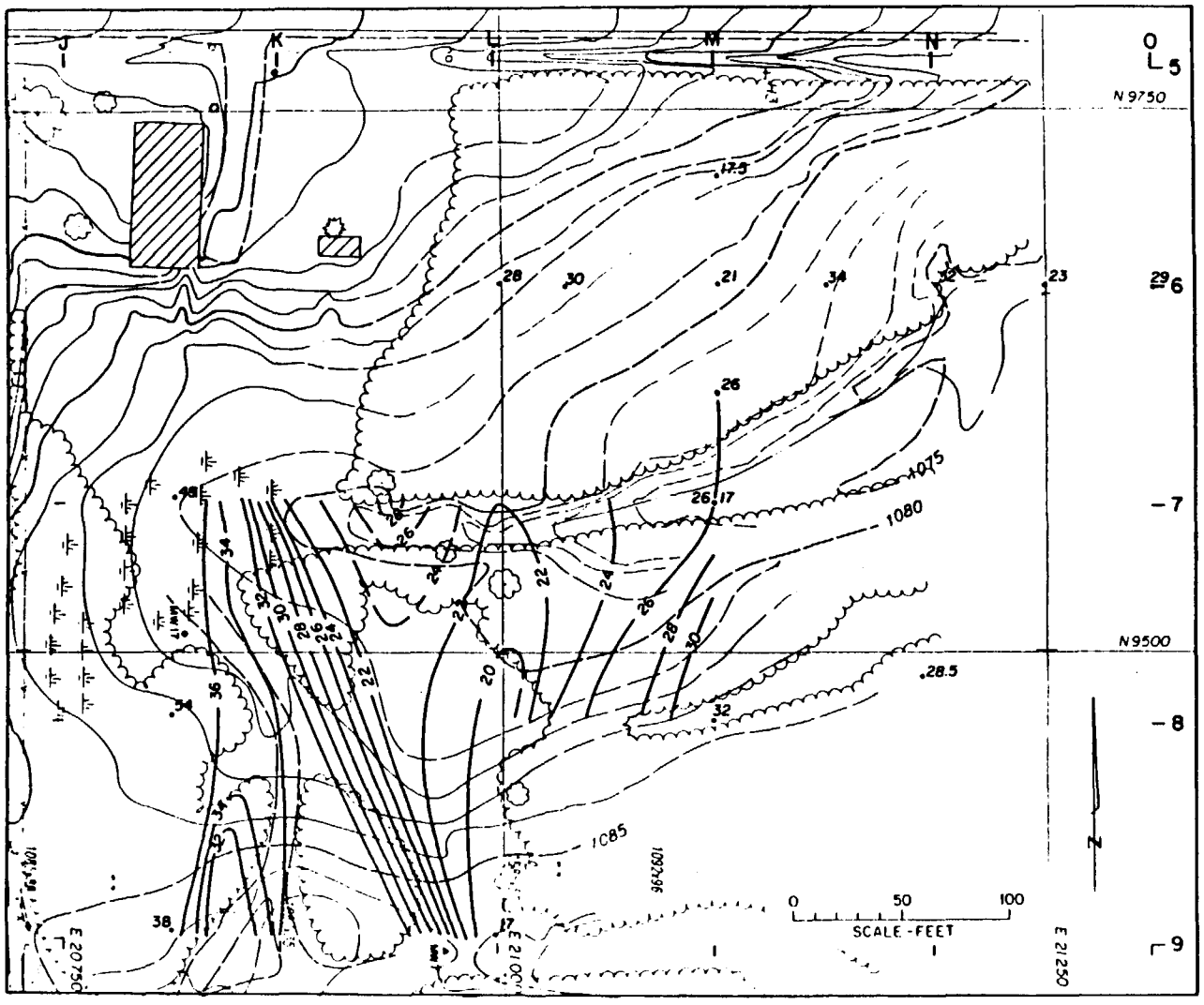
FIGURE 9
CONTOUR MAP EM 34-3 (OFF-SITE)
(10M COIL SEPERATION , VERTICALS)
SUMMIT NATIONAL SITE



NOTES:

1. Apparent conductivity in millimhos/meter.
2. Data from EM 34-3.
   Coil spacing 20M.
   Coils vertical.

FIGURE 10
CONTOUR MAP EM 34-3 (OFF-SITE)
(20M COIL SEPERATION, VERTICAL COILS)
SUMMIT NATIONAL SITE



NOTES:

1. Apparent conductivity in millimhos/meters.
2. Data from EM 34-3.
   Coil spacing 20M.
   Coils horizontal.

FIGURE 11
CONTOUR MAP EM 34-3 (OFF-SITE)
(20M COIL SEPERATION, HORIZONTAL COILS)
SUMMIT NATIONAL SITE

APPENDIX A

MAGNETOMETER [TOTAL FIELD] MEASUREMENTS FOR DETECTION OF BURIED METAL OBJECTS METHOD OF INVESTIGATION

Introduction

The magnetic method is a versatile, relatively inexpensive, geophysical exploration technique. Aeromagnetic surveys and deep water marine studies are commonly used as a reconnaissance tool for tracing large-scale geologic structure. Land and coastal water marine data are more useful in tracing smaller, more localized geologic structures, such as mineral and ore deposits. Land and marine surveys yield more detail and higher resolution, since the measurements are taken closer to the anomaly source. Land and shallow water magnetic data is commonly used to locate larger, buried, man-made objects such as pipelines, barrels or other buried metal objects, and smaller objects such as involved in archealogical prospecting.

Earth Magnetism

Magnetics is a "potential field" method. For a given magnetic field, the magnetic force in a given direction is equal to the derivative of the magnetic potential in that direction. The source of the earth's magnetic potential is its own magnetic field and the induction effect this field has on magnetic objects or bodies above and below the surface. The earth's field is a vector quantity having a unique magnitude and direction at every point on the earth's surface. This magnetic field is defined in three dimensions by angular quantities known as declination and inclination. Declination is defined as the angle between geographic north and magnetic north, and inclination is the angle between the direction of the earth's field and the horizontal [Figure 1]. The earth's magnetic field is measured in "gammas" [where 1 gamma = 10^{-5} Oersted]; the total field ranges from about 25,000 gammas near the equator to 70,000 gammas near the poles.

The earth's magnetic field is not completely stable. It undergoes long-term [secular] variations over centuries; small, daily [diurnal] variations [less than 1% of the total field magnitude]; and transient fluctuations called magnetic storms resulting from solar flare phenomena.

The earth's ambient magnetic field is modified locally by both naturally-occurring and man-made magnetic materials. Iron or steel objects act as "local" dipoles, which are generally oriented differently than the earth's external magnetic field.

The iron or steel objects represents a local perturbation in the main earth field. The net field in the vicinity of this perturbation is simply the vector sum of the induced and earth fields. Thus, the induced field is a function of the "susceptibility" of the material, or its ability to act like a magnet.

Remanent magnetization is produced in materials which have been heated above the Curie point allowing magnetic minerals in the material to become aligned with the earth's field before cooling. The remanent field direction is not always parallel to the earth's present field, and can often be completely reversed. The remanent field combines vectorially with the ambient and induced field components. The contribution of the remanent components must be considered in magnetic interpretations.

Instrumentation

At present, the most widely used magnetometer is the "proton precession" type. This device utilizes the precession of spinning protons of the hydrogen atoms in a sample of fluid [kerosene, alchohol, or water] to measure total magnetic field intensity.

Protons spinning in an atomic nucleus behave like magnetic dipoles, which are aligned [polarized] in a uniform magnetic field. The protons initially aligned themselves parallel to the earth's field. A second, much stronger magnetic field is produced approximately perpendicular to the earth's field by introducing current through a coil of wire. The protons become temporarily aligned with this stronger secondary field. When this secondary field is removed, the protons tend to realign [precess] themselves parallel to the earth's field direction. The precessing protons will generate a small electric signal in the same coil used to polarize them with a frequency [about 2,000 Hz] proportional to the total magnetic field intensity but independent of the coil

orientation. By measuring the signal frequency, the absolute value of the total earth field intensity can be obtained to a 1 gamma accuracy. The total magnetic field value measured by the proton precession magnetometer is the net vector sum of the ambient earth's field and any local induced and/or remanent perturbations.

A total field proton precession magnetometer can be made portable and does not require orientation or leveling. There are a few limitations associated with the precession system. The precession signal can be severely degraded in the presence of large field gradients [greater than 200 gammas per foot] are near 60-cycle A/C power lines. Also, the interpretation of total field data is sometimes more complicated than vertical field data which, however, is more time consuming to take.

Field Techniques

The field operator must avoid or note any sources of high magnetic gradients and alternating currents, such as power lines, buildings, and any large iron or steel objects. Readings are taken at a predetermined interval which depends on the nature of the survey, the accuracy required, and the gradients encountered. Base station readings, if required, are usually made several times a day to check for diurnal variations and magnetic storms.

Interpretation

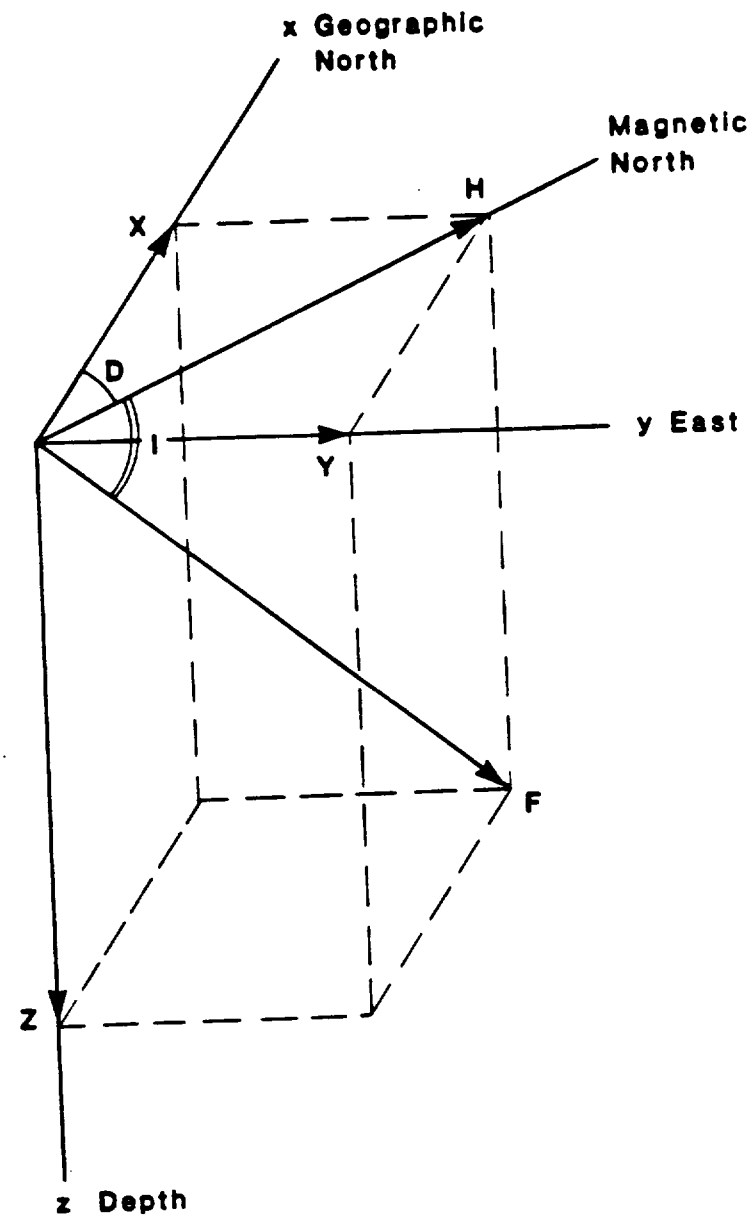
Lateral variations in susceptibility and/or remanent magnetization in crustal rocks give rise to localized anomalies in the measured total magnetic field intensity. Geologic structural features [faults, contacts, intrusions, etc.] and metal objects will cause magnetic anomalies, which can be interpreted to define the location of the causative source.

After diurnal effects and regional gradients have been removed, magnetic anomalies can be studied in detail with derivative operations and frequency filtering employed to define depth and shape.

Because it is a potential field method, there are a number of possible source configurations for any given magnetic anomaly. There is also an inherent complexity in magnetic dipole behavior. If the various magnetic field parameters [inclination, declination, and susceptibility] are well defined, and some reasonable assumptions can be made regarding the nature of the source, an accurate source model can generally be derived.

Magnetic anomalies can be analyzed both qualitatively and quantitatively. The physical dimensions of an anomaly [slope, wave-length, amplitude, etc.] often reveal enough to draw some general qualitative conclusions regarding the location and depth of the causative source.

Precise interpretation must be done quantitatively and requires prior knowledge of earth and remanent magnetic field parameters. Modeling can be performed by various approximation methods, whereby one reduces the source to a system of poles or dipoles, or assumes it to be one of several simple, geometric forms [vertical prism, horizontal slab, step, etc.]. The magnetic properties for this simplified model can be rather easily defined mathematically. Simple formulas can be derived which relate readily measurable anomaly parameters, such as slope, width, and amplitude ratios, to the general dimensions of the anomaly source, including depth to top, thickness, dip, and width normal to strike. Since these methods involve very limiting geometric assumptions, the results can be treated as good approximations only for very simplified sources.



I = Inclination

D = Declination

H = Horizontal Field Strength

F = Total Magnetic Force

ELEMENTS OF THE EARTH'S MAGNETIC FIELD

FIGURE 1

Weston Geophysical

APPENDIX B

ELECTROMAGNETIC TERRAIN CONDUCTIVITY METHOD OF INVESTIGATION

GENERAL CONSIDERATIONS

The electromagnetic terrain conductivity [EM] survey is a method of obtaining subsurface information through electric measurements made at the surface of the earth. The parameter measured with this technique is the apparent conductivity of the subsurface. The conductivity meter consists of receiver coil and a separate transmitter coil which induces an electrical source field [a circular eddy current loop] in the earth [Figure A-1]. Each one of the current loops generates a magnetic field proportional to the value of the current flowing within the loop. A part of the magnetic field from each current loop is intercepted by the receiver coil and converted to an output voltage which is linearly related to terrain conductivity. The instrument is calibrated to permit direct reading of conductivity values in millimhos per meter. The conductivity meter has a variable operating frequency, from 9.8 KH_z for the EM31 to a range of 6.4 KH_z to 0.4 KH_z for the EM34-3. The measurement precision is $\pm$ 2% of full scale with a measurement accuracy of + 5% at 20 millimhos per meter. The operating frequency of the EM34-3 decreases as the coil spacing increases. Coil spacings of 10, 20 and 40 meters are standard with the EM34-3.

Geologic materials have unique electrical characteristics and lateral variations in conductivity values indicate a change in subsurface conditions. The relative conductivity of earth materials is proportional to their content of water and dissolved salts or ions. Accordingly, dry sands and gravels, and massive rock formations would have low conductivity values; conversely, most clays and materials with a high ion content would have high conductivity values.

FIELD PROCEDURE FOR DATA ACQUISITION

Conductivity measurements are generally made at 10 meter spacings along a survey line to yield good spatial resolution. Readings taken with the EM31 at a height of one meter above ground surface are sufficiently accurate but for maximum accuracy the instrument can be read at the ground surface. Readings obtained with the EM34-3 are commonly made with the coils in the vertical coplanar configuration, horizontal dipole mode [HDM]. Deeper, approximately 15 meters vs. 7.5 meters, penetration with an equivalent coil spacing can be achieved by using the horizontal coplanar configuration, vertical dipole mode [VDM].

APPENDIX C

GROUND PENETRATING RADAR [GPR] Survey
METHOD OF INVESTIGATION

Ground penetrating radar is an electromagnetic survey technique that reveals a graphic cross sectional view of layered material below the ground surface. It is an echo-ranging technique similar to the single-trace reflection method commonly used in marine subbottom profiling in which reflective layers are traced by echo patterns generated in response to acoustic impulses. The two techniques differ in that the acoustic method uses audio frequency sound waves transmitted through a water medium to the material under investigation. The radar method transmits, directly to the surface, impulses of radio waves at frequencies up to a thousand megahertz.

In a radar system [Figure 1], high-frequency impulses of radio energy are generated by the transmitter. A beam of these impulses is emitted by a special antenna placed in close proximity to the ground so that it couples electromagnetically to the surface material. Each impulse propagates downward through the ground surface and into the material below. At interfaces, part of the signal is reflected while part is transmitted still deeper to be reflected by other layers or isolated bodies. For each impulse transmitted, a string of reflected impulses is returned to the antenna in a time sequence proportional to the round-trip travel time to each reflector. After transmitting the outgoing pulse, the system instantly switches from the transmitter to the receiver in order to detect the echo signals. When operated in the field during data acquisition, a graphic recorder provides an immediate view of the data. Data enhancement is possible if the data are recorded on a magnetic tape recorder for later playback at a slower speed.

Ground penetrating radar surveys are carried out by pulling the antenna slowly along a pre-measured survey line. Radar impulses are transmitted in synchronism with a swept-stylus type graphic recorder. The graphic recorder stylus sweeps across the paper at a uniform speed and echo signals cause the paper to be darkened at points proportional to the total travel time to the reflector producing the echo. Because the antenna is being pulled forward, each pass of the stylus represents a slightly different antenna position. As the recorder paper is pulled under the moving stylus, a pattern of reflective interfaces is generated.

Figure 2 shows a typical record and a representation of the radar echo impulses. The recorder detects the presence of an echo whenever the signal level exceeds a preset threshold. The paper is darkened to coincide with every exceedance along any given sweep of the stylus. The pattern of darkened regions on the paper marks the reflective horizons in the earth. The distance shown on the recorder paper to any reflector is proportional to its depth below the path of the antenna.

Accurate determination of the depth to any layer requires cali- bration of the radar system.

The depth to an identified reflector such as a pipe, a barrel or a geologic feature, is the most direct and easiest method available for vertical scale calibration.

If the depth to an observed reflector is not known, a borehole can be drilled to establish its depth. This is a more costly procedure, but it provides an exact depth calibration at each drill location and also allows propagation velocity and a more precise dielectric constant to be determined.

Depth of penetration in a given material is limited by attenuation of the signal. Attenuation is a function of dielectric loss and of electrical conductivity loss which, in a given material, will vary with the amount of water, dissolved salt, temperature, density, and frequency of the radar impulses. Penetration of up to 75 feet has been reported for water saturated sands in a Massachusetts glacial delta. The antarctic ice shelf has been penetrated to 230 feet. Wet clays, however, will attenuate the signal within five feet, and sea water is transparent to less than one foot. It is important to note that in a layered material a single, highly reflective layer alone can limit penetration by preventing the propagation of energy past it. In this case, apparent loss of energy is caused by reflection rather than by dissipation.

Radar has been used to locate underground pipes, foundations, voids, sand, gravel, peat, and archeological artifacts. Layered structures in soils and hard rock have been accurately charted in long continuous profiles. The ease with which modern systems can be used makes ground penetrating radar a logical choice where rapid and accurate shallow surveys are required.

TABLE 1

Table of Typical Electromagnetic Constants
for Earth Materials at Radio Frequencies

Material	Dielectric Constant [relative]
Air	1
Clay	8-12
Fresh Water	80
Sea Water	80
Granite, dry	5-19
Granite, typical	15
Ice	4
Limestone	7-15
Sand, Dry	3
Sandstone, 4% water	11
Sandstone, dry	5
Soil, 42% water	30
Soil, 8% water	4

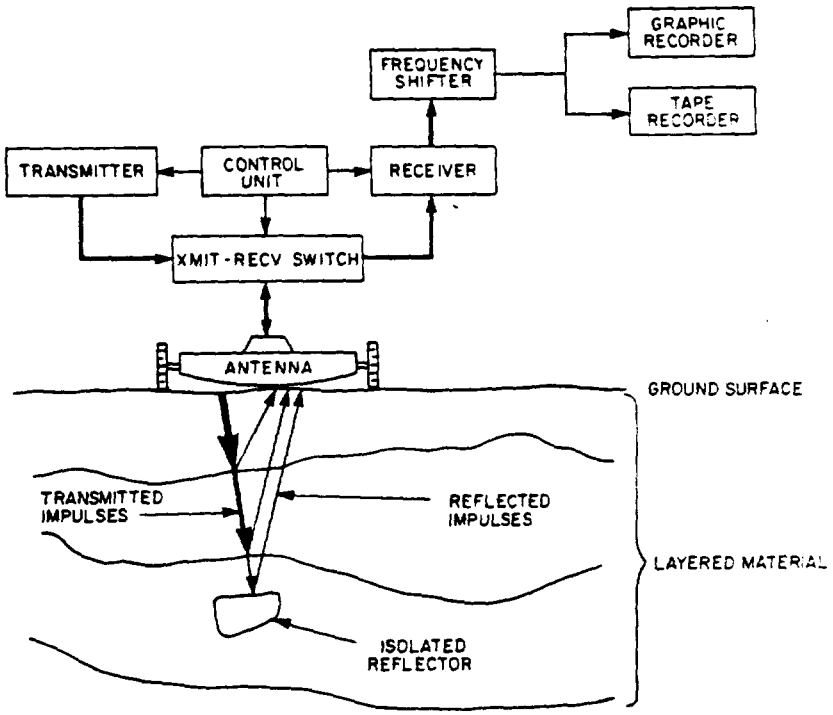


FIGURE 1. RADAR SYSTEM BLOCK DIAGRAM

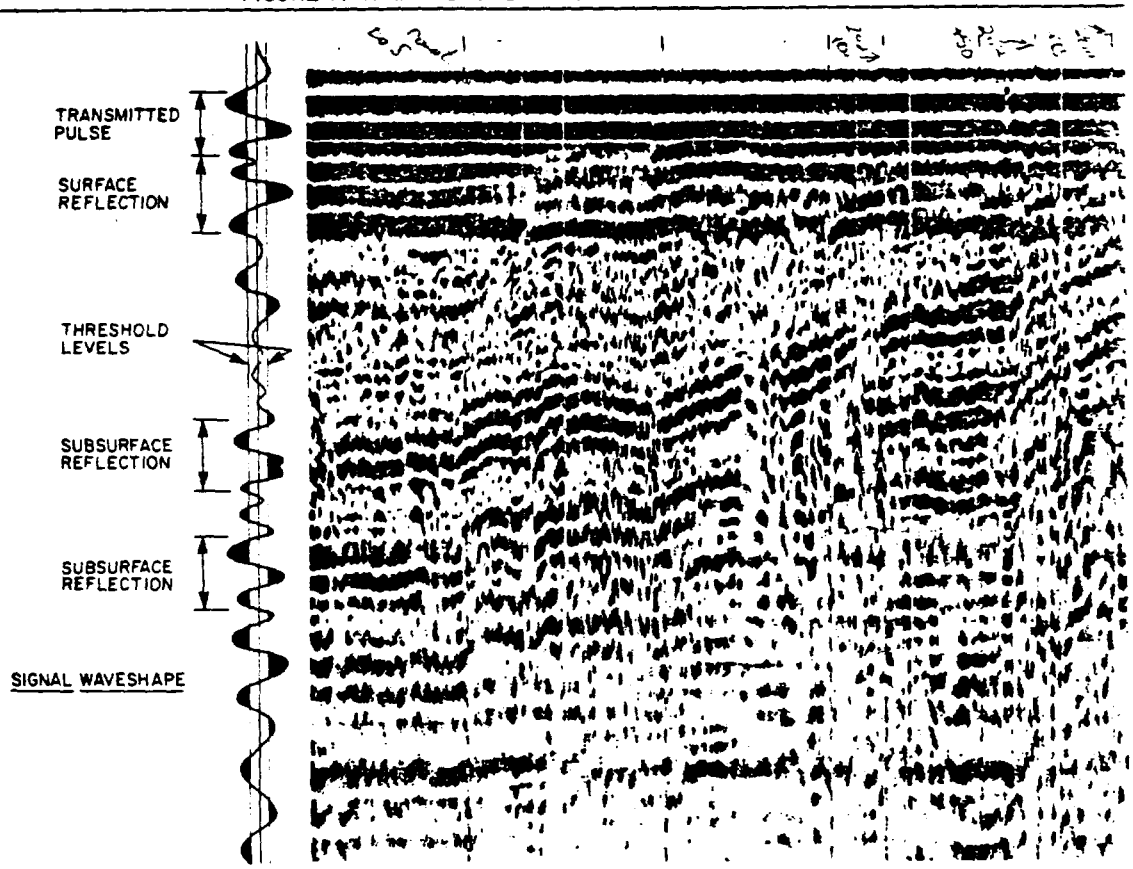


FIGURE 2. TYPICAL RADAR RECORD

Appendix H

APPENDIX H - PUBLIC HEALTH EVALUATION APPENDICES

PHE1	Summaries of Contaminants Found On Site
PHE2	Chemical Toxicity Profiles
PHE3	Estimated Soil Ingestion Rates for Use in Risk Assessments

APPENDIX PHE 1

Table 1 - Ranking of Selected Chemicals Detected in Surface Soil[a]

Ranking Based on Potential Carcinogenic Effects	Frequency of Detection (b)	Concentration Minimum (ug/kg)	Concentration Maximum (ug/kg)	Toxicity Constant (c) (kg/ug)	Indicator Score (d)
PCBs	14/47	40 -	590000	2.86E-08	1.69E-02
arsenic*	40/47	7300 -	35000	2.03E-07	7.11E-03
hexachlorobenzene	11/47	280 -	32000	1.68E-08	5.38E-04
polycyclic aromatic hydrocarbons (PAHs)	13/47	150 -	1600	2.28E-07	3.65E-04
1,2-dichloroethane	6/47	44 -	23000	2.93E-09	6.74E-05
bis (2-ethylhexyl) phthalate	34/47	550 -	1400000	2.86E-11	4.00E-05
trichloroethene	28/47	2 -	86000	2.14E-10	1.84E-05
tetrachloroethene	11/47	1 -	4600	4.43E-10	2.04E-06
chloroform	6/47	2 -	42	2.81E-09	1.18E-07

Ranking Based on Noncarcinogenic Effects	Frequency	Minimum	Maximum	Toxicity Constant	Indicator Score
bis (2-ethylhexyl) phthalate	34/47	550 -	1400000	2.23E-07	3.12E-01
antimony	10/47	16000 -	545000	2.17E-07	1.18E-01
barium	47/47	47000 -	244000	2.04E-07	4.98E-02
arsenic	40/47	7300 -	35000	9.00E-07	3.15E-02
cadmium	7/47	3000 -	112000	2.23E-07	2.50E-02
nickel	44/47	11000 -	56000	2.13E-07	1.19E-02
lead	47/47	10000 -	116000	4.46E-08	5.17E-03
trichloroethene	28/47	2 -	86000	5.26E-08	4.52E-03
zinc	47/47	26000 -	803000	5.33E-09	4.28E-03
copper	47/47	10000 -	67000	3.57E-08	2.39E-03
PAHs	13/47	150 -	1600	1.33E-06	2.13E-03
mercury	28/47	100 -	800	9.21E-07	7.37E-04
hexachlorobenzene	11/47	280 -	32000	2.00E-08	6.40E-04
vanadium	47/47	14000 -	62000	7.14E-09	4.43E-04
phenol	5/47	290 -	44000	5.02E-09	2.21E-04
toluene	29/47	3 -	260000	2.60E-10	6.76E-05
chlorobenzene	7/47	4.9 -	3600	7.14E-09	2.57E-05
ethyl benzene	13/47	3 -	36000	5.52E-10	1.99E-05
tetrachloroethene	11/47	1 -	4600	4.81E-10	2.21E-06
benzene	27/47	1 -	21	5.85E-09	1.23E-07
dichloromethane	38/47	2 -	910	4.60E-11	4.19E-08
1,2-dichloroethane	6/47	2 -	42	8.80E-10	3.70E-08
diethyl phthalate	8/47	330 -	1600	1.34E-11	2.14E-08
cyanide	30/47	310 -	43600		
acetone	21/47	6 -	8200		
beryllium	23/47	640 -	1900		
iron	47/47	11489000 -	95300000		
total xylenes	18/47	7.8 -	210000		
hexachlorocyclopentadiene	1/47		53000		
manganese	47/47	29000 -	2620000		
isophorone	3/47	800 -	3000		
chromium	47/47	10000 -	102000		

(a) 1984 surface soil data
(b) Frequency = # detected/#sampled
(c) USEPA (1986)
(d) Indicator score = maximum concentration X toxicity constant

Table 2 - Ranking of Selected Chemicals Detected in Subsurface Soil[a]

Ranking Based on Potential Carcinogenic Effects	Frequency of Detection (b)	Concentration Minimum (ug/kg)	Concentration Maximum (ug/kg)	Toxicity Constant (c) (kg/ug)	Indicator Score (d)
PCBs (arochlor 1248)	5/26	990 -	310000	2.86E-08	8.87E-03
arsenic	26/26	12000 -	27000	2.03E-07	5.48E-03
hexachlorobenzene	7/26	96 -	59000	1.68E-08	9.91E-04
polycyclic aromatic hydrocarbons (PAHs)	16/26	43 -	630	2.28E-07	1.44E-04
1,2-dichloroethane	8/26	21 -	8900	2.93E-09	2.61E-05
trichloroethene	19/23	5 -	99000	2.14E-10	2.12E-05
bis (2-ethylhexyl) phthalate	25/26	47 -	330000	2.86E-11	9.44E-06
1,1-dichloroethene	3/26	3 -	430	6.14E-09	2.64E-06
tetrachloroethene	5/26	3 -	2500	4.43E-10	1.11E-06

Ranking Based on Noncarcinogenic Effects	Frequency	Minimum	Maximum	Toxicity Constant	Indicator Score
bis (2-ethylhexyl) phthalate	25/26	47 -	330000	2.23E-07	7.36E-02
barium	26/26	35000 -	245000	2.04E-07	5.00E-02
arsenic*	26/26	12000 -	27000	9.00E-07	2.43E-02
nickel	26/26	10000 -	42000	2.13E-07	8.95E-03
trichloroethene	19/26	5 -	99000	5.26E-08	5.21E-03
silver	7/26	2600 -	4200	1.00E-06	4.20E-03
lead	26/26	12000 -	84000	4.46E-08	3.75E-03
cadmium	9/26	2400 -	13000	2.23E-07	2.90E-03
zinc	26/26	34000 -	448000	5.33E-09	2.39E-03
copper	26/26	22000 -	51000	3.57E-08	1.82E-03
hexachlorobenzene	7/26	96 -	59000	2.00E-08	1.18E-03
polycyclic aromatic hydrocarbons (PAHs)	16/26	43 -	630	1.33E-06	8.38E-04
mercury	6/26	84 -	810	9.21E-07	7.46E-04
vanadium	26/26	11000 -	26000	7.14E-09	1.86E-04
1,1-dichloroethane	8/26	5 -	41000	1.29E-09	5.29E-05
ethyl benzene	20/26	4 -	76000	5.52E-10	4.20E-05
phenol	6/26	52 -	7800	5.02E-09	3.92E-05
chlorobenzene	4/26	3 -	5200	7.14E-09	3.71E-05
toluene	26/26	17 -	140000	2.60E-10	3.64E-05
1,2,4-trichlorobenzene	4/26	100 -	1400	1.07E-08	1.50E-05
1,1-dichloroethene	3/26	3 -	430	1.86E-08	8.00E-06
1,2-dichloroethane	8/26	29 -	8900	8.80E-10	7.83E-06
tetrachloroethene	5/26	3 -	2500	4.81E-10	1.20E-06
1,1,1-trichloroethane	14/26	6 -	24000	3.67E-11	8.81E-07
dichloromethane	26/26	5 -	5100	4.60E-11	2.35E-07
carbon disulfide	9/26	3 -	10	2.12E-08	2.12E-07
cyanide	5/26	1100 -	8800		
beryllium	23/26	490 -	1600		
acetone	25/26	26 -	48000		
manganese	26/26	57000 -	683000		
total xylenes	26/26	9 -	270000		
iron	26/26	16100000 -	50800000		
chromium	26/26	9000 -	732000		

(a) 1986 subsurface soil data
(b) Frequency = # detected/#sampled
(c) USEPA (1986)
(d) Indicator score = maximum concentration X toxicity score

a

Table 3 - Ranking of Selected Chemicals Detected in Groundwater

	Frequency of Detection (b)	Concentration Minimum (ug/l)	Concentration Maximum (ug/l)	Toxicity Constant(c) (l/ug)	Indicator Score (d)
Ranking Based on Potential Carcinogenic Effects					
1,2-dichloroethane	10/23	2 -	130000	5.86E-05	7.62E+00
polycyclic aromatic hydrocarbons (PAHs)	1/23		77	4.55E-03	3.50E-01
1,1-dichloroethylene	3/23	1 -	2600	1.23E-04	3.20E-01
trichloroethylene	5/23	4 -	27000	4.29E-06	1.16E-01
arsenic (e)	4/23	12 -	19	4.07E-03	7.73E-02
bis (2-ethylhexyl) phthalate	19/23	3 -	8600	5.71E-07	4.91E-03

Ranking Based on Noncarcinogenic Effects	Frequency	Minimum	Maximum	Toxicity Constant	Indicator Score
trichloroethylene	5/23	4 -	27000	1.00E-03	2.70E+01
barium	13/23	4.8 -	1550	4.08E-03	6.32E+00
nickel	11/23	12 -	1120	4.26E-03	4.77E+00
1,2-dichloroethane	10/23	2 -	130000	1.76E-05	2.29E+00
polycyclic aromatic hydrocarbons (PAHs)	1/23		77	2.67E-02	2.06E+00
1,1-dichloroethylene	3/23	1 -	2600	3.71E-04	9.65E-01
phenol	5/23	260 -	7000	1.00E-04	7.00E-01
zinc	22/23	5.5 -	3750	1.07E-04	4.01E-01
arsenic	4/23	12 -	19	1.80E-02	3.42E-01
1,1-dichloroethane	9/23	2 -	12000	2.58E-05	3.10E-01
ethyl benzene	4/23	1 -	11000	1.10E-05	1.21E-01
toluene	13/23	1 -	20000	5.20E-06	1.04E-01
1,1,1-trichloroethane	7/23	3 -	53000	7.33E-07	3.88E-02
dichloromethane	23/23	1 -	24000	9.20E-07	2.21E-02
copper	2/23	6.1 -	20	7.14E-04	1.43E-02
vanadium	4/23	7.1 -	47	1.43E-04	6.72E-03
di-n-butyl phthalate	9/23	2 -	130	3.81E-05	4.95E-03
isophorone	7/23	3 -	2600		
chromium	7/23	4.2 -	55		
iron	20/23	24 -	982000		
acetone	23/23	2 -	1300000		
manganese	19/23	14 -	72200		
bis (2-ethylhexyl) phthalate	19/23	3 -	8600		

(a) 1986 groundwater data
(b) Frequency = #detected/#sampled
(c) USEPA (1986)
(d) Indicator score = maximum concentration X toxicity constant
(e) All metals concentrations are dissolved concentrations

Table 4 - Ranking of Selected Chemicals Detected in Groundwater[a]

Ranking Based on Potential Carcinogic Effects	Frequency of Detection (b)	Concentration Minimum (ug/l)	Concentration Maximum (ug/l)	Toxicity Constant (c) (l/ug)	Indicator Score (d)
1,2-dichloroethane	10/23	2 -	130000	5.86E-05	7.62E+00
polycylcic aromatic hydrocarbons (PAHs)	1/23		77	4.55E-03	3.50E-01
1,1-dichloroethylene	3/23	1 -	2600	1.23E-04	3.20E-01
arsenic (e)	9/23	13 -	72	4.07E-03	2.93E-01
trichloroethylene	5/23	4 -	27000	4.29E-06	1.16E-01
bis (2-ethylhexyl) phthalate	19/23	3 -	8600	5.71E-07	4.91E-03

Ranking Based on Noncarcinogenic Effects	Frequency	Minimum	Maximum	Toxicity Constant	Indicator Score
trichloroethylene	5/23	4 -	27000	1.00E-03	2.70E+01
barium	20/23	12 -	3520	4.08E-03	1.44E+01
nickel	20/23	7.5 -	1210	4.26E-03	5.15E+00
1,2-dichloroethane	10/23	2 -	130000	1.76E-05	2.29E+00
PAHs	1/23		77	2.67E-02	2.06E+00
arsenic	9/23	13 -	72	1.80E-02	1.30E+00
1,1-dichloroethylene	3/23	1 -	2600	3.71E-04	9.65E-01
phenol	5/23	260 -	7000	1.00E-04	7.00E-01
zinc	23/23	24 -	4360	1.07E-04	4.67E-01
copper	21/23	6.8 -	502	7.14E-04	3.58E-01
1,1-dichloroethane	9/23	2 -	12000	2.58E-05	3.10E-01
lead	5/23	15 -	220	8.93E-04	1.96E-01
ethyl benzene	4/23	1 -	11000	1.10E-05	1.21E-01
toluene	13/23	1 -	20000	5.20E-06	1.04E-01
vanadium	15/23	5.2 -	321	1.43E-04	4.59E-02
1,1,1-trichloroethane	7/23	3 -	53000	7.33E-07	3.88E-02
dichloromethane	23/23	1 -	24000	9.20E-07	2.21E-02
mercury	9/23	0.3 -	0.9	1.84E-02	1.66E-02
di-n-butyl phthalate	9/23	2 -	130	3.81E-05	4.95E-03
chromium	18/23	4.1 -	318		
bis (2-ethylhexyl) phthalate	19/23	3 -	8600		
manganese	22/23	21 -	69500		
beryllium	6/23	2.5 -	22		
iron	23/23	160 -	1020000		
isophorone	7/23	3 -	2600		
acetone	23/23	2 -	1300000		
cyanide	4/23	16 -	239		

(a) 1986 groundwater data
(b) Frequency = # detected/#sampled
(c) USEPA (1986)
(d) Indicator score = maximum concentration X toxicity constant
(e) All metals concentrations are total concentrations

Table 5 - Ranking of Selected Chemicals Detected in Sediment[a]

Ranking Based on Potential Carcinogenic Effects	Frequency of Detection (b)	Concentration Minimum (ug/kg)	Concentration Maximum (ug/kg)	Toxicity Constant (c) (kg/ug)	Indicator Score (d)
arsenic	10/12	14000 -	38000	2.03E-07	7.71E-03
PCBs	3/12	4063 -	21000	2.86E-08	6.01E-04
polycyclic aromatic hydrocarbons (PAHs)	1/12		309	2.28E-07	7.05E-05
1,2-dichloroethane	7/12	3 -	16608	2.93E-09	4.87E-05
hexachlorobenzene	1/12		518	1.68E-08	8.70E-06
bis (2-ethylhexyl) phthalate	11/12	997 -	291808	2.86E-11	8.35E-06
heptachlor epoxide	1/12		8.1	4.14E-07	3.35E-06
1,1-dichloroethene	4/12	13 -	15	6.14E-09	9.21E-08
vinyl chloride	1/12		102	2.14E-10	2.18E-08
benzene	2/12	10 -	25	3.86E-10	9.65E-09
trichloroethene	3/12	10 -	20	2.14E-10	4.28E-09

Ranking Based on Noncarcinogenic Effects	Frequency	Minimum	Maximum	Toxicity Constant	Indicator Score
bis (2-ethylhexyl) phthalate	11/12	997 -	291808	2.23E-07	6.51E-02
barium	12/12	31000 -	170000	2.04E-07	3.47E-02
arsenic	10/12	14000 -	38000	9.00E-07	3.42E-02
antimony	9/12	52000 -	143000	2.17E-07	3.10E-02
nickel	12/12	15000 -	65000	2.13E-07	1.38E-02
vinyl chloride	1/12		102	8.77E-05	8.95E-03
zinc	12/12	82000 -	1570000	5.33E-09	8.37E-03
lead	12/12	23000 -	92000	4.46E-08	4.10E-03
copper	12/12	34000 -	74000	3.57E-08	2.64E-03
PAHs	1/12		309	1.33E-06	4.11E-04
vanadium	11/12	13000 -	31000	7.14E-09	2.21E-04
di-n-butyl phthalate	7/12	339 -	55738	1.90E-09	1.06E-04
1,2-dichloroethane	7/12	3 -	16608	8.80E-10	1.46E-05
hexachlorobenzene	1/12		518	2.00E-08	1.04E-05
1,1-dichloroethane	3/12	69 -	2261	1.29E-09	2.92E-06
chlorobenzene	4/12	8 -	329	7.14E-09	2.35E-06
trichloroethene	3/12	10 -	20	5.26E-08	1.05E-06
1,1-dichloroethene	4/12	13 -	15	1.86E-08	2.79E-07
benzene	2/12	10 -	25	5.85E-09	1.46E-07
ethyl benzene	2/12	20 -	74	5.52E-10	4.08E-08
dichloromethane	12/12	8 -	870	4.60E-11	4.00E-08
1,1,1-trichloroethane	9/12	27 -	787	3.67E-11	2.89E-08
toluene	2/12	20 -	74	2.60E-10	1.92E-08
chromium	12/12	10000 -	73000		
cyanide	7/12	2400 -	74000		
iron	12/12	31800000 -	166000000		
acetone	8/12	8 -	240		
manganese	12/12	112000 -	2810000		
total xylenes	3/12	4 -	67		

(a) 1985-6 sediment data
(b) Frequency = #detected/#sampled
(c) USEPA (1986)
(d) Indicator score = maximum concentration X toxicity constant

Table 6 - Ranking of Selected Chemicals Detected in Surface Water[a]

Ranking Based on Potential Carcinogenic Effects	Frequency of Detection (b)	Concentration Minimum (ug/l)	Concentration Maximum (ug/l)	Toxicity Constant (c) (l/ug)	Indicator Score (d)
arsenic (e)	1/6		25	4.07E-03	1.02E-01
polycyclic aromatic hydrocarbons (PAHs)	1/6		3	4.55E-03	1.37E-02
1,2-dichloroethane	4/6	38 -	78	5.86E-05	4.57E-03
tetrachloroethene	1/6		24	8.86E-06	2.13E-04
hexachloroethane	1/6		14	2.29E-06	3.21E-05
vinyl chloride	1/6		7	4.29E-06	3.00E-05
trichloroethene	1/6		6	4.29E-06	2.57E-05
bis (2-ethylhexyl) phthalate	6/6	4 -	14	5.71E-07	7.99E-06

Ranking Based on Noncarcinogenic Effects	Frequency	Minimum	Maximum	Toxicity Constant	Indicator Score
selenium	1/6		16	1.05E-01	1.68E+00
nickel	5/6	20 -	322	4.26E-03	1.37E+00
arsenic	1/6		27	1.80E-02	4.86E-01
antimony	1/6		43	4.35E-03	1.87E-01
zinc	6/6	15 -	1660	1.07E-04	1.78E-01
barium	5/6	9.9 -	34	4.08E-03	1.39E-01
cadmium	1/6		23	4.45E-03	1.02E-01
copper	6/6	9.4 -	122	7.14E-04	8.71E-02
PAHs	1/6		3	2.67E-02	8.01E-02
chlorobenzene	2/6	2 -	59	1.43E-04	8.44E-03
trichloroethene	1/6		6	1.00E-03	6.00E-03
1,2-dichloroethane	4/6	38 -	78	1.76E-05	1.37E-03
vanadium	1/6		8.3	1.43E-04	1.19E-03
1,1-dichloroethane	3/6	3 -	34	2.58E-05	8.77E-04
vinyl chloride	1/6		7	8.77E-05	6.14E-04
tetrachloroethene	1/6		24	9.62E-06	2.31E-04
hexachloroethane	1/6		14	6.62E-06	9.27E-05
1,1,1-trichloroethane	3/6	5 -	29	7.33E-07	2.13E-05
toluene	3/6	1 -	2	5.20E-06	1.04E-05
beryllium	1/6		7.9		
chromium	3/6	4.2 -	22		
total xylenes	2/6		1		
bis (2-ethylhexyl) phthalate	6/6	4 -	14		
isophorone	1/6		4		
manganese	6/6	212 -	7880		
iron	6/6	657 -	131000		
acetone	6/6	15 -	47		

(a) 1986 onsite and downstream surface water data
(b) Frequency = # detected/# sampled
(c) USEPA (1986)
(d) Indicator score = maximum concentration X toxicity constant
(e) Metals concentrations are dissolved concentrations

APPENDIX PHE 2

ACETONE

INTRODUCTION

Acetone is a widely used industrial solvent that is found in paints, varnishes, and lacquers. The rapid evaporation rate of acetone makes it useful for cleaning and drying precision parts.

PHARMACOKINETICS

Several studies in humans and animals indicate that acetone is absorbed through the oral and pulmonary routes of exposure (EPA 1984). Orally administered acetone is eliminated through the expired air and in the urine (EPA 1984).

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

Acetone has not been tested in a carcinogenicity bioassay but was found to be nonmutagenic in microbial assay systems and cell transformation systems (EPA 1984). Acetone gave negative results in assays that tested for chromosomal aberrations, sister-chromatid exchange, DNA cell binding, and point mutation in mouse lymphoma cells (EPA 1984).

No changes in clinical chemistry variables or histological changes in the liver, brain, kidneys, lungs, or heart were found in rats exposed to acetone vapors at levels of either 0 or 19,0000 ppm for 3 hours/day, 5 days/week for 8 weeks. Slight decreases in organ weights and body weights were observed in rats killed during exposure but not in rats killed 2 weeks after exposure (Bruckner and Peterson 1981).

QUANTITATIVE DESCRIPTION OF HEALTH EFFECTS

Based on EPA guidelines for the assessment of carcinogen risk (EPA 1986), acetone is most appropriately classified Group D—Not Classified. This

category applies to agents for which there is inadequate evidence of carcinogenicity from human and animal studies.

EPA (1984) determined an acceptable intake subchronic (AIS) of 2,096 mg/day for acetone based on the inhalation study in rats by Bruckner and Peterson (1981) using a no-observed-adverse-effect level (NOAEL) OF 19,000 PPM.

The American Conference of Governmental Industrial Hygienists (ACGIH 1986) recommended a time-weighted average threshold limit value of 750 ppm (1,780 mg/m^3) for occupational exposure to acetone. The National Institute of Occupational Safety and Health (NIOSH 1978) recommended an exposure limit of 250 ppm for acetone.

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ANTIMONY

INTRODUCTION

Antimony (Sb) is a brittle, silver-white metal with specific gravity 6.68, atomic number 51, and an atomic weight of 121.75 g/mole. In compounds, antimony exists in the +3 and +5 oxidation states; the most important Sb compound in commerce is Sb_2O_3, but tri-and penta-sulfides and -chlorides are also commonly utilized. Antimony compounds are utilized in therapeutics for schistosomiasis and other parasitic infections.

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

The incidence of lung cancer deaths in smelter workers at the Newcastle-upon-Tyne (Great Britain) antimony and zircon works was slightly higher than expected (NIOSH 1978). However, definitive conclusions on the carcinogenicity of antimony could not be developed because the sample size was small, workers may have been exposed to other agents, and only two workers were nonsmokers. Presently available experimental studies with animals do not implicate antimony as a carcinogen.

A single report (Balyeava 1967) indicated an increase in late occurring spontaneous abortions (12.5% vs. 4.1% expected), premature births (3.4% vs. 1.2% expected), and gynecological problems (77.5% vs. 56% expected) in 318 female workers exposed to mixed dusts of antimony metal, Sb_2O_3 and Sb_2S_5, when compared with a control population. Studies reported by the same author, in which rats were administered 50 mg/kg antimony intraperitoneally or 250 mg/m^3 Sb_2O_3 dust 4 hr/day up to day 16 of gestation reported reduced litter sizes and abnormalities of the uterus and ovaries which were believed to complicate ovulation and implantation (Balyeava 1967). Casals (1972) observed no fetal abnormalities when 125 or 250 mg/kg antimony dextran glycoside was administered to pregant rats, although other reports indicate reduced rate of growth when rats were fed a diet containing 2% Sb_2O_3 (Gross et al. 1955), and a shortened life span of

rats provided 5 ppm potassium antimony tartrate in drinking water (Schroeder et al. 1970).

Cardiovascular changes associated with exposure to antimony represent a serious health effect. Exposure to either trivalent or pentavalent antimonial compounds can produce electrocardiogram (ECG) changes in humans. Histopathological evidence of cardiac edema, myocardial fibrosis, and other signs of myocardial structural damage indicates that antimony may produce even more severe, possibly permanent, myocardial damage in humans. Parallel findings of functional changes in ECG patterns and of histopathological evidence of myocardial structural damage have also been obtained in animal toxicity studies. Pneumoconiosis in response to inhalation exposure and dermatitis in response to skin exposure have also been observed among individuals exposed to antimony or its compounds.

QUANTITATIVE DESECRIPTION OF HEALTH EFFECTS

EPA (1986) calculated a reference dose (RfD) for oral exposure to antimony of 0.4 ug/kg/day (28 ug/day for the average person weighing 70 kg) based on a chronic oral bioassay in rats conducted by Schroeder et al. (1970). In this study, rats administered 0.35 mg/kg/day antimony in their drinking water exhibited decreased longevity and altered blood glucose and cholesterol levels. EPA used this study and an uncertainty factor of 1,000 to arrive at the RfD of 0.4 ug/kg/day.

NIOSH recommends a standard of 0.5 mg/m^3 in its Criteria Document (NIOSH 1978) for protection of workers from ECG alterations, dermatitis, mucous membrane irritation, and possible pneumoconiosis. The American Conference of Governmental Industrial Hygienists (ACGIH) recommends a time-weighted average Threshold Limit Value (TLV) of 0.5 mg/m^3. However, there is uncertainty associated with this standard because of a report of increased lung cancer among workers in one smelter exposed to Sb (Davies 1973) and also reported spontaneous late abortions and premature deliveries among

Soviet women workers in antimony smelting and processing (Balyeava 1967 as cited in Stokinger 1981).

Only occupational guidelines for exposure to airborne antimony were available. Therefore, a reference concentration for antimony was calculated using the procedures outlined by EPA in their health effects assessment documents. The TLV of 0.5 mg/m^3 is multiplied by 10 m^3/20 m^3 to adjust for the difference in breathing rates between workers (10 m^3 for an 8-hour workday) and the average person (20 m^3 for 24 hours exposure) and by 5/7 to adjust for a 5 day workweek. This adjusted TLV is then divided by an uncertainty factor of 100 to protect individuals in the general population who may be especially sensitive to the chemical agent and to compensate for differences in exposure duration (workers are exposed for less than their full lifetime; the average person is assumed to be exposed for their full lifetime). Based on this calculation, the reference concentration for airborne antimony is 1.8 ug/m^3.

EPA (1980) has established an Ambient Water Criterion (AWQC) of 146 ug/liter for the protection of human health from the toxic effects of antimony ingested through water and aquatic organisms and a criterion of 45 mg/liter for antimony exposure through the ingestion of aquatic organisms only.

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BARIUM

INTRODUCTION

Barium is a reactive metal which exists in nature as a number of salts such as barium sulfate ($BaSO_4$) and barium carbonate ($BaCO_3$) (EPA 1984). These mineral forms are relatively insoluble in water (EPA 1985a).

PHARMACOKINETICS

In experimental animals, barium absorption varies with the species of animal, the compound tested, the age of the animal, and the dietary composition (EPA 1985a). Barium was found to distribute widely in the mouse but was principally found in the bone (Dencker et al. 1976). In humans, barium is primarily excreted via the feces (Tipton et al. 1966).

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

Barium carbonate and more soluble barium compounds are quite toxic to humans. Doses of barium carbonate and barium chloride of 57 mg/kg and 12 mg/kg, respectively, were fatal when ingested by humans. Toxic effects of ingestion include gastroenteritis, muscular paralysis, hypertension, cardiotoxicity including ventricular fibrillation, and damage to the central nervous system (Perry et al. 1983). Inhalation of barium sulfate or barium carbonate dust causes baritosis, a benign pneumoconiosis, in occupationally exposed workers. This effect is reversible upon cessation of exposure.

No information on the carcinogenicity, teratogenicity, mutagenicity, or chronic toxicity of barium compounds was found in the literature reviewed.

QUANTITATIVE DESCRIPTION OF HEALTH EFFECTS

Using the EPA Carcinogen Assessment Group's criteria for evaluating weight of evidence of carcinogenicity in humans (EPA 1986), barium is most appropriately

classified in Group D--Not Classified. This category applies to agents with inadequate animal evidence of carcinogenicity.

EPA (1976) has established a maximum contaminant level (MCL) drinking water standard of 1 mg/liter for barium.

EPA (1985b) recently calculated an acceptable daily intake (ADI) for barium based on a study by Perry et al (1983) in which rats were exposed to 1, 10, or 100 mg/liter barium in drinking water for 1 to 16 months. A lowest-observed-adverse-effect level of 100 mg/liter (5.1 mg/kg/day) was identified based on the occurrence of hypertensinogenic and cardiotoxic effects. Applying an uncertainty factor of 100 (10 for interspecies extrapolation and 10 for sensitive individuals), an ADI of 0.051 mg/kg/day was recommended. An uncertainy factor of 100 rather than the traditional 1,000-fold factor was used because of the minimal exposure of the rats to trace elements (e.g., calcium) in the experiment. EPA (1985b) determined that this lack of calcium could contribute to the hypertensinogenic effects observed. Based on the ADI of 0.051 mg/kg/day and factoring in data on human exposure (0.7 mg/day via diet and 0 mg/day via air), EPA (1985b) recommended a maximum contaminant level goal (MCLG) of 1.5 mg/liter.

The American Conference of Governmental Industrial Hygienists (ACGIH 1986) has recommended a time-weighted average threshold limit value of 0.5 mg/m^3 for soluble compounds of barium and 10 mg/m^3 for barium sulfate as a nuisance dust.

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BIS(2-ETHYLHEXYL)PHTHALATE

INTRODUCTION

Bis(2-ethylhexyl)phthalate (DEHP) is widely used as a plasticizer, primarily in the production of polyvinyl chloride resins (EPA 1980). Polyvinyl chloride resins are used in construction materials, home furnishings, transportation, apparel, and food and medical packaging materials.

PHARMACOKINETICS

The primary route of exposure to DEHP is via inhalation; ingestion of DEHP from surface water and from foods and beverages packaged in polyvinyl chloride products can also occur. Dermal absorption of DEHP is also likely (EPA 1980).

DEHP and its metabolites are readily absorbed from the gastrointestinal tract, intraperitoneal cavity, and lungs. The absorption, distribution, and elimination of DEHP can be influenced by the vehicle in which it is administered (EPA 1980).

Absorbed DEHP is distributed to various organs and tissues in animals and humans, primarily to the lungs, heart, liver, kidney, gonads, and spleen. Excretion of DEHP occurs in urine and feces; excretion into bile also occurs and can increase the amount of DEHP (or metabolites) in the intestine (EPA 1980).

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

CARCINOGENICITY

DEHP is reported to be carcinogenic in rats and mice, causing increased incidences of hepatocellular carcinomas or neoplastic nodules following oral administration (NTP 1982).

MUTAGENICITY

The results of dominant lethal experiments in mice suggest that DEHP is mutagenic when injected intraperitoneally (Singh et al. 1974). However, most experiments conducted with microorganisms and mammalian cells have failed to demonstrate genotoxic activity (EPA 1980).

TERATOGENICITY/REPRODUCTIVE EFFECTS

Singh et al. (1972) reported dose-related gross or skeletal abnormalities in mouse fetuses from pregnant females injected intraperitoneally with 5 or 10 ml/kg DEHP. Nikonorow et al. (1973) orally administered 0.34 and 1.70 g/kg/day DEHP to pregnant rats during the gestation period and reported a reduction in fetal weight and increased number of resorptions. Other reproductive effects, including testicular changes in mice and rats, have also been reported (NTP/IRLG 1982).

ACUTE/CHRONIC TOXICITY

DEHP appears to have a relatively low toxicity in experimental animals. The oral, intraperitoneal, and intravenous LD_{50} values reported for DEHP in rats are 31 g/kg, 30.7 g/kg, and 0.25 g/kg, respectively. DEHP is poorly absorbed through the skin, and no irritant response or sensitizing potential from dermal application has been note in experimental animals or humans (NIOSH 1985, NTP/IRLG 1982, EPA 980).

Chronic exposure to relatively high concentrations of DEHP in the diet can cause retardation of growth and increased liver and kidney weights in experimental animals (NTP/IRLG 1982, EPA 1980).

QUANTITATIVE DESCRIPTION OF HEALTH EFFECTS

Applying EPA's criteria for evaluating the overall weight of evidence of carcinogenicity (EPA 1986a), DEHP would be most appropriately classified in Group B2--Possible Human Carcinogen. This category applies to agents for

which there is inadequate evidence of carcinogenicity in humans and sufficient evidence of carcinogenicity in experimental animals.

Because DEHP has been identified as a hepatocarcinogen in $B6C3F_1$ mice and F344/N rats (NTP 1982), it is prudent to consider the potential carcinogenicity of this compound. Using the NTP (1982) data for male mice, EPA (1986b) recently calculated an oral cancer potency factor (q_1*) of 6.86×10^{-4} $(mg/kg/day)^{-1}$.

More recently, EPA (1986b) recommended a reference dose (RfD) of 0.02 mg/kg/day for DEHP. This value was based on a study by Carpenter et al. (1953) in which guinea pigs were fed diets containing 0, 0.04, or 0.13% DEHP for 1 year. No treatment-related effects were observed on mortality, body weight, kidney weight, or on gross pathology or histopathology of kidney, liver, lung, spleen, or testes. Statistically significant increases in relative liver weights were observed in both groups of treated females (64 and 19 mg/kg/day). Using 19 mg/kg/day as the lowest-observed-adverse-effect level and a safety factor of 1,000, the RfD of 0.02 mg/kg/day was derived.

EPA (1980) derived an acceptable daily intake (ADI) for DEHP from the results of a chronic ingestion study in rats, guinea pigs, and dogs. Although details of this derivation were not presented, an ADI of 0.6 mg/kg/day (42 mg/day) was calculated. Based on this value, EPA recommended an ambient water quality criterion (AWQC) of 15 mg/liter for protection of human health from the toxic properties of DEHP ingested through water and contaminated aquatic organisms. The AWQC for exposure to DEHP in drinking water alone would be 21 mg/liter. The lower value of 15 mg/liter was used to back-calculate an acceptable intake chronic (AIC) of 0.86.

SUMMARY OF DEHP CRITERIA

EPA carcinogen classification	Group B2
Oral cancer potency factor (q_1*)	6.86×10^{-4} $(mg/kg/day)^{-1}$
RfD	0.02 mg/kg/day

AWQC:

Ingestion of water and aquatic organisms	15 mg/liter
Ingestion of water	21 mg/liter

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CADMIUM

INTRODUCTION

Cadmium is an element of the transitional metal series that occurs widely in nature, usually in lead or zinc ores. Elemental cadmium is insoluble in water, although many cadmium salts are quite soluble (EPA 1985 a,b). The general human population is exposed to cadmium in drinking water and food; cigarette smoke also contains high levels of cadmium. Additional inhalation exposure occurs in industrial settings (EPA 1985a,b).

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

The toxicology of cadmium has been reviewed by Friberg et al. (1974), IARC (1976), and EPA (1980, 1981, 1985b,c). Injection of cadmium into laboratory animals results in injection-site sarcomas and testicular tumors of the Leydig cells (EPA 1981). A relationship between human exposure to cadmium and cancer of the prostate, lung, or kidney has been suggested by several epidemiological studies (Thun et al. 1985, EPA 1985b). Cadmium may impair DNA repair but has not been shown to be mutagenic. It is a well-documented animal teratogen.

Cadmium bioaccumulates in mammals, particularly in the kidney and liver (EPA 1981, 1985c). Epidemiological studies have revealed an association between nonmalignant pulmonary diseases and inhalation of cadmium. Renal tubular dysfunction, of which the first sign is proteinuria, occurs at lower levels of oral or inhalation exposure to cadmium and may be the primary defect responsible for the bone damage characteristic of Itai-Itai disease. It is also suspected that chronic exposure to cadmium produces hypertension, anemia, sensory loss (particularly smell), endocrine alterations, and immunosuppression in humans.

QUANTITATIVE DESCRIPTION OF HEALTH EFFECTS

INGESTION TOXICITY

The maximum contaminant level (MCL) established for cadmium by EPA in its national interim primary drinking water standards and the Ambient Water Quality Criterion for the protection of human health are both 10 ug/liter (EPA 1980, CFR 1984). EPA established the standard for cadmium on the basis of the "generally accepted" estimate of 200 ug/g wet weight of cadmium in the renal cortex as the critical concentration for renal toxicity. Friberg et al. (1974) estimated that daily ingestion of 250-350 ug cadmium over 50 years would result in such renal concentrations. Other more recent reviews suggest that 200 ug/day is an acceptable daily limit for cadmium intake.

The EPA Office of Drinking Water has recently promulgated a proposed Recommended Maximum Contaminant Level (RMCL) of 0.005 mg/liter. The proposed RMCL is based on the estimate of 200 ug/g wet weight of cadmium in the renal cortex as the critical concentration for renal toxicity (Freiberg et al. 1974) and a 25% contribution to daily exposure from drinking water. The proposed RMCL is comparable to the NAS and WHO guidelines of 0.005 mg/liter (EPA 1985a).

Aughey et al. (1984) reported that treatment of male Wistar rats for only 24 weeks with 50 mg/liter cadmium in their drinking water produced clear symptoms of nephritis when the accumulated renal concentration of cadmium was 60 ug/g wet weight. This last concentration is less than one-third the 200 ug/g wet weight identified as the critical level in humans.

Cadmium and some of its compounds are known to be carcinogenic in experimental animals exposed by injection or inhalation, but the carcinogenic effects are absent when cadmium is administered orally (EPA 1985b). It is not known which cadmium compounds are responsible for the inhalation carcinogenic effects in humans.

INHALATION TOXICITY

EPA (1981) has reviewed the health risks posed by airborne cadmium compounds in considerable detail, while studies on the carcinogenicity of cadmium compounds have been reviewed by the IARC (1976). Both reviews were updated by EPA (1985b), which also presented a risk assessment for exposure to airborne cadmium.

Applying the criteria described in EPA's Guidelines for Assessment of Carcinogenic Risk (EPA 1986), cadmium has been classified by EPA (1985a) on the basis of inhalation data in Group B1--Probable Human Carcinogen. This category applies to agents for which there is limited evidence from human studies and sufficient evidence from animal studies (EPA 1984).

The evidence that exposure to airborne cadmium compounds increases the risk of cancer in humans is characterized as limited (IARC 1982, EPA 1985b). Although several studies of exposed workers have suggested that airborne cadmium increases the risk of cancer of the lung or prostate, most of the results have been inconclusive because of small sample sizes, lack of statistical significance, confounding effects of other exposures, or other factors. The most recent study (Thun et al. 1985), however, showed a significant increase in the number of lung cancer deaths (16 observed versus 6.99 expected) among a group of cadmium smelter workers. Although this finding may be somewhat confounded by the effects of smoking and exposure to arsenic, EPA (1985b) concluded that neither of the latter was sufficient to explain the observed effect.

EPA (1985b) based its quantitative risk assessment for inhaled cadmium on the study by Thun et al. (1985). Very scanty information on exposure levels and incomplete information on exposure duration were used to compile a single average measure of cumulative exposure of the exposed workers. This was converted to a lifetime average exposure level. The extent of the deviations of the exposure estimates from the actual exposure is unknown. Use of the lifetime average exposure level in the risk calculations incorporates the questionable assumption that exposure to cadmium at any time

during life would lead to the same increase in lifetime risk of lung cancer. The data were then fitted to a model which assumed that the effect of exposure to cadmium would be to increase the background rate of lung cancer by a factor proportional to the lifetime average exposure level. The selection of this model was arbitrary, in that no information on the dose-response relationship was provided between exposure and induction of lung cancers, and excess risk is likely to be very conservative. The best estimate of the exposure and response of the exposed population gave rise to a "unit risk" estimate of 1.8×10^{-3} $(ug/m^3)^{-1}$. However, because of uncertainties in the estimates of both exposure and response, the range of uncertainties in the unit risk estimate was very wide, ranging from 4.3×10^{-6} to 3.8×10^{-2} $(ug/m^3)^{-1}$. The last figure was obtained by combining "worst case" estimates of all exposure and risk parameters, and probably represents a "worse than worst case" calculation.

Given the severe limitations of the available date, this quantitative risk assessment appears as reasonable as could be achieved. However, the estimate of "unit risk" is extremely uncertain and probably extremely conservative. The study itself is not regarded as fully conclusive in showing any increased cancer risk and at least part of this is attributable to confounding factors. The exposure estimates are very uncertain, the assumption of a linear exposure response relationship is arbitrary, and the extrapolation over a range of 5 orders of magnitude in dose is very tenuous. Thus, the estimate of "unit risk" presented by EPA (1985b) could be inaccurate and is likely to be conservative when applied to general population exposure.

Recent studies have firmly associated inhalation of airborne cadmium with lung cancer in animals. In a bioassay in which male Wistar rats were administered cadmium chloride aerosols 23 hours/day for 18 months at concentrations of 0, 12.5, 25, and 50 ug/m^3, Takenaka et al. (1983) found a highly significant dose-response relationship. The incidence of lung carcinomas was 0/38, 6/39, 20/38, and 25/35 in the four treatment groups. This marked response adds further support to the evidence on the carcinogenicity of inhaled cadmium and justifies the use of Thun et al.'s (1985)

data as the basis for risk assessments of airborne cadmium. Like the injection-site sarcomas and Leydigomas reported in animals (EPA 1985b), these lung carcinomas might be interpreted as carcinogenic responses in the directly exposed tissue only.

The American Conference of Governmental Industrial Hygienists (ACGIH 1986) recommends a time-weighted average Threshold Limit Value (TLV) of 0.05 mg/m^3 for all forms of cadmium dusts and salts and a ceiling limit of 0.05 mg/m^3 for cadmium oxide fume.

SUMMARY

Cadmium has not been demonstrated to be a systemic carcinogen, but it has been shown to be a highly potent pulmonary carcinogen (see Takenaka et al. 1983) and renal effects are associated with ingestion. For inhalation, the unit risk value of 1.8×10^{-3} $(ug/m^3)^{-1}$ is an appropriate basis for risk assessment. This unit risk was derived from epidemiological data and does not incorporate any conservative assumptions (except that the dose-response relationship is linear), but it is subject to a wide range of uncertainty. For ingestion, the calculations upon which the MCL and ambient water quality criterion are based are equally applicable to ingestion via soil or other media. Based on the assessment of Friberg et al. (1974), daily ingestion of 20 ug cadmium (in addition to background exposure via food) would contribute between 6% and 8% of the estimated critical daily intake of cadmium. This intake of 20 ug/day from other than normal dietary sources was intended to provide an ample margin of safety, but Aughey et al.'s (1984) study suggests that it may not be as conservative as originally intended. The EPA Office of Drinking Water has recently promulgated a proposed Recommended Maximum Contaminant Level of 5 ug/liter for cadmium (EPA 1985d). This value is based on a reference dose of 5×10^{-4} mg/kg/day after allowing for contribution to daily exposure by other routes.

Summary of Cadmium Criteria

EPA carcinogen classification	Group B1
Oral chronic allowable intake	5×10^{-4} mg/kg/day
Inhalation carcinogenic potency (q_1^*)	6.1 $(mg/kg/day)^{-1}$
Maximum Contaminant Level (MCL)	10 ug/liter
Proposed RMCL	5 ug/liter
EPA Drinking Water Health Advisories	
Lifetime Health Advisory (HA)	5 ug/liter
Longer-term HA	
Child	5 ug/liter
Adult	18 ug/liter
Shorter-term HA	
10-day HA (child)	8 ug/liter
One-day HA (child)	43 ug/liter
AWQC	
Ingestion of water and aquatic organisms	10 ug/liter
Freshwater aquatic life chronic toxicity	exp(0.7852(ln hardness)-3.490)

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CHROMIUM

INTRODUCTION

Chromium is a steel-grey lustrous metal with the atomic number 24 and an atomic weight of 52 g/mole. It can have a valence of 2, 3, or 6. Chromium is used in stainless and alloy steels, in corrosion-resistant products, in pigments, and as a tanning agent for leather.

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

Chromium is an essential nutrient for normal glucose metabolism, and low level exposure to chromium compounds has not been found to result in systemic toxicity. However, hexavalent chromium (Cr VI) compounds are strong oxidizing agents, a characteristic that explains much of their irritating and toxic properties (EPA 1980). Chronic inhalation of dust or air containing Cr VI in the form of chromic acid or as soluble salts may cause respiratory problems including irritation, perforated or ulcerated nasal septa, and decreased spirometric values. Studies of acute exposure of humans and animals using a variety of routes of administration have indicated that soluble Cr VI and trivalent chromium (Cr III) compounds can produce kidney and liver damage, although the dose levels employed were relatively high. From the evidence available from both human case reports and animal studies, it is uncertain whether the kidneys and liver may be target organs following chronic exposure to chromium compounds. Dermal exposure to chromic acid or chromium VI salts may cause contact dermatitis, sensitivity, and ulceration of the skin (EPA 1984a).

Epidemiological studies of worker populations have clearly established that inhaled Cr VI is a human carcinogen, with the respiratory passages and the lungs as target organs. Convincing evidence for carcinogenicity of Cr VI compounds in animals is not available, except for the induction of sarcomas at the sites of implantation or injection of certain chromium VI salts and chromium trioxide (EPA 1980, 1984a).

Neither chromium III or chromium IV compounds have been shown to be carcinogenic by the oral route. Rats administered chromium III oxide at doses up to 5% of their diet for two years had no increase in tumor rates over control animals (Ivankovic and Preussmann 1975 as cited in EPA 1984a). Dogs given Cr VI as potassium chromate at concentrations of 0.45 to 11.2 mg/liter in drinking water for 4 years had no observed adverse effects (Anwar et al. 1961 as cited in EPA 1984a).

QUANTITATIVE DESCRIPTION OF HEALTH EFFECTS

The health risks posed by airborne chromium III and chromium VI have been reviewed in considerable detail by EPA (1984b). Studies on the carcinogenicity of chromium compounds were earlier reviewed by the International Agency for Research on Cancer (1980). A risk assessment for exposure to airborne chromium VI was included in the health assessment document by EPA (1984b). The following summary is based in part on these reviews and risk assessments, augmented by review of key primary papers. However, Clement scientists were not able to review the unpublished study by Mancuso (1975) which served as the primary basis for EPA's risk assessment.

EPA (1984b) based its quantitative risk assessment for inhaled hexavalent chromium on an unpublished study by Mancuso (1975). This study, although limited, was judged to be more adequate for risk assessment than three other studies (conducted in Norway, Sweden, and the USSR) which suffered from deficiencies in measurement of exposure, statistical power, and reporting. Mancuso's study showed excess risks of lung cancer in workers exposed to chromates between 1931 and 1937 and followed until 1974. Lung cancer risks increased with duration of exposure and with age. Estimates of cumulative exposure to soluble, insoluble, and total chromium were derived from a single set of industrial hygiene measurements taken in 1949. Smoking habits of the workers were not determined or discussed.

To construct dose-response relationships, EPA (1984b) converted all exposure data into average lifetime ambient concentrations. This is equivalent to assuming that exposure to chromium at any time during life leads to

the same increase in lifetime risk of lung cancer; this assumption is questionable, especially in view of the fact that measures of exposure were available for only one year. The data were fitted to a dose-response relationship of the Weibull type, in which cancer risk is assumed to be proportional to age raised to the kth power and to a second order polynominal ($ad + bd^2$) in dose d. Fitting the data to observed estimates of age-specific cancer risk and average exposure of the chromate workers, EPA estimated that k was approximately 1.9 and both the linear and quadratic terms in d were significant. At low doses, the term ad dominates the risk calculations, and for lifetime exposure the "unit risk" was calculated to be 1.2×10^{-2} $(ug/m^3)^{-1}$. However, because of small sample size (only 35 observed lung cancer deaths distributed over 9 age-exposure classes), the statistical uncertainty of this estimate was very high (standard deviation = 7 x mean). Expressed in terms of total intake, the cancer potency factor was calculated as 41 $(mg/kg/day)^{-1}$ (EPA 1984b).

Although Mancuso's unpublished study is not available for independent review, EPA's procedures in using the data appear reasonable. However, the results are subject to a wide range of statisitcal uncertainty, in addition to their incorporation of a number of assumptions that are uncertain and/or conservative. EPA suggested that the assumptions made about exposure and the failure to control for smoking might have led to overestimation of risk by a factor of up to 4. The assumption that risk would be proportional to average lifetime exposure introduces additional uncertainties. More important, the linear extrapolation of the dose-response relationship estimated for highly-exposed workers to predict risks of the general population exposure to concentrations about 10^5 times lower is likely to be very conservative. Finally, the unit risk estimate is directly applicable only to persons exposed to chromium compounds similar to those involved in the study by Mancuso. EPA (1984b) stated (without giving details) that trivalent and hexavalent chromium compounds were present in the ratio 6:1, so that the unit risk for hexavalent chromium might be 7 times higher than that estimated for total chromium. Overall, therefore, EPA's estimate of the unit risk for exposure to chromium in ambient air must be characterized as extremely uncertain (primarily because of statistical uncertainty and

uncertainty in measuring exposure) and probably very conservative (primarily because of the wide range of extrapolation, but also because of assumptions about exposure and failure to control for smoking).

Based on exposure via inhalation, the IARC (1982) classified Cr VI as Group 1, human carcinogen. The evidence for the carcinogenicity of Cr III compounds was judged to be inadequate. However, IARC (1980) concluded that the epidemiological data do not allow elucidation of the relative contributions to carcinogenic risk of Cr III or Cr VI or of soluble versus insoluble compounds. EPA classified inhaled Cr VI as Group A--Human Carcinogen and inhaled Cr III as Group D--Not Classified (EPA 1984b, 1984c). Ingested chromium compounds were classified as Group D (EPA 1984d).

Hexavalent chromium's potent carcinogenic effects when inhaled make calculation of subchronic or chronic allowable intakes by inhalation for non-carcinogenic endpoints of toxicity inappropriate (EPA 1984b). For trivalent chromium, a chronic allowable intake (AIC) by inhalation of 0.0051 mg/kg/day was calculated in the Health Effects Assessment for Trivalent Chromium (EPA 1984c). This number was derived from a TLV. The studies used for derivation of the TLV involved workers concomitantly exposed to other dusts and fumes (ACGIH 1986).

For oral exposure to Cr VI, a subchronic allowable intake (AIS) of 0.025 mg/kg/day was derived in the Health Effects Assessment for Hexavalent Chromium (EPA 1984b). The AIS was based on a one-year study in which rats were exposed to 0-25 mg/liter Cr VI as potassium chromate in drinking water. Increased tissue concentrations of chromium, but no adverse health effects were reported at the highest dose (Mackenzie et al. 1958 as cited in EPA 1984b). An oral chronic allowable intake (AIC) of 0.005 mg/kg/day was derived from the same study, with application of an additional safety factor of 5 to adjust for less than lifetime exposure (EPA 1984b).

For oral exposure to Cr III, a subchronic allowable intake of 14 mg/kg/day was established based on a study by Ivankovic and Preussmann (1975 as cited in EPA 1984c). Rats were fed Cr III as chromium oxide at 2% and

5% of the diet for 90 days. A NOAEL of 5% Cr III was suggested, which corresponds to 1,399 mg/kg/day based on measured food consumption and body weight. Slightly depressed spleen and liver weights were reported.

For chronic oral exposure to Cr III, the EPA RfD Workgroup identified a risk reference dose (RfD) of 1 mg/kg/day based on the Ivankovic and Preussman (1975) study. Rats were fed chromic oxide baked in bread at dietary levels of 0, 1, 2, or 5%, 5 days/week for 600 feedings (840 total days). No effects due to chromic oxide treatment were observed at any dose levels.

The interim MCL for total chromium under the National Interim Primary Drinking Water Regulations is 0.05 mg/liter. A proposed Recommended Maximum Contaminant Level (RMCL) of 0.12 mg/liter is proposed for total chromium, based on an Adjusted Allowable Daily Intake (AADI) of 0.17 mg/liter with data on human exposure by other routes factored in (0.10 mg/day via the diet and 0 mg/day via air) (EPA 1985).

SUMMARY

Chromium is an essential micronutrient and is not toxic in trace quantities. High levels of soluble Cr VI and Cr III produce kidney and liver damage. Chronic inhalation exposure may lead to respiratory system damage. Epidemiological studies of workers exposed to Cr VI via inhalation demonstrate that it is a human carcinogen. EPA's (1984b) quantitative risk assessment is based upon a single study of a cohort of workers exposed over a six year period and followed for approximately 40 years. Smoking habits were not considered in the study. Assumptions and extrapolations included in the calculations lead to a very wide range of uncertainty in the risk factor. The relative carcinogenic potency of Cr III has not been demonstrated. A Risk Reference Dose (RfD) of 1 mg/kg/day has been established for oral exposure to Cr III. An oral AIC of 0.005 mg/kg/day was derived for Cr VI.

Summary of Chromium Criteria

EPA carcinogen classification (inhalation of Cr VI only)	Group A
Inhalation carcinogenic potency factor (q_1*)	41 $(mg/kg/day)^{-1}$
Oral AIC (Cr VI)	0.005 mg/kg/day
Oral risk reference dose (Cr III)	1 mg/kg/day
Maximum Contaminant Level (MCL) (total Cr)	0.05 mg/liter
Proposed RMCL (total Cr)	0.12 mg/liter

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CYANIDE

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

Hydrogen cyanide and its simple salts, such as sodium cyanide, are highly toxic by all routes (ACGIH 1986, EPA 1980). Many reports are available regarding acute poisonings in humans. Hydrogen cyanide vapor is irritating at very low concentrations, is considered dangerous at 20 ppm (20 mg/m^3), and is fatal at concentrations of 100 ppm (100 mg/m^3) for 1 hour. NIOSH (1976) noted reports of chronic poisoning resulting in fatigue, weariness, and other subjective symptoms in workers, but these findings have been disputed by other investigators. Chronic exosure to low levels of cyanide salts has been reported to cause enlargement of the thyroid gland in humans, apparently due to inefficient elimination of the cyanide metabolite thiocyanate. NIOSH (1976) concluded that there was no evidence of carcinogenicity, mutagenicity, or teratogenicity for cyanides. Cyanide has been shown to produce chromosome breaks in a bean plant, Vicia faba. Because of its mechanism of action, inhibition of the electron transport system in oxidative phosphorylation, cyanide is acutely toxic to almost all forms of life.

QUANTITATIVE DESCRIPTION OF HEALTH EFFECTS

EPA (1986) calculated a reference dose (RfD) for cyanide. The RfD was based on a study by Howard and Hanzal (1955) in which rats were maintained for 104 weeks on a diet containing 76 or 190 mg/kg of cyanide. From data reported on food consumption and body weight, daily doses were estimated at 3.6 to 7.5 mg/kg/day for the male rats and 4.6 or 10.8 mg/kg/day for the female rats. No clinical or histological effects were observed at either dose level. Using the highest no-observed-adverse-effect level (NOAEL) OF 10.8 mg/kg/day and a safety factor of 500 (10 for species extrapolation, 10 for sensitive members of the population, and 5 to compensate for the apparent tolerance to cyanide when it is ingested in food rather than in water), an RfD of 0.02 mg/kg/day was derived.

EPA (1985) recommended a lifetime health advisory of 750 ug/liter for exposure to cyanide in drinking water. It was assumed that exposed individuals weigh 70 kg and ingest 2 liters of water per day. The difference between this value and a drinking water criteria based on the RfD noted above (700 ug/liter) is due to rounding error.

The ambient water quality criterion (AWQC) for cyanide is 200 ug/liter (EPA 1980).

The American Conference of Governmental Industrial Hygienists (ACGIH 1986) has recommended a time-weighted average threshold limit value of 5 mg/m^3 for occupational exposure to cyanide.

SUMMARY OF CYANIDE CRITERIA

RfD	0.02 mg/kg/day
Lifetime HA	750 ug/liter
AWQC	200 ug/liter

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1,1-DICHLOROETHANE

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

Limited information is available concerning the effects of 1,1-dichloroethane (1,1-DCA). The extent or rate of absorption of 1,1-DCA has not been determined, but based on its chemical properties, rapid gastrointestinal absorption and moderate absorption from inhalation are expected (EPA 1984a).

1,1-DCA is probably less toxic than the 1,2-isomer (EPA 1980). At one time, the compound was used as an anesthetic, but it induced cardiac arrhythmias and its use was discontinued. It is probable that human exposure to sufficiently high levels of 1,1-DCA would cause central nervous system depression and respiratory tract and skin irritation, since many of the chlorinated aliphatics cause these effects (Parker at al. 1979). However, no dose-response data concerning these effects are available. Renal damage was observed in cats exposed by inhalation in a subchronic study (Hoffman et al. 1971). Inhalation exposure of pregnant rats to high doses of 1,1-DCA (6,000 ppm) retarded fetal development (Schwetz et al. 1974).

A carcinogenicity bioassay of 1,1-DCA was limited by poor survival of both treatment and control groups, and the physical conditions of the treated animals was markedly stressed. A dose-related increase in the number of tumors was not observed by the Fisher exact test, but the data suggest that the compound may have carcinogenic properties (NCI 1978).

QUANTITATIVE DESCRIPTION OF HEALTH EFFECTS

Applying the criteria for evaluating the weight of evidence for carcinogenicity proposed by EPA's Carcinogen Assessment Group (EPA 1984b), 1,1-DCA is most appropriately classified inGroup D--Not Classified (EPA 1984a). This category applies to agents for which there is inadequate human and animal evidence of carcinogenicity.

EPA derived health-based criteria for subchronic and chronic exposure to 1,1-dichlorethane in its Health Effects Assessment for this compound (EPA 1984a). The oral subchronic acceptable intake (AIS) and chronic acceptable intake (AIC) were calculated from the Hoffman et al. (1971) study in which cats exposed to 500 ppm 1,1-DCA for 26 weeks had no observed effects, but cats exposed to 500 ppm for 13 weeks and then 1,000 ppm for an additional 13 weeks suffered renal damage. The other mammalian species tested (rats, rabbits, and guinea pigs) had no observed adverse effects. The oral AIS is 1.2 mg/kg/day. The oral AIC of 0.12 mg/kg/day was derived from the AIS by applying an additional safety factor of 10 to compensate for less than lifetime exposure in the animal study (EPA 1984a).

The inhalation AIS of 1.38 mg/kg/day and the AIC of 0.14 mg/kg/day were also derived from the Hoffman et al. (1971) study (EPA 1984a).

EPA (1980) was unable to determine an ambient water quality criterion for humna health for 1,1-dichloroethane because of insufficient mammalian toxicological information.

The American Conference of Governmental Industrial Hygienists (ACGIH 1986) has recommended a time-weighted average threshold limit value of 200 ppm (810 mg/m^3) for occupational exposure to 1,1-dichloroethane.

SUMMARY OF 1,1-DICHLOROETHANE CRITERIA

EPA carcinogen classification	Group D
Oral AIS	1.2 mg/kg/day
Oral AIC	0.12 mg/kg/day
Inhalation AIS	1.38 mg/kg/day
Inhalation AIC	0.14 mg/kg/day

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1,2-DICHLOROETHANE

PHARMACOKINETICS

Data on the pharmacokinetics of 1,2-dichloroethane in humans are limited, but data from animal studies suggest that the chemical is rapidly absorbed following oral and inhalation exposure and after dermal contact with the liquid form of the compound (EPA 1985a). Reitz et al. (1982) reported that a 150 mg/kg bw peroral dose of radio-labelled 1,2-dichloroethane given to rats was completely absorbed 48 hours after administration, and Spreafico et al. (1978, 1979, 1980) reported 78% absorption in rats given a single oral dose of 25 mg/kg bw 1,2-dichloroethane in a water vehicle. Absorption rates of inhaled 1,2-dichloroethane have not been quantified, but because the chemical has a moderately high vapor pressure (80 mm Hg at 25°C) and a high blood-air partition coefficient (19.5), pulmonary absorption is probably rapid and complete (EPA 1984). Dermal absorption of 1,2-dichloroethane following vapor exposure is negligible, but direct skin application studies in mice (Tsuruta 1975, 1977) and guinea pigs (Jakobson et al. 1983) indicate that percutaneous absorption following direct liquid contact can be substantial and is linearly related to exposure duration.

After peroral or pulmonary absorption, 1,2-dichloroethane is distributed to all body tissues. The substance readily passes the blood-brain and placental barriers (EPA 1985a). In rats, the highest tissue concentrations following acute exposure are reached in the adipose tissue, followed by the blood and liver (Spreafico et al. 1978, 1977, 1980).

Studies in mice (Yllner 1971) and rats (Reitz et al. 1980, 1982) indicate that 1,2-dichloroethane is extensively metabolized, and the liver is the primary site of metabolic activity (EPA 1985a). 1,2-Dichloroethane is metabolized to 2-chloroacetaldehyde, S-(2-chloroethyl)-glutathione, and other putative reactive metabolites capable of covalent binding to cellular macromolecules (EPA 1985a). Metabolism appears to be dose related; percent metabolized decreases as dose increases (Yllner 1971, Reitz et al. 1980). Elimination of unmetabolized 1,2-dichloroethane is almost exclusively through the lungs (EPA 1985a).

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

CARCINOGENICITY

No epidemiological data are available to evaluate the carcinogenicity of 1,2-dichloroethane in humans. However, several chronic bioassays of 1,2-dichloroethane have been conducted in animals and some of these are outlined below.

In a study sponsored by the National Cancer Institute (NCI), groups of 50 male and 50 female 9-week-old Osborne-Mendel rats were administered technical grade 1,2-dichloroethane (>99% pure) in corn oil by gavage 5 days/week for 78 weeks (NCI 1978). Surviving animals were observed for up to 32 weeks following termination of treatment. The time-weighted average doses were 95 and 47 mg/kg bw/day for high- and low-dose males and females. A group of 20 male and 20 female rats received corn oil alone and were used as matched vehicle controls, and an additional group of 60 male and 60 female rats received corn oil and were used as pooled vehicle controls. (The group of matched vehicle controls was not considered in the statistical analyses of tumor incidences.) Mortality was increased in the high-dose group; all high-dose females were dead by week 15 of the post-treatment observation period, and all high-dose males died by week 23 of the observation period. All low-dose rats survived the 32-week post-treatment observation period. All treated and control animals were histologically examined. There was a statistically significant increase in total number of tumors in high-dose females when compared with pooled controls. Additionally, a statistically significant increase in the incidence of squamous-cell carcinomas of the forestomach in high-dose male rats and mammary gland adenocarcinomas in high-dose female rats was observed. Hemangiosarcomas occurred in some treated rats but not in any of the controls. Low-dose males and females showed higher incidences of hemangiosarcomas than high-dose animals. There was a statistically significant positive trend in the incidence of hemangiosarcomas in male and female rats as compared with pooled vehicle controls.

In a second oral-dosing study sponsored by NCI (1978), groups of 50 male and 50 female 5-week-old $B6C3F_1$ mice were administered technical grade (>99% pure) 1,2-dichloroethane in corn oil by gavage 5 days/week for 78 weeks, followed by a 12-week (females) or 13-week (males) period without treatment. The time-weighted doses were 195 and 299 mg/kg bw/day for high-dose males and females, respectively, and 97 and 149 mg/kg bw/day for low-dose males and females, respectively. A group of 60 male and 60 female mice received corn oil alone and served as pooled vehicle controls. Of the high-dose animals, 42% of the males survived until the end of the study, and 72% of the females died between weeks 60 and 80. In the low-dose group, 48% of the males survived more than 74 weeks, and 68% of the females survived until the end of the study. In the vehicle control groups, 55% of the males and 80% of the females survived until the end of the study. When compared with controls, the number of animals with tumors and the total number of tumors were significantly greater in both male and female high-dose mice and also in low-dose female mice.

Maltoni et al. (1980) exposed groups of 180 male and 180 female Sprague-Dawley rats and Swiss mice to 1,2-dichloroethane (>99% pure) vapor concentrations of 250-150 ppm, 50 ppm, 10 ppm, or 5 ppm, respectively, for 7 hours/day, 5 days/week for 78 weeks. (The initial 250 ppm concentration was reduced to 150 ppm after several days of exposure to the higher level elicited severe toxic effects.) Two groups of 180 rats per group served as controls for the rat study, and one group of 249 mice served as the control for the mice study. At the end of the treatment period, all animals were allowed to live until spontaneous death. A complete necropsy was performed on all rats and mice. The results of the histopathological analyses revealed no statistically significant increases in the incidence of any specific type of tumor in treated rats or mice when compared with controls.

MUTAGENICITY

1,2-Dichloroethane has been shown to cause gene mutations in bacteria, plants, Drosophila, and cultured Chinese hamster ovary cells (EPA 1985a). The majority of the in vitro tests have reported marginal positive responses without metabolic activation and stronger positive responses with exogenous

hepatic metabolic activation, indicating that 1,2-dichloroethane is mutagenic by itself but that metabolites are more potent mutagens. In addition, 1,2-dichloroethane also has been observed to cause meiotic chromosomal nondisjunction in Drosophila and to alkylate DNA in several somatic tissues in the rat (EPA 1985a).

REPRODUCTIVE TOXICITY

Available data suggest that 1,2-dichloroethane does not adversely affect reproductive or developmental processes in experimental animals except at maternally toxic levels (EPA 1985a). However, the data are limited, and additional experimental and epidemiological studies are needed to conclusively demonstrate that this compound is not a human teratogen and does not produce adverse reproductive effects.

CHRONIC TOXICITY

Data on chronic toxicity of 1,2-dichloroethane in humans are limited (primarily) to foreign case reports and health surveys. Repeated exposure to 1,2-dichloroethane vapor in the work place has been reported to result in anorexia, nausea, vomiting, weakness and fatigue, nervousness, epigastric pain, and irritation of the respiratory tract and eyes (EPA 1984, 1985a). Kozik (1957) reported that workers in the Russian aircraft industry who were exposed for at least 4 years to approximately 10-15 ppm 1,2-dichloroethane experienced increased incidences of gastrointestinal disease, liver and gall bladder disease, and diseases of the muscles, tendons, and ganglia. Cetnarowicz (1959) reported dizziness, fatigue, drowsiness, nausea, and epigastric pain in Polish oil refinery workers exposed to 1,2-dichloroethane concentrations between 10 and 200 ppm for an unspecified period of time.

Chronic studies in animals also have revealed toxic effects following inhalation exposure. Spencer et al. (1951) exposed eight guinea pigs of both sexes, one female and two male rabbits, and two male monkeys to 1,2-dichloroethane vapor at concentrations of 400 and 100 ppm for 7 hours/day, 5 days/week for 6 months. In addition, 15 rats of both sexes and 8 guinea pigs of both sexes were similarly exposed to 200 ppm 1,2-dichloroethane for

151 and 180 7-hour periods, respectively. Exposure to 200 ppm 1,2-dichloroethane caused parenchymatous degeneration of the liver in guinea pigs. Severe toxic effects were found in all animals exposed to the 400-ppm concentration, but no toxic effects were observed in any animals exposed to the 100-ppm concentration.

Heppel et al. (1946) observed increased mortality and/or significant pathological changes in various organs of rats, rabbits, and guinea pigs exposed to 1,000 or 400 ppm of 1,2-dichloroethane 7 hours/day for 5 days/week but not in animals similarly exposed to concentrations of 100 ppm.

No pertinent data on the chronic oral toxicity of 1,2-dichloroethane in humans were located in the available literature, and limited reports of chronic oral exposure in laboratory animals were available. In the NCI (1978) bioassay previously discussed, groups of 50 male and 50 female Osborne-Mendel rats were treated by gavage with time-weighted average (TWA) 1,2-dichloroethane concentrations of 45 or 74 mg/kg bw/day, respectively, for 78 weeks and observed for up to an additional 32 weeks. Groups of 50 male and 50 female $B6C3F_1$ mice were treated by gavage with TWA doses of 195 or 97 mg/kg bw/day (male) or 299 or 149 mg/kg bw/day (female) 1,2-dichloroethane for 78 weeks, followed by a 12 to 13-week observation period. No significant dose-related body weight depression in rats of either sex was noted, but there was increased mortality, particularly in the high-dose groups, which appeared to be related to toxic rather than to carcinogenic effects. Mean body weight depression was noted as early as week 15 of the study in high-dose female mice but not in high- or low-dose males or low-dose females.

In a chronic feeding study, rats received diets containing 1,2-dichloroethane at concentrations of 0, 250, or 500 mg/kg fed for 2 years (Alumot et al. 1976). No biochemical or histopathological abnormalities attributable to 1,2-dichloroethane were observed. However, there was a widespread incidence of chronic respiratory disease and low survival rates. A lack of detailed data prevents establishment of the actual dose administered.

ACUTE TOXICITY

Effects of acute inhalation exposure in humans are similar to those observed in humans following chronic work-time exposure and include irritation of mucous membranes and the respiratory tract and central nervous system depression (EPA 1985a). Death may occur as a result of respiratory and circulatory failure. Pathologic examinations typically show congestion, degeneration, necrosis, and hemorrhagic lesions of most internal organs, including the liver, kidney, spleen, lungs, and respiratory and gastrointestinal tracts (EPA 1985a). Adverse effects caused by less extreme exposures were generally associated with the gastrointestinal and nervous systems.

QUANTITATIVE DESCRIPTION OF HEALTH EFFECTS

Applying EPA's criteria for evaluating overall weight of evidence of carcinogenicity to humans, 1,2-dichloroethane has been classified in Group B2 as a probable carcinogen in humans. This category applies to agents for which there is inadequate evidence of carcinogenicity from human studies and sufficient evidence of carcinogenicity from animal studies.

EPA (1985a) derived a carcinogenic potency factor (q_1^*) for ingestion based on the incidences of hemangiosarcomas in Osborne-Mendel male rats observed in the NCI (1978) gavage study outlined previously. The final time-weighted average doses in male and female rats were 95 and 47 mg/kg/day for the high- and low-dose groups, respectively. Animals were observed for up to an additional 32 weeks before terminal sacrifice. Based on the hemangiosarcoma response in male rats using a time-to-death adjustment and an adjusted dose derived from the metabolism/kinetic evaluation, EPA used the multistage model to estimate an upperbound carcinogenic potency factor of 9.1×10^{-2} $(mg/kg/day)^{-1}$ for 1,2-dichloroethane.

EPA (1980) also based is ambient water quality criterion for 1,2-dichloroethane on the incidences of hemangiosarcomas observed in male rats in the NCI (1978) study previously discussed. However, because a somewhat

different approach was used, a carcinogenic potency factor of 3.697×10^{-2} $(mg/kg/day)^{-1}$ was derived. The resulting water concentration to keep the lifetime excess cancer risk below 10^{-6} was 0.94 ug/liter. This value assumes ingestion of contaminated water and aquatic organisms (e.g., fish) from the contaminated water. Without consumption of contaminated aquatic organisms, a lifetime cancer risk of 10^{-6} would be associated with ingestion of water containing 0.95 ug/liter of 1,2-dichloroethane.

Another carcinogenic potency factor, also based on the NCI (1978) hemangiosarcoma data for male rats, was reported in the EPA Health Effects Assessment for 1,2-dichloroethane (EPA 1984); the reported value was 6.9×10^{-2} $(mg/kg/day)^{-1}$.

The EPA Office of Drinking Water developed a longer-term health advisory (HA) for 1,2-dichloroethane based upon the results of two chronic inhalation studies (Heppel et al. 1946, Spencer et al. 1951) and one subchronic inhalation study (Hofmann et al. 1971) in which various animal species were exposed to 1,2-dichloroethane. In these studies, exposure to air containing 100 ppm 1,2-dichloroethane for 6-7 hours/day, 5 days/week for up to 8 months resulted in no mortality and no adverse effects on behavior, growth, organ function, or blood chemistry. Similar exposures to 400-500 ppm 1,2-dichloroethane resulted in high mortality and various pathological effects. The 100-ppm level (405 mg/m^3) was used as the no-observable-adverse-effect level (NOAEL) for the determination of the HA. The HAs derived for a 10-kg child consuming 1 liter of water per day and for a 70-kg adult consuming 2 liters of water per day are 740 ug/liter and 2,800 mg/liter, respectively.

EPA (1985b) recently published under the Safe Drinking Water Act, a proposed maximum contaminant level (MCL) of 5 ug/liter for 1,2-dichloroethane. The proposed MCL was determined based upon consideration of best available technology for removal of 1,2-dichloroethane from drinking water and upon the lowest achievable detection level for 1,2-dichloroethane by routine laboratory operating conditions within specified limits of precision and accuracy.

SUMMARY OF 1,2-DICHLOROETHANE CRITERIA

EPA carcinogen classification	Group B2
Oral carcinogenic potency factor (q_1*)	9.1×10^{-2} $(mg/kg/day)^{-1}$
Longer-term HA:	
Child	740 ug/liter
Adult	2,600 mg/liter
Proposed MCL	5 ug/liter
AWQC (concentration associated with a 10^{-6} lifetime cancer risk:	
Ingestion of water and aquatic organisms	0.94 ug/liter
Ingestion of water only	0.95 ug/liter

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1,1-DICHLOROETHYLENE

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

Several comprehensive reviews of the toxicology and potential health effects of 1,1-dichloroethylene have been prepared. The following summary is based primarily on information presented in three EPA documents. These include "Ambient Water Quality Criteria for Dichloroethylene" (EPA 1980), "Drinking Water Criteria Document for Dichloroethylenes" (EPA 1984a), and "Health Assessment Document for Vinylidene Chloride" (EPA 1985a).

1,1-Dichloroethylene is a central nervous system depressant and has been used as an anesthetic. Chronic low-level exposure to this substance may result in neurotoxicity, nephrotoxicity, hepatotoxicity, and cardiac arrhythmia. Inhalation or oral exposure of rats and rabbits has produced fetotoxicity and minor skeletal abnormalities, but at doses associated with some degree of maternal toxicity.

1,1-Dichloroethylene has been found to be a point mutagen in bacterial systems with metabolic activation, but dominant lethal studies in rats and mice were negative. The evidence for the potential of 1,1-dichloroethylene to act as a human germ-cell mutagen is currently regarded by EPA (1985a) as limited. Although this designation indicates that there are insufficient data to classify this evidence as sufficient or suggestive of potential germ-cell mutagenicity, the available data also do not permit classification of 1,1-dichloroethylene as a non-germ cell mutagen.

A number of laboratory studies have investigated the carcinogenic potential of 1,1-dichloroethylene. A significantly increased incidence of renal adenocarcinoma was observed in male mice treated by inhalation with 1,1-dichloroethylene in a study by Maltoni et al. (1985); female mice in the same study showed an equivocal increase in mammary adenocarcinomas. Other studies with mice, rats and hamsters have not shown increased tumor incidences after exposure by the oral or inhalation routes.

The effects of 1,1-dichloroethylene on humans have not been studied in large enough populations to provide meaningful results (EPA 1980, 1985a).

QUANTITATIVE DESCRIPTION OF HEALTH EFFECTS

The EPA concluded that the evidence for carcinogenicity of 1,1-dichloroethylene is inadequate in humans and limited in experimental animals. Applying the criteria for evaluating the overall weight of evidence of carcinogenicity to humans proposed by the EPA (1984b), this compound is most appropriately classified in Group C—Possible Human Carcinogen.

The carcinogenic potency for exposure by ingestion was derived by EPA (1985a) by estimating an upper-limit value from the negative data of a drinking water study by Quast et al. (1983) in Sprague-Dawley rats and a negative NTP (1982) gavage study in Fischer 344 rats and B6C3F1 mice. Quast et al. (1983) treated Sprague-Dawley rats with 50, 100, or 200 ppm 1,1-dichloroethylene in their drinking water for 2 years and observed only minimal hepatotoxicity. In the NTP bioassay (NTP 1982), no significant increases in tumor incidence were observed, but a maximum tolerated dose was apparently not achieved in the gavage treatment of F344 rats with 1 or 5 mg/kg and B6C3F1 mice with 2 or 10 mg/kg 5 times a week for 104 weeks. This approach assumes that a response occurs via ingestion, although there is no direct evidence that this is true. The highest upper-bound carcinogenic potency (q_1*) estimate using these data was 0.58 $(mg/kg/day)^{-1}$.

The carcinogenic potency for exposure by inhalation reported by EPA (1985a) is based on an inhalation study in mice by Maltoni et al. (1985). Swiss mice of both sexes were exposed to 0, 10, or 25 ppm (0, 40, or 100 mg/m^3) 1,1-dichloroethylene for 4 hours/day, 4 to 5 days/week for 52 weeks, and were observed for a total of 121 weeks. The most marked finding was the significantly increased incidence of renal adenocarcinomas in the high-dose male mice. Using data from this study, calculation of the cancer risk estimates by the multistage model yielded an inhalation carcinogen potency of 1.16 $(mg/kg/day)^{-1}$.

Under the Safe Drinking Water Act, EPA has recently promulgated a final recommended maximum contaminant level (RMCL) and proposed a maximum contaminant level (MCL) of 7 ug/liter for 1,1-dichloroethylene in drinking water (EPA 1985b). RMCLs are nonenforceable health goals that are to be set at levels that would result in no known or anticipated adverse health effects with an adequate margin of safety. MCLs, which are enforceable standards when finalized, are EPA set as close as feasible to RMCLs after consideration of treatment and analytical technologies, costs, and other factors.

In setting the 7 ug/liter RMCL for 1,1-dichloroethylene, EPA determined that limited but insufficient evidence of carcinogenicity exists for this compound. Accordingly, it was classified in Regulatory Category II—equivocal evidence of carcinogenicity. RMCLs for Category II contaminants are set based on chronic toxicity data with an additional margin of safety or on lifetime risk calculations if chronic toxicity data are not available. For 1,1-dichloroethylene, EPA set the RMCL based on chronic toxicity data, primarily liver effects, obtained from the Quast et al. (1983) study in rats. An adjusted acceptable daily intake (AADI) of 350 ug/liter was derived from these data. By applying an extra safety factor of 10 to account for the possible carcinogenicity of this compound and assuming a 20% contribution to exposure from drinking water, the final RMCL of 7 ug/liter was determined (EPA 1984, EPA 1985b).

The EPA Office of Drinking Water developed one-day, longer-term, and lifetime health advisories (HAs) for 1,1-dichloroethylene (EPA 1985c). The one-day HA derived for a 10-kg child is 1,000 ug/liter. This HA was based on a study in which adult rats received single doses of 100, 300, or 500 mg/kg 1,1-dichloroethylene in corn oil (Jenkins et al. 1972). A lowest-observed-adverse-effect level (LOAEL) of 100 mg/kg for liver enzyme changes was identified. The longer-term HA was based on a 90-day study in which rats received 0, 50, 100, or 200 ppm 1,1-dichloroethylene in their drinking water (Rampy et al. 1977). This study identified a no-observed-adverse effect level (NOAEL) of 100 ppm (a decreased kidney-body weight ratio in males was observed at 50 ppm); increased cytoplasmic vacuolization of hepatocytes was observed in both sexes at 200 ppm. Based on

the NOAEL of 100 ppm, a longer-term HA was derived for a 10-kg child consuming 1 liter of water per day and a 70-kg adult consuming 2 liters of water per day. These values are 1,000 ug/liter and 3,500 ug/liter, respectively. EPA noted that the longer-term HA of 1,000 ug/liter for a 10-kg child would also be appropriate for protection over a ten-day period.

A lifetime HA of 70 ug/liter was based on the Quast et al. (1983) study cited above. A LOAEL of 100 ppm was identified based upon a trend towards increased fatty deposition in the liver. A relative source contribution of 20% for drinking water was included in this value. A risk reference dose (RfD) of 0.01 mg/kg/day was determined by EPA from data presented in this study. An RfD is an estimate of daily exposure which appears to be without appreciable risk of deleterious noncarcinogenic effects over a lifetime of exposure. This value corresponds approximately to the oral reference dose (RfD) of 0.009 mg/kg/day (EPA 1986) also recommended by EPA and based on the Quast et al. (1983) study.

EPA (1980) determined an ambient water quality criteria (AWQC) of 0.06 ug/liter for 1,1-dichloroethylene, which corresponds to a 10^{-6} excess lifetime cancer risk.

The American Conference of Governmental Industrial Hygienists (ACGIH 1986) has recommended a time-weighted average threshold limit value of 5 ppm (20 mg/m^3) for occupational exposure to 1,1-dichloroethylene.

SUMMARY OF 1,1-DICHLOROETHYLENE CRITERIA

EPA carcinogen classification	Group C
Oral carcinogenic potency factor(q_1*)	0.58 (mg/kg/day)$^{-1}$
Inhalation carcinogenic potency factor (q_1*)	1.16 (mg/kg/day)$^{-1}$
Final MCL/proposed MCL	7 ug/liter
One-day HA (child)	1,000 ug/liter
Ten-day HA (child)	1,000 ug/liter

Longer-term HA	
Child	1,000 ug/liter
Adult	3,500 ug/liter
Lifetime HA	70 ug/liter
RfD	0.009 mg/kg/day
AWQC corresponding to a 10^{-6} excess lifetime cancer risk	0.06 ug/liter

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trans-1,2-DICHLOROETHYLENE

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

Information on the health effects of trans-1,2-dichloroethylene is limited. Freundt et al. (1977) exposed female rats by inhalation to 200 ppm trans-1,2-dichlorothylene for 8 hours per day, 5 days per week for 1, 2, 8, or 16 weeks and noted progressive damage to the lungs and progressive fatty degeneration of the liver.

trans-1,2-Dichloroethylene was not mutagenic in the Ames assay and did not induce chromosomal aberrations in mouse bone marrow cells (Cerna and Kypenova 1977). Galli et al. (1982) reported that it was not mutagenic when tested in a diploid strain (D7) of Saccharomyces cerevisiae with and without metabolic activation. Finally, trans-1,2-dichloroethylene was not mutagenic in the Escherichia coli K12 assay system (Greim et al. 1975).

QUANTITATIVE DESCRIPTION OF HEALTH EFFECTS

According to EPA's Proposed Guidelines for Carcinogenic Risk Assessment (EPA 1984a), trans-1,2-dichloroethylene has been classified in Group D--Not Classified (EPA 1985). This category applies to agents for which there is inadequate evidence of carcinogenicity from animals studies.

EPA (1980) was unable to derive ambient water quality criteria for trans-1,2-dichloroethylene because of lack of data.

The EPA opinion concerning protection of human health from the toxic effects of trans-1,2-dichloroethylene in drinking water is summarized in proposed national primary drinking water regulations for synthetic organic chemicals (EPA 1985). Because compound-specific information concerning toxicity of the 1,2-dichloroethylenes is not adequate, EPA has chosen to derive longer-term (1- to 12-year) and lifetime exposure criteria for both the cis- and trans-isomers from data on 1,1-dichloroethylene, a compound with similar structure (a geometric isomer of 1,2-dichloroethylene) and similar noncarcinogenic toxic

end points. Derivation of these criteria are documented in detail in the Drinking Water Criteria Document for Dichloroethylenes (EPA 1984b). Available information from shorter-term exposures to all three compounds also suggests that the noncarcinogenic toxicity induced by the 1,2-isomers is likely to be no more severe than that of 1,1-dichloroethylene. Accordingly, EPA derived longer-term draft health advisories for both cis- and trans-1,2-dichloroethylene of 1,000 and 3,500 ug/liter for children and adults, respectively, from data on 1,1-dichloroethylene.

EPA also derived an acceptable daily intake (ADI) for lifetime exposure based on the results of a 2-year chronic toxicity/oncogenicity study (Quast et al. 1983) in which rats received 0, 50, 100, or 200 mg/liter 1,1-dichloroethylene in drinking water. For the highest dose group, significant microscopic liver changes were seen in animals of both sexes, and minimal hepatocellular swelling and fatty changes were seen in female rats at all dose levels. At 100 ppm (10 mg/kg mean daily dose in males), a trend toward an increase in focal fatty changes in the liver was observed in males. No exposure-related changes were seen in males at the low dose. An ADI of 0.01 mg/kg/day for a 70-kg person was determined using a lowest-observed-adverse effect level (LOAEL) of 10 mg/kg/day and an uncertainty factor of 1,000, since a no-observed-adverse effect level (NOAEL) was not identified. The corresponding adjusted acceptable daily intake (AADI) for a 70-kg person drinking 2 liters of water per day is 350 ug/liter. EPA proposed an RMCL of 70 ug/liter for both cis- and trans-1,2-dichloroethylene based on the AADI of 350 ug/liter, assuming 20% of the exposure is via drinking water. Based on consideration of currently available data, EPA's proposed recommended guidelines for longer-term and lifetime exposure appear adequate for protection of the health of exposed individuals.

The American Conference of Governmental Industrial Hygienists (ACGIH 1986) has recommended a time-weighted average threshold limit value of 200 ppm (790 mg/m^3) for occupational exposure to trans-1,2-dichloroethylene.

STANDARDS AND CRITERIA

EPA carcinogen classification	Group D
ADI	0.01 mg/kg/day
Proposed RMCL	70 ug/liter

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DI-n-BUTYL-PHTHALATE

INTRODUCTION

Di-n-butyl phthalate (DBP) is a phthalate ester commonly used as a plasticizer and in the production of polyvinyl chloride (PVC) resins (EPA 1980).

PHARMACOKINETICS

The phthalic acid esters and/or their metabolites are readily absorbed from the gastrointestinal tract, intraperitoneal cavity, and the lungs and distributed to various organs and tissues. The esters are excreted primarily in urine and feces (EPA 1980).

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

There are no reports that DBP is carcinogenic in animals or humans. However, DBP was reported to be mutagenic in a bacterial test system (Seed 1982). Reduced fetal weight, resorptions, and dose-related musculoskeletal abnormalities were observed among fetuses from rats and mice exposed to very high doses of DBP during gestation (Shiota and Nishimura 1982).

The acute toxicity for laboratory animals by most routes of administration is very low. Oral, inhalation, and intraperitoneal LD_{50} values of 8,000 mg/kg, 7,900 mg/m^3, and 3,050 mg/kg, respectively, have been reported for the rat (EPA 1980). Smith (1953) fed male Sprague-Dawley rats diets containing 0, 0.01, 0.05, 0.25 and 1.25% di-n-butyl phthalate for 1 year. At the highest di-n-butyl phthalate concentration, one-half of all rats died during the first week of exposure.

QUANTITATIVE DESCRIPTION OF HEALTH EFFECTS

Applying the carcinogen risk guidelines established by the Carcinogen Assessment Group of EPA (EPA 1986a), di-n-butyl phthalate is most

appropriately classified in Group D--Not Classified. This category applies to agents for which there is no evidence of carcinogenicity.

EPA (1986b) calculated a risk reference dose (RfD) of 0.1 mg/kg/day for di-n-butyl phthalate based on a study by Smith (1953) in which male Sprague-Dawley rats fed diets containing 0.25% (125 mg/kg/day) di-n-butyl phthalate did not exhibit any effects on gross pathology or hematology.

EPA (1980) also determined an ambient water quality criterion (AWQC) of 34.1 mg/liter for the protection of human health from the toxic properties of di-n-butyl phthalate ingested through water.

The American Conference of Governmental Industrial Hygienists (ACGIH 1986) has recommended a time-weighted average threshold limit value (TLV) of 5 mg/m^3 for occupational exposure to di-n-butyl phthalate.

SUMMARY OF DI-n-BUTYL PHTHALATE

EPA carcinogen classification	Group D
RfD	0.1 mg/kg/day
AWQC	34.1 mg/liter

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ETHYLBENZENE

INTRODUCTION

Ethylbenzene (EB) is a clear, colorless, flammable liquid found in gasoline. It is used as a solvent and in the manufacture of styrene and acetophenone. Ethylbenzene is also a constituent of asphalt and naptha.

PHARMACOKINETICS

Ethylbenzene absorbed via inhalation was found to be distributed throughout the body in Harlan-Wistar rats. However, the highest levels were detected in the kidney, lung, adipose tissue, digestive tract, and liver (Chin et al. 1980a). Data regarding the absorption of ethylbenzene from the gastrointestinal tract following oral ingestion were not located in the available literature. The elimination of ethylbenzene is primarily through urinary excretion of metabolites (EPA 1984).

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

CARCINOGENICITY

Pertinent data on the carcinogenic potential of ethylbenzene were not identified in the available literature.

MUTAGENICITY

Ethylbenzene was found to be nonmutagenic in *Salmonella typhimurium* strains TA98, TA100, TA1535, and TA1537 tested with and without metabolic activation (Florin et al. 1980). Pure ethylbenzene did not increase the frequency of recessive lethals in the *Drosophila* recessive lethal test (Donner et al. 1979).

TERATOGENICITY/REPRODUCTIVE EFFECTS

Hardin et al. (1981) found that ethylbenzene did not elicit embryo toxicity, teratogenicity, or maternal toxicity in New Zealand white rabbits exposed for 6-7 hours/day at 100 or 1,000 ppm (435 or 4,348 mg/m^3) during gestation days 1-24. However, female Wistar or Sprague-Dawley rats exposed to 1,000 ppm ethylbenzene for 6-7 hours/day during gestation days 1-19 had increased liver, kidney, and spleen weights indicating maternal toxicity.

ACUTE/CHRONIC TOXICITY

Wolf et al. (1956) administered a single oral doses of ethylbenzene (in olive oil or corn oil solution) by stomach tube to male and female Wistar-derived rats to determine the acute toxicity of ethylbenzene. The reported LD_{50} for both sexes was 3.5 g/kg bw; systemic toxic effects occurred primarily in the liver and kidney.

Wolf et al. (1956) also administered ethylbenzene in olive oil by stomach tube 5 days/week for 6 months to groups of 10 female Wistar rats. Doses of 468 and 680 mg/kg caused increased liver and kidney weights and cloudiness and swelling of hepatocytes and renal tubular epithelium. No effects were observed in rats exposed to 13.6 and 136 mg/kg/day.

QUANTITATIVE DESCRIPTION OF HEALTH EFFECTS

Applying the criteria in EPA's guidelines for assessment of carcinogenic risk (EPA 1986a), ethylbenzene is most appropriately classified in Group D--Not Classified. This category applies to agents for which there is inadequate evidence of carcinogenicity.

EPA (1985b) derived one-day health advisories (HAs) for ethylbenzene based on a study by Bordodej and Bordodejova (1970) in which no adverse health effects were reported in humans exposed via inhalation for 8 hours to 100 ppm (435 mg/m^3) ethylbenzene. The one-day HAs for a 10-kg child and 70-kg adult

are 73 mg/liter and 21 mg/liter, respectively. Because of a lack of appropriate exposure duration data, EPA (1985b) derived the ten-day HAs from the one-day HAs by dividing the one-day HAs by ten. The resulting ten-day HAs for a 10-kg child and 70-kg adult are 2.1 mg/liter and 7.3 mg/liter, respectively. EPA (1985b) derived a lifetime health advisory of 3.4 mg/liter from the Wolf et al. (1956) study in which rats were treated orally at four doses of ethylbenzene 5 days/week for 6 months exhibited no adverse effects at 136 mg/kg/day. Based on the lifetime health advisory of 3.4 mg/liter and assuming 20 percent of exposure to ethylbenzene would be via drinking water, EPA (1985c) proposed a recommended maximum contaminant level (RMCL) of 0.68 mg/liter.

EPA (1986b) determined a reference dose (RfD) of 0.1 mg/kg/day for oral exposure to ethylbenzene based on the Wolf et al. (1956) data using the no-observed-adverse-effect level (NOAEL) of 136 mg/kg/day

EPA (1980b) has established an ambient water quality criterion (AWQC) of 1.4 mg/liter for the protection of human health from the toxic properties of ethylbenzene ingested through water and contaminated aquatic organisms.

The American Conference of Governmental Industrial Hygienists (ACGIH 1986) has recommended a time-weighted average threshold limit value of 100 ppm (435 mg/m^3) for occupational exposure to ethylbenzene.

SUMMARY OF ETHYLBENZENE CRITERIA

EPA carcinogen classification	Group D
One-day HA:	
Adult	73 mg/liter
Child	21 mg/liter
Ten-day HA:	
Adult	7.3 mg/liter
Child	2.1 mg/liter
Lifetime HA	3.4 mg/liter
Proposed RMCL	0.68 mg/liter

RfD	0.1 mg/kg/day
AWQC	1.4 mg/liter

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HEXACHLOROBENZENE

INTRODUCTION

Hexachlorobenzene is a synthetic organic compound that is produced during the synthesis of several chlorinated compounds. At one time, hexachlorobenzene was used as a fungicide, but this use has been discontinued (EPA 1985a).

PHARMACOKINETICS

No information was present in the available literature on hexachlorobenzene absorption from the lungs or skin (EPA 1985a). Absorption of hexachlorobenzene from the gastrointestinal tract appears to depend on the vehicle used during test material administration (EPA 1985a). Eighty percent of the dose is absorbed when hexachlorobenzene is administered in olive oil; less than 20% of the dose is absorbed when hexachlorobenzene is administered in an aqueous solution (EPA 1985a, 1984a). Intestinal absorption of hexachlorobenzene occurs mainly via the lymphatic system (IARC 1979). Hexachlorobenzene is distributed to tissues that have a high lipid content (EPA 1985a). The adipose tissue accumulates the greatest concentrations of hexachlorobenzene in all of the species studied (EPA 1985a). Bone marrow and skin also accumulate large amounts of hexachlorobenzene (EPA 1985a). Hexachlorobenzene is metabolized to lesser chlorinated benzenes and chlorinated phenols which are excreted in the urine as glucuronide and glutathione conjugates together with small amounts of unchanged hexachlorobenzene (EPA 1985a). The excretion of hexachlorobenzene occurs primarily as the parent compound through the feces (EPA 1985a).

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

CARCINOGENICITY

Cabral et al. (1977) fed diets containing 0, 50, 100, or 200 ppm hexachlorobenzene to Syrian golden hamsters for life (EPA 1984a). These diets contained 4, 8, or 16 mg/kg/day hexachlorobenzene and resulted in significant

increases in the incidences of hepatomas and hemangioendothelioma of the livers of exposed male and female rats (EPA 1984a). The incidence of hepatoma was 47% for both sexes at 4-5 mg/kg/day (EPA 1984a). The incidences of hemangioendothelioma were 20% in males at 8 mg/kg/day and 12% in females at 16 mg/kg/day (EPA 1984a).

Liver hepatomas were also produced in both sexes of Swiss mice administered hexachlorobenzene for 106 weeks (EPA 1984a). At 24 mg/kg/day, the incidences were 34% for females and 16% for males (EPA 1984a).

Liver tumors (hepatomas or hepatocellular carcinomas) were found in three studies which included three different strains of rats: Agus, Wistar, and Sprague-Dawley (EPA 1985a). These tumors were induced at doses between 1.5 and 8 mg/kg/day (EPA 1985a). Smith and Cabral (1980) demonstrated an increased incidence of liver cell tumors in female MRC Wistar and Agus rats exposed to dietary levels of 100 ppm hexachlorobenzene for 75 to 95 weeks (EPA 1984a). Liver tumors were observed in rats exposed to 75 or 150 ppm hexachlorobenzene in the diet for up to 2 years (EPA 1984a). Arnold (1983) observed hepatocellular carcinomas in male and female Sprague-Dawley rats exposed to hexachlorobenzene <u>in utero</u>, during lactation, and in the diet for the remainder of their lifetimes (130 weeks) (EPA 1985a).

The data on hexachlorobenzene provide sufficient evidence of the carcinogenicity of hexachlorobenzene, since there were increased incidences of malignant tumors of the livers in two species (hemangioendothelioma in hamsters and hepatocellular carcinoma in rats) as well as reports of hepatomas in mice, rats and hamsters (EPA 1985a).

MUTAGENICITY

Hexachlorobenzene was not mutagenic when tested in the <u>Salmonella typhimurium</u> histidine reversion assay with and without metabolic activation (EPA 1985b). It did not induce dominant lethal effects in male rats (EPA 1985a). Hexachlorobenzene was found to be mutagenic in a yeast assay, <u>Saccharomyces cerevisiae</u> at a concentration of 100 ppm (EPA 1985a).

TERATOGENICITY/REPRODUCTIVE EFFECTS

Hexachlorobenzene is fetotoxic and produces some teratogenic effects in experimental animals (IARC 1979). Fetotoxic effects include elevated liver weights in rats and hepatomegaly and reduced survival in cats (EPA 1985a). Hexachlorobenzene given to pregnant mice was found to produce cleft palates and renal agenesis in exposed (concentrations unspecified) pups (EPA 1985a).

ACUTE/CHRONIC EFFECTS

The acute oral toxicity of hexachlorobenzene has been found to be low (EPA 1985a). The following LD_{50} values have been reported in the literature: rats, 3,500-10,000 mg/kg; rabbits, 2,600 mg/kg; cats, 1,700 mg/kg; and mice, 4,000 mg/kg (EPA 1985b).

Subchronic oral toxicity studies conducted in several mammalian species indicate a significant increase in liver and kidney weights (EPA 1985a). Histological changes have been identified in the livers of exposed animals (i.e., irregular shaped and moderately enlarged liver mitochondria and increases in the size of the centrilobular hepatocytes) (EPA 1985b).

Chronic oral toxicity studies revealed similar effects to those seen in the subchronic studies (EPA 1985a). In addition, hexachlorobenzene is associated with increases in mortality and with lesions of the liver and kidney (EPA 1985a). Other effects reported include multiple alopecia and scabbing, associated with neurological effects in rats, mice and dogs (EPA 1985a). Increased porphyrin levels in the liver and urine have been reported for all species studied except the dog (EPA 1985a).

The exposure of humans to hexachlorobenzene (0.05 to 0.2 g/day) in Turkey from 1955-1959 resulted in hexachlorobenzene-induced porphyria turcica (EPA 1985a). This disease is manifested by disturbed porphyrin metabolism, cutaneous lesions and hyperpigmentation (EPA 1985a). Follow-up studies conducted with patients 20 to 25 years after the onset of porphyria showed that a few patients still had active porphyria, whereas 50% exhibited

hyperpigmentation and scarring as well as other dermatologic, neurological and skeletal features of hexachlorobenzene toxicity (EPA 1985a).

QUANTITATIVE DESCRIPTION OF HEALTH EFFECTS

Applying EPA's criteria for evaluating the overall weight of evidence of carcinogenicity to humans (EPA 1984b), hexachlorobenzene has been classified by EPA in Group B2--Probable Human Carcinogen. This category applies to agents for which there is inadequate evidence of carcinogenicity from human studies and sufficient evidence from animal studies (EPA 1984b).

EPA (1984c) derived a carcinogenic potency factor (q_1^*) of 1.7 $(mg/kg/day)^{-1}$ based on the incidence of hepatocellular carcinoma in female rats fed diets containing hexachlorobenzene for up to 2 years (EPA 1984a). The concentration in drinking water corresponding to a 10^{-6} excess lifetime cancer risk is 0.02 ug/liter (EPA 1984a).

The EPA Office of Drinking Water developed longer-term health advisories (HAs) of 0.175 mg/liter for a 70 kg adult and 0.050 mg/liter for a 10 kg child (EPA 1985b). The HAs are based on the study by Kuiper-Goodman et al. (1977) in which male and female Charles River rats were fed hexachlorobenzene at 0.5, 2.0, 8.0, or 32.0 mg/kg bw/day for 15 weeks. Female rats were found to be more susceptible to hexachlorobenzene, as indicated by all parameters studied, and a no-observed-adverse-effect level (NOAEL) of 0.5 mg/kg/day was concluded by the authors. At higher doses there was an increase in liver porphyrin levels in females and an increase in the size of centrilobular hepatocytes along with depletion of hepatocellular marker enzymes.

The EPA Office of Drinking Water also developed a drinking water equivalent level (DWEL) for noncarcinogenic end points of toxicity over a lifetime of exposure (EPA 1985b). A drinking water equivalent level of 0.028 mg/liter was derived for a 70-kg adult drinking 2 liters of water per day. The derivation of the DWEL was based on a 130-week study in which male and female Sprague-Dawley rats were exposed to hexachlorobenzene <u>in utero</u>, during lactation, and in the diet for the remainder of their lifetimes (EPA 1985b). A NOAEL of 1.6 mg/kg (0.08 mg/kg bw/day) was identified. At higher dietary

levels, there was an increase in the incidence of hepatic centrilobular basophilic chromogenesis. EPA (1985b) estimated the excess cancer risk that would result if exposure were to occur at the DWEL over a lifetime. The estimated excess cancer risk associated with lifetime exposure to drinking water containing hexachlorobenzene at 0.028 mg/liter is approximately 1×10^{-3}. This estimate represents the upper 95% confidence limit from extrapolations prepared by EPA's Carcinogen Assessment Group using the linearized, multistage model.

EPA (1980) has set ambient water quality criteria (AWQC) for hexachlorobenzene of 7.2, 0.72, and 0.072 mg/liter corresponding to cancer risks of 10^{-5}, 10^{-6}, and 10^{-7}, respectively, assuming 70-kg humans consume 2 liters water and 6.5 g fish and shell fish.

SUMMARY OF HEXACHLOROBENZENE CRITERIA

EPA carcinogen classification	Group B
Oral carcinogenic potency factor	1.7 $(mg/kg/day)^{-1}$
Longer-term HA:	
Adult	0.175 mg/liter
Child	0.050 mg/liter
DWEL	0.028 mg/liter
AWQC (corresponding to a 10^{-6} excess lifetime cancer risk	0.720 mg/liter

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APPENDIX PHE-2

TOXICITY PROFILES OF SELECTED INDICATOR CHEMICALS

PHENOL

INTRODUCTION

Phenol is a high volume industrial chemical that is widely used as an intermediate in the manufacture of other chemicals and is a by-product of combustion and some industrial processes. It is also produced by biological processes, e.g., microbial metabolism in the gut and metabolism of certain drugs in vivo (EPA 1980). It is a component of several over-the-counter medicines for both topical and oral administration.

PHARMACOKINETICS

Phenol is readily absorbed through the gut, by inhalation, and percutaneously. Following absorption, the compound is rapidly distributed systemically. The majority of phenol and its metabolites are excreted rapidly in the urine (EPA 1980).

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

The National Cancer Institute (NCI 1980) conducted a subchronic (90-day) study and a carcinogenesis bioassay of phenol administered in drinking water to F344/N rats and $B6C3F_1$ mice. In the subchronic study, doses of 100, 300, 1,000, 2,000, and 10,000 ppm phenol were not associated with mortality or histological changes; rats and mice of both sexes receiving 10,000 ppm consumed less water than animals in the control or other treatment groups and their body weights decreased. In the 105-week carcinogenesis bioassay, no treatment-related mortality, tumors, or nonneoplastic lesions were reported in rats or mice ingesting water containing 2,500 or 5,000 ppm phenol. A dose-related depression in mean body weight, which was related to decreased water consumption, occurred in both species of rodents.

Phenol exhibited tumor-promoting activity in the mouse skin painting system following initiation with 9,10-dimethyl-1,2-benzanthracene (DMBA) or benzo(a)pyrene (BaP), and it exhibited cutaneous carcinogenic activity in a

sensitive mouse strain when applied at concentrations that produced repeated skin damage (EPA 1980).

There are no data in the literature on the carcinogenicity of inhaled phenol in experimental animals or humans. The compound is mutagenic in several systems, but not in others (NCI 1980). There are no data on its teratogenicity (EPA 1984a).

Signs of acute phenol toxicity in humans and experimental animals are central nervous system depression, collapse, coma, cardiac arrest, and death. Acutely toxic doses can also cause extensive necrosis at the site of exposure (eyes, skin, oropharynx) (EPA 1980).

In a subchronic oral (gavage) study in rats (Dow Chemical Co. 1976), 0.1 g/kg phenol induced "slight liver changes and slight to moderate kidney damage" in animals. However, lack of study details (numbers of animals, incidence figures, specific lesions) in the 1980 EPA document make these results unreliable for interpreting the toxic changes. Subchronic inhalation studies conducted by Deichmann and Witherup (1944) in guinea pigs, rabbits, and rats were inadequately designed (no control groups). Therefore, caution should be used in interpreting the pulmonary, myocardial, renal, and hepatic damage as compound induced. The results of other subchronic inhalation studies are difficult to interpret based on the information in secondary sources (EPA 1980, 1984a).

QUANTITATIVE DESCRIPTION OF HEALTH EFFECTS

Applying the criteria for overall weight of evidence of carcinogenecity proposed by the Carcinogen Assesment Group of EPA (EPA 1984b), phenol has been classified in Group D--Not Classified (EPA 1984a). This category applies to agents for which there are no data available regarding carcinogenicity in humans or experimental animals.

A reference dose (RfD) of 0.1 mg/kg/day for ingestion of phenol was based on the Dow Chemical Co. (1976) subchronic rat study. The ambient water quality criterion (AWQC) of 3.5 mg/liter/day for drinking water was extrapolated from

this study. The AWQC based on organoleptic properties was established at 0.3 mg/liter (EPA 1980).

An inhalation acceptable intake chronic (AIC) of 1.4 mg/person/day was recommended by EPA (1984a) based on the threshold limit value of 19 mg/m^3 phenol established by the American Conference of Governmental Industrial Hygienists (ACGIH 1983).

SUMMARY OF PHENOL CRITERIA

EPA Carcinogen Classification	Group D
Reference dose (RfD)	0.1 mg/kg/day
AIC (inhalation)	1.4 mg/person/day
AWQC	3.5 mg/liter

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POLYCHLORINATED BIPHENYLS (PCBs)

INTRODUCTION

PCBs are complex mixtures of chlorinated biphenyls. The commercial PCB mixtures that were manufactured in the United States were given the trade name of "Aroclor." Aroclors are distinguished by a four-digit number (for example, Aroclor 1260). The last two digits in the Aroclor 1200 series represent the average percentage by weight of chlorine in the product.

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

PHARMACOKINETICS

Absorption

PCBs are readily absorbed through the gastrointestinal (G.I.) tract and somewhat less readily through the skin. G.I. absorption in rats is greater than 90% for a wide range of isomers (Albro and Fishbein 1972). Dermal absorption of Aroclor 1242 in a benzene/hexane solution was 15-34% in monkeys (Wester et al. 1983). PCBs are presumably readily absorbed from the lungs, but few data are available that experimentally define the extent of absorption after inhalation (EPA 1985a).

Metabolism and Excretion

Absorbed PCBs in the blood are distributed initially to the liver, but within a few days the liver concentrations are greatly reduced as redistribution occurs. Less chlorinated chlorobiphenyl isomers are metabolized, but chlorobiphenyl isomers with higher percentages of chlorine are very lipophilic and are redistributed to adipose tissue, skin, and other organs (Matthews 1983). The major metabolic products of PCBs are phenolic derivatives or dihydrodiols.

Sequestering of PCBs in adipose tissue isolates them from metabolically active liver enzymes and greatly retards their clearance from the body. PCB metabolites are excreted in the urine and bile, apparently exclusively in the conjugated form. Excretion in urine is more prominent for less chlorinated chlorobiphenyl isomers while bile becomes significant for more highly chlorinated compounds (Safe 1980). Excretion of PCBs also has been reported in milk (Deichmann 1981).

Enzyme Induction

Like other organochlorine compounds, PCBs can cause marked induction of microsomal enzymes. Microsomal mixed-function enzymes metabolize a large variety of lipophilic compounds. In general, the intensity of induction increases with increasing chlorination of the mixture of PCBs and is dose-related. The enhanced activity of hepatic enzymes induced by PCBs can persist for a considerable period of time after dosing (NRCC 1978).

NONCARCINOGENIC HEALTH EFFECTS

PCBs have a number of documented toxic effects on humans and other mammals; noncarcinogenic effects are summarized in the following subsections.

Health Effects Observed in Humans

In considering the health effects of PCB exposure observed in humans, it is important to note that PCBs are often contaminated with highly toxic impurities, particularly polychlorinated dibenzofurans (PCDFs). As the effects due to PCDFs versus PCBs have not been separated in most human studies and because the two cause similar effects, the following discussion refers to commercial mixtures. The reader should recognize that at least some of the reported effects may be due to the PCDF impurities.

Dermatitis and chloracne (a disfiguring and long-term skin disease) have been the most prominent and consistent findings in studies of occupational exposure to PCBs. Interpretation of these data is complicated by the

difficulty of diagnosing chloracne and the uncertainties of blood PCB determinations. Reports of both chloracne and other PCB-related skin effects have generally been associated with exposures to more highly chlorinated PCB mixtures containing 42% chlorine or more (Chase et al. 1982, Emmett et al. 1983, Maroni et al. 1981a,b, Fischbein et al. 1979). Smith et al. (1982) reported no PCB-related skin effects in workers exposed to high levels of Aroclor 1016, which is less chlorinated.

Several studies examining liver function in exposed humans have reported disturbances in blood levels of liver enzymes. Maroni et al. (1981b), Chase et al. (1982), Smith et al. (1982), and Emmett et al. (1983) found statistically significant associations between blood PCB levels and elevated levels of GGTP, SGOT, or both. There is no evidence that a "no-effect" level exists for these effects, since correlations were found in individuals with low mean blood PCB levels.

Reproductive outcomes of women exposed to PCBs from high consumption of PCB-contaminated fish from Lake Michigan were compared to births from women who reported no such exposure (Fein et al. 1984a,b, Jacobson et al. 1983, Jacobson et al. 1984). Reduced birth weights, slow weight gain, reduced gestational ages, and behavioral deficits in infants were reported in a methodologically sound study. The study did not, however, rigorously establish that the causative factor was exposure to PCBs rather than other contaminants present in Lake Michigan fish.

Health Effects Reported from Animal Studies

Based on the published literature, reproductive, hepatic, and immunotoxic effects appear to be the most sensitive end points of PCB toxicity in non-rodent species, and the liver appears to be the most sensitive target organ for toxicity in rodents.

PCBs are not highly toxic when given as a single oral dose to mammals (Kimbrough et al. 1978), PCBs and would be classified as only slightly toxic based on acute oral toxicity (Hodge and Sterner 1949). The more significant

toxic effects of PCBs are observed on repeated exposure over a period of time.

The most consistent pathological changes occurring in mammals other than monkeys and mink after PCB exposure are in the liver (EPA 1985a). Fatty deposits and increased liver sizes are commonly reported. Individual hepatocytes may appear foamy and vacuolated. Cellular necrosis can occur at high doses, and the location of lesions is often centrilobular (Sleight 1983).

Comparative studies have shown that Aroclor 1254 is usually the most hepatotoxic mixture. In rats, Aroclor 1260 was significantly less toxic to the liver than Aroclor 1254 (Kimbrough et al. 1972). Aroclors 1248, 1242, and 1016 are progressively less toxic than Aroclor 1254 (Koller 1977, Burse et al. 1974).

A skin syndrome similar to the effects seen in humans has been reported in monkeys. Barsotti et al. (1976) and Allen et al. (1979) fed diets containing 2.5 and 5 ppm Aroclor 1248 to rhesus monkeys for 7 months. Weight loss, followed by hair loss, acne of the face and neck, eyelid edema and erythema, and keratinization of hair follicles were reported. McNulty et al. (1980) reported similar effects in rhesus monkeys exposed to Aroclor 1242 and individual chlorobiphenyl isomers. These authors indicated that swelling of the eyelids, resulting from dilation of the Meibomian glands is the most sensitive indicator of chlorinated aromatic hydrocarbon poisoning of monkeys.

Reproductive effects of PCBs have been demonstrated in animals, but there appear to be major differences in the susceptibility of different species. Mink and monkeys appear to be relatively sensitive; mice, rats, and rabbits appear relatively insensitive.

Dietary administration of PCBs for 9 months prior to whelping caused lowered reproductive success in mink. Feeding Aroclor 1254 at 2 ppm or Aroclor 1243 at 5 ppm was detrimental to reproduction. Aroclor 1016 at concentrations

as high as 20 ppm did not lower the number of young born per female. The PCBs were embryotoxic to developing embryos, but spermatogenesis, oogenesis, and implantation were unaffected. Transfer of PCBs to the surviving pups through mother's milk was a significant contributing factor to offspring exposure (Ringer 1983).

Monkeys also appear to be sensitive to the reproductive effects of PCBs. Altered menstrual cycles, reduced breeding success, and lowered birth rates were reported in monkeys exposed to dietary levels of 2.5 and 5.0 ppm Aroclor 1248 for 6 to 7 months before breeding (Barsotti et al. 1976). When female monkeys were exposed to 0.5 or 1 ppm Aroclor 1248 (three times per week) for 7 months prior to breeding (Allen et al. 1979, Bowman et al. 1981), no toxic signs were observed in the mothers. The infants, however, had reduced birth weights, developed hyperpigmentation during nursing, and were marginally hyperactive at age 12 months. "No-effect" levels have not been demonstrated for reproductive effects in monkeys, since toxicity was observed at the lowest doses tested. For comparison, Linder et al. (1974) performed a two-generation study in rats and reported dose-related effects (reduced numbers of litters, litter-sizes and pup survivals, and pathological lesions in offspring) of Aroclor 1254 at dietary concentrations down to 20 ppm. Aroclor 1260 was not as toxic in the same experiment.

Immunotoxic and immunosuppresive effects have been reported in most experiments in which these end points have been investigated, and are among the more sensitive indicators of PCB exposure (EPA 1985a). Monkeys seem to be the most sensitive species; guinea pigs are relatively sensitive; and rabbits, rats and mice appear relatively insensitive. Rhesus monkeys chronically exposed to Aroclor 1248 exhibited atrophy or hypocellularity of the thymus, spleen, lymph nodes, and bone marrow; these effects were particularly marked in infants after chronic exposures of their mothers to diets containing 2.5 ppm Aroclor 1248 (Allen and Barsotti 1976, Allen et al. 1980). Reductions in cell-mediated immunity, humoral immunity, or both were reported in monkeys chronically exposed to diets containing 1.5 or 5 ppm Aroclor 1248 (Thomas and Hinsdill 1978), and in monkeys dosed with

100 or 400 ug/kg/day Aroclor 1254 (Truelove et al. 1982). Increased susceptibilities to infectious diseases in PCB-exposed monkeys have been reported by Allen et al. (1979), McNulty et al. (1980), and Barsotti et al. (1976).

CARCINOGENIC HEALTH EFFECTS

A number of studies have suggested that PCB mixtures are capable of increasing the frequency of tumors in animals exposed to the mixtures for long periods. Three studies in particular were well-conducted and well-reported. Kimbrough et al. (1975) exposed female rats to 0 and 100 ppm Aroclor 1260 in the diet for 20-21 months and the treated animals had a high frequency of liver tumors. The National Cancer Institute (NCI 1978) reported significant dose-related increases of liver tumors and hyperplastic nodules in the livers of rats fed diets containing 0, 25, 50, or 100 ppm Aroclor 1254 for 104-105 weeks. Schaeffer et al. (1984) reported on a comparative study in male rats of the carcinogenicity and chronic toxicity of Clophen A60 (equivalent to Aroclor 1260) and Clophen A30 (equivalent to Aroclor 1242) fed at concentrations of 100 ppm in the diets for up to 832 days. A strong carcinogenic effect of Clophen A60 (hepatocellular carcinomas and/or neoplastic nodules) and a weaker carcinogenic effect of Clophen A30 (neoplastic nodules) were reported.

Studies have suggested that PCB mixtures can act to promote or inhibit the action of other carcinogens in rats and mice. Preston et al. (1981) reported that exposure to Aroclor 1254 at a concentration of 100 ppm in the diet for 18 weeks markedly augmented the development of liver tumors initiated by diethylnitrosamine in rats. In two-stage bioassay systems in rat livers using diethylnitrosamine as an initiator, Clophen A50 (equivalent to Aroclor 1254) and Aroclor 1254 were shown to have promoting activities by Oesterle and Deml (1984) and Pereira et al. (1982), respectively. The Oesterle and Deml (1984) study is noteworthy as the only dose-response study of cancer promotion by PCBs.

PCB mixtures and several isomers have been studied for genotoxic effects, and the results have been generally negative (EPA 1985a). Studies of the

metabolic activation of PCBs and their ability to induce microsomal enzymes have demonstrated that PCB isomers and their metabolites do bind to macromolecules, including DNA, with varying degrees of affinity. This suggests that PCBs are capable of damaging DNA, but it is unclear whether the damage is repairable or likely to produce permanent alterations in the genome. Their ability to induce enzymes responsible for the metabolic activation of other known mutagens and carcinogens may be the greatest genetic hazard posed by PCBs.

QUANTITATIVE DESCRIPTION OF HEALTH EFFECTS

EPA Carcinogen Assessment Group (EPA 1985a) calculated a low-level cancer potency factor for PCBs based on a study of rats exposed to Aroclor 1260 (Kimbrough et al., 1975). The data on liver tumor incidence in the rat study was used in the linearized multistage model to calculate 95% upper confidence limits on risk. The risks determined using this approach are unlikely to underestimate the actual risks posed by exposure to low levels of PCBs in the environment and may overestimate risk. The carcinogenic potency factor for lifetime exposure to PCBs is 4.34 $(mg/kg/day)^{-1}$, indicating that a risk of 4.34 (upper bound) is associated with continuous lifetime exposure to a dose of 1 mg/kg/day. EPA (1984) classified the weight of the evidence for carcinogenicity as B2--Probable Human Carcinogen based on sufficient evidence in animal bioassays and inadequate evidence from studies in humans. Based on the Schaeffer et al. (1984) study, one would expect less chlorinated PCB mixtures to be less potent, but potency factors for mixtures other than Aroclor 1260 have not been calculated.

EPA (1980) derived an Ambient Water Quality Criterion (AWQC) for the protection of human health from the potential carcinogenic effects of PCBs through ingestion of contaminated water and contaminated aquatic organisms. The recommended AWQC corresponding to a 10^{-6} incremental increase of cancer risk over a lifetime is 0.079 ng/liter.

The American Conference of Governmental Industrial Hygienists (ACGIH 1986) recommends a time-weighted average Threshold Limit Value (TLV) of 1 mg/m^3

for Arochlor 1242, which should offer good protection against systemic intoxication. The ACGIH also recommends a time-weighted average TLV of 0.5 mg/m^3 for Arochlor 1254.

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POLYCYCLIC AROMATIC HYDROCARBONS

INTRODUCTION

Polycyclic aromatic hydrocarbons (PAHs) are a diverse class of compounds consisting of two or more fused aromatic rings. They are formed during the incomplete combustion of materials containing carbon and hydrogen and are ubiquitous in the modern environment. PAHs are commonly found as constituents of coal tar, soots, vehicular exhausts, cigarettte smoke, certain petroleum products, road tar, mineral oils, creosote, and many cooked foods.

A number of reviews have been prepared on the toxicology of the PAHs. The Environmental Protection Agency (EPA) prepared an Ambient Water Quality Criteria Document on the general class of polynuclear aromatic hydrocarbons (EPA 1980a) and also prepared Criteria Documents on several specific PAHs, including acenaphthene, fluoranthene, and naphthalene (EPA 1980b-d). More recently, EPA (1984a-f) prepared Health Effects Assessments for PAHs as a class, for coal tars, and for the individual compounds benzo(a)pyrene (B(a)P), naphthalene, phenanthrene, and pyrene. In addition to the EPA documents, Santodonato et al. (1981) prepared a review and risk assessment of polynuclear aromatic hydrocarbons, and the International Agency for Research on Cancer (IARC) reviewed the toxicity and carcinogenicity of a large number of individual PAHs and PAH-containing mixtures (IARC 1973, 1983, 1984, 1985).

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

Acute effects from direct contact with PAHs and related materials are limited primarily to phototoxicity. Phototoxicity is caused by exposure to a toxic substance followed by exposure to sunlight. The primary effects are dermatitis—skin reddening, itching, and burning. NIOSH (1977) reviewed the phototoxic effects of exposure to coal tar and found that phototoxicity can result from a single 90-minute exposure to a 1% solution of coal tar.

These dermatoses usually disappear when contact with the sensitizer is eliminated.

The polycyclic aromatic hydrocarbons have been shown to cause cytotoxicity in rapidly proliferating cells throughout the body, with the hematopoietic system, lymphoid system, and testes frequently noted as targets (Santodonato et al. 1981). This effect appears to be due to inhibition of DNA replication by the PAHs. Destruction of the sebaceous glands, hyperkeratosis, hyperplasia, and ulceration have been observed in mouse skin following dermal application of the carcinogenic PAHs, with the degree of induced morphological changes appearing to correlate with the carcinogenic activity. However, it does not seem that this dermal toxicity is necessary or sufficient for carcinogenesis (Santodonato et al. 1981). It should be noted that similar types of dermatitis have been observed in workers exposed to such PAH-containing materials as coal tar and mineral oil. The carcinogenic PAHs have also been shown to have an immunosuppressive effect in animals. Again, it is not clear what relationship, if any, this immunosuppression has with carcinogenesis.

Some of the noncarcinogenic PAHs have been shown to cause systemic toxicity, but these effects are generally seen only at rather high doses (Santodonato et al. 1981). For example, slight morphological changes in the livers and kidneys of rats have been reported following oral administration of acenaphthene. Oral administration of naphthalene to rabbits has resulted in cataract formation.

Nonneoplastic lesions are seen in animals exposed to the more potent carcinogenic PAHs only after exposure to levels well above those required to elicit a carcinogenic response. Consequently, carcinogenicity is the toxic effect of greatest public health concern following exposure to materials containing carcinogenic PAHs. A number of the PAHs have been shown to be potent carcinogens, producing tumors both at the site of application and systemically, in several different animal species, when administered by any of a number of routes. For example, Rigdon and Neal (1969) reported gastric tumors, pulmonary adenomas and leukemias in mice fed B(a)P, and

intratracheal instillation of a number of PAHs has been shown to cause lung tumors in both mice and hamsters (Santodonato et al. 1981). In addition, IARC (1984, 1985) have noted that occupational exposure to coal soot, coal tar and pitch, coal tar fumes, and some impure mineral oils causes cancer in humans at several sites, including the skin, and concluded that there is sufficient evidence that soots, tars, and some mineral oils are carcinogenic in humans. Fractionation procedures have demonstrated that the PAHs are the carcinogenic agents in coal tar.

QUANTITATIVE DESCRIPTION OF HEALTH EFFECTS

Not all PAHs have been demonstrated to be carcinogenic in animals, and some carcinogenic PAHs are clearly more potent than others (IARC 1983). A number of factors have been shown to influence the relative carcinogenic potencies of the PAHs. These include planarity of the molecule, cellular absorption, binding affinity, the presence or absence of a particular molecular structure, and the electron configuration of the molecule (Dipple et al. 1984, Frierson et al. 1986). In addition, genetic differences in the exposed animals, particularly in their ability to produce aryl hydrocarbon hydroxylase (AHH), have been shown to influence carcinogenic potency. Finally, the PAHs are not ultimate carcinogens but must be metabolized before they become biologically activated. A complete description of the complex metabolism of these compounds is beyond the scope of this report, but a detailed review of the factors influencing the carcinogenicity of the PAHs and metabolism of these compounds can be found in Dipple et al. (1984), Santodonato et al. (1981), and Frierson et al. (1986). For purposes of risk assessment, it is sufficient to note that the potencies of different PAHs vary over a wide range and that a number of factors, including factors specific to the chemical, the host animal, and the circumstances of exposure, affect carcinogenic potency.

For practical purposes, the PAHs are often separated into two categories, the "carcinogenic" and the "noncarcinogenic" PAHs. This is a somewhat misleading categorization as many of the "noncarcinogenic" PAHs have been shown to have some, albeit weak, carcinogenic activity, or to act as promoters

or cocarcinogens. A more accurate designation would be to differentiate between potent carcinogens, weak carcinogens, and noncarcinogens. Another factor complicating the assessment of risks posed by the PAHs is that they do not occur alone in nature, but occur as complex mixtures containing numerous PAHs of varying carcinogenic potencies. The potential interactions of the individual PAHs present as components of these mixtures must be addressed in attempting to quantify the carcinogenic risks posed by exposure to the mixtures.

The approach adopted by EPA (1980a, 1984a) as the basis for risk assessment is to apply a carcinogenic potency factor calculated from assays on B(a)P to the subclass of carcinogenic PAHs within the mixture that is to be assessed. This approach involves three assumptions: (1) that all carcinogenic PAHs have the same potency as B(a)P; (2) that their effects are additive; and (3) that the noncarcinogenic PAHs do not contribute to the carcinogenic effects of the mixture. Although there is limited empirical evidence to support assumptions (2) and (3), assumption (1) may lead to large overestimates of risk because B(a)P is one of the most potent carcinogens among the PAHs and is usually present only in a small percentage of the total mixture.

EPA (1980a, 1984a) calculated a value of 11.5 $(mg/kg/day)^{-1}$ as the carcinogenic potency factor (upper bound on lifetime risk) for oral exposure to the carcinogenic PAHs, based on the study of Neal and Rigdon (1967) in which oral administration of B(a)P led to forestomach tumors in mice. EPA (1984a) calculated a cancer potency factor for inhalation of B(a)P based on the study of Thyssen et al. (1981 as cited in EPA 1984a). This assay evaluated the production of respiratory tract tumors in hamsters using B(a)P at concentrations of 2.2-9.5 mg/m^3. The linearized multistage model yielded a carcinogenic potency factor of 6.11 $(mg/kg/day)^{-1}$.

EPA's Carcinogen Assessment Group has not reported a risk assessment for dermal exposure to the carcinogenic PAHs. Santodonato et al. (1981) performed risk assessments for both dermal and oral exposure and indicated that

B(a)P was more potent when applied dermally than when administered orally. A number of factors may account for this difference in relative potency and a complete derivation of a dermal potency factor is beyond the scope of this profile.

In addition to quantification of the effects of individual PAHs, EPA developed a cancer potency factor for inhalation of coal tar pitch volatiles (EPA 1984b). This study evaluated epidemiological data from exposure of coke oven workers to between 0 and greater than 700 mg/m^3-month coal tar vapors. The equivalent incremental risk calculated from the study was 3.2 $(mg/kg/day)^{-1}$. Coal tar pitch volatiles were classified in Group A--Human Carcinogen.

IARC (1983) in reviewing the carcinogenicity of the PAHs, indicated those for which there was sufficient, limited, inadequate, or adequate negative evidence of carcinogenicity (Table 1). The more potent carcinogens are almost certainly included within the group for which sufficient evidence of carcinogenicity is available.

TABLE 1

CLASSIFICATION OF PAHs ACCORDING TO
EVIDENCE FOR CARCINOGENICITY

Chemicals for which there is sufficient evidence that they are carcinogenic in animals:

Benzo(a)anthracene	7H-Dibenzo(c,g)carbazole
Benzo(b)fluoranthene	Dibenzo(a,e)pyrene
Benzo(j)fluoranthene	Dibenzo(a,h)pyrene
Benzo(k)fluoranthene	Dibenzo(a,i)pyrene
Benzo(a)pyrene	Dibenzo(a,l)pyrene
Dibenzo(a,h)acridine	Indeno(1,2,3-c,d)pyrene
Dibenzo(a,j)acridine	5-Methylchrysene
Dibenzo(a,h)anthracene	

Chemicals for which there is limited evidence that they are carcinogenic in animals:

Anthranthrene	Dibenzo(a,c)anthracene
Benzo(c)acridine	Dibenzo(a,j)anthracene
Carbazole	Dibenzo(a,e)fluoranthene
Chrysene	2-, 3-, 4-, and 6-Methylchrysene
Cyclopenta(c,d)pyrene	2- and 3-Methylfluoranthene

Chemicals for which the evidence is inadequate to assess their carcinogenicity:

Benzo(a)acridine	Coronene
Benzo(g,h,i)fluoranthene	1,4-Dimethylphenanthrene
Benzo(a)fluorene	Fluorene
Benzo(b)fluorene	1-Methylchrysene
Benzo(c)fluorene	1-Methylphenanthrene
Benzo(g,h,i)perylene	Perylene
Benzo(c)phenanthrene	Phenanthrene
Benzo(e)pyrene	Triphenylene

Chemicals for which the available data provide no evidence that they are carcinogenic:

Anthracene	Pyrene
Fluoranthene	

SOURCE: IARC 1983

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TOLUENE

INTRODUCTION

Toluene occurs naturally as a component of petroleum oil. It is used in the production of benzene and other organic solvents and as a solvent for paints, coatings, gums, oils, and resins.

PHARMACOKINETICS

In humans, toluene is absorbed quickly through the respiratory tract; dermal absorption of aqueous toluene is directly related to concentration (EPA 1985a). Because of its lipophilic nature and low water solubility, toluene is expected to distribute and accumulate in lipid tissue (EPA 1985b). In humans and animals, toluene is excreted via the urine as the metabolite hippuric acid and through pulmonary exhalation as the unchanged compound (EPA 1985a).

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

CARCINOGENICITY

Toluene has not been adequately tested for carcinogenicity. A chronic (106-week) oral bioassay of toluene conducted in F344 rats of both sexes resulted in no carcinogenic effects (CIIT 1980 as cited in EPA 1985b). Gross and microscopic examination of tissues and organs revealed no increase in neoplastic tissues or tumor masses among rats treated at 30, 100, or 300 ppm when compared with controls. However, the highest dose used did not approach the maximum tolerated dose (MTD); therefore, it has been suggested that toluene may not have been adequately tested for carcinogenicity. The National Toxicology Program is currently conducting an inhalation carcinogenicity bioassay in rats and mice (NTP 1985 as cited in EPA 1985a).

MUTAGENICITY

Toluene has been tested for genotoxicity by many investigators using various assay methods and has not been demonstrated to be genotoxic (EPA 1985a).

TERATOGENICITY/REPRODUCTIVE EFFECTS

Toluene administered by gavage to CD-1 mice at 260 mg/kg/day on days 6-15 of gestation caused embryo deaths, and higher doses (430 or 870 mg/kg/day) also caused fetal and maternal toxicities and cleft palates (Nawrot and Staples, 1979 Abstract as cited in EPA 1985b).

ACUTE/CHRONIC EFFECTS

The oral LD_{50} in rats is between 5,300 and 7,500 mg/kg (EPA 1985b). The LC_{50} for inhaled toluene is 4,618 ppm after a 6-hour exposure in rats (EPA 1985a). The dermal LD_{50} in rabbits is 12.2 g/kg (EPA 1985a). In experimental animals, acute oral and inhalation exposures to toluene result in CNS depression and histological changes in the lungs, liver, and kidneys (EPA 1985b). In humans, the major acute effects of toluene (375-1,500 mg/m^3) are CNS depression and narcosis (EPA 1985b).

Toxic effects following prolonged exposure of experimental animals to toluene are similar to those seen following acute exposure, predominantly to the CNS, liver, kidneys, and lungs (EPA 1985b). In humans, chronic exposures to toluene vapors at levels of approximately 200 and 800 ppm have been associated with CNS and, possibly, peripheral nervous system effects, hepatomegaly, and hepatic and renal function changes (EPA 1985b).

QUANTITATIVE DESCRIPTION OF HEALTH EFFECTS

Applying EPA's criteria for evaluating the overall weight of evidence of carcinogenicity to humans (EPA 1986a), toluene is most appropriately classified in Group D--Not Classified. This category indicates that the evidence for carcinogenicity in animals is inadequate (EPA 1986a).

The ADI Work Group of the Risk Assessment Forum (EPA 1986b) has identified an oral risk reference dose (RfD) of 0.3 mg/kg/day (20 mg/day for a 70-kg man). The risk RfD is based on a 24-month chronic toxicity study conducted in male and female F344 rats (CIIT 1980). Toluene was administered by inhalation at 30, 100, or 300 ppm to 120 male and female F344 rats, 6 hours/day, 5 days/week. The same number of animals was used as a control. Clinical chemistry, hematology, and urinalysis testing were conducted at 18 and 24 months. All parameters measured at the termination of the study were normal except for a dose-related reduction in hematocrit values in females exposed at 100 and 300 ppm toluene. Based on these findings, a no-observed-adverse-effect level (NOAEL) of 300 ppm was identified and an oral RfD of 0.3 mg/kg/day was derived.

The EPA Office of Drinking Water developed one-day, ten-day, and lifetime health advisories (HAs) for toluene (EPA 1985a). The one-day HA values, derived for a 10-kg child and a 70-kg adult, are 18.0 and 63.0 mg/liter, respectively. The ten-day HA values are based on the accumulated data on human inhalation exposure to toluene which indicate that approximately 100 ppm toluene for up to 8 hours/day causes no apparent adverse effects in humans. The ten-day HA values, derived for a 10-kg child and a 70-kg adult, are 6.0 and 21.0 mg/liter, respectively. The lifetime health advisory was based on the study by CIIT (1980) described above. A NOAEL of 300 ppm was identified and used to derive the risk reference dose of 0.288 mg/kg/day. The resultant adjusted acceptable daily intake (AADI) for toluene was 10.1 mg/liter. EPA's Office of Drinking Water has proposed a recommended maximum contaminant level (RMCL) of 2 mg/liter for toluene based on consideration of a source contribution factor of 20%.

The American Conference of Governmental Industrial Hygienists has recommended a time-weighted average threshold limit value of 100 ppm (approximately 435 mg/m^3) for occupational exposure to toluene.

SUMMARY OF TOLUENE CRITERIA

EPA carcinogen classification	Group D
One-day HA:	
Child	18.0 mg/liter
Adult	63.0 mg/liter
Ten-day HA:	
Child	6.0 mg/liter
Adult	21.0 mg/liter
Lifetime HA (AADI)	10.1 mg/liter
Oral RfD	0.3 mg/kg/day

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TRICHLOROETHYLENE

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

Trichloroethylene is a central nervous system depressant from acute and chronic exposure. High level exposure can result in death due to respiratory and cardiac failure. Trichloroethylene was once used as a general anesthetic, but its use was discontinued due to longer-term CNS effects. The longer-term effects may have been due to impurities introduced by soda lime used to remove carbon dioxide (EPA 1980).

The extent of trichloroethylene absorption after oral ingestion is virtually complete. With air exposure, absorption is proportional to concentration and duration of exposure. Trichloroethylene is eliminated by pulmonary excretion of the unchanged parent compound and by liver metabolism of urinary metabolites (EPA 1985a).

The hepatotoxic potential of trichloroethylene has been evaluated in human and animal studies. Animal studies have revealed transient increased liver weights, but relative liver weights decreased post-exposure (Kjellstrand et al. 1983 as cited in EPA 1985a). Observations of liver or renal dysfunction in workers have been infrequent, and factors other than trichloroethylene probably were more causally related to the hepatorenal disturbances noted (EPA 1985a).

Industrial use of trichloroethylene is often associated with dermatological problems. These include reddening and skin burns on contact, and dermatitis resulting from vapors. These effects are usually the result of contact with concentrated solvent, however, and no effects have been reported with exposure to trichloroethylene in dilute, aqueous solutions (EPA 1985a).

Studies investigating the carcinogenic potential of trichloroethylene have been carried out, and two of these studies revealed significant increases

in the incidence of liver tumors among both sexes of B6C3F1 mice exposed by gavage (NCI 1976, NTP 1982 as cited in EPA 1985a).

There is disagreement in the scientific community about the relevance of mouse liver tumors as indicators of human cancer risk. Several strains of laboratory mice, including the B6C3F1 hybrid, appear to develop a high and variable proportion of liver tumors with or without exposure to chemicals. Certain scientists believe that the increased incidence of mouse liver tumors should be treated in the same manner as the increased incidence of tumors at other rodent organ sites, while others believe that mouse liver tumors are an experimental artifact which is not relevant to human hazard (EPA 1985b).

QUANTITATIVE DESCRIPTION OF HEALTH EFFECTS

EPA's Science Advisory Board examined the toxicology of trichloroethylene and its ranking under the IARC criteria. The majority of the Committee members felt that the compound should be classified in IARC Category 3 (compound cannot be classified as to its carcingenicity in humans), while one member felt that IARC category 2B (probable human carcinogen) was more appropriate. The committee concluded that a definitive scientific opinion concerning the carcinogenicity of trichloroethylene could not be made at that time because the interpretation of male mouse hepatocellular carcinomas is uncertain and the animal evidence is limited (EPA 1985b).

EPA's Risk Assessment Forum classified trichloroethylene in Group B2 (probable human carcinogen, sufficient animal evidence of carcinogenicity and inadequate human evidence). The National Academy of Sciences has classified it as an animal carcinogen (EPA 1985b). Expressed in terms of relative potency, trichloroethylene ranks in the lowest quartile among the suspect or known human carcinogens evaluated by EPA's Carcinogen Assessment Group (CAG) (EPA 1985a).

CAG derived carcinogenic potencies (q_1^*) of 1.1×10^{-2} $(mg/kg/day)^{-1}$ for oral exposure and 4.6×10^{-3} $(mg/kg/day)^{-1}$ for inhalation exposure, derived

from the mouse liver tumor data in the NCI (1976) and NTP (1982) gavage studies (EPA 1984a).

EPA (1984b) determined a lifetime health advisory based on a study by Kimmerle and Eben (1973) that reported increased liver weights when rats were administered 55 ppm trichloroethylene for 14 weeks. The estimated excess cancer risk associated with lifetime exposure to drinking water containing 260 ug/liter of trichloroethylene is 8.2×10^{-5}.

STANDARDS AND CRITERIA

EPA carcinogen classification	Group B2
Oral carcinogenic potency (q_1^*)	1.1×10^{-2} $(mg/kg/day)^{-1}$
Inhalation carcinogenic potency (q_1^*)	4.6×10^{-3} $(mg/kg/day)^{-1}$
Proposed MCL (EPA 1985c)	5 ug/liter
Lifetime Health Advisory	260 ug/liter (for noncarcinogenic effects only)

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VINYL CHLORIDE

Vinyl chloride and polyvinyl chloride (PVC) are synthetic chemicals used as starting materials in the rubber, paper, glass, and automotive industries. They are used in the manufacture of a wide variety of products, including electrical wire insulation, piping, food packaging materials, medical supplies, and building and construction products (EPA 1987a).

TOXICOKINETICS

Vinyl chloride is rapidly absorbed in rats following ingestion and inhalation exposure. Dermal absorption of vinyl chloride is minor. Absorbed vinyl chloride is distributed primarily to the liver and kidney, with lower levels found in muscle, lung, fat, spleen, and brain . The toxicity of vinyl chloride appears to be attributable to its metabolism in the liver to reactive polar metabolites. The metabolism to toxic metabolites is saturable between 105 and 220 ppm. At low doses of vinyl chloride, metabolites are excreted primarily in the urine. At high doses most of the solvent is expired as unchanged vinyl chloride (EPA 1980, 1985a,b).

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

CARCINOGENICITY

Occuptional exposure to vinyl chloride has been associated with an increased incidence of hepatic angiosarcoma. Vinyl chloride exposure has also been implicated in brain, lung, and hemolymphopoietic cancers in humans. Animal studies in several species support the findings of epidemiological studies. Chronic inhalation and ingestion of vinyl chloride has induced cancer in the liver (liver angiosarcomas and hepatocellular carcinomas) and in other tissues in rats and mice (IARC 1979).

MUTAGENICITY

The mutagenic effects of vinyl chloride have been demonstrated in metabolically activated systems using S. typhimurium, E. coli, yeast, germ cells of Drosophila, and Chinese hamster V79 cells. Vinyl chloride was effective in producing chromosome damage in rat bone marrow after a multiple-exposure regime. Tests for chromosomal aberrations in humans have yielded inconsistent results (EPA 1985a).

TERATOGENICITY/REPRODUCTIVE EFFECTS

Inhalation exposures of rats, rabbits, and mice to vinyl chloride did not induce teratogenic effects (EPA 1985a). Evidence for an association between human exposure to vinyl chloride and birth defects or fetal loss is conflicting (EPA 1987a). Potential effects on reproductive capacity have not been studied.

ACUTE/CHRONIC EFFECTS

At high inhalation exposure levels, workers have experienced dizziness, headaches, euphoria, and narcosis. In experimental animals, inhalation exposure to high levels of vinyl chloride can induce narcosis and death. Lower doses result in ataxia, narcosis, congestion, and edema of the lungs and hyperemia in the liver (EPA 1985a).

Chronic inhalation exposure of workers to vinyl chloride is associated with hepatotoxicity, central nervous system disturbances, pulmonary insufficiency, cardiovascular toxicity, gastrointestinal toxicity, and acro-osteolysis (EPA 1985a). Chronic studies of experimental animals exposed to vinyl chloride by inhalation or ingestion report effects involving the liver, spleen, kidneys, hematopoietic system, and skeletal system (EPA 1984).

QUANTITATIVE DESCRIPTION OF HEALTH EFFECTS

Applying EPA's criteria for evaluating the overall weight of evidence of carcinogenicity to humans, vinyl chloride has been classified in Group A--Human Carcinogen (EPA 1984).

EPA (1984) reported carcinogenic potency factors (q_1*) for exposure by inhalation and ingestion to vinyl chloride. The q_1* for inhalation is based on an inhalation bioassay in rats (Maltoni and Lefemine 1975). Groups of 64 to 96 Sprague-Dawley rats were exposed to various concentrations of vinyl chloride for 4 hours a day, 5 days a week, for 52 weeks, and the survivors were sacrificed after 135 weeks. Angiosarcomas, particularly of the liver, were the predominant tumors observed. The linearized multistage model was fitted to the incidences of male and female rats with any type of malignant tumor (6/58, 10/59, 16/69, 22/59, and 32/59 in the 0-, 50-, 250-, 500-, and 2,500 ppm dose groups, respectively. The 6,000- and 10,000-ppm groups were not included in the final fitted model because the tumor incidence was said to have effectively plateaued at 51.7% and 62.3%. Using the linear nonthreshold model, the data of Maltoni and Lefemine (1975), and interspecies scaling factors, a human q_1* of 2.5×10^{-2} $(mg/kg/day)^{-1}$ was calculated.

The q_1* for oral exposure to vinyl chloride is based on a long-term ingestion study in rats (Feron et al. 1981). Groups of male and female Wistar rats were exposed to vinyl chloride via ingestion of polyvinyl chloride powder containing some unreacted monomer. The doses of vinyl chloride administered were 0, 1.7, 5.0, and 14.1 mg/kg/day. Dosing was continued for lifetimes with terminal sacrifices at 135 weeks for males and at 144 weeks for females. A significant dose-related increase in the incidence of hepatocellular carcinomas and hepatic angiosarcomas was observed in both males and females, with angiosarcomas becoming more prevalent with increasing doses. The linearized multistage model was fitted to the incidences of total female rats with tumors (2/57, 26/58, 42/59, in the 0-, 1.7-, 5.0-, and 14.1-mg/kg/day dose groups, respectively). The incidence of hepatocellular carcinoma was not included in these tallies; it was assumed that rats having hepatocellular carcinoma also had hepatic neoplastic nodules which were included in the tallies. In addition, the total number of animals bearing tumors in the high

dose group was arbitrarily reduced to one less than the total number of animals examined, so the data would fit the linear nonthreshold model used for estimation of carcinogenic potency. Using the data of Feron et al. (1981) and interspecies scaling factors, a human q_1* of 2.3 $(mg/kg/day)^{-1}$ was calculated. The concentration in drinking water corresponding to a 10^{-6} excess lifetime cancer risk is 0.015 ug/liter. The EPA Carcinogen Assessment Group (CAG) is presently reassessing the cancer risk estimate based on the Feron et al. (1981) study by evaluating the more recent data by Til et al. (1983) which is an extension of the earlier Feron et al. (1981) work, but includes lower doses.

EPA promulgated a drinking water maximum contaminant level goal (MCLG) of zero because vinyl chloride is a human carcinogen. A drinking water MCL of 0.002 mg/liter has also been promulgated (EPA 1987b).

SUMMARY OF VINYL CHLORIDE CRITERIA

EPA carcinogen classification	Group A
Oral carcinogenic potency factor (q_1*)	2.3 $(mg/kg/day)^{-1}$
Inhalation carcinogenic potency factor (q_1*)	2.5×10^{-2} $(mg/kg/day)^{-1}$
MCLG	0 µg/liter
Final MCL	2 µg/liter
AWQC (10^{-6} upper-bound excess lifetime cancer risk)	0 (2 µg/liter)

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XYLENES

INTRODUCTION

Xylenes are used as solvents for paints, inks, and adhesives and as components of detergents and other industrial and household products. Xylene has three isomers, o, m-, and p-xylene. These three compounds generally have similar chemical and biological characteristics and therefore will be discussed together.

PHARMACOKINETICS

Although the available data are limited, inference from metabolism and excretion studies suggests that absorption of orally administered xylene is nearly complete. Data from animals and humans suggest that approximately 60% of an inhaled dose is absorbed. Dermal absorption is reported to be minor following exposure to xylene vapor but may be significant following contact with the liquid (EPA 1985a). Elimination of xylenes is through urinary excretion of metabolites and through pulmonary exhalation of unchanged solvent (EPA 1985b).

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

CARCINOGENICITY

The National Toxicology Program (NTP) has tested xylene for carcinogenicity by administering the compound orally to rats and mice. Although the results have not been finalized, xylene does not appear to be carcinogenic in rats (EPA 1985b). Results have not been reported for mice.

MUTAGENICITY

Xylene was not found to be mutagenic in a battery of short-term tests (Litton Bionetics 1978).

TERATOGENICITY/REPRODUCTIVE EFFECTS

Xylene appears to be fetotoxic and may increase malformations in the offspring of exposed experimental animals. Except for one oral study in mice in which the incidence of cleft palates was increased, the available teratogenic studies have reported generally retarded skeletal development and body weight gains in fetuses (EPA 1985a).

ACUTE/CHRONIC EFFECTS

Most of the available toxicity data for xylene assesses the adverse effects associated with exposure by inhalation. Acute exposure to relatively high concentrations of xylene adversely affects the central nervous system and lungs, and can irritate the mucous membranes. The liver is reportedly affected by longer-term exposure to lower levels of xylene (EPA 1984, 1985a).

QUANTITATIVE DESCRIPTION OF HEALTH EFFECTS

Using the criteria for evaluating the overall weight-of-evidence of carcinogenicity to humans proposed by EPA's Carcinogen Assessment Group (EPA 1986), xylene is most appropriately assigned to Group D--Not Classified because of inadequate data from animal studies.

The EPA Office of Drinking Water proposed a recommended maximum contaminant level (RMCL) of 0.44 mg/liter based on an inhalation study in rats, guinea pigs, monkeys, and dogs (Jenkins et al. 1970). The experimental animals were exposed continuously for 90 days at a dose level of 337 mg/m^3. No significant effects were observed with respect to body weight, hematology, and histopathological examination of treated animals. Using 337 mg/m^3 as the no-observed-adverse-effect level (NOAEL), an uncertainty factor of 1,000 for an animal study with few animals per dose level, and assuming consumption of 2 liters of water per day, a provisional adjusted acceptable daily intake of 2.2 mg/liter was calculated. The proposed RMCL was derived from this value by assuming a 20% drinking water contribution to total exposure (EPA 1985a,c).

EPA's Office of Drinking Water also drafted short-term assessments for xylene. One-day and longer-term health advisories of 42 mg/liter and 27.3 mg/liter were recommended. The one-day value was based on a NOAEL identified in a single-exposure inhalation study in humans, and the longer-term value was based on a NOAEL identified in a subchronic inhalation study in experimental animals (EPA 1985a).

The EPA (1984) health effects assessment for xylene derived oral subchronic acceptable intake (AIS) and chronic acceptable intake (AIC) values of 0.1 mg/kg/day and 0.01 mg/kg/day, respectively, based on a subchronic dietary exposure study in rats (Bowers et al. 1982). Groups of five male Long-Evans rats received approximately 10 mg/kg/day o-xylene in the diet for 1, 2, 3, or 6 months. No gross or light microscopic effects were observed. However, ultrastructural changes in liver morphology, which the EPA did not consider to be toxicologically significant, were noted. The exposure dose of 10 mg/kg/day was thus identified as the NOAEL and, incorporating an uncertainty factor of 100, the AIS for xylene was calculated. The AIC was derived by incorporating an additional uncertainty factor of 10. Based on available information, EPA assumed that until more experimental data become available it may be appropriate to apply the AIS and AIC derived from the o-xylene study to mixed xylenes and m-xylene, but not to p-xylene.

EPA (1984) derived an inhalation AIS based on a study in female Charles River CD rats exposed to mixed xylenes at 433 or 1,733 mg/m^3 on days 6 through 15 of gestation, 6 hours/day (Litton Bionetics 1978 as reported in EPA 1984). An increased number of fetuses, but not litters, with skeletal abnormalities was observed in the high dose group. The lower exposure concentration clearly defined a no-observed-effect level (NOEL) of 69 mg/kg/day. The NOEL was divided by an uncertainty factor of 100 to give an AIS of 0.69 mg/kg/day. Carpenter et al. (1975) defined an inhalation NOEL of 398 mg/kg for mixed xylenes in a subchronic inhalation study in rats. Applying an uncerainty factor of 1,000, EPA recommended an inhalation AIC of 0.398 mg/kg/day.

The American Conference of Governmental Industrial Hygienists (ACGIH 1986) has recommended a time-weighted average threshold limit value (TLV) of 100 ppm (approximately 435 mg/m^3) for occupational exposure to xylene. It is believed that at this concentration, irritant effects will be minimal.

SUMMARY OF XYLENE CRITERIA

EPA carcinogen classification	Group D
One-day HA	42 mg/liter
Longer-term HA	27.3 mg/liter
EPA Proposed RMCL	0.44 mg/liter
EPA Health Effects Assessment	
Oral AIS	0.1 mg/kg/day
Oral AIC	0.01 mg/kg/day
Inhalation AIS	0.69 mg/kg/day
Inhalation AIC	0.398 mg/kg/day

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ZINC

INTRODUCTION

Zinc (Zn) is a silvery metal of low to intermediate hardness, atomic number 30 and atomic weight 65.38 g/mole. Primary uses of zinc in industry are as a component of dry cells and other batteries, in electrogalvanizing, and as alloys. Zinc compounds are used therapeutically as topical astringents, antidandruff products, antiseptics, and emetics.

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

Zinc is an essential element, and it is present in a number of metalloenzymes, including carbonic anhydrase carboxypeptidase, alcohol dehydrogenase, glutamic dehydrogenase, lactic dehydrogenase, and alkaline phosphatase (Vallee 1959 as cited by Hammond and Beliles 1980). Zinc is necessary for normal growth and development. Human dwarfism and a lack of sexual development have been related to Zn deficiency (Halsted et al. 1974 as cited by Hammond and Beliles 1980).

There is no evidence that zinc is carcinogenic. Studies which have been performed on zinc-containing organics failed to demonstrate teratogenic effects (Stokinger 1981).

Zinc salts of strong acids are astringent and corrosive. Upon ingestion they act as emetics, and they can cause symptoms of fever, nausea, vomiting, stomach cramps and diarrhea.

Zinc chloride is caustic and causes severe and occasionally fatal irritation of the epithelium lining the trachea and bronchi. Acute interstitial fibrosis of the lung occurred in one fatal case following inhalation of $ZnCl_2$ smoke from a smoke generator (Milliken et al. 1963).

Chronic administration of 0.5-34.4 mg zinc oxide per day for periods of 1 month to 1 year failed to produce signs of toxicity in rats

(Drinker et al. 1927 as cited by Stokinger 1981). In another study, 0.1% zinc was tolerated in the diet of rats, but more than 0.5% zinc reduced their capacity to reproduce, and 1% inhibited growth and caused severe anemia and death (Sutton and Nelson 1937 as cited by Stokinger 1981).

Zinc oxide has been implicated as the cause of metal fume fever in industrial situations. Typically, brass foundry workers exposed to fumes containing zinc experience an unusual metallic taste which is accompanied by dryness and irritation of the throat, with coughing and dyspnea, weakness, pains in the muscles and joints, and a high fever which is followed by profuse sweating. Recovery occurs within 24-48 hours after an attack provided exposure is discontinued. Gastrointestinal disturbances and localized dermatitis may also occur after exposure to zinc oxide.

QUANTITATIVE DESCRIPTION OF HEALTH EFFECTS

EPA (1984) derived an inhalation reference dose for zinc of 0.7 mg/day based on the American Conference of Governmental Industrial Hygienists (ACGIH 1980) recommended time-weighted average Threshold Limit Value (TLV) for zinc chloride of 1 mg/m^3. This TLV was adjusted to account for differences in the likely exposure of worker and nonoccupationally-exposed individuals, and was divided by an uncertainty factor of 10 to protect individuals in the general population who might be especially sensitive to the chemical agent. Dividing this reference dose of 0.7 mg/day by the breathing rate of the average person (20 m^3/day) gives a reference concentration for zinc in air of 35 ug/m^3.

An oral reference dose of 14.9 mg/day (0.21 mg/kg/day) was derived by EPA (1984) based on the occurrence of anemia and reduced blood copper in some patients receiving therapeutic doses of approximately 150 mg/day zinc for extended periods of time. A safety factor of 10 was used to protect sensitive individuals.

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APPENDIX PHE-3

ESTIMATED SOIL INGESTION RATES FOR USE IN RISK ASSESSMENTS

APPENDIX PHE-3

ESTIMATED SOIL INGESTION RATES FOR USE IN RISK ASSESSMENTS

SUMMARY

Assessing the risks to human health posed by contaminants present in soil often requires some information on likely soil ingestion rates. Several authors have attempted to estimate these rates, but their estimates were based primarily on limited information about the amount of soil that people get on their hands and assumptions about mouthing behavior. However, some empirical data on soil ingestion rates have recently become available. These data can be used to derive more accurate estimates of soil ingestion rates for use in risk assessments. Estimates of the most probable soil ingestion rates range from 20 to 100 mg/day, depending on the age of the individual at risk. Realistic worst-case estimates unlikely to underestimate exposure range from 100 to 500 mg/day. A value of 5,000 mg/day is considered a reasonable worst-case estimate for children with habitual pica.

Exposure is a function of both the quantity of contaminants with which one comes into contact and the duration of that contact. Therefore, the frequency of exposure is also important in determining annual exposure rates and, consequently, the risks posed by contaminated soil. This factor can only be assessed on a site-specific basis. For sites where residential areas are contaminated, exposure should be considered to be year-round. Of course, people in warmer climates will spend more time outdoors and will be exposed to larger amounts of soil than people in areas that are covered with snow for much of the year. These factors should be considered at least qualitatively in assessing exposure. In situations where contact with contaminated soil is likely to be infrequent, the exposure frequency should be estimated.

INTRODUCTION

Scientists attempting to evaluate the risks posed by contamination at a hazardous waste site must generally examine several routes of exposure. Those usually considered of most concern are:

- Ingestion of contaminated drinking water,
- Ingestion of contaminated fish and shellfish, and
- Inhalation of airborne contaminants.

These are probably the most significant routes of exposure to chemicals that are mobile in the environment. However, exposure via other routes may pose significant risks, particularly for contaminants that are quite toxic but not very mobile (e.g., polychlorinated biphenyls (PCBs), tetrachlorodibenzo- p-dioxin (TCDD), and some heavy metals). Exposure parameters such as liters of water consumed per day or cubic meters of air breathed per day have been fairly well defined for the more common routes of exposure. However, only limited work has been done to estimate these parameters for other pathways. This paper will address a potentially significant route of exposure to relatively immobile hazardous materials in contaminated soil, namely, ingestion.

PREVIOUS ESTIMATES OF SOIL INGESTION RATES

Exposure to contaminants via ingestion of soil[1] can occur by inadvertent consumption of soil on the hands or food items, mouthing behavior, consumption of nonfood items (pica[2]), or a combination of these routes. Several authors have attempted to quantify the amount of soil ingested by children. A review of these studies provides the information needed to derive a reasonable upper limit and a most probable estimate of soil ingestion rates for children and adults.

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[1]Although several authors distinguish between soil and dust in their assessments, the data do not appear to be complete enough to allow this type of differentiation. In addition, soil commonly makes up a major portion of indoor dust (Hawley, 1985). Consequently, the term "soil" will be used in this discussion to refer to soil and dust combined.

[2]See bottom of next page.

Lepow et al. (1974, 1975) measured the amount of dirt that could be removed from children's hands using an adhesive label and observed the frequency with which children mouthed nonfood objects and their hands. The average age of the children was 4.3 years. The authors measured an average of 11 mg of soil on the children's hands. They observed that a reasonable estimate of mouthing frequency is 10 times per day but that this value may underestimate the number of times children put their hands or nonfood objects into their mouths. They concluded that 100 mg/day was a reasonable estimate of the amount of soil ingested by children. They also performed several calculations using 250 mg as the amount of soil children ingest, apparently as an upper limit estimate.

Day et al. (1975) estimated that children playing outdoors could collect between 5 and 50 mg of soil on a sticky sweet. They estimated that children eat 2 to 20 sweets per day, which would lead to the ingestion of between 10 and 1,000 mg/day of soil.

Duggan and Williams (1977) attempted to determine the amount of street dust that urban children ingest daily. The authors estimated the amount of dust that was retained on the inside of the forefinger and thumb by rubbing a specified amount of dust between the fingers and reweighing the dust that was not retained. They ran several tests on different people and determined that about 4 mg (2 mg per finger) were retained. The authors then assumed that a child would suck his or her forefinger or thumb 10 times per day and concluded that 20 mg was a reasonable estimate of the amount of dust ingested daily. Duggan and Williams, (1977) also cited the estimates of Day et al. (1975) and Lepow et al. (1974) and a value

[2]The term "pica" refers to both normal mouthing with subsequent ingestion of nonfood items, which is quite common among children at certain ages, and the unnatural craving for and habitual ingestion of nonfood items. The latter is an uncommon condition that is generally associated with medical conditions such as malnutrition, certain neurobehavioral disorders, and iron deficiency anemia or, less often, with a particular cultural background. The term "habitual pica" will be used in this paper to refer to this unusual type of ingestion of nonfood items. The term "pica" will be used for the normal ingestion of nonfood items common in children at certain ages.

from Bryce-Smith (1974 as cited in Duggan and Williams 1977) of one-thirtieth of a gram (derivation unspecified). They concluded that children probably ingest between 10 and 100 mg of street dust per day and estimated that the average daily ingestion rate is 25 mg.

Mahaffey (1977) examined sources of lead to which children might be exposed. She reported that the best clinical estimates indicate that children with pica (nonhabitual) are likely to ingest between 1,000 and 3,000 mg of paint per week. Assuming that similar amounts of soil are ingested, a child with pica would ingest between 140 and 430 mg of soil per day.

Schaum (1984) also estimated the amount of soil that children are likely to ingest. He cited the Lepow et al. (1975) estimate (100 mg/day) and also reported that habitual pica could increase ingestion levels to as much as 5,000 mg/day (Chisolm, 1982 as cited in Schaum, 1984). He determined that a range of 100 to 5,000 mg/day was reasonable for use in risk assessments.

Kimbrough et al. (1984) estimated age-specific levels of soil ingestion that the authors felt were reasonable yet unlikely to underestimate exposure (Table 1). These estimates were reportedly based on a study of lead uptake from contaminated soils.

Hawley (1985) estimated outdoor soil and indoor dust ingestion rates for three age groups: young children (2.5 years old), older children (6 years old), and adults. He based his soil ingestion estimate for very young children on Lepow et al.'s (1975) calculations of the maximum soil intake (250 mg/day), and his other soil and dust ingestion estimates on assumptions about the amount of soil or dust likely to collect on the hands and subsequently be ingested. Hawley's (1985) values for daily soil and dust ingestion are presented in Table 2; his average daily ingestion rates for soil and dust combined are also reported.

TABLE 1

SOIL INGESTION BY AGE AS ESTIMATED BY KIMBROUGH ET AL. 1984

(mg/day)

Age	Level
0-9 months	0
9-18 months	1,000
1.5-3.5 years	10,000
3.5-5 years	1,000
Over 5 years	100

TABLE 2

SOIL AND DUST CONTACT RATES AS ESTIMATED BY HAWLEY 1985

Age Exposure Route	Medium	Ingestion Rate (mg/day)	Frequency of Exposure	Comments
2.5 year old				
Outdoors (May-Oct.)	Soil	250	5 days/wk for 5 years	Based on Lepow et al. (1975) study
Indoors (May-Oct.)	Dust	50	Daily for 6 months	Assumes ingestion of dust on inside of hands
Indoors (Nov.-Apr.)	Dust	100	Daily for 6 months	
Total	Soil and dust	164	Daily	
6 year old				
Outdoors (May-Sept.)	Soil	50	Daily for 5 months	Assumes ingestion of half the dirt on fingers
Indoors	Dust	3	Daily	Assumes ingestion of dust on inside of hands
Total	Soil and dust	24	Daily	
Adult				
Outdoors (May-Sept.)	Soil	480	2 days/week for 5 months	Assumes ingestion of dirt while smoking
Attics	Dust	110	12 times/ year	Assumes ingestion of dirt on surface of hands while in dusty attic
Living space	Dust	0.56	Daily	
Total	Soil and dust	61	Daily	

The first empirical data on soil ingestion rates were recently collected by Binder et al. (1985), who measured soil ingestion by children 1 to 3 years old using a method previously employed to measure soil ingestion by ruminants. The trace elements silicon, aluminum, and titanium, all of which are present at high concentrations in soil and none of which are absorbed by humans, were measured in the soil and in stool samples from 59 children 1 to 3 years old. The concentrations of the elements in the soil and in daily fecal samples were then compared to estimate daily soil ingestion. The authors used several assumptions in their calculations. Two of these, that dietary intake of the elements was negligible and that fecal weight was 15 g (and not the 7 g they measured) would lead to an overestimation of soil ingestion rates, possibly by a significant amount. Their assumption that the elements were entirely unabsorbed might lead to a slight underestimation of exposure. They attempted to determine the likely qualitative effects of each of these assumptions but could not estimate the magnitude of any potential effect.

The arithmetic means of the soil ingestion levels that were estimated using two of the elements, silicon and aluminum, were in general agreement (184 vs. 181 mg/day), while the mean value reported for titanium (1,834 mg/day) was an order of magnitude higher (Table 3). It appears likely that some other source of titanium in the diet was responsible for the high mean value. Therefore, the values reported for silicon and aluminum--approximately 180 mg/day—are probably more accurate. As noted above, the effect of the various assumptions on the reported values has not been quantified. However, it seems likely that the values overestimate soil consumption by the average child.

ESTIMATION OF SOIL INGESTION RATES

Soil ingestion can occur at any age but is most prevalent in young children. Baltrop (1966 as cited in Mahaffey, 1977) reported that over 75% of children 1 to 3 years old mouthed objects and that 35% ingested them. The author also noted that the prevalence of these activities decreased with age; only 33% of children 4 to 5 years old mouthed objects, and only 6% had pica.

TABLE 3

SOIL INGESTION BY CHILDREN 1 TO 3 YEARS OLD AS ESTIMATED BY BINDER ET AL. 1985

(mg/day)

Estimation Method[a]	Arithmetic Mean	Geometric Mean	Standard Deviation	Upper 95th Percentile
Aluminum	181	128	203	584
Silicon	184	130	175	578
Titanium	1,834	401	3,091	9,590

[a]In other words, elements upon which estimates are based.

SOURCE: Binder et al., 1985

Mahaffey (1977) further reported that other estimates indicate that approximately one-half of all children 1 to 3 years old have pica. Mahaffey and Annest (1985) reported that pica is most prevalent in children 6 months to 3 years old, and it is significantly more common in children from lower income families.

The estimates of soil ingestion levels reported in previous studies are summarized in Table 4. Reasonable estimates of soil ingestion by children can be derived from this information. To ensure that risk assessments based on these estimates do not underestimate risk, we will also calculate upper confidence levels.

The Binder et al. (1985) study is the only paper that presents clearly empirical data. Therefore, it is appropriate to use this study as the basis for estimating soil ingestion levels. The authors reported an average intake of 180 mg/day of soil (after excluding the results based on titanium levels) for children 1 to 3 years old. The standard deviation was approximately 200 mg/day, and the 95th percentile upper confidence limit was 580 mg/day. Binder and her colleagues assumed that none of the elements came from the normal diet, which, as mentioned above, is likely to lead to an overestimation of the amount of soil ingested. Consequently, a value of 500 mg/day, which is around the 95th percentile upper confidence limit of the arithmetic mean values reported, would appear to be a conservative yet reasonable estimate of soil ingestion for children 1 to 3 years old. As noted above, older children are less likely to exhibit pica. However, Lepow et al. (1974, 1975) observed children 2 to 6 years old mouthing objects, and it is probably reasonable to use this value of 500 mg/day as a worst-case estimate of soil ingestion for children 1 to 6 years old. A value of 100 mg/day, which is near the geometric mean of Binder et al.'s (1985) data, appears to be a reasonable estimate of the most probable ingestion rates.

Children less than 1 year old are not likely to come into direct contact with soil regularly. However, very young children may be exposed to contaminated house dust. No specific information is available on ingestion

TABLE 4

ESTIMATED LEVELS OF SOIL INGESTION
REPORTED IN THE LITERATURE

(mg/day)

Reference	Age	Level	Comments
Lepow et al., 1974, 1975	4.3 years (mean)	100	Based on observations of mouthing behavior; (see text)
Day et al., 1975	Children 1-3 years	10-1,000	Based on ingestion of soil on candy
Duggan and Williams, 1977	Children 2-6 years	25	See text
Mahaffey, 1977	1-3 years	140-430	Based on estimate of paint consumption by children with pica
Schaum, 1984	2-6 years	100-5,000	See text
Kimbrough et al., 1984	0-9 months 9-18 months 1.5-3.5 years 3.5-5 years Over 5 years	0 1,000 10,000 1,000 100	Based on study of lead exposure; probably overestimates risk
Hawley, 1985	2.5 years 6 years Adults	164 24 61	Based on estimated ingestion of both and dust; see text
Binder et al., 1985	1-3 years	180±200	Based on measurement of trace elements; see text

of dust by children in this age group, and we suggest a value of half the previous value, or 250 mg/day, as a reasonable, worst-case estimate of ingestion levels. Similarly, 50 mg/day is probably a reasonable estimate of the most probable ingestion rate for children in this age group.

No empirical information on older children was available. Mahaffey (1977) reported that mouthing decreased in most children more than 4 years old. It seems reasonable to assume that almost all children 6 to 11 years old would have reduced their soil ingestion by at least 50%. Consequently, we suggest that 250 mg/day is a worst-case estimate and 50 mg/day, a most probable case estimate of soil ingestion by children in this age group.

For children more than 11 years old and adults, the value of 100 mg/day recommended by Kimbrough et al. (1984) appears to be a reasonable, worst-case estimate of daily soil ingestion. Based on Hawley's (1985) assumptions, 50 mg/day appears to be a reasonable estimate of the most probable ingestion rate for people who have frequent hand-to-mouth contact (e.g., smokers) or who are in direct contact with contaminated soil (e.g., construction workers, gardeners). A value of 20 mg/day appears to be a reasonable estimate of the most probable soil ingestion rates for adults who are not smokers and do not regularly engage in outdoor activities.

As noted earlier, certain individuals exhibit pica habitually, i.e., they eat nonfood items regularly, even daily. The values for soil ingestion reported above may underestimate exposure for people exhibiting this type of behavior. The upper limit on soil ingestion of 5,000 mg/day recommended by Schaum (1984) probably is a reasonable, worst-case estimate of soil ingestion by a person with habitual pica.

Our estimates of soil ingestion by persons in different age groups are presented in Table 5. These values fall within the range of soil ingestion levels suggested by Schaum (1984) but are generally lower than the values presented by Kimbrough et al. (1984). However, it should be noted that these estimates are in general agreement with the estimated levels of soil ingestion presented in Table 4. Consequently, we feel that these

TABLE 5

ESTIMATES OF SOIL INGESTION RATES

Age	Average Weight[a] (kg)	Worst Case[b] (mg/day)	Most Probable Case (mg/day)
0-1 years	10	250	50
1-6 years	15	500	100
6-11 years	30	250	50
Over 11 years	70	100	50[c]

[a]EPA, 1985

[b]This does not include individuals who exhibit habitual pica. For them, the upper value presented in Schaum (1984) of 5,000 mg/day would be more appropriate.

[c]A value of 20 mg/day is probably a more reasonable estimate of soil ingestion rates for adults who do not exhibit frequent hand-to-mouth activity (e.g., most nonsmokers) and do not regularly engage in outdoor activities.

values are reasonable estimates that are unlikely to underestimate soil ingestion levels. Therefore, they are unlikely to lead to any underestimation of exposure via this route.

ESTIMATION OF EXPOSURE FREQUENCY

Several authors estimated the frequency of exposure to soil. Kimbrough et al. (1984) assumed that people would only come into contact and ingest soil for 6 months each year. Schaum (1984) noted that the ground is frozen for an average of 118 days/year in the coldest parts of the United States, while in other parts, people can come into contact with outdoor soil year-round. He therefore determined that exposure could occur for anywhere between 247 and 365 days/year. Hawley (1985) noted that people are likely to be exposed year-round to soil, both outdoors as soil and indoors as a major component of dust. Consequently, a reasonable, worst-case assumption appears to be that people come into contact with and ingest soil year-round.

Clearly, site-specific factors should be considered if in estimating likely contact and ingestion rates. It usually is not possible to determine the effect of these factors on the rates of exposure to soil quantitatively. However, any site-specific factors (such as climate) likely to affect the frequency of exposure should be addressed qualitatively.

This discussion of exposure frequency only applies to inhabitants of contaminated residential areas or to people living immediately adjacent to a source of contamination. In the case of people (children or adults) who infrequently use a contaminated area, a site-specific estimate of the frequency of exposure must be derived.

CONCLUSION

No single value will accurately reflect daily soil ingestion rates for all individuals. Too many factors can influence contact with soil and consequently affect the quantity of soil ingested. However, risk managers often need to estimate average soil ingestion rates in order to assess

potential exposure to soil-bound contaminants. The values for soil ingestion rates presented in this paper have been derived using the best information currently available. As such, they provide reasonable, yet conservative (unlikely to underestimate exposure), estimates for use in the risk assessment process.

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